as

CRUDE OIL PRICE PREDICTION

IBM-Project-17865-1659676801

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PROJECT REPORT

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Table of Contents

Chapter 1: INTRODUCTION

1.1 Project Overview

Crude oil, which can be separated into several kinds of consumer fuels, is a naturally occurring yellow-black liquid that is found in geological formations beneath the surface of the Earth. Currently, one of the most significant sources of energy on the world is crude oil. It continues to be the most significant fuel in the world today, accounting for around one-third of all energy used worldwide. Petroleum products are also made from refined crude oil. The promotion of fossil fuel consumption is losing favour because it is clear that these fuels cause global warming and other detrimental consequences on ecosystems. The globe is working cooperatively to phase out fossil fuels in an effort to address the climate catastrophe. The globe is working cooperatively to phase out fossil fuels in an effort to address the climate catastrophe. Petroleum is essential to both industry and everyday life, and as it supplies a large amount of the world's energy needs, it plays a vital role in world politics and international relations. According to current estimates, up to 95 million barrels of oil are consumed globally each day. The forecasting utilised for crude oil price prediction is important for both large and small businesses, as well as the government, who benefits from the projected prices, but it is highly challenging to obtain precision because to the evaporative nature of oil.

1.2 Purpose

We propose a cutting-edge and ground-breaking approach for predicting crude oil prices using machine learning algorithms

CHAPTER 2 : LITERATURE SURVEY

2.1 Refrences

1. R. K. Kaufmann and B. Ullman (2009). Interpreting causal relationships between spot and futures prices in the context of oil prices, speculation, and fundamentals. Energy Economics, 31(4), 550–558.

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4. Shuang Gao and Yalin Lei, "A new approach for crude oil price prediction using stream learning," Geoscience Frontiers, 2017.

5. Ramakanta Mohanty, Lecture Notes in Computer Science, 2009. "Software Reliability Prediction Using Group Method of Data Handling."

6. Kulkarni and I. Haidar, 2009. Using artificial neural networks and commodity future prices, a crude oil price forecasting model is developed. International Journal of Computer Science and Engineering and Information Security.

7. S. Haykin (1999). Prentice Hall, 2nd edition, Neural Networks: A Comprehensive Foundation.

8. Dursun, Onur. Walter de Gruyter GmbH, "3 Methodology," 2014.

9. Lakshmanan, Indhurani, and Subburaj Ramasamy are nine "A Software Approach Based on Artificial Neural Networks Modeling Reliability and Growth "2015, Procedia Computer Science

10. S. Haykin (2009). Pearson, 3rd edition, Neural Networks and Learning Machines

2.2 Problem Statement Definition

Forecasting the price of crude oil has long been a heated topic. People use a range of methods, as well as their intuition, to estimate crude oil prices. You need to know a lot about crude oil in order to predict it with any degree of accuracy. For countries that export crude oil as well as those that import it, being able to predict the price of crude oil is essential in a range of economic, political, and industrial circumstances.

Considering that it is the most important strategic resource on the planet, crude oil has developed into a crucial part of the global economy. Since predicting crude oil prices is so challenging, it has long attracted the attention of professionals, academics, and organisations all around the world.

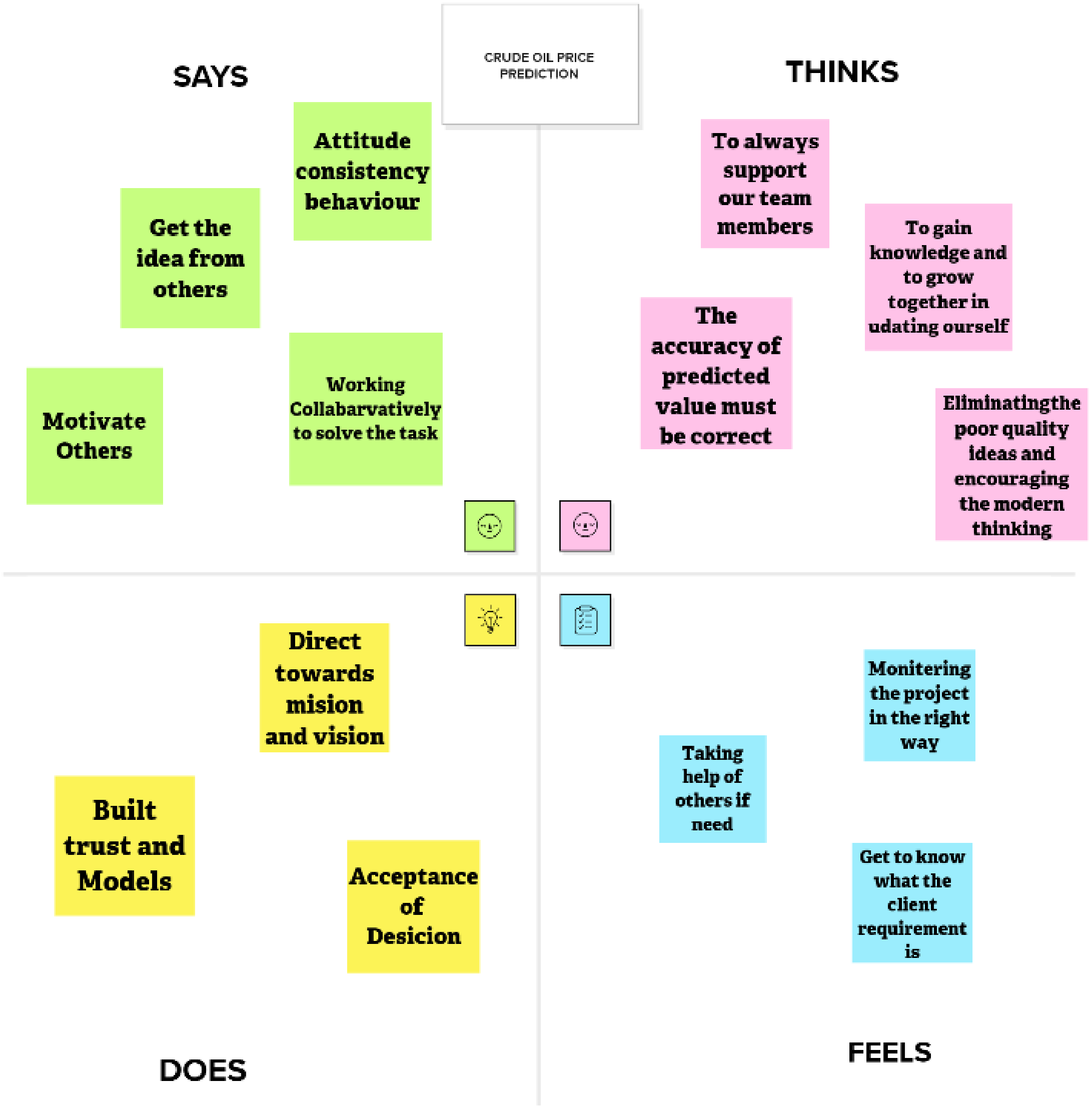
Crude oil's volatility is also a significant factor. Furthermore, the volatility of crude oil has a considerable impact on the macroeconomic indicators of inflation, unemployment, exchange rates, and economic growth of countries whose economy heavily rely on the export or import of crude oil. On the global environment, our economy, and the discovery, development, and use of oil, among other things. Oil price forecasting has become essential; it benefits numerous big and small businesses, people, and the government. Crude oil's evaporative properties make price prediction highly challenging and challenging to be precise with. Crude oil prices are influenced by numerous factors. We suggest a cutting-edge and original approach to utilise artificial intelligence to forecast crude oil prices. There are a variety of techniques and strategies for forecasting crude oil prices, one of which is intuition. In intuition, the expertise, experience, and opinions of those who have worked in the sector for a long time are utilised to forecast future prices. Many economists and analysts use data transformation and regression models, such as autoregressive moving average (ARMA) models and vector autoregressive (VAR) models with a different value for the input each time, to forecast crude oil prices. They then plot the graph with their predicted prices while taking the main economic factors into consideration. Crude oil forecasting is a crucial subject in financial and economic studies. Forecasting crude oil prices has been the subject of numerous research. After running a number of studies, Moshiri and Foroutan came to the conclusion that future price time series are stochastic and non-linear in 2005. They found that ANN performed better for forecasting crude oil prices than the ARMA and GARCH methods. A model developed by Kulkarni and Haidar uses a multilayered feedforward neural network to predict the direction of the spot price of crude oil up to three days in advance. They looked into the connection between spot pricing and crude oil futures. They found proof that future crude oil prices will reveal fresh data on spotting oil spot prices.

Therefore, projecting the price of crude oil can help governments all over the world create economic strategies and make quick judgments that will safeguard them from any threats to these economic parameters. Predicting crude oil prices is therefore quite useful, and that is what this research aims to do.

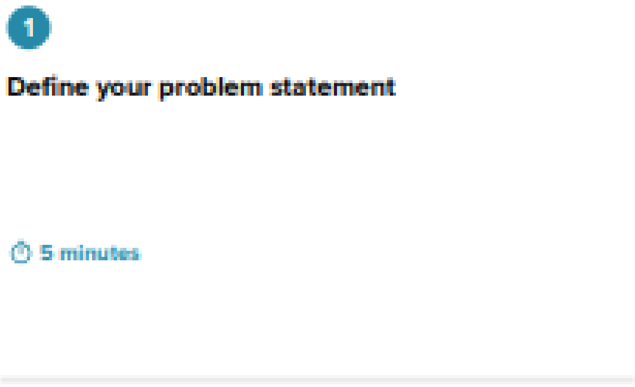
Chapter 3: IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.


CRUDE OIL PRICE PREDICTION
SAYS
Attitude consistency behaviour
Get the idea from others
Motivate Others
Working Collabarvatively to solve the task
THINKS
To always support our team members
To gain knowledge and to grow together in udating ourself
The accuracy of predicted value must be correct
Eliminatingthe poor quality ideas and encouraging the modern thinking
Direct towards mision and vision
Built trust and Models
Acceptance of Desicion
DOES
Monitering the project in the right way
Taking help of others if need
Get to know what the client requirement is
FEELS

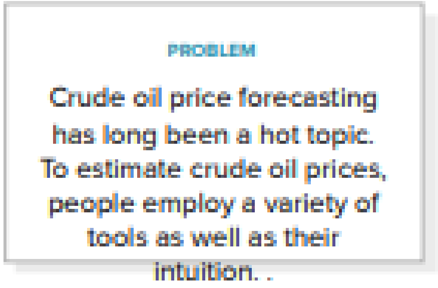
3.2 Ideation & Brainstorming



1

Define your problem statement

5 minutes



PROBLEM

Crude oil price forecasting has long been a hot topic. To estimate crude oil prices, people employ a variety of tools as well as their intuition. .

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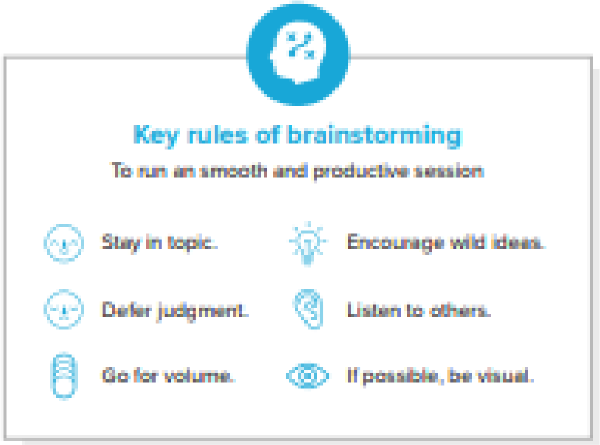


Key rules of brainstorming

To run an smooth and productive session

Stay in topic.

Encourage wild ideas.

Defer judgment.

Listen to others.

Go for volume.

If possible, be visual.

2

Brainstorm

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

10 minutes

1.Day to day updates
2. Instant notifcations
3. Avoid unwanted content
4. Accurate price prediction
5. Display price graph
6. Shows the percentage increase or decrease.
7.Used to show prediction accuracy
8. Price will be dispalyed in differnt currencies
9. Used to show prediction accuracy
10. Shows average prices
11. Different categories available
12. Tells about sudden rise or fall
13. Easy to use for a beginner
14. Voice assistant for help
15. Every one can easily access
16. Attract the users with realiability.

Sarvesh SM

2 7 12 15

Roshan M

3 4 10 16

Sachit R

1 5 8 11

Salman latheef T A

6 9 13 14

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

UI (User Interface)

6 7 10 11

Feasiblity

1 2 3

Effenciency

4 9 8

Responsive

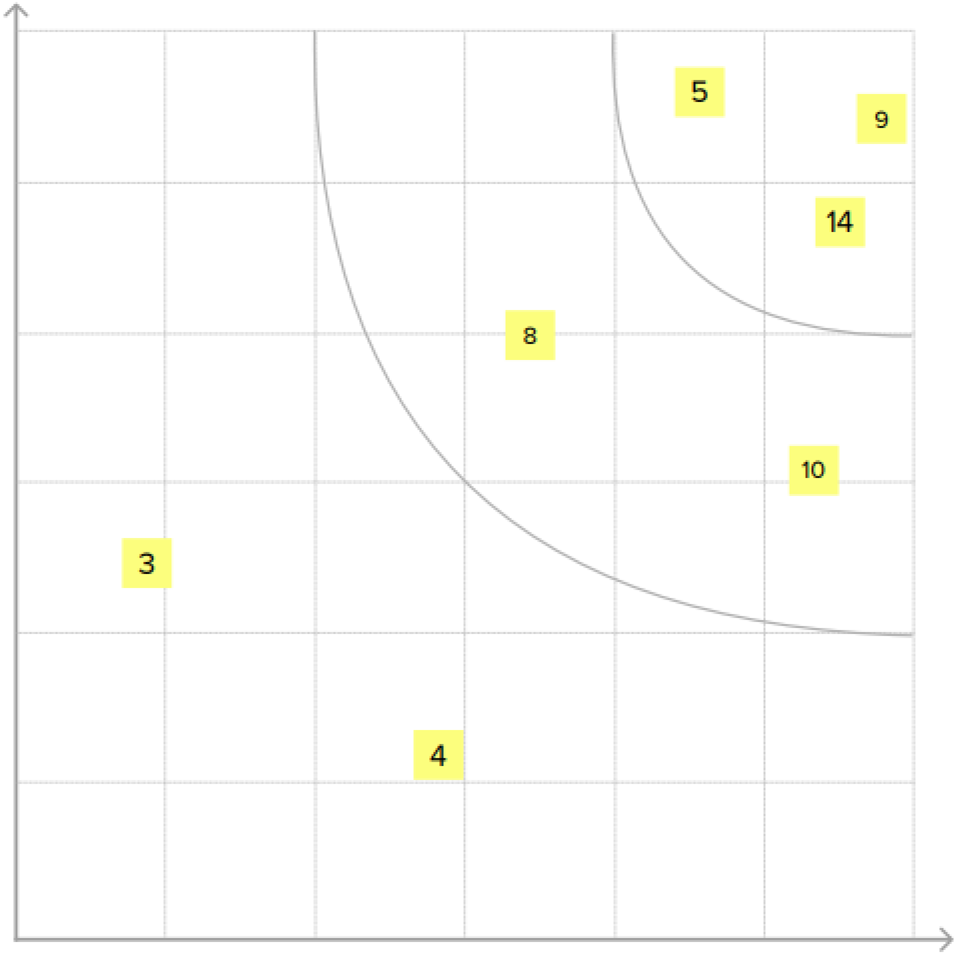
5 12 14

4

Prioritize

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

⏱ 20 minutes



Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Feasibility

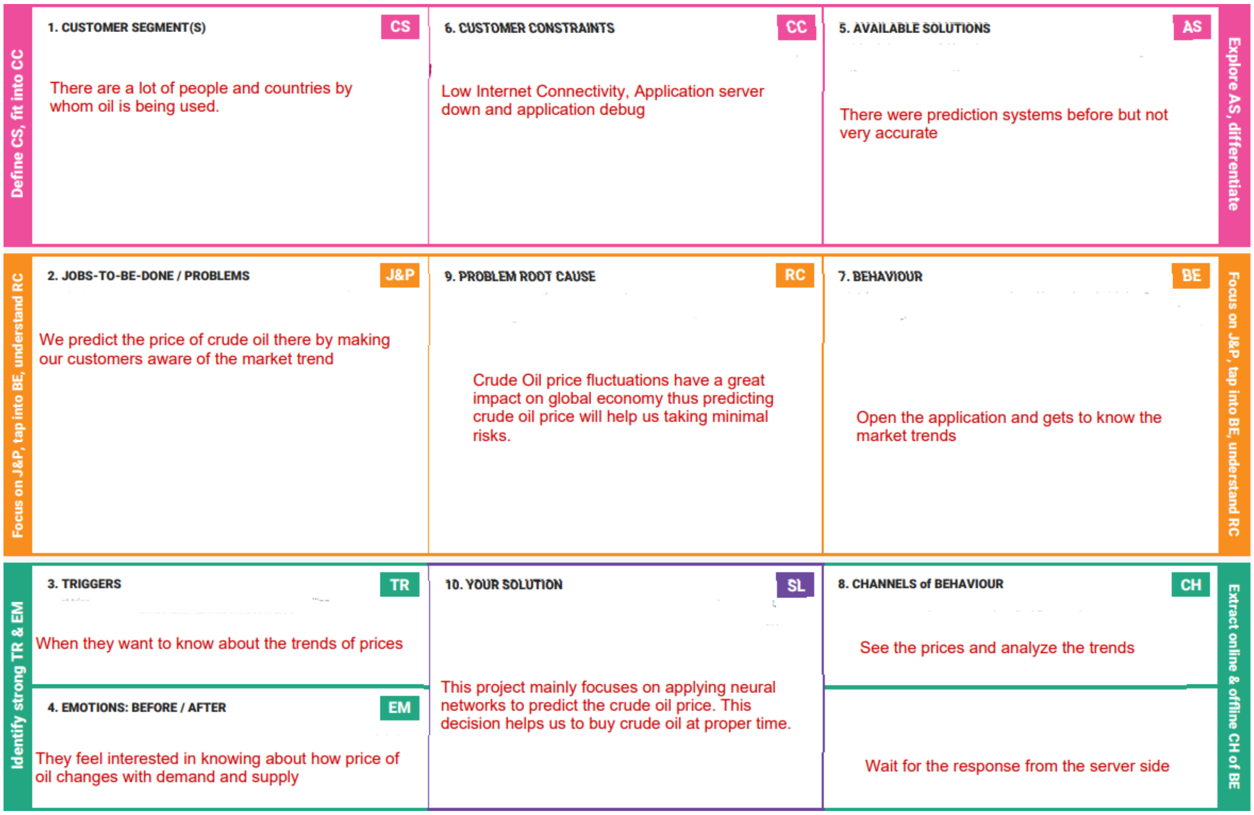
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 Proposed Solution

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)	As with the erratic changes in supply and demand and also the influence of geopolitics, it is very hard to predict the value of crude oil prices in the global market.
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 a better 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 in the 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



Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

There are a lot of people and countries by whom oil is being used.

6. CUSTOMER CONSTRAINTS CC

Low Internet Connectivity, Application server down and application debug

5. AVAILABLE SOLUTIONS AS

There were prediction systems before but not very accurate

Explore AS, differentiate

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

2. JOBS-TO-BE-DONE / PROBLEMS J&P

We predict the price of crude oil there by making our customers aware of the market trend

9. PROBLEM ROOT CAUSE RC

Crude Oil price fluctuations have a great impact on global economy thus predicting crude oil price will help us taking minimal risks.

7. BEHAVIOUR BE

Open the application and gets to know the market trends

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

Identify strong TR & EM

3. TRIGGERS TR

When they want to know about the trends of prices

4. EMOTIONS: BEFORE / AFTER EM

They feel interested in knowing about how price of oil changes with demand and supply

10. YOUR SOLUTION SL

This project mainly focuses on applying neural networks to predict the crude oil price. This decision helps us to buy crude oil at proper time.

8. CHANNELS of BEHAVIOUR CH

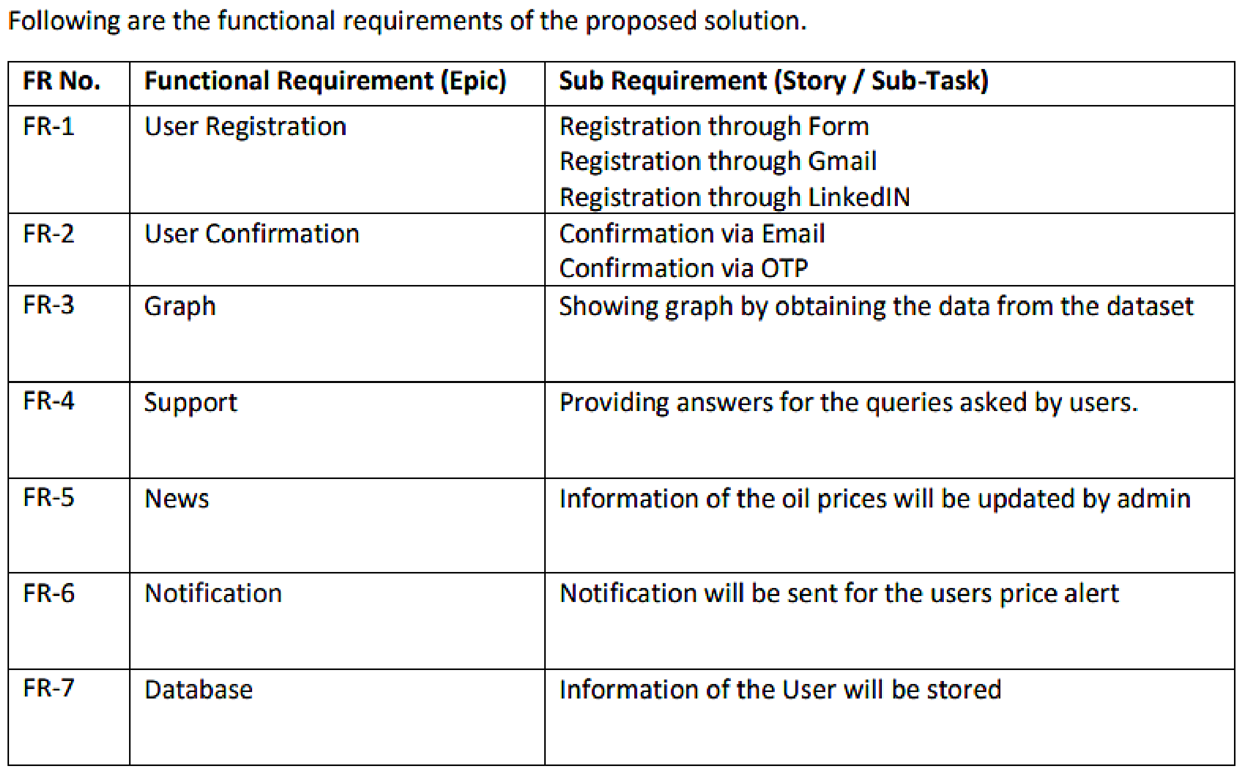
See the prices and analyze the trends

Wait for the response from the server side

Extract online & offline CH of BE

Chapter 4: REQUIREMENT ANALYSIS

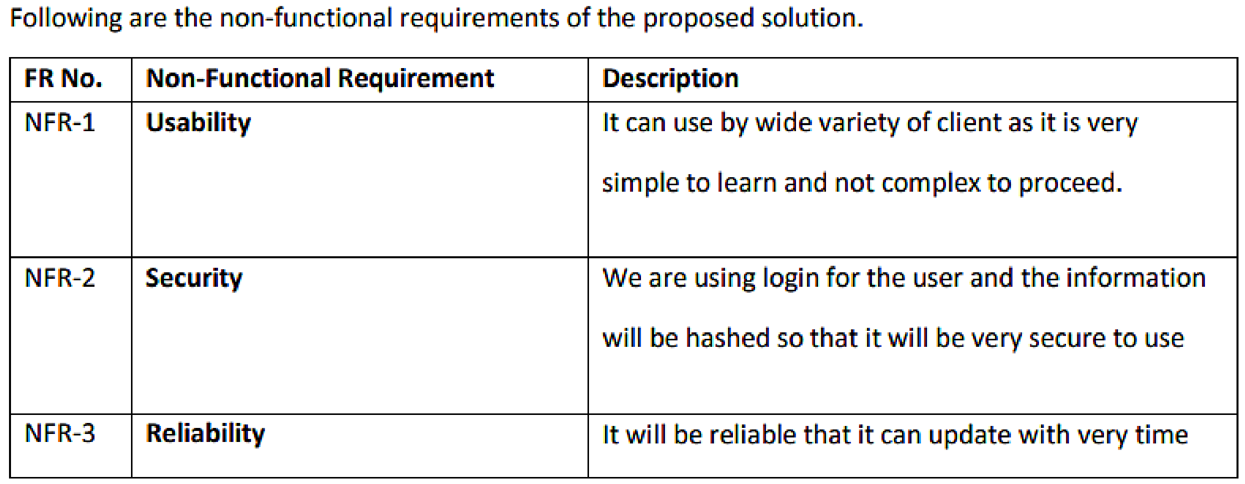
4.1 Functional requirement



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 obtaining the data from the dataset
FR-4	Support	Providing answers for the queries asked by users.
FR-5	News	Information of the oil prices will be updated by admin
FR-6	Notification	Notification will be sent for the users price alert
FR-7	Database	Information of the User will be stored

4.2 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 wide variety of client as it is very simple to learn and not complex to proceed.
NFR-2	**Security**	We are using login for the user and the information will be hashed so that it will be very secure to use
NFR-3	**Reliability**	It will be reliable that it can update with very time

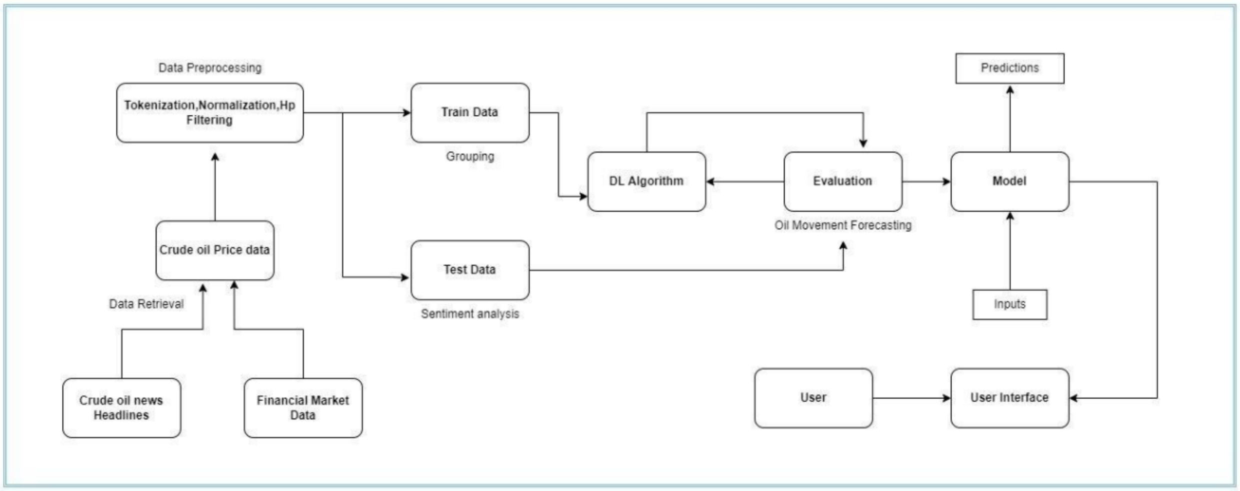
		period so that the accuracy will be good.
NFR-4	**Performance**	It will be perform fast and secure even at the lower bandwidth.
NFR-5	**Availability**	Prediction will be available for every user but only for premium user news,database and price alert will be alert.
NFR-6	**Scalability**	It is scalable that we are going to use data in kb so that the quite amount of storage is satisfied.

Chapter 5: PROJECT DESIGN

5.1 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



5.2 Technical Architecture & Stack

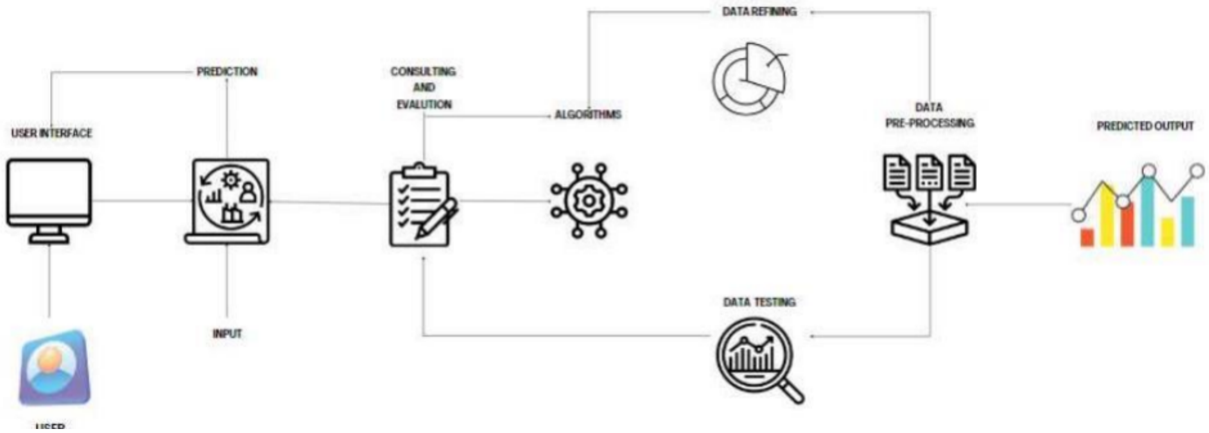
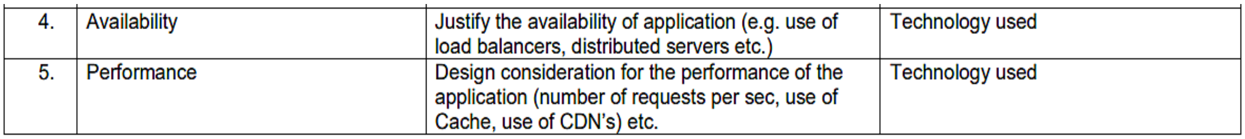


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g. Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.



4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

Table-2: Application Characteristics:

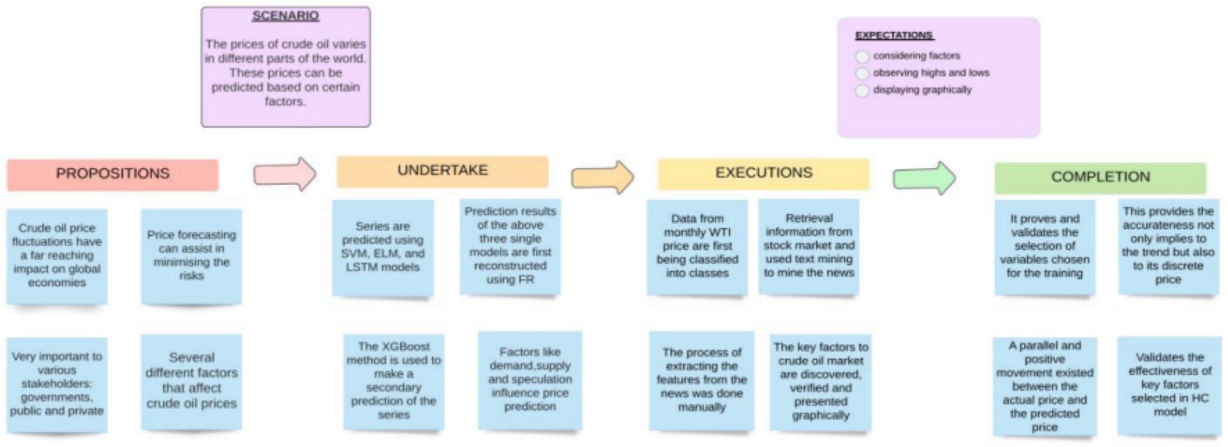
S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register through already logged in gmail account.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	After registration,I can log in 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 (Web user)	Login	USN-1	As the web user,I can login simply by using Gmail or Facebook account.	Already created gmail can be used for Login.	Medium	Sprint-2
Customer Care Executive	Support		The Customer care service will provide solutions for any FAQ and also provide ChatBot.	I can solve the problems arised by Support.	Low	Sprint-4

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
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

5.4 Customer Journey



SCENARIO

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

EXPECTATIONS

○ considering factors
○ observing highs and lows
○ displaying graphically

PROPOSITIONS

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

Price forecasting can assist in minimising the risks

Very important to various stakeholders: governments, public and private

Several different factors that affect crude oil prices

UNDERTAKE

Series are predicted using SVM, ELM, and LSTM models

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

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

Factors like demand,supply and speculation influence price prediction

EXECUTIONS

Data from monthly WTI price are first being classified into classes

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

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

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

COMPLETION

It proves and validates the selection of variables chosen for the training

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

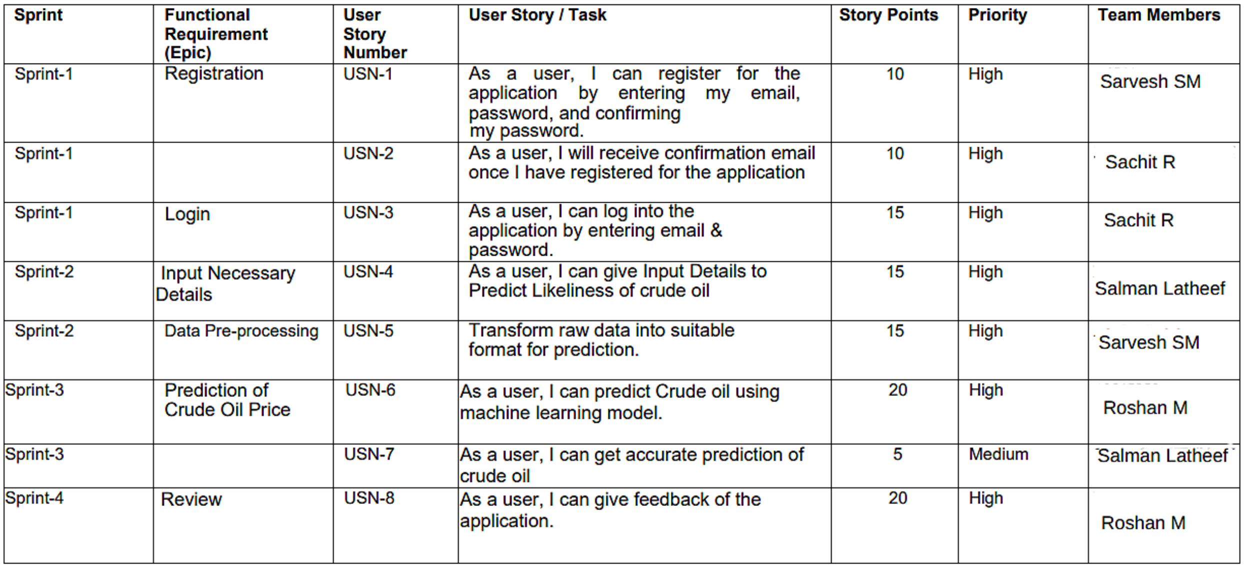
A parallel and positive movement existed between the actual price and the predicted price

Validates the effectiveness of key factors selected in HC model

Chapter 6: PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation



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	Sarvesh SM
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	10	High	Sachit R
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password.	15	High	Sachit R
Sprint-2	Input Necessary Details	USN-4	As a user, I can give Input Details to Predict Likeliness of crude oil	15	High	Salman Latheef
Sprint-2	Data Pre-processing	USN-5	Transform raw data into suitable format for prediction.	15	High	Sarvesh SM
Sprint-3	Prediction of Crude Oil Price	USN-6	As a user, I can predict Crude oil using machine learning model.	20	High	Roshan M
Sprint-3		USN-7	As a user, I can get accurate prediction of crude oil	5	Medium	Salman Latheef
Sprint-4	Review	USN-8	As a user, I can give feedback of the application.	20	High	Roshan M

6.2 Project Tracker, Velocity & Burndown Chart

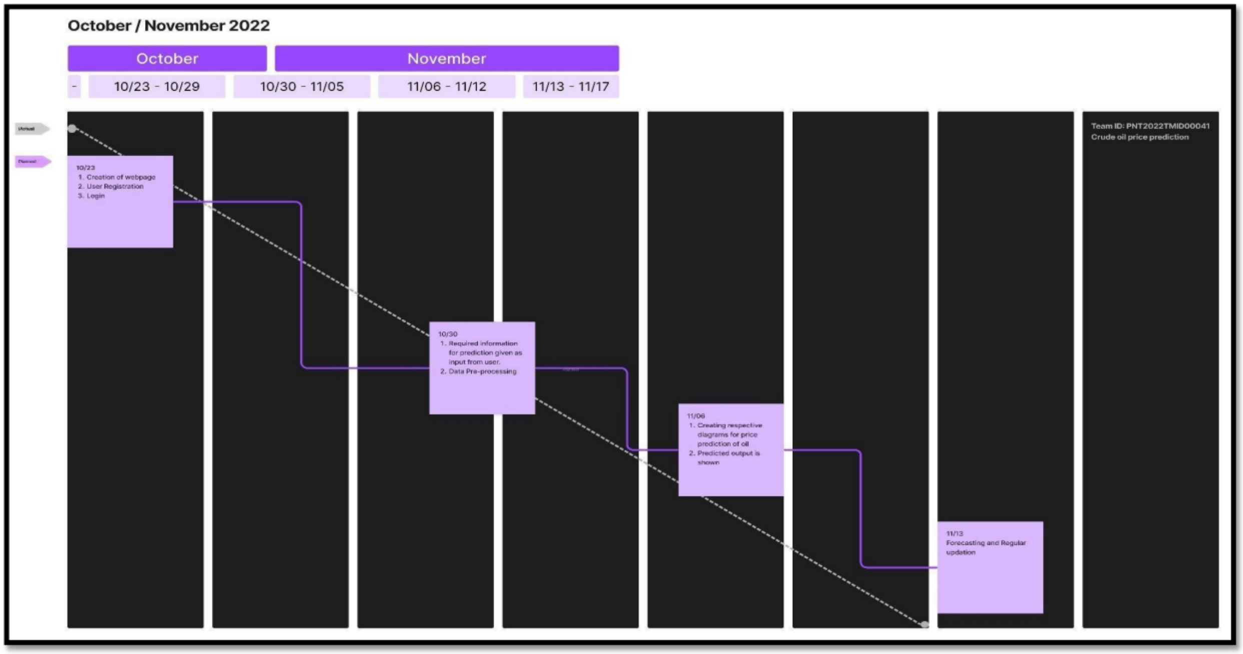
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022		
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022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

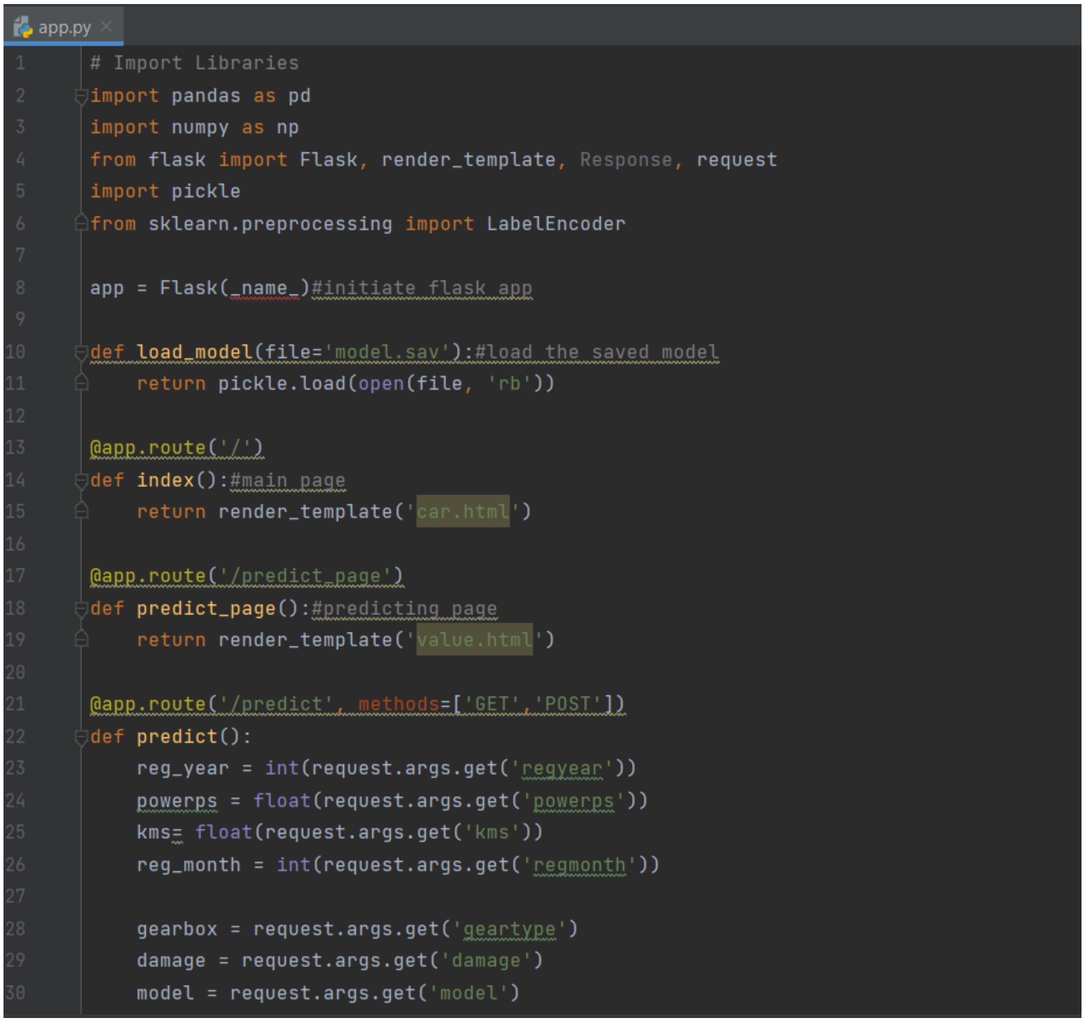
$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.3 Burndown Chart

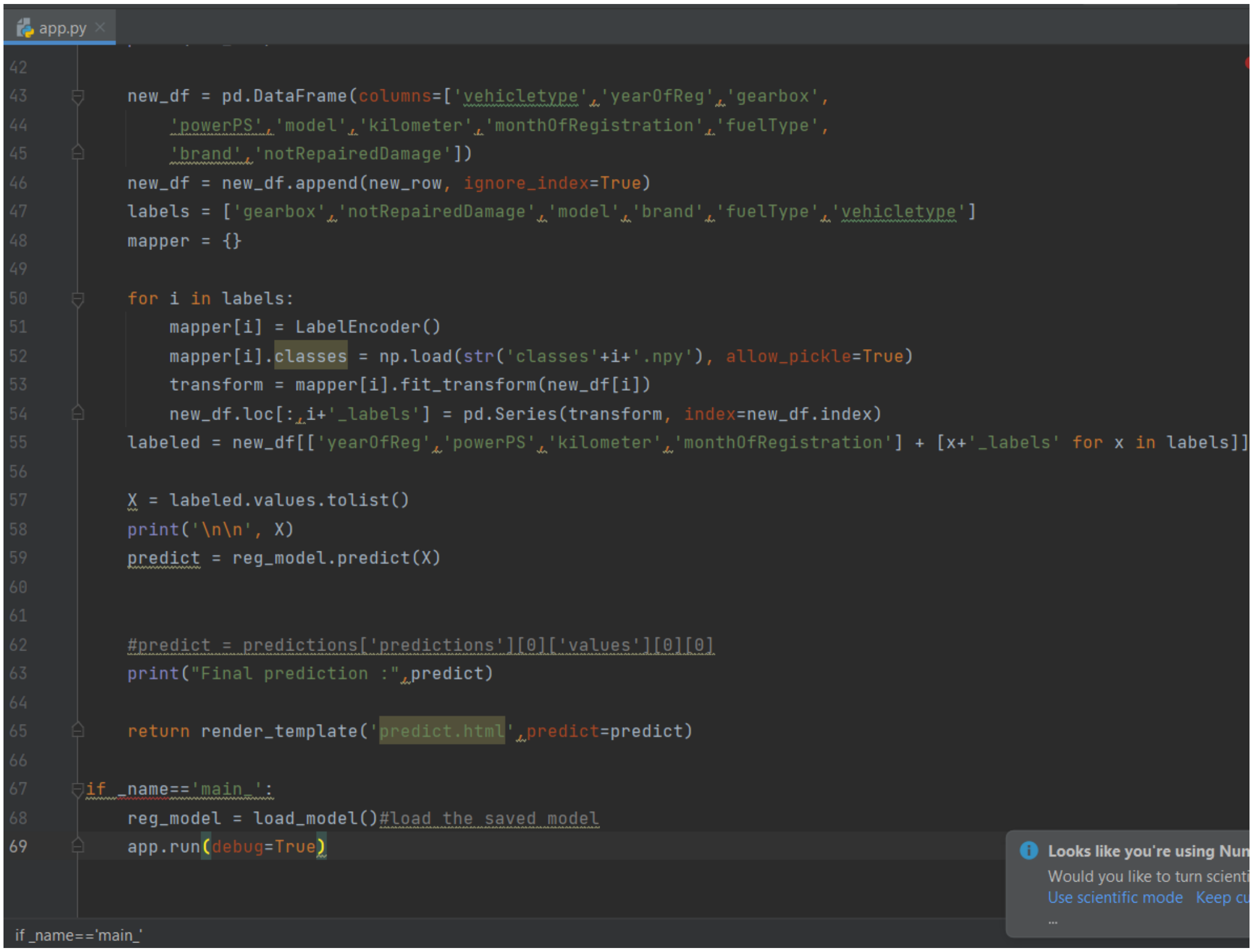


7. CODING & SOLUTION

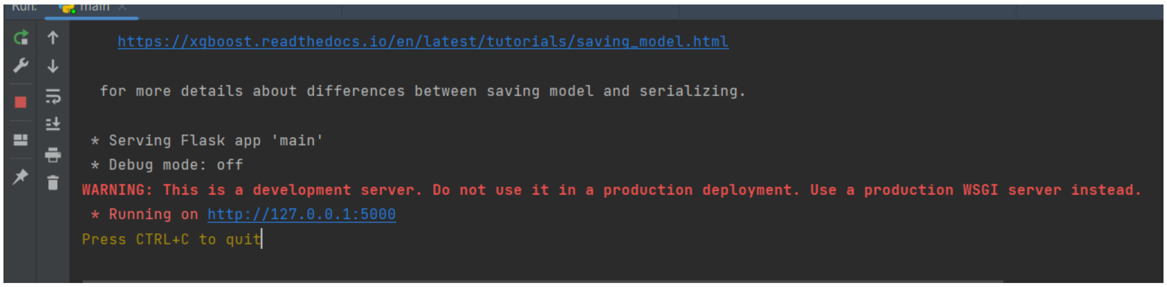
7.1 Feature 1



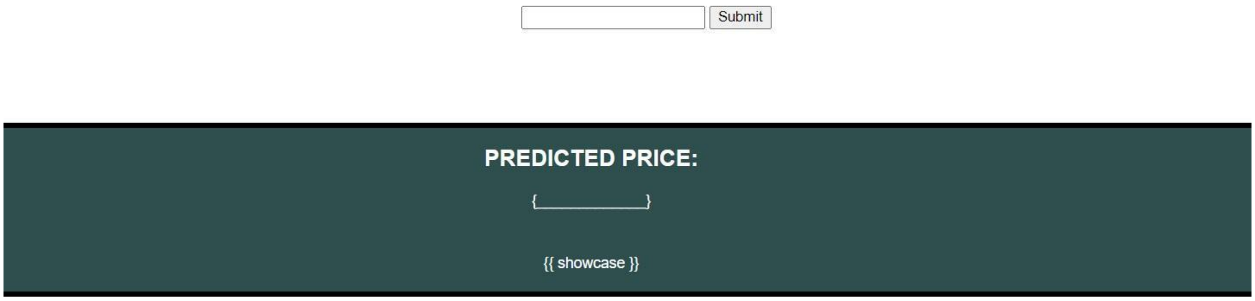
```python
# Import Libraries
import pandas as pd
import numpy as np
from flask import Flask, render_template, Response, request
import pickle
from sklearn.preprocessing import LabelEncoder

app = Flask(_name_)#initiate flask app

def load_model(file='model.sav'):#load the saved model
    return pickle.load(open(file, 'rb'))

@app.route('/')
def index():#main page
    return render_template('car.html')

@app.route('/predict_page')
def predict_page():#predicting page
    return render_template('value.html')

@app.route('/predict', methods=['GET','POST'])
def predict():
    reg_year = int(request.args.get('regyear'))
    powerps = float(request.args.get('powerps'))
    kms= float(request.args.get('kms'))
    reg_month = int(request.args.get('regmonth'))

    gearbox = request.args.get('geartype')
    damage = request.args.get('damage')
    model = request.args.get('model')
```



```python

    new_df = pd.DataFrame(columns=['vehicletype','yearOfReg','gearbox',
        'powerPS','model','kilometer','monthOfRegistration','fuelType',
        'brand','notRepairedDamage'])
    new_df = new_df.append(new_row, ignore_index=True)
    labels = ['gearbox','notRepairedDamage','model','brand','fuelType','vehicletype']
    mapper = {}

    for i in labels:
        mapper[i] = LabelEncoder()
        mapper[i].classes = np.load(str('classes'+i+'.npy'), allow_pickle=True)
        transform = mapper[i].fit_transform(new_df[i])
        new_df.loc[:,i+'_labels'] = pd.Series(transform, index=new_df.index)
    labeled = new_df[['yearOfReg','powerPS','kilometer','monthOfRegistration'] + [x+'_labels' for x in labels]]

    X = labeled.values.tolist()
    print('\n\n', X)
    predict = reg_model.predict(X)


    #predict = predictions['predictions'][0]['values'][0][0]
    print("Final prediction :",predict)

    return render_template('predict.html',predict=predict)

if _name=='main_':
    reg_model = load_model()#load the saved model
    app.run(debug=True)
```



```
    https://xgboost.readthedocs.io/en/latest/tutorials/saving_model.html

  for more details about differences between saving model and serializing.

 * Serving Flask app 'main'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
```



PREDICTED PRICE:

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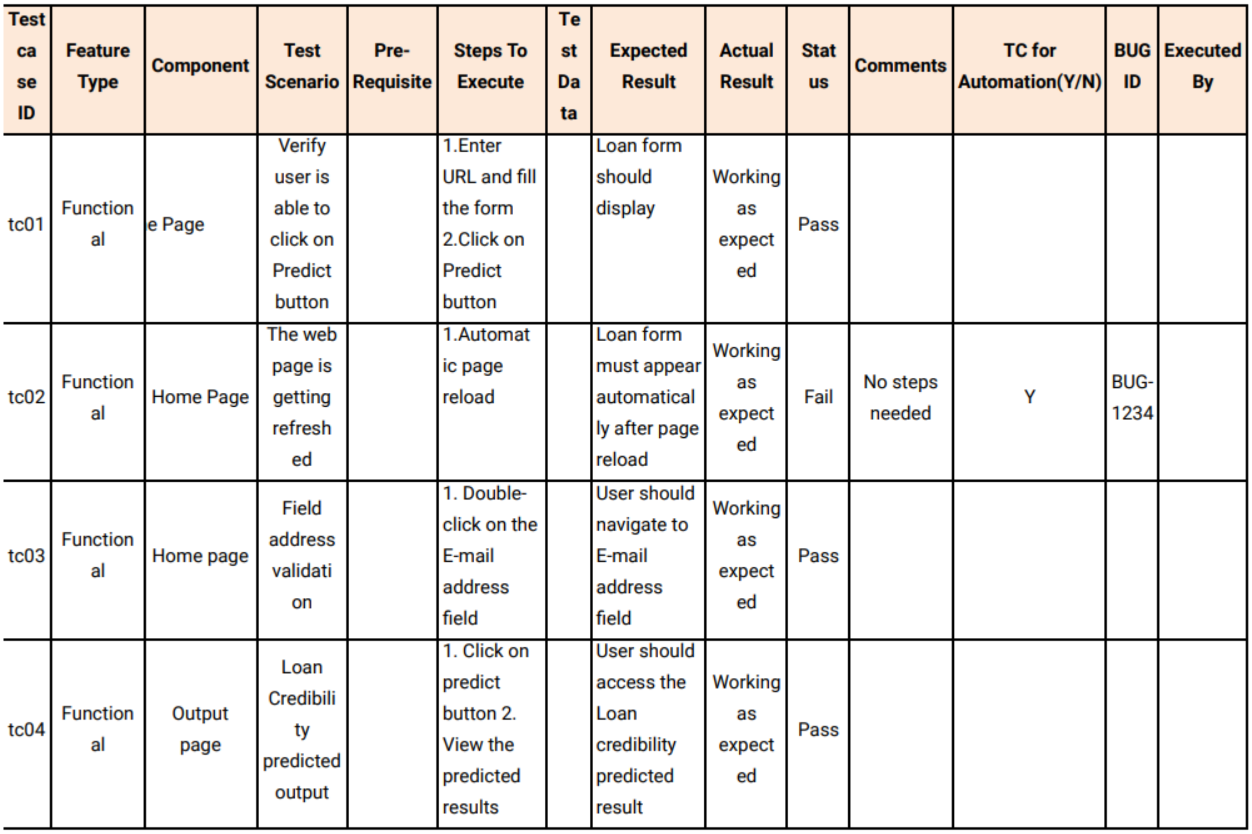
Chapter 8: TESTING

8.1 Test Cases



Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
tc01	Functional	e Page	Verify user is able to click on Predict button		1.Enter URL and fill the form 2.Click on Predict button		Loan form should display	Working as expected	Pass				
tc02	Functional	Home Page	The web page is getting refreshed		1.Automatic page reload		Loan form must appear automatically after page reload	Working as expected	Fail	No steps needed	Y	BUG-1234	
tc03	Functional	Home page	Field address validation		1. Double-click on the E-mail address field		User should navigate to E-mail address field	Working as expected	Pass				
tc04	Functional	Output page	Loan Credibility predicted output		1. Click on predict button 2. View the predicted results		User should access the Loan credibility predicted result	Working as expected	Pass				

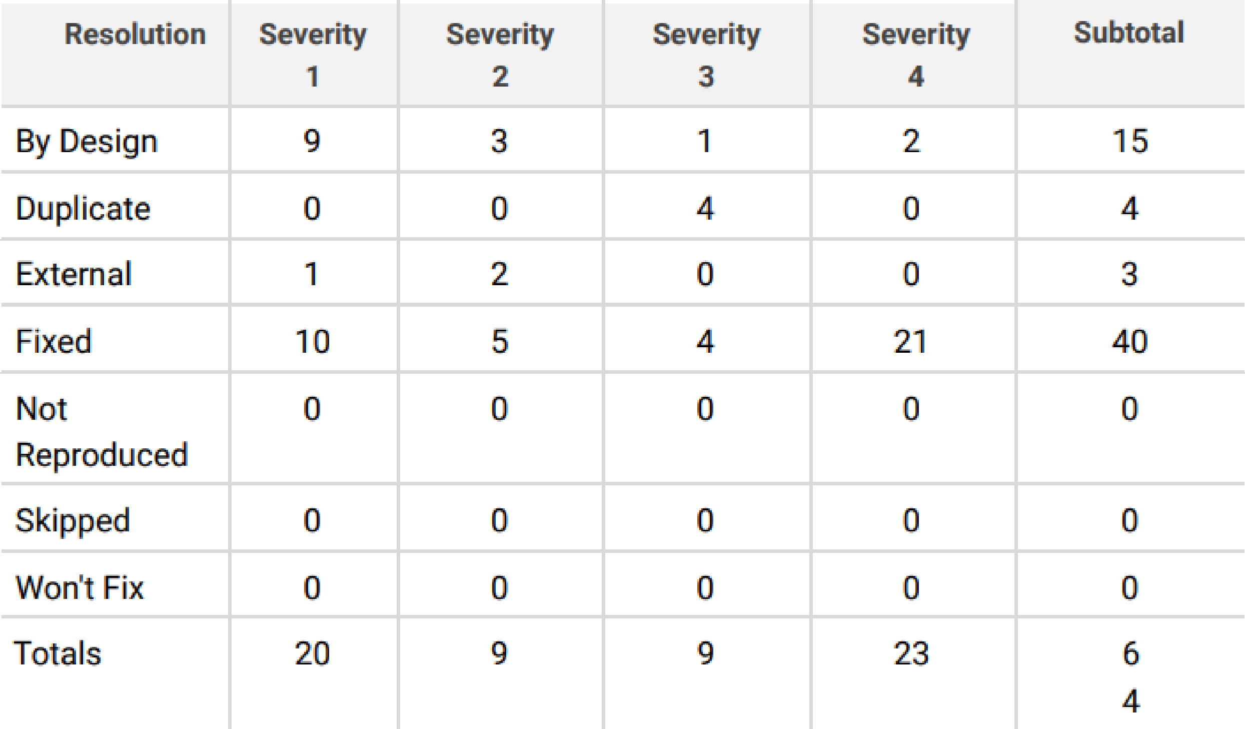
8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

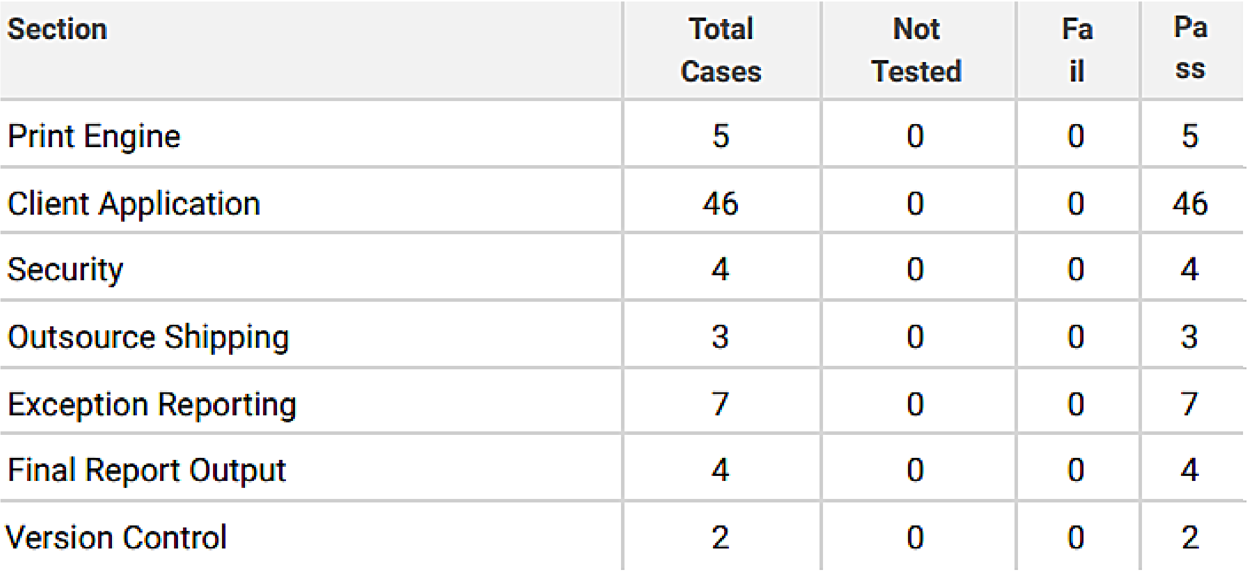
2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved



Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	9	3	1	2	15
Duplicate	0	0	4	0	4
External	1	2	0	0	3
Fixed	10	5	4	21	40
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	20	9	9	23	64

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

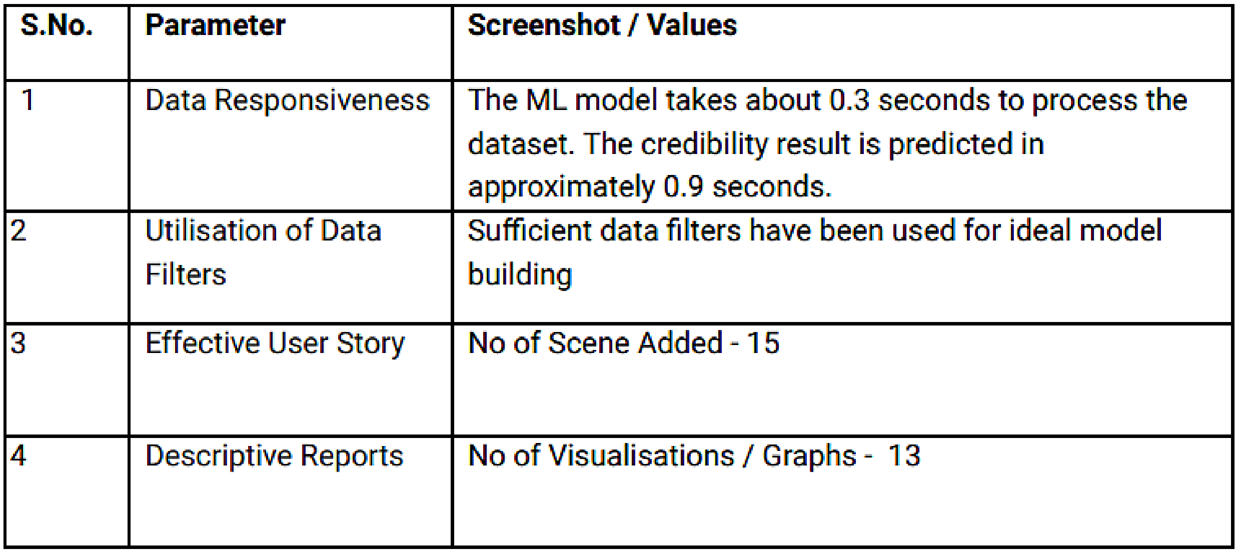


Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	46	0	0	46
Security	4	0	0	4
Outsource Shipping	3	0	0	3
Exception Reporting	7	0	0	7
Final Report Output	4	0	0	4
Version Control	2	0	0	2

Chapter 9: RESULTS

9.1 Performance Metrics

Model Performance Testing:
Project team shall fill the following information in the model performance testing template.



S.No.	Parameter	Screenshot / Values
1	Data Responsiveness	The ML model takes about 0.3 seconds to process the dataset. The credibility result is predicted in approximately 0.9 seconds.
2	Utilisation of Data Filters	Sufficient data filters have been used for ideal model building
3	Effective User Story	No of Scene Added - 15
4	Descriptive Reports	No of Visualisations / Graphs - 13

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES :

For a variety of stakeholders, including governments, public and private organizations, politicians, and investors, price projections are crucial.

Prices for oil futures represent the price that the buyer and the seller concur will be the cost of the oil when it is delivered. As a result, these prices give a clear indication of what investors anticipate the price of oil to be in the future.

Price prediction analyzes a good or service based on its attributes, demand, and current market trends using an algorithm. The pricing is then adjusted by the programme at a level that it believes would both draw people and optimize sales.

DISADVANTAGES :

Pollution is a major disadvantage of fossil fuels. This is because they give off carbon dioxide when burned thereby causing a greenhouse effect. This makes it difficult to predict the price.
We can choose the algorithms based on accurate results. For that, we have to run the results on every algorithm. The main problem occurs in the training and testing of data. The data is huge, so sometimes removing errors becomes nearly impossible. These errors can cause a headache to users. Since the data is huge, the errors take a lot of time to resolve.
Possibility of High error.

11. CONCLUSION & FUTURE WORK

A crucial and difficult issue in a country's economy is figuring out an effective and efficient method of anticipating a very complicated and unpredictable price like the price of crude oil. Prediction employing a potent AI tool like the LSTM of the DL is quite uncommon. The majority of prediction approaches are built with a focus on statistical and econometrics point of view, which has been helpful in several instances. In this paper, we developed a novel complex network analysis and LSTM-based crude oil price prediction method. We ran the experiment using ten (10) different global crude oil prices utilised by other researchers in order to assess the efficacy and robustness of the method.

We may infer from the experiment that the choice of batch size and the number of LSTM layers during training greatly affects the value of the objective function, the effectiveness of fitting, and the running duration. The amount of LSTM layers and batch size that are appropriate can significantly enhance the model.

The model chooses more datasets over a longer period of time as training samples compared to the conventional and classic econometric prediction approach. The application possibilities for the LSTM prediction model are more varied and have higher precision. The price trend of crude oil for the upcoming time period can be accurately predicted using the LSTM model.

For upcoming work, the following ideas can be taken into account:

(1) This study just takes into account the price of crude oil in Nigeria; it does not need to take into account other variables like the financial market, economic growth, dollar exchange rate, demand and supply, etc. The prediction horizons for the model presented in this thesis are limited to months because it is built using monthly data.

(2) The suggested method can be improved by taking into account additional variables that affect the volatility of crude oil prices, such as the financial market, economic growth, currency rate, demand and supply, and weather. By taking into account daily data, the prediction's time frame can also be expanded.

(3) In the future, the proposed technique can be used with various datasets, such as stock market data, to further evaluate its viability.

12. APPENDIX

12.1 Source Code

index.html

```
<!DOCTYPE html>
<html>

<head>
  <title>PRICE PREDICTION</title>
</head>

<body>
  <p>&nbsp;</p>

  <p>&nbsp;</p>
  <style>
    body {
      background-image: url(background.jpg);
      background-repeat: no-repeat;
      background-attachment: fixed;
      background-size: cover;
    }

    form {
      min-height: 70%;
    }

    body,
    form {
      padding: 0;
      margin: 0;
      outline: none;
      font-family: Roboto, Arial, sans-serif;
      font-size: 14px;
      color: #FFFFFF;
      line-height: 22px;
    }

    .myDiv {
      border: 5px outset #000000;
      background-color: #2F4F4F;
      text-align: center;
      font-family: Roboto, Arial, sans-serif;
      font-size: 14px;
      color: #FFFFFF;
    }
  </style>

  <h1 style="text-align:center"><span style="color:#ffffff"><strong><span
        style="font-family:Arial,Helvetica,sans-serif"><span style="font-size:36px">CRUDE
OIL PRICE
          PREDICTION&nbsp;</span></span></strong></span></h1>
  <p>&nbsp;</p>
  <p>&nbsp;</p>
  <p>&nbsp;</p>
  <form method="post" style="text-align:center">
    <label for="ENTER PRICE">ENTER PRICE:</label>
    <input type="text" id="PRICE" name="year">
    <input type="submit">
  </form>

  <p>&nbsp;</p>
  <p>&nbsp;</p>

  <div class="myDiv">
    <h2>PREDICTED PRICE:</h2>
    <p>{____________}</P><br>
    {{ showcase }}



    </p>
  </div>

</body>

</html>
```

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_oil.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")

@app.route('/login',methods = ['POST'])
def login() :
    x_input=str(request.form['year'])
    x_input=x_input.split(',')
    print(x_input)
    for i in range(0, len(x_input)):
        x_input[i] = float(x_input[i])
    print(x_input)
    x_input = np.array(x_input).reshape(1,-1)
    temp_input=list(x_input)
    temp_input=temp_input[0].tolist()
    last_output=[]
    n_steps=10
    i=0

    while(i<1):
        if(len(temp_input) > 10):
            x_input = np.array(temp_input[1:])
            print("{} day input {}".format(i,x_input))
            x_input = x_input.reshape(1,-1)
            x_input = x_input.reshape((1, n_steps, 1))
            yhat = model.predict(x_input, verbose=0)
            print("{} day output {}".format(i, yhat))
            temp_input.extend(yhat[0].tolist())
            temp_input = temp_input[1:]

            lst_output.extend(yhat.tolist())
            i=i+1
        else:
            x_input = x_input.reshape((1,n_steps,1))
            yhat = model.predict(x_input, verbose=0)
            print(yhat[0])
            temp_input.extend(yhat[0].tolist())
            print(len(temp_input))
            lst_output.extend(yhat.tolist())
            i=i+1

    print(lst_output)

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

if _name== 'main_' :
    app.run(debug = True,port=5000)
```

12.2 GitHub Link

Github: https://github.com/IBM-EPBL/IBM-Project-17865-1659676801