

PROJECT REPORT

CRUDE OIL PRICE PREDICTION

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Darshini B - CITC1907006

Deveshwar R- CITC1907008

Kausik Subramanaiyam G - CITC1907019

Shunmuga Sundaram.K – CITC2007206

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CHAPTER 1 - INTRODUCTION

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Oil demand 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.

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. Time series analysis is the best option for this kind of prediction because we are using the Previous history of crude oil prices to predict future crude oil. So we would be implementing RNN(Recurrent Neural Network) with LSTM(Long Short Term Memory) to achieve the task.

1.2 PURPOSE

The purpose of this project is to help the society use the crude oil In an efficient way and also to help the vendors and buyers in the crude oil industry by providing them with an user friendly platform so that they will be able to know about the immediate future through which they will be able to make decisions wisely and avoid wastage/loss in business as well as resources. This can also lead to the reduction in scarcity of the resources since it is utilised efficiently.

CHAPTER 2 – LITERATURE SURVEY

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

With rising global demand, highly volatile prices and increasingly stringent environmental regulations, the oil and gas industry faces three major challenges : reduce costs, optimize the performance of its industrial base assets and improve its environmental footprint. The oil and gas sector in Kenya faces various challenges such as inadequate capacity, weak institutional framework, revenue management, weak bargaining power, lack of transparency and accountability. However these challenges can be strengthened through reinforcement.

2.2 REFERENCES

- [1] Yu Runfang, Du Jiangze and Liu Xiaotao, "Improved Forecast Ability of Oil Market Volatility Based on combined Markov Switching and GARCH-class Model, *Procedia Computer Science*, vol. 122, pp. 415-422, 2017.
- [2] K. Greff, R. K. Srivastava, J. Koutník, B. R. Steunebrink and J. Schmidhuber, "LSTM: A Search Space Odyssey," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 28, no. 10, pp. 2222-2232, Oct. 2017.
- [3] Mohammad Reza Mahdiani and Ehsan Khamsehchi, "A modified neural network model for predicting the crude oil price", *Intellectual Economics*, vol. 10, no. 2, pp. 71-77, Aug. 2016.
- [4] Manel Hamdi and Chaker Aloui, "Forecasting Crude Oil Price Using Artificial Neural Networks: A Literature Survey," *Economics Bulletin, AccessEcon*, vol. 35, no. 2, pp. 1339-1359, 2015.
- [5] Aloui, Chaker & Hamdi, Manel. (2015). Forecasting Crude Oil Price Using Artificial Neural Networks: A Literature Survey. *Economics Bulletin*. 35. 1339-1359.

2.3 PROBLEM STATEMENT DEFINITION

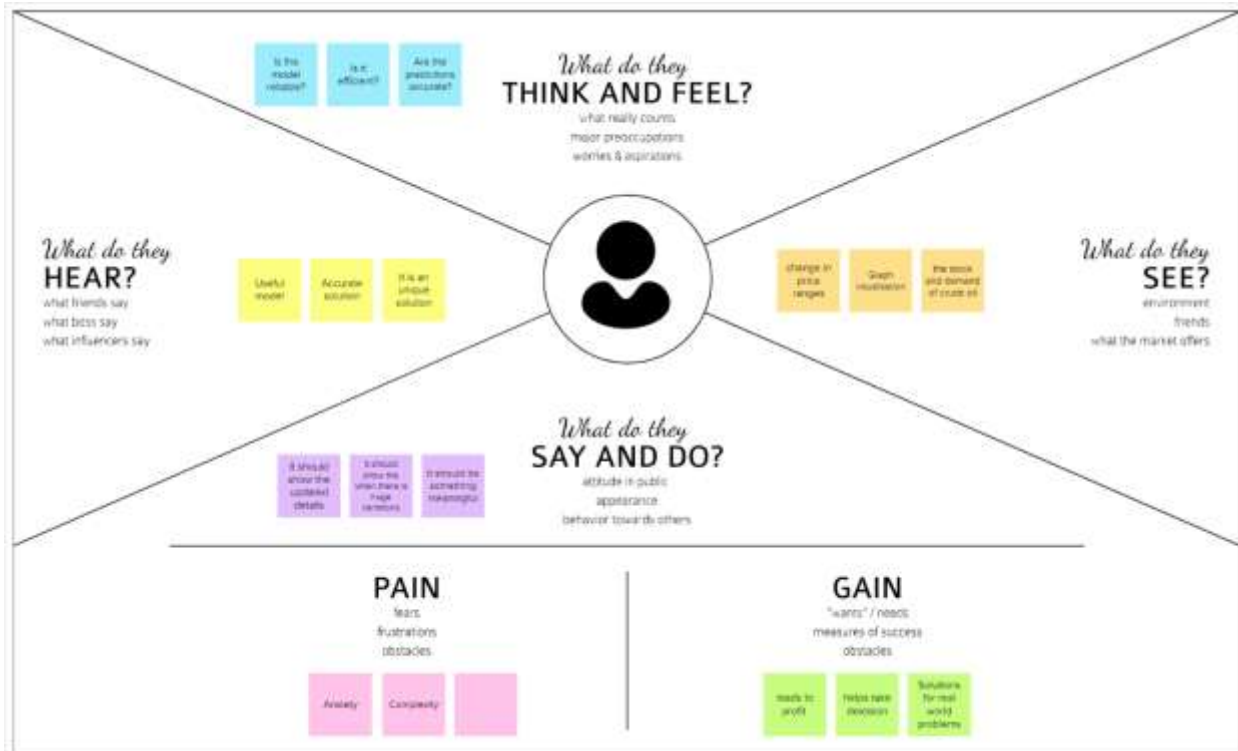
The Government, private and public enterprise, policymakers and investors are mainly dependent on the price fluctuations and it is an very important aspect to them. Thus the crude oil price causes a global economic impact and it can be prevented by predicting the price which minimises the risks associated with the volatility in oil prices. Petrol bunk owners, Crude oil investors , Investors who invest on products the runs or depends on crude oil are the ones who are the most affected. Crude oil price changes every day. It depends on many factors. Sudden fluctuations in the crude oil can result in major changes. So, prediction of the crude oil price can help to cut the loss percentage, and increase the profit margin. It can

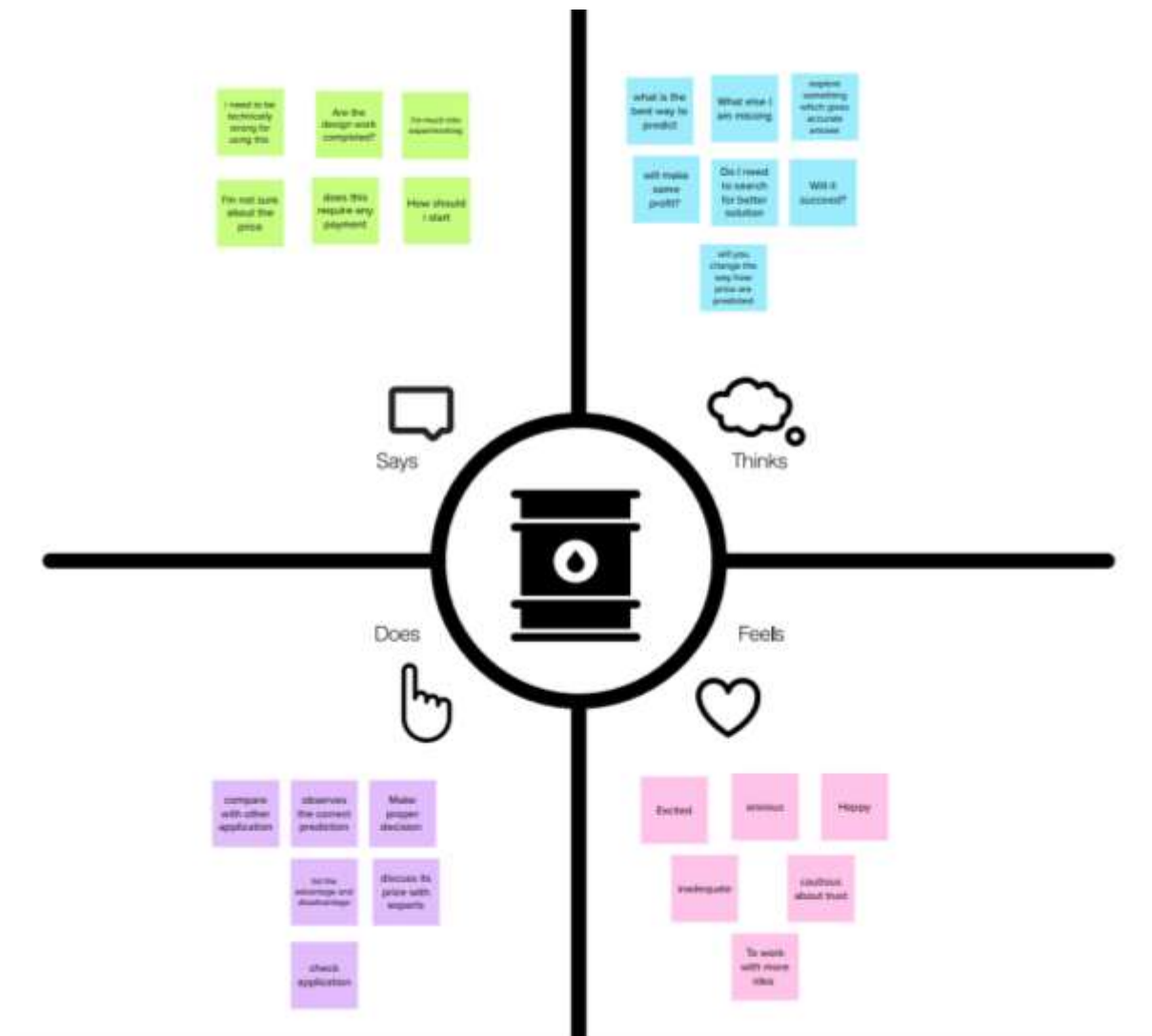
also help to overcome the demand supply issues. This issue occurs in the investment related areas and also affects the product development and functioning that depends on crude oil. Solving this problem can increase the profits from investment. It may not only help individuals but also can affect national level income. Machine learning and deep learning algorithms can be used in order to provide the solution for this problem.

CHAPTER 3 – IDEATION AND PROPOSED SOLUTION

3.IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS





3.2 IDEATION & BRAINSTORMING

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

10 minutes to prepare
15 minutes to collaborate
2-8 people recommended

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

1. **Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

2. **Set the goal**
Think about the problem you're focusing on solving in the brainstorming session.

3. **Learn how to use the facilitation tools**
Use the Facilitation Superpowers to host a happy and productive session.

Open agenda

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

10 minutes

How might we [your problem statement]?

Key rules of brainstorming
To ensure smoothly and productively sessions

- Stay in topic
- Encourage wild ideas
- Defer judgment
- Build on others
- Go for volume
- It's possible, be visual

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil (switch to sketch) icon to start drawing!

Kausik Subramaniyam G

Define and understand the problem statement	Considered related govt	Turnover percentage recommendation on
Referring Local energy prices	Number of electric cars	Check for solutions
Consider the implementation using different resources		

B.Darshini

Prior fluctuation	To reduce the usage of oil	alternative non-oil based oil
Explore the most optimal solution	How development of alternatives to oil	Collection of large amount to improve economy
Reduce the adverse effect		

Deveshwar.R

First, Metrics to calculate efficiency	Think about the social impacts	Avoid to create transportation
Improving scale of and assess price fluctuations	Make activities fast efficient	Flexible platform

Shunmuga Sundaram.K

Evaluate the algorithms	Examine the algorithms	Order Oil stock and demand
Reduce the usage of oil	visualize using graphs	Define and understand the problem statement

Person 5

Person 6

Person 7

Person 8

Practical Feasibility

Create models based on societal impacts. We will have to decide a time frame when the number of global crisis events significant.

Data Set

Data Sets will be collected from various possible sources

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

Training Data

Data is trained using different algorithms and best model is chosen, according to the metrics

Alternative and Availability

Alternatives for oil, reduction of usage and crude oil supply, stocks will be updated

Environmental impacts

Environmental regulations, russia ukraine war



3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Crude oil is one the most important need in day to day life, and its prices have a big impact on the global environment and the prediction of prices will be useful to government, industry and individuals. The continuous usage of statistical and econometric techniques including AI for crude oil price prediction might demonstrate demotions to the prediction performance. The price might the used to be the

		time analysis prediction which will help in buying the crude oil at the best time period. This is enable the industries to increase the profit rate.
2.	Idea / Solution description	A data driven approach is used to predict the prices. RNN is used to achieve future crude oil prices using previous history of crude oil. The cost is measured to determine its effectiveness. The performance of the proposed model is evaluated using the price data and other materials.
3.	Novelty / Uniqueness	Building an user friendly interface, to enable any kind of user to make use of the application. The prediction will be made not only based on the prices but also considering other factors affecting the price fluctuation. Application will help the industries and the government benefit in many ways.
4.	Social Impact / Customer Satisfaction	By predicting the crude oil prices it will help the users be prepared for uncertainties and improve the performance. It will also help to stabilise the economy. Price has direct effect on several goods and products and its fluctuations affect the stock markets. The prices are also affected by other factors.
5.	Business Model (Revenue Model)	These days the business using supply chain rely on crude oil for transportation. So the prediction of crude oil prices will help the firms increase the profit rate and also result in growth of the firm. It can help decision makers such as firms, private investors, or individuals chose to buy or sell the crude oil . Crude oil is one of the most profitable trading commodities for traders. RNN and LSTM models are used as the key model to predict the crude oil prices.
6.	Scalability of the Solution	User friendly application to enable users to access from anywhere. Algorithms and methods are used to improve the accuracy and prediction.

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) <small>Who is your customer? i.e. working parents of 0-3 yrs. kids</small> CS	6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choice of solution? i.e. spending power, budget, no cash, network connectivity, available devices</small> CC	5. AVAILABLE SOLUTIONS <small>What solutions are available to the customer when they face the problem?</small> AS	Explore AS, differentiate
	<p>The crude oil industries, crude oil investors and all the people in the society will be the customers. Anyone who is involved in the crude oil sector can be benefited.</p>	<p>User must follow the guidelines Proper Internet Connectivity There is no requirement to spend much money to use the software</p>	<p>or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital solution</p> <p>If crude oil price goes <u>low</u>, the easiest way to take advantage of the low prices is to fleece the bears. In case of failures the price prediction can be given updated through social media and newspapers. The predicted details are available in dashboard, which will be available without internet connectivity in the portal.</p>	
Focus on JAP - up into RC, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS <small>What jobs to be done (or problems) do you address for your customer? There could be more than one, explore different roles</small> J	9. PROBLEM ROOT CAUSE <small>What is the real reason that the problem exists? What is the back story behind the need to do the job? i.e. customers have to do it because of the change in regulations</small> RC	7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done?</small> BE	Focus on JAP - up into RC, understand RC
	<p>Websites crashes should be avoided. Improve the accuracy and the <u>cost efficient</u> application model. Growing economies increase demand for energy in general and especially for transportation.</p>	<p>Changing pattern of oil prices with respect to time. Crude oil price fluctuations have a great impact on global economy thus predicting crude oil price will help us taking minimal risks.</p>	<p><u>BE</u> directly related: find the right order panel install, calculate usage and benefits indirectly associated: customers spend less time on volunteering work (i.e. Greenpeace)</p> <p>Sharing the problem about crude oil price prediction on their sharing on social media. The Closing Price helps the investor understand the market sentiment of the stocks over time. It is <u>most</u> to determine the valuation of stock until the market resumes trading the next day.</p>	
Identify strong TR & EM	3. TRIGGERS <small>What triggers customers to act? i.e. seeing their <u>gasoline</u> rising faster prices, seeing about a more efficient solution on the news</small> TR	10. YOUR SOLUTION <small>If you are working on an existing business, write down your current solution flow. Write the process, and check how much it fits reality. If you are working on a new business proposition, then keep it tight with you fit to the canvas and come up with a solution that fits within customer behaviors, solve a problem and matches customer <u>behavior</u></small> S	8. CHANNELS OF BEHAVIOUR <small>S.T. ONLINE</small> <small>What kind of channels do customers take online? External online channels from 8T</small> CH	Identify strong TR & EM
	<p>Cost Effective Seeing another alternative which is more effective</p>	<p>A data driven approach is used to predict the prices. RNN is used to achieve future crude oil prices using previous history of crude oil. The cost is <u>measured to</u> determine its effectiveness. The performance of the proposed model is evaluated using the price data and other materials.</p>	<p>Looking for the latest crude oil prices</p> <p><u>ALJ</u> (OFFLINE) What kind of actions do customers take offline? External offline channels from 8T and use them for customer development.</p> <p>Performing tests on using the appropriate metrics Analysis</p>	
4. EMOTIONS: BEFORE / AFTER <small>How do customers feel when they face a problem or a job and afterwards? i.e. less, increase in confidence, in comfort - use it to shape communication strategy & design</small> EM				
<p>Reliability and Trust worthy Fear of loss in profit</p>				

CHAPTER 4 – REQUIREMENT ANALYSIS

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

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 Additional Features	User Can Read Latest information And View Oil Price User friendly records and history of prices are visible
FR-4	User Exceptions	User Can Exchange Rates And convert currencies
FR-5	User Support	FAQ's and any other queries raised will be answered
FR-6	Database	The Information given by the user is stored
FR-7	Notifications	Daily updates and notifications are sent to the user
FR-8	Generating Results	Oil Price Prediction

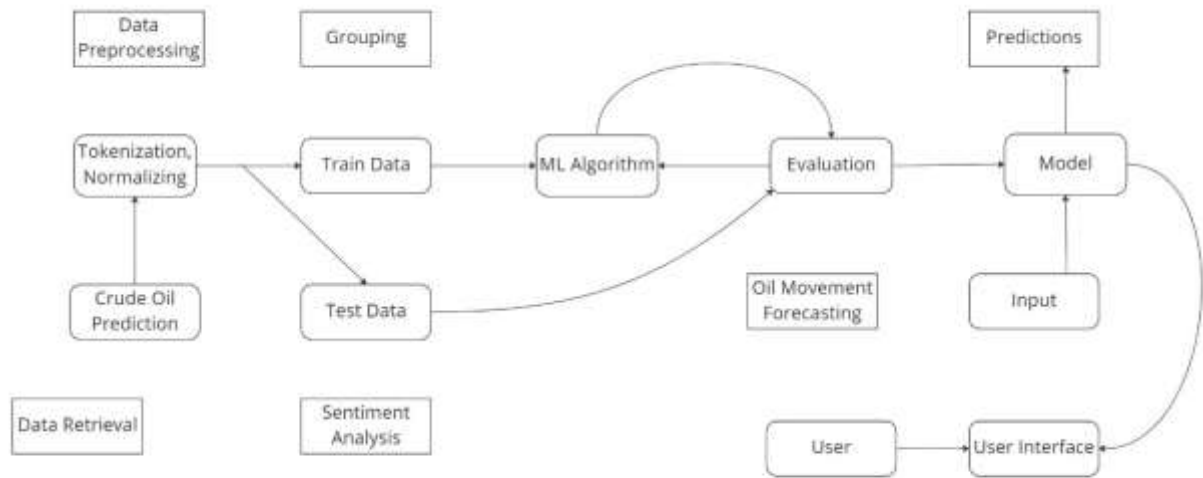
4.2 NON-FUNCTIONAL REQUIREMENT

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It is easy to use for a client and the portal will be user friendly. It can be used by clients of any age group
NFR-2	Security	Sensitive data is being protected and the login information is hashed. Some data require authentication in order to view
NFR-3	Reliability	The data will be reliable since it is updated on the day to day basis with accurate information from multiple resources.
NFR-4	Performance	The portal can be used at a low bandwidth network connection in a hassle free manner. Fast and smooth working of the portal is ensured.
NFR-5	Availability	The history of the previous predictions will be available, updates are also sent regularly.
NFR-6	Scalability	The storage space can be expanded and the required data can be given on demand

CHAPTER 5 – PROJECT DESIGN

5.PROJECT DESIGN

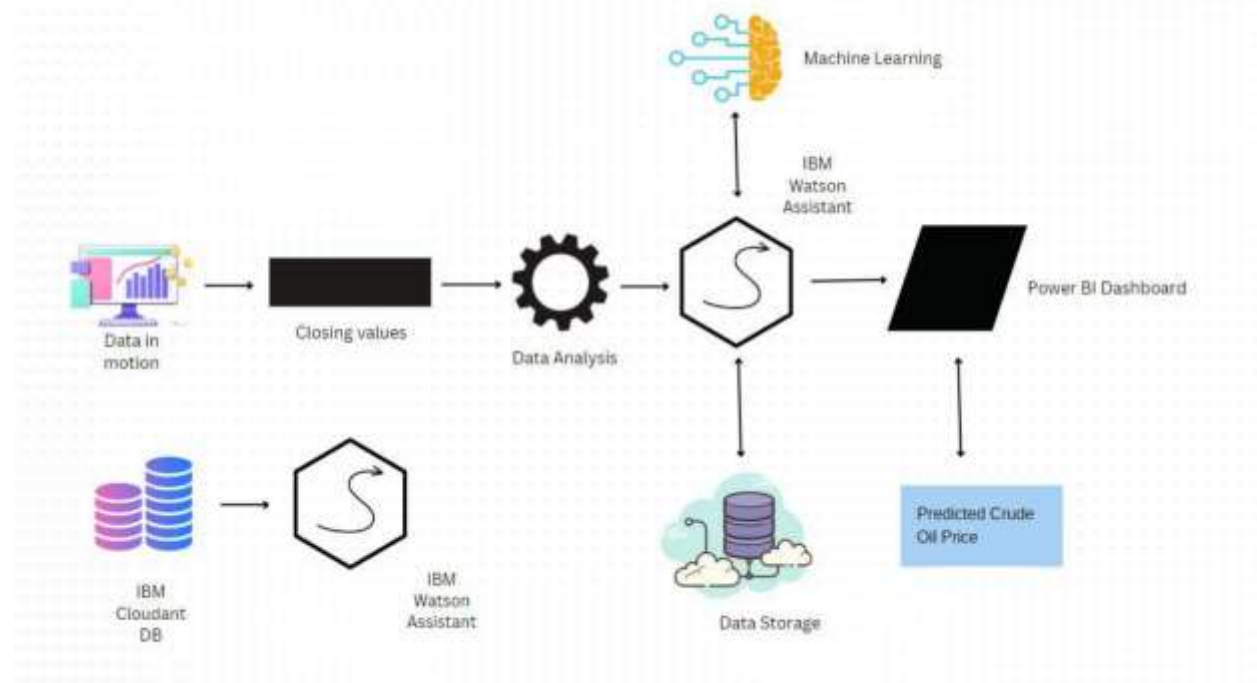
5.1 DATA FLOW DIAGRAMS



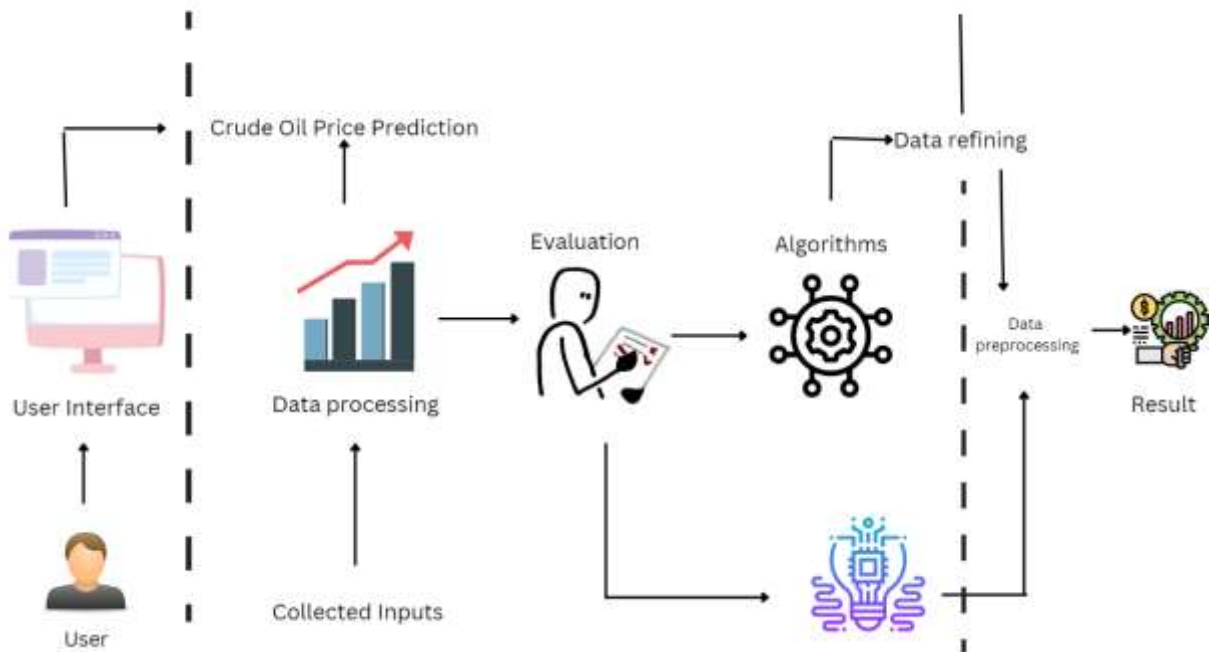
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5.2 SOLUTION AND TECHNICAL ARCHITECTURE

Solution Architecture :



Technical Architecture :



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 email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		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	Medium	Sprint-1

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
				through existing gmail account.		
	Login	USN-5	As a user, I can log into the application by entering email & password	after registration,I can log in by only registered details	High	Sprint-1
	Dashboard (graphs)		After entering the inputs,the model will statistical results	Can be logged in through gmail or other social media account	High	Sprint-3
Customer (Web user)	Login	USN-1	As the web user,I can login simply by using Social Media Account.(gmail,facebook,linkedin)	An existing account can be used for login	Medium	Sprint-2
Customer Care Executive	Support		The help and support section will work towards the FAQ and the chatbot will reply to basic questions	I can solve the problems arised by Customers	Low	Sprint-3
Administrator	News		Admin will give the recent updates of Oil Prices.	Provide the recent oil prices	High	Sprint-4
	Notification		Admin will notify the customers with the oil prices changes and other updates.	Notification by Gmail and SMS	High	Sprint-4
	Accessibility		Admin can control the access of users	Access permission for Users	High	Sprint-4
	Database		Admin can store the details of users.	Admin can store the details of users.	High	Sprint-4

CHAPTER 6 – PROJECT PLANNING AND SCHEDULING

6.PROJECT PLANNING AND SCHEDULING

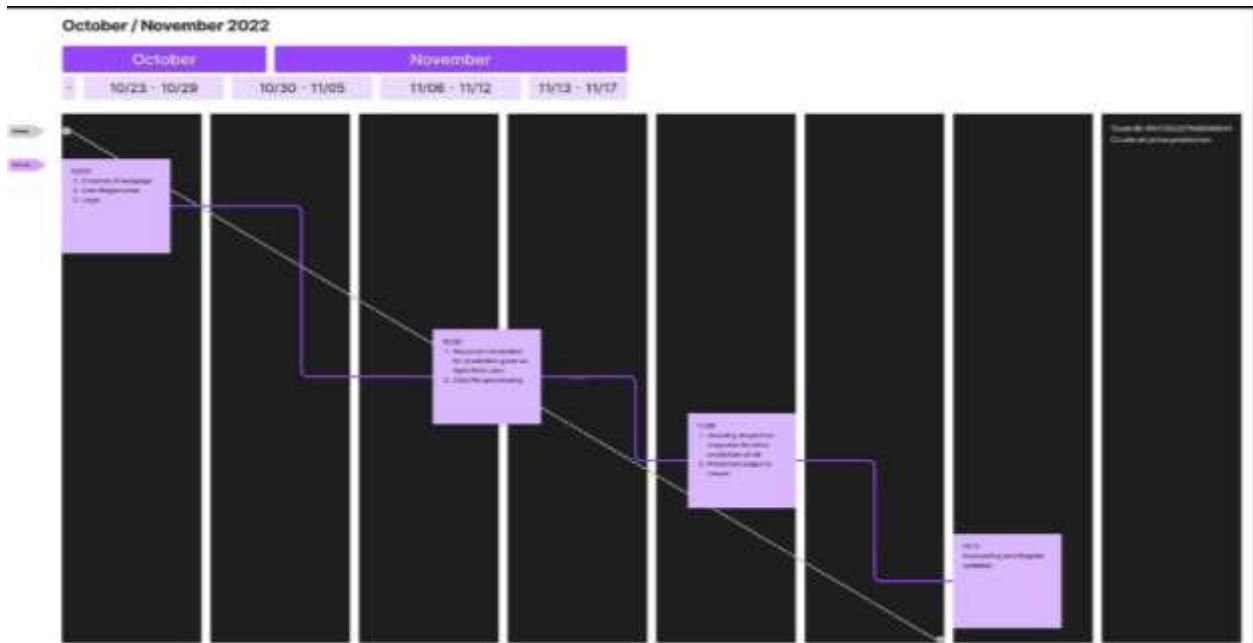
6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	10	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-1	Login	USN-3	As a user, I can register for the application through Facebook	15	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-2	Input	USN-4	As a user, I can give Input Details to Predict Likelihood of crude oil	15	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-2	Data pre-processing	USN-5	Transform raw data into suitable format for prediction.	15	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-3	Prediction of crude oil price	USN-6	As a user, I can predict Crude oil using machine learning model.	20	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-3		USN-7	As a user, I can get accurate prediction of crude oil	5	Medium	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K
Sprint-4	Review, Deployment	USN-8	As a user, I can give feedback of the application	20	High	Kausik Subramaniam.G ,B.Darshini,Deveshwar.R, Shunmuga Sundaram.K

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	14 Nov 2022

6.3 REPORTS FROM JIRA



CHAPTER 7 – CODING AND SOLUTIONING

7.CODING AND SOLUTIONING

7.1 STATISCAL VISUALIZATION

The statistics of the crude oil price trends are displayed on the website which will enable the users to visualize the trends of the crude oil price. Various trends can be seen rather than having only a single graph. Multiple trends based on the time is recorded and displayed respectively.

CODE :

```
<html>
```

```
<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;

}
```

```
body

{

background-image:url("{ {url_for('static', filename='zp.png')} }");

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 black;

padding:15px 3px;

width:400px;

outline:none;

color:black;

border-radius:0px;

transition:0.25s;
```

```

        font-size:20;

    }

    .bor{
border:0;

        background:none;

        display:block;

        margin:20px auto;

        text-align:center;

        border:2px solid black;

        padding:10px 3px;

        width:500px;

        outline:none;

        color:black;

        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;

        color: black;

        border-color:black;

    }

    .logbtn{

        display:block;

        width:35%;

        height:50px;

        border:none;

```

```
border-radius:24px;

background:linear-gradient(120deg,#3498db,#8e44ad,#3498db,#8e44ad);

background-size:200%;

color:black;

outline:none;

cursor:pointer;

transition:.5s;

font-size:25;

}

.logbtn:hover{

background-center;

}


input::placeholder{

color:purple;

font-family: verdana;

font-size: 15;

}

.bottom-text{

margin-top:60px;

text-align:center;

font-size:13px;

}


</style>
```

```

<body>

<div class="navbar">

<a href="/contact" style="font-size: 20px;color: blue;font-family: verdana;" >Contact | </a>

<a href="/" style="font-size: 20px;color: blue;font-family: verdana;" >Home</a>

<br>

<center>

<h1 style="color: white;font-family: verdana;font-size:
50px;">STATISTICS</h1></center><br><br><br><br>

<center><br></center><br><br>

<center><br></center><br><br>

<center></center>

</body>

</html>

```

7.2 LSTM WITH DROP OUT

We have built another layer with drop out to compare the accuracy of different models.

CODE :

```

import matplotlib.pyplot as plt

import pandas as pd

import numpy as np

import datetime

import warnings

import itertools

```

```

import statsmodels.api as sm

import seaborn as sns

data=pd.read_excel("Crude Oil Prices Daily.xlsx")

data.isnull().any()

data.dropna(axis=0,inplace=True)

data.isnull().sum()

data.head()

oil_price=data.reset_index()['Closing Value']

oil_price

from sklearn.preprocessing import MinMaxScaler

scaler=MinMaxScaler(feature_range=(0,1))

oil_price=scaler.fit_transform(np.array(oil_price).reshape(-1,1))

lst_output=[]

n_steps=10

i=0

while(i<10):

    if(len(temp_input)>10):

        #print(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[0])  
    temp_input.extend(yhat[0].tolist())  
    print(len(temp_input))  
    lst_output.extend(yhat.tolist())  
    i=i+1  
df3=oil_price.tolist()  
df3.extend(lst_output)  
plt.plot(df3[8100:])
```

CHAPTER 8 – TESTING

8.TESTING

8.1 TEST CASES

Sprint 1 :

Test Scenario	Pre-Requisite	Steps To Execute
Collect all the necessary datasets for the project	Dataset	1. Collect Dataset required for the project.
Check if the login details is appropriate and login in to the portal	Registered credentials	1. Enter the appropriate details
Accept only if the details are not existing	User data	Enter a new detail which is not registered with the portal

Sprint 2 :

Test Scenario	Pre-Requisite	Steps To Execute
Check if the data is able to be normalized and fitted	Data Set	1. Data preprocessing
Verify whether the model gives accurate statistical results	Data Set	1. Image Processing 2. Compiling the Deep Learning Model
Verify whether the data is splitted properly into train and test data	Visualization	Compile the model, Run the code Check for errors

Sprint 3 :

Test Scenario	Pre-Requisite	Steps To Execute
To Test the Model with the Test Data	Model Building	1. Fit the test data to the model 2. Calculate the accuracy
To Test the Model with Different algorithms	Model Building	1. Fit the data to the model

8.2 USER ACCEPTANCE TESTING

DEFECT ANALYSIS

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	3	3	4	19
Duplicate	2	1	2	0	5
External	1	5	1	0	7
Fixed	8	4	5	17	34
Not Reproduced	0	0	1	0	1
Skipped	0	1	0	0	1
Won't Fix	0	4	3	2	9
Totals	20	18	15	23	76


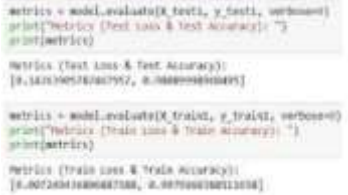
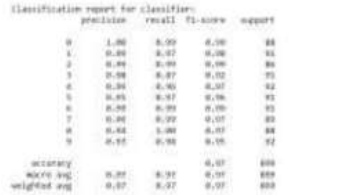

TEST CASE ANALYSIS

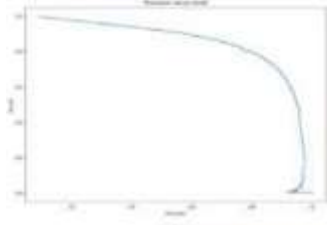
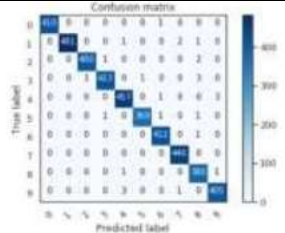
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	2	0	0	2
Client Application	1	0	0	1
Security	2	0	0	2
Outsource Shipping	0	0	0	0
Exception Reporting	1	0	0	1
Final Report Output	3	0	0	3
Version Control	0	0	0	0

CHAPTER 9 – RESULTS

9. RESULTS

9.1 PERFORMANCE METRICS

S.No.	Parameter	Values	Screenshot
1.	Model Summary	Model: "sequential" Layer (type) Output Shape Param # conv2d (Conv2D) (None, 26, 26, 64) 640 conv2d_1 (Conv2D) (None, 24, 24, 32) 18464 flatten (Flatten) (None, 18432) 0 dense (Dense) (None, 10) 184330 Total params: 203,434 Trainable params: 203,434 Non-trainable params: 0	
2.	Accuracy	Training Accuracy - 0.9979166388511658 Validation Accuracy -0.98089998960495	
3.	Metrics	Classification Model: precision, recall, f1-score, support	
4.	Metrics	ROC (Receiver Operating Characteristics) curve	

5.	Metrics	Precision-Recall or PR curve	
6.	Metrics	Confusion Matrix	

CHAPTER 10 – ADVANTAGES AND DISADVANTAGES

10. ADVANTAGES

According to economic theory, the price of crude oil should be easily predictable from the equilibrium between demand and supply, wherein demand forecasts are usually made from GDP, exchange rates and domestic prices, and supply is predicted from past production data and reserve data.

Prediction of future crude oil price with the history

The statistical records are displayed which will improve the users usability

DISADVANTAGES

Only if the data for the past 10 days is available the future can be prediction can be made. So the previous data is crucial.

CHAPTER 11 – CONCLUSION

11.CONCLUSION

For predicting the crude oil price, we have chosen the machine learning approach to study the crude oil price dataset. We have applied various deep learning algorithms to decide which one will be the best for applying on the dataset to get the result with the highest accuracy.

CHAPTER 12 – FUTURE SCOPE

12.FUTURE SCOPE :

In the future modules will be developed and the project will be made use as a tool to make the users more efficient and help them take wiser decisions. The model will be developed with various features which includes the admin module to manage the usage and the data more wisely. It will also be made into a live portal which shows the statistical data of the crude oil price as well the updates will be sent to the users registered dashboard as well as the email and contact credentials. By building such a model some of the people in the society might be use it for a good cause.

CHAPTER 13 – APPENDIX

13.APPENDIX

SOURCE CODE :

```
import numpy as np # used for numerical analysis

from flask import Flask, render_template, request, url_for, redirect # Flask is a application used to
run/serve our application

# request is used to access the file which is uploaded by the user in our application

# render_template is used for rendering the html pages

from tensorflow.keras.models import load_model # we are loading our model from keras

app = Flask(__name__) # our flask app

model = load_model('crude_oil_price_prediction.h5') # loading the model in the flask app

@app.route('/', methods=['GET', 'POST'])

def home():

    error = None

    if request.method == 'POST':

        if request.form['username'] != "admin" or request.form['password'] != "admin":

            error = 'Invalid Credentials. Please try again.'

        else:

            return redirect(url_for('mains'))

    return render_template('login.html', error=error)
```

```
@app.route('/mains', methods=['GET', 'POST'])

def mains():

    return render_template('index.html')

@app.route('/stats', methods=['GET', 'POST'])

def stats():

    return render_template('stats.html')

@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('/contact')

def contact():

    return render_template("contact.html")

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

def login():

    a = request.form['year1']

    b = request.form['year2']
```

```

c = request.form['year3']

d = request.form['year4']

e = request.form['year5']

f = request.form['year6']

g = request.form['year7']

h = request.form['year8']

i = request.form['year9']

j = request.form['year10'] # requesting the file

x_input = [[float(a), float(b), float(c), float(d), float(e), float(f), float(g), float(h), float(i), float(j)]]

print(x_input)

lst_output = model.predict(x_input)

lst_output = np.round(lst_output[0][0], 2)

return render_template("web.html", showcase="The Predicted crude oil price is : Rs. "+str(lst_output))

if __name__ == '__main__':

    app.run(debug=False)

```

MODEL BUILDING

```

from tensorflow.keras.layers import LSTM

from tensorflow.keras.layers import Dense

from tensorflow.keras.models import Sequential

model=Sequential()

```

```

model.add(LSTM(50,return_sequences=True,input_shape=(10,1)))

model.add(LSTM(50,return_sequences=True))

model.add(LSTM(50))

model.add(Dense(1))

model.summary()

model.compile(loss='mean_squared_error',optimizer='adam')

model.fit(x_train,y_train,validation_data=(x_test,y_test),epochs=30,batch_size=64,verbose=1)

train_predict=scaler.inverse_transform(train_data)

test_predict=scaler.inverse_transform(test_data)

import math

from sklearn.metrics import mean_squared_error

math.sqrt(mean_squared_error(train_data,train_predict))

from tensorflow.keras.models import load_model

model.save("crude_oil_price_prediction.h5")

look_back=10

trainpredictPlot = np.empty_like(oil_price)

trainpredictPlot[:, :]= np.nan

trainpredictPlot[look_back:len(train_predict)+look_back, :] = train_predict

testPredictplot = np.empty_like(oil_price)

testPredictplot[:, : ] = np.nan

```

```
testPredictplot[look_back:len(test_predict)+look_back, :] = test_predict
```

```
plt.plot(scaler.inverse_transform(oil_price),color="red")
```

```
plt.show()
```

```
len(test_data)
```

```
x_input=test_data[2866:2876].reshape(1,-1)
```

```
x_input.shape
```

```
temp_input=list(x_input)
```

```
temp_input=temp_input[0].tolist()
```

```
lst_output=[]
```

```
n_steps=10
```

```
i=0
```

```
while(i<10):
```

```
    if(len(temp_input)>10):
```

```
        x_input=np.array(temp_input[1:11])
```

```
        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[0])

temp_input.extend(yhat[0].tolist())

print(len(temp_input))

lst_output.extend(yhat.tolist())

i=i+1

day_new=np.arange(1,11)

day_pred=np.arange(11,21)

len(oil_price)

plt.plot(day_new, scaler.inverse_transform(oil_price[8206:]))

plt.plot(day_pred, scaler.inverse_transform(lst_output))

df3=oil_price.tolist()

df3.extend(lst_output)

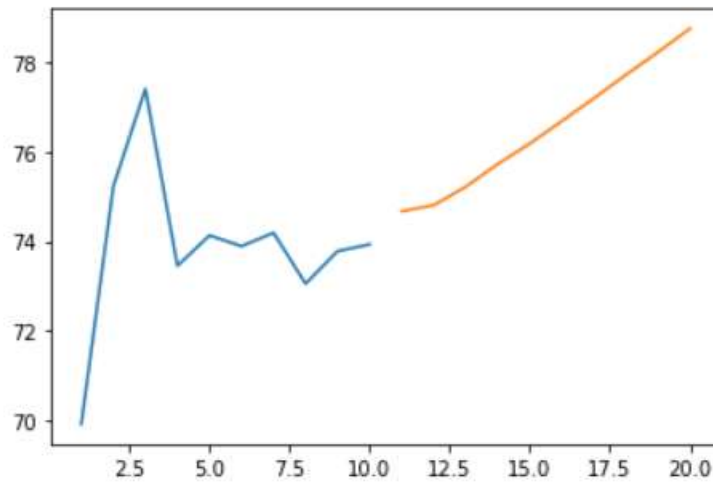
plt.plot(df3[8100:])

```

```
df3=scaler.inverse_transform(df3).tolist()
```

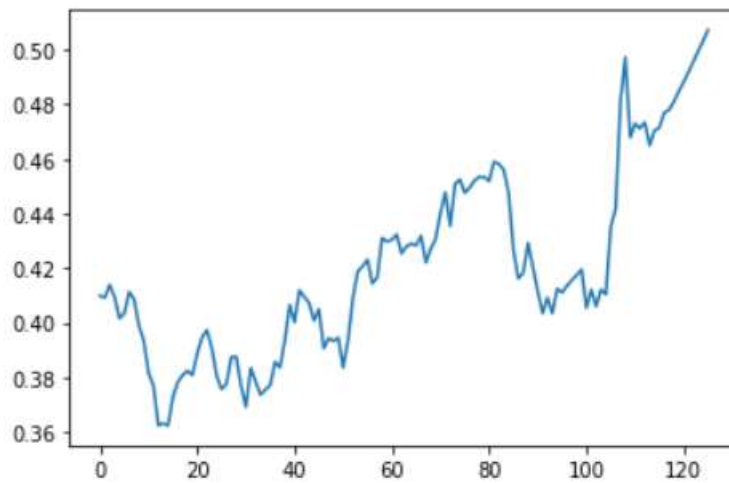
```
plt.plot(scaler.inverse_transform(oil_price))
```

Out[46]: []



```
In [47]: df3=oil_price.tolist()  
df3.extend(lst_output)  
plt.plot(df3[8100:])
```

Out[47]: []



```
In [48]: df3=scaler.inverse_transform(df3).tolist()
```

GITHUB AND PROJECT DEMO LINK:

Github :

<https://github.com/IBM-EPBL/IBM-Project-13344-1659516895>

Project Demo Link:

https://drive.google.com/file/d/1aGhMBd6bYX4x548pyD8KPqASCaRv_8Ou/view?usp=share_link