CRUDE OIL PRICE PREICTION

TEAM ID: PNT2022TMID24389

PROJECT REPORT

Submitted by

KAMALESH U. (113319104035)

RAJESH P. (113319104066)

THARUN KARTHIKEYAN K. (113319104092)

VARUN BABU B. (113319104100)

In partial fulfilment for the award of degree

of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

NOVEMBER 2022

INDEX

ABSTRACT

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, the government. The evaporative nature of crude oil, its price prediction becomes extremely difficult and it is hard to be precise with the same. Several different factors that affect crude oil prices. We propose a contemporary and innovative method of predicting crude oil prices using the artificial neural network (ANN). The main advantage of this approach of ANN is that it continuously captures the unstable pattern of the crude oil prices which have been incorporated by finding out the optimal lag and number of the delay effect that controls the prices of crude oil. Variation of lag in a period of time has been done for the most optimum and close results, we then have validated our results by evaluating the root mean square error and the results obtained using the proposed model have significantly outperformed

1.INTRODUCTION

1.1Project Overview

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, the government. The evaporative nature of crude oil, its price prediction becomes extremely difficult and it is hard to be precise with the same. Several different factors that affect crude oil prices. We propose a contemporary and innovative method of predicting crude oil prices using the artificial neural network (ANN). The main advantage of this approach of ANN is that it continuously captures the unstable pattern of the crude oil prices which have been incorporated by finding out the optimal lag and number of the delay effect that controls the prices of crude oil. Variation of lag in a period of time has been done for the most optimum and close results, we then have validated our results by evaluating the root mean square error and the results obtained using the proposed model have significantly outperformed. We have used HTML, Javascript.CSS, Python, Flask.

1.2 Purpose

Crude oil is one of the most important commodities in the world, accounting for one-third of global energy consumption. It is a starting material for most of the products that we use in everyday life, ranging from transportation fuels to plastics. Crude oil price fluctuations have a far reaching impact on global economies and thus 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. According to economic theory, the price of crude oil should be easily predictable from the equilibrium between demand and supply, wherein demand forecasts are usually made from GDP, exchange rates and domestic prices, and supply is predicted from past production data and reserve data. Predicting demand for oil is usually straightforward, however supply is heavily affected by political activity such as cartelization by OPEC to regulate prices, technological advances leading to the extraction of higher amounts of oil, and wars and other conflicts which can affect supply unpredictably.

2.LITERATURE SURVEY

2.1. EXISTING PROBLEM

Prediction of future crude oil price is considered a significant challenge due to the extremely complex and dynamic nature of the market and stakeholder's perception. We did a survey over the possible sources that we could access. In our exploration, we did find the authors. Predictive analytics is a piece of advanced research used to gage obscure future opportunities by statistical models and other scientific approaches aimed at making practical forecasts (as opposed to the theory-only forecasts), as well as tools for testing the accuracy of these prediction in reality. Predictive analytics has not only been applied in the financial sector but also has been used in user profiling, health, and many others. Several algorithms and methods related to predictive analytics include adaptive neuro-fuzzy system (ANFIS), spiking neural network, Recurrent Neural Network, Long-Short Term Memory (RNN-LSTM) and others. These methods are useful to produce an insight towards data such as historical crude oil prices to be used by experts[1]. Similar to many other products, crude oil prices depend on the supply and demand curves. In other words, if the demand is more than the supply, it means the oil market is currently in shortage condition, hence the price of oil increases due to its limited supply and availability. Conversely, if the supply is more than the demand, the oil supply and availability are in surplus; hence the price becomes cheaper as it is widely available, and it has only a few buyers. Equilibrium price exists when there are no surpluses or deficiencies in the market. Other factors, such as the supply-demand curve and competitive factors, have a short-term effect

[2]. The neural network contains a set of neurons (or perceptron) which acts as processing units, interlinked, and may reside within an extensive network. The network can be designed to handle deep learning. The working mechanism of a neuron combines inputs from the data with a set of coefficients that either amplify or reduce that input. Upon reaching a threshold value, an output is produced. The number of hidden layers may vary based on the complexity of computation. Due to the popularity of neural networks, many researchers have introduced different approaches for predictive analytics task including spiking neural network data modelling , ANFIS, deep learning, EEMD-LSTM, and many other

[3]. RNN-LSTM NETWORK: Despite being an effective method for predictive tasks, the traditional neural networks method is not capable of holding memories. The Recurrent Neural Network (RNN), on the other hand, is a chunk of a neural network made into a loop— giving its capability to retain information from its previous state.The architecture of a standard RNN is related to sequences and lists. In the unrolled state, an input x0 fed into a chunk of neural network A, which gives out an output , preserving information to the next chunk of neural network. A special kind of RNN that works better than the standard RNN utilizes LSTM

[4]. Hochreiter & Schmidhuber have introduced the concept of Long-Short Term Memory (LSTM), which has proven its accuracy across various domains. LSTM is a type of Recurrent Neural Network (RNN) that can learn longterm dependencies and is useful for a sequence to sequence prediction—such as prediction of upcoming crude oil prices using time-series data. RNN has a powerful potential to increase input information by refeeding the output as the input. Therefore, the output is created based on the previous iteration output. After the output is created, it is duplicated and sent back to the intermittent system. In order to create a decision, RNN relies on the new information fed into the network and the output produced from the previously fed information

[5]. ANN has gained much attention for its computational intelligence approach and its capability to make prediction. It is popular for capable on modelling the nonlinearity, which results to a class of general function approximators. The development of this ANN-Q model is based on a process development suggested by and presented. There are three steps of development for this model; (i) objective determination, (ii) data pre-processing and (iii) ANN modelling

[6]. (i) Objective Determination: The objectives are determined to focus on developing a suitable and an accurate prediction tool for the crude oil market and predict its price for every barrel of crude oil in US Dollar (USD). USD is used as a standard price in NYMEX where WTI is traded. More over at this phase, we determined and analysed the selection of inputs and output to be used in the prediction so to find the fittest and right observations for the prediction. Nonetheless, it is important to ensure ANN capable of learning the connections between inputs effectively so to successfully achieve the final objective model.

2.2 REFERENCES:

[1]. A. H. Bukhari, M. A. Z. Raja, M. Sulaiman, S. Islam, M. Shoaib, and P. Kumam, “Fractional neuro-sequential ARFIMA-LSTM for financial market forecasting,” IEEE Access, vol. 8, pp. 71326–71338, 2020.

[2]. R. Zazo, P. Sankar Nidadavolu, N. Chen, J. Gonzalez-Rodriguez, and N. Dehak, “Age Estimation in Short Speech Utterances Based on LSTM Recurrent Neural Networks,” IEEE Access, vol. 6, pp. 22524–22530, 2018.

[3]. M. Othman, S. A. Mohamed, M. H. A. Abdullah, M. M. Yusof, and R. Mohamed, “A Framework to Cluster Temporal Data Using Personalised Modelling Approach,” in Advances in Intelligent Systems and Computing, vol. 700, 2018, pp. 181–190.

[4]. M. H. A. Abdullah, M. Othman, and S. Kasim, “A Spiking Neural Networks Model with Fuzzy-Weighted k-Nearest Neighbour Classifier for Real-World Flood Risk Assessment,” Adv. Intell. Syst. Comput., vol. 978, pp. 1–9, 2020.

[5]. M.F. Nasrudin, “Pembangunan Model dan Aplikasi Ramalan Pasaran Saham BSKL Menggunakan Rangkaian Neural Perambat Balik,” Msc. of Computer Science, Faculty of Technology and Science Information, Universiti Kebangsaan Malaysia, Bangi, Selangor, 2001.

[6]. M. Negnevitsky, Book Artificial Intelligence: A Guide to Intelligent System, Pearson Education Ltd., 2005, p. 415

2.3. PROBLEM STATEMENT DEFINITION

1. STATEMENT 1: There are five main problems identified based on investigations made on previous research. Firstly, data used in the previous predictions are majority employed from WTI or Brent crude oil price without taking into consideration other inputs that are involved together in the market. The crude oil price market volatiles from the contributions made by other factors surround it and neglecting these factors will demote the capability of a prediction tool. A good prediction is the one that can comprehend and correlates between factors, sparks information on the trend and finally, predict it accurately.

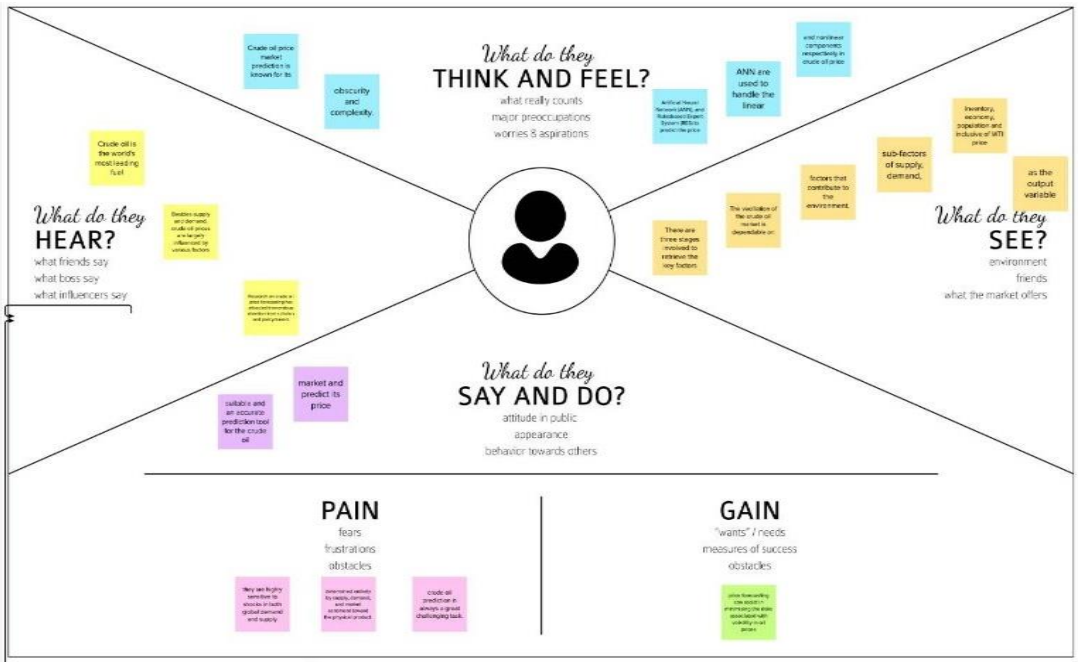
2. STATEMENT 2: Secondly, there are scarce numbers of research that implement the verification and validation technique on the main factors involving in the fluctuation. Besides the global crude oil price, other popular factors that being used in previous research are demand and supply. Although, demand and supply of oil plays vital role to the market volatility, the use of these observations only is not enough to comprehensively render the information offered by the trend. There are also other factors that contributed to the trend and gave impact to the price. Therefore, by embracing appropriate key factors and later correlate them will help to achieve a thorough and comprehensive prediction for the market.

3. STATEMENT 3: Thirdly, time-series data are mainly used for prediction. Nevertheless, data pre-processing and data representation process are made absent in some of the previous research. These two processes are important to cleanse and reduce errors and noises in data set and uniform it. Later, these will help to organise the process of prediction, make it more systematic and finally, generates more stable result. Without these processes, the prediction tool will be less reliable.

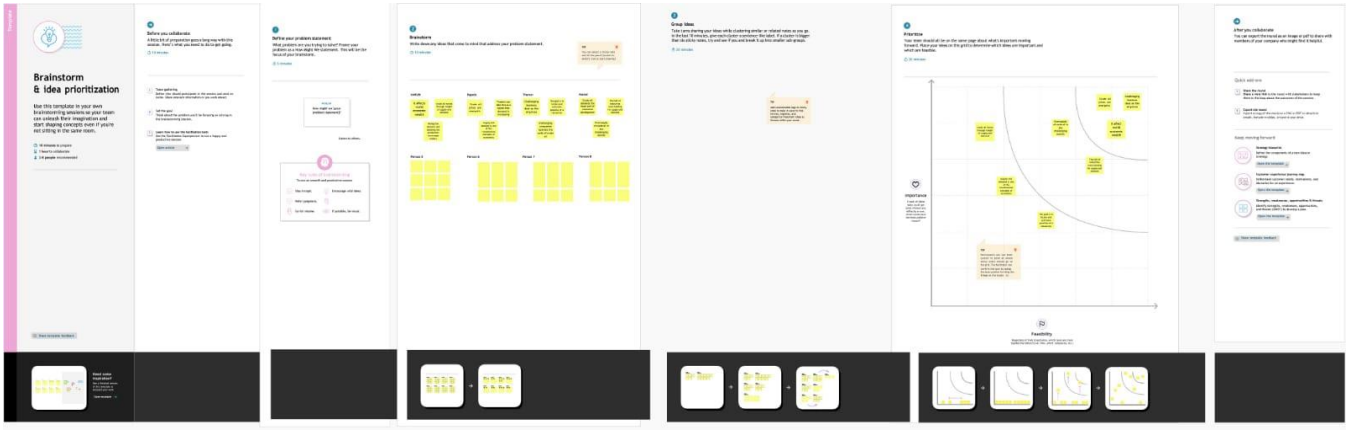
4. STATEMENT 4: Fourthly, the crude oil price movement was the popular topic studied previously and not the crude oil price itself. Predicting the movement of the price only is not sufficient to characterise the market where else, crisp prediction will offer far more persona. A prediction on the movement together with the price itself will tender more usable, discrete and practical implementation to the real worlds problem.

3.IDEATION AND PROPOSED SOLUTION

3.1. Empathy Map Canvas



3.2. Ideation and Brainstorming



3.3Proposed Solution

Project Design Phase-I
Proposed Solution Template

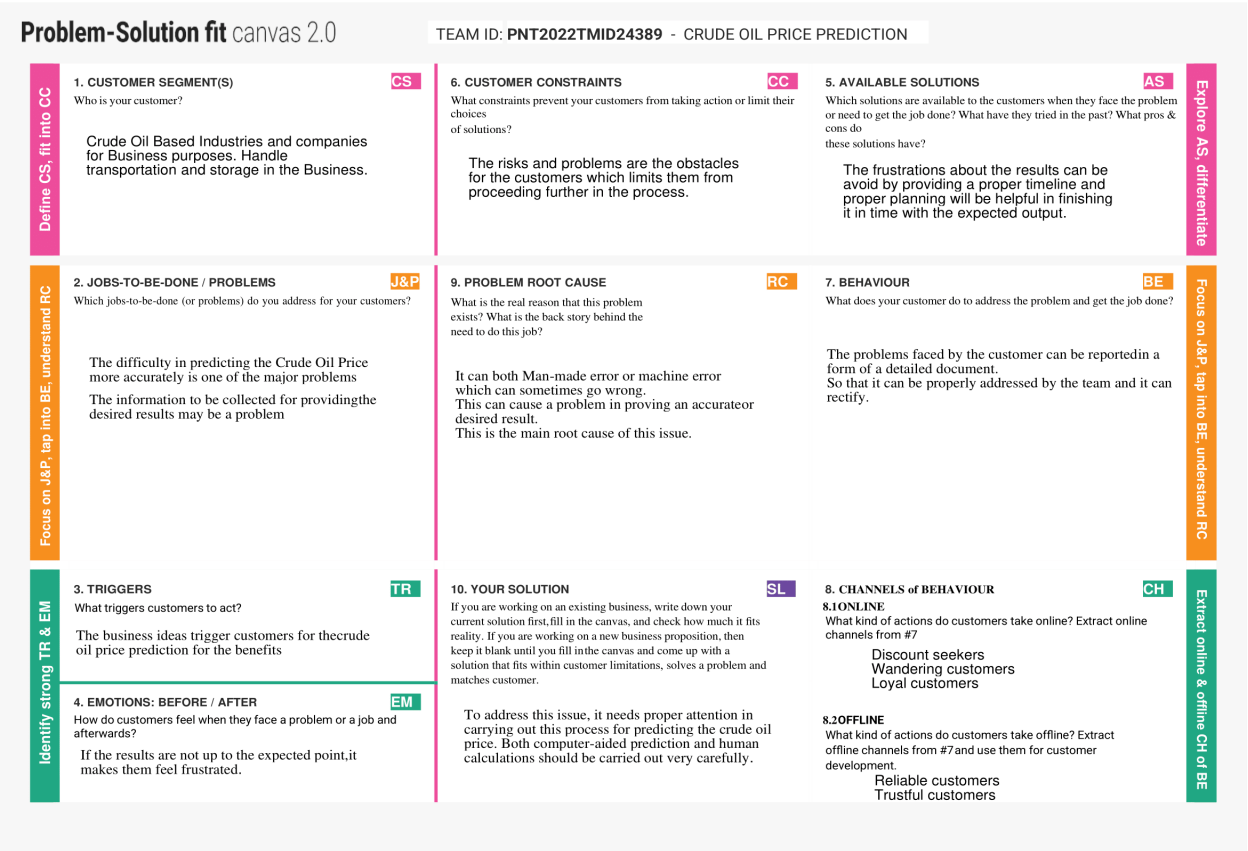
Date	19 September 2022
Team ID	PNT2022TMID24389
Project Name	Project – Crude Oil Price Prediction
Maximum Marks	2 Marks

Proposed Solution Template:

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

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Based on investigations made on previous research, A good prediction is the one that can comprehend and correlates between factors, sparks information on the trend, predict it accurately.
2.	Idea / Solution description	We are going to collect the dataset of the past oil prices with time so that by feeding those to the model and training it and compiling it and when it's achieved the optimal state we can implement it in the web application.
3.	Novelty / Uniqueness	It may be a traditional idea but the implementation of periodic training will have abetter effect on it.
4.	Social Impact / Customer Satisfaction	By using the web app customer can gain knowledge of the crude oil price and get benefits financially.
5.	Business Model (Revenue Model)	It will be used by every individual at ease so that they can have an idea of the crude price. So, that the use of the crude will be stable inthe market
6.	Scalability of the Solution	The idea we proposed it take the input in the periodic and adjust and train through these so,that it will adapt to very different situations.

3.4. Problem Solution Fit



4.REQUIREMENT ANALYSIS

4.1Functional requirement

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	08-10-2022
Team ID	PNT2022TMID34866
Project Name	Crude oil price prediction
Maximum Marks	4 - marks

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 Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	graph	Showing graph by gaining data from the dataset
FR-4	support	Queries from the users that will be solved by support section
FR-5	News	Oil prices of the information will be updated by the admin
FR-6	Notification	Price message will be send to client
FR-7	Database	All information will be stored by the client

4.2.Non-Functional requirement

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It can use by vast verity of client has it is very easy to learn and not difficult to proceed.
NFR-2	**Security**	We are using login for the user and the information will be confused so that it will be very secure to use.
NFR-3	**Reliability**	It will be reliable that can update with long time period ,so that the accuracy will be fine.
NFR-4	**Performance**	It will be perform fast and secure even at the lower bandwidth.
NFR-5	**Availability**	Prediction will be available for all client but only for additional user news, database and price will be alert by message.
NFR-6	**Scalability**	It is scalable that we are moving to use data in kb. So that the total amount of storage is requested.

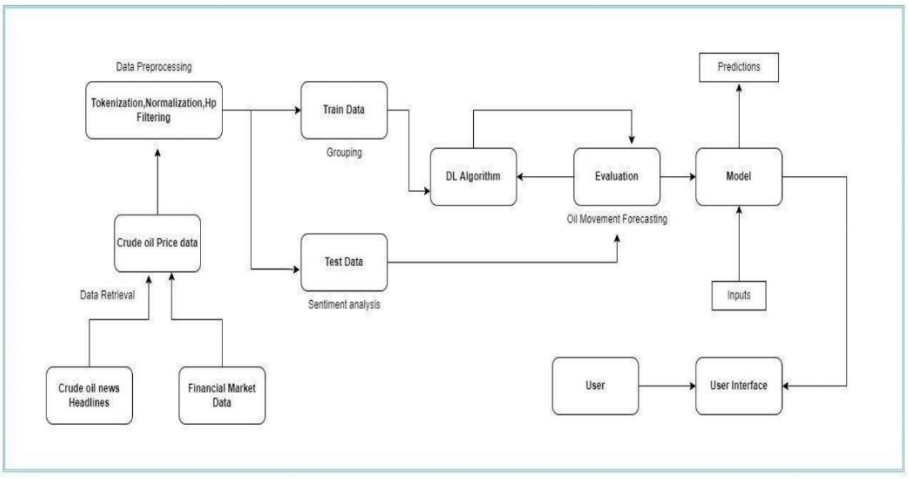
5.PROJECT DESIGN

5.1Data Flow Diagram

DATA FLOW DIAGRAMS:

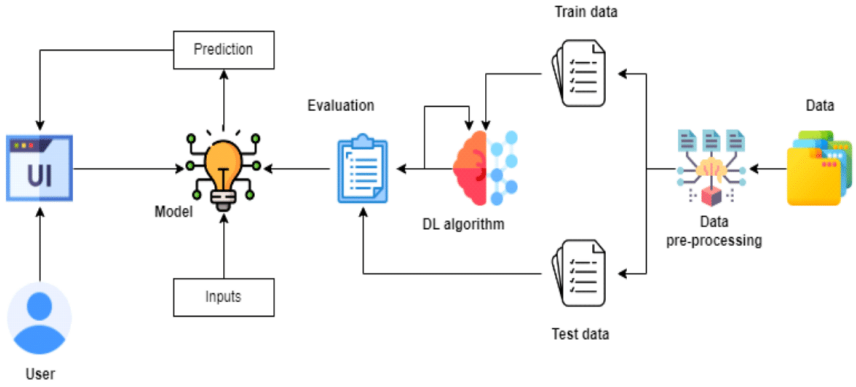
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

DATA FLOW DIAGRAM



5.2Solution & Technical Architecture

- Solution architecture is the initial step taken to create a set of enterprise solutions, applications and processes that integrate with each other in order .
- It specifies a certain level of vision for all current and future solutions, applications and processes.
- Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- Design and development of solutions and applications then follow the guidelines specified in the solution architecture document.
- Provide specifications according to which the solution is defined, managed, and delivered.



5.3 User Stories

USER STORIES

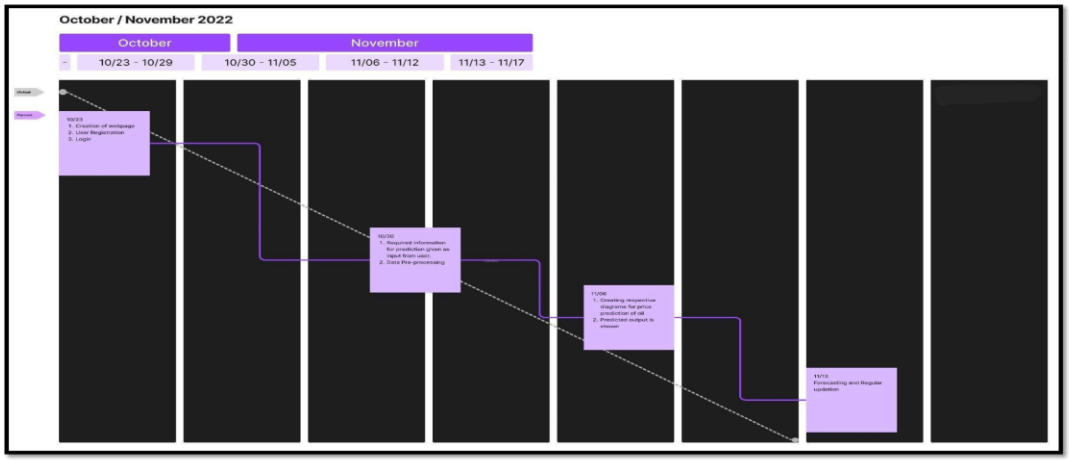
Use the below template to list all the user stories for the product.

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 confirmingmy password.	I can access my account/ Displays Line graph / Bar graph.	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 applicationthrough Facebook	I can register & access my Account	Low	Sprint-2
		USN-4	As a user, I can register for the applicationthrough Gmail	I can register through already logged in Gmail account.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application byentering email & password	After registration, I can log in by only email & password.	High	Sprint-1
	Line\Bar graph		After entering the inputs, the model will display predictions in Line\Bar graph format.	I can get the expected prediction in various formats.	High	Sprint-3
Customer (Webuser)	Login	USN-1	As the web user, I can login simply by usingGmail or Facebook account.	Already created Gmail can be used for Login.	Medium	Sprint-2
Customer Care Executive	Support		The Customer care service will provide solutionsfor any FAQ and provide Chatbot.	I can solve the problems raised by Support.	Low	Sprint-3
Administrator	News		Admin will give the recent news of Oil Prices.	Provide the recent oil prices.	High	Sprint-4
	Notification		Admin will notify when the oil prices changes.	Notification by Gmail.	High	Sprint-4
	Access Control		Admin can control the access of users.	Access permission for Users.	High	Sprint-4
	Database		Admin can store the details of users.	Stores User details.	High	Sprint-4

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Burndown Chart:



Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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	THARUN KARTHIKEYAN
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	10	High	KAMALESH
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email &password.	15	High	VARUN BABU
Sprint-2	Input Necessary Details	USN-4	As a user, I can give Input Details toPredict Likeliness of crude oil	15	High	VARUN BABU
Sprint-2	Data Pre-processing	USN-5	Transform raw data into suitableformat for prediction.	15	High	THARUN KARTHIKEYAN
Sprint-3	Prediction of Crude Oil Price	USN-6	As a user, I can predict Crude oil usingmachine learning model.	20	High	RAJESH
Sprint-3		USN-7	As a user, I can get accurate prediction ofcrude oil	5	Medium	KAMALESH
Sprint-4	Review	USN-8	As a user, I can give feedback of theapplication.	20	High	RAJESH

6.2 Sprint Delivery Schedule

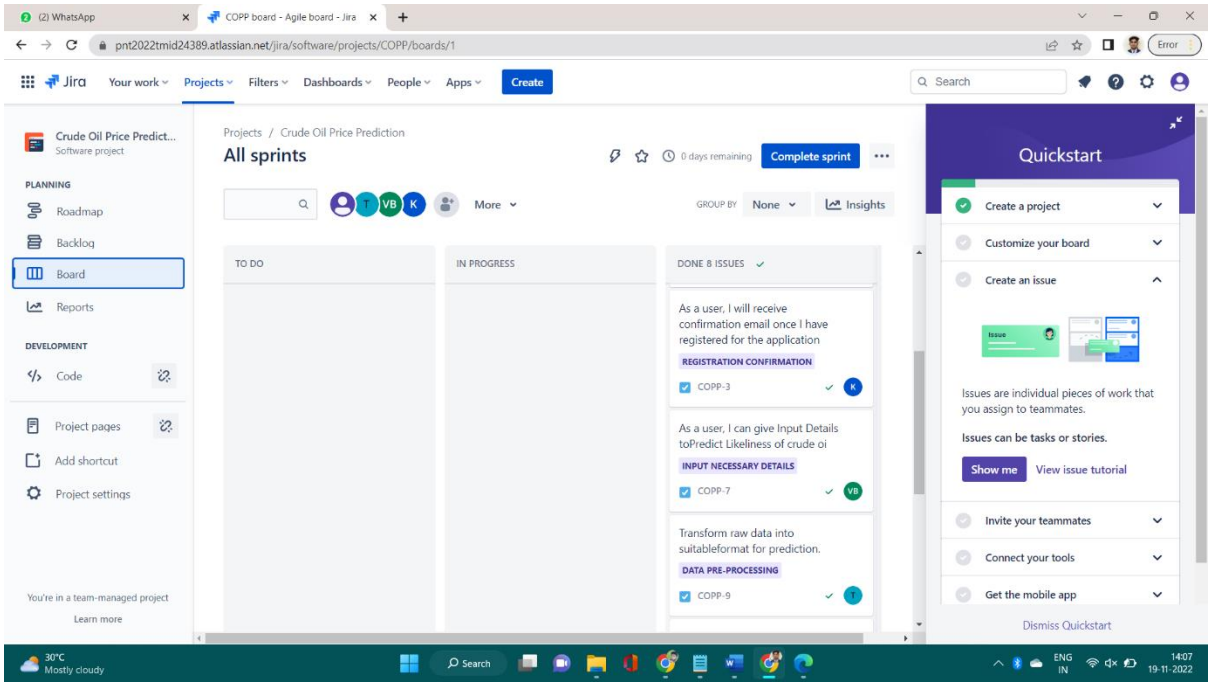
Project Tracker, Velocity & Burndown Chart: (4 Marks)

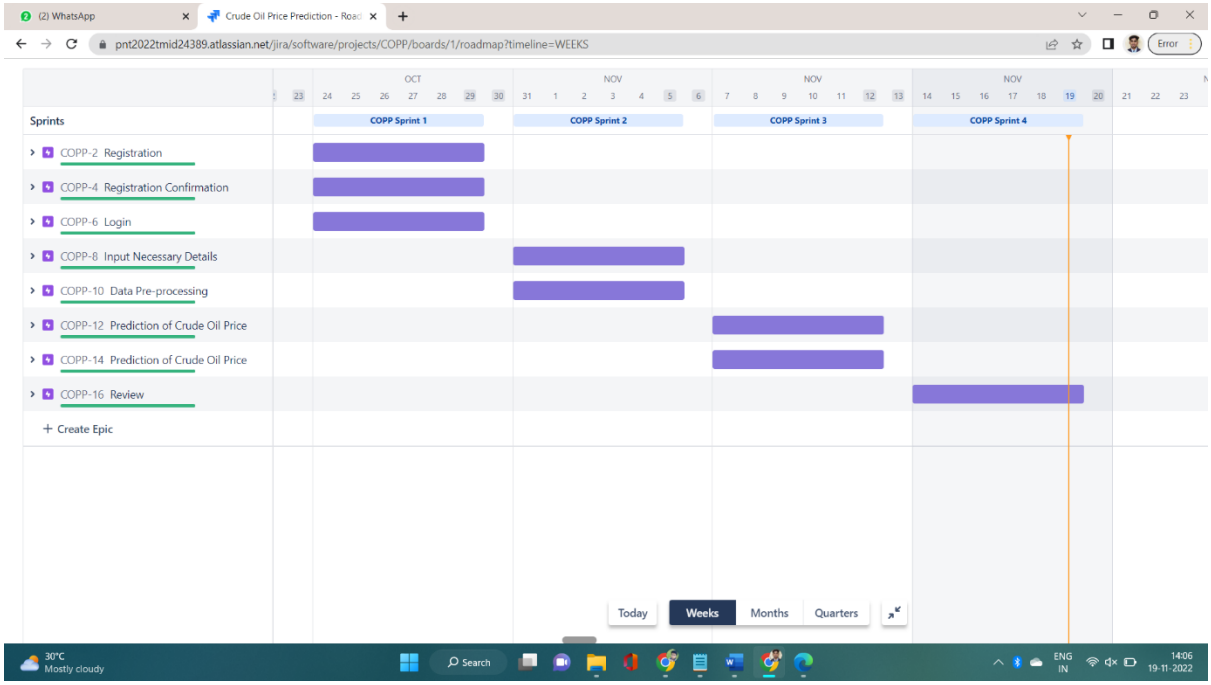
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022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

Velocity:
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.3. Reports From JIRA


(2) WhatsApp
COPP board - Agile board - Jira
pnt2022tmid24389.atlassian.net/jira/software/projects/COPP/boards/1
Jira
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Crude Oil Price Predict...
Software project
PLANNING
Roadmap
Backlog
Board
Reports
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / Crude Oil Price Prediction
All sprints
0 days remaining
Complete sprint
More
GROUP BY
None
Insights
TO DO
IN PROGRESS
DONE 8 ISSUES
As a user, I will receive confirmation email once I have registered for the application
REGISTRATION CONFIRMATION
COPP-3
As a user, I can give Input Details toPredict Likeliness of crude oi
INPUT NECESSARY DETAILS
COPP-7
Transform raw data into suitableformat for prediction.
DATA PRE-PROCESSING
COPP-9
Quickstart
Create a project
Customize your board
Create an issue
Issues are individual pieces of work that you assign to teammates.
Issues can be tasks or stories.
Show me
View issue tutorial
Invite your teammates
Connect your tools
Get the mobile app
Dismiss Quickstart
30°C
Mostly cloudy
Search
ENG
IN
14:07
19-11-2022


(2) WhatsApp
Crude Oil Price Prediction - Roac
pnt2022tmid24389.atlassian.net/jira/software/projects/COPP/boards/1/roadmap?timeline=WEEKS
OCT
NOV
NOV
NOV
Sprints
COPP Sprint 1
COPP Sprint 2
COPP Sprint 3
COPP Sprint 4
COPP-2 Registration
COPP-4 Registration Confirmation
COPP-6 Login
COPP-8 Input Necessary Details
COPP-10 Data Pre-processing
COPP-12 Prediction of Crude Oil Price
COPP-14 Prediction of Crude Oil Price
COPP-16 Review
Create Epic
Today
Weeks
Months
Quarters
30°C
Mostly cloudy
Search
ENG
IN
14:06
19-11-2022

7.CODING & SOLUTIONING

7.1 Feature 1

7.1.1 HTML CODE FOR INDEX PAGE

Index1.html :

```
<!DOCTYPE html>
<!-- Created By CodingLab - www.codinglabweb.com -->
<html lang="en" dir="ltr">
  <head>Login page
    <meta charset="UTF-8">
    <title>login to CrudeOil</title>
    <!---<title> Responsive Login Form | CodingLab </title>--->
    <link rel="stylesheet" href="index1.css">
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.2/css/all.min.css"/>
     <meta name="viewport" content="width=device-width, initial-scale=1.0">
  </head>
  <body class="background">
    <div class="icon">
              <h2 class="logo">CRUDE OIL</h2>
           </div>
    <div class="container">
      <form action="#">
        <div class="title">Login</div>
        <div class="input-box underline">
          <input type="text" placeholder="Enter Your Email" required>
          <div class="underline"></div>
```

```
        </div>
        <div class="input-box">
          <input type="password" placeholder="Enter Your Password" required>
          <div class="underline"></div>
        </div>
        <div class="input-box button"><a href="predictionPage.html"></a>
          <input type="submit" name="" value="Continue">


        </div>
      </form>
        <div class="option"><a href="register1.html">or didn't have an account</a></div>
        <div class="twitter">
          <a href="#"><i class="fab fa-twitter"></i>Sign in With Twitter</a>
        </div>
        <div class="facebook">
          <a href="#"><i class="fab fa-facebook-f"></i>Sign in With Facebook</a>
        </div>
    </div>
  </body>
</html>
```

Index1.css :

```
@import url('https://fonts.googleapis.com/css2?family=Poppins:wght@200;300;400;500;600;700&display=swap');
```

```
@import
url('https://fonts.googleapis.com/css2?family=Poppins:wght@200;300;400;500;
600;700&display=swap');
*{
  margin: 0;
  padding: 0;
  box-sizing: border-box;
  font-family: 'Poppins',sans-serif;
}
html, body{
  display: grid;
  height: 100vh;
  width: 100%;
  place-items: center;
 /* background: linear-gradient(to right, #99004d 0%, #ff0080 100%);*/
}
.background{
  background-image: url(crudeoil5.jpg);
  width: 100%;
  height: 100vh;
  background-repeat: no-repeat;
  background-attachment: fixed;
  background-size: cover;
}
::selection{
  background: #ff80bf;

}
```

```
.container{
  background: transparent;
  max-width: 350px;
  width: 100%;
  padding: 25px 30px;
  border-radius: 5px;
  box-shadow: 0 10px 10px rgba(0, 0, 0, 0.15);
}
.container form .title{
  font-size: 30px;
  font-weight: 600;
  margin: 20px 0 10px 0;
  position: relative;
}
.container form .title:before{
  content: '';
  position: absolute;
  height: 4px;
  width: 33px;
  left: 0px;
  bottom: 3px;
  border-radius: 5px;
  background: linear-gradient(to right, #99004d 0%, #ff0080 100%);
}
.container form .input-box{
  width: 100%;
  height: 45px;
```

```
  margin-top: 25px;
  position: relative;
}
.container form .input-box input{
  width: 100%;
  height: 100%;
  outline: none;
  font-size: 16px;
  border: none;
}
.container form .underline::before{
  content: '';
  position: absolute;
  height: 2px;
  width: 100%;
  background: #ccc;
  left: 0;
  bottom: 0;
}
.icons ion-icon{
    color: #fff;
    font-size: 40px;
    padding-left: 60px;
    padding-top: 5px;
    transition: 0.3s ease;
}
@media screen and (max-width: 450px){
```

```
    /*mobile*/
    .logo{
        margin-left: 140px;
        font-size: 4vw;
    }
}
@media screen and (max-width: 600px){
    /*IPAD*/

    .content{
        margin-top: 80px;
        margin-left: 20px;
    }
    .search{
        margin-top: -40px;
        margin-left: 42px;
    }
    .logo{
        margin-left: 180px;
        font-size: 4vw;
    }
    ul{
        margin-top: -25px;
        margin-left: -5px;
    }
    ul li {
        margin-left: 50px;
```

```
    }
    ul li a{
        font-size: 2vw;
    }
}
.container form .underline::after{
  content: '';
  position: absolute;
  height: 2px;
  width: 100%;
  background: linear-gradient(to right, #99004d 0%, #ff0080 100%);
  left: 0;
  bottom: 0;
  transform: scaleX(0);
  transform-origin: left;
  transition: all 0.3s ease;
}
.container form .input-box input:focus ~ .underline::after,
.container form .input-box input:valid ~ .underline::after{
  transform: scaleX(1);
  transform-origin: left;
}
.container form .button{
  margin: 40px 0 20px 0;
}
.container .input-box input[type="submit"]{
  background: linear-gradient(to right, #99004d 0%, #ff0080 100%);
```

```
  font-size: 17px;
  color: #fff;
  border-radius: 5px;
  cursor: pointer;
  transition: all 0.3s ease;
}
.container .input-box input[type="submit"]:hover{
  letter-spacing: 1px;
  background: linear-gradient(to left, #99004d 0%, #ff0080 100%);
}
.container .option{
  font-size: 14px;
  text-align: center;
  color: #c7029c;
}
.container .facebook a,
.container .twitter a{
  display: block;
  height: 45px;
  width: 100%;
  font-size: 15px;
  text-decoration: none;
  padding-left: 20px;
  line-height: 45px;
  color: #fff;
  border-radius: 5px;
  transition: all 0.3s ease;
```

```
}

.container .facebook i,
.container .twitter i{
  padding-right: 12px;
  font-size: 20px;
}
.container .twitter a{
  background: linear-gradient(to right,  #00acee 0%, #1abeff 100%);
  margin: 20px 0 15px 0;
}
.container .twitter a:hover{
  background: linear-gradient(to left,  #00acee 0%, #1abeff 100%);
  margin: 20px 0 15px 0;
}
.container .facebook a{
  background: linear-gradient( to right,  #3b5998 0%, #476bb8 100%);
  margin: 20px 0 50px 0;
}
.container .facebook a:hover{
  background: linear-gradient( to left,  #3b5998 0%, #476bb8 100%);
  margin: 20px 0 50px 0;
}
```

7.1.2 HTML CODE FOR PREDICTION PAGE

predictionPage.html :

```
<html>
 <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">

<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;
```

```
}
.navbar
{
margin-left:10px;
padding:10px;
background-color:hsl(180, 96%, 52%);
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:30px;
font-size:30px;
box-sizing: border-box;
max-width: 18%;
text-align:center;
}
a:hover{
background-color:black;
color:white;
border-radius:16px;0
font-size:30px;
padding:10px;
}

body
{
background-image:url("crudeoil5.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"]{
                                                                    border:0;
                                                                    backgrou
nd:none;
                                                                    display:bl
ock;
                                                                    margin:2
0px auto;
                                                                    text-
align:center;
                                                                    border:2p
x solid #800080;
                                                                    padding:1
5px 3px;
                                                                    width:40
0px;
                                                                    outline:n
one;
                                                                    color:whi
te;
                                                                    border-
radius:100px;
                                                                    transition
:0.25s;
                                                                    font-
size:20;
```

```
}
.bor{
border:0;
                                                    backgrou
nd:none;
                                                    display:bl
ock;
                                                    margin:2
0px auto;
                                                    text-
align:center;
                                                    border:2p
x solid #800080;
                                                    padding:1
0px 3px;
                                                    width:50
0px;
                                                    outline:n
one;
                                                    color:whi
te;
                                                    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:28
0px;
```

```
                                                                border-
color:#8e44ad;
}
.logbtn{
                                                                display:bl
ock;
                                                                width:35
%;
                                                                height:50
px;
                                                                border:no
ne;
                                                                border-
radius:24px;
                                                                backgrou
nd:linear-gradient(120deg,#3498db,#8e44ad,#3498db,#8e44ad);
                                                                backgrou
nd-size:200%;
                                                                color:#fff
;
                                                                outline:n
one;
                                                                cursor:po
inter;
                                                                transition
:.5s;
                                                                font-
size:25;
}
.logbtn:hover{
                                                                backgrou
nd-center;
```

```
}

input::placeholder{
                                                    color:#F5
FFFA;
}
.bottom-text{
                                                    margin-
top:60px;
                                                    text-
align:center;
                                                    font-
size:13px;

}
</style>
<body>
<div class="navbar">
<a href="index.html">Home</a>
<br>
</div>
                                                    <center>
<div><font color="blue" font-family="sans-serif" size=8 ><b>Crude Oil  Price
Prediction</b></font></div></center>



<br><br><br><br>
                                                    <form
class="main" action="/login" method="post">
                                                    <br>
```

<input type="text" name="year6" placeholder="Enter previous 5th day price"/>

<input type="text" name="year7" placeholder="Enter previous 4th day price"/>

<input type="text" name="year8" placeholder="Enter previous 3th day price"/>

<input type="text" name="year9" placeholder="Enter previous 2nd day price"/>

<input type="text" name="year10"placeholder="Enter previous 1st day price"/>

<input type="submit" class="logbtn" value="Predict">

showcase

</form>

</body>

</html>

7.2 Feature 2

7.2.1 FLASK CODE :

```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import datetime
from pylab import rcParams
import matplotlib.pyplot as plt
import warnings
import itertools
import statsmodels.api as sm
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Dropout
from sklearn.metrics import mean_squared_error
from keras.callbacks import ReduceLROnPlateau, EarlyStopping, ModelCheckpoint
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
import seaborn as sns
sns.set_context("paper", font_scale=1.3)
sns.set_style('white')
import math
from sklearn.preprocessing import MinMaxScaler
# Input data files are available in the "../input/" directory.
# For example, running this (by clicking run or pressing Shift+Enter) will list all files under the input directory
warnings.filterwarnings("ignore")
plt.style.use('fivethirtyeight')
import os
```

```
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))
  dateparse = lambda x: pd.datetime.strptime(x, '%b %d, %Y')
#Read csv file
from google.colab import files
uploaded = files.upload()
import io
df = pd.read_excel(io.BytesIO(uploaded['Crude Oil Prices Daily.xlsx']))
df.head()
df[:10]
#Sort dataset by column Date
df = df.sort_values('Date')
df = df.groupby('Date')['Closing Value'].sum().reset_index()
df.set_index('Date', inplace=True)
df=df.loc[datetime.date(year=2000,month=1,day=1):]
df.head()
def DfInfo(df_initial):
    # gives some infos on columns types and numer of null values
       tab_info = pd.DataFrame(df_initial.dtypes).T.rename(index={0: 'column type'})
                                                    tab_info =
tab_info.append(pd.DataFrame(df_initial.isnull().sum()).T.rename(index={0:
'null values (nb)'}))
          tab_info = tab_info.append(pd.DataFrame(df_initial.isnull().sum() /
df_initial.shape[0] * 100).T.
                          rename(index={0: 'null values (%)'}))
    return tab_info
DfInfo(df)
```

```
df.index
y = df['Closing Value'].resample('MS').mean()
y.plot(figsize=(15, 6))
plt.show()
rcParams['figure.figsize'] = 18, 8
decomposition = sm.tsa.seasonal_decompose(y, model='additive')
fig = decomposition.plot()
plt.show()
sc = MinMaxScaler(feature_range = (0, 1))
df = sc.fit_transform(df)
train_size = int(len(df) * 0.70)
test_size = len(df) - train_size
train, test = df[0:train_size, :], df[train_size:len(df), :]
def create_data_set(_data_set, _look_back=1):
    data_x, data_y = [], []
    for i in range(len(_data_set) - _look_back - 1):
        a = _data_set[i:(i + _look_back), 0]
        data_x.append(a)
        data_y.append(_data_set[i + _look_back, 0])
    return np.array(data_x), np.array(data_y)
look_back =90
X_train,Y_train,X_test,Ytest = [],[],[],[]
X_train,Y_train=create_data_set(train,look_back)
X_train = np.reshape(X_train, (X_train.shape[0], X_train.shape[1], 1))
X_test,Y_test=create_data_set(test,look_back)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))
regressor = Sequential()
```

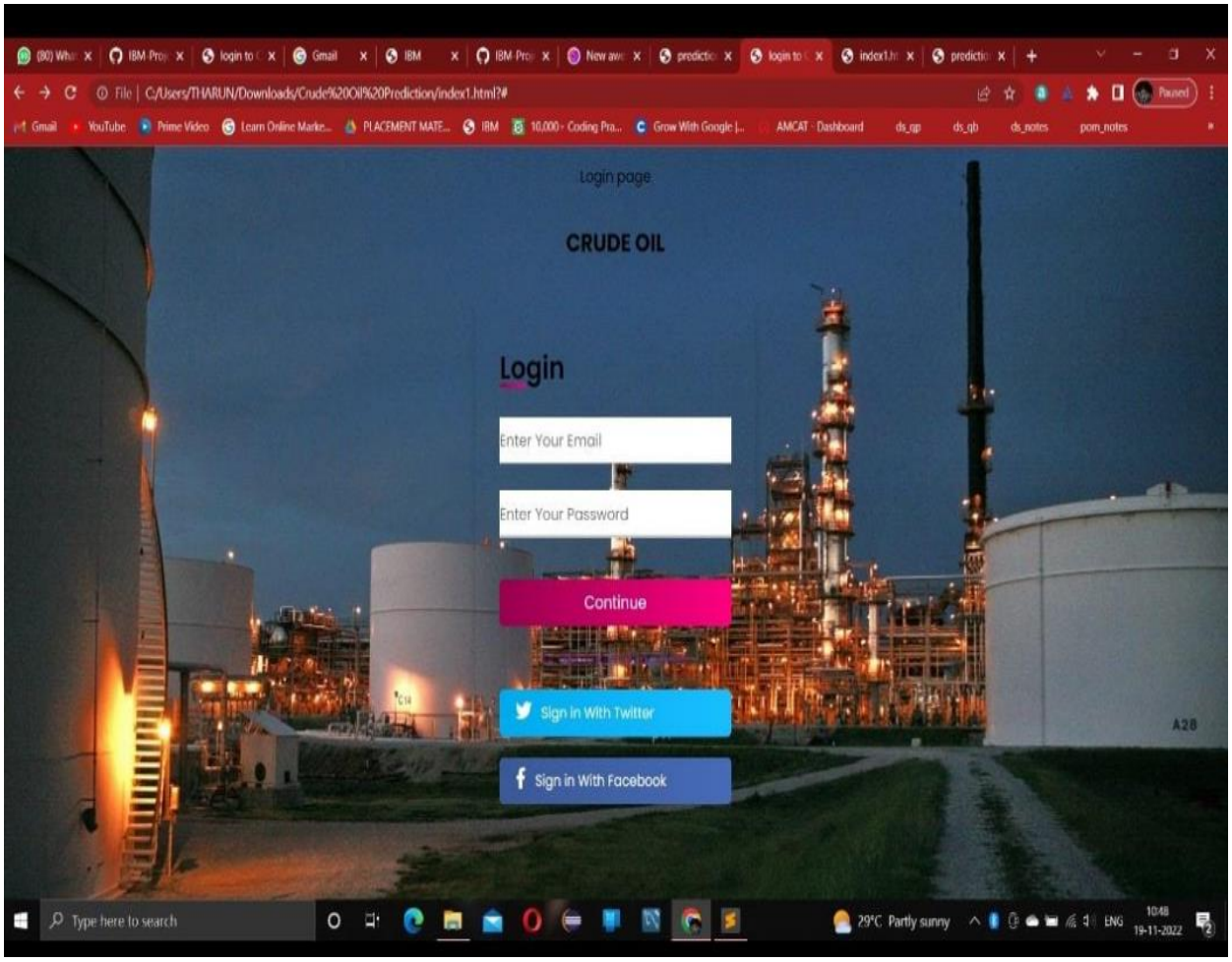
```
regressor.add(LSTM(units = 60, return_sequences = True, input_shape = (X_train.shape[1], 1)))
regressor.add(Dropout(0.1))

regressor.add(LSTM(units = 60, return_sequences = True))
regressor.add(Dropout(0.1))

regressor.add(LSTM(units = 60))
regressor.add(Dropout(0.1))

regressor.add(Dense(units = 1))



regressor.compile(optimizer = 'adam', loss = 'mean_squared_error')
reduce_lr = ReduceLROnPlateau(monitor='val_loss',patience=5)
history =regressor.fit(X_train, Y_train, epochs = 20, batch_size = 15,validation_data=(X_test, Y_test), callbacks=[reduce_lr],shuffle=False)
train_predict = regressor.predict(X_train)
test_predict = regressor.predict(X_test)
train_predict = sc.inverse_transform(train_predict)
Y_train = sc.inverse_transform([Y_train])
test_predict = sc.inverse_transform(test_predict)
Y_test = sc.inverse_transform([Y_test])
print('Train Mean Absolute Error:', mean_absolute_error(Y_train[0], train_predict[:,0]))
print('Train Root Mean Squared Error:',np.sqrt(mean_squared_error(Y_train[0], train_predict[:,0])))
```

```
print('Test Mean Absolute Error:', mean_absolute_error(Y_test[0], test_predict[:,0]))

print('Test Root Mean Squared Error:',np.sqrt(mean_squared_error(Y_test[0], test_predict[:,0])))

plt.figure(figsize=(8,4))

plt.plot(history.history['loss'], label='Train Loss')

plt.plot(history.history['val_loss'], label='Test Loss')

plt.title('model loss')

plt.ylabel('loss')

plt.xlabel('epochs')

plt.legend(loc='upper right')

plt.show();

aa=[x for x in range(180)]

plt.figure(figsize=(8,4))

plt.plot(aa, Y_test[0][:180], marker='.', label="actual")

plt.plot(aa, test_predict[:,0][:180], 'r', label="prediction")

plt.tight_layout()

sns.despine(top=True)

plt.subplots_adjust(left=0.07)

plt.ylabel('Price', size=15)

plt.xlabel('Time step', size=15)

plt.legend(fontsize=15)

plt.show();
```

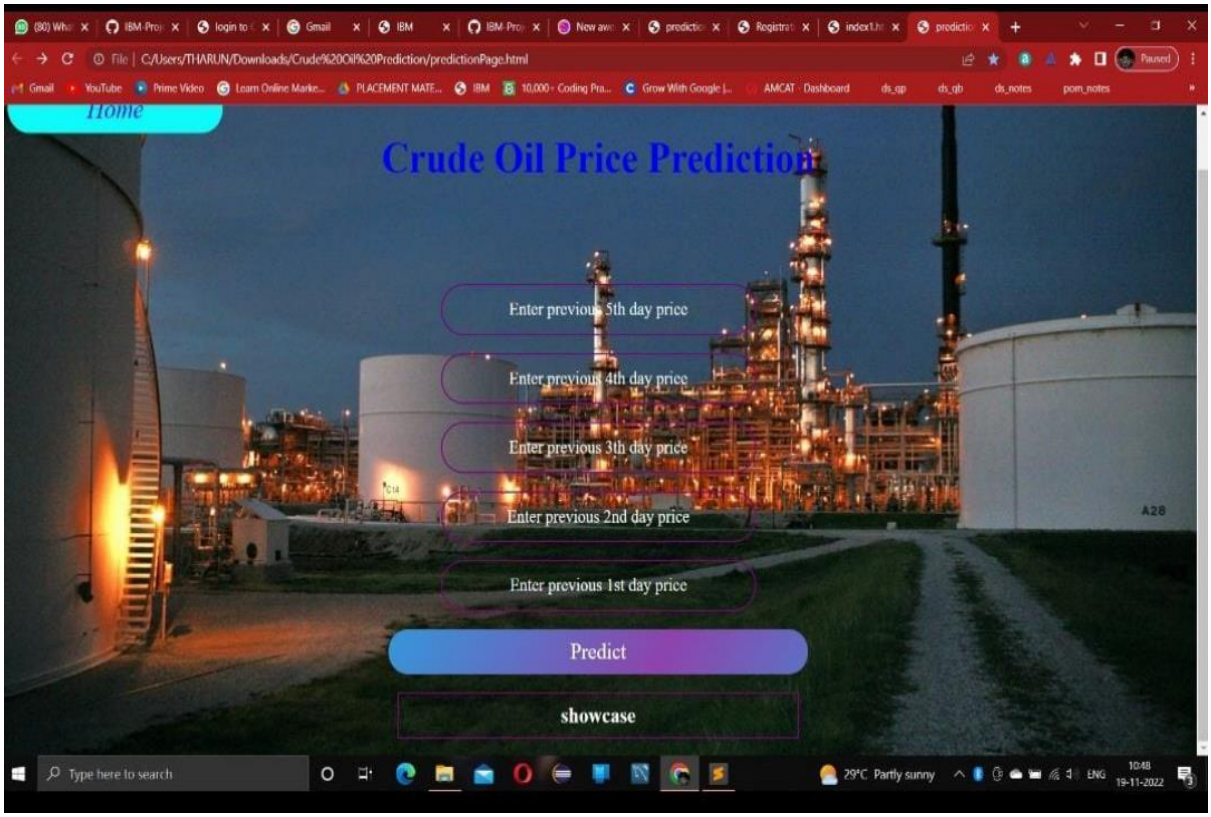
8.TESTING

8.1Testcase

Testing is the main purpose to detecting and training the code to execute the given output to certain source to analysis the crude oil price prediction to demanding the purpose of the oil calculation to adapt the situation of the trading ,demands and market prices



8.2. User Acceptance



9.RESULT

9.1 Performance metrics

We used two standard performance metrics in the oil price prediction literature for comparing different oil price prediction models. The first metric is Mean to oil price Prediction Error (ANN). ANN of a prediction model measures the average of the squares of the prediction errors. The prediction error is the difference between the true value and the predicted value. Let y1, y2, ..., y n be the true oil prices and 1 y , 2 y , ..., n y be the predicted oil prices under an oil price prediction model, then the ANN of that model is:

$$\mathrm{AV} = \frac{SPRINT\ DURATION}{VELOCITY} = \frac{20}{10} = 2$$

10. ADVANTAGE & DISADVANTAGE

10.1 ADVANTAGE

 The crude oil price is an important indicator of the economy Oil is the most used resource in the world.

 This bullish forecast is driven by the belief that OPEC has a limited capacity to increase oil production.

 Full form of OPEC is organization of the petroleum exporting countries Oil has one of the highest energy Density which means that a small amount of oil can produce a large amount of energy.

 The crude oil makes very useful as its high energy density has made is that preferred choice of use as fuel in automobile

10.2Disadvantage

 Crude oil prices had been suffering amid news that covid-19. Inflection rates were rising in China

 Burning oil produces carbon dioxide gas Lower oil prices means less drilling and exploration activity

 Because most of the news oil driving the economic activity is unconventional and has a higher cost per barrel than a conventional source of oil

 An increase in the price of crude oil means that would increase the cost of production goods. the price rise would finally be passed on to consumers resulting in inflation

11. CONCLUSION

Artificial Neural Network is one of the most important ways to predict a lot of reservoir parameters or functions, as well as search for new sites of infill wells, which is an important use of this technique in conjunction with simulators because of their relationship with development operations and production of oil and gas fields. Both Artificial Neural Network and Data Mask technique gave a good and easy way for the preparation and data management in every phase of prediction and optimization technique. The constructed Artificial Neural Network model (FFNN), had good training and validating Results according to the data sets used in both of training and validation steps, and obtained good behavior after many trials and reflecting high confidence to the prediction or simulation stage. Clear and quite improvement appeared with additional

cumulative oil production for the production field sector under the current study, especially with the wells M, O and P, among those elected locations of infill wells. This became a good decision maker to which of the well can we implement for the future production plan and development field strategy view point. ANN used and proved to be an effective tool within prediction and optimization process, especially when dealing with developmental ideas of the oil and gas production, from the standpoint of oil reservoir management and field directorate for future strategic planning

12.FUTURE SCOPE

This work indicates that the ANN model is an effective tool for crude oil price prediction and can be efficiently used for short term price forecasting by determining the optimal lags. The proposed model is powerful and highly suggested because investors can use it not only to initiate trades but also as an effective tool to judge various strategies relating. to investments. This work is carried out on the closing price of crude oil; however, there are various other factors which also affect the crude oil prices like change in the prices and quantities (demand and supply), change in the economy and current affairs as shown by the media. The main advantage of this research is in capturing the changing pattern of these prices. In the coming future, fundamental indicators and market trends have been planned to be incorporated into a model which will help the proposed model perform more efficiently.

13.APPENDIX

13.1Source Code

FLASK CODE :

```
import numpy as np # linear algebra

import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

import datetime

from pylab import rcParams

import matplotlib.pyplot as plt

import warnings

import itertools
```

```
import statsmodels.api as sm
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Dropout
from sklearn.metrics import mean_squared_error
from keras.callbacks import ReduceLROnPlateau, EarlyStopping, ModelCheckpoint
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
import seaborn as sns
sns.set_context("paper", font_scale=1.3)
sns.set_style('white')
import math
from sklearn.preprocessing import MinMaxScaler
# Input data files are available in the "../input/" directory.
# For example, running this (by clicking run or pressing Shift+Enter) will list all files under the input directory
warnings.filterwarnings("ignore")
plt.style.use('fivethirtyeight')
import os
for dirname, _, filenames in os.walk('/kaggle/input'):
for filename in filenames:
print(os.path.join(dirname, filename))
  dateparse = lambda x: pd.datetime.strptime(x, '%b %d, %Y')
#Read csv file
from google.colab import files
uploaded = files.upload()
```

```
import io
df = pd.read_excel(io.BytesIO(uploaded['Crude Oil Prices Daily.xlsx']))
df.head()
df[:10]
#Sort dataset by column Date
df = df.sort_values('Date')
df = df.groupby('Date')['Closing Value'].sum().reset_index()
df.set_index('Date', inplace=True)
df=df.loc[datetime.date(year=2000,month=1,day=1):]
df.head()
def DfInfo(df_initial):
# gives some infos on columns types and numer of null values
tab_info = pd.DataFrame(df_initial.dtypes).T.rename(index={0: 'column type'})
tab_info=tab_info.append(pd.DataFrame(df_initial.isnull().sum()).T.rename(index={0: 'null values (nb)'}))
tab_info=tab_info.append(pd.DataFrame(df_initial.isnull().sum()/df_initial.shape[0] * 100).T.
rename(index={0: 'null values (%)'}))
 return tab_info
DfInfo(df)
df.index
y = df['Closing Value'].resample('MS').mean()
y.plot(figsize=(15, 6))
plt.show()
rcParams['figure.figsize'] = 18, 8
decomposition = sm.tsa.seasonal_decompose(y, model='additive')
fig = decomposition.plot()
plt.show()
```

```
sc = MinMaxScaler(feature_range = (0, 1))
df = sc.fit_transform(df)
train_size = int(len(df) * 0.70)
test_size = len(df) - train_size
train, test = df[0:train_size, :], df[train_size:len(df), :]
def create_data_set(_data_set, _look_back=1):
 data_x, data_y = [], []
 for i in range(len(_data_set) - _look_back - 1):
 a = _data_set[i:(i + _look_back), 0]
 data_x.append(a)
 data_y.append(_data_set[i + _look_back, 0])
 return np.array(data_x), np.array(data_y)
look_back =90
X_train,Y_train,X_test,Ytest = [],[],[],[]
X_train,Y_train=create_data_set(train,look_back)
X_train = np.reshape(X_train, (X_train.shape[0], X_train.shape[1], 1))
X_test,Y_test=create_data_set(test,look_back)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))
regressor = Sequential()
regressor.add(LSTM(units = 60, return_sequences = True, input_shape = (X_train.shape[1], 1)))
regressor.add(Dropout(0.1))
regressor.add(LSTM(units = 60, return_sequences = True))
regressor.add(Dropout(0.1))
regressor.add(LSTM(units = 60))
regressor.add(Dropout(0.1))
regressor.add(Dense(units = 1))
regressor.compile(optimizer = 'adam', loss = 'mean_squared_error')
```

```
reduce_lr = ReduceLROnPlateau(monitor='val_loss',patience=5)

history =regressor.fit(X_train, Y_train, epochs = 20, batch_size = 15,validation_data=(X_test, Y_test), callbacks=[reduce_lr],shuffle=False)

train_predict = regressor.predict(X_train)

test_predict = regressor.predict(X_test)

train_predict = sc.inverse_transform(train_predict)

Y_train = sc.inverse_transform([Y_train])

test_predict = sc.inverse_transform(test_predict)

Y_test = sc.inverse_transform([Y_test])

print('Train Mean Absolute Error:', mean_absolute_error(Y_train[0], train_predict[:,0]))

print('Train Root Mean Squared Error:',np.sqrt(mean_squared_error(Y_train[0], train_predict[:,0])))

print('Test Mean Absolute Error:', mean_absolute_error(Y_test[0], test_predict[:,0]))

print('Test Root Mean Squared Error:',np.sqrt(mean_squared_error(Y_test[0], test_predict[:,0])))

plt.figure(figsize=(8,4))

plt.plot(history.history['loss'], label='Train Loss')

plt.plot(history.history['val_loss'], label='Test Loss')

plt.title('model loss')

plt.ylabel('loss')

plt.xlabel('epochs')

plt.legend(loc='upper right')

plt.show();

aa=[x for x in range(180)]

plt.figure(figsize=(8,4))

plt.plot(aa, Y_test[0][:180], marker='.', label="actual")

plt.plot(aa, test_predict[:,0][:180], 'r', label="prediction")
```

```
plt.tight_layout()
sns.despine(top=True)
plt.subplots_adjust(left=0.07)
plt.ylabel('Price', size=15)
plt.xlabel('Time step', size=15)
plt.legend(fontsize=15)
plt.show();
```

13.2GitHub & Project Demo Link

Github: https://github.com/IBM-EPBL/IBM-Project-54066-1661588623