CRUDE OIL PRICE PREDICTION

A PROJECT REPORT

Submitted by

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BACHELOR OF ENGINEERING

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ABSTRACT

As the most important strategic resource around the globe, crude oil is the “key” commodity for the world’s economy. Therefore forecasting it has been a challenging task as a lot of events influence its price so it is very hard to forecast its prices. Crude oil prices suffer from high volatility and fluctuations. Forecasting its needs will be helpful for our government, Companies and Investors. This project involves creating an artificial neural network (ANN) to predict the price of crude oil. In this project, we propose a novel approach for crude oil price prediction based on artificial Intelligence. It will be beneficial for our government, businesses, and investors to anticipate its demands. As part of thisresearch, artificial neural networks (ANNs) will be built to forecast crude oil prices. Inthis study, we suggest a cutting-edge method for predicting the price of crude oil usinganalytical. The future price of the crude oil will be predicted on basis of the inputs given by the user. The predicted price would be for the next day. Hence, it is concluded that the proposed model achieved higher forecasting accuracy and takes less computational time with the modes’ reconstruction as opposed to using all the decompose modes. As a part of future scope, there is being an idea to improve the model by considering the latest news, disaster, tweet, and social media sensitive messages.

CHAPTER 1
INTRODUCTION

CHAPTER - 1
INTRODUCTION

1.1 Project Overview

Owing to the fact that crude oil provides around one-third of the world's energy needs, crude oil is important to the global economy. Additionally, changes in oil priceshave a big impact on both countries' economies that export and buy oil. Forecasting the oil price accurately would assist policymakers in enacting the right legislation and selecting the best energy sources. However, because there are numerous factors that affect oil prices, forecasting researchers have found it difficult to estimate the price of crude oil. Economic growth, conflicts, wars, and breaking news all have a significant impact on oil price fluctuations in addition to the basic market elements like supply, demand, and inventory. For instance, oil producers were paying buyers to take the commodity off their hands because they were concerned that storage space might be depleted in May 2020. On April 20, 2020, the price of WTI oil even became negative for the first time ever. Another recent example is the higher association between changes in crude oil prices and the severity of the COVID-19 epidemic. Since the majority of this information is found in unprocessed texts, characterizing and modelling these nonlinear and non-quantitative factors is difficult.

1.2 Purpose

The three primary factors that impact the price of oil are:

- Supply and demand

The idea of supply and demand is rather simple. Price should rise as demand (orsupply) rises or falls. Price should decrease when supply grows or as demand declines.Actually, the oil futures market is where the price of oil as we know it is set. A legally binding agreement known as an oil futures contract offers one the right to buy oil by the barrel at a specified price on a specified date in the future. In a futures contract, each party is responsible for carrying out their portion of the deal before the deadline.

- Cost of production

Cost of production refers to the total cost incurred by a business to produce a specific quantity of a product or offer a service. Production costs may include things such as lab our, raw materials, or consumable supplies. In other words, the cost of production is defined as the expenditures incurred to obtain the factors of production such as lab our, land, and capital, that are needed in the production process of a product.

- Market sentiment

Sentiment is the other important factor that impacts oil prices. The simple expectation that oils demand would rise sharply at some point in the future can cause speculators and hedgers to buy up oil futures contracts, driving up oil prices now.

There used to be a recognizable seasonal swing in oil prices. As oil dealers anticipated a large demand for driving over the summer vacation, they increased in thespring. Prices fell in the fall and winter once the demand peaked.

Geopolitical instability and civil upheaval also have a significant impact on global supply and prices. There are several reasons why oil prices are more unpredictable now, but five are the most significant.

- The Russian Invasion of Ukraine

Russia is the third-largest producer of liquid fuels and petroleum, so when the country invaded Ukraine in late February 2022, it had immediate impact on Brent crude oil futures prices.10 As the conflict continued, the prices of crude oil settled in out on an upward trajectory, reaching nearly $130/b in early March, and staying well above $100/b into April.

- US Oil Supply

The coronavirus pandemic and natural events are still affecting oil demand and supply. The U.S. experienced a drop in production following Hurricane Ida in September as the storm shut at least nine refineries.

The EIA estimates that U.S. crude oil production will average 12.01 million b/din 2022 and 12.95 million b/d in 2023.11

- Diminished OPEC Output

Oil price increases also reflect supply limitations by the Organization of the Petroleum Exporting Countries (OPEC) and OPEC partner countries. In 2020, OPEC cut oil production due to decreased demand during the pandemic. It gradually increased oil output through 2021 and into 2022. Supply chain disruptions in late 2021affected global trade as well.

At its most recent meeting in December 2021, OPEC stated it would continueto gradually adjust oil production upward by 0.4 million barrels per day (mb/d) in January 2022.

- Natural Gas

Countries in Asia have relied on coal to generate power, but recent shortages have turned them to natural gas. Higher temperatures in parts of Asia and Europe haveled to high demand for natural gas to generate power.

COVID-19 has hampered Europe's natural gas production, and a colder-than- expected heating season in early 2021 reduced supplies further.

As a result, natural gas prices soared in 2021 and are expected to remain highin 2022 and affected countries have turned to gas-to-oil switching to reduce power generation costs.

- Global Inventory Draw

As a reduction in oil production continues globally, countries are forced todraw from their stored reserves (not including the strategic petroleum reserves). This steady draw of oil is contributing to the increase in prices because inventories are decreasing.

Models incorporating economic parameters such as supply, and demand and their determinants are known as structural models. Even though structural models are found to be the most logical ways of modelling the prices of industrial products, the price of crude oil is affected by many other factors. One of these factors is that the price of crude oil is determined in the futures market which enables the purchase of a predefined amount of oil at a particular price in the future. Additionally, only 1% of the crude oil traded in futures contracts results in the actual purchase of a physical commodity; its chief purpose is to make money out of price fluctuations in crude oil. Hence the price of crude oil behaves more like a financial asset and therefore is more representative of the expectations of traders rather than just predictions based on economic theories of supply and demand.

There are other categories of models which are non-structural and considertime variation of crude oil prices, known as time series models. It is difficult to obtain reliable data to formulate a structural model, while time series data for crude oil pricesis easily available and hence it is easier to build a time series model. We focus on timeseries modelling of crude oil prices in this article.

In time series models, it is assumed that the current price of crude oil reflects the effects of all influencing factors, and that price forecasting can be done based on the behavior of past

crude oil prices. The main assumption in such models is that the past behavior of oil prices can explain future prices. Although time series models can capture trends or any cyclical patterns in the data, there are limitations to the forecasting capability of these models when trend reversals are observed in the data,or the repeating pattern captured in the model is not followed in future prices. Different trends in a time series can be classified as increasing, decreasing and periodic patterns. Time series models are quite useful and forecast reasonably well when the data follows any of these types of trends.

We can easily observe the downtrends, uptrends and repeating patterns in crudeoil prices within specific years. Crude oil monthly price data is obtained from the US Energy Information Administration (EIA) website.1 Different subsets of crude oil price data are formed to demonstrate the utility of time series modelling and its limitations in some scenarios.

Time Series Modelling Techniques

Several methods are proposed in the literature to build time series models.They include autoregressive integrated moving average (ARIMA), generalized auto regressive conditional heteroscedastic (GARCH), Holt-Winters, autoregressive neural networks, and support vector regression.2 Various hybrid models are also suggested such as combination of ARIMA and neural networks with support vector regression, genetic algorithms and wavelets.3-7 Discussion of various methodologies applied for crude oil price modelling can be found in review articles available in the literature.8,7 We have used ARIMA and auto regressive neural networks for modelling oil prices,as these techniques cover both linear and non-linear types of modelling. A short description of these methods is given below.

ARIMA

ARIMA is the most widely used and well-known technique for time series analysis, developed by Box and Jenkins. In an ARIMA model, future values are predicted as a linear combination of previous oil prices and the associated errors. This model consists of three parts: the AR (auto regressive) component is a linear combination of past observations; MA (moving average) is a linear combination of lagged error terms; and I (integrated) replace the original series with differenced series.

Auto regressive Neural Network

An autoregressive neural network (ANN) is a non-linear model in which future prices are expressed as a non-linear function of lagged prices in the series, in contrast to linear

modelling in ARIMA. Additionally, neural network-based models have the ability to learn and capture patterns in data sets without the need to specify the exact model form. Multilayer perceptron (MLP) is the most widely used ANN in forecastingproblems. Typically, the model is composed of input layer, hidden layer and output layer. The connecting nodes in these layers are called neurons. Input to the neurons is mapped using transfer functions and the weighted average of output from all the nodesis sent to next layer. There are various parameters that need to be specified for anANN model: number of hidden layers, number of neurons in each layer, type of transfer function, and number of lags. The selection of appropriate network parameters is crucial to the fitting and forecast accuracy of an ANN model. We have used the near function in R to build a neural network model.

Benefits of predicting crude oil prices:

- Some Sectors Thrive It probably counts as obvious that there are sectors that thrive when oil prices march upward. High prices for oil fuel the same sort of process as in any other sector; suppliers look for ways to provide more of the product and take advantage of those higher prices. For energy, then, that means opportunities for companies involved in exploration (seismic survey, for instance), drilling, production and servicing.
- New Technologies Become Viable Cheap oil is problematic for companies and industries looking to supplant oil. While most people can agree that there are vague and nebulous costs associated with accessing and utilizing oil (pollution, for starters), the United States has been reticent to translate those costs into higher energy taxes. What's more, it is not clear that higher taxes on fossil fuelsin Europe and much of Asia really do anything to mitigate environmental damage beyond reducing consumption. All in all, then, when oil prices are low it is very hard for cleaner energy technologies to compete effectively on price.
- Changes in Behavior For those who believe that burning oil (and other hydrocarbons) is generally a bad thing, higher prices that lead to lower use has to be counted as a benefit. When people are faced with higher prices and no obvious substitutes, they will consume less assuming that their demand is relatively elastic.

  Alternatives Come to the Fore If increased exploration and production is a normal by-product of higher oil prices, so too is substitution. When Nazi Germany faced oil shortages in World War II, methods of producing oil, diesel and gasoline substitutes from vegetable oils, animal fats and coal were thoroughly explored. Likewise, the oil crisis of the 1970s gave the developmentof ethanol in Brazil a major boost

CHAPTER 2

LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

Crude oil is amongst the most important resources in today's world, it is the chief fuel and its cost has a direct effect on the global habitat, our economy, and other activities. Prediction of oil prices has become the need of the hour, it is a boon to many large and small industries, individuals, the government. From the past few years, crude oil price fluctuates more than any other commodities prices. As the crude oil price depends on several external factors and there is high volatility predicting crude oil prices is very challenging. This Project mainly focuses on applying Neural Networks to predict the Crude Oil Price. This decision helps us to buy crude oil at the proper time. So, we would be implementing RNN (Recurrent Neural Network) with LSTM (Long Short-Term Memory) to achieve the task.

SOME OF THE EXISTING SOLUTIONS:

Prediction Using Deep Learning:

Long Short-Term Memory (LSTM) based on a recurrent neural network has shown better results in predicting prices that have high volatility. By utilizing this model, the significant crude oil price is evaluated and modelled. The exhibition of the proposed model is assessed by utilizing the valuable information in the WTI unrefined petroleum markets. The exploratory results show that the proposed model achieves increments in the expected precision of results.

Prediction Using Artificial Neural Networks:

The main approach of ANN is that it continuously captures the unstable pattern of the crude oil prices which have been incorporated by finding out the optimal lag and number of the delay effect that controls the prices of crude oil. Variation of lag in a period of time has been done for the most optimum and close results, we then have validated our results by evaluating the root mean square error and the results obtained using the proposed model have significantly outperformed.

Predication Using stream Learning:

In stream learning approach the prediction model can capture the changing pattern of oil prices since the model is continuously updated whenever new oil price data are available, with very small constant overhead. To evaluate the forecasting ability of our stream learning model, we compare it with three other popular oil price prediction models. The experiment results show that our stream learning model achieves the highest accuracy in terms of both mean

squared prediction error and directional accuracy ratio over a variety of forecast time horizons.

Prediction using Support Vector Regression (SVR) with grid search – cross validation algorithm:

The Algorithm to determine the optimal parameters in the model using the SVR is a grid search algorithm. This algorithm divides the range of parameters to be optimized into the grid and across all points to get the optimal parameters. In its application the grid search algorithm should be guided by a number of performance metrics, usually measured by cross-validation on the training data. Therefore, it is advisable to try some variations pair hyperplane parameters on SVR. Based on analysis calculation of accuracy and the prediction error using the training data generating R2 99.10868% while the value of MAPE by 1.789873%. The data testing generates R2 96.1639% while the value of MAPE by 1.942517%. This indicates to the data of testing using a linear kernel or accuracy of prediction accuracy results are quite large. Best model using the SVR has been formed can be used as a predictive model of crude oil prices

WTI oil price prediction modeling and forecasting:

This modelling and Forecasting examine two different Bayesian approaches to model short term oil price return for past decades and forecast it. We first built the multivariable linear regression model based on relevant explanatory variables. Then we build the univariate time series model using ARIMA models, followed by ARCH and GARCH models. Both methods are followed by required procedures and econometrics tests. The forecasting powers of time series approach perform better than linear regression and even structural models, yet linear approach is very relevant for knowing incapability of each variable to oil price.

Conclusion

One of the most important role of economic variables in today's world countries are the price and the change of the price of crude oil. Changes in the price of crude oil have a very critical role in terms of treasury and budget, both in company and state planning. For example, one may choose one of the energy or natural gas indexed energy production plans based on the trend of the crude oil price, for planning to meet the need for electricity next year. Accurate forecasting of the crude oil price and realization of the forecasts based on this forecast will provide savings or gains in government and corporate economies, which can reach billions of dollars. There is a great need for this estimation in countries where crude oil production is low and heavily dependent on crude oil import.

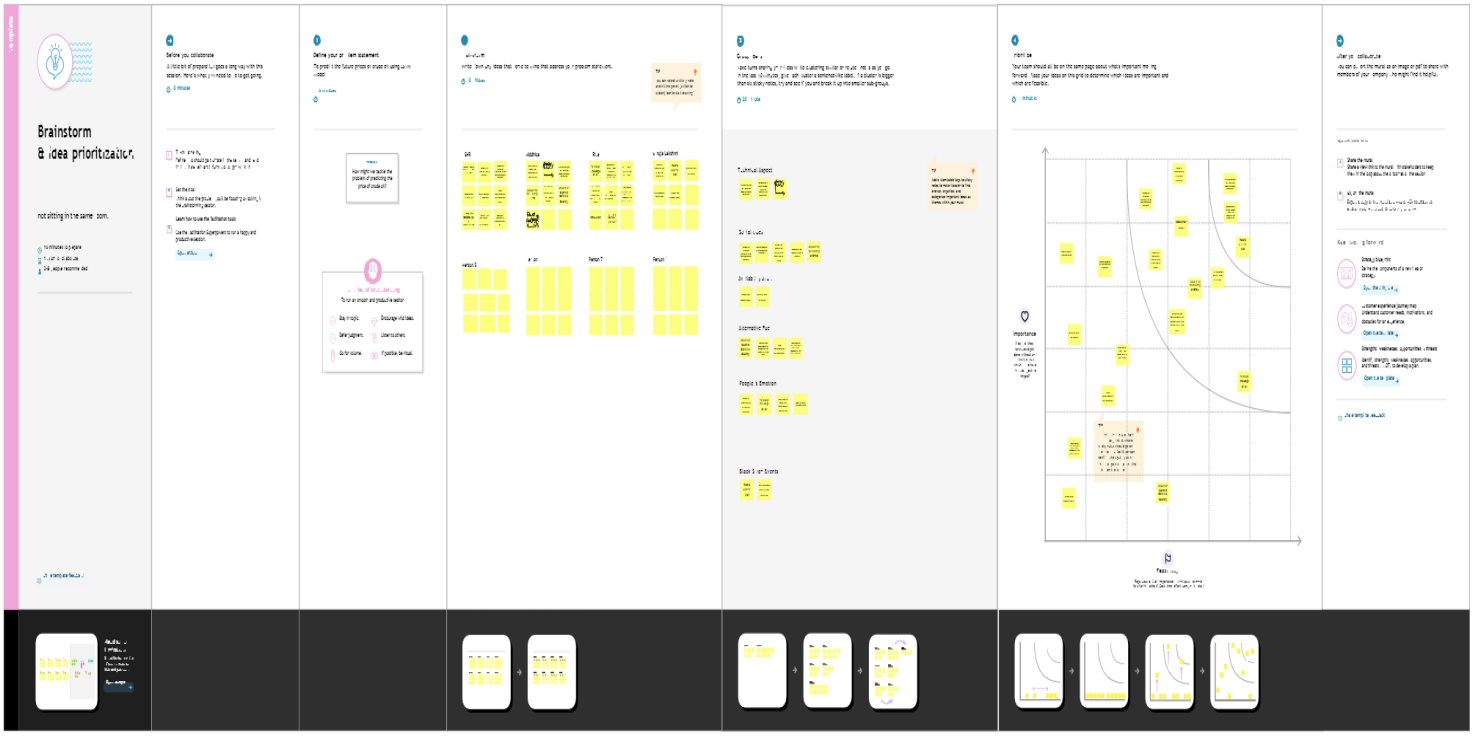
CHAPTER 3

IDEATION AND PROPOSED SOLUTION

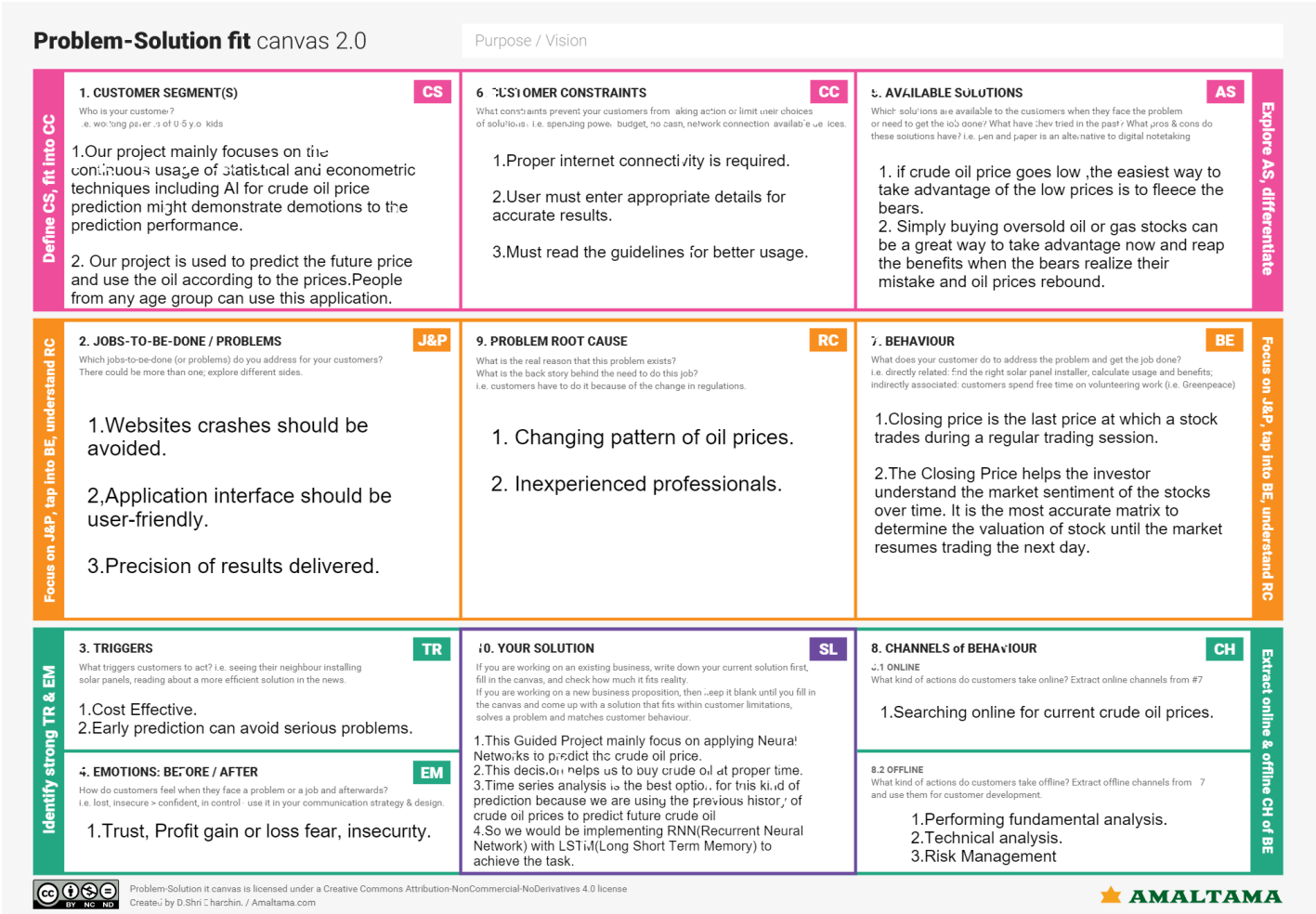
CHAPTER 3

IDEATION AND PROPOSED SOLUTION

IDEATION PHASE:

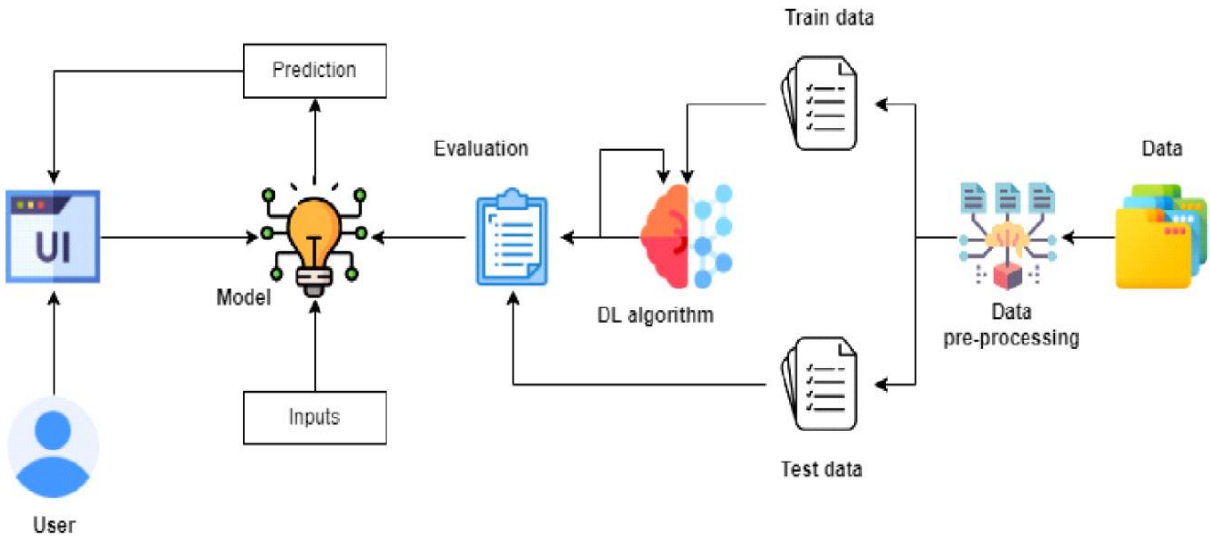


PROPOSED SOLUTION FIT:



SOLUTION ARCHITECTURE:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to: • Find the best tech solution to solve existing business problems. • Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders. • Define features, development phases, and solution requirements. • Provide specifications according to which the solution is defined, managed, and delivered.



EMPATHY MAP:


There is a gain
What is the risk?
What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
How to use this?
There is a loss
What do they
HEAR?
what friends say
what boss say
what influencers say
Did you lose any money by using it?
The prediction is too off
What is the accuracy percentage?
Crude oil investors
Crude oil based companies
Fuel station owners
Crude oil price history in bar graph form
Current crude oil price
Past crude oil prices
Profit from the predicted prices
Loss from the predicted price
What do they
SEE?
environment
friends
what the market offers
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
What is the error percentage?
Easier interface
What is the current prediction percentage?
How it calculates the price?
Can it show the data in graphical form?
PAIN
fears
frustrations
obstacles
Loss in business
Explaining to others why bought this many barrels at once
Approval from higher authority
GAIN
"wants" / needs
measures of success
obstacles
Business gain
Notification on huge chances
Precaution can be taken on high reduction in price

CHAPTER 4

REQUIREMENT ANALYSIS

CHAPTER 4
REQUIREMENT ANALYSIS

4.1Functional Requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	● Registration through Form ● Registration through Gmail ● Registration through LinkedIn
FR-2	User Confirmation	● Confirmation via Email ● Confirmation via OTP
FR-3	User Login	● Login through username and password ● Login through Gmail ● Login through LinkedIn
FR-4	Primary specifics	● Sync oil price every second ● Show Up and Down graph in real timein accordance with the oil price
FR-5	Additional Requirement	● Read latest news ● View price charts ● Review futures on selected quotation ● Analyse historical price trends ● Check exchange rates and commodities futures
FR-6	System Responsibility	● Allowing the user to select a date ● Track the precious results ● The pricing news should be updated

Table 1 – Functional Requirements

4.2 Non-Functional Requirements

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	● To utilize a system easily and accelerate routine operations, it must have a logical user interface. ● Anyone who registers on the portal can utilize the system.
NFR-2	**Security**	The following is a list of some of the factors that have been found to prevent malicious or unintentional access, usage, modification, destruction, or disclosure of the software: ● Maintain particular log or historical data sets. ● Apply specific cryptography methods. ● Limit the number of devices that can access the website for predicting the price. ● Verify the integrity of the data.

NFR-3	**Reliability**	● At the time of entry, all user variable data will be committed tothe database. ● By using the available backup procedures and techniques, data corruption is avoided.
NFR-4	**Performance**	● The system must allow for the simultaneous use of many users atall times. ● The accuracy of the price should be at the maximum.
NFR-5	**Availability**	● The system should always be accessible, allowing for simple user access. ● A replacement page will be displayed in the event that hardwareor data base failure increases, and data should be obtained to restore the system.
NFR-6	**Scalability**	● Identifies the maximum workloads at which the system will still operate well. ● Focus on the measurement of the system's response time under various load levels.

Table 2 – Non-Functional Requirements

CHAPTER 5

PROJECT DESIGN

CHAPTER 5
PROJECT DESIGN

5.1 Data Flow Diagram

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system,what changes the information, and where data is stored.

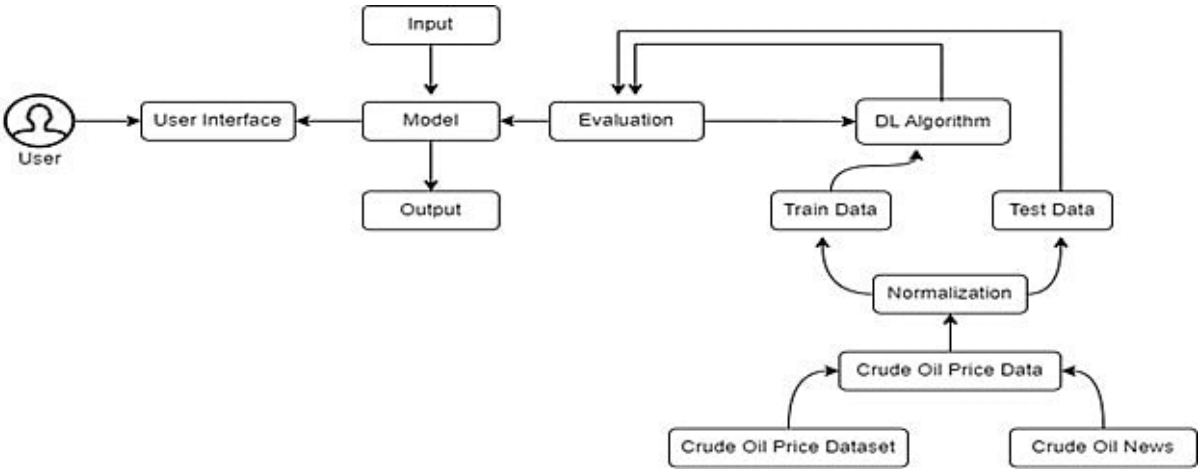


Figure 8 – Data Flow Diagram

5.2 Solution & Technical Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.

- Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture Diagram:

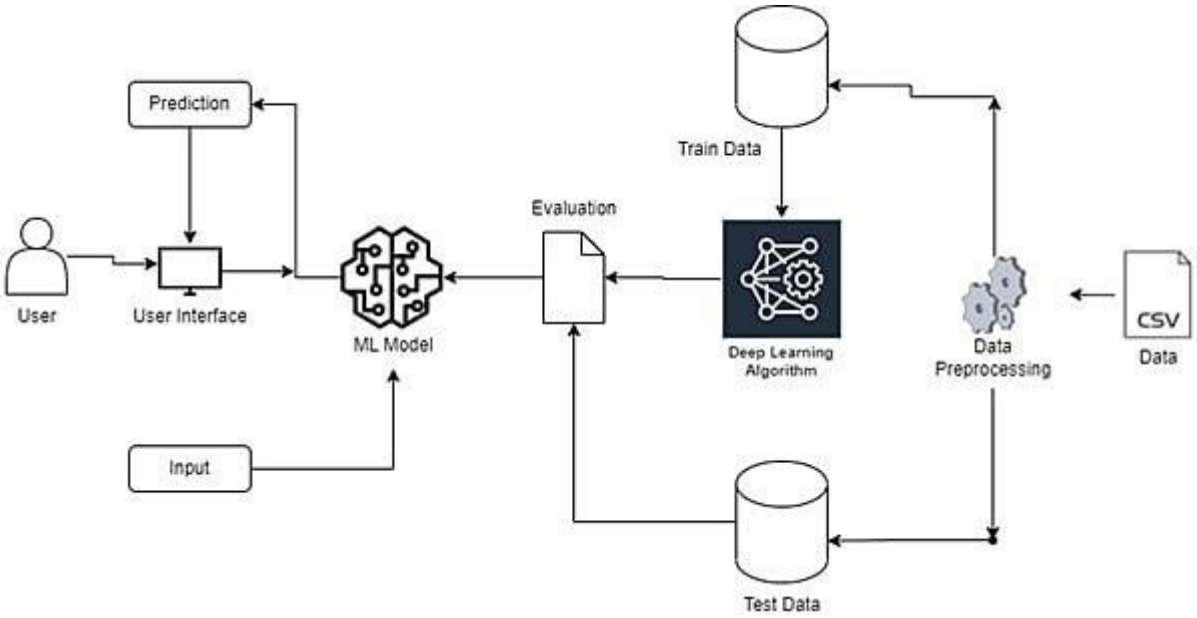


Figure 9 - Architecture Diagram

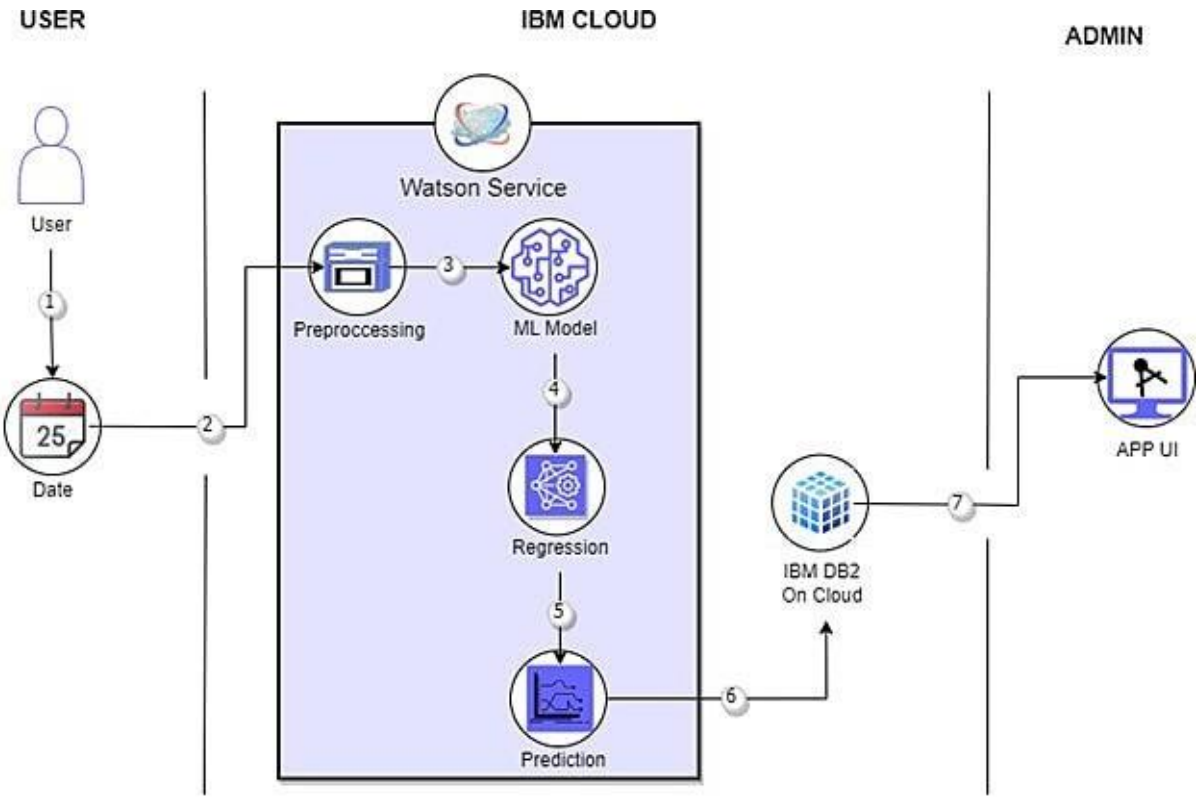


Figure 10 – Technical Architecture Diagram

Components & Technologies

S.No	Component	Description	Technology
1.	User Interface	Through a web UI, the user can engage with the application.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	It has many in built libraries which help in machine learning	Python
3.	Application Logic-2	It helps to build machine learning model	IBM Watson Jupyter Notebook service
4.	Application Logic-3	It is fast and accurate	IBM Watson Assistant
5.	Database	MySQL is used to store the user information and warehouse the crude oil price	MySQL
6.	Cloud Database	IBM Db2 is reliable and scalable	IBM DB2
7.	File Storage	Maintain files easily	Local Filesystem
8.	External API-2	Aadhar and customer KYC verification takes a little amount of time	Aadhar API, etc.
9.	Machine Learning Model	To recognize the patterns and trends	Sequential, Dense & LSTM Model

10.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration	Local System and IBM Watson

Table 3 – Components & Technologies

Application Characteristics

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Tensor flow – Implements model building and training. Flask – Can handle multiple user request simultaneously. Scikit learn – Contains model for classification, regression, clustering.	Tensor flow, Flask, Scikit learn.
2.	Security Implementations	SHA-256 doesn't have any known vulnerabilities	SHA-256.
3.	Scalable Architecture	MySQL can store huge amount of data and it is easily scalable.	MySQL
4.	Availability	This application can be accessed from anywhere easily and it is easily scalable.	IBM Watson Cloud.

5.	Performance	Flask can handle multiple user request simultaneously.	Flask

Table 4 – Application Characteristics

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / Dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation on email once I have	I can receive confirmation on email & click	High	Sprint-1

			registered for the application	confirm		
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register through already existing mail account.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	After registration, I can log in via only email & password.	High	Sprint-1

	Dashboard	USN-6	Display the oil price, line graph / bar graph real time.	I can expect the prediction in various formats.	Low	Sprint-3
Customer (Web user)	Login	USN-7	As the user, I can login by using Gmail or Facebook account or LinkedIn or by registering.	Existing users can easily login.	High	Sprint-2
Customer Care Executive	Support	USN-8	The Customer care service will provide solutions for any FAQ and also provide Chat-Bot.	I can solve the problems raised.	High	Sprint-3
Administrator	Access Control	USN-9	Admin can control the access of users.	Access permission for Users.	High	Sprint-4

	Database	USN-10	Admin can store the details of users.	Stores User details.	Medi um	Sprint-4
	News	USN-11	Admin will give the recent news of Oil Prices.	Provide the recent oil prices.	Medi um	Sprint-4
	Notification	USN-12	Admin will notify when the oil prices changes.	Notification by Gmail.	High	Sprint-4

Table 5 – User Stories

CHAPTER 6
PROJECT PLANNING AND SCHEDULING

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PROJECT PLANNING AND SCHEDULING

Sprint	Functional Requirement(Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Download Crude Oil Price Dataset	2	Medium	Harshinni M
Sprint-1	Data Preprocessing	USN-2	Importing The Dataset into Workspace	1	Low	Jegan S
Sprint-1		USN-3	Handling Missing Data	3	Medium	Joel J D
Sprint-1		USN-4	Feature Scaling	3	Low	Kannathal A R
Sprint-1		USN-5	Data Visualization	3	Medium	Jegan S
Sprint-1		USN-6	Splitting Data into Train and Test	4	High	Harshinni M
Sprint-1		USN-7	Creating A Dataset with Sliding Windows	4	High	Kannathal A R
Sprint-2	Model Building	USN-8	Importing The Model Building Libraries	1	Medium	Jegan S
Sprint-2		USN-9	Initializing The Model	1	Medium	Harshinni M
Sprint-2		USN-10	Adding LSTM Layers	2	High	Joel J D
Sprint-2		USN-11	Adding Output Layers	3	Medium	Kannathal A R
Sprint-2		USN-12	Configure The Learning Process	4	High	Jegan S

Sprint	Functional Requirement (Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-2		USN-13	Train The Model	2	Medium	Kannathal A R
Sprint-2		USN-14	Model Evaluation	1	Medium	Joel J D
Sprint-2		USN-15	Save The Model	2	Medium	Harshinni M
Sprint-2		USN-16	Test The Model	3	High	Kannathal A R
Sprint-3	Application Building	USN-17	Create An HTML File	4	Medium	Jegan S
Sprint-3		USN-18	Build Python Code	4	High	Harshinni M
Sprint-3		USN-19	Run The App in Local Browser	4	Medium	Kannathal A R
Sprint-3		USN-20	Showcasing Prediction On UI	4	High	Joel J D
Sprint-4	Train The Model On IBM	USN-21	Register For IBM Cloud	4	Medium	Harshinni M
Sprint-4		USN-22	Train The ML Model On IBM	8	High	Jegan S
Sprint-4		USN-23	Integrate Flask with Scoring End Point	8	High	Kannathal A R

Project Tracker, Velocity &Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date(Planned)	Story Points Completed (as on Planned EndDate)	Sprint Release Date(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	20	6Days	31Oct2022	05Nov2022	20	03Nov2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	20	10Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	20	17Nov2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20(points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies suchas Scrum. However, burndown charts can be applied to any project containing measurable progress over time.

CHAPTER 7

CODING AND SOLUTION

CHAPTER 7
CODING AND SOLUTION

Interactive UI

The area where interactions between people and machines take place is known as a user interface (UI) in the subject of industrial design known as human-computer interaction. This interaction's purpose is to enable efficient machine operation and control from the human end, while the machine also feeds information back to the operators to support their decision-making. The general objective of user interface design is to provide an interface that makes it simple, effective, and pleasurable (user- friendly) to operate a machine in a way that yields the desired outcome (i.e., maximum usability). This typically means that the machine reduces undesirable outputs to the user while simultaneously requiring the operator to input as little as possible to produce the desired output.

We have included a user interface in our project to make it easier for users to forecast the price of crude oil in the future. Users simply need to visit the website to access the interface and can click a button to forecast the price. Once the button has been clicked, the user will be taken to another website where they can enter the price of crude oil for 10 days. In that case, the user should click Predict. The user can then view the price of crude oil after ten days.

7.1 Cloud Integration

The on-demand availability of computer system resources, in particular data storage (cloud storage) and processing power, without direct active supervision by the user, is known as cloud computing. Functions in large clouds are frequently dispersed over several sites, each of which is a data centre. Cloud computing often uses a "pay as you go" model, which can help reduce capital expenses but may also result in unanticipated running expenses for users. Cloud computing depends on resource sharing to accomplish coherence.

Our project is cloud-integrated, allowing it to run anywhere and be accessible atany time. Anytime the user desires, they will be able to forecast the price of crude oil. Through the IBM Cloud, this is accomplished. On the IBM Watson Studio, which makes use of the Watson Machine Learning Platform, we developed and trained the model. We generated a deployment space and ran the code using the API key todeploy the model. The Flask app, which is used to link to the backend and frontend, was then finally integrated.

CHAPTER 8

RESULT

Performance Metrics:

We attempted to forecast the output of the crude oil by entering various input variables in order to assess the accuracy and performance of this project. These are theinput values.

[0.44172960165852215, 0.48111950244335855, 0.49726047682511476, 0.4679401747371539, 0.4729749740855915, 0.47119798608026064, 0.47341922108692425, 0.4649785280616022, 0.4703835332444839, 0.47149415074781587]

The anticipated outcome after providing the input values is 0.46976325.

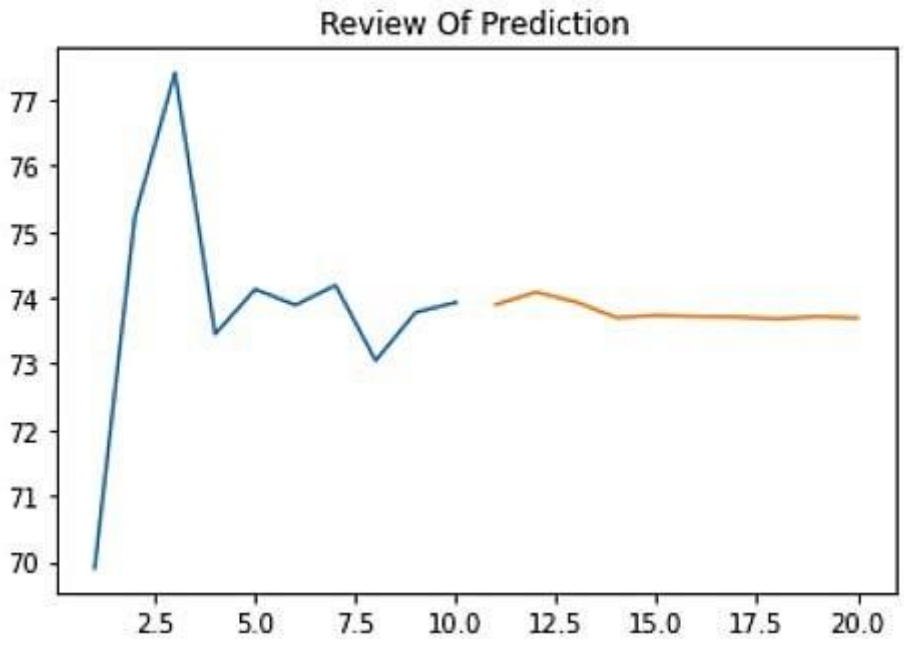

Figure 14 – Review of Prediction

Figure 13 gives a review of prediction how the system has predicted the future price based on the given input values

.

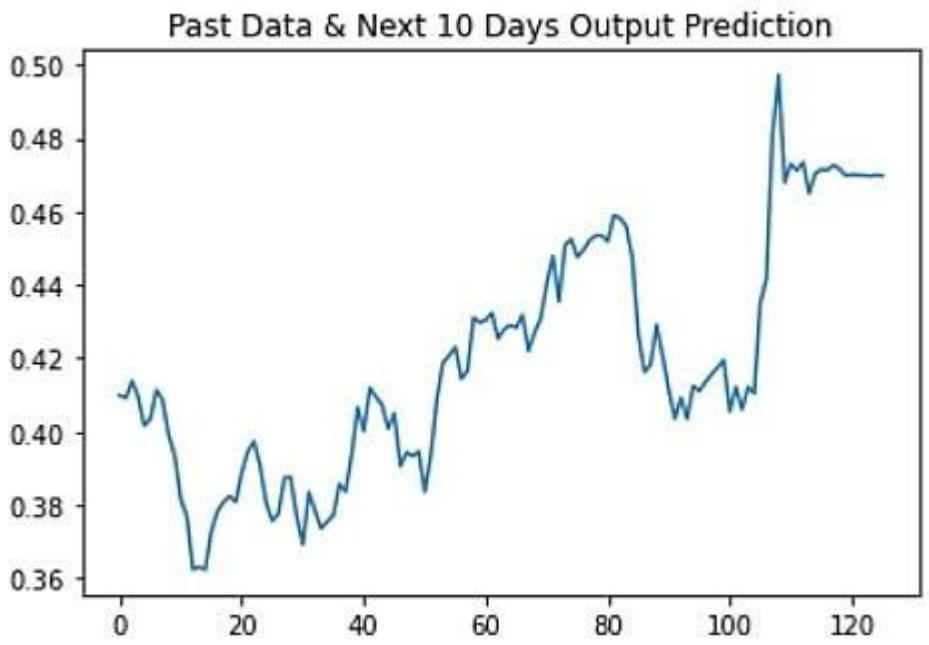

Figure 15 – Next 10 Days Prediction

It can be seen that the graph was drawn using the provided data and a projection for the next 10 days. There was a little discrepancy between the output and the real pricing.

The developed system shows a clear prediction of the future prices which has very less deviations from the true prices by using LSTM in tensor flow and karas in python. There is always a thin line between the overfitting of the model and its best performance. This project helps a lot to learn about the developed model and the algorithm and using this model as a base, a much more complicated model can be easily developed. The facet of more prediction algorithms for crude oil can concoct with the help of this system.

This system concludes that the machine learning model LSTM (Long Short- Term Method) predicts the future price of crude oil by bordering the actual price of the crude oil price.

CHAPTER 9

ADVANTAGES & DISADVANTAGES

CHAPTER 9

ADVANTAGES AND DISADVANTAGES

Advantages

- High Accuracy
- Removes the investment bias
- Develop the habit of complete analysis
- Minimise our losses
- Allows smart way of making money

High Accuracy:

The model which we predicted had a high accuracy of above 90 per cent in all aspects. The other advantages of predicting the price of crude oil are discussed below.

Removes the investment bias:

The Indian stock market offers a variety of chances for traders and investors, but it is also helpful to be aware of the market environment before taking a position in a particular stock. Take the weather prediction as an example to help you comprehend this; being aware of the weather forecast for the coming week enables you to make appropriate plans. The situation with stock market investments is comparable. Let's look at a few of the major benefits connected with stock market prediction now tohelp you grasp.

Develop the habit of complete analysis:

Investors don't always conduct a thorough research of the stock before learning how to anticipate the stock market and putting what they have learned into practice. They only start to establish the habit of comprehensive analysis before making any investing decisions after they learn how to apply formulae and procedures to forecast stock market movements. Once or initially, making a successful stock market prediction gives investors the confidence to form the habit of conducting a thorough analysis each time. Here, "complete analysis" refers to both the fundamental and the technical analysis of the stocks because the combination of these two forecasting methods results in predictions that are more precise.

Minimize our losses:

Another benefit of stock market prediction is that it significantly reduces your losses or restricts them. Investors sometimes make the error of not doing their studies thoroughly before learning how to anticipate, which results in them frequently employing the incorrect prediction strategies. As a result, many put their money into the stocks based solely on intuition or merely wild estimates in the hopes that the prices will rise, and they will profit. They lose most of the time because it doesn't happen. They can reduce their losses by correctly implementing and using the appropriate forecast strategies. The converse of this is also true, and given the information provided, you can make wise selections.

Allows smart way of making money:

Making steadily increasing profits through the use of your trading expertise and knowledge is the smart method to make money. The most desired and ideal approach to make money in the stock market is to become a day trader and make money every day, unless of course a person has long-term aspirations. But in order to do that, you must be aware of the various difficulties and difficulties that come with intraday trading, as well as how to deal with them. That can only occur when you understand how to forecast the stock market using a variety of tools and tactics and how to maximise intraday trading, enabling yourself to consistently make money.

Disadvantages

- Forecasts are never 100% accurate
- It can be time-consuming and resource-intensive

Forecasts are never 100% accurate:

Let’s face it: it’s hard to predict the future. Even if you have a great process in place and forecasting experts on your payroll, your forecasts will never be spot on. Some products and markets simply have a high level of volatility. And in general, there is just an endless number of factors that influence demand.

It can be time-consuming and resource-intensive:

Forecasting involves a lot of data gathering, data organizing, and coordination. Companies typically employ a team of demand planners who are responsible for coming up with the forecast. But in order to do this well, demand planners need substantial input from the sales and marketing teams. In addition, it’s not uncommon for processes to be manual and labor-

intensive, thus taking up a lot of time. Fortunately, if you have the right technology in place, this is much less of an issue.

CHAPTER 10

CONCLUSION

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CONCLUSION

In today's world and in such a dynamic atmosphere where everyone wants to know what will happen in the future, artificial intelligence and deep learning are the foundation for upgrading technology. The path to future prediction has been established by several facilities. It previously hard to predict the prices of cryptocurrencies since they change randomly, but machine learning has made it feasible.

By integrating LSTM in TensorFlow and karas in Python, the constructed model demonstrates a clear prediction of the future prices with very little variance from the genuine prices. Between the model being overfitted and performing at its optimum, there is always a fine line. With a few minor adjustments, the model may beapplied to different time series data. With the knowledge gained from this research, a far more complex model may be created with relative ease utilizing the generated model and algorithm as a foundation. With the aid of this model, more prediction algorithms for bitcoin may be developed.

This project comes to the conclusion that the LSTM (Long Short-Term Method) machine learning algorithm predicts the future price of crude oil by edging the current price of the oil with high accuracy

CHAPTER 11

FUTURE SCOPE

CHAPTER 11
FUTURE SCOPE

The Long Short-Term Method (LSTM) machine learning algorithm is shown tohave a high degree of accuracy in predicting the future price of crude oil by edging thecurrent price of the oil.

In the future, it will be possible to estimate crude oil prices by taking into account additional variables that influence the price, such as tweets, national news, natural disasters, the cost of forecasting, conflict, demand, and floods. By doing this, the model's precision and accuracy would both be enhanced.

The dataset will be obtained from Kaggle, a sizable platform that is frequently used for data mining and doing analysis. The model would similarly be created using these elements. If this is carried out, the accuracy of forecasting the price of crude oil will exceed 98 percent.

CHAPTER 12

APPENDIX

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APPENDIX

BUILDED PYTHON CODE

```
from flask import Flask,render_template,request #Flask is a application used to run/serve our aplication
import tensorflow as tf
from tensorflow.keras.models import load_model #we are loading our model from keras

tf.get_logger().setLevel('ERROR')
app = Flask(__name__) #our flask app
# import os
# print(os.getcwd())
model = load_model('crude_oil.h5',) #loading the model in the flask app

@app.route('/') #rendering html template
def home() :
    return render_template("index.html") #rendering html template
@app.route('/about')
def home1() :
    return render_template("index.html") #rendering html template
@app.route('/predict')
def home2() :
    return render_template("web.html") #rendering html template

@app.route('/login',methods = ['POST']) #route for our prediction
def login() :
    print()

    x_input=[x for x in request.form.values() ]
    print(x_input)
    for i in range(0, len(x_input)):
        if x_input[i]:
            x_input[i] = float(x_input[i])
        else:
            x_input[i] = 0.0
    if sum(x_input) ==0:
        return render_template("web.html",showcase = 'The predicted value is:'+" "+str(0))

    print(x_input)
    x_input=np.array(x_input).reshape(1,-1)
    temp_input=list(x_input)
```

```
    temp_input=temp_input[0].tolist()
    lst_output=[]
    n_steps=10
    i=0
    while(i<1):

        if(len(temp_input)>10):
            #print("temp input",temp_input)
            x_input=np.array(temp_input[1:])
            print("{} day input {}".format(i,x_input))
            x_input=x_input.reshape(1,-1)
            x_input = x_input.reshape((1, n_steps, 1))
            #print(x_input)
            yhat = model.predict(x_input, verbose=0)
            print("{} day output {}".format(i,yhat))
            temp_input.extend(yhat[0].tolist())
            temp_input=temp_input[1:]
            #print(temp_input)
            lst_output.extend(yhat.tolist())
            i=i+1
        else:
            x_input = x_input.reshape((1, n_steps,1))
            yhat = model.predict(x_input, verbose=0)
            print(yhat)
            temp_input.extend(yhat[0].tolist())
            # print(len(temp_input))
            lst_output.extend(yhat.tolist())
            i=i+1

    print(lst_output)


    return render_template("web.html",showcase = 'The predicted value is:'+"
"+str(lst_output))
    #return str(x)

if __name__ == '__main__' :
    app.run(debug = True,port=8080,host='0.0.0.0')
```

Html code:

```
<!DOCTYPE html>
<html>
<head>
<title>Home</title>
 <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
<style>
body
{
background-image:url("https://img.freepik.com/premium-photo/two-black-barrels-petroleum-yellow-background-small-puddle-crude-oil-spilled-ground_516190-345.jpg?w=900");
background-position: center;
font-family:Times-new roman;
background-size:cover;
margin-top:40px;
}
.pd{
padding-bottom:100%;}
.navbar
{
margin-left:10px;
padding:10px;
background-color:hsl(180, 96%, 52%);
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:30px;
font-size:30px;
box-sizing: border-box;
max-width: 18%;
text-align:right;

}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
```

```
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
}
p
{
color:turqouise;
font-style:italic;
font-size:30px;
text-align: left;
padding-left: 500px;
text-align: justify;
}
</style>
</head>
<body>
<div class="navbar">
<a href="/predict" >Predict</a>
<a href="/">Home</a>
<br>
</div>
<br>
<center><b class="pd"><font color="white" size="15" font-family="Comic Sans MS" >Crude Oil Price Prediction</font></b></center><br><br>
<div>
<br>
<center>
<p><font color="white">Demand for oil is inelastic, therefore the rise in price is good news for producers because they will see an increase in their revenue. Oil importers, however, will experience increased costs of purchasing oil.
 Because oil is the largest traded commodity, the effects are quite significant.
 A rising oil price can even shift economic/political power from oil importers to oil exporters.
 The crude oil price movements are subject to diverse influencing factors.</p>

</center>
</div>
</body>
</html>
```

```
<html>
 <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
<style>
div.header{
  top: 0;
  position: fixed;
  padding-left: 400px;}
div.header1{
  top:20;
  position: fixed;
  padding-left: 490px;
}

*{
  margin:0;
        padding:0;
        border:0;
        outline:0;
        text-decoration:none;
        font-family:montserrat;
}
.navbar
{
margin-left:10px;
padding:10px;
background-color:hsl(180, 96%, 52%);
```

```
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:30px;
font-size:30px;
box-sizing: border-box;
max-width: 18%;
text-align:center;
}
a:hover{
background-color:black;
color:white;
border-radius:16px;0
font-size:30px;
padding:10px;
}

body
{
background-image:url("https://img.freepik.com/premium-photo/two-black-barrels-petroleum-yellow-background-small-puddle-crude-oil-spilled-ground_516190-345.jpg?w=900");
background-position: center;
font-family:sans-serif;
background-size:cover;
margin-top:40px;
}

.main input[type="text"],.main input[type="text"],.main input[type="text"],.main
```

```
input[type="text"],.main input[type="text"],.main input[type="text"],.main
input[type="text"]{
        border:0;
        background:none;
        display:block;
        margin:20px auto;
        text-align:center;
        border:2px solid #800080;
        padding:15px 3px;
        width:400px;
        outline:none;
        color:white;
        border-radius:100px;
        transition:0.25s;
        font-size:20;

}
.bor{
border:0;
        background:none;
        display:block;
        margin:20px auto;
        text-align:center;
        border:2px solid #800080;
        padding:10px 3px;
        width:500px;
        outline:none;
        color:white;
```

```
        transition:0.25s;
}
.main input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus{
        width:280px;
        border-color:#8e44ad;
}
.logbtn{
        display:block;
        width:35%;
        height:50px;
        border:none;
        border-radius:24px;
        background:linear-gradient(120deg,#3498db,#8e44ad,#3498db,#8e44ad);
        background-size:200%;
        color:#fff;
        outline:none;
        cursor:pointer;
        transition:.5s;
        font-size:25;
}
.logbtn:hover{
        background-center;
}

input::placeholder{
```

```
        color:#F5FFFA;
}
.bottom-text{
        margin-top:60px;
        text-align:center;
        font-size:13px;

}

</style>
<body>
<div class="navbar">
<a href="/">Home</a>
<br>
</div>
        <center><div><font color="Powderblue" font-family="sans-serif" size=8
><b>Crude Oil  Price Prediction</b></font></div></center>


<br><br><br><br>
        <form class="main" action="/login" method="post">
                <br>
                <font size=20><input type="text" name="year1" placeholder="Enter
previous 10th day price"/></font>
                <font size=20><input type="text" name="year2" placeholder="Enter
previous 9th day price"/></font>
                <font size=20><input type="text" name="year3" placeholder="Enter
previous 8th day price"/></font>
```

```
            <font size=20><input type="text" name="year4" placeholder="Enter
previous 7th day price"/></font>
            <font size=20><input type="text" name="year5" placeholder="Enter
previous 6th day price"/></font>
            <font size=20><input type="text" name="year6" placeholder="Enter
previous 5th day price"/></font>
            <font size=20><input type="text" name="year7" placeholder="Enter
previous 4th day price"/></font>
            <font size=20><input type="text" name="year8" placeholder="Enter
previous 3th day price"/></font>
            <font size=20><input type="text" name="year9" placeholder="Enter
previous 2nd day price"/></font>
            <font size=20><input type="text" name="year10"placeholder="Enter
previous 1st day price"/></font>
            <center><input type="submit" class="logbtn"
value="Predict"></center>
            <div class="bor"><b><font color="white"
size=5>{{showcase}}</font></b></div>
        </form>
</div>
</body>
</html>
```