

Crude Oil Price Prediction

Team ID : PNT2022TMID14370

Team Members :

- Niranjan Jp
- Rex Milton
- Mohammed Umar
- Praveen Kumar AM
- Madhavan

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.

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

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

- [1] Kaufmann, R. K., & Ullman, B. (2009). Oil prices, speculation, and fundamentals: Interpreting causal relations among spot and futures prices. *Energy Economics*, 31(4), 550–558.
- [2] Shobhit Nigam. "Chapter 84 Single Multiplicative Neuron Model in Reinforcement Learning" , Springer Science and Business Media LLC, 2019
- [3] "Harmony Search and Nature Inspired Optimization Algorithms" , Springer Science and Business Media LLC, 2019
- [4] Shuang Gao, Yalin Lei. "A new approach for crude oil price prediction based on stream learning" , Geoscience Frontiers, 2017
- [5] Ramakanta Mohanty. "Software Reliability Prediction Using Group Method of Data Handling" , Lecture Notes in Computer Science, 2009
- [6] Kulkarni, S., Haidar, I., 2009. Forecasting model for crude oil price using artificial neural networks and commodity future prices. *International Journal of Computer Science and Information Security* 2 (1).
- [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.
- [10] Haykin, S. (2009). *Neural Networks and Learning Machines*, 3rd edition, Pearson, 938 pages

[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.

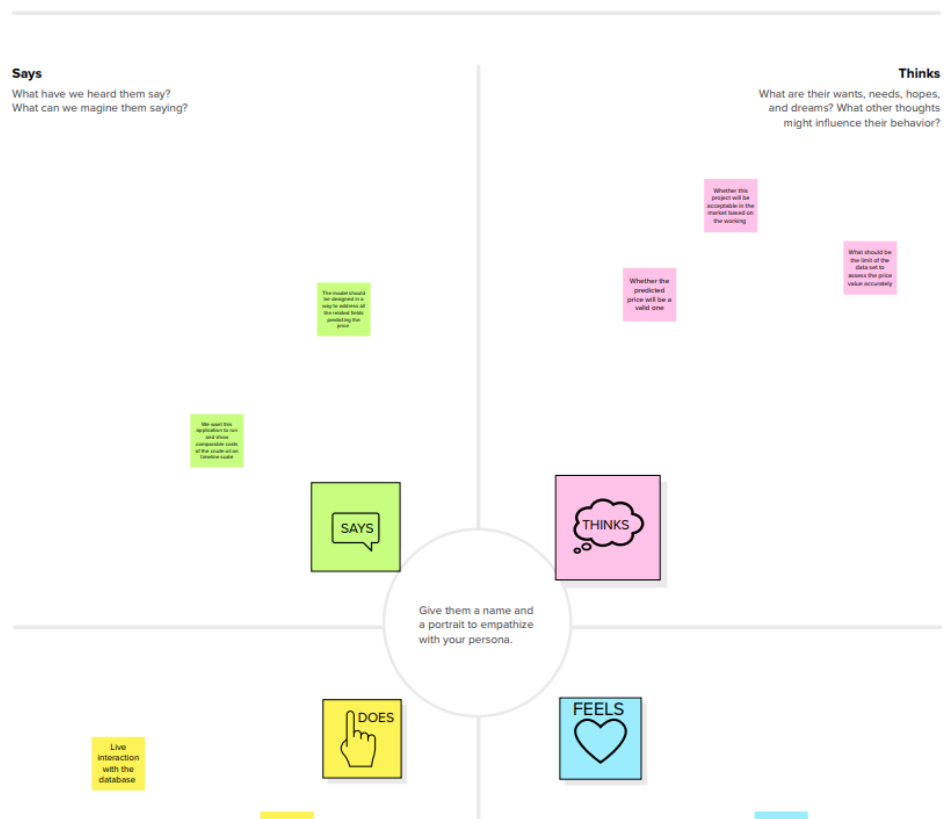
This Guided Project mainly focuses on applying Neural Networks to predict the Crude Oil Price. This decision helps us to buy crude oil at the proper time. Time series analysis is the best option for this kind of prediction because we are using the Previous history of crude oil prices to predict future 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

We'll share any ideas that come to mind that address your problem statement.

10 minutes

3 Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is larger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 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.

20 minutes

PROBLEM

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

Key rules of brainstorming

To get an unusual and productive session

- Stay to topic
- Encourage wild ideas
- Deflate judgments
- Listen to others
- Go for volume
- If possible, be visual

Niranjan

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

Rex Milton

- deep learning can be used for analysis
- history of prices can be used for references
- the integration of AI and machine learning can be used for prediction

Praveen AM

- Python can be used to represent the ideas
- Visual representation can be done to get a better idea about the data
- Visual representation can be done to get a better idea about the data

Umar

- Price prediction can be done by analyzing the data from different time period
- Visual representation can be done to get a better idea about the data
- Visual representation can be done to get a better idea about the data

Madhavan

- Python can be used to represent the ideas
- Visual representation can be done to get a better idea about the data
- Visual representation can be done to get a better idea about the data

Basic level

- can be predicted using the raw data
- artificial intelligence can be very effective in prediction
- sample 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 can be used for prediction
- Python can be used to represent the ideas
- The overall results can be recorded and can be used for the prediction
- Visual representation can be done to get a better idea about the data
- Visual representation can be done to get a better idea about the data

Price prediction can be done by analyzing the data from different time period

Visual representation can be done to get a better idea about the data

Visual representation can be done to get a better idea about the data

Importance

Importance of ideas and their impact on the business and which would have the most significant impact

Feasibility

Feasibility of ideas and their impact on the business and which would have the most significant impact

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	<p>We use the concept of Artificial Neural Network and Machine Learning To predict the price of Crude Oil More accurately Than other existing Models.</p> <p>The main advantage of artificial neural network is that it continuously captures the unstable pattern and variations of crude oil price.</p>
4.	Social Impact / Customer Satisfaction	<p>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.</p> <p>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.</p>
5	Business Model (Revenue Model)	<p>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 .</p>
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>

3.4 Proposed Solution fit

Project Title : Crude Oil Price Prediction

Project Design Phase-I - Proposed Solution Fit

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Define CS, fit into CC	1. CUSTOMER SEGMENT(S) <small>Who is your customer? i.e. working parents of 5-5 y.o. kids</small> Government of different countries and Industries which depends on the crude oil for their business	6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connectivity, available devices.</small> 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.	5. AVAILABLE SOLUTIONS <small>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 & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</small> As well as past crude oil prices we also take other environmental and economical factors into account for getting more accurate result.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS <small>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different roles.</small> 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.	9. PROBLEM ROOT CAUSE <small>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.</small> 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.	7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done? i.e. directly related: find the right online panel installer, calculate usage and benefits, indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</small> 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.	
Focus on J&P, fit into BE, understand RC	3. TRIGGERS <small>What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. Government of one nation tries to buy oil cheaper than other nations so they try to adopt this Technique</small> 4. EMOTIONS: BEFORE / AFTER <small>How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure -> confident, in control - use it in your communication strategy & 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.</small>	10. YOUR SOLUTION <small>If you are working on an existing business, write down your current solution first, fit 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 fit in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behavior.</small> 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.	8. CHANNELS OF BEHAVIOUR <small>8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 customers might search for reliable eligibility predictors that are available online and rate them based on their liking. 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 overseer from for customer development. 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</small>	Extract online & offline CH of BE
	Identify strong TR & EM			

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.

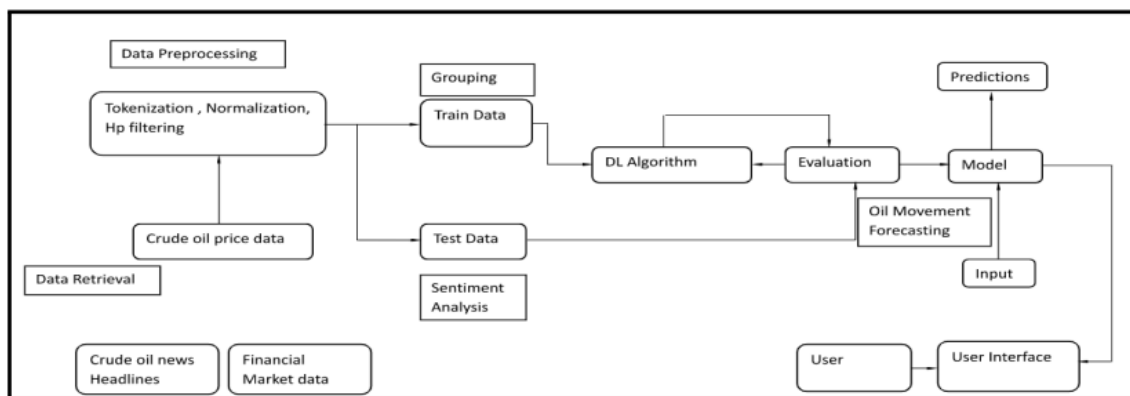
NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	user interfaces are easy to use.
NFR-2	Security	Sensitive data is protected.
NFR-3	Reliability	Because there is very little variance from the prediction, the testing is highly dependable.
NFR-4	Performance	Using LSTM networks gives highly 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

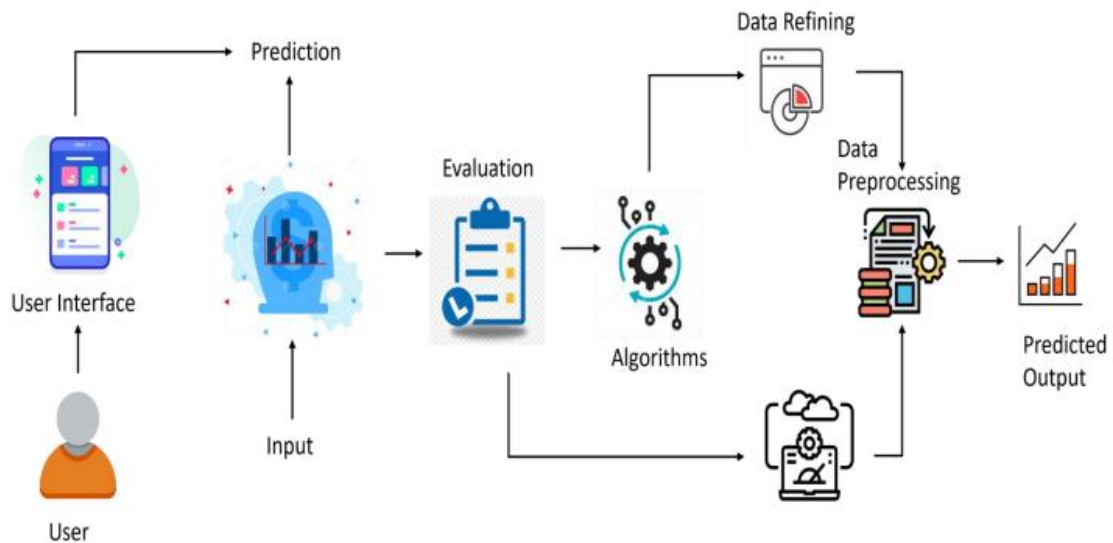
5.1 Data Flow Diagrams

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



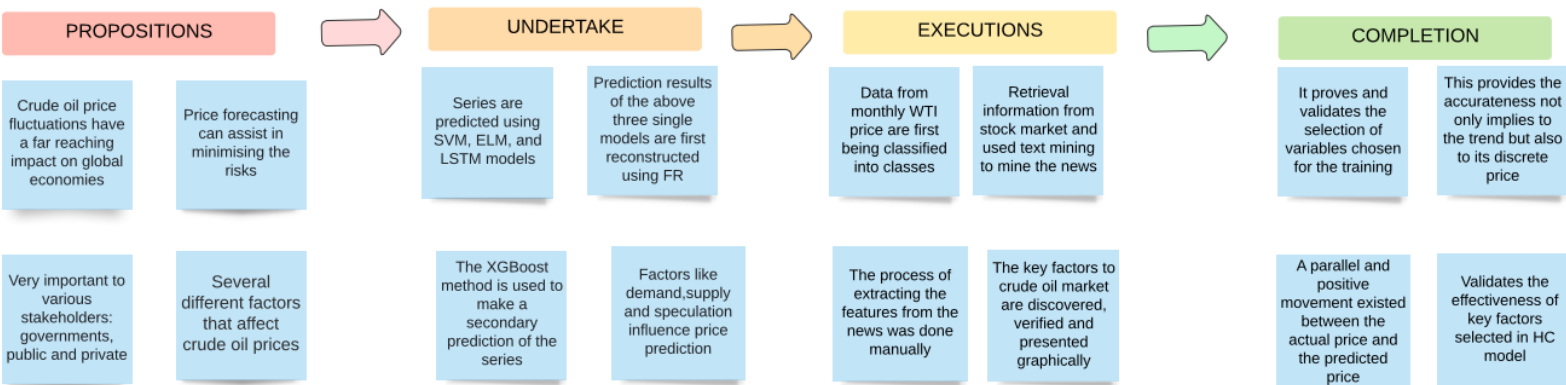
5.3 User Stories

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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



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	Rex Milton S
Sprint-1	Data Pre processing	USN-2	Importing The Dataset into Workspace	1	Low	Niranjan JP
Sprint-1		USN-3	Handling Missing Data	3	Medium	Praveen Kumar AM
Sprint-1		USN-4	Feature Scaling	3	Low	Mohammed Umar
Sprint-1		USN-5	Data Visualization	3	Medium	Madhavan
Sprint-1		USN-6	Splitting Data into Train and Test	4	High	Rex Milton S
Sprint-1		USN-7	Creating A Dataset with Sliding Windows	4	High	Niranjan JP
Sprint-2	Model Building	USN-8	Importing The Model Building Libraries	1	Medium	Praveen Kumar AM
Sprint-2		USN-9	Initializing The Model	1	Medium	Mohammed Umar
Sprint-2		USN-10	Adding LSTM Layers	2	High	Madhavan
Sprint-2		USN-11	Adding Output Layers	3	Medium	Rex Milton S
Sprint-2		USN-12	Configure The Learning Process	4	High	Niranjan JP

Sprint	Functional Requirement (Epic)	UserStory Number	UserStory/Task	StoryPoints	Priority	TeamMembers
Sprint-2		USN-13	Train The Model	2	Medium	Praveen Kumar AM
Sprint-2		USN-14	Model Evaluation	1	Medium	Mohammed Umar
Sprint-2		USN-15	Save The Model	2	Medium	Madhavan
Sprint-2		USN-16	Test The Model	3	High	Rex Milton S
Sprint-3	Application Building	USN-17	Create An HTML File	4	Medium	Niranjan JP
Sprint-3		USN-18	Build Python Code	4	High	Praveen Kumar AM
Sprint-3		USN-19	Run The App in Local Browser	4	Medium	Mohammed Umar
Sprint-3		USN-20	Showcasing Prediction On UI	4	High	Madhavan
Sprint-4	Train The Model On IBM	USN-21	Register For IBM Cloud	4	Medium	Rex Milton S
Sprint-4		USN-22	Train The ML Model On IBM	8	High	Niranjan JP
Sprint-4		USN-23	Integrate Flask with Scoring EndPoint	8	High	Praveen Kumar AM

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

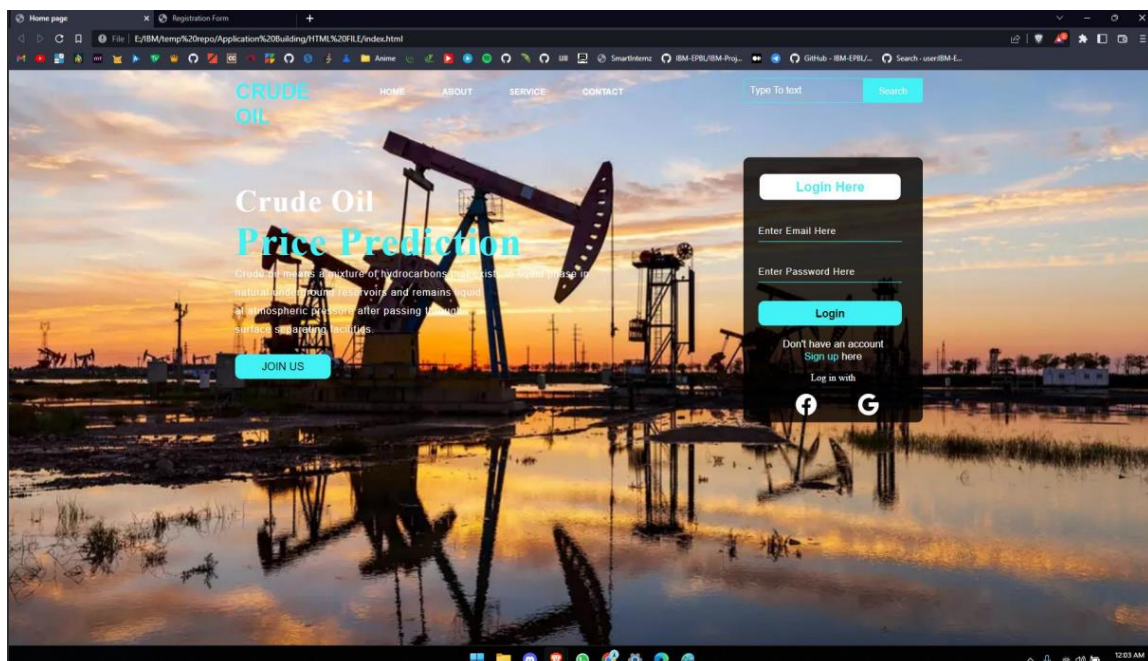
7.1 Feature 1

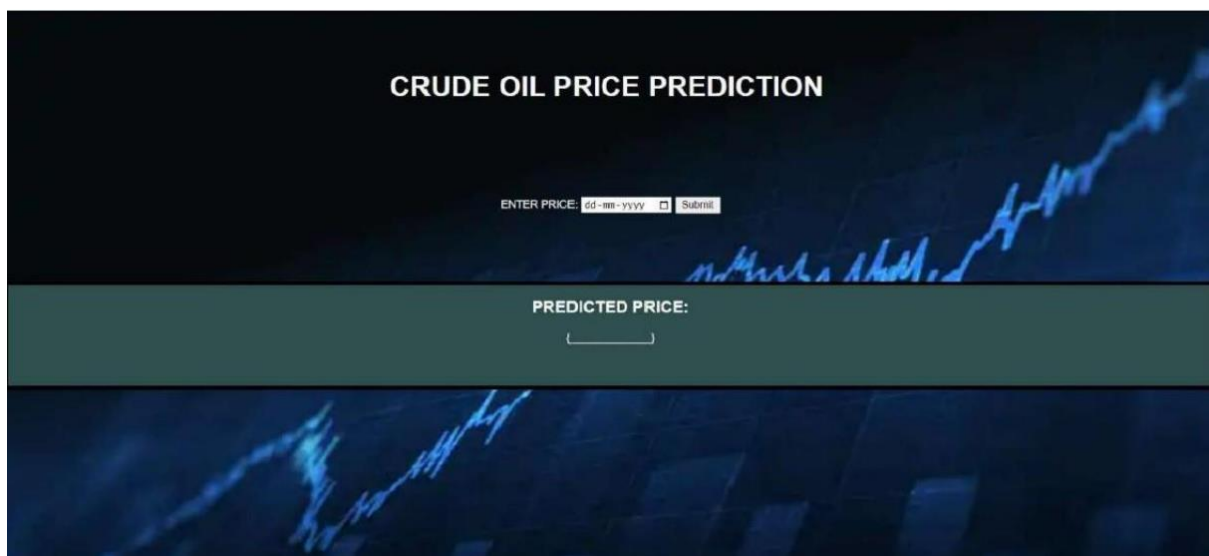
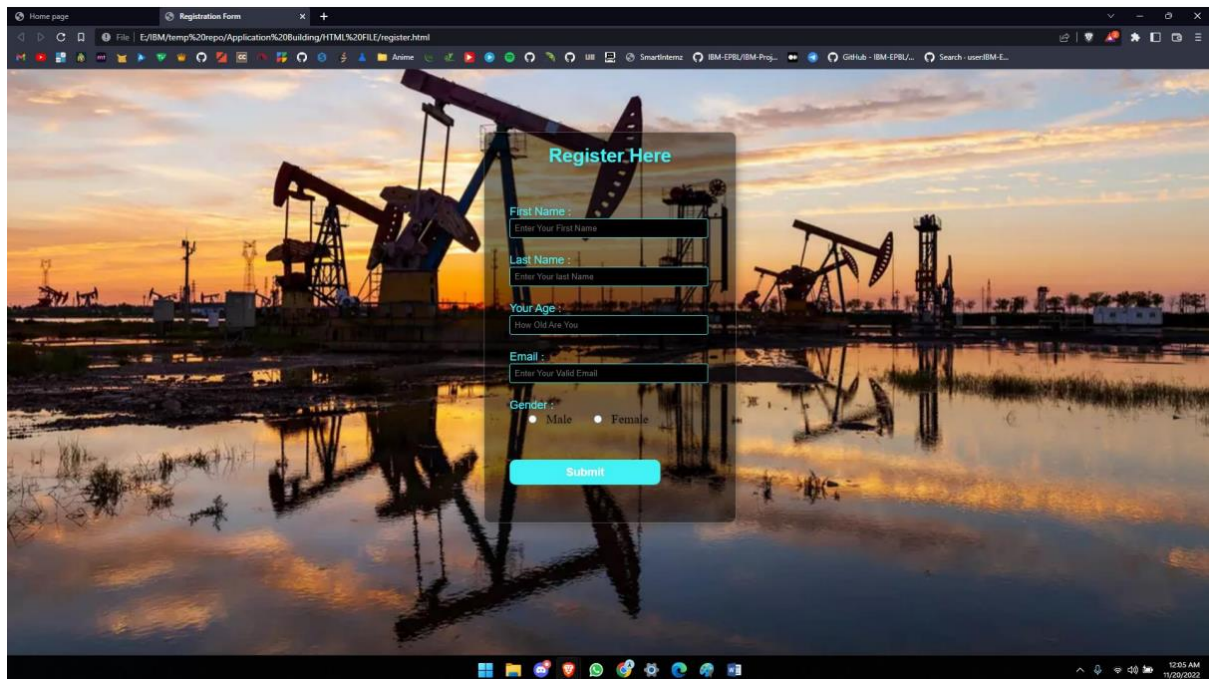
- IBM Watson Platform
- Web UI
- Python Code
- HTML
- CSS
- JS

7.2 Feature 2

- Cloudant DB
- Neural Network
- NLP
- Artificial Intelligence

8. Testing And Results





9. Advantages

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

10. Disadvantages

- The Predicted price by the system will not be always correct.
- 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-39676-1660487181>