

# **Crude Oil Price Prediction**

**Team ID : PNT2022TMID14256**

**Team Members :**

- GOKUL RAJ
- GOKUL
- KAMAL RAJESWAR
- BALA KRISHNA

## **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 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 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 is amongst the most important resources in today's world, it is the chief fuel and its cost has a direct effect on the global habitat, our economy and oil exploration, exploitation and other activities. Prediction of oil prices has become the need of the hour, it is a boon to many large and small industries, individuals and the government.

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## **2. Literature Survey**

### **2.1 Existing Problem**

Although many methods and models have been developed for predicting crude oil prices, it remains one of the most challenging forecasting problems due to the high volatility of oil prices. In this project, we propose a novel approach for crude oil price prediction based on a new machine learning paradigms and Neural Network Concept . The main advantage of our project is that the prediction model can capture the changing pattern of oil prices since the model is continuously updated whenever new oil price data are available, with very small constant overhead.

## 2.2 References

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- [7] Haykin, S. (1999). *Neural Networks: A Comprehensive Foundation*, 2nd edition, Prentice Hall, 842 pages
- [8] Onur Dursun. "3 Methodology" , Walter de Gruyter GmbH, 2014
- [9] Lakshmanan, Indhurani, and Subburaj Ramasamy. "An Artificial Neural-Network Approach to Software Reliability Growth Modeling" , *Procedia Computer Science*, 2015.
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[11] N. Raj Kiran, V. Ravi. "Software reliability prediction by soft computing techniques" , Journal of Systems and Software, 2008

[12] Lean Yu. "An EMD-Based Neural Network Ensemble Learning Model for World Crude Oil Spot Price Forecasting" , Studies in Fuzziness and Soft Computing, 2008

[13] Xin Wang, Ji Wu, Chao Liu, Senzhang Wang, Wensheng Niu. "A Hybrid Model Based on Singular Spectrum Analysis and Support Vector Machines Regression for Failure Time Series Prediction" , Quality and Reliability Engineering International, 2016

## 2.3 Problem Statement Definition

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.

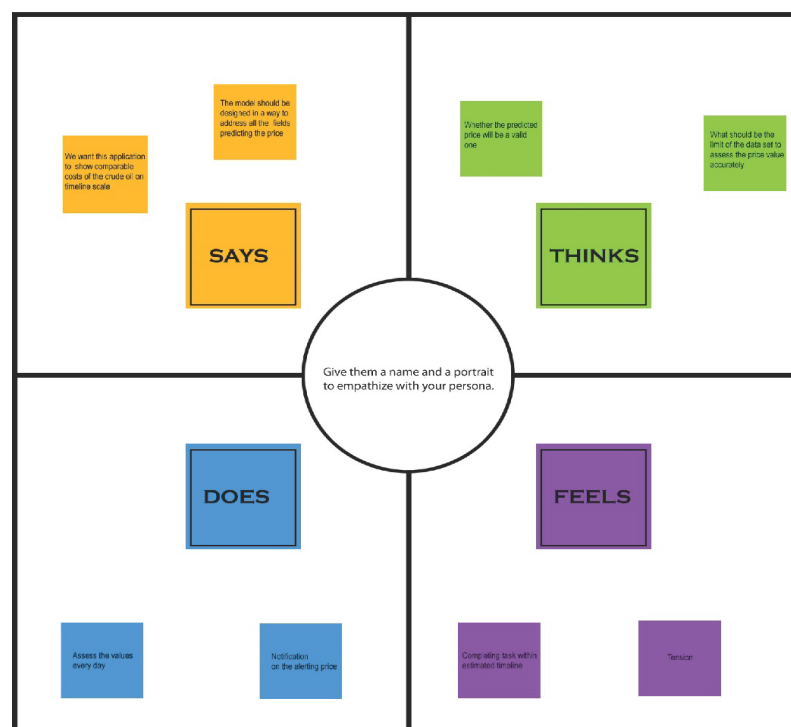
This Guided Project mainly focuses on applying Neural Networks to predict the Crude Oil Price. This decision helps us to buy crude oil at the proper time. Time series analysis is the best option for this kind of prediction because we are using the Previous history of crude oil prices to predict future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

## 3. IDEATION & PROPOSED SOLUTION

### 3.1 Empathy Map Canvas

#### Empathy map

Use this framework to develop a deep, shared understanding and empathy for other people. An empathy map helps describe the aspects of a user's experience, needs and pain points, to quickly understand your users' experience and mindset.



## 3.2 Ideation & Brainstorming

**1 Define your problem statement**

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

5 minutes

**2 Brainstorm**

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

10 minutes

**3 Group ideas**

Take time sharing your ideas while clustering similar or related notes to you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than its sticky notes, try and see if you can break it up into smaller subgroups.

10 minutes

**4 Prioritize**

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

10 minutes

**PROBLEM**

How crude oil price can be predicted? what are the ways to predict and what are the impacts?

**Key ideas of brainstorming**

To run an smooth and productive session:

- Stick to topic.
- Encourage wild ideas.
- Defer judgement.
- Listen to others.
- Go for volume.
- If possible, be visual.

**GOKUL RAJ K**

- can be predicted using the raw data
- artificial intelligence can be very effective in prediction
- sampling and records are used for prediction

**KAMAL RAJESHWAR**

- deep learning can be used for analysis
- history of prices can be used for references
- the frequency of oil and reserves having effect on price

**GOKUL RJ**

- python can be used to represent the data
- visual representation can be used to get a better idea about trends
- clear formulae should be followed to represent the model

**BALA KRISHNA GAGAN SAI**

- Price prediction can be done by analysing the data from different time period
- The model must be trained and used for prediction
- It includes an algorithm which is used for prediction

**Basic level**

- can be predicted using the raw data
- artificial intelligence can be very effective in prediction
- sampling and records are useful for prediction

**Advanced level**

- deep learning can be used for analysis
- history of prices can be used for references
- the integration of AI and machine learning will be useful
- python can be used to represent the data
- the model must be trained and can be used for the prediction
- prediction can be made by using the data from different time period
- visual representation can be used to get a better idea about the data

**Importance**

Ranking of ideas based on importance

How useful the idea actually is, ranked from the most useful to the least useful.

**Feasibility**

Ranking of ideas based on feasibility, which ideas are most feasible (the most ideal idea, which is most likely to be implemented).

## 3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	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.

2.	Idea / Solution description	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 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.
3	Novelty / Uniqueness	We use the concept of Artificial Neural Network and Machine Learning To predict the price of Crude Oil More accurately Than other existing Models. The main advantage of artificial neural network is that it continuously captures the unstable pattern and variations of crude oil price.
4.	Social Impact / Customer Satisfaction	Crude oil is amongst the most important resources in today's world, it is the chief fuel and its cost has a direct effect on the global habitat, our economy and oil exploration, exploitation and other activities. Prediction of oil prices has become the need of the hour, it is a boon to many large and small industries, individuals and the government.
5	Business Model (Revenue Model)	Financially, this project could benefit the small scale and large-scale industries. The receipt and expenditure of oil revenues are matters for fiscal policy, and we consider them in the context Of India's federal system, where fiscal responsibility is divided between the federal government and state governments. But the time profile Of oil revenues is distinctive compared with fiscal revenues more generally: oil revenues are volatile, driven largely by the volatility of oil prices. The required data sets are obtained from Kaggle.com The dataset was used to train various models .

6	Scalability of the Solution	<p>In this Project , We use Artificial Neural Network and various ML Algorithms To predict the Unstable Variations of Crude Oil Price Over a Given Time Period.</p> <p>To Predict the Price of Crude Oil In Future We Train The Data Model With The Past Oil Prices Data Which we Obtain From Kaggle.com.</p>
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## 3.4 Proposed Solution fit

<p><b>1. CUSTOMER SEGMENT(S)</b> Who is your customer?</p> <p>Government of different countries and Industries which depends on the crude oil for their business</p>	<p><b>6. CUSTOMER CONSTRAINTS</b> What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.</p> <p>There might be a lack of trust in the predictor's accuracy or reliability, causing customers to refrain from using it. Furthermore, users would need to enter confidential information into the model. The predictor might be avoided by a certain segment of customers due to concerns about data misuse.</p>	<p><b>5. AVAILABLE SOLUTIONS</b> Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros &amp; cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</p> <p>As well as past crude oil prices we also take other environmental and economical factors into account for getting more accurate result.</p>
<p><b>2. JOBS-TO-BE-DONE / PROBLEMS</b> Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</p> <p>Designing a predictor requires a lot of data collection, so it is important that it is done. Customers should be assured of optimum data security in order to have them retain their trust in our predictor.</p>	<p><b>9. PROBLEM ROOT CAUSE</b> What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.</p> <p>If inaccurate data is collected or not enough factors are taken into account to predict the price of oil, the predictor's reliability may be compromised. The second reason may be that customers may refrain from using our product if they perceive it to be a cyberattack.</p>	<p><b>7. BEHAVIOUR</b> What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</p> <p>Analyze the past data of Crude oil Prices and Predict the Price of Crude oil in the future and buy the oil when it is cheap.</p>
<p><b>3. TRIGGERS</b> What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</p> <p>Government of one nation tries to buy oil cheaper than other nations so they try to adopt this Technique</p> <p><b>4. EMOTIONS: BEFORE / AFTER</b> How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure &gt; confident, in control - use it in your communication strategy &amp; design. The Government and industries does not know the correct time to buy the crude oil. Result: Secure, user-friendly, and aware of the process. Costs are reduced, and the government and industries buy the oil at right time when the prices are cheaper.</p>	<p><b>10. YOUR SOLUTION</b> If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</p> <p>Design a predictor with the help of the data collected, and ensure that it is accurate/reliable. Also make sure that the data collected from the users is safe and secure.</p>	<p><b>8. CHANNELS of BEHAVIOUR</b> <b>8.1 ONLINE</b> What kind of actions do customers take online? Extract online channels from #7</p> <p>customers might search for reliable eligibility predictors that are available online and rate them based on their liking.</p> <p><b>8.2 OFFLINE</b> What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</p> <p>Government and Industries would discuss amongst their peer group about such predictors and if they find one to be reliable enough, they would spread the word about it</p>

## 4. REQUIREMENT ANALYSIS

### 4.1 Functional requirement

#### Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form.
FR-2	User Confirmation	Confirmation via SMS.
FR-3	Fetching input data	Give the model the input data.
FR-4	Generating Results	Prediction of Oil Prices.

## 4.2 Non Functional requirement

### Non-functional Requirements:

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

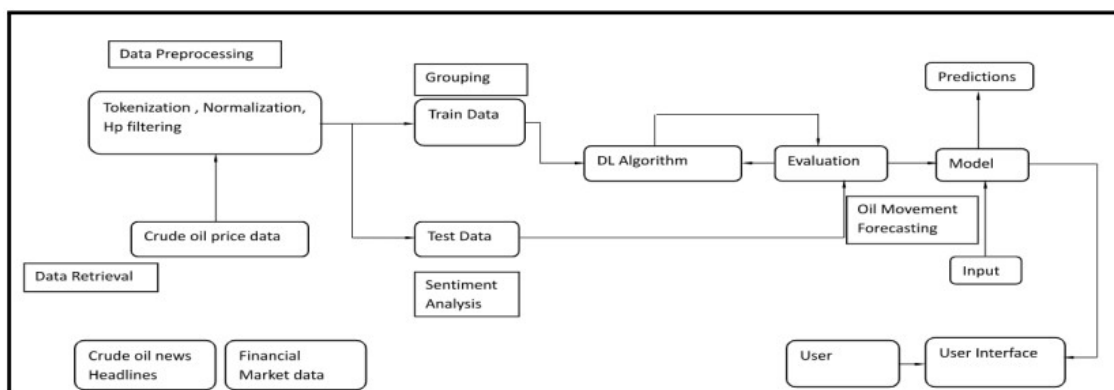
NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	user interfaces are easy to use.
NFR-2	Security	Sensitive data is protected.
NFR-3	Reliability	Because there is very little variance from the prediction, the testing is highly dependable.
NFR-4	Performance	Using LSTM networks gives highly performance.
NFR-5	Availability	The system tested with 4 datasets and the system operating properly.
NFR-6	Scalability	LSTM network model works efficiently for large number of users.

## 5. PROJECT DESIGN

### 5.1 Data Flow Diagrams

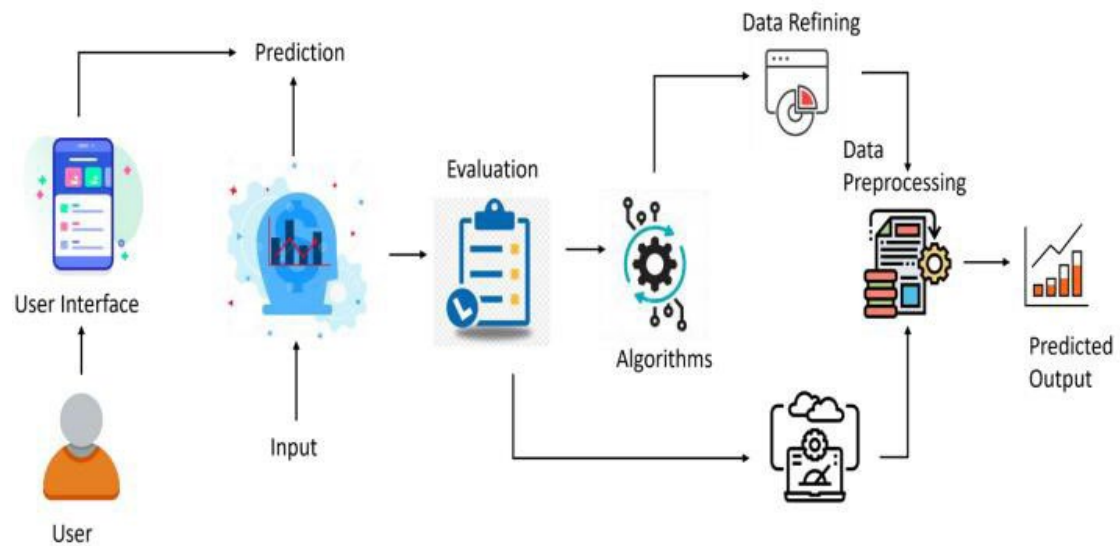
#### Data Flow Diagrams:

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





## 5.2 Solution & Technical Architecture



## 5.3 User Stories

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**SCENARIO**  
The prices of crude oil varies in different parts of the world. These prices can be predicted based on certain factors.

### EXPECTATIONS

- ☐ considering factors
- ☐ observing highs and lows
- ☐ displaying graphically

### PROPOSITIONS

Crude oil price fluctuations have a far reaching impact on global economies

Price forecasting can assist in minimising the risks

Very important to various stakeholders: governments, public and private

Several different factors that affect crude oil prices

### UNDERTAKE

Series are predicted using SVM, ELM, and LSTM models

Prediction results of the three single models are first reconstructed using FR

The XGBoost method is used to make a secondary prediction of the series

Factors like demand, supply and speculation influence price prediction

### EXECUTIONS

Data from monthly WTI price are first being classified into classes

Retrieval information from stock market and used text mining to mine the news

The process of extracting the features from the news was done manually

The key factors to crude oil market are discovered, verified and presented graphically

### COMPLETION

It validates the selection of variables chosen for the training

This provides the accurateness not only implies to the trend but also to its discrete price

A parallel and positive movement existed between the actual price and the predicted price

## 6. PROJECT PLANNING & SCHEDULING

### 6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	UserStory Number	UserStory/Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Download Crude Oil Price Dataset	2	Medium	GOKUL
Sprint-1	Data Pre processing	USN-2	Importing The Dataset into Workspace	1	Low	GOKUL RAJ
Sprint-1		USN-3	Handling Missing Data	3	Medium	KAMAL RAJESWAR
Sprint-1		USN-4	Feature Scaling	3	Low	BALAKRISHNA
Sprint-1		USN-5	Data Visualization	3	Medium	KAMAL RAJESWAR
Sprint-1		USN-6	Splitting Data into Train and Test	4	High	GOKUL
Sprint-1		USN-7	Creating A Dataset with Sliding Windows	4	High	GOKUL
Sprint-2	Model Building	USN-8	Importing The Model Building Libraries	1	Medium	GOKUL
Sprint-2		USN-9	Initializing The Model	1	Medium	GOKUL RAJ
Sprint-2		USN-10	Adding LSTM Layers	2	High	GOKUL
Sprint-2		USN-11	Adding Output Layers	3	Medium	BALAKRISHNA
Sprint-2		USN-12	Configure The Learning Process	4	High	KAMAL RAJESWAR

Sprint	Functional Requirement (Epic)	UserStory Number	UserStory/Task	StoryPoints	Priority	TeamMembers
Sprint-2		USN-13	Train The Model	2	Medium	GOKUL RAJ
Sprint-2		USN-14	Model Evaluation	1	Medium	BALAKRI SHNA
Sprint-2		USN-15	Save The Model	2	Medium	KAMAL RAJESWAR
Sprint-2		USN-16	Test The Model	3	High	GOKUL
Sprint-3	Application Building	USN-17	Create An HTML File	4	Medium	GOKUL RAJ
Sprint-3		USN-18	Build Python Code	4	High	GOKUL
Sprint-3		USN-19	Run The App in Local Browser	4	Medium	KAMAL RAJESWA R
Sprint-3		USN-20	Showcasing Prediction On UI	4	High	GOKUL BALAKRISH NA
Sprint-4	Train The Model On IBM	USN-21	Register For IBM Cloud	4	Medium	GOKUL RAJ
Sprint-4		USN-22	Train The ML Model On IBM	8	High	GOKUL KAMAL RAJESWAR
Sprint-4		USN-23	Integrate Flask with Scoring EndPoint	8	High	GOKUL GOKUL RAJ

## 6.2 Sprint Delivery Schedule

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

## 7. CODING & SOLUTIONING

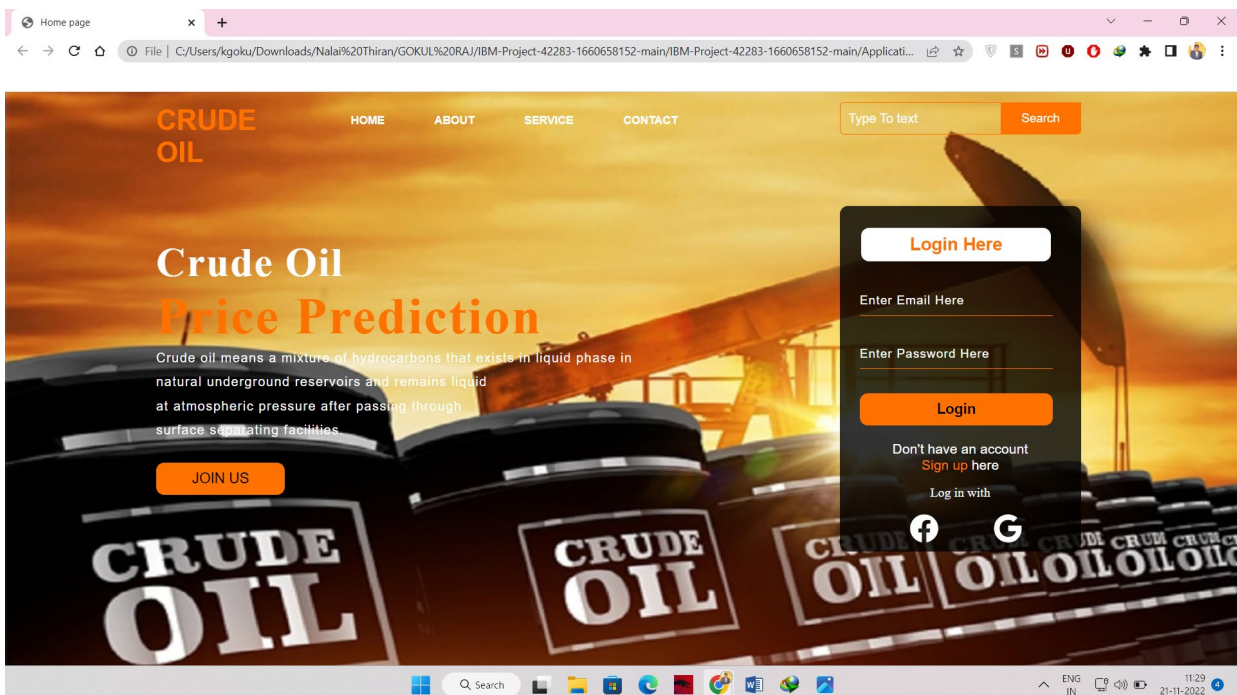
### 7.1 Feature 1

- IBM Watson Platform
- Web UI
- Python Code
- HTML
- CSS
- JS

### 7.2 Feature 2

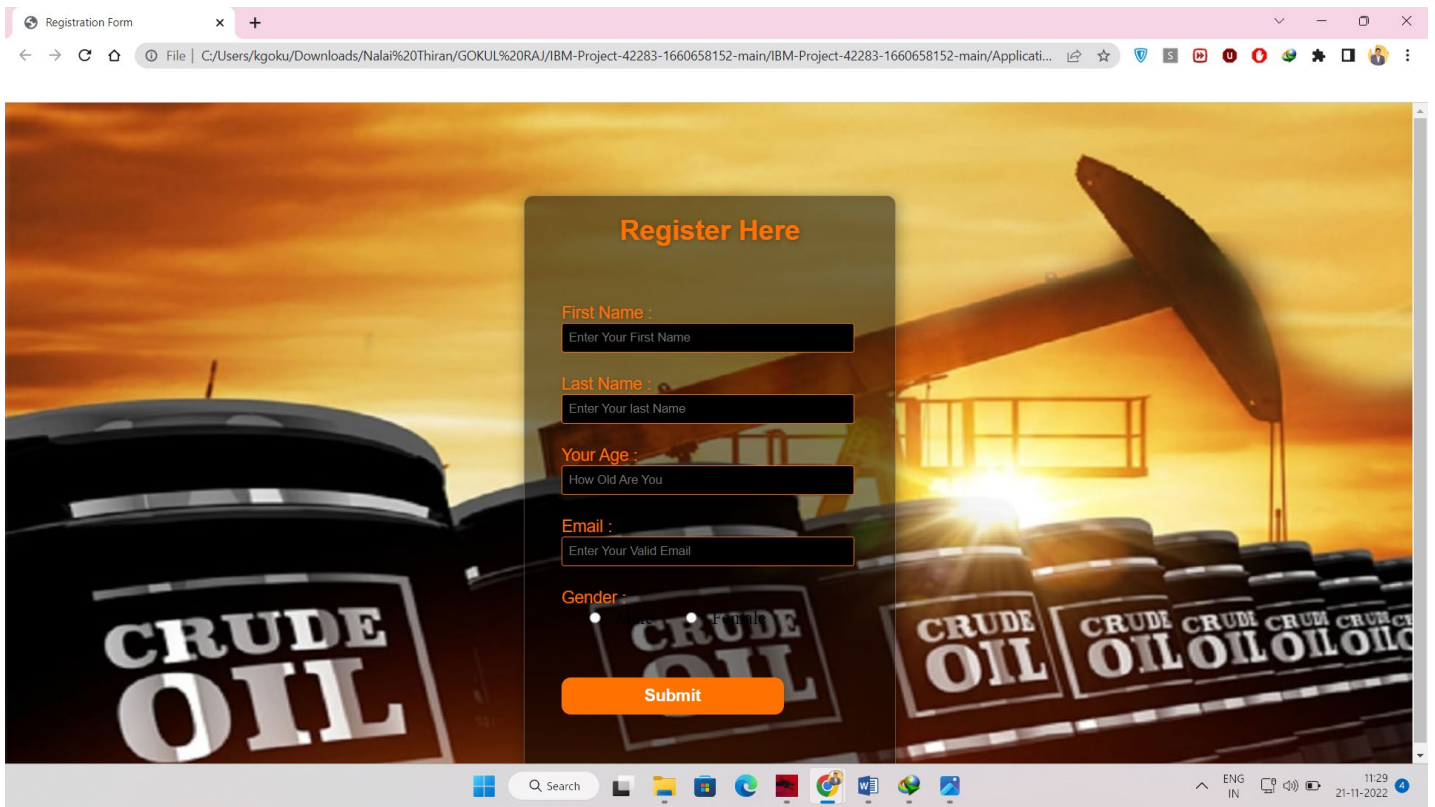
- Cloudant DB
- Neural Network
- NLP
- Artificial Intelligenc

## 8. Testing And Results



Registration Form

File | C:/Users/kgoku/Downloads/Nalai%20Thiran/GOKUL%20RAJ/IBM-Project-42283-1660658152-main/IBM-Project-42283-1660658152-main/Applicati...



The registration form is centered on a background image of oil barrels and a pumpjack. The form has a dark gray background with orange text and buttons. It includes fields for First Name, Last Name, Your Age, Email, and Gender (Male/Female), followed by a Submit button.

**Register Here**

**First Name :**  
Enter Your First Name

**Last Name :**  
Enter Your last Name

**Your Age :**  
How Old Are You

**Email :**  
Enter Your Valid Email


**Gender :**  
☐ Male ☐ Female

**Submit**

**CRUDE OIL PRICE PREDICTION**

ENTER PRICE: dd-mm-yyyy

**PREDICTED PRICE:**



The interface features a dark blue background with a glowing blue line graph showing an upward trend. The text is white and bold. There is a text input field for the price and a submit button.

## 9. Advantages

- User Friendly
- Predicts Crude Oil price precisely and approximately
- Helps Industries and Factories to Buy Crude oil at proper time.

## 10. Disadvantages

- The Predicted price by the system will is not the exact value.
- Need Accurate Data of Crude Oil Prices in past to predict the accurate price of crude oil.

## 11. Conclusion

Crude Oil plays a major in the nations economy so that predicting the crude oil prices proves worthy and our project predicts the crude oil prices to a high accuracy.

## 12. Future Scope

Our projects plays a major role in predicting the crude oil prices it is of great importance in the upcoming years.

## 13. Appendix

### 13.1 Source Code

```
import numpy as np

from flask import Flask, render_template, request

from tensorflow.keras.models import load_model

app = Flask(__name__, template_folder='template')

model = load_model("./model/crude_oil.h5")

@app.route('/')

def home():

    return render_template('index.html')

@app.route('/predict')

def home2():

    return render_template('predict.html')

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

def Login():

    if request.method=='POST':

        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("predict.html", showcase='The next day predicted value is:' +
str(lst_output))

if __name__ == '__main__':
    app.run(debug=True, port=5000)
```

## 13.2 GitHub

<https://github.com/IBM-EPBL/IBM-Project-42283-1660658152>