KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

HX 8001-PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

CRUDE OIL PRICE PREDICTION

NALAIYA THIRAN PROJECT REPORT 2022

Submitted by

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1. INTRODUCTION

1.1. PROJECT OVERVIEW

The important source available on earth is crude oil. It is the main fuel in the globe. Nearly one-third of the world's energy is produced by petroleum. Additionally,refined crude oil is used to make petroleum products. This will spread worms over the world because of increased environmental utilization. Petroleum is currently used in the world at a rateof up to 95 million barrels per day. To anticipate crude oil with any degree of accuracy, you need to know a lot about it. Predicting the price of oil is crucial in a variety of economic, political, and industrial contexts for both crude oil exporting and importing nations. Crude oil has evolved into a key component of the global economy sinceit is a strategic resource of great importance. By using the oil price prediction method , we can easily predicted thetomorrow price of the oil. It will help the government has fixed the price of the gasoline of day after. In this method, it helps the people too. The people will knows the economy of our country. This method will help as to predict the price of the oil without the man power. The crude oil price has a huge impact on the world's economy. LSTM based on a neural network hasshown better results is predicted. By utilizing this model, the significant crude oil price is evaluated and modeled.

1.2. PURPOSE

Crude oil is the most important resources in world. The vapor nature of crude oil, its price prediction becomes highly difficult. We propose a contemporary and innovative method using the Artificial Intelligence (AI).The advantage of the approach of AI is that itcontinuously captures the unstable pattern of the oil prices. The volatility of crude oil market and its chain effects to the world economy augmented the interest and fear of individuals, public and private sectors. Previous statistical and the econometric techniques used for prediction offed good results when dealed with linear data the crude oil price series deal with high irregular events. The continuous use of statistical and econometries technique for oil price prediction might demonstrate to the prediction performance. Machine Learning and Computational Intelligence approach through combination of historical quantitative data with qualitative data from experts view and news is a remedy proposed to predict this.

2. LITERATURE SURVEY

TITLE: The Natural Gas Liquids Markets.

AUTHOR: Ali Jadidzadehs, Apostolos Serletiss.

YEAR OF PUBLICATION: 2022

This paper investigates the impact of oil market structural shocks on the prices of NGLs including ethane and propane and normal butane, isobutene, and natural gasoline, over the period from January 1985 to April 2020. To identify the structural demand and supply shocks in the crude oil market, we use a vector auto regression model and assume that the innovations to the real price of crude oil are predetermined with respect to the local NGLs markets. Our results show that, in the long run, more than 55% of the variation in the real price of NGLs is explained by the structuralshocks in the global oil market.

TITLE: Crude Oil Prices, Clean Energy Investments.

AUTHOR: Caner Ozdurak.

YEAR OF PUBLICATION: 2021

The crude oil prices, clean energy investments, technology companies, and energy democracy. Our dataset incorporates four variables which are S & P Global Clean Energy Index (SP Clean), Brent crude oil futures (Brent), CBOE Volatility Index (VIX), and NASDAQ 100 Technology Sector (DXNT) daily prices between 2009 and 2021. The novelty of our study is that we included technology development and market fear as important factors and assess their impact on clean energy investments. DCC-GARCH models are utilized to the spillover impact of oil prices, and technology company stock returns to clean energy investment. According to our findings when oil prices decrease, the volatility index usually responds by increasing which means that the market is afraid of oil price surges. Renewable investments also tend to decrease in that period following the oil price trend. Moreover, a positive relationship between technology stocks and renewable energy stock returns also exists.

TITLE: Analysis Of capital asset pricing model on crude oil.

AUTHOR: Tolulope Latunde, Lukman Shina Akinola, Damilola Deborah Dare.

YEAR OF PUBLICATION: 2020

Capital asset pricing model (CAPM) is one of the widely used asset pricing models in modern securities theory. This mathematical model can help investors understand the relationship between expected returns and investment risk. To help energy commodity to makes the best decisions in investment management, this paper uses the CAPM and some statistical tools (variance, covariance and mean) to study risks on the expected return of investing in four common Deutsche Bank (DB) crude oil assets (DB crude oil double short, SZO-DB crude oil short order, OLO-DB crude oil short position, DBO-Invesco DB Petroleum Fund). The result reveals that DTO-DB Crude oil Doubled Shorts has the highest beta risk and highest expected return that is, the risk is directly proportional to the expected return.

TITLE: price prediction using complex network and deep learning algorithmAUTHOR:

Makumbonori Bristone ,Rajesh Prasadand Adamu Ali Abubakar

YEAR OF PUBLICATION: 2020

They use the complex network analysis and LSTM for price prediction. They only consider crude oil price without necessarily considering other factor such as financial market,economic growth, dollar exchange rate ,demand and supply etc. The superiority performance of DBN based model against the benchmark autoregressive moving average model is striking; however, it is not statistically impressive when the predictive power is compared against the RW model. This leads to the discovery that the predictive performance of deep learning is very sensitive to parameters. Thus, in this paper, a deep learning approach known as LSTM network was proposed to predict the price of the oil. LSTM was established to mitigate the important issue with standard recurrent neural network's(RNNs) difficulty in learning long range dependencies between data instance that are far from each other. Basically, this approach is an evolution of a standard RNN where

hidden layer is replaced by a memory cell. A memory cell contains a node with a self-connected recurrent edge, ensuring that the gradient can pass across many time steps without vanishing. Thus, considering the important role crude oil price plays in the economy today, the greater demand of techniques that will efficiently and proactively predict accurately future behaviors of crude oil price justifies the need for effective, prediction approaches, hence the reason for adopting LSTM in this paper.

TITLE: Crude Oil Prices Forecast Based on EMD and BP Neural Network

AUTHOR: Malli Suresh Babu, DR .S Naveen Kumar

YEAR OF PUBLICATION: 2021

Crude oil is part of the most importance financial instruments in the commodity market. Predicting the price fluctuations and trends of the oil market accurately is very significant for the country, enterprises, financiers and investors. However, crude oil price fluctuations usually present non-stationary, complex, non-linear research. With the development of the crude oil market, it is particularly important to use appropriate decomposition methods and establish appropriate time-series prediction models to forecast oil prices In recent years, people have been paying more and more attention to the application of multi-scale decomposition methods in non-stationary financial time series. The multi-scale decomposition methods are mainly wavelet analysis me thuds and empirical mode decomposition methods. Wavelet analysis can perform multi-scale analysis on signals in the time domain and frequency domain, and gradually refine the original sequence into sub-sequences of different frequencies. The neural network method based on wavelet transform has been extensively used in financial time-series analysis, but wavelet analysis still has some defects, which cannot be adaptively decomposed, because wavelet transform is generated on the basis of Fourier transform. The essence is still the window- adjustable Fourier transform, and there are still limitations of the Fourier transform.

TITLE: Oil And Stock Markets Volatility During Pandemic Times.

AUTHOR: Tahir Mumtaz Awan, Muhammad Shoaib Khan, Inzamam Ul Haq,Sarwat Kazmi.

YEAR OF PUBLICATION: 2021

The main aim is to produce insight into the volatilities trio (COVID-19 crisis, stock markets, and crude oil volatility). The understanding of risk trends in stock markets economies and crude oil as hedge are two vital concerns for investors, researchers, and portfolio managers in global. During the pandemic times, globally among others oil and stock markets are severely getting affected. Considering the main purpose and role of G7 countries to resolve global issues focusing on economic concerns, this review is planned. The published work in journals of repute was selected on the term mechanism (COVID-19 and stock markets or COVID-19 and oil prices) was conducted which resulted in 29 articles in total.

EXISTING PROBLEM

The existing system uses ML and AI approachthrough HC and ANN-Q model is applied to predict the monthly WTI crude oil price for every barrel in USD. The result obtained from simulation study validates the effectiveness of data. HC model successfully extracts from comprehensive list of key factors that cause the crude oil price market to volatile. The effectiven and accurate of the data selection also helps to extensively give the input variables combination for ANN-Q model. Data represented in One- step Returns function had successfully proved to cleanse and uniform the data from errors and noises hence, the crisp prediction result. This research is now inits extension level to comprehend this quantitative part of prediction with the qualitative part. This mathematical model can help investors understand the relationship between expectedreturns and investment risk.

2.1. REFERENCE

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2.2. PROBLEM STATEMENT DEFINITION

Crude oil is an important fuel resource for all countries. Accurate predictions of oil prices have important economic and social values. In order to solve the problem, this paper proposes using Long Short-Term Memory Network (LSTM) based on transfer learning to predict the price of crude oil in Shanghai. The basic idea is to take advantage of the correlation between Brent crude oil and Shanghai crude oil, crude oil to fine-tune the network. The empirical results show that the LSTM model based on transfer learning has strong generalization ability and high prediction accuracy. Factors Impacted : 1. Supply Supply and demand has to do with how much oil is available. Supply has historically been determined by countries that are part of OPEC. But now, the United States is playing a bigger role in supply thanks to booming production from American shale fields. So if major oil producing countries are pumping out a lot of crude, the supply will be high. Just look at what happened in 2014. “Saudi Arabia made the decision that they were not going to cut back production, they were going to continue to produce at record high levels,” said Tamar Essner, senior energy director at Nasdaq IR Solutions. “At the same time, you had very robust output from the United States, and from other producers around the world.” Oil prices fell sharply as producers pumped more than the world could consume. But OPEC said U.S. shale drillers were to blame for pumping too much, and should cut their production first. In 1973, Arab members of OPEC put an embargo against the United States as a retaliatory measure for U.S. support of Israel during the Yom Kippur War. After the embargo, the oil supply in the U.S. was so scarce and the demand was so high, it drove the price of crude to the point that gas stations began rationing gasoline. 2. Demand Demand on the other hand is determined by how much need there is for oil at a given time.

That need is often for things like heat, electricity and transportation. The more economic growth a region sees, the more demand there will be for oil. “Economies around the world have picked up since the financial crisis, and growth has gotten stronger so people have been using more energy,” Essner said. And then there’s the question of how the market will react to renewable energy.

3. IDEATION & PROPOSED SOLUTIONS

3.1. EMPATHY MAP CANVAS

An empathy map canvas is a more in-depth version of the original empathy map, which helps identify and describe the user's needs and pain points. And this is valuable information for improving the user experience. Good canvases rely on insights from actual users, which help provide an accurate picture of how they feel about their experience with the product. This provides insight into which features are accessed the most often and how they are used. And this knowledge empowers teams to make the improvements that most benefit the user and increase the product's value.

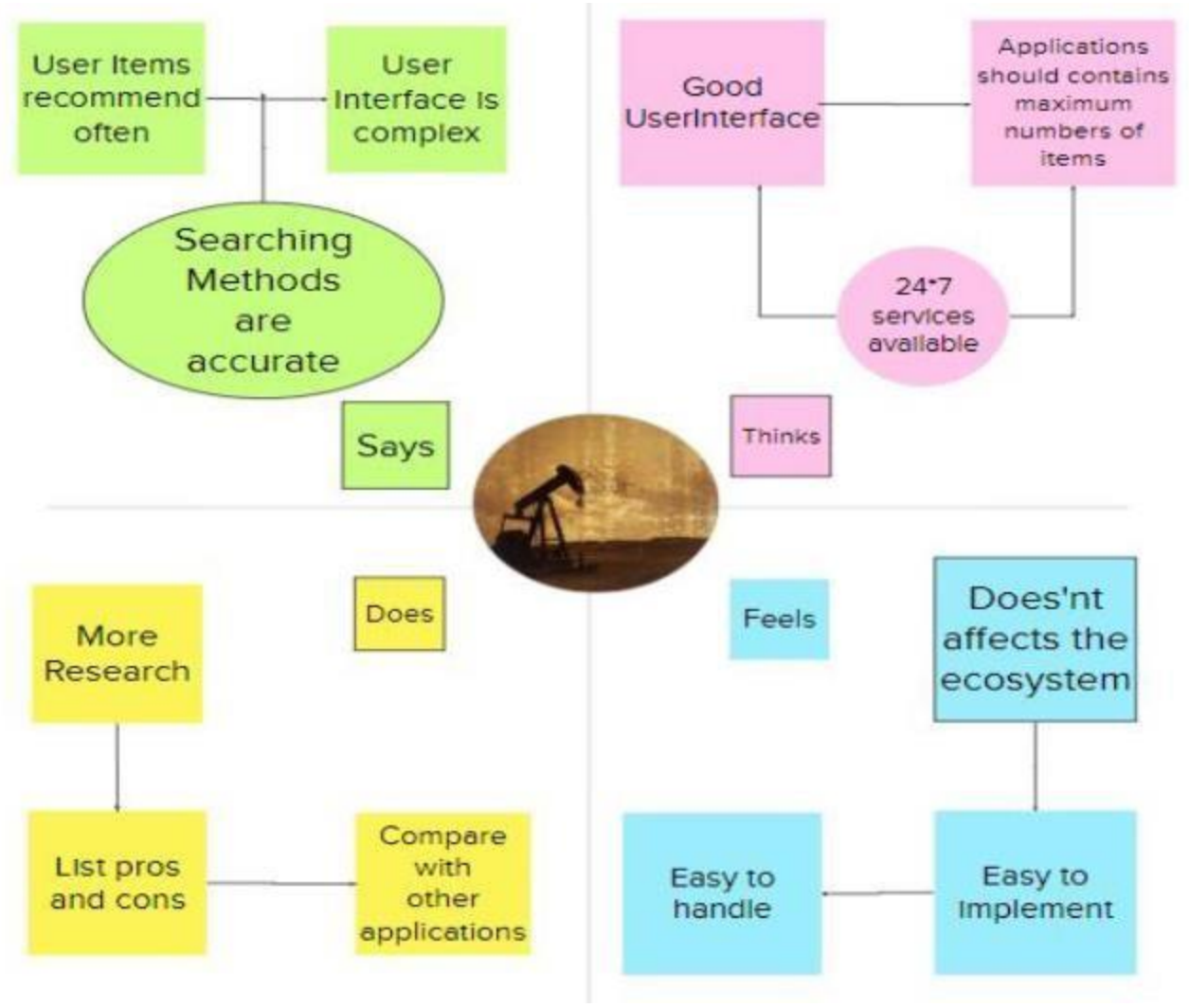


FIGURE 3.1

3.2. IDEATION AND BRAINSTORMING

Brainstoming is the process where you generate ideas and solutions through sessions such as Sketching, Prototyping, Brainstorming, Brain writing, Worst Possible Idea, and a wealth of otherideation techniques. It's important to notethat these ideas don't have to be completely new. You can ideate to solve specific problems, look into new ways of implementing a solution, or even collect feedback and evaluate ideas.As you can see, ideation is not just a one-time idea generation or a brainstorming session. In fact, we can divide ideation in these three stages: generation, selection, and development. To paint a clearer picture, we've illustrated below the ideation process. In this diagram represented as the four types of ideas in nutritional dietary assessment.

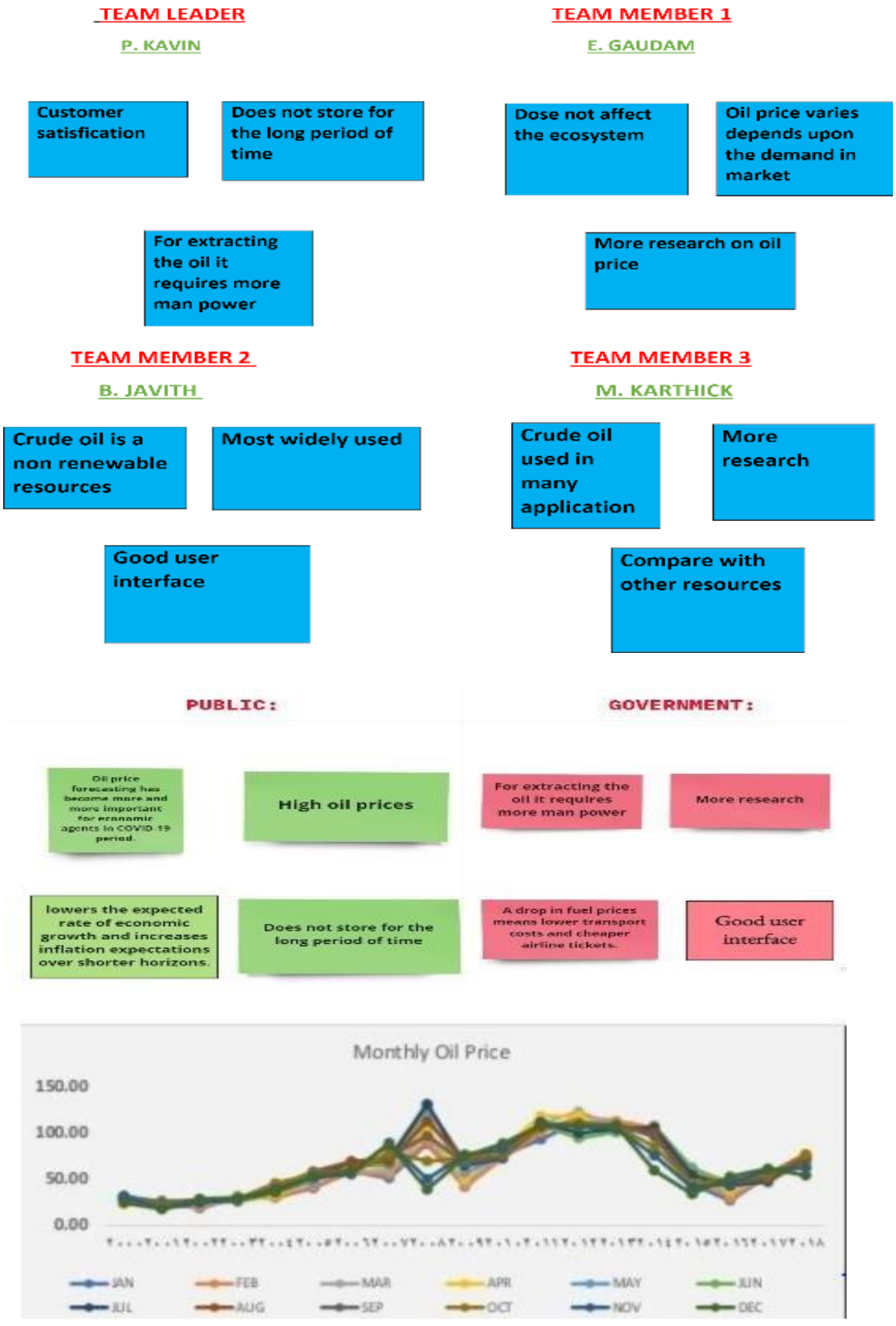

TEAM LEADER
P. KAVIN
Customer satisfication
Does not store for the long period of time
For extracting the oil it requires more man power
TEAM MEMBER 1
E. GAUDAM
Dose not affect the ecosystem
Oil price varies depends upon the demand in market
More research on oil price
TEAM MEMBER 2
B. JAVITH
Crude oil is a non renewable resources
Most widely used
Good user interface
TEAM MEMBER 3
M. KARTHICK
Crude oil used in many application
More research
Compare with other resources
PUBLIC:
Oil price forecasting has become more and more important for economic agents in COVID-19 period.
High oil prices
lowers the expected rate of economic growth and increases inflation expectations over shorter horizons.
Does not store for the long period of time
GOVERNMENT:
For extracting the oil it requires more man power
More research
A drop in fuel prices means lower transport costs and cheaper airline tickets.
Good user interface
Monthly Oil Price
150.00
100.00
50.00
0.00
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

FIGURE 3.2

3.3. PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Predicting the movement of the price only is not sufficient to characterise the market where else crisp prediction will offer far more persona.
2.	Idea / Solution description	To forecast the oil price using the Artificial Neural Network models and comparison between feedforward and backpropagationneural network.
3.	Novelty / Uniqueness	To predict the oil price ,depending upon the price and demand they use various strategy.
4.	Social Impact / Customer Satisfaction	In terms of inflation , oil price directly affect the price of Goods made with the petroleum products.
5.	Business Model (Revenue Model)	Traders analyzed demand and supply factors and take calculated positions.If the prediction comes true,traders clos their position to book profits way before expiry.
6.	Scalability of the Solution	The price forecasting is done by the means of the descriptive and predictive analytics.

3.4. PROBLEM SOLUTION FIT

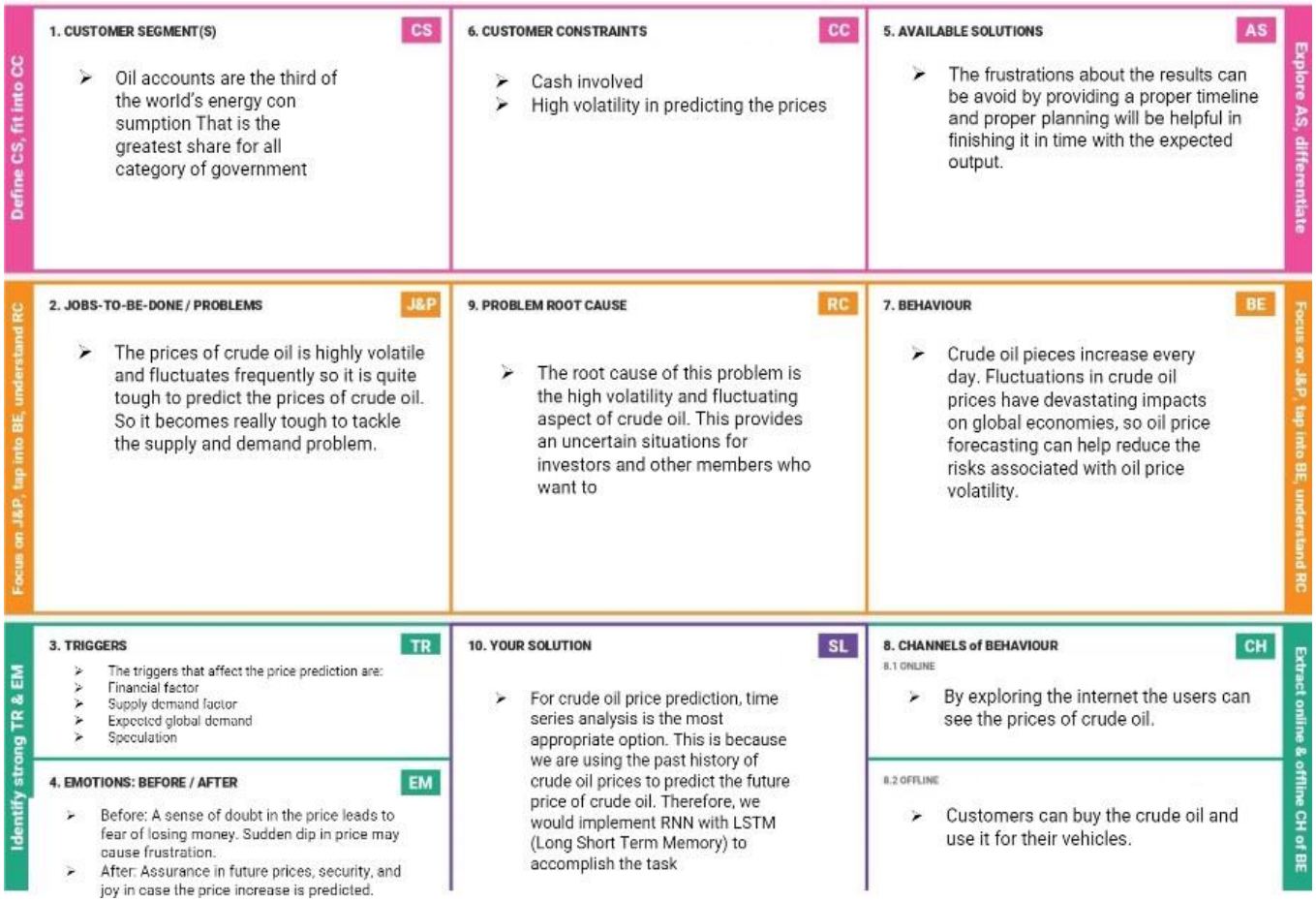


FIGURE 3.4

4. REQUIREMENT ANALYSIS

In software engineering, such requirements are often called functional specifications. Requirements analysis is important aspect of project. Requirements analysis involves frequent communication with system users to determine specific feature expectations, resolution of conflict or ambiguity in requirements as demanded by the various users or groups of users, avoidance of feature creep and documentation of all aspects of the project development process from start to finish. Energy should be directed towards ensuring that the final system or product conforms to client needs rather than attempting to mold user expectations to fit the requirements.

4.1. FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Linked IN.
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP.
FR-3	User login	Login through username and password.
FR-4	User Solution	Model creation using python with necessary libraries.
FR-5	Fetching input data	Give the input to the model.
FR-6	User Acknowledgement	Sending and receiving data will be made by using flask libraries.
FR-7	Additional datas	Read latest news. Check exchange rates.
FR-8	Database	Data are stored in a database.
FR-9	Result generating	Oil price will be displayed to the user.

4.2. NON-FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It can used by wide variety of client as it is very simple. Available in all mobile and laptop.
NFR-2	**Security**	User can't share the login id and password to the unknown person/third person.
NFR-3	**Reliability**	At the time of entry all user variable data will be committed to the database. Update the database within the particular time.
NFR-4	**Performance**	It will be perform fast and secure.
NFR-5	**Availability**	The system should always be accessible allowing for simple user access. Available for 24x7.
NFR-6	**Scalability**	Focus on the measurement of the system response time under various load levels.

5. PROJECT DESIGN

5.1. DATA FLOW DIAGRAMS

A two dimensional diagram explain show data is processed and transferred in a system. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram must identify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in. This type of diagram helps business development and design teams visualize how data is processed and identify or improve certain aspects.

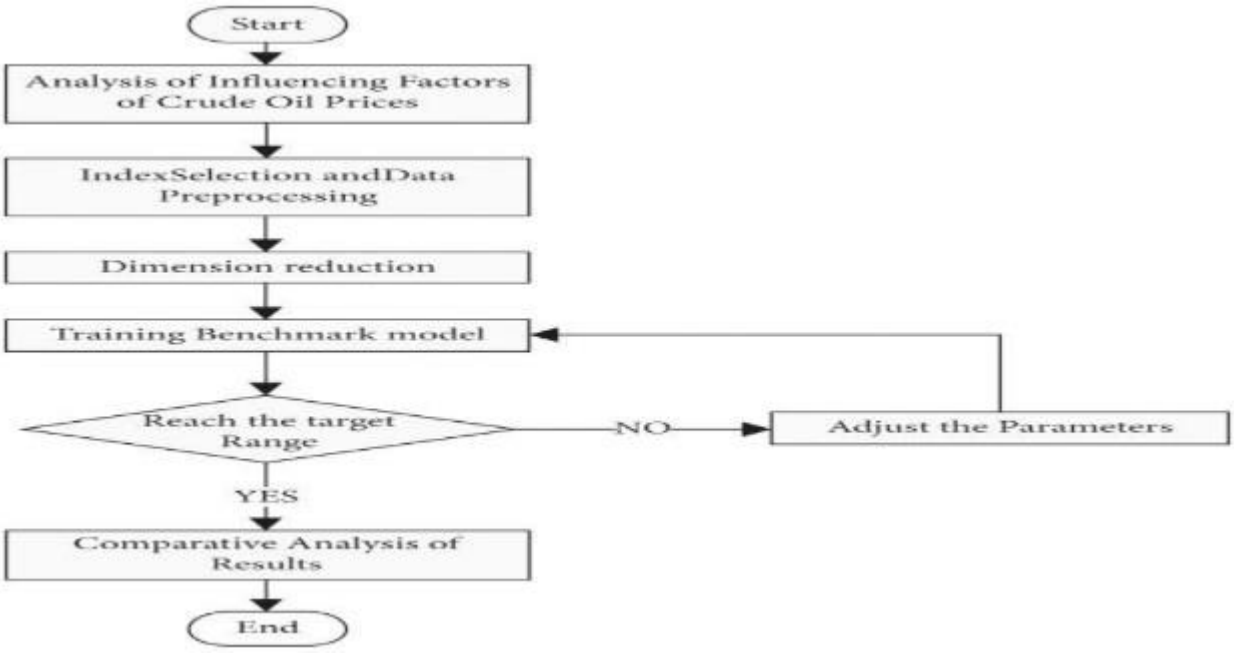
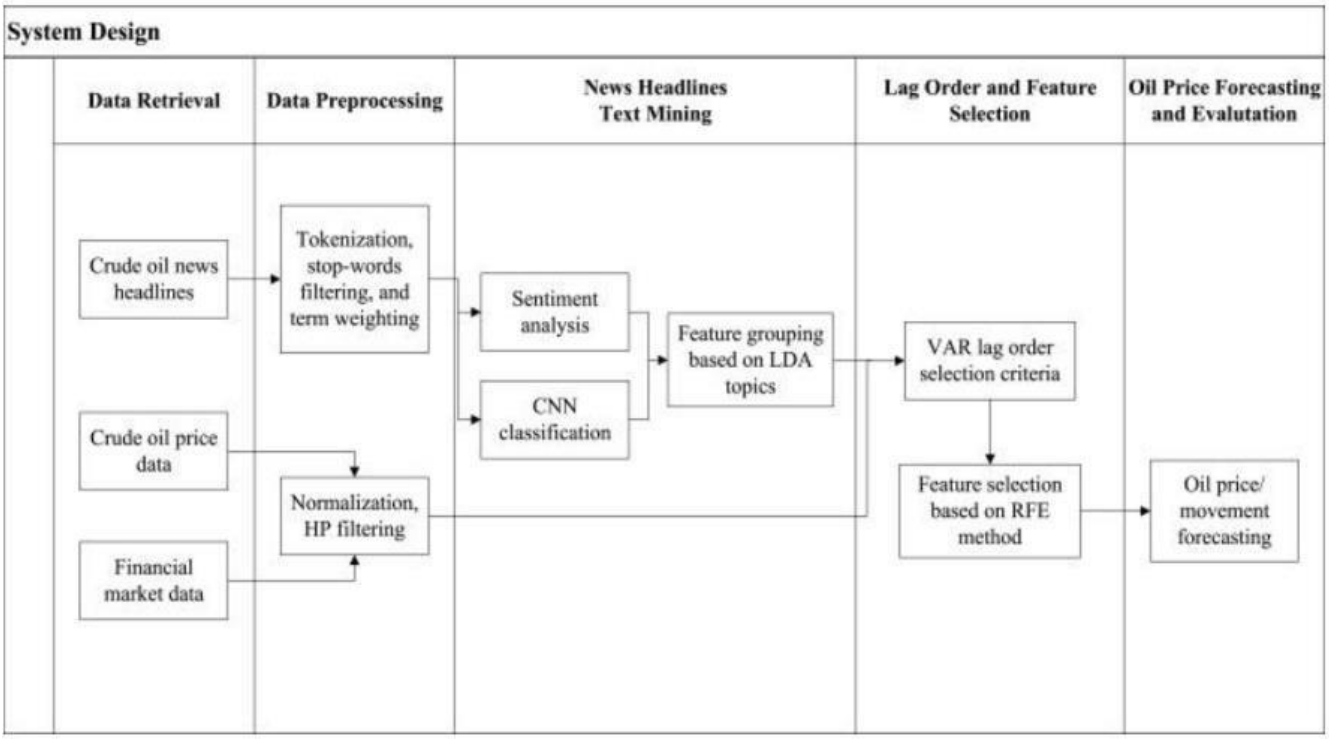


FIGURE 5.1

5.2 SOLUTION ARCHITECTURE

Solution architecture diagram should visualize above three critical elements in a way that is useful for both business stakeholders and developers. Based on the complexity of the deployment, a solution architecture diagram may actually be a set of diagrams documenting various levels of the architecture.

FIGURE 5.2.1



TECHNICAL ARCHITECTURE

Technical architecture aids in visualizing how various business, informational, and technological components interact to create a certain solution. Solution architecture diagram should represent the aforementioned three essential components in a form that is helpful to engineers as well as business stakeholders. A solution architecture diagram could actually be a collection of diagrams outlining different layers of the architecture, depending on how complicated the deployment is. The diagram makes it simple to understand how the data you gather about the environment relates to both the physical and logical decisions you make for your design.

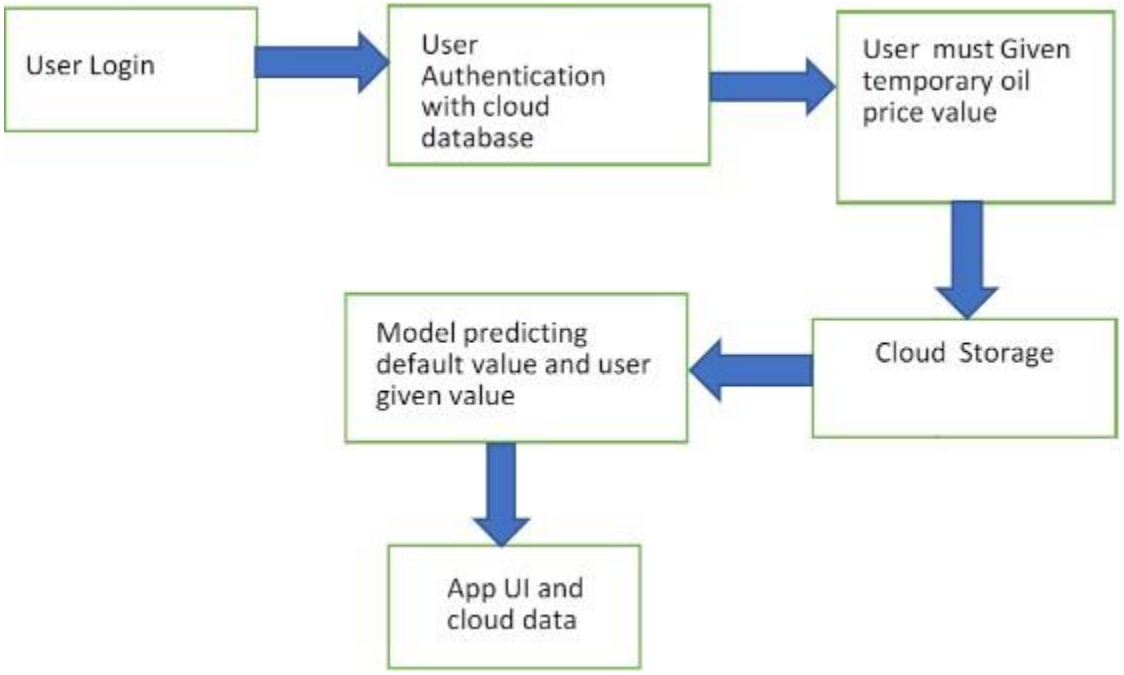


FIGURE 5.2.2

5.3 USER STORIES

A user story is the smallest unit of work in an agile framework. In an It's an end goal of the project architecture. A user story is an informal, general explanation of a software feature written for the end user or customer. The purpose of a user story is to articulate how a piece of work will deliver a particular value back to the customer. Note that "customers" don't have to be external end users in the traditional sense, they can also be internal customers or colleagues within your organization who depend on your team.

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 byentering my email, password, and confirming my password.	I can access my account /dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation emailonce I have registered for the application	I can receive confirmationemail & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the applicationthrough Facebook	I can register & access thedashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the applicationthrough Gmail	I can register through already logged in gmailaccount.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application byentering email & password	After registration user can login by through email and password.	High	Sprint-1
	Dashboard		After entering the input ,the model will displayprediction in graph or line 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 face book account.	Already created gmail canbe used for login.	Medium	Sprint-2
Customer Care Executive	Support		Customer care service will provide solutions for the any FAQ and also provide Chatbot.	I can solved the problems arised by support.	Low	Sprint-3
Administrator	Notification		Admin will be notify when the oil price change.	Notification will send to theuser gmail.	High	Sprint-4
	News		Admin will give the recent news of the oilprice.	Provide the recent oilprice.	High	Sprint-4
	Access Control		Admin can control the access of the users.	Access permission for users.	High	Sprint-4
	Database		Admin can store the details of the users.	Stores the user detail inthe database.	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

Planning - Planning is the process of determine the what supplies and resources will be needed to meet incoming and anticipated demand. This stage is essential to making sure you have the necessary supplies and resource capacity on hand to fulfill your orders on time. This element relates to the "what" and "how" of every project: precisely what must be performed and how it will be done.

Scheduling - The time of the utilization of specific organizational resources is determined by scheduling. In manufacturing, scheduling entails creating schedules for personnel, machinery, and supplies. By allocating the proper resources to finish the production plan within a certain time frame, it addresses the "when" of a project. Your facility will be able to cut expenses, boost productivity, and deliver goods on time if you create efficient production schedules. It is crucial to have a production plan that is in line with the resource and material scheduling process in order to develop precise and realistic production plans that enable manufacturers to respond swiftly to changes. The bigger the divergence, the larger the cost.

6.1 SPRINT PLANNING AND ESTIMATION

Planning:

In Sprint Planning, the team decides what it will build in the upcoming Sprint and how they will build it. The time period for the sprint is about 10 days.

Estimation:

The Estimation is done by the entire team during Sprint Planning Meeting.The objective of the Estimation would be to consider the User Stories for the Sprint by Priority and by the Ability of the team to deliver during the Time Box of the Sprint.

ensures that the prioritized User Stories are clear, can be subjected to estimat on, and they are brought to the beginning of the Product Backlog. As the Scrum Team in total is responsible for the delivery of the product increment, care would be taken to select the User Stories for the Sprint based on the size of the Product Increment and the effort required for the same. The size of the Product Increment is estimated in terms of User Story Points. Once the size is determined, the effort is estimated by means of the past data, i.e., effort per User Story Point called Productivity.

SPRINT	FUNCTIONAL REQUIREMENT	USER STORY	USER STORY / TASK	STORY POINTS	PRIORITY	MEMBERS
1	Registration	1	Register for the Application	2	High	2
2	Confirmation	2	Receiving Confirmation Mail	1	Medium	2
2	Login	3	Log in into the application	2	High	2
1	Enquiry	4	Enter the range of dates	2	Medium	2
1	Visualize	5	Visualize the Trend	2	High	2
1	Endowment	6	See the result	2	High	2
2	Utilization	7	Log Out	1	Medium	2

6.2 SPRINT DELIVERY SCHEDULE

Since sprints take place over a fixed period of time, it’s critical to avoid wasting time during planning and development. And this is precisely where sprint scheduling enters the equation. In case you’re unfamiliar, a sprint schedule is a document that outlines sprint planning from end to end. It’s one of the first steps in the agile sprint planning process-and something that requires adequate research, planning, and communication. Teams often run into trouble when they create more than few schedules. This can create conflict and derail projects midway through their cycles. To ensure things stay on track, one schedule makes sense.

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed	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	20	03 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	10 Oct 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	17 Oct 2022

6.3 Reports from JIRA

The Daily Scrum the Development Team updates the Sprint Burn Down and plots the remaining work of the day.

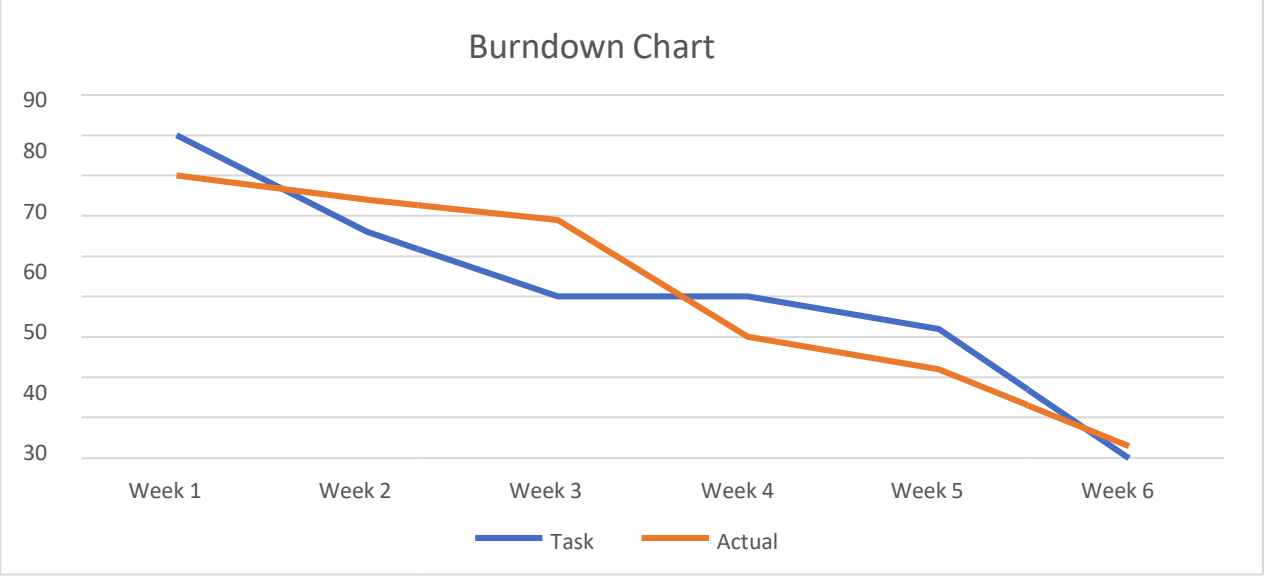


FIGURE 6.3

7. CODING AND SOLUTIONING

7.1 Feature 1

app.py

```
import numpy as np

from flask import Flask,render_template,request

from tensorflow.keras.models import load_model

app=Flask(_name_)

model=load_model('crude.h5',)

@app.route('/')

def home():

 return render_template("index.html")

@app.route('/about')

def home1():

 return render_template("index.html")

@app.route('/predict')

def home2():

return render_template("web.html", showcase="")

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

def login():

x_input=[]

for i in request.form:
```

```
x_input.append(float(request.form[i]))
    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
    return render_template("web.html",showcase='Next Day Predicted Price
Is:'+str(lst_output[0][0]))
if _name=='main_':
app.run(debug=True,port=5000)
```

Output:

```
(base) C:\Users\navee>cd C:\Users\navee\OneDrive\Desktop\ibm\Flask
(base) C:\Users\navee\OneDrive\Desktop\ibm\Flask>python app.py
Debugger is active!
Debugger PIN: 342-672-433
Running on http://127.0.0.1:5000/
```

7.2 Feature 2

index.html

```
<html>
<head>
<title>Home</title>
 <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
<style>
body
{
background-image:url("https://etimg.etb2bimg.com/photo/94227420.cms");
background-position: center;
font-family:Times-new roman;
background-size:cover;
margin-top:40px;
}
.pd{
padding-bottom:100%;}
.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:right;

}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
```

```
}
p
{
color:turqouise;
font-style:italic;
font-size:30px;
text-align: left;
padding-left: 500px;
text-align: justify;
}
</style>
</head>
<body>
<div class="navbar">
<a href="/predict" >Predict</a>
<a href="/">Home</a>
<br>
</div>
<br>
<center><b class="pd"><font color="200FF3" size="15" font-family="Comic Sans MS" >Crude Oil Price Prediction</font></b></center><br><br>
</body>
</html>
```

Output:

FIGURE 7.2.1

Web.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;
font-size:30px;
padding:10px;
}

body
{
background-image:url('https://wallpapercave.com/wp/wp9553498.jpg');
```

```
  background-position: center;
  font-family:sans-serif;
  background-size:cover;
  margin-top:40px;
  }

  .main input[type="text"],.main input[type="text"],.main input[type="text"],.main input[type="text"],.main
input[type="text"],.main input[type="text"],.main input[type="text"]{
      border:0;
      background:none;
      display:block;
      margin:20px auto;
      text-align:center;
      border:2px solid white;
      padding:15px 3px;
      width:400px;
      outline:none;
      color:white;
      border-radius:100px;
      transition:0.25s;
      font-size:20;

  }
  .bor{
  border:0;
      background:none;
      display:block;
      margin:20px auto;
      text-align:center;
      border:2px solid white;
      padding:10px 3px;
      width:500px;
      outline:none;
      color:black;
      transition:0.25s;
  }
  .main input[type="text"]:focus,.main input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus,.main input[type="text"]:focus,.main input[type="text"]:focus,.main
input[type="text"]:focus{
      width:280px;
      border-color:black;
  }
  .logbtn{
      display:block;
      width:35%;
      height:50px;
      border:none;
      border-radius:24px;
      background:linear-gradient(120deg,#3498db,#8e44ad,#3498db,#8e44ad);
      background-size:200%;
```

```
    color:black;
    outline:none;
    cursor:pointer;
    transition:.5s;
    font-size:25;
  }


  input::placeholder{
    color:white;
  }
  .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="Powderblue" 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>
      <font size=20><input type="text" name="year1" placeholder="Enter previous 10th day price"/></font>
      <font size=20><input type="text" name="year2" placeholder="Enter previous 9th day price"/></font>
      <font size=20><input type="text" name="year3" placeholder="Enter previous 8th day price"/></font>
      <font size=20><input type="text" name="year4" placeholder="Enter previous 7th day price"/></font>
      <font size=20><input type="text" name="year5" placeholder="Enter previous 6th day price"/></font>
      <font size=20><input type="text" name="year6" placeholder="Enter previous 5th day price"/></font>
      <font size=20><input type="text" name="year7" placeholder="Enter previous 4th day price"/></font>
      <font size=20><input type="text" name="year8" placeholder="Enter previous 3th day price"/></font>
      <font size=20><input type="text" name="year9" placeholder="Enter previous 2nd day price"/></font>
      <font size=20><input type="text" name="year10"placeholder="Enter previous 1st day price"/></font>
      <center><input type="submit" class="logbtn" value="Predict"></center>
      <div class="bor"><b><font color="white" size=5>Next Day Price</font></b></div>
    </form>
  </div>
  </body>

  </html>
```

Output:

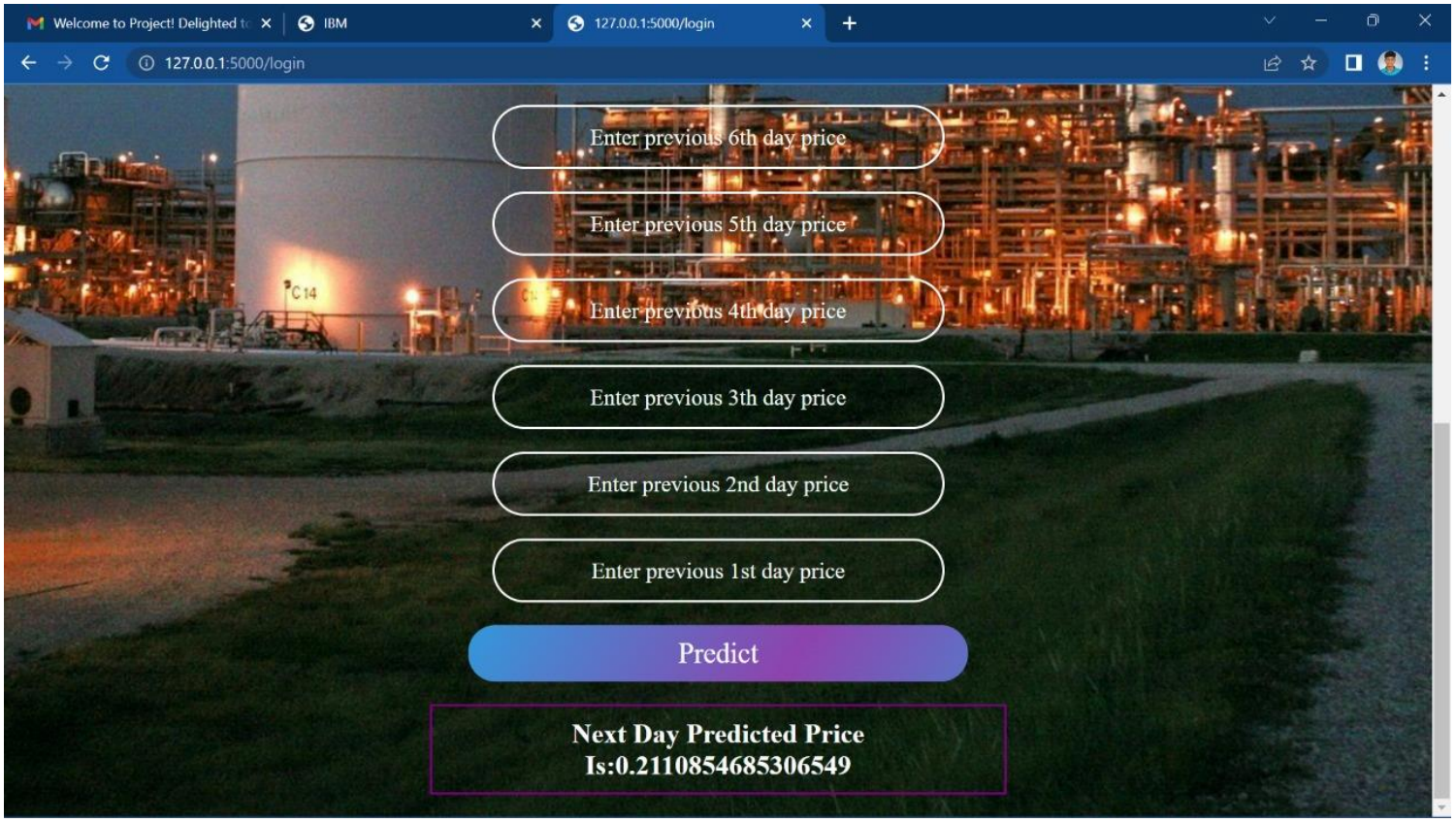


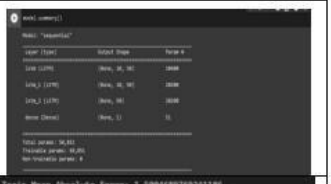
FIGURE 7.2.2

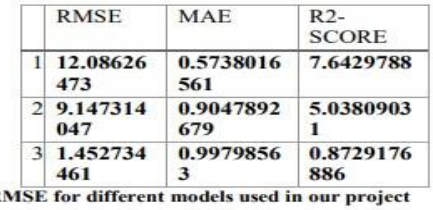
8. TESTING

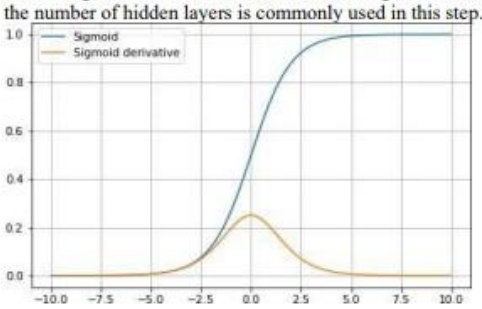
8.1 TEST CASES

A test case is a set of actions performed on a system to determine if it satisfies software requirements and functions correctly. Test case designing includes preconditions, case name, input conditions, and expected result. A test case is a first level action and derived from test scenarios.

MODEL PERFORMANCE

S.No.	Parameter	Values	Screenshot
1.	Model Summary	-	
2.	Accuracy	Training Accuracy - 2.03291747578067 Validation Accuracy - 2.9096238300262343	

S.No.	Parameter	Values	Screenshot
1.	Metrics	**Regression Model:** MAE - , MSE - , RMSE - , R2 score **Classification Model:** Confusion Matrix - , Accuracy Score- & Classification Report -	 **RMSE for different models used in our project** Linear Regression : 19.3533662859143 Decision Tree Regression : 9.14731404717267 Random Forest Regression : 1.45273446145987 **R2 Score for different models used in our project :** Linear Regression : 0.57380165610804 Decision Tree Regression : 0.90478926790260 Random Forest Regression : 0.997598562970117 ***Calculate RMSE performance metrics*** *Accuracy :* **29.367830543269938**
2.	Tune the Model	Hyper parameter Tuning Validation Method -	**Hyper parameter tuning** In the case of over fitting, some inclusion of regularization and further hyper parameter tuningfor the training process must be considered. A good model should be based on a compromise between capturing the essential patterns in the data without

			over fitting to the training data. This can be achieved with regularization parameters such as L1 and L2 in for example Lasso,Ridge and Elastic Net regression . Inclusion of the dropout strategy for regularization to prevent over fitting will be discussed further in chapter 3.5 about Recurrent Neural Networks. The dropout method is also a common technique used for fully connected dense networks. Other possibilities like adjusting learning rate, increasing or decreasing the number of nodes, and increasing or decreasing the number of hidden layers is commonly used in this step. 

8.2 USER ACCEPTANCE TESTING

User Acceptance Testing also known as beta or end-user testing, is defined as testing the software by the user to determine whether it can be accepted or not. This is the final testing performed once the functional, system and regression testing are completed. The main purpose of this testing is to validate the software against the business requirements. This validation is carried out by the end-users who are familiar with the business requirements. UAT,alpha and beta testing are different types of acceptance testing. As the user acceptance test is thelast testing that is carried out before the software goes live, obviously this is the last chance for the customer to test the software and measure if it is fit for the purpose. Need for user acceptance testing arises once software has undergone Unit, Integration and System testing because developers might have built software based on requirements document by their own understanding and further required changes during development may not be effectively communicated to them, so for testing whether the final product is accepted by client/end-user, user acceptance testing is needed.

- Developers code software based on requirements document which is their “own” understanding of the requirements and may not actually be what the client needs from the software. •
- Requirements changes during the course of the project may not be communicated effectively to the developers.

Defect Analysis

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	3	2	19
Duplicate	1	0	2	0	3
External	2	2	0	1	5
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	1	0	0	1
Won't Fix	1	5	0	0	6
Totals	25	14	10	23	72

Test Case Analysis

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	1	1	5
Client Application	51	0	1	50
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

9.1 PERFORMANCE METRICS

Performance metrics are defined as figures and data representative of an organization's actions, abilities, and overall quality. There are many different forms of performance metrics, including sales, profit, return on investment, customer happiness, customer reviews, personal reviews, overall quality, and reputation in a marketplace. Performance metrics can vary considerably when viewed through different industries. Performance metrics are integral to an organization's success. It's important that organizations select their chief performance metrics and focus on these areas because these metrics help guide and gauge an organization's success. Key success factors are only useful if they are acknowledged and tracked.

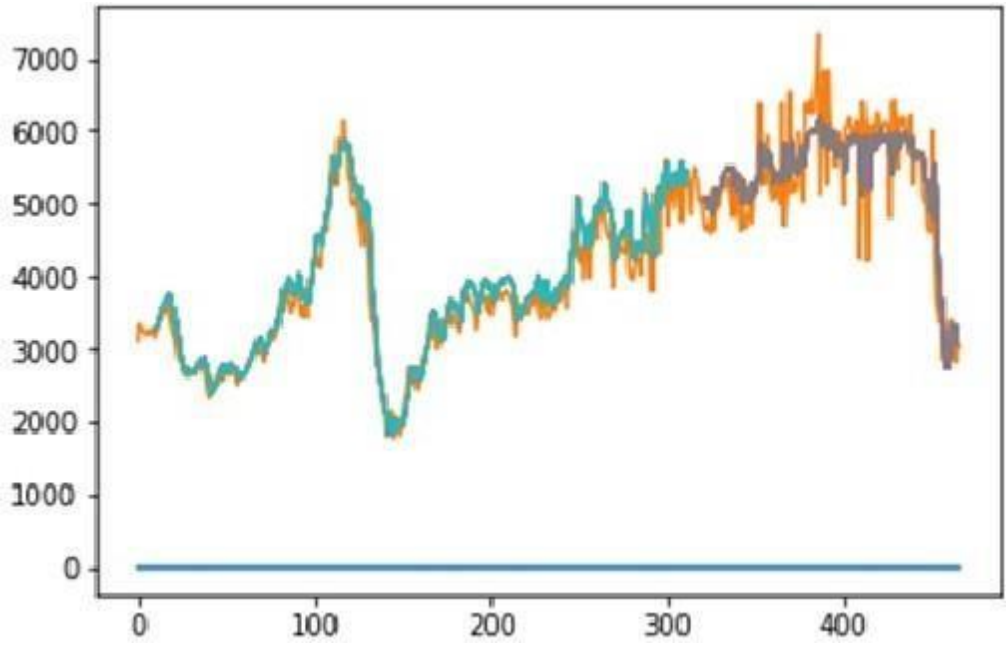


FIGURE 9.1

10. ADVANTAGES AND DISADVANTAGES

Advantages

- 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.
- It will help the government to fix the price of the gasoline of day after.
- This method will help as to predict the price of the crude oil without the man power.
- In this method, it helps the people too.
- The people will know the economy of our country.

Disadvantages

- Much of our oil has to be imported and it is becoming more and more expensive as reserves reduce and imports increase.
- Producing electricity from crude oil is expensive compared to other fossil fuels such as coal or gas.

11. CONCLUSION

In this project, we have presented a system to predict the prices of crude oil. We propose a contemporary and innovative method of predicting crude oil prices using the Artificial Intelligence (AI). The main advantage of this approach of AI is that it continuously captures the unstable pattern of the crude oil prices. The volatility of crude oil market and its chain effects to the world economy augmented the interest and fear of individuals, public and private sectors. The crude oil price has a huge impact on the world's economy. From the past few years, crude oil price fluctuates more than any other commodities prices. As the crude oil price depends on several external factors and there is high volatility predicting crude oil prices is very challenging. Long Short-Term Memory (LSTM) based on a recurrent neural network has shown better results in predicting prices that have high volatility. By utilizing this model, the significant crude oil price is evaluated and modeled.

12. FUTURE SCOPE

This further research is implementing the proposed algorithm with the existing public datasets. Also, various prediction algorithms can be implemented to improve accuracy. 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

SOURCE CODE

GitHub : https://github.com/IBM-EPBL/IBM-Project-2939-1658487342

Project Demo Link: https://youtu.be/96NFFiO9Sz0