COIMBATORE INSTITUTE OF TECHNOLOGY

TEAM ID: PNT2022TMID52593

CRUDE OIL PRICE PREDICTION

TEAM MEMBERS

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2005202	- Abuthageer S
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INDEX

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

Crude oil prices are controlled by many factors which include the difficulty for industrialists to make profit out of volatility, downfall in the market because of sudden fall in prices, and so on. This problem affects the industrialists, crude oil investors, supply and demand. It is important to fix the problem as it can stabilize the market. The boundaries of the problem are to increase the profit and to predict crude oil investments. Therefore, Prediction of crude oil can help in dealing with the sudden rise and fall of prices.

2. LITERATURE SURVEY

2.1 Existing problem

2.1.1 Prediction Model for Crude Oil Price Using Artificial Neural Network

The prediction model based on artificial neural network (ANN) to forecast and compared with least square method (LSM). The results show that on the shortterm, the best prediction model for ANN of four, three, two and one hidden layers, respectively. The ANN of one - four hidden layers is found to be able to forecast better than the LSM. This presents a hybrid methodology to forecast crude oil monthly prices. The model consists of combination of three separate components that they extract rule based system. These three components work disjointedly, and then intergraded together to get the final results. They claimed that nonlinear integration of these three models has outperformed any single one. However, there are several issues in this system. For example, the rule base system of the text mining model 3 depends on the knowledge base which developed by human experts. This process is not only controversial, but also unreliable, experts opinions vary on the same problem. Moreover, neither the rules nor the knowledge base was made available to the public.

2.1.2 Crude Oil Price Prediction Using LSTM Networks

Crude oil market is an immensely complex and dynamic environment and thus the task of predicting changes in such an environment becomes challenging with regards to its accuracy. A number of approaches have been adopted to take on that challenge and machine learning has been at the core in many of them. There are plenty of examples of algorithms based on machine learning yielding satisfactory results for such type of prediction. In this paper, we have tried to predict crude oil prices using Long Short-Term Memory (LSTM) based recurrent neural networks. We have tried to experiment with different types of models using different epochs, lookbacks and other tuning methods. The results obtained are promising and presented a reasonably accurate prediction for the price of crude oil in near future.

2.1.3 Oil Price Prediction Using Ensemble Machine Learning

Crude oil price forecasting is a challenging task due to its complex nonlinear and chaotic behavior. During the last couple of decades, both academicians and practitioners devoted proactive knowledge to address this issue. A strand of them has focused on some key factors that may influence the crude oil price prediction accuracy.

2.2 References

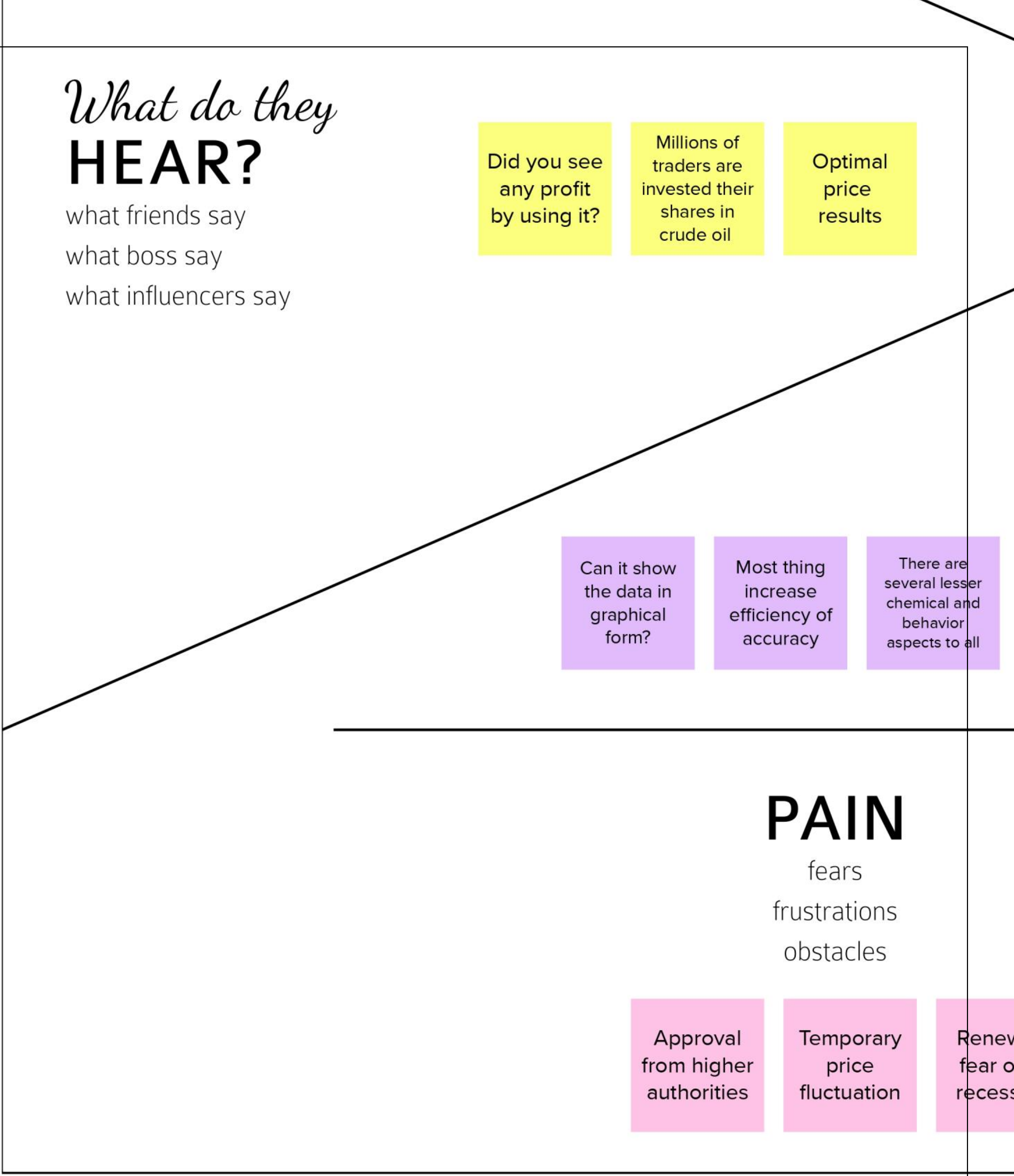
I. Gao, S., & Lei, Y. (2017). A new approach for crude oil price prediction based on stream learning. Geoscience Frontiers, 8(1), 183-187.

II. Bollapragada, R., Mankude, A., & Udayabhanu, V. (2021). Forecasting the price of crude oil. Decision, 48(2), 207-231.

III. Gupta, N., & Nigam, S. (2020). Crude oil price prediction using artificial neural network. Procedia Computer Science, 170, 642-647.

2.3 Problem Statement Definition

Crude oil price prediction is a challenging task in oil producing countries. Its price is among the most complex and tough to model because fluctuations of price of crude oil are highly irregular, nonlinear and vary dynamically with high uncertainty. The problem statement is to propose a hybrid model for crude oil price prediction that uses the



What do they

HEAR?

what friends say

what boss say

what influencers say

Did you see any profit by using it?

Millions of traders are invested their shares in crude oil

Optimal price results

Can it show the data in graphical form?

Most thing increase efficiency of accuracy

There are several lesser chemical and behavior aspects to all

PAIN

fears

frustrations

obstacles

Approval from higher authorities

Temporary price fluctuation

Renew fear o recess

3.2 Ideation & Brainstorming

Define your problem statement

Easy way to solve the prediction of crude oil which involves various factors like supply, demand, geo location etc.

Brainstorm

Renuka Devi

- Implementing ML algorithms to predict the future prices of crude oil.
- Crude oil market is one of the most important the market.
- Oil price are not only driven by economic variables but also affected by critical events.
- There was a strong positive relationship between the oil price and the interest rates.
- Depends on the imports and exports.
- Also depends on the country economy

Gayathiri

- Find similar patterns in past incident with current situation to determine the price
- By knowing demand needed and supply gone rate, calculate the price
- Indian economy depends on crude oil its fast growth
- The impact of crude oil prices on interest rates and inflation in the international context
- crude oil prices have been decreasing significantly

NaveenKumar

- The oil prices is influenced not only the fundamentals of supply and demand

- The risk of crude oil price shocks from unexpected events is predicted
- COVID-19- crude oil price dependence analysis application of ANN model
- crude oil prices have been decreasing significantly

Abuthageer

- Deep learning techniques for the forecast
- Use the history of crude oil prices for forecasting
- the oil price fluctuations have a direct effect on the nation 's economy
- Crude oil price have always been volatile affecting the performance of the economy

GROUP IDEAS

GROUP -1

Indian economy depends on crude oil ,its fast growth

Crude oil price have always been volatile affecting the performance of the economy

Indian stock market and concluded there was a long term relationship

GROUP-2

one of the method of application of is ANN Model

The back propagation rule using problem

ANN is the most popular nonlinear AI model used to predict crude oil price

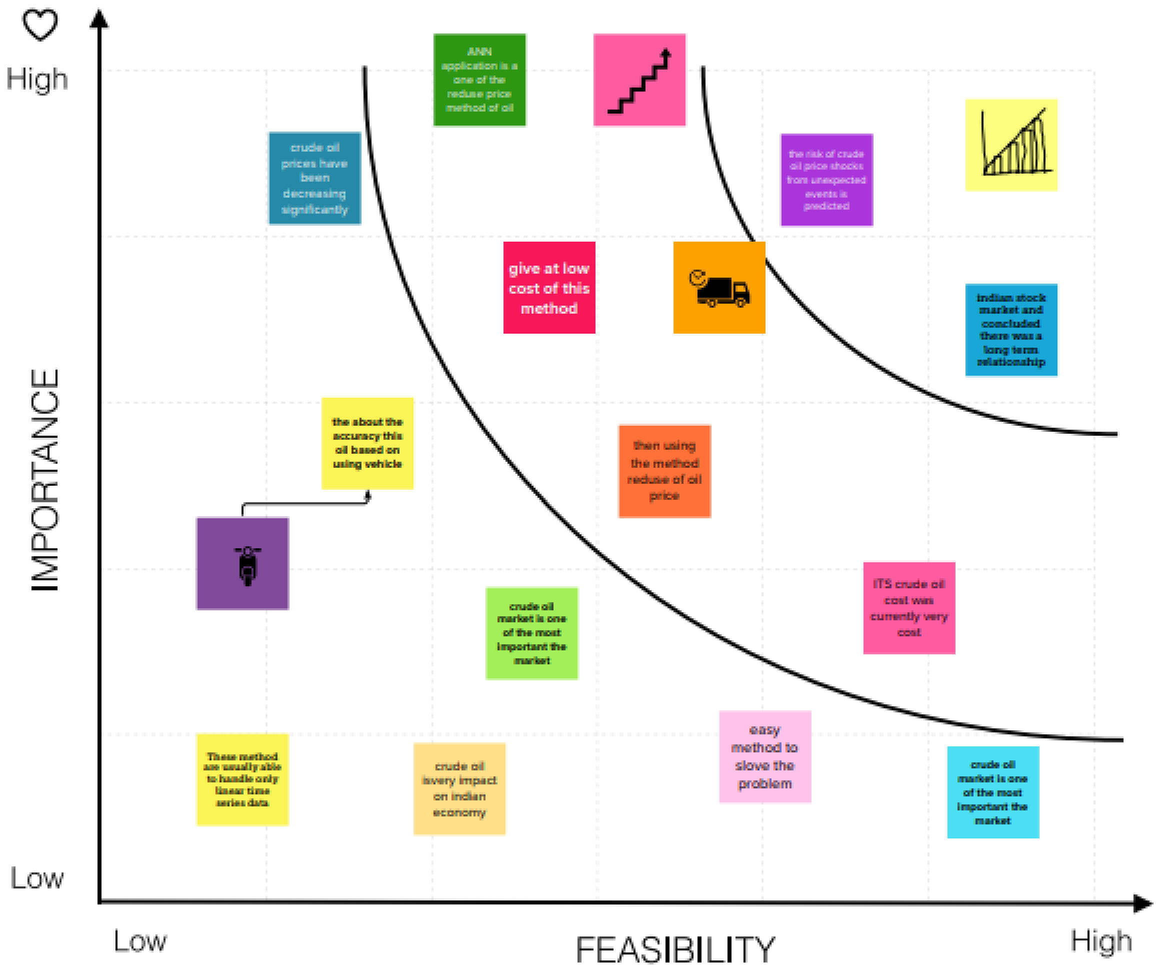
GROUP-3

crude oil have more impact on the industrial on the industrial production

COVID-19 crude oil dependence analysis

The oil prices is infuenced not only the fundamentals of supply and demand

IDEA PRIORITISATION



ANN application is a one of the reduse price method of oil

crude oil prices have been decreasing significantly

the risk of crude oil price shocks from unexpected events is predicted

give at low cost of this method

indian stock market and concluded there was a long term relationship

the about the accuracy this oil based on using vehicle

then using the method reduse of oil price

ITS crude oil cost was currently very cost

crude oil market is one of the most important the market

easy method to slove the problem

These method are usually able to handle only linear time series data

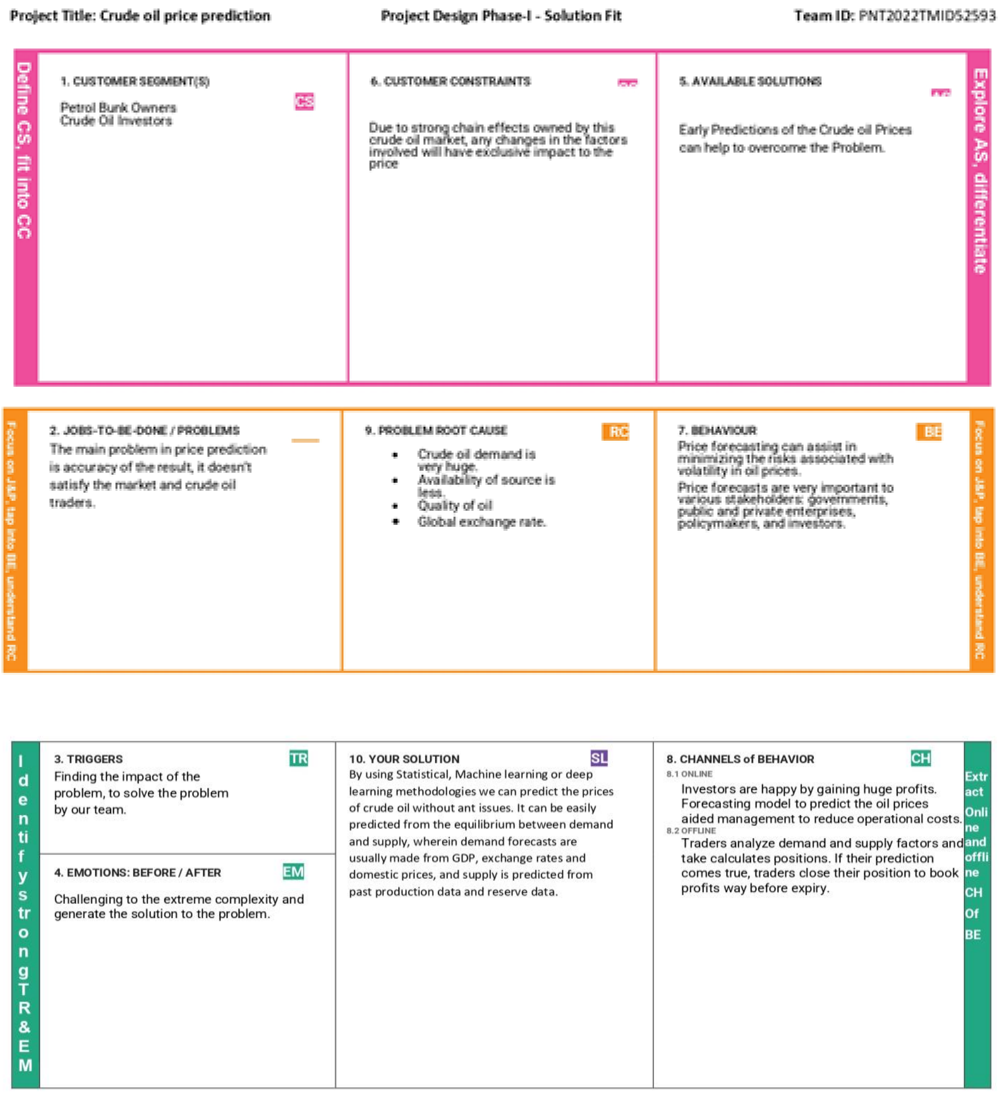
crude oil isvery impact on indian economy

crude oil market is one of the most important the market

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Crude oil is the world’s leading fuel, and its prices have a big impact on the global environment and its forecasts are very useful to governments, industry is individuals. The crude oil price movements are subject to diverse influencing factors. The price of crude oil has a significant impact on the environment globally, and its forecasts are particularly helpful to governments and industry. There is a need for a decision which helps us to buy crude oil at the proper time.
2.	Idea / Solution description	In order to predict future crude oil using historical data on crude oil, RNN (Recurrent Neural Network) is utilised with long short-term memory. The effectiveness of the cost is calculated using the mean squared error. Using the pricing information in the crude oil materials, the proposed model's performance is assessed.
3.	Novelty / Uniqueness	Since changes in the price of crude oil have a significant impact on national economies Around the world. Governments, public and private businesses, legislators, and investors all place a high value on price estimates.
4.	Social Impact / Customer Satisfaction	By accurately predicting prices investing Firms, trading firms can potentially benefit. This model is used to forecast future pricing and to manage oil use and also has an effect on country’s economics.
5.	Business Model (Revenue Model)	RNN and LSTM models are used as the benchmark model to predict the crude oil Prices. This have an potential impact on investors, country’s imports and exports and also for businesses.
6.	Scalability of the Solution	The price forecasting is done by the means of the descriptive and predictive analytics. Enhancing the RNN and LSTM models' accuracy and also with the help of larger data sets.

3.4 Problem Solution fit



Project Title: Crude oil price prediction **Project Design Phase-I - Solution Fit** **Team ID:** PNT2022TMID52593

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Petrol Bunk Owners
Crude Oil Investors

6. CUSTOMER CONSTRAINTS

Due to strong chain effects owned by this crude oil market, any changes in the factors involved will have exclusive impact to the price

5. AVAILABLE SOLUTIONS

Early Predictions of the Crude oil Prices can help to overcome the Problem.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS

The main problem in price prediction is accuracy of the result, it doesn't satisfy the market and crude oil traders.

9. PROBLEM ROOT CAUSE RC

- Crude oil demand is very huge.
- Availability of source is less.
- Quality of oil
- Global exchange rate.

7. BEHAVIOUR BE

Price forecasting can assist in minimizing the risks associated with volatility in oil prices.

Price forecasts are very important to various stakeholders: governments, public and private enterprises, policymakers, and investors.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

Finding the impact of the problem, to solve the problem by our team.

4. EMOTIONS: BEFORE / AFTER EM

Challenging to the extreme complexity and generate the solution to the problem.

10. YOUR SOLUTION SL

By using Statistical, Machine learning or deep learning methodologies we can predict the prices of crude oil without ant issues. It can be easily predicted 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.

8. CHANNELS of BEHAVIOR CH

8.1 ONLINE

Investors are happy by gaining huge profits. Forecasting model to predict the oil prices aided management to reduce operational costs.

8.2 OFFLINE

Traders analyze demand and supply factors and take calculates positions. If their prediction comes true, traders close their position to book profits way before expiry.

Extract Online and offline CH Of BE

4. REQUIREMENT ANALYSIS

4.1 Functional requirements

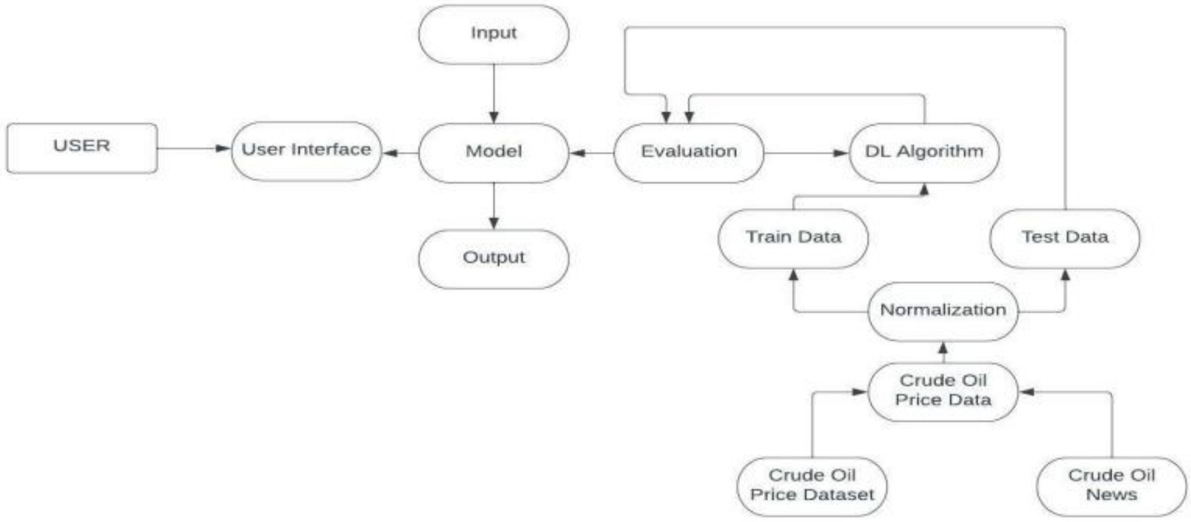
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Login	Login through username and password Login through Gmail
FR-4	Primary specifics	Sync oil price every second Show up and down graph in real time in accordance with the oil price
FR-5	Additional Requirement	Read latest news View price chart Analyze historical price trends
FR-6	System Responsibility	Allowing the user to select a date The pricing news should be updated.

4.2 Non-Functional requirements

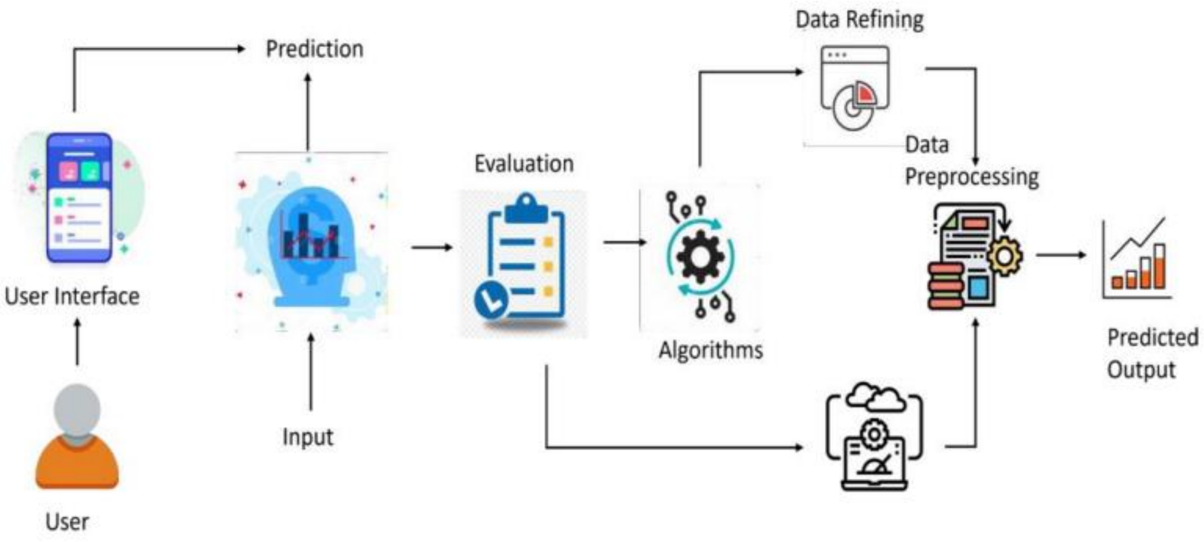
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	User interfaces are easy to use.
NFR-2	**Security**	Sensitive data is protected.
NFR-3	**Reliability**	At the time of entry, all user variable data will be committed to the database.
NFR-4	**Performance**	The accuracy of the price should be at the maximum.
NFR-5	**Availability**	Accessible at any time.
NFR-6	**Scalability**	It will perform well for many number of users with the same speed.

5. PROJECT DESIGN

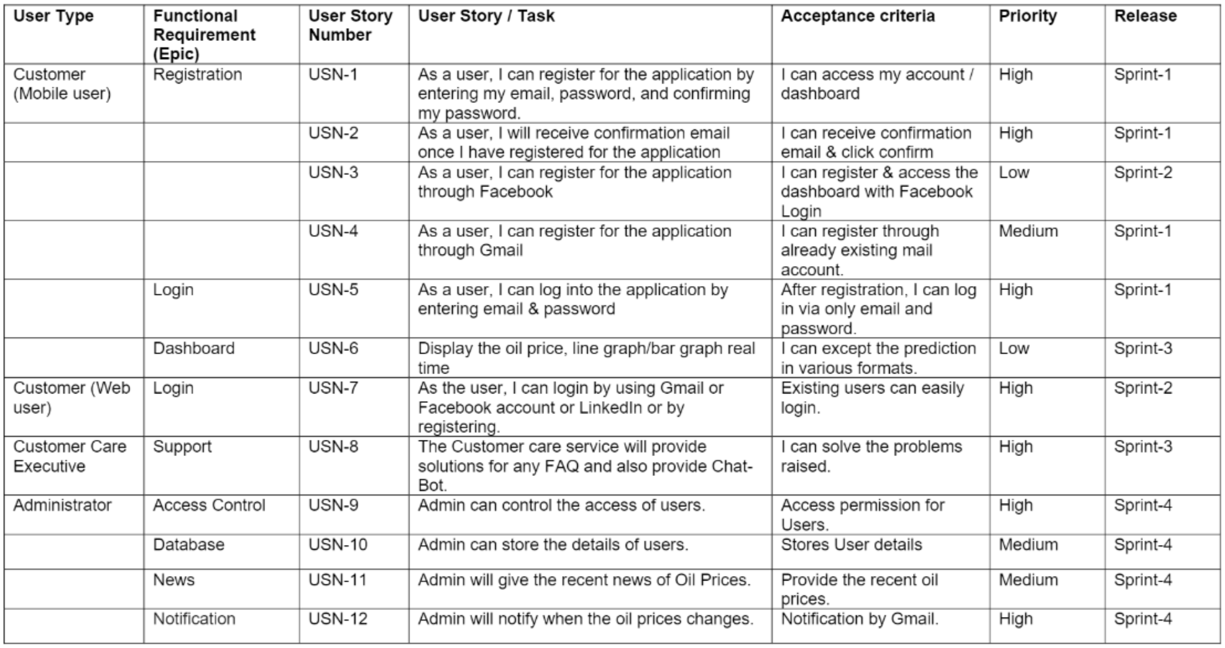
5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



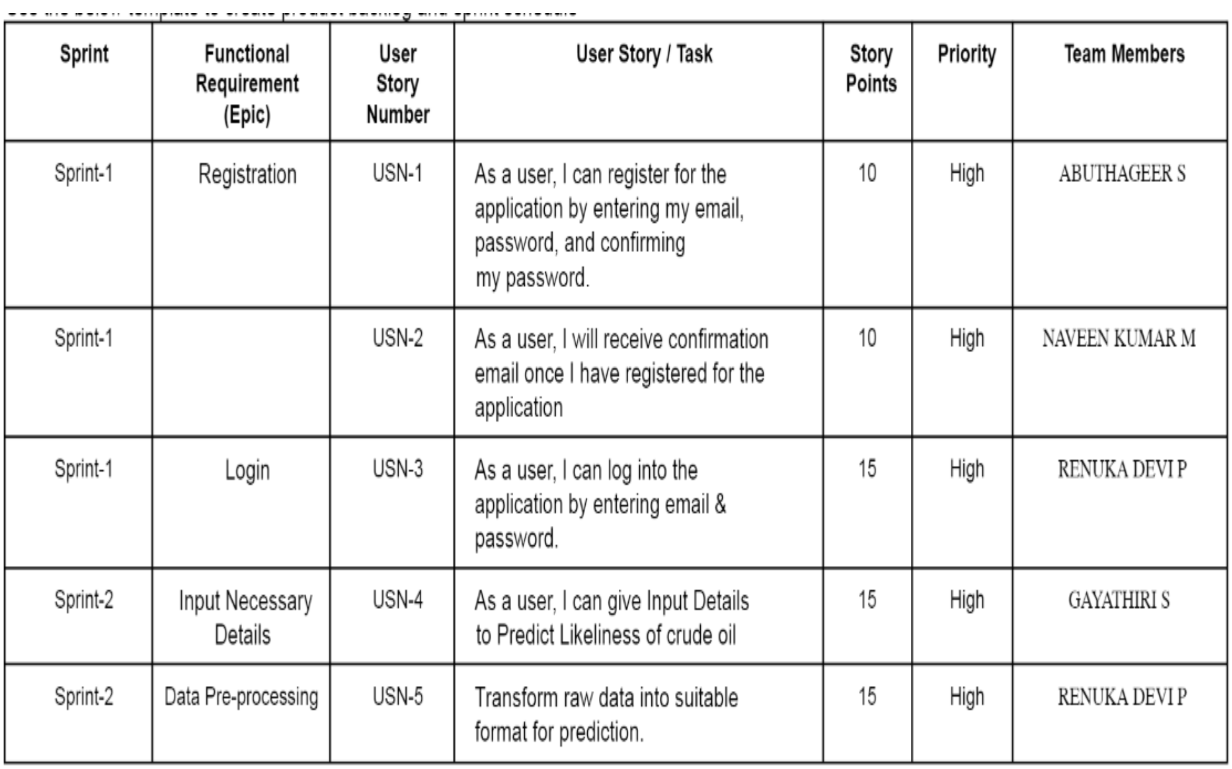
5.3 User Stories



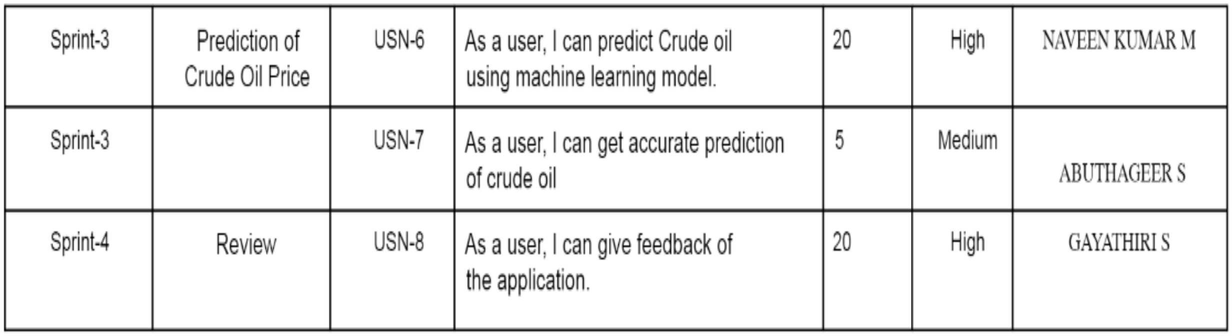
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	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 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 and password.	High	Sprint-1
	Dashboard	USN-6	Display the oil price, line graph/bar graph real time	I can except 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	Medium	Sprint-4
	News	USN-11	Admin will give the recent news of Oil Prices.	Provide the recent oil prices.	Medium	Sprint-4
	Notification	USN-12	Admin will notify when the oil prices changes.	Notification by Gmail.	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

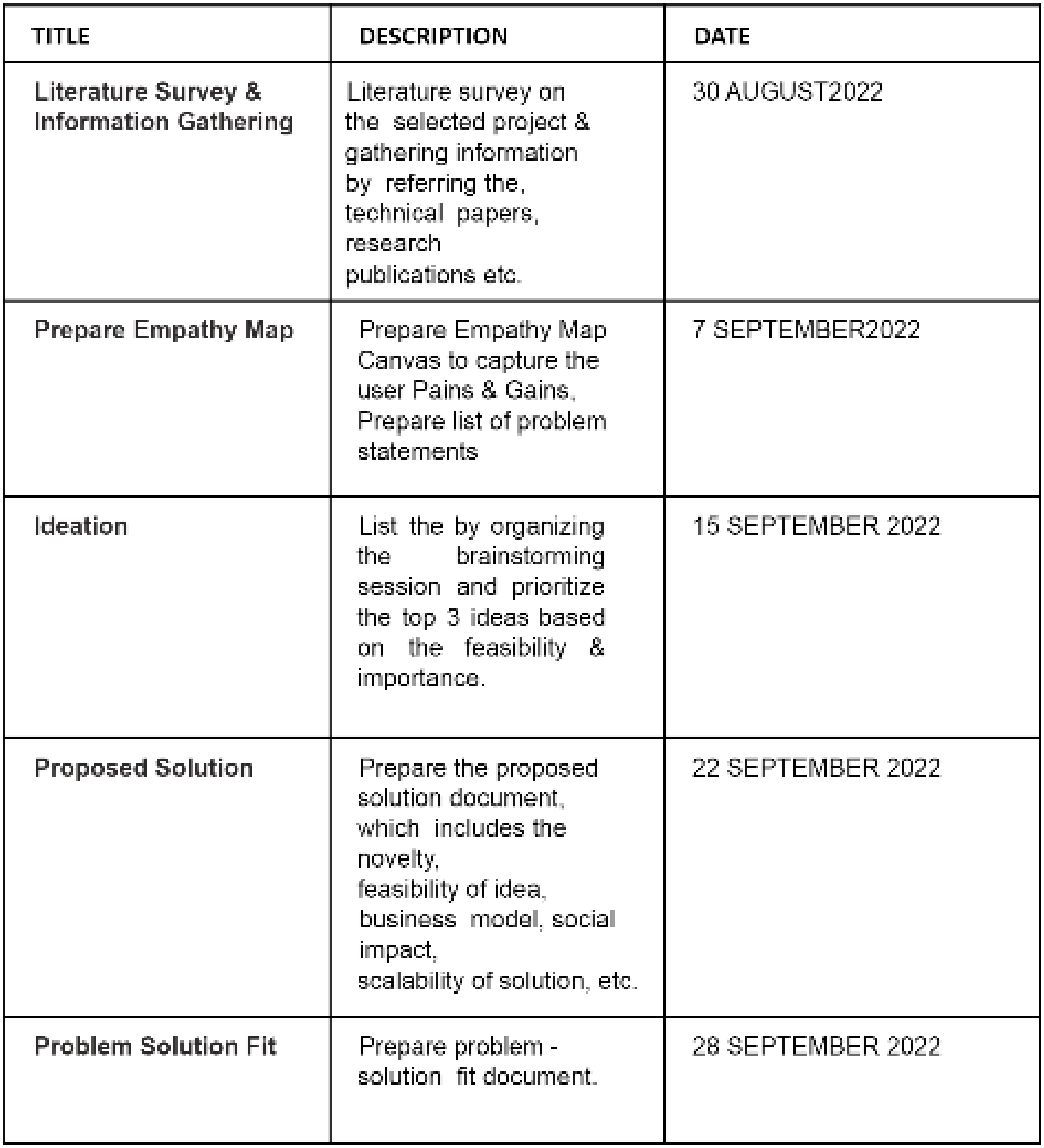
6.1 Sprint Planning & Estimation



Use the below template to create product backlog and sprint schedule



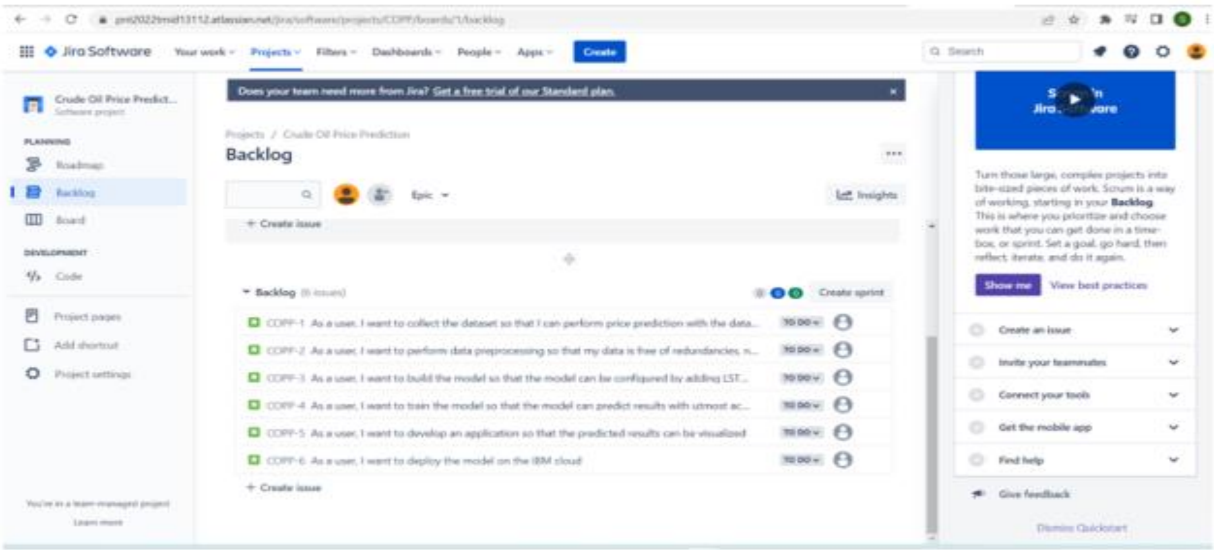
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	ABUTHAGEER S
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	10	High	NAVEEN KUMAR M
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password.	15	High	RENUKA DEVI P
Sprint-2	Input Necessary Details	USN-4	As a user, I can give Input Details to Predict Likeliness of crude oil	15	High	GAYATHIRI S
Sprint-2	Data Pre-processing	USN-5	Transform raw data into suitable format for prediction.	15	High	RENUKA DEVI P
Sprint-3	Prediction of Crude Oil Price	USN-6	As a user, I can predict Crude oil using machine learning model.	20	High	NAVEEN KUMAR M
Sprint-3		USN-7	As a user, I can get accurate prediction of crude oil	5	Medium	ABUTHAGEER S
Sprint-4	Review	USN-8	As a user, I can give feedback of the application.	20	High	GAYATHIRI S



TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	30 AUGUST2022
Prepare Empathy Map	Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	7 SEPTEMBER2022
Ideation	List the by organizing the brainstoming session and prioritize the top 3 ideas based on the feasibility & importance.	15 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	22 SEPTEMBER 2022
Problem Solution Fit	Prepare problem - solution fit document.	28 SEPTEMBER 2022

Solution Architecture	Prepare solution architecture document.	29 SEPTEMBER 2022
Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to exit).	4 OCTOBER 2022
Functional Requirement	Prepare the functional requirement document.	4 OCTOBER 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	11 OCTOBER 2022
Technology Architecture	Prepare the technology architecture diagram.	13 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	21 OCTOBER 2022
Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS...

6.3. REPORT FROM JIRA



Backlog

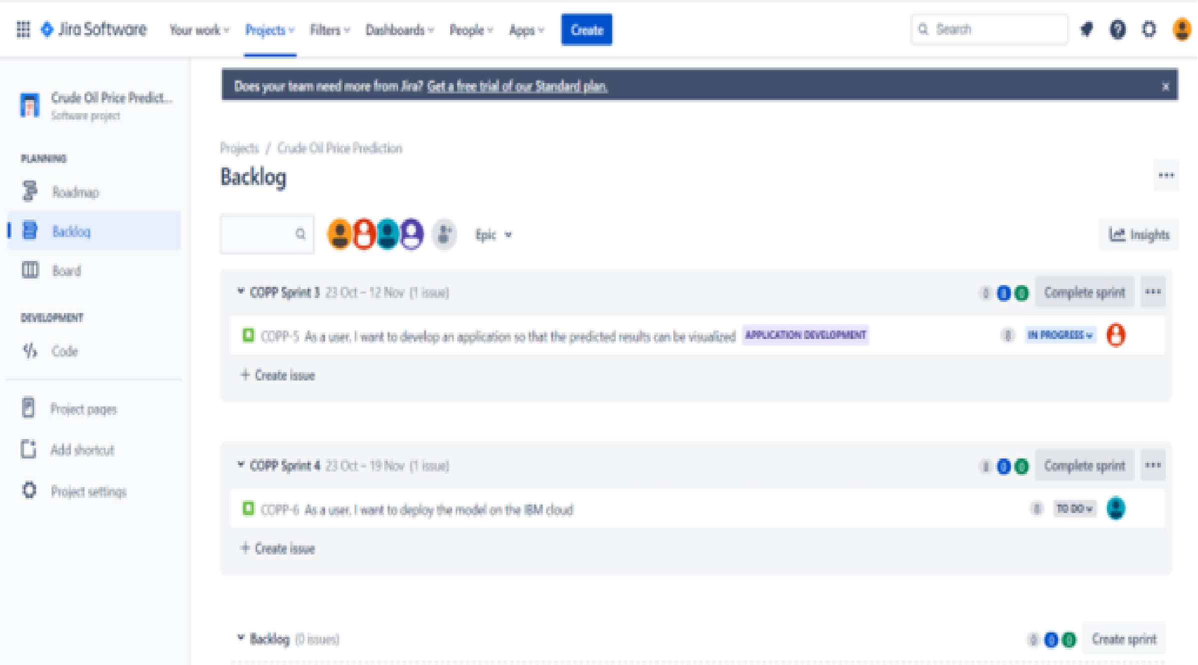
+ Create issue

Backlog (6 issues)

COPP-1	As a user, I want to collect the dataset so that I can perform price prediction with the data...	TO DO
COPP-2	As a user, I want to perform data preprocessing so that my data is free of redundancies, n...	TO DO
COPP-3	As a user, I want to build the model so that the model can be configured by adding LST...	TO DO
COPP-4	As a user, I want to train the model so that the model can predict results with utmost ac...	TO DO
COPP-5	As a user, I want to develop an application so that the predicted results can be visualized	TO DO
COPP-6	As a user, I want to deploy the model on the IBM cloud	TO DO

+ Create issue

Turn those large, complex projects into bite-sized pieces of work. Scrum is a way of working, starting in your **Backlog**. This is where you prioritize and choose work that you can get done in a time-box, or sprint. Set a goal, go hard, then reflect, iterate, and do it again.



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Projects / Crude Oil Price Prediction

Backlog

COPP Sprint 3 23 Oct – 12 Nov (1 issue) 0 0 0 Complete sprint

COPP-5 As a user, I want to develop an application so that the predicted results can be visualized APPLICATION DEVELOPMENT 0 IN PROGRESS

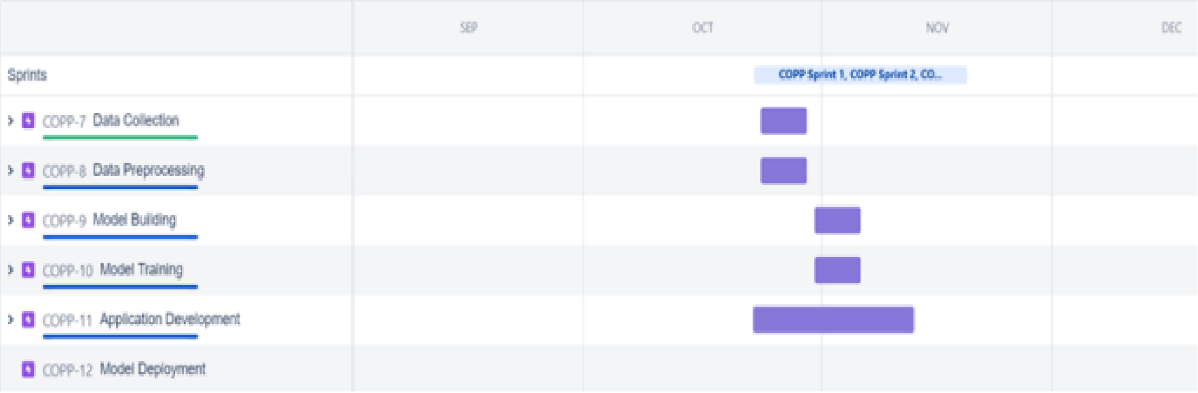
+ Create issue

COPP Sprint 4 23 Oct – 19 Nov (1 issue) 0 0 0 Complete sprint

COPP-6 As a user, I want to deploy the model on the IBM cloud 0 TO DO

+ Create issue

Backlog (0 issues) 0 0 0 Create sprint



COPP-7 Data Collection

COPP-8 Data Preprocessing

COPP-9 Model Building

COPP-10 Model Training

COPP-11 Application Development

COPP-12 Model Deployment

7. CODING & SOLUTIONING

7.1 Feature

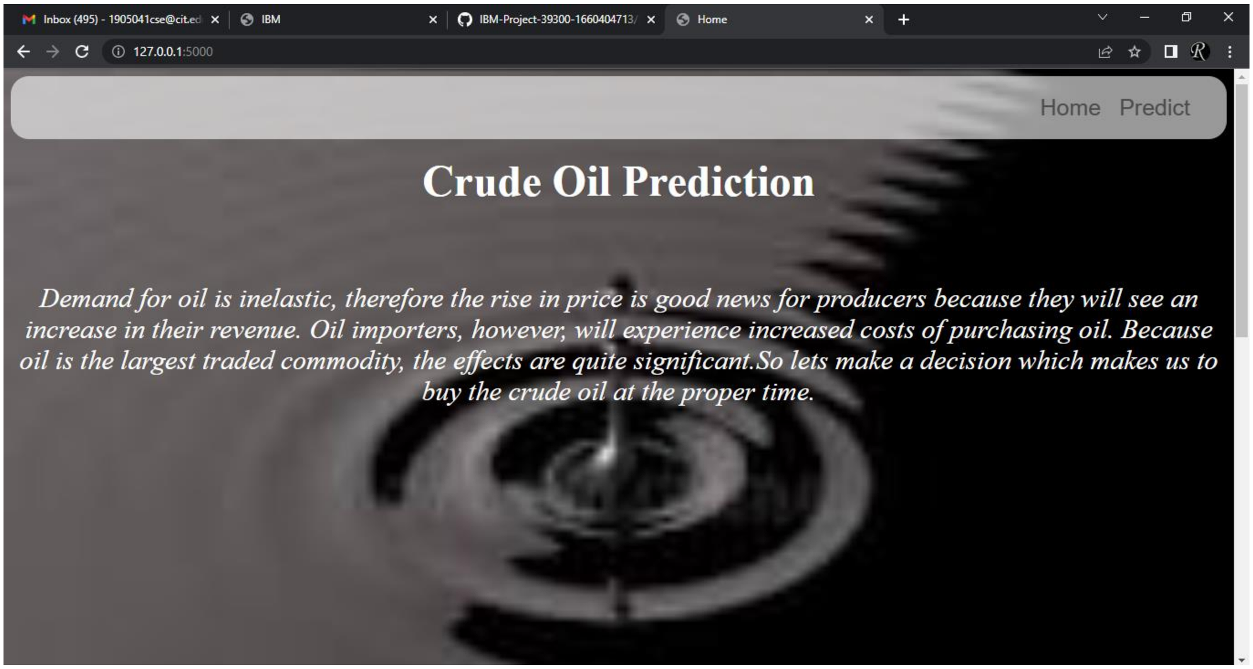
❖ The crude oil prediction website provides two options

➢ Home

➢ predict

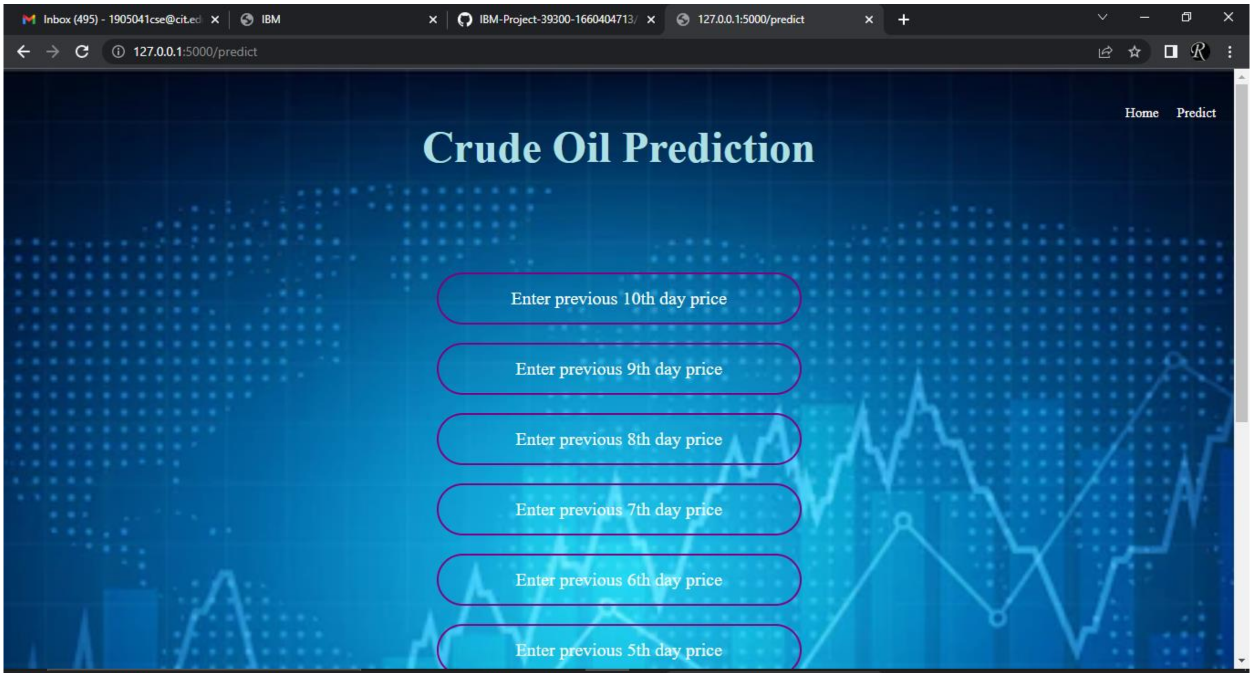
❖ The home allows the user to have an insight on the importance of crude oil price prediction

❖ The predict allows the user to give the 10 days input and arrive at the prediction results


Inbox (495) - 1905041cse@cit.ed
IBM
IBM-Project-39300-1660404713/
Home
127.0.0.1:5000
Home
Predict

Crude Oil Prediction

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.So lets make a decision which makes us to buy the crude oil at the proper time.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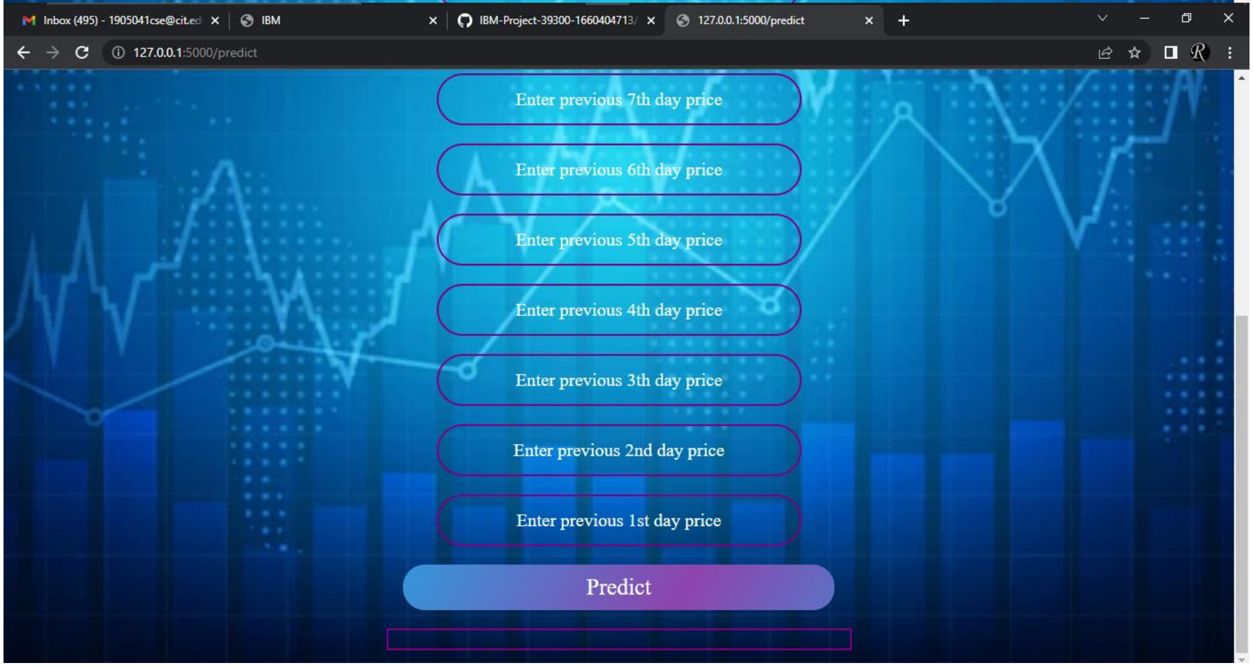
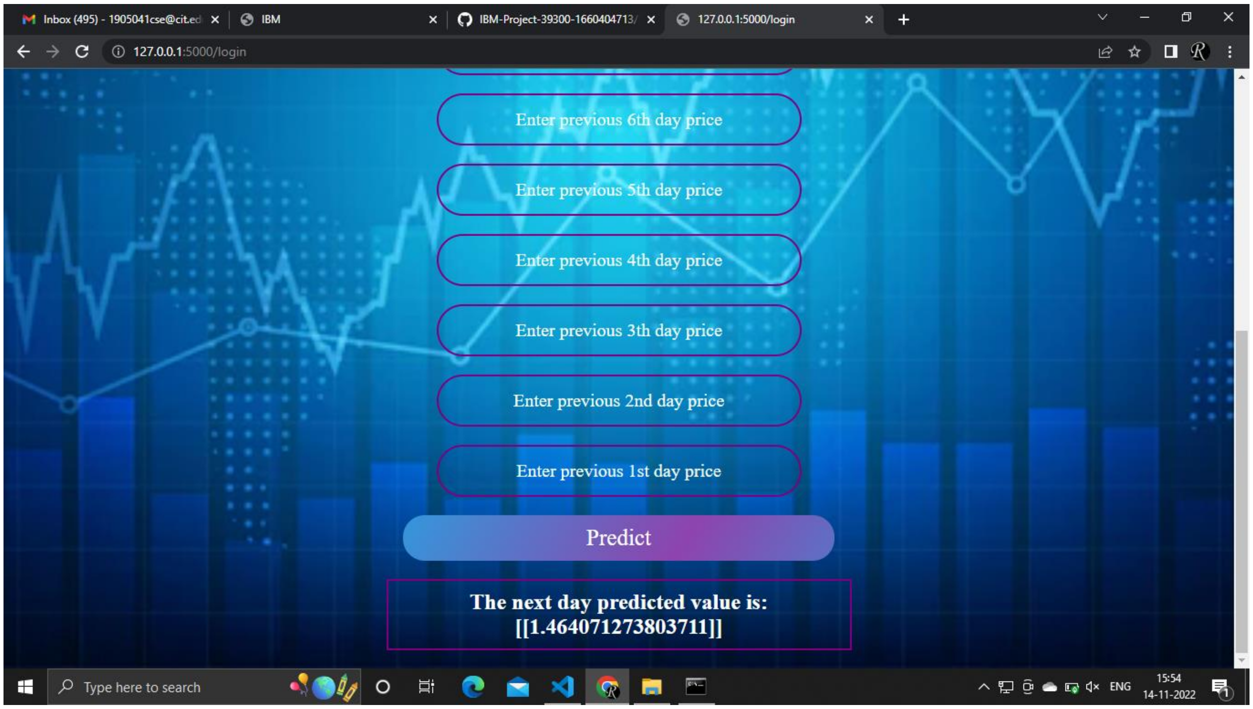
IBM
IBM-Project-39300-1660404713
127.0.0.1:5000/predict
127.0.0.1:5000/predict
Home
Predict
Crude Oil Prediction
Enter previous 10th day price
Enter previous 9th day price
Enter previous 8th day price
Enter previous 7th day price
Enter previous 6th day price
Enter previous 5th day price


Inbox (495) - 1905041cse@cit.ed
IBM
IBM-Project-39300-1660404713
127.0.0.1:5000/predict
127.0.0.1:5000/predict
Enter previous 7th day price
Enter previous 6th day price
Enter previous 5th day price
Enter previous 4th day price
Enter previous 3th day price
Enter previous 2nd day price
Enter previous 1st day price
Predict



Enter previous 6th day price

Enter previous 5th day price

Enter previous 4th day price

Enter previous 3th day price

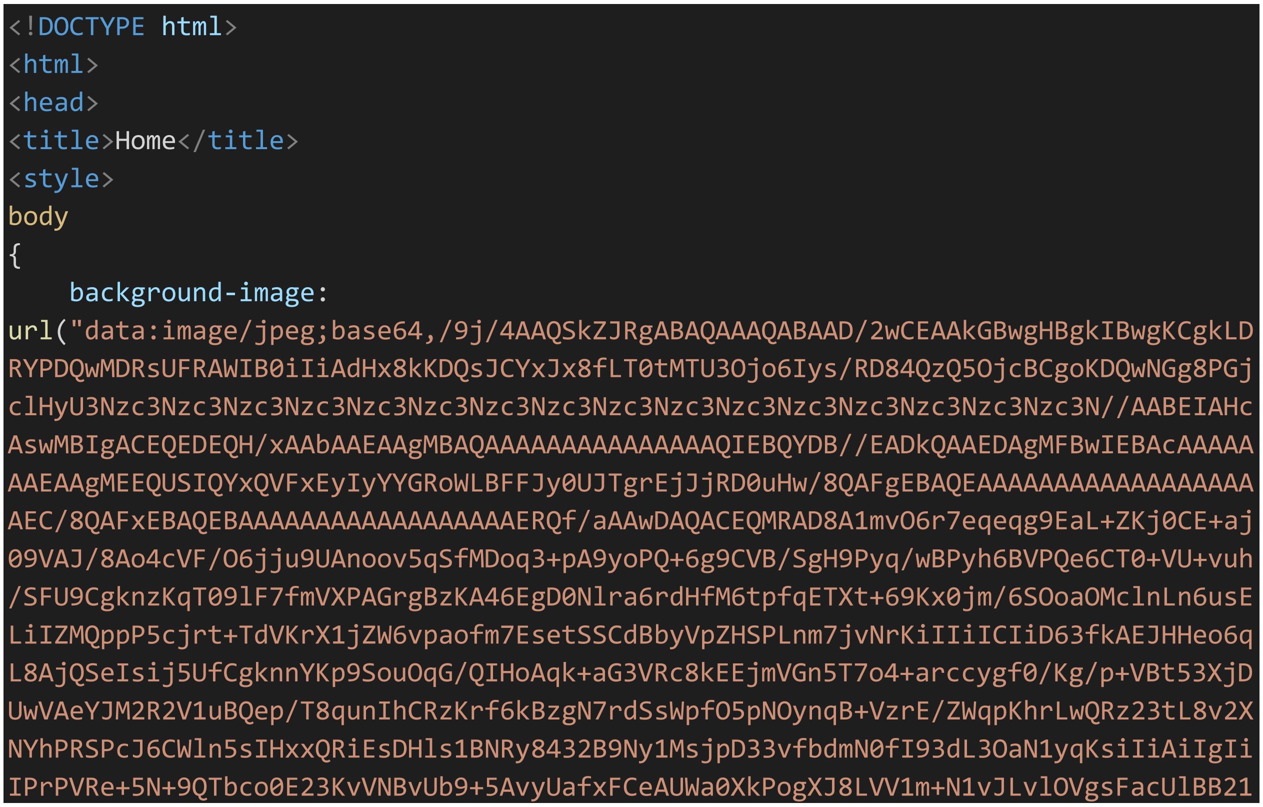
Enter previous 2nd day price

Enter previous 1st day price

Predict

The next day predicted value is:
[[1.464071273803711]]

CODE:
File1.html



```
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<style>
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```
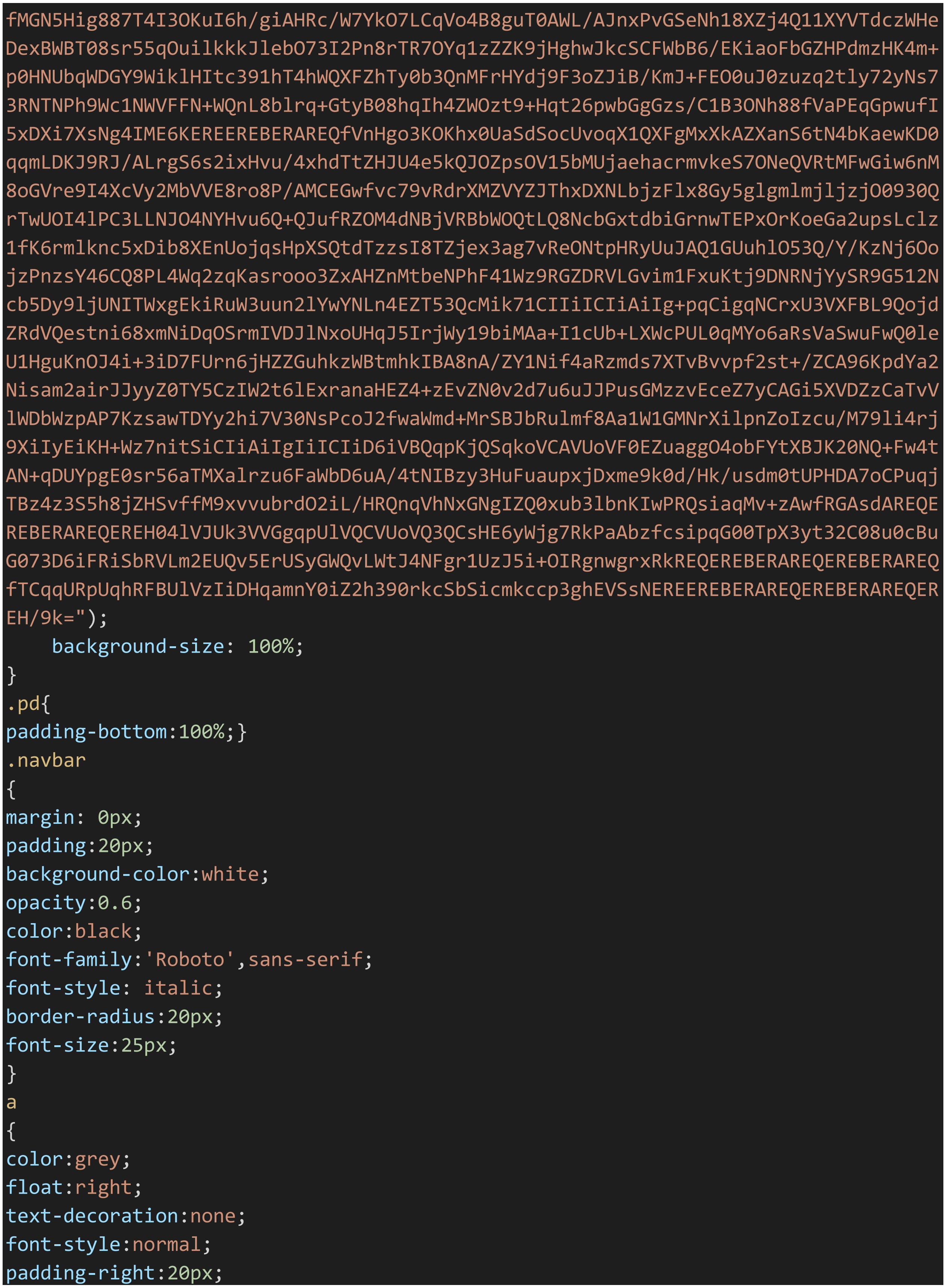
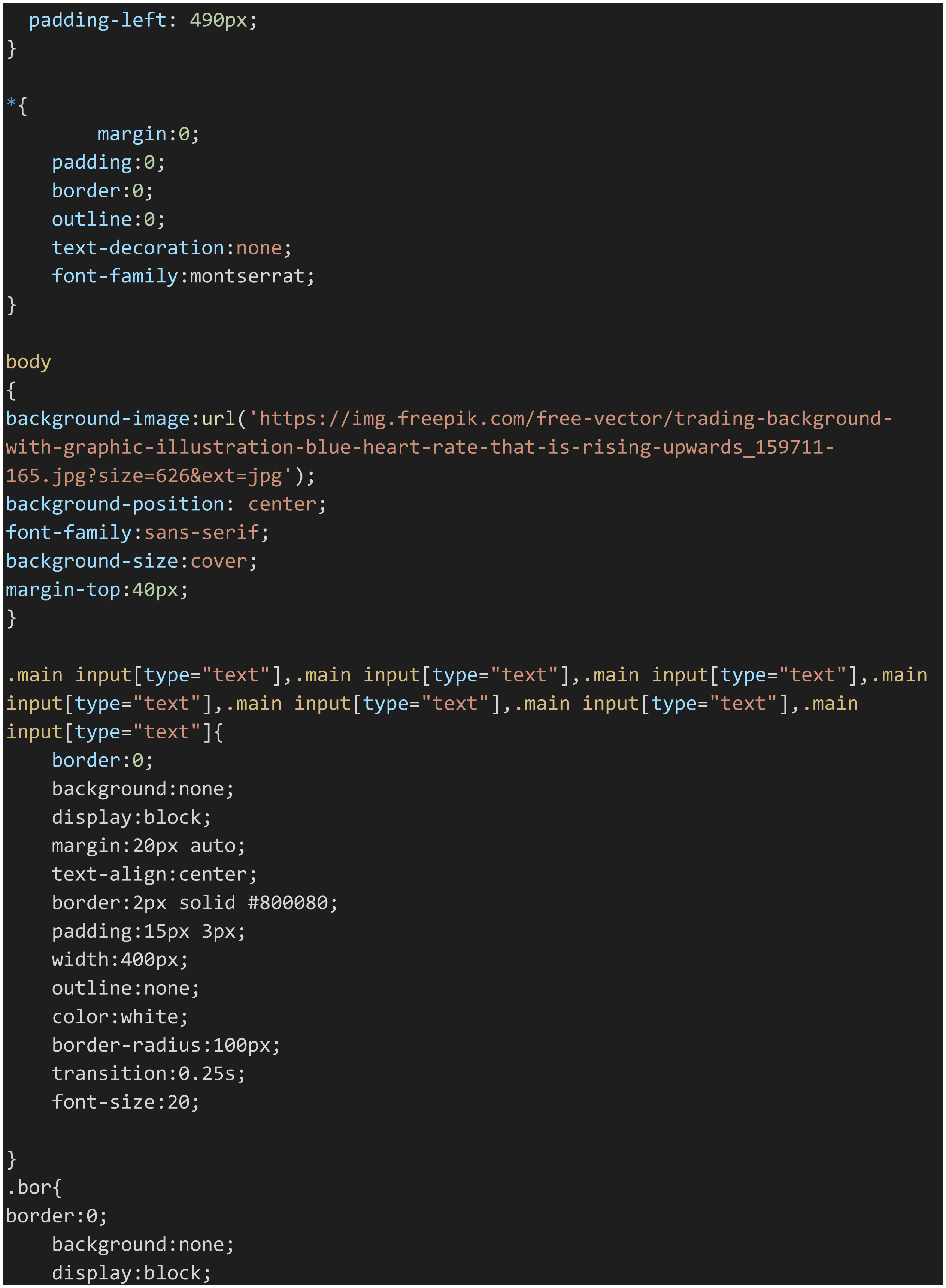



```
fMGN5Hig887T4I3OKuI6h/giAHRc/W7YkO7LCqVo4B8guT0AWL/AJnxPvGSeNh18XZj4Q11XYVTdczWHe
DexBWBT08sr55qOuilkkkJlebO73I2Pn8rTR7OYq1zZZK9jHghwJkcSCFWbB6/EKiaoFbGZHPdmzHK4m+
p0HNUbqWDGY9WiklHItc391hT4hWQXFZhTy0b3QnMFrHYdj9F3oZJiB/KmJ+FEO0uJ0zuzq2tly72yNs7
3RNTNPh9Wc1NWVFFN+WQnL8blrq+GtyB08hqIh4ZWOzt9+Hqt26pwbGgGzs/C1B3ONh88fVaPEqGpwufI
5xDXi7XsNg4IME6KEREEREBERAREQfVnHgo3KOKhx0UaSdSocUvoqX1QXFgMxXkAZXanS6tN4bKaewKD0
qqmLDKJ9RJ/ALrgS6s2ixHvu/4xhdTtZHJU4e5kQJOZpsOV15bMUjaehacrmvkeS7ONeQVRtMFwGiw6nM
8oGVre9I4XcVy2MbVVE8ro8P/AMCEGwfvc79vRdrXMZVYZJThxDXNLbjzFlx8Gy5glgmlmjljzjO0930Q
rTwUOI4lPC3LLNJO4NYHvu6Q+QJufRZOM4dNBjVRBbWOQtLQ8NcbGxtdbiGrnwTEPxOrKoeGa2upsLclz
1fK6rmlknc5xDib8XEnUojqsHpXSQtdTzzsI8TZjex3ag7vReONtpHRyUuJAQ1GUuhlO53Q/Y/KzNj6Oo
jzPnzsY46CQ8PL4Wq2zqKasrooo3ZxAHZnMtbeNPhF41Wz9RGZDRVLGvim1FxuKtj9DNRNjYySR9G512N
cb5Dy9ljUNITWxgEkiRuW3uun2lYwYNLn4EZT53QcMik71CIIiICIiAiIg+pqCigqNCrxU3VXFBL9Qojd
ZRdVQestni68xmNiDqOSrmIVDJlNxoUHqJ5IrjWy19biMAa+I1cUb+LXWcPUL0qMYo6aRsVaSwuFwQ0le
U1HguKnOJ4i+3iD7FUrn6jHZZGuhkzWBtmhkIBA8nA/ZY1Nif4aRzmds7XTvBvvpf2st+/ZCA96KpdYa2
Nisam2airJJyyZ0TY5CzIW2t6lExranaHEZ4+zEvZN0v2d7u6uJJPusGMzzvEceZ7yCAGi5XVDZzCaTvV
lWDbWzpAP7KzsawTDYy2hi7V30NsPcoJ2fwaWmd+MrSBJbRulmf8Aa1W1GMNrXilpnZoIzcu/M79li4rj
9XiIyEiKH+Wz7nitSiCIiAiIgIiICIiD6iVBQqpKjQSqkoVCAVUoVF0EZuaggO4obFYtXBJK20NQ+Fw4t
AN+qDUYpgE0sr56aTMXalrzu6FaWbD6uA/4tNIBzy3HuFuaupxjDxme9k0d0/Hk/Hk/usdm0tUtUPHDA7oCPuqj
TBz4z3S5h8jZHSvffffM9xvvubrdO2iL/HRQnqVhNxGNgIZQ0xub3lbnKIwPRQsiaqMv+zAwfRGAsdAREQE
REBERAREQEREH04lVJUk3VVGgqpUlCVQCVUoVF0EZuaggO4obFYtXBJK20NQ+Fw4t
fTCqqURpUqhRFBUlVzIiDHqamnY0iZ2h390rkcSbSicmccp3ghEVSsNEREQEREBERAREQER
EH/9k=");
    background-size: 100%;
}
.pd{
padding-bottom:100%;}
.navbar
{
margin: 0px;
padding:20px;
background-color:white;
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
```

```
}

p
{
color:turqouise;
font-style:oblique;
font-size:30px;
}
</style>
</head>
<body>
<div class="navbar">
<a href="/predict" >Predict</a>
<a href="/about">Home</a>
<br>
</div>
<br>
<center><b class="pd"><font color="white" size="15" font-family="Comic Sans MS"
>Crude Oil 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.So lets make a decision which makes us to buy the crude oil at the
proper time.</p>
</center>
</div>
</body>
</html>
```

File2.html

```
<html>

<style>
div.header{
  top: 0;
  position: fixed;
  padding-left: 400px;}
div.header1{
  top:20;
  position: fixed;
```



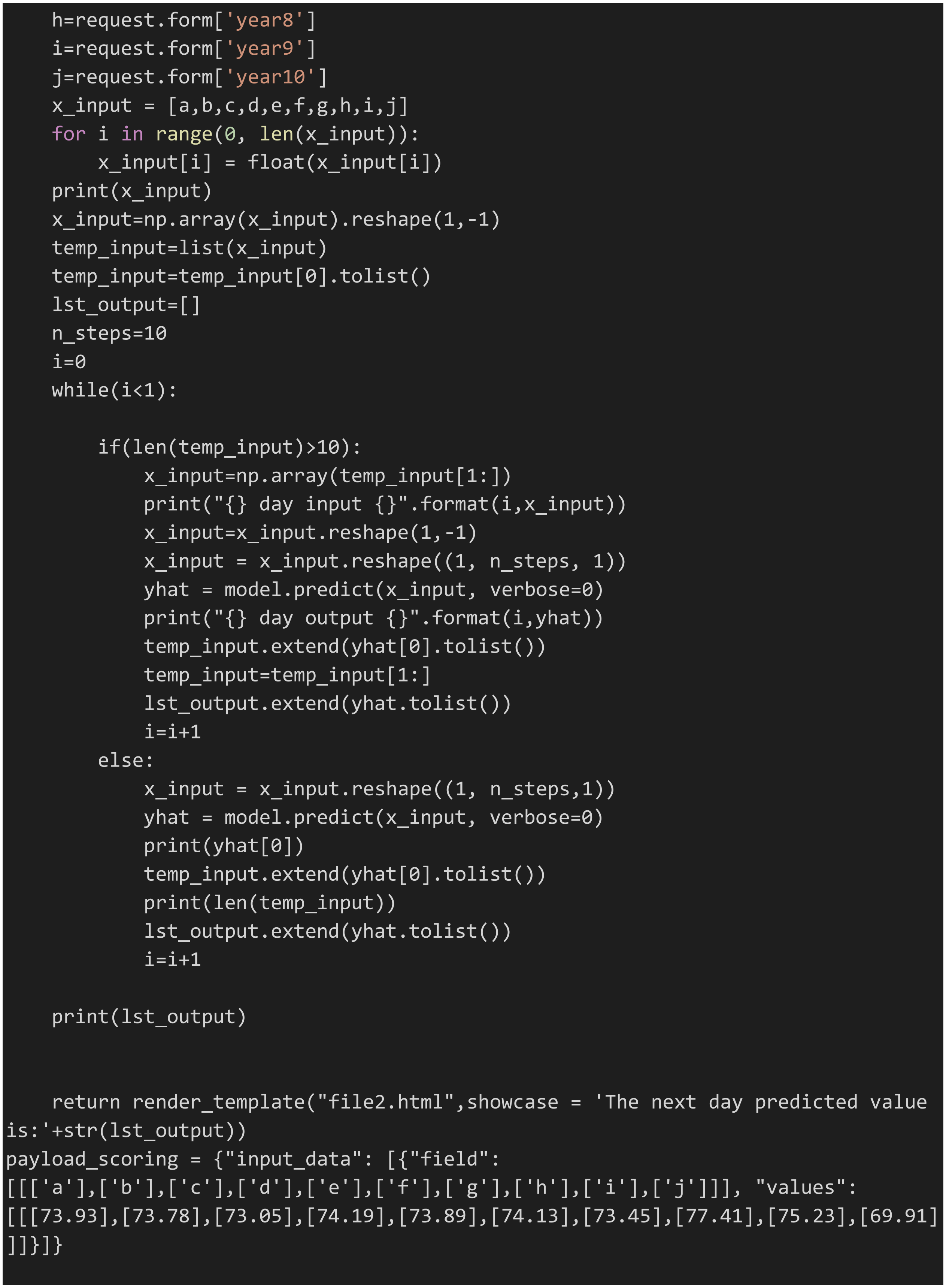
```
  padding-left: 490px;
}

*{
        margin:0;
    padding:0;
    border:0;
    outline:0;
    text-decoration:none;
    font-family:montserrat;
}

body
{
background-image:url('https://img.freepik.com/free-vector/trading-background-
with-graphic-illustration-blue-heart-rate-that-is-rising-upwards_159711-
165.jpg?size=626&ext=jpg');
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;

}
a
{
color:white;
```

```
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
font-size: 15px;
}


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

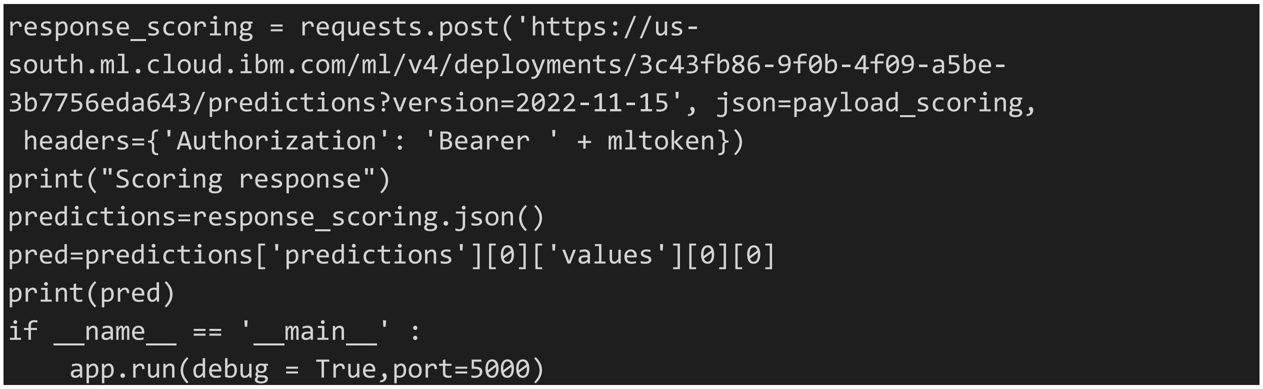
```
    </form>
</div>
</body>

</html>
```

App.py

```
import numpy as np
from flask import Flask,render_template,request
from keras.models import load_model
import requests

API_KEY = "Rg0cfF6TtFNPcwNKGgF_2IN9wC5hvgnfHA0ZmzykQ2cK"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token',
data={"apikey":
 API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' +
mltoken}

app = Flask(__name__)
model = load_model('crude_oil.h5')

@app.route('/')
def home() :
    return render_template("file1.html")
@app.route('/about')
def home1() :
    return render_template("file1.html")
@app.route('/predict')
def home2() :
    return render_template("file2.html")

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



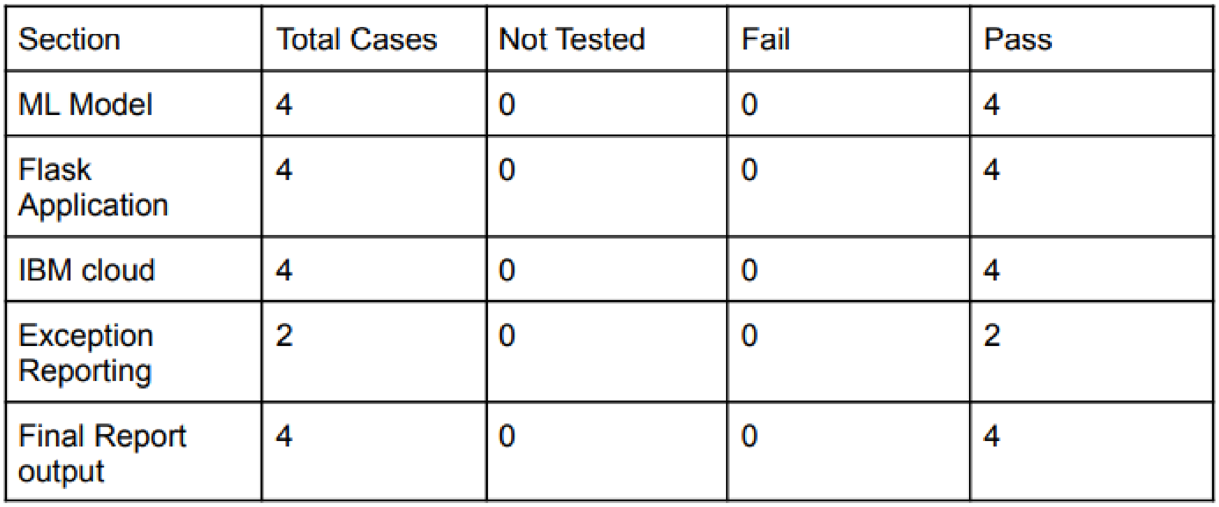
```
    h=request.form['year8']
    i=request.form['year9']
    j=request.form['year10']
    x_input = [a,b,c,d,e,f,g,h,i,j]
    for i in range(0, len(x_input)):
        x_input[i] = float(x_input[i])
    print(x_input)
    x_input=np.array(x_input).reshape(1,-1)
    temp_input=list(x_input)
    temp_input=temp_input[0].tolist()
    lst_output=[]
    n_steps=10
    i=0
    while(i<1):

        if(len(temp_input)>10):
            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))
            yhat = model.predict(x_input, verbose=0)
            print("{} day output {}".format(i,yhat))
            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)
            print(yhat[0])
            temp_input.extend(yhat[0].tolist())
            print(len(temp_input))
            lst_output.extend(yhat.tolist())
            i=i+1

    print(lst_output)


    return render_template("file2.html",showcase = 'The next day predicted value
is:'+str(lst_output))
payload_scoring = {"input_data": [{"field":
[[['a'],['b'],['c'],['d'],['e'],['f'],['g'],['h'],['i'],['j']]], "values":
[[[73.93],[73.78],[73.05],[74.19],[73.89],[74.13],[73.45],[77.41],[75.23],[69.91]
]]}]}
```



```
response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/3c43fb86-9f0b-4f09-a5be-
3b7756eda643/predictions?version=2022-11-15', json=payload_scoring,
 headers={'Authorization': 'Bearer ' + mltoken})
print("Scoring response")
predictions=response_scoring.json()
pred=predictions['predictions'][0]['values'][0][0]
print(pred)
if __name__ == '__main__' :
    app.run(debug = True,port=5000)
```

8. Testing

8.1.Test cases



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 Report output	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 price prediction project at the time of the release to user acceptance testing

Defect Analysis:

The report shows the number of resolved and closed bugs at each severity level and how they were resolved.This report shows the number of test cases that have passed, failed, and untested.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

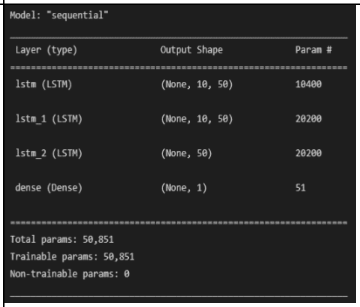
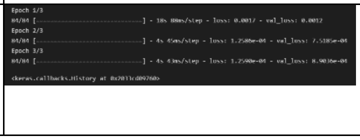
Test case analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Login page	7	0	0	7
Prediction page	51	0	0	51
History page	2	0	0	2
Favorite page	3	0	0	3
Feedback page	9	0	0	9

9. RESULTS

9.1 Performance Metrics

S.No.	Parameter	Values	Screenshot
1.	Model Summary		
2.	Accuracy	Training Accuracy – 96.3% Validation Accuracy -90.6%	

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 10, 50)            10400

 lstm_1 (LSTM)               (None, 10, 50)            20200

 lstm_2 (LSTM)               (None, 50)                20200

 dense (Dense)               (None, 1)                 51

=================================================================
Total params: 50,851
Trainable params: 50,851
Non-trainable params: 0
_________________________________________________________________
```

```
Epoch 1/3
84/84 [==============================] - 10s 80ms/step - loss: 0.0017 - val_loss: 0.0012
Epoch 2/3
84/84 [==============================] - 4s 45ms/step - loss: 1.2586e-04 - val_loss: 7.5185e-04
Epoch 3/3
84/84 [==============================] - 4s 43ms/step - loss: 1.2590e-04 - val_loss: 8.9036e-04

<keras.callbacks.History at 0x2033cd09760>
```

10. ADVANTAGES & DISADVANTAGES

Advantages:

● Prediction of crude oil price can help the importers to choose the right time to buy as they wait for the prices to fall down

● Prediction of crude oil prices can help the exporters to increase the demand

● It can even help in shifting the political powers

● can assist in minimizing the risks associated with volatility in oil prices

Disadvantages

● The prediction results may lack accuracy

● Volatility in prices may be misleading

11. CONCLUSION

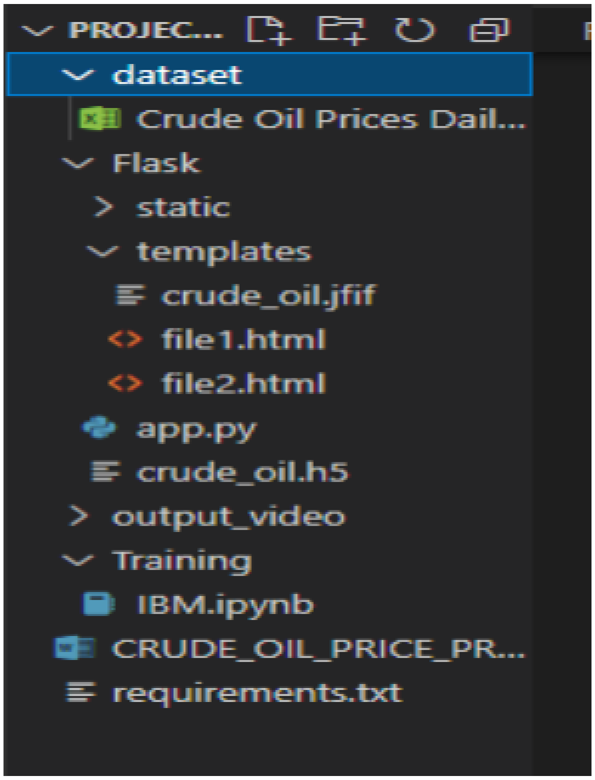
LSTM network is better than other traditional neural networks for forecasting prices as it aims in using a back propagation model. Traditional neural networks such as CNN on the other hand predicts the next outgoing but doesn’t necessarily save the previous data or connection which is based on feed-forwarding, in the sense the previous data is not necessary to predict the future data. LSTM focuses on storing the previous data and prediction which is rather encouraging and more approximate. The outcomes derived are relatively encouraging. The results show that large lookups 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 project can be enhanced with real time data.

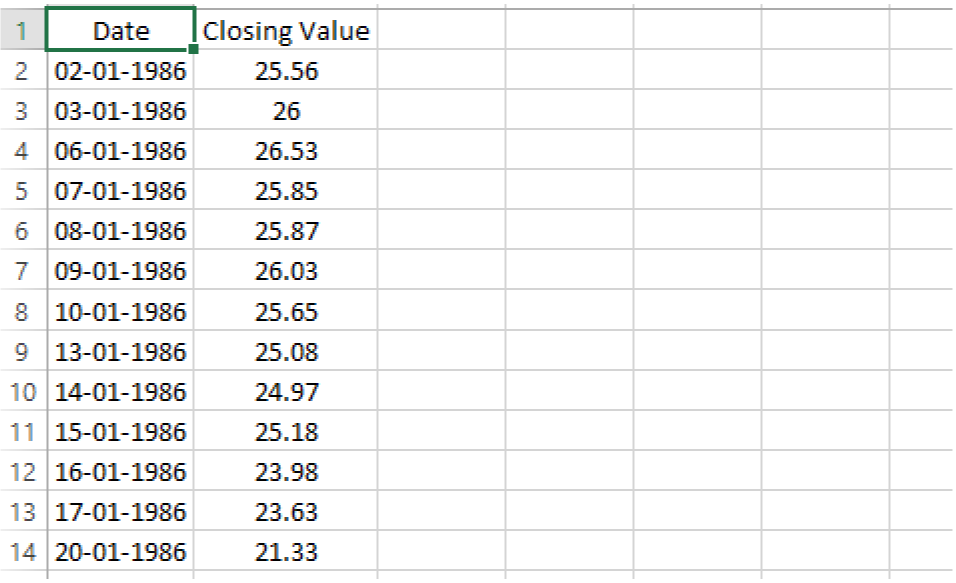
APPENDIX

PROJECT STRUCTURE



```
PROJEC...
  dataset
    Crude Oil Prices Dail...
  Flask
    static
    templates
      crude_oil.jfif
      file1.html
      file2.html
    app.py
    crude_oil.h5
  output_video
  Training
    IBM.ipynb
  CRUDE_OIL_PRICE_PR...
  requirements.txt
```

DATASET



	Date	Closing Value
2	02-01-1986	25.56
3	03-01-1986	26
4	06-01-1986	26.53
5	07-01-1986	25.85
6	08-01-1986	25.87
7	09-01-1986	26.03
8	10-01-1986	25.65
9	13-01-1986	25.08
10	14-01-1986	24.97
11	15-01-1986	25.18
12	16-01-1986	23.98
13	17-01-1986	23.63
14	20-01-1986	21.33

Source Code

MODEL:

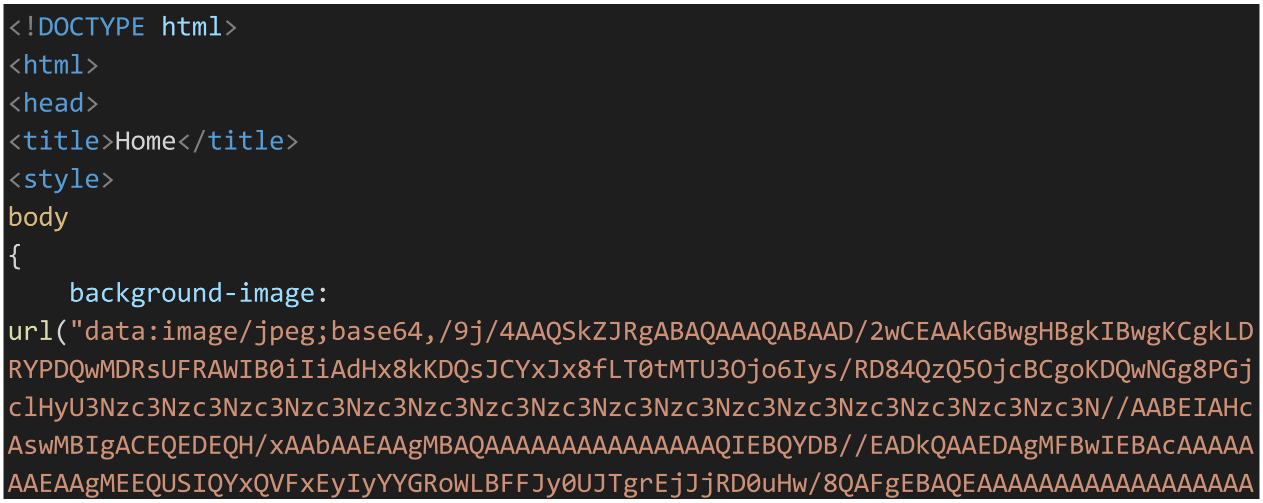
```
# IMPORTING THE LIBRARIES
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
# IMPORTING THE DATASET
data=pd.read_csv('Crude_Oil_Prices_Daily.csv')
print(data)
# HANDLING MISSING DATA
data.isnull().any()
data.isnull().sum()
data.dropna(axis=0,inplace=True)
data.isnull().sum()
data_oil=data.reset_index()['Closing Value']
data_oil
# FEATURE SCALING
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler(feature_range=(0,1))
data_oil=scaler.fit_transform(np.array(data_oil).reshape(-1,1))
data_oil
# DATA VISUALIZATION
plt.plot(data_oil)
# SPLITTING DATA INTO TRAINING AND TEST
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 THE DATASET
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=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)
# IMPORTING THE MODEL BUILDING LIBRARIES
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import LSTM
pip install tensorflow
# 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()
# CONFIGURING THE LEARNING PROCESS
model.compile(loss='mean_squared_error',optimizer='adam')
model.fit(x_train,y_train,validation_data=(x_test,y_test),epochs=3,batch_size=64,verbose=1)
# MODEL EVALUATION
train_predict=scaler.inverse_transform(train_data)
test_predict=scaler.inverse_transform(test_data)
### Calculate RMSE performance metrics
import math
from sklearn.metrics import mean_squared_error
math.sqrt(mean_squared_error(train_data,train_predict))
# SAVING THE MODEL
from tensorflow.keras.models import load_model
model.save("crude_oil.h5")
# TESTING THE MODEL
look_back=10
trainpredictPlot = np.empty_like(data_oil)
trainpredictPlot[:, :]= np.nan
trainpredictPlot[look_back:len(train_predict)+look_back, :] = train_predict
# shift test predictions for plotting
```

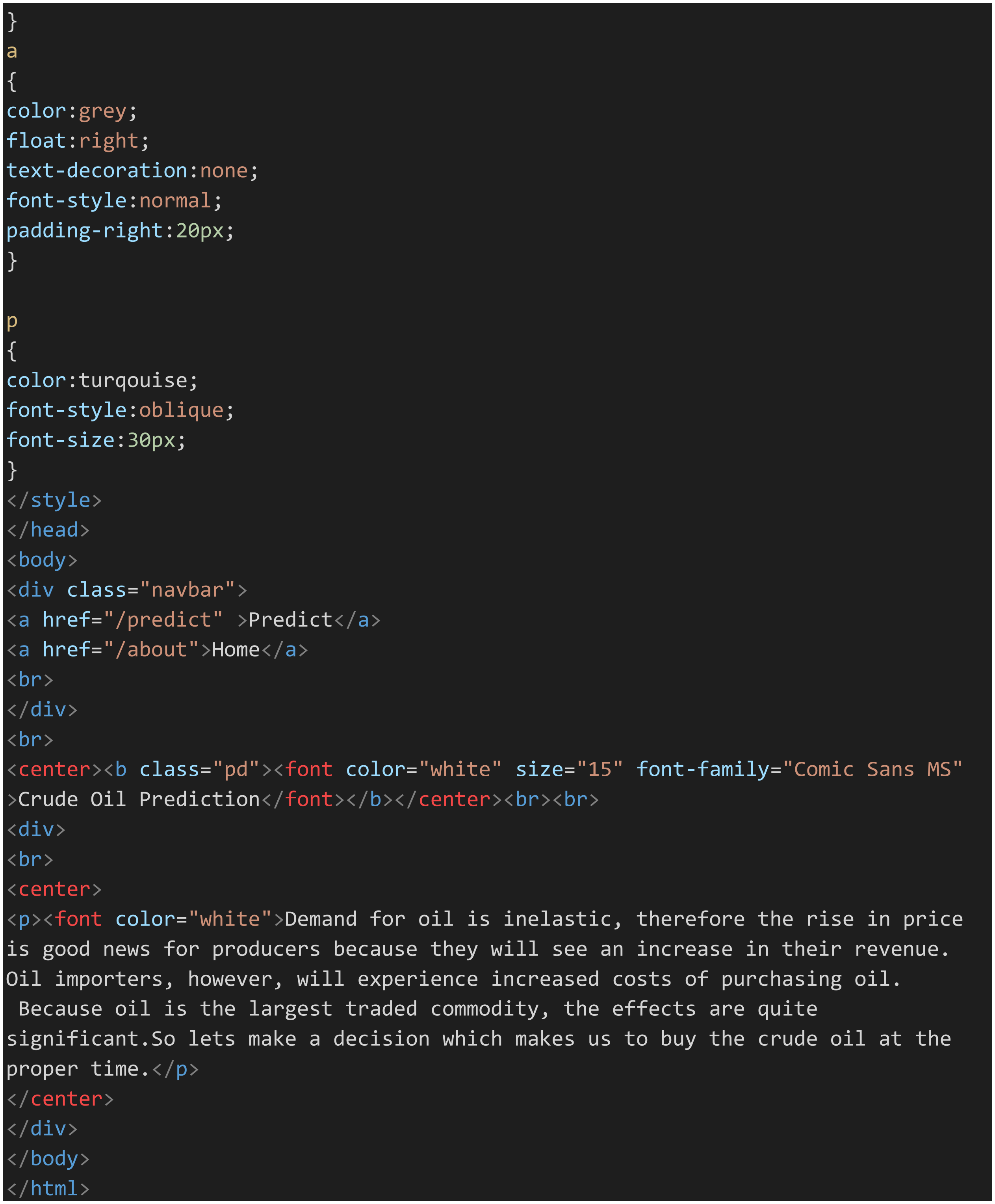
```
testPredictplot = np.empty_like(data_oil)
testPredictplot[:,: ] = np.nan
testPredictplot[look_back:len(test_predict)+look_back, :] = test_predict
# plot baseline and predictions
plt.plot(scaler.inverse_transform(data_oil))
plt.show()
x_input=test_data[2866:].reshape(1,-1)
x_input.shape
temp_input=list(x_input)
temp_input=temp_input[0].tolist()
temp_input
lst_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
day_new=np.arange(1,11)
day_pred=np.arange(11,21)
len(data_oil)
plt.plot(day_new, scaler.inverse_transform(data_oil[8206:]))
plt.plot(day_pred, scaler.inverse_transform(lst_output))
df3=data_oil.tolist()
df3.extend(lst_output)
plt.plot(df3[8100:])
df3=scaler.inverse_transform(df3).tolist()
plt.plot(scaler.inverse_transform(data_oil))
```

file1.html



```
<!DOCTYPE html>
<html>
<head>
<title>Home</title>
<style>
body
{
    background-image:
url("data:image/jpeg;base64,/9j/4AAQSkZJRgABAQAAAQABAAD/2wCEAAkGBwgHBgkIBwgKCgkLD
RYPDQwMDRsUFRAWIB0iIiAdHx8kKDQsJCYxJx8fLT0tMTU3Ojo6Iys/RD84QzQ5OjcBCgoKDQwNGg8PGj
clHyU3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3Nzc3N//AABEIAHc
AswMBIgACEQEDEQH/xAAbAAEAAgMBAQAAAAAAAAAAAAAAAQIEBQYDB//EADkQAAEDAgMFBwIEBAcAAAAA
AAEAAgMEEQUSIQYxQVFxEyIyYYGRoWLBFFJy0UJTgrEjJjRD0uHw/8QAFgEBAQEAAAAAAAAAAAAAAAAAAA
```

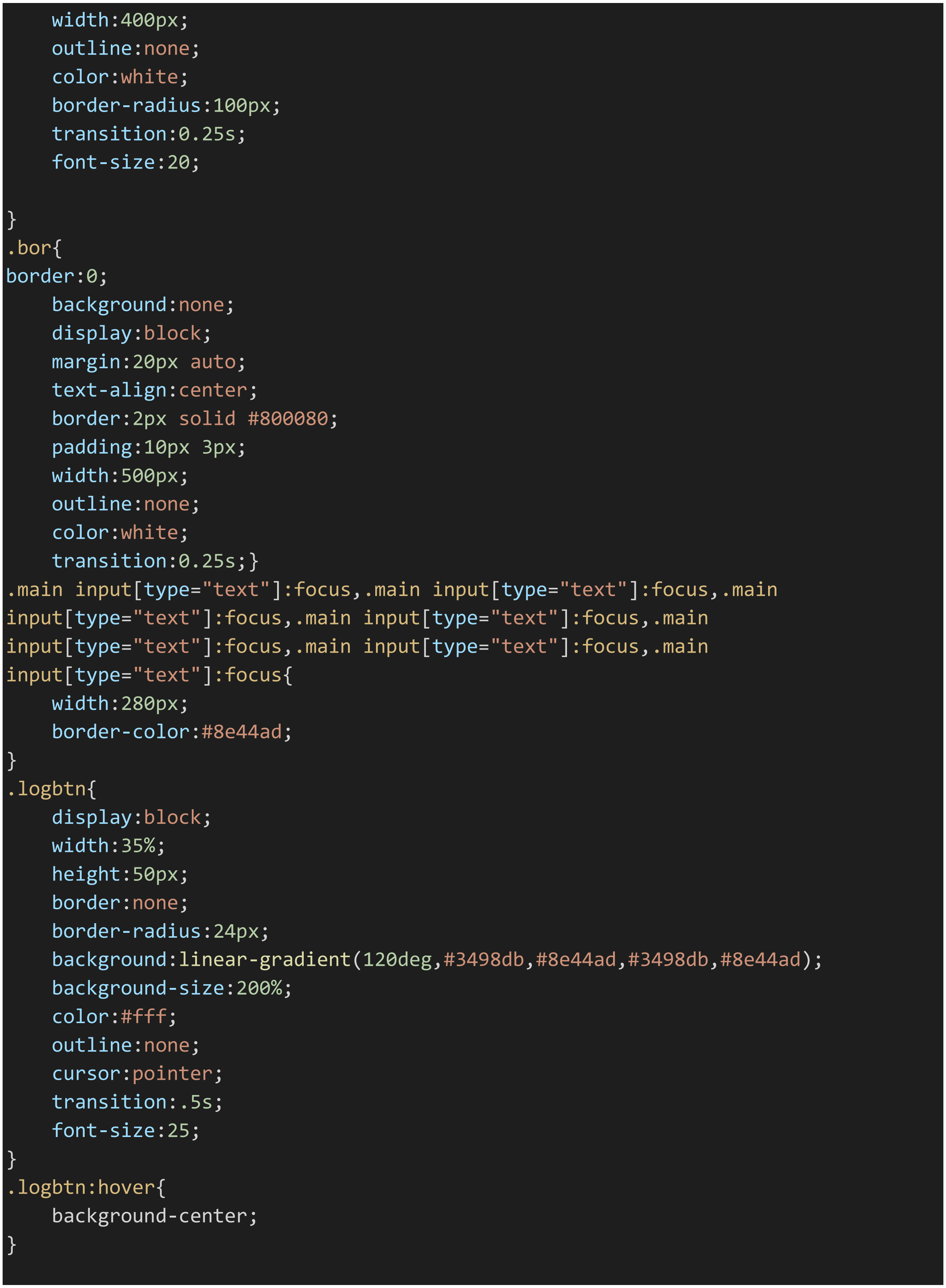
```
AEC/8QAFxEBAQEBAAAAAAAAAAAAAAAAAAERQf/aAAwDAQACEQMRAD8A1mvO6r7eqeqg9EaL+ZKj0CE+aj
09VAJ/8Ao4cVF/O6jju9UAnoov5qSfMDoq3+pA9yoPQ+6g9CVB/SgH9Pyq/wBPyh6BVPQe6CT0+VU+vuh
/SFU9CgknzKqT09lF7fmVXPAGrgBzKA46EgD0Nlra6rdHfM6tpfqETXt+69Kx0jm/6SOoaOMclnLn6usE
LiIZMQppP5cjrt+TdVKrX1jZW6vpaofm7EsetSSCdBbyVpZHSPLnm7jvNrKiIIiICIiD63fkAEJHHeo6q
L8AjQSeIsij5UfCgknnYKp9SouOqG/QIHoAqk+aG3VRc8kEEjmVGn5T7o4+arccygf0/Kg/p+VBt53XjD
UwVAeYJM2R2V1uBQep/T8qunIhCRzKrf6kBzgN7rdSsWpfO5pNOynqB+VzrE/ZWqpKhrLwQRz23tL8v2X
NYhPRSPcJ6CWln5sIHxxQRiEsDHls1BNRy8432B9Ny1MsjpD33vfbdmN0fI93dL3OaN1yqKsiIiAiIgIi
IPrPVRe+5N+9QTbco0E23KvVNBvUb9+5AvyUafxFCeAUWa0XkPogXJ8LVV1m+N1vJLvlOVgsFacUlBB21
fMGN5Hig887T4I3OKuI6h/giAHRc/W7YkO7LCqVo4B8guT0AWL/AJnxPvGSeNh18XZj4Q11XYVTdczWHe
DexBWBT08sr55qOuilkkkJlebO73I2Pn8rTR7OYq1zZZK9jHghwJkcSCFWbB6/EKiaoFbGZHPdmzHK4m+
p0HNUbqWDGY9WiklHItc391hT4hWQXFZhTy0b3QnMFrHYdj9F3oZJiB/KmJ+FEO0uJ0zuzq2tly72yNs7
3RNTNPh9Wc1NWVFFN+WQnL8blrq+GtyB08hqIh4ZWO0ozt9+Hqt26pwbGgGzs/C1B3ONh88fVaPEqGpwufI
5xDXi7XsNg4IME6KEREEREBERAREQfVnHgo3KOKhrLDKJ9RJ/ALrgS6s2ixHvu/4xQ11XYVTdczWHe
9IAT0WWBT08sr55qOuilkkkJleb073I2Pn8rTR7OYq1zZZK9jHghwJkcSCFWbB6/EKiaoFbGZHPdmzHK4m+
8oGVre9I4XcVy2MbVVE8ro8P/AMCEGwfvc79vRdrXMZVYZJThxDXNLbjzFlx8Gy5glmjljzj00930Q
rTwUOI4lPC3LLNJO4NYHvu6Q+QJufRZOM4dNBjVRBbWQtLQ8NcbGxtdbiGrnwTEPxOrKoeGa2upsLclz
1fK6rmlknc5xDib8XEnUojqsHpXSQtdzTzsI8TZjex3ag7vReONtpHRyUuJA0Q1GUuhO/53Q/Y/KzNj6Oo
jzPnzsY46CQ8PL4Wq2zqKasrooo3ZxAHnMtbeNPhF41Wz9RGZDRVLGvim1RCSbhdEFPsfxJmNvTDqm9x2N
cb5Dy9ljUNITWxgEkiRuW3uun2lYwYNLn4EZT53QcNqv9QoJd6RHZ6/YhMAa+I1cUb+LXWcPUL0qMYo6aRsVaSwuFQ0le
U1HguKnOJ4i+3iD7FUrn6jHZZGuhkzWBtmHzxRDn+AfZ/ZCA96KpdYa2
Nisam2airJJyyZ0TY5CzIW2t6lExranaHEZ4+zEvZN0v2d7u6uJJPusGMzzvEceZ7yCAGi5XVDZzCaTvV
lWDbWzpAP7KzsawTDYy2hi7V30NsPcoJ2fwaWmd+MrSBJbRulmf8Aa1W1GMNrXilpnZoIzcu/M79li4rj
9XiIyEiKH+Wz7nitSiCIiAiIgIiICIiD6iVBQqpKjQSqkoVCAVUoVF0ZuaggO4obJK20NQ+Fw4t
AN+qDUYpgE0sr56aTMXalrzu6/FaWbD6uA/4tNIBzy3Dxme9k0d/Hk/usdm0tUPHDA7oCPuqj
TBz4z3S5h8jZHSvffM9xvvvubrd2iL/HRQnqVhNxGNgIZQ0xub3Hub3lbnKIwPRQsiaqMv+zAwfRGAsdAREQE
REBERAREQEREH04lVJUk3Ok3VGGgqpUTVQCVUouXs0m6X5iuqY0qR6CqzBUVaWYumGGBIwEbBkBrACGfAR
fTCqqURpUhFBUlVzVBkYX8xMBVDG3pMrqGDGsQ9sKl30rcZaf9ezZY4bHCd4s+ErkrVEVpEuC5REqJUIkZ
fTCqqURpUqhRFBUlVzIiDHqamnY0iZ2h390rkcSbSicmccp3EVSsNEREBERAREQEREH/9k=");
    background-size: 100%;
}
.pd{
padding-bottom:100%;}
.navbar
{
margin: 0px;
padding:20px;
background-color:white;
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
```



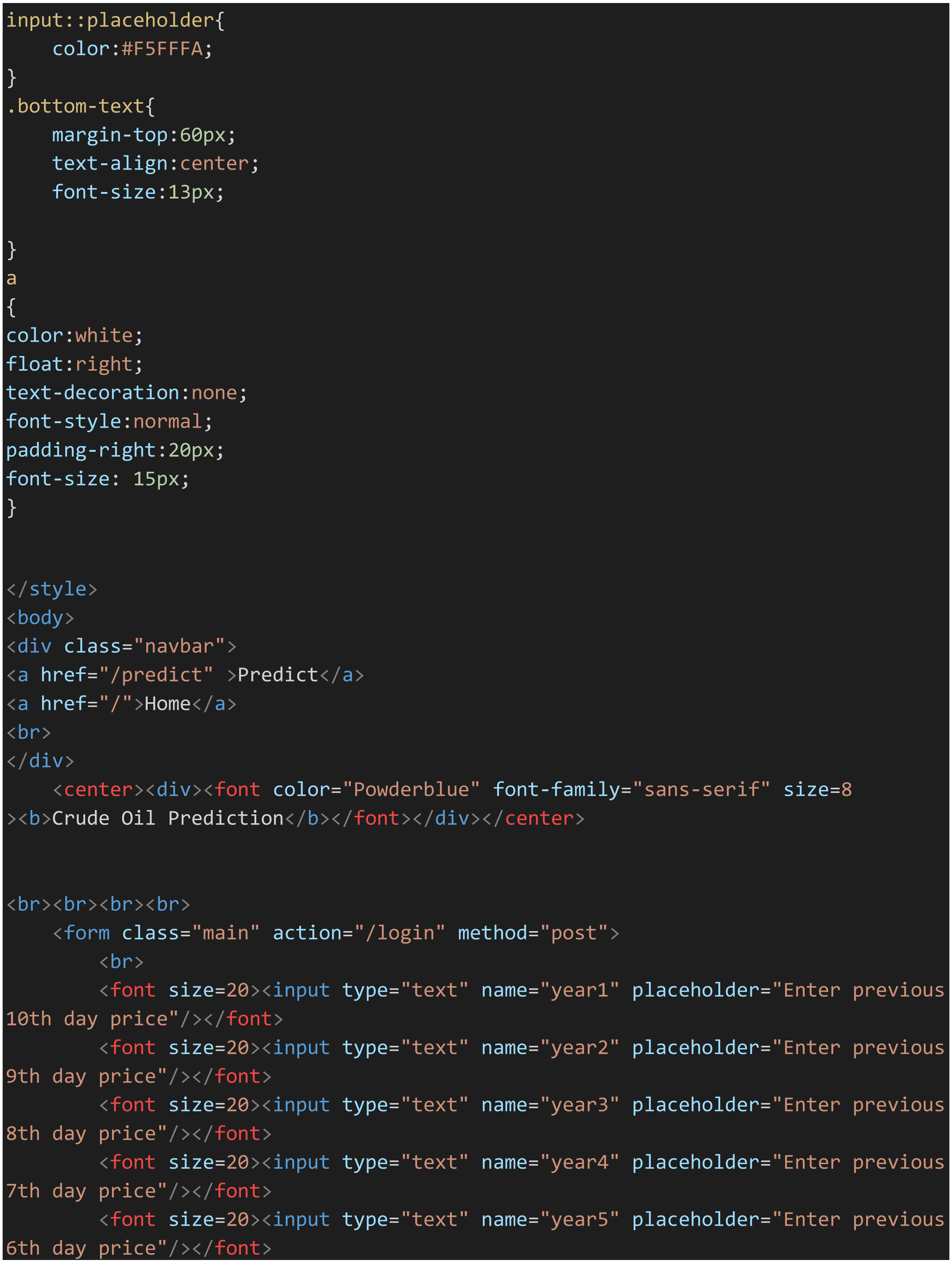
```
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}

p
{
color:turqouise;
font-style:oblique;
font-size:30px;
}
</style>
</head>
<body>
<div class="navbar">
<a href="/predict" >Predict</a>
<a href="/about">Home</a>
<br>
</div>
<br>
<center><b class="pd"><font color="white" size="15" font-family="Comic Sans MS"
>Crude Oil 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.So lets make a decision which makes us to buy the crude oil at the
proper time.</p>
</center>
</div>
</body>
</html>
```

File2.html

```
<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('https://img.freepik.com/free-vector/trading-background-with-graphic-illustration-blue-heart-rate-that-is-rising-upwards_159711-165.jpg?size=626&ext=jpg');
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;
}
```

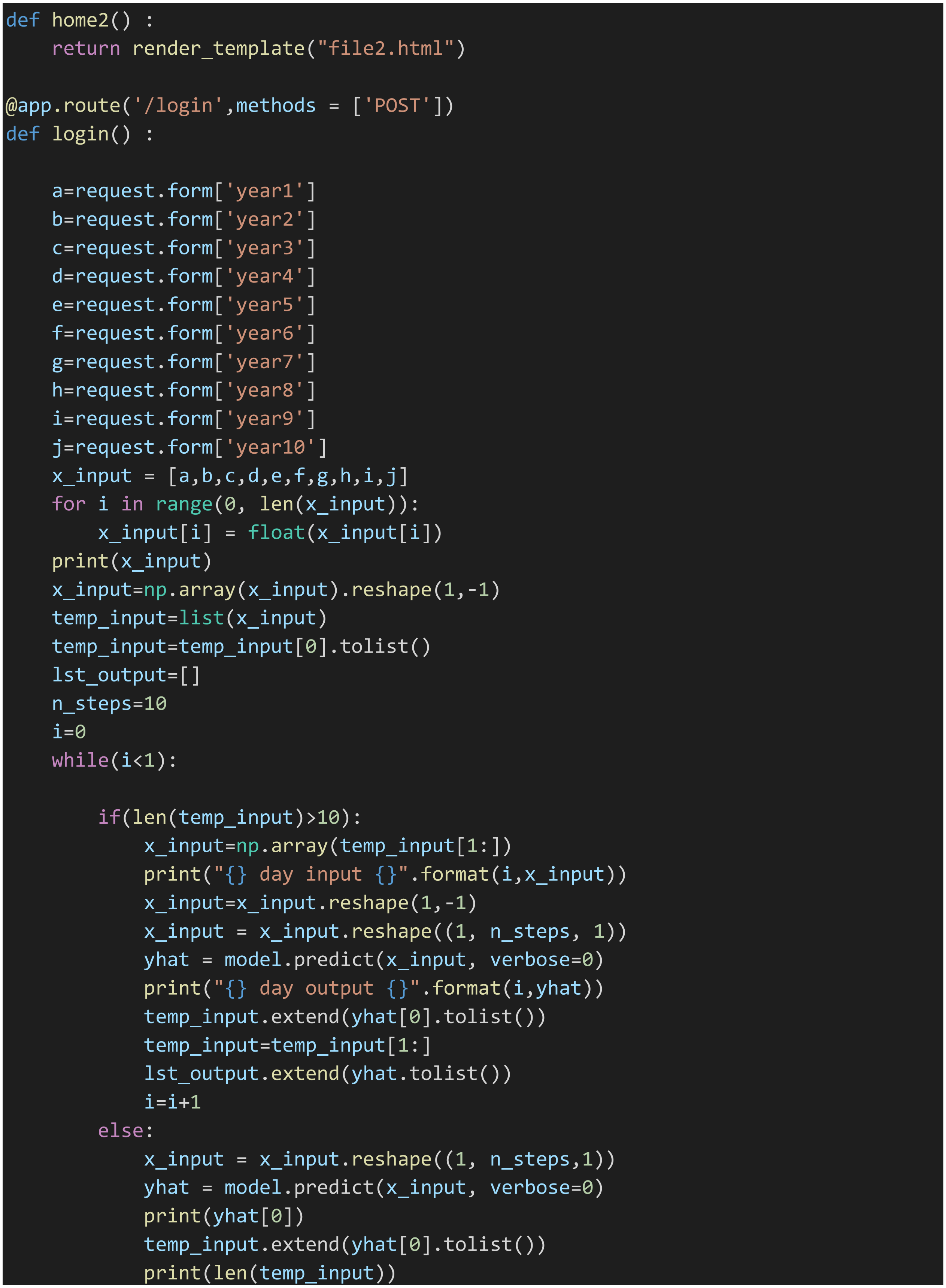


```
input::placeholder{
    color:#F5FFFA;
}
.bottom-text{
    margin-top:60px;
    text-align:center;
    font-size:13px;

}
a
{
color:white;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
font-size: 15px;
}


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

App.py

```
import numpy as np
from flask import Flask,render_template,request
from keras.models import load_model
import requests

API_KEY = "Rg0cfF6TtFNPcwNKGgF_2IN9wC5hvgnfHA0ZmzykQ2cK"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token',
data={"apikey":
 API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' +
mltoken}

app = Flask(__name__)
model = load_model('crude_oil.h5')

@app.route('/')
def home() :
    return render_template("file1.html")
@app.route('/about')
def home1() :
    return render_template("file1.html")
@app.route('/predict')
```



```
def home2() :
    return render_template("file2.html")

@app.route('/login',methods = ['POST'])
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']
    x_input = [a,b,c,d,e,f,g,h,i,j]
    for i in range(0, len(x_input)):
        x_input[i] = float(x_input[i])
    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):
            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))
            yhat = model.predict(x_input, verbose=0)
            print("{} day output {}".format(i,yhat))
            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)
            print(yhat[0])
            temp_input.extend(yhat[0].tolist())
            print(len(temp_input))
            lst_output.extend(yhat.tolist())
            i=i+1

    print(lst_output)


    return render_template("file2.html",showcase = 'The next day predicted value 
is:'+str(lst_output))
payload_scoring = {"input_data": [{"field": 
[[['a'],['b'],['c'],['d'],['e'],['f'],['g'],['h'],['i'],['j']]], "values": 
[[[73.93],[73.78],[73.05],[74.19],[73.89],[74.13],[73.45],[77.41],[75.23],[69.91]
]]}]}

response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/3c43fb86-9f0b-4f09-a5be-
3b7756eda643/predictions?version=2022-11-15', json=payload_scoring,
 headers={'Authorization': 'Bearer ' + mltoken})
print("Scoring response")
predictions=response_scoring.json()
pred=predictions['predictions'][0]['values'][0][0]
print(pred)
if __name__ == '__main__' :
    app.run(debug = True,port=5000)
```

Integrate_flask_with_scoring_endpoint

```
import requests

# NOTE: you must manually set API_KEY below using information retrieved from your 
IBM Cloud account.
API_KEY = "Rg0cfF6TtFNPcwNKGgF_2IN9wC5hvgnfHA0ZmzykQ2cK"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', 
data={"apikey":
 API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + 
mltoken}

# NOTE: manually define and pass the array(s) of values to be scored in the next 
line
payload_scoring = {"input_data": [{"field": 
[[['a'],['b'],['c'],['d'],['e'],['f'],['g'],['h'],['i'],['j']]], "values": 
[[[73.93],[73.78],[73.05],[74.19],[73.89],[74.13],[73.45],[77.41],[75.23],[69.91]
]]}]}
```

```
response_scoring = requests.post('https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/3c43fb86-9f0b-4f09-a5be-
3b7756eda643/predictions?version=2022-11-15', json=payload_scoring,
 headers={'Authorization': 'Bearer ' + mltoken})
print("Scoring response")
predictions=response_scoring.json()
pred=predictions['predictions'][0]['values'][0][0]
print(pred)
```

#cloud deployment code in ml model

```
from ibm_watson_machine_learning import APIClient
wml_credentials ={
    "url":"https://us-south.ml.cloud.ibm.com",
    "apikey":"Rg0cfF6TtFNPcwNKGgF_2IN9wC5hvgnfHA0ZmzykQ2cK"
}
client = APIClient(wml_credentials)
client
def guid_space_name(client,B2_deploy):
  space = client.spaces.get_details()
  return(next(item for item in space['resources'] if
item['entity']['name']==B2_deploy)['metadata']['id'])
space_uid = guid_space_name(client,'models')
space_uid
client.set.default_space(space_uid)
client.software_specifications.list()
software_space_uid =
client.software_specifications.get_uid_by_name('tensorflow_rt22.1-py3.9')
software_space_uid
model_details = client.repository.store_model(model='crudeoils.tgz',meta_props={
    client.repository.ModelMetaNames.NAME:"Crude_Oil_Prediction",
    client.repository.ModelMetaNames.TYPE:"tensorflow_2.7",
    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid
})
model_details
```

GitHub & Project Demo Link

https://github.com/IBM-EPBL/IBM-Project-39300-1660404713

PROJECT DEMO LINK: https://drive.google.com/file/d/1Nxuz0MQce93pEKa-SitBibGUYkLM5a9C/view?usp=sharing