**TEAM ID : PNT2022TMID28055**

# CRUDE OIL PRICE PREDICTION

# INDEX

# 1. INTRODUCTION

## 1.1 PROJECT OVERVIEW

Crude oil is amongst the most important resources in today'sworld, it is the chief fuel, and its cost has a direct effect on the global habitat, our economy and oil exploration, exploitation and otheractivities. Prediction of oil prices has becomethe need of the hour, it is a boon to many large and small industries, individuals, the government. The evaporative natureof crude oil, its price prediction becomesextremely difficult, and it is hard to be precise with the same. Several different factors that affect crude oil prices. We propose a contemporary and innovative method of predicting crude oil prices using the artificial neural network (ANN). The main advantage of this 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 numberof the delay effect that controls the prices of crude oil. Variation of lag in a period 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 obtainedusing the proposedmodel have significantlyoutperformed

## 1.2 PURPOSE

Crude oil price fluctuations have a far reaching impact on global economies and thus priceforecasting can assist in minimising the risks associated with volatility in oil prices.Price forecasts are very importantto various stakeholders: governments, public and private enterprises, policymakers, and investors. Energyhas been a crucial production input in the production activities and economic growth and development processes of many countries. In fact, in the face of the global call for sustainable environment through the promotion of green energy sources, the role of fossil fuels, especially crude oil, cannot still be sufficiently relegatedparticularly in many industrialized and energy-dependent economies.

# 2. LITERATURE SURVEY

## 2.1 EXISTING PROBLEM

In recent years, the crude oil market has entered a new period of development and the core influence factors of crude oil have also been a change. Thus, we develop a new research framework for core influence factors selection and forecasting. Firstly, this paper assesses and selects core influence factors with the elastic-net regularized generalized linear Model (GLMNET), spike-slab lasso method, and Bayesian model average (BMA). Secondly, the new machine learning method long short-term Memory Network (LSTM) is developed for crude oil price forecasting. Then six different forecasting techniques, random walk (RW), autoregressive integrated moving average models (ARMA), Elman neural Networks (ENN), ELM Neural Networks (EL), walvet neural networks (WNN) and generalized regression neural network Models (GRNN) were used to forecast the price. Finally, we compare and analyse the different results with root mean squared error (RMSE), mean absolute percentage error (MAPE), directional symmetry (DS). Our empirical results show that the variable selection-LSTM method outperforms the benchmark methods in both level and directional forecasting accuracy

## 2.2 REFERENCE


1.A deep learning ensemble approach for crude oil price forecasting: Author: Yang Zhao,Jianping Li, Lean Y (2017)

2. Baumeister C, Kilian L, Zhou X (2013) Are product spreads useful for forecasting? An empirical evaluation of the Verleger hypothesis. Available at SSRN DP9572Castle JL, Qin X,Reed WR (2009)

3. How to pick the best regression equation: a review and comparison of model selection algorithms. Working Papers in Economics 32(5):979– 986

4. Chiroma H, Abdulkareem S, Herawan T (2015) Evolutionary neural network model for WestTexas intermediate crude oil price prediction. Apply Energy 142:266–273.

5. Cifarelli G, Paladino G (2010) Oil price dynamics and speculation: a multivariate financial approach. Energy Econ 32(2):363–372

## 2.3 PROBLEM STATEMENT DEFINITION

Crude oil is the world's leading fuel, and its prices have a big impact on the global environment, economy as well as oil exploration and exploitation activities. Oil price forecasts are very useful to governments, industry individuals. Although many methods have been developed for predicting oil prices, it remains one of the most challenging forecasting problems due to the high volatility of oil prices. The volatility of crude oil market and its chain effects to the world economy augmented the interest and fear of individuals, public and private sectors. Previous statistical and econometric techniques used for prediction, offer good results when dealing with linear data. Nevertheless, crude oil price series deal with high nonlinearity and irregular events. The continuous usage of statistical and econometric techniques including AI for crude oil price prediction might demonstrate demotions to the prediction performance

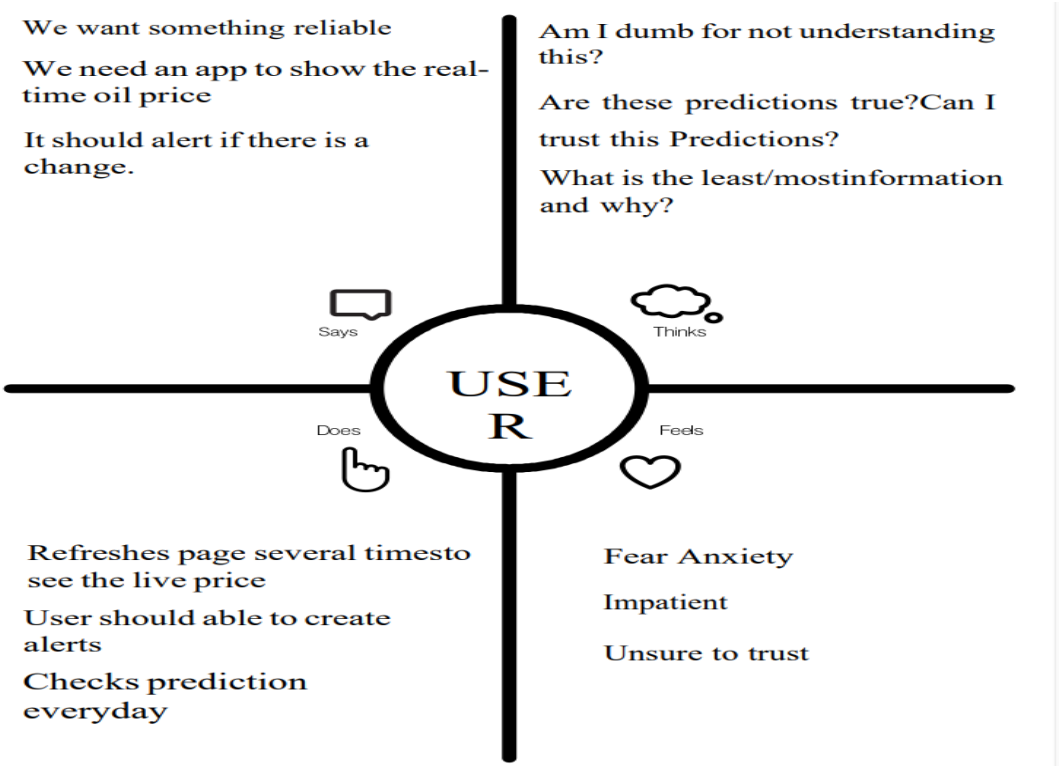
This Guided Project mainly focuses on applying Neural Networks to predict the Crude Oil Price. This decision helps us to buy crude oil at the proper time. Time series analysis is the best option for this kind of prediction because we are usingthe Previous history of crude oil prices to predict future crude oil. So we would be implementing RNN (Recurrent Neural Network) with LSTM(Long Short Term Memory) to achieve the task.

# 3. IDEATHON AND PROPOSED SOLUTION

## 3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about auser's behaviours and attitudes.
It is a useful tool to helps teams betterunderstand their users.

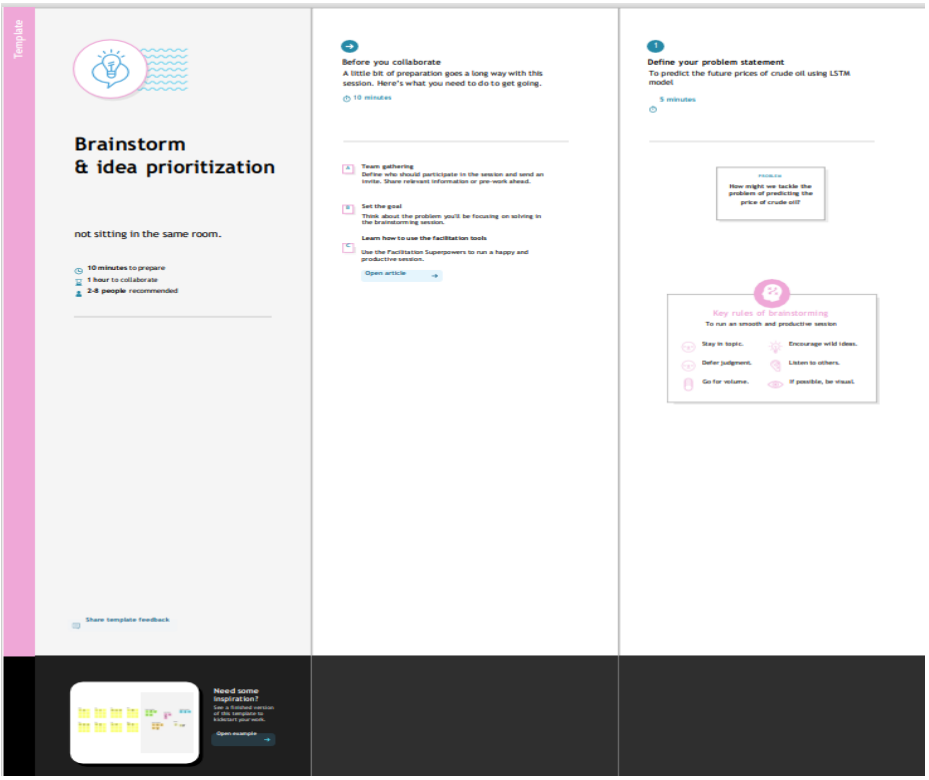
Creating an effective solution requires understanding the true problem and thepersonwho is experiencing it. The exerciseof creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



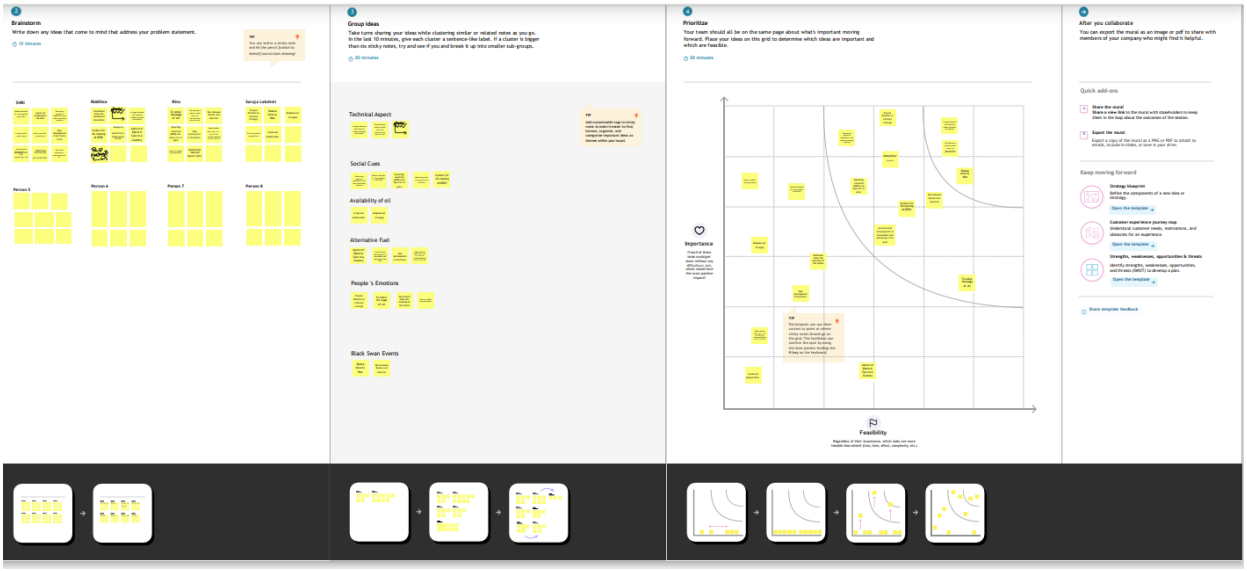
## 3.2 IDEATHON AND BRAINSTORMING

Brainstorm & Idea Prioritization:

Step 1: Team Gathering, Collaboration and Select the Problem Statement



Step 2: Brainstorm, Idea listing and Grouping



## 3.3 PROPOSED SOLUTION

**Proposed Solution Template:**

The project team shall fill in the following information in the proposed solution template.

| S.NO | PARAMETER | DESCRIPTION |
|---|---|---|
| **1.** | Problem Statement (Problem to be | The value of crude oil prices on the worldwide market is extremely difficult to anticipate due to the unpredictable variations in supply and demand as well as theimpact of geopolitics. |
| **2.** | Idea / Solution description | We will gradually compile a dataset of historical oil price data, feed it to the model, train it, compile it, and then implement it in the web application after it has reachedthe ideal state. |
| **3.** | Novelty/uniquness | Despite beingan old concept, it will workbetter if periodic training is used. |
| **4.** | Social Impact / Customer Satisfaction | Customers may learn about the price of crude oil and profit financially by utilisingthe online app. |
| **5.** | Business Model (Revenue Model) | Customers may learn about the price of crude oil and profit financially by utilising the online app. |

# 3.4 PROBLEM SOLUTION FIT

# 4. REQUIREMENT ANALYSIS

## 4.1 FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposedsolution.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story/ Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form<br>Registration throughGmail |
| FR-2 | User Confirmation | Confirmation via Email<br>Confirmation via OTP |
| FR-3 | Graph | Showing graph by obtaining the data from the dataset |
| FR-4 | Support | Providing answersfor the queries asked by users. |
| FR-5 | News | Information of the oil prices will be updated by admin |
| FR-6 | Notification | Notification will besent for theusers price alert |
| Fr-7 | Database | Information of the Userwill be stored |

## 4.2 NON-FUNCTIONAL REQUIREMENTS:

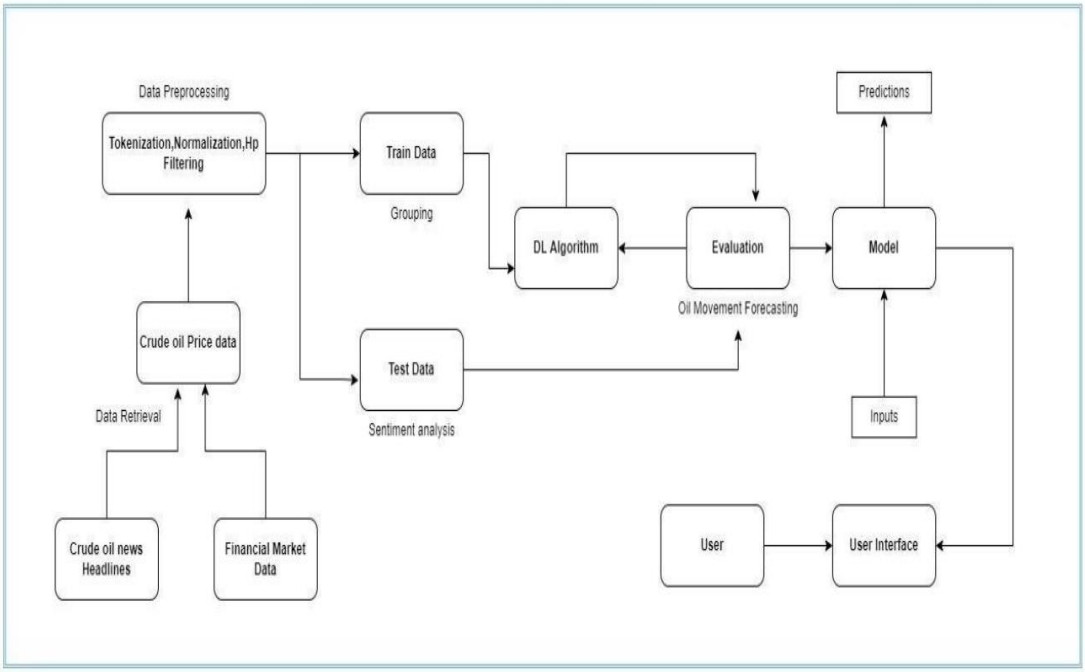
Following are the non-functional requirements of the proposedsolution.

| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | It can use by wide varietyof client as it is verysimple to learn and not complex to proceed. |
| NFR-2 | **Security** | We are using loginfor the userand the information will be hashedso that it willbe very secureto use. |
| NFR-3 | **Reliability** | It will be reliable that it can update with very timeperiod so thatthe accuracy will be good. |
| NFR-4 | **Performance** | It will be performfast and secureeven at the lower bandwidth. |
| NFR-5 | **Availability** | Prediction will be available forevery user but onlyfor premium user news, database and price alert will be alert. |
| NFR-6 | **Scalability** | It is scalable that we are going to usedata in kb so thatthe quite amount of storage is satisfied. |

# 5. PROJECT DESIGN

## 5.1 DATA FLOW DIAGRAMES

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



# 5.2 SOLUTION & TECHNICAL ARCHITECTURE

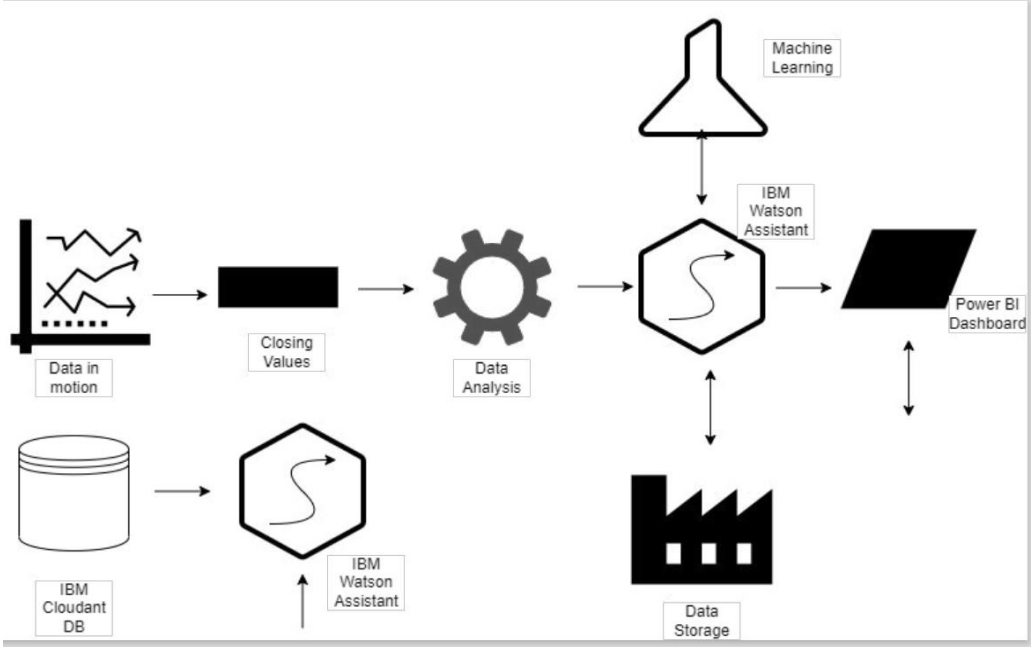
## SOLUTION ARCHITECTURE

i. A complicated process with severalsub-processes, solution architecture connectsbusiness issues with technological solutions. Its objectives are to

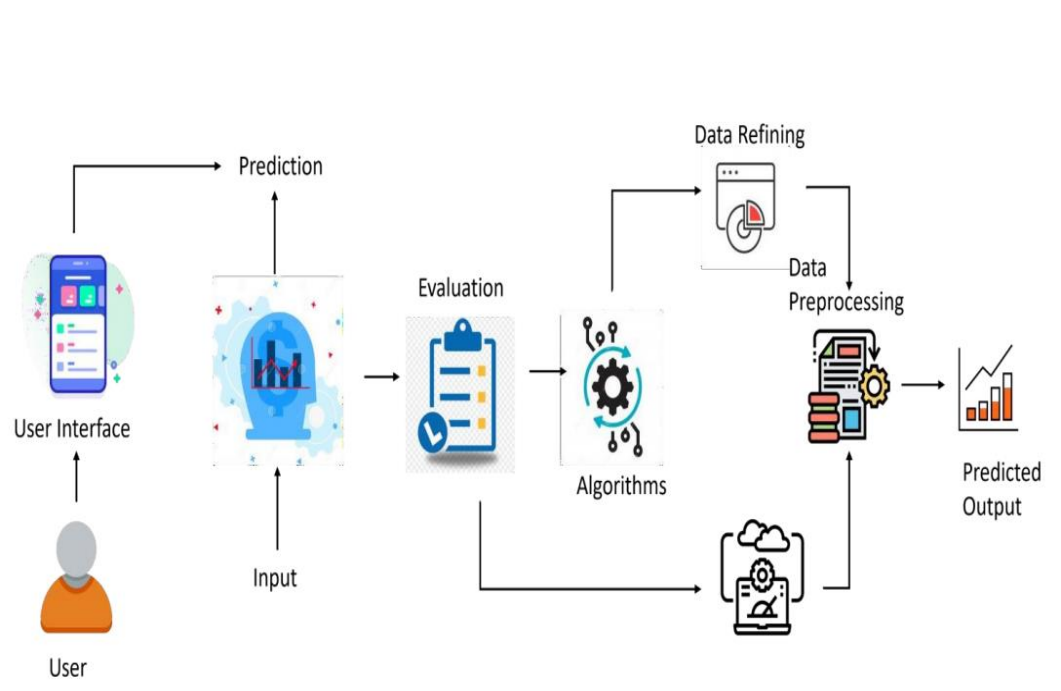
ii. Find the most effectiveinnovative solution for resolving currentbusiness difficulties. Understanding to project stakeholders the structure, traits,functionality and other features of the application.

iii. Define objectives, phases for development and solution requirements.

iv. Specific guidance for how the solution is established, developed and provided



# TECHNICAL ARCHITECTURE



# 5.3 USER STORIES

Use the below templateto list all the user stories for the product

| User Type | Functional Requirement(Epic) | User Story Number | User Story/Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (MobileUser) | Registration | USN-1 | I may sign up for The program as a user by providing my email address, a password, and a password confirmation. | I have access to my account, whichshows line and bar graphs. | High | Sprint-1 |
| | | USN-2 | If I register for the application asa user, I will receive a confirmation email. | I can get a confirmation email and confirm it. | High | Sprint-1 |
| | | USN-3 | I may sign up forthe application as a user through Facebook. | I can sign up and access my account. | Low | Sprint-2 |
| | | USN-4 | I may sign up for the application as a user using gmail. | Through my existing logged-in gmail account, I may signup. | Medium | Sprint-1 |
| | Login | USN-5 | I may access the application as a user by providing my email address and password. | After signing up, Ican onlylog in using my email and password. | High | Sprint-1 |
| | Line\Bar graph | | The model will provide predictions in LineBar Gragh Format when the inputs are entered. | I can obtain the anticipated result in a number of forms. | High | Sprint-3 |
| Customer (Web user) | Login | USN-1 | As a user of the internet, I can log in easily using my Gmail or Facebookaccount. | It is possible to log in using a Gmail account that has already been setup. | Medium | Sprint-2 |
| Customer CareExecutive | Support | | The customer service department will address any FAQ and alsooffer ChatBox | I am able to fix the issues causedby Support. | Low | Sprint-3 |
| Administrator | News | | Admin will providet he most recent oil price information. | Give the current oilpricing. | High | Sprint-4 |
| | Notification | | When oil prices change,the administrator will notify. | Gmail-based notification | High | Sprint-4 |
| | Access Control | | Admins have access control over | Users' authorization to access. | High | Sprint-4 |
| | Database | | Admins have access touser information. | keeps userinformation. | High | Sprint-4 |

# 6. PROJECT PLANNING & SCHEDULING

## 6.1 SPRINT PLANNING & ESTIMATION

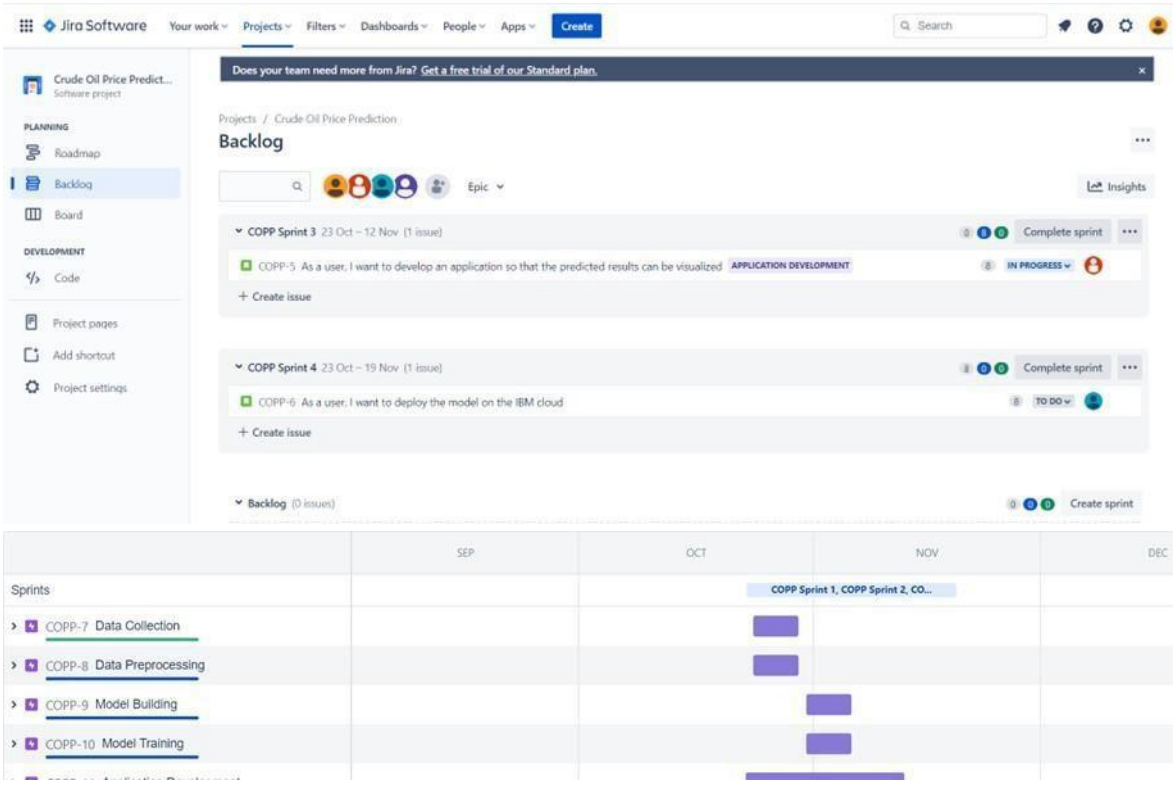
| Sprint | FunctionalRequirement(Epic) | UserStoryNumber | UserStory/Task | StoryPoints | Priority | TeamMembers |
|---|---|---|---|---|---|---|
| Sprint-1 | DataCollection | USN-1 | DownloadCrudeOilPriceDataset | 2 | Medium | Amal L |
| Sprint-1 | DataPreprocessing | USN-2 | ImportingTheDatasetintoWorkspace | 1 | Low | Gowind Eshvar R |
| Sprint-1 | | USN-3 | HandlingMissingData | 3 | Medium | Bharathkumar A |
| Sprint-1 | | USN-4 | FeatureScaling | 3 | Low | Gokul P |
| Sprint-1 | | USN-5 | DataVisualization | 3 | Medium | Bharathkumar A |
| Sprint-1 | | USN-6 | SplittingDataintoTrain andTest | 4 | High | Amal L |
| Sprint-1 | | USN-7 | CreatingADatasetwith SlidingWindows | 4 | High | Bharathkumar A |
| Sprint-2 | ModelBuilding | USN-8 | ImportingTheModelBuildingLibraries | 1 | Medium | Gokul P |
| Sprint-2 | | USN-9 | InitializingTheModel | 1 | Medium | Gowind Eshvar R |
| Sprint-2 | | USN-10 | AddingLSTMLayers | 2 | High | Bharathkumar A |
| Sprint-2 | | USN-11 | AddingOutputLayers | 3 | Medium | Amal L |
| Sprint-2 | | USN-12 | ConfigureTheLearningProcess | 4 | High | Gokul P |

| Sprint | FunctionalRequirement(Epic) | UserStoryNumber | UserStory/Task | StoryPoints | Priority | TeamMembers |
|---|---|---|---|---|---|---|
| Sprint-2 | | USN-13 | TrainTheModel | 2 | Medium | Bharathkumar A |
| Sprint-2 | | USN-14 | ModelEvaluation | 1 | Medium | Amal L |
| Sprint-2 | | USN-15 | SaveTheModel | 2 | Medium | Gowind Eshvar R |
| Sprint-2 | | USN-16 | TestTheModel | 3 | High | Gokul P |
| Sprint-3 | ApplicationBuilding | USN-17 | CreateAnHTMLFile | 4 | Medium | Gowind Eshvar R |
| Sprint-3 | | USN-18 | BuildPythonCode | 4 | High | Bharathkumar A |
| Sprint-3 | | USN-19 | RunTheAppinLocalBrowser | 4 | Medium | Amal L |
| Sprint-3 | | USN-20 | ShowcasingPredictionOn UI | 4 | High | Gokul P |
| Sprint-4 | TrainTheModelOnIBM | USN-21 | RegisterForIBMCloud | 4 | Medium | Bharathkumar A |
| Sprint-4 | | USN-22 | TrainTheMLModelOnIBM | 8 | High | Bharathkumar A |
| Sprint-4 | | USN-23 | IntegrateFlaskwithScoringEndPoint | 8 | High | Bharathkumar A |

## 6.2 SPRINT DELIVERY SCHEDULE

| Sprint | Total StoryPoints | Duration | Sprint Start Date | Sprint EndDate (Planned) | Story PointsCompleted (as onPlanned End Date) | Sprint Release Date (Actual) |
|---|---|---|---|---|---|---|
| Sprint-1 | 8 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | 8 | 29 Oct 2022 |
| Sprint-2 | 8 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 8 | 05 Nov 2022 |
| Sprint-3 | 8 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 8 | 12 Nov 2022 |
| Sprint-4 | 8 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 8 | 19 Nov 2022 |

# 6.3 REPORTS FROM JIRA

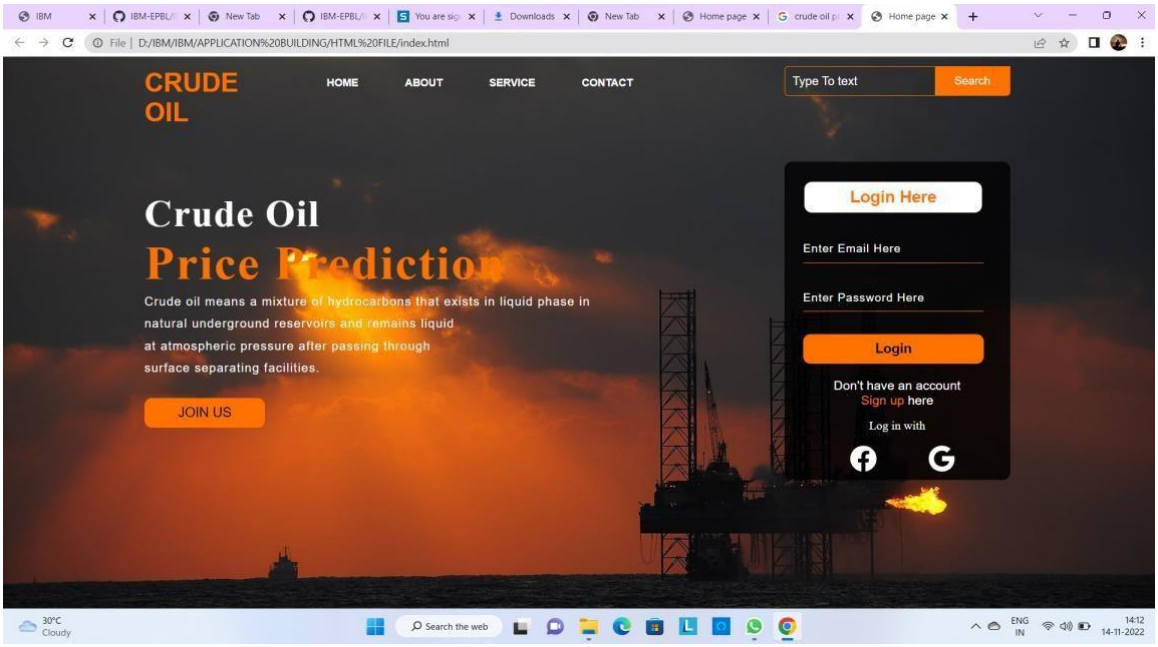


# 7. CODING & SOLUTIONING

i. The crude oil prediction websiteprovides two options
   1. Home
   2. predict

ii. The home allows the user to have an insight on theimportance of crude oil priceprediction

iii. The predictallows the user to give the 10 days inputandarrive at the predictionresults.



## CODE

### Index:

```
        <!DOCTYPE html>
<html lang="en">
<head>
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Home page</title>
   <link rel="stylesheet" href="style.css">
</head>
<body>

   <div class="main">
  <div class="navbar">
     <div class="icon">
          <h2 class="logo">CRUDE OIL</h2>
        </div>

        <div class="menu">
          <ul>
            <li><a href="#">HOME</a></li>
            <li><a href="#">ABOUT</a></li>
            <li><a href="#">SERVICE</a></li>
            <li><a href="#">CONTACT</a></li>
          </ul>
        </div>

        <div class="search">
          <input class="srch" type="search" name="" placeholder="Type To text">
          <a href="#"> <button class="btn">Search</button></a>
        </div>
```

```
        </div>
        <div class="content">
            <h1>Crude Oil<br><span>Price Prediction</span><br></h1>
            <p class="par"> Crude oil means a mixture of hydrocarbons that exists in liquid phase

in<br>

natural underground reservoirs and remains liquid <br>at atmospheric pressure
afterpassing through <br>surface separating facilities.</p>

                <button class="cn"><a href="register.html">JOIN US</a></button>

                <div class="form">
                    <h2>Login Here</h2>
                    <input type="email" name="email" placeholder="Enter Email Here">
                    <input type="password" name="" placeholder="Enter Password Here">
                    <button class="btnn"><a href="#">Login</a></button>

                    <p class="link">Don't have an account<br>
                    <a href="#">Sign up </a> here</a></p>
                    <p class="liw">Log in with</p>

                    <div class="icons">
                        <a href="#"><ion-icon name="logo-facebook"></ion-icon></a>
                        <a href="#"><ion-icon name="logo-google"></ion-icon></a>
                    </div>

                </div>
                    </div>
                </div>
        </div>
    </div>
    <script src="https://unpkg.com/ionicons@5.4.0/dist/ionicons.js"></script>
</body>
```

```
</html>
```

Register:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Registration Form</title>
    <link
    rel="stylesheet"href="register.cs
    s" type="text/css">
  </head>
  <body>
    <div class="main">
      <div class="register">
        <h2>Register Here</h2>
        <form id="register" method="post">
          <label>First Name : </label>

          <br>
          <input type="text" name="fname"
          id="name" placeholder="Enter Your First Name">
          <br><br>
          <label>Last Name : </label>
          <br>
          <input type="text" name="lname"
          id="name" placeholder="Enter Your last Name">
          <br><br>
          <label>Your Age : </label>
          <br>
          <input type="number" name="age"
          id="name" placeholder="How Old Are
          You">
          <br><br>
          <label>Email : </label>
```

```
                <br>
                <input type="email" name="email"
                id="name" placeholder="Enter Your Valid Email">
                <br><br>
                <label>Gender : </label>
                <br>
                     
                <input type="radio"
                name="gender"id="male">
                 
                <span
                id="male">Male</span>
                     
                <input type="radio"
                name="gender"id="female">
                 
                <span id="female">Female</span>
                <br><br>
                <input type="submit"
                value="Submit"name="submit"
                id="submit">
            </form>
        </div>
    </div>
</body>
 </
```

# 8. TESTING

## 8.1 TEST CASES

Test case analysis

This report shows the number of test cases that have passed, failed, and untested

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| ML Model | 4 | 0 | 0 | 4 |
| Flask Application | 4 | 0 | 0 | 4 |
| IBM cloud | 4 | 0 | 0 | 4 |
| Exception Reporting | 2 | 0 | 0 | 2 |
| Final Reportoutput | 4 | 0 | 0 | 4 |

## 8.2 USER ACCEPTANCE TESTING

The purpose is to briefly explain the test coverage and open issues of the crude oil priceprediction project at the time of the releaseto user acceptancetesting

Defect Analysis:

The reportshows the number of resolvedand closed bugs at each severity level andhow they were resolved

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 3 | 0 | 0 | 0 | 3 |
| Duplicate | 1 | 0 | 1 | 0 | 2 |
| External | 0 | 0 | 0 | 0 | 0 |
| Fixed | 4 | 0 | 1 | 1 | 6 |
| Not Reproduced | 0 | 0 | 0 | 0 | 0 |
| Skipped | 0 | 0 | 0 | 0 | 0 |
| Won't fix | 0 | 0 | 0 | 1 | 1 |
| Totals | 8 | 0 | 2 | 2 | 12 |

Test case analysis

This report shows the number of test cases that have passed, failed, and untested

| Section | Total Cases | Not Tested | Fail | Pass |
|---|---|---|---|---|
| ML Model | 4 | 0 | 0 | 4 |
| Flask Application | 4 | 0 | 0 | 4 |
| IBM Cloud | 4 | 0 | 0 | 4 |
| Exception Reporting | 2 | 0 | 0 | 2 |
| Final ReportOutput | 4 | 0 | 0 | 4 |

# 9. RESULTS

## a. PERFORMANCE METRICS

| S.No | Parameters | Values | Screenshot |
|---|---|---|---|
| 1. | Model Summary | | |
| 2 | Accuracy | | |

# 10. ADVANTAGES & DISADVANTAGES

## ADVANTAGES:

i. Prediction of crude oil price can help the importers to choosethe right time to buyasthey wait for the prices to fall down
ii. Prediction of crudeoil prices can help the exporters to increase thedemand
iii. It can even help in shiftingthe political powers
iv. can assistin minimizing the risks associated with volatility in oilprices

## DISADVANTAGES

v. The prediction results may lack accuracy
vi. Volatility in prices may be misleading

# 11. CONCLUSION

LSTM network is better than other traditional neural networks for forecasting prices as it aims in using a back propagation model. Traditional neural networks such as CNN on the other hand predicts the next outgoing but doesn't necessarily save the previous dataor connection which is based on feed-forwarding, in the sense the previous data is not necessary to predict the future data. LSTM focuseson storing the previous data and prediction which is ratherencouraging and more approximate. The outcomes derivedare relatively encouraging. The results show that largelookups do not necessarily improve the accuracy of the predictions of crude oil prices. Hence it can be concluded, the model with a single LSTM model is definitely the most accurate.

# 12. FUTURE SCOPE

The project's future potential is enormous. The project can be implemented with the real-time functionalities that are necessary.Because it is quite versatile in terms of expansion, the project can be upgraded in the near future as and when the need arises.The complete prediction value can be increased in a much better, accurate, and error-free manner with the proposed approach. The projectcan be enhanced with realtime data.

# 13. APPENDIX

**Source**

**Code**

**MODEL:**

**# DATA PREPROCESSING**

**## Importing the libraries** import pandas as pd import numpy as np

import matplotlib.pyplot as pltimporttensorflow as tf
data=pd.read_excel(r"Crude Oil Prices Daily.xlsx")data.head()

**## Handling missing values**

data.isnull().any()

data.isnull().sum()
data.dropna(axis=0,inplace=True)
data_oil=data.reset_index()['Closing Value']data_oil  data.isnull().any()

**## Feature Scaling**

from sklearn.preprocessing import MinMaxScaler
scalar=MinMaxScaler(feature_range=(0,1))
data_oil=scalar.fit_transform(np.array(data_oil).reshape(-1,1))

**## Data Visualization**

plt.title('Crude oil price')

```
plt.plot(data_oil)
```

## Splittingdata into Train and Test Data

```
training_size=int(len(data_oil)*0.
65)test_size=len(data_oil)-
training_size
train_data,test_data=data_oil[0:training_size,:],data_oil[training_size:len(data_oil),:1]
training_size,test_size
train_data.shape
```

**## Creating a datasetwith sliding windows**

```
def create_dataset (dataset,
    time_step=1):dataX,dataY = [], []
    for i in range(len(dataset)-
        time_step-1):a =
        dataset[i:(i+time_step), 0]
        dataX.append(a)
        dataY.append(dataset[i +time_step, 0])
    return
np.array(dataX),np.array(dataY)
time_step = 10
X_train,
y_train=create_dataset(train_data,time_step)
X_test, y_test =
create_dataset(test_data,time_step)
print(X_train.shape),print(y_train.shape)
print(X_test.shape),print(y_test.shape)
X_train
X_train.sh
ape
X_train=X_train.reshape(X_train.shape[0],X_train.shape[1],1)
X_test=X_test.reshape(X_test.shape[0],X_test.shape[1],1)
```

**# MODEL BUILDING**

**# Importingthe model buildinglibraries**

```
from tensorflow.keras.models
importSequentialfrom
tensorflow.keras.layers import Dense
from tensorflow.keras.layers importLSTM# Initializing the model model=Sequential()
```

```
# Adding LSTM Layers
model.add(LSTM(50,return_sequences=True,input_shape=(10,1)))
model.add(LSTM(50,return_sequences=True))
model.add(LSTM(50))
# Adding Output
Layers
model.add(Dense(1))
model.summary()

# Configure The LearningProcess
model.compile(loss='mean_squared_error',optimizer='adam')#
Train The Model

model.fit(X_train,y_train,validation_data=(X_test,y_test),epochs=10,batch_size=64,verbose=
1)
# Model Evaluation
train_predict=model.predict(X_train)
test_predict=model.predict(X_test)
train_predict=scalar.inverse_transform(train_predict)
test_predict=scalar.inverse_transform(test_predict)
importmath
from sklearn.metrics import mean_squared_error


math.sqrt(mean_squared_error(y_train,train_predict))
# Save The Model
from tensorflow.keras.models
importload_model
model.save("crudeoilprediction.h5")
# Test The Model
look_back= 10
trainPredictPlot =
np.empty_like(data_oil)
trainPredictPlot[:, :]= np.nan
trainPredictPlot[look_back:len(train_predict)+look_back,  :]=
train_predicttestPredictPlot =np.empty_like(data_oil)
testPredictPlot[:, :]= np.nan
```

```
testPredictPlot[len(train_predict)+(look_back*2)+1:len(data_oil)-1, :]=
test_predictplt.plot(scalar.inverse_transform(data_oil))
plt.plot(trainPredictP
lot)
plt.plot(testPredictPl
ot) plt.show()
len(test_data)
x_input=test_data[2866:].reshape(1
,-1)x_input.shape
temp_input=list(x_input)
temp_input=temp_input[0].tolist()
temp_input
lst_outpu
t=[]
n_steps=
10 i=0
while(i<1
0):
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
print (lst_output)
day_new=np.arange(1,1
1)
day_pred=np.arange(11,
21)len(data_oil)
plt.plot(day_new,scalar.inverse_transform(data_oil[8206:]))
plt.title("Review of prediction")
plt.plot(day_pred,scalar.inverse_transform(lst_output))
plt.show()df3=data_oil.tolist()
df3.extend(lst_output)
plt.title("Past data nad next 10 days
outputprediction")plt.plot(df3[8100:])
df3=scalar.inverse_transform(df3).tolist()
plt.title("Past data nad next 10 days output prediction after reversing the scaled
values")plt.plot(df3)
```

**Index.html:**

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <meta charset="UTF-8">
        <title>Crudeoil price prediction</title>
        <!--<link rel="stylesheet" href="in.css">
        <link
href="https://fonts.googleapis.com/css2?family=Poppins:wght@300;400;500;600;700&d
isplay=swap"rel="stylesheet">
        <link rel="stylesheet" href="https://www.w3schools.com/w3css/4/w3.css">
<link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css">--
```

```
>
      <st
        yl
        e
        >
        ul
        {
  list-style-type:
  none;margin: 0;
  padding: 0;
  overflow:hidde
  n;
  border: 1px solid
  #e7e7e7; background-
  color: #057514;
}

li {
  float: left;
}

li a {
  display: inline-
  block;color:
  rgb(78, 3, 3);
  text-align: center;
  padding: 14px
  16px; text-
  decoration: none;
  background-color:rgb(18, 116, 5) ;
}
li a:hover{

    border:1px solid;
    background-color: lightseagreen;
}
      </style>
    </head>
```

```
<body>
    <nav class="navbar navbar-inverse">
        <div class="container-fluid">
            <ul>
              <li class="parts"><a href="#">Home</a></li>
              <li class="parts"><a href="predict.html">predict</a></li>
            </ul>
        </div>
    </nav>

    <h1 >Crudeoil price prediction</h1>

    <style>
        body {
          background-image:
          url('static/css/image.jpeg');background-
          repeat: no-repeat;
          background-
        attachment:fixed;
        background-size: 100%
        100%;

        }
        </style>

      <h3 style="font-family:system-ui;">
          Demand for oil is inelastic, therefore the rise in
          price is good news for producers because they will see an
          increaseintheir revenue.Oil importers, however,will experience
          increased costs of purchasing oil. Because oil is the largest
          tradedcommodity,theeffectsare quite significant. A rising oil price can even
          shift
economic/political
        power from oil importers to oil exporters. The crude oil ricemovements
        aresubject todiverse influencing factors</h3>
    </body>
```

```
        </html>
```

**Predict.html:**

```
<html>
    <head>
        <link rel="stylesheet" href="static/css/style.css">
        <style>
            body {
              background-image:
              url('static/css/image3.jpg');background-
              repeat: no-repeat;
              background-
            attachment:fixed;
            background-size: 100%
            100%;

            }
            </style>

    </head>
    <script>
        document.getElementByID("demo").innerHT
ML =document.getElementById("ten");
    </script>
<body>
<form action="/method" method="POST" enctype = "multipart/form-data">
<div class="container">
    <!--<div class="brand-logo"></div>-->
    <div class="brand-title">predict the oil price</div>
    <div class="inputs">
      <label>Enter Price</label>
      <input type="text" placeholder="Enter ten days price" id="ten" name="val"/>
      <button
        type="submit">Predict</button><br><br>
```

```
        The next day price is : {{prediction}}
      </div>
    </div>
  </form>
  </body>
  </html>
```

**App.py:**

```
from flask import Flask, render_template, request,
redirectimport numpy as np
# from tensorflow.k

from keras.saving.save import load_model
app = Flask(___name___,template_folder='template')

@app.route('/',
methods=["GET"])def index():
    return render_template('index.html')

@app.route('/predict.html', methods=["POST",
"GET"])@app.route('/method', methods=["POST",
"GET"])
def method():
    if request.method ==
        "POST":string =
        request.form['val']
        string= string.split(',')
        temp_input = [eval(i) for i in string]

        x_input = np.zeros(shape=(1,
        10))x_input.shape

        lst_output
        = []
        n_steps =
        10
```

```
i = 0
while (i < 10):
    if (len(temp_input) > 10):
        x_input =
        np.array(temp_input[1:])x_inp
        ut = x_input.reshape(1, -1)
        x_input = x_input.reshape((1, n_steps, 1))yhat
        = model.predict(x_input,
        verbose=0)
        temp_input.extend(yhat[0].tolist(
        )) temp_input = temp_input[1:]
        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)
        temp_input.extend(yhat[0].tolist(
        )) lst_output.extend(yhat.tolist())
     i = i + 1
        val =
  lst_output[9]
 return render_template('predict.html', prediction=val)

            if request.method == "GET":
                return render_template('predict.html')

          if__name____== "_main____
            ":model =
            load_model(r'crudeoilpr
            ediction.h5')
            app.run(debug=True)
```

**#cloud deployment code in ml model**

```
!pip install

ibm_watson_machine_learningfrom

ibm_watson_machine_learning
import APIClientwml_credentials
= {
        "url" : "https://us-south.ml.cloud.ibm.com",
        "apikey" : "cRkqykhsnLO1Ogs_xoYjgLkNTtTS1Qxyi0Mn1GSlQ1P5"
}
client = APIClient(wml_credentials)

#for creating a deployment
phasedef
   guid_from_space_name
   (client, space_name):
   space=client.spaces.get
   _details()#print(space)
return(next(item for item in
space['resources'] ifitem['entity']['name'] ==
space_name)['metadata']['id'])
space_uid =
guid_from_space_name(client,
'models')print("Space UID =
"+space_uid)
client.set.default_space(space_uid
)
client.software_specifications.list(
) software_spec_uid=
client.software_specifications.get_uid_by_name("tens
orfl ow_rt22.1-py3.9")software_spec_uid
```