CRUDE OIL PRICE PREDICTION PROJECT REPORT

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1.INTRODUCTION

1.1 PROJECT OVERVIE:

Crude oil is the world’s leading fuel, and its prices have a big impact on the global environment, economy as well as oil exploration and exploitation activities. Oil price forecasts are very useful to industries, governments and individuals. Although many methods have been developed for predicting oil prices, it remains one of the most challenging forecasting problems due to the high volatility of oil prices. In this paper, we propose a novel approach for crude oil price prediction based on a new machine learning paradigm called stream learning. The main advantage of our stream learning approach is that the prediction model can capture the changing pattern of oil prices since the model is continuously updated whenever new oil price data are available, with very small constant overhead. To evaluate the forecasting ability of our streaming learning model, we compare it with three other popular oil price prediction models. The experiment results show that our stream learning model achieves the highest accuracy in terms of both mean squared prediction error and directional accuracy ratio over a variety of forecast time horizons.

1.2 PURPOSE:

Crude oil price fluctuations have a far reaching impact on global economies and thus price forecasting can assist in minimising the risks associated with volatility in oil prices. Price forecasts are very important to various stakeholders: governments, public and private enterprises, policymakers, and investors.

2.LITERATURE SURVAY

2.1 Existing problem:

The prediction of the ende oil rates based on the previous datasets on the data and prices as the feature _list are inputs and and target list are predicted values. The implementation was on the Linear Regression Model which is feasible to some extend for the prediction of the crude oil prices. The implementation is on predicting the crude oil prices for the days using Linear Regression Python Machine Algorithm and plotting the graph based on the prediction.

2.2 Reference:

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.

2.3 Problem statement definition:

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 comprehends and correlates between factors, sparks information on the trend and finally, predict it accurately.

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.

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.

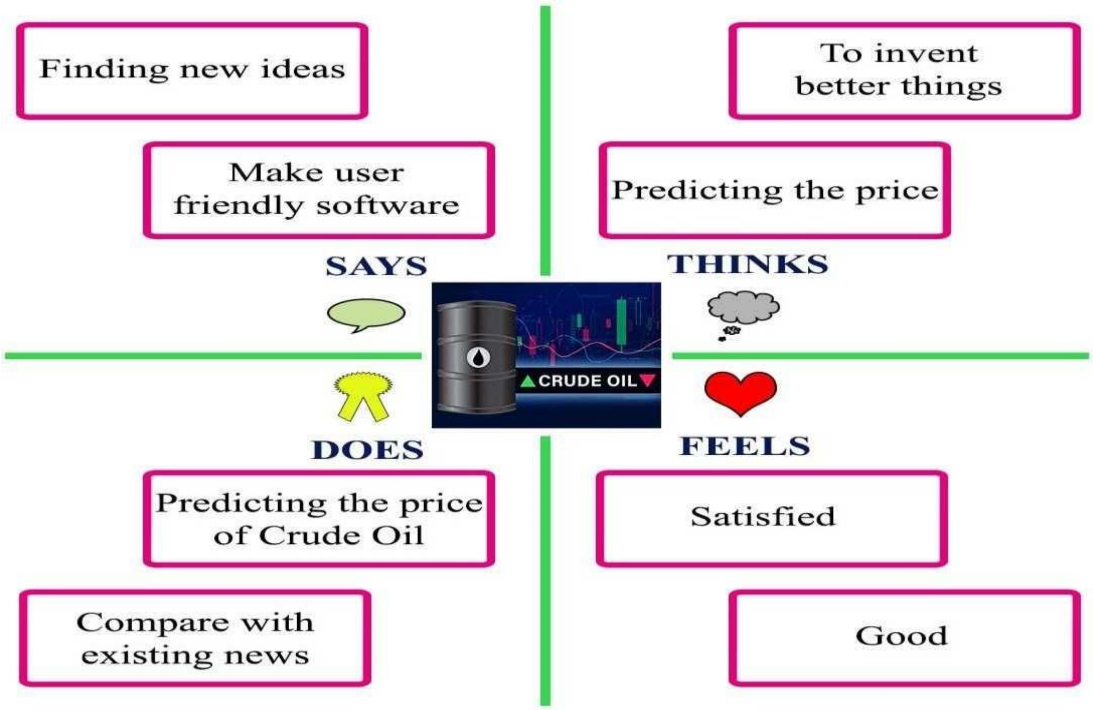
Fourthly, the crude oil price movement was the popular topic studied previously and not the crude oil price itself.

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 world problem.

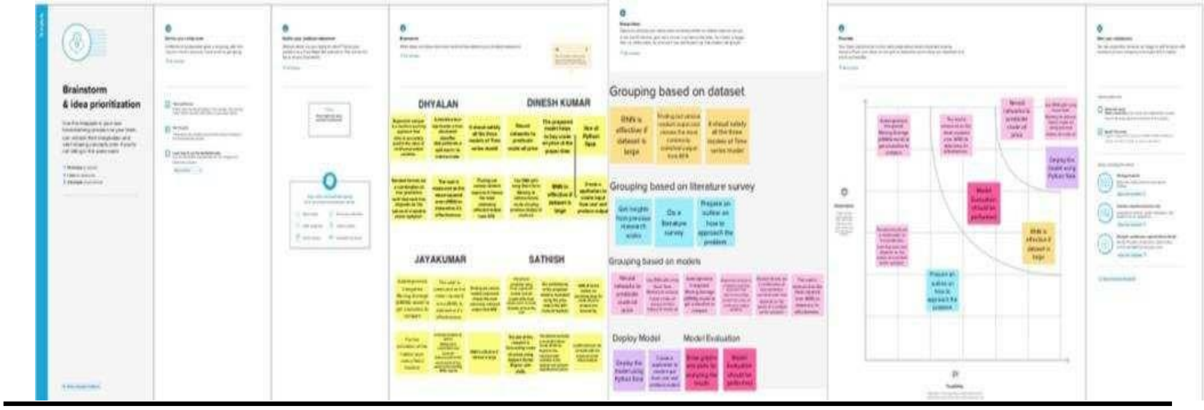
Sincerely, the practicability of the previous study is still dubious as the crude oil market itself is chaotic. Still, there are opportunities for improvement in the future as the advancement of our world technology is rapid.

3.IDEATION AND PROPOSED SOLUTION

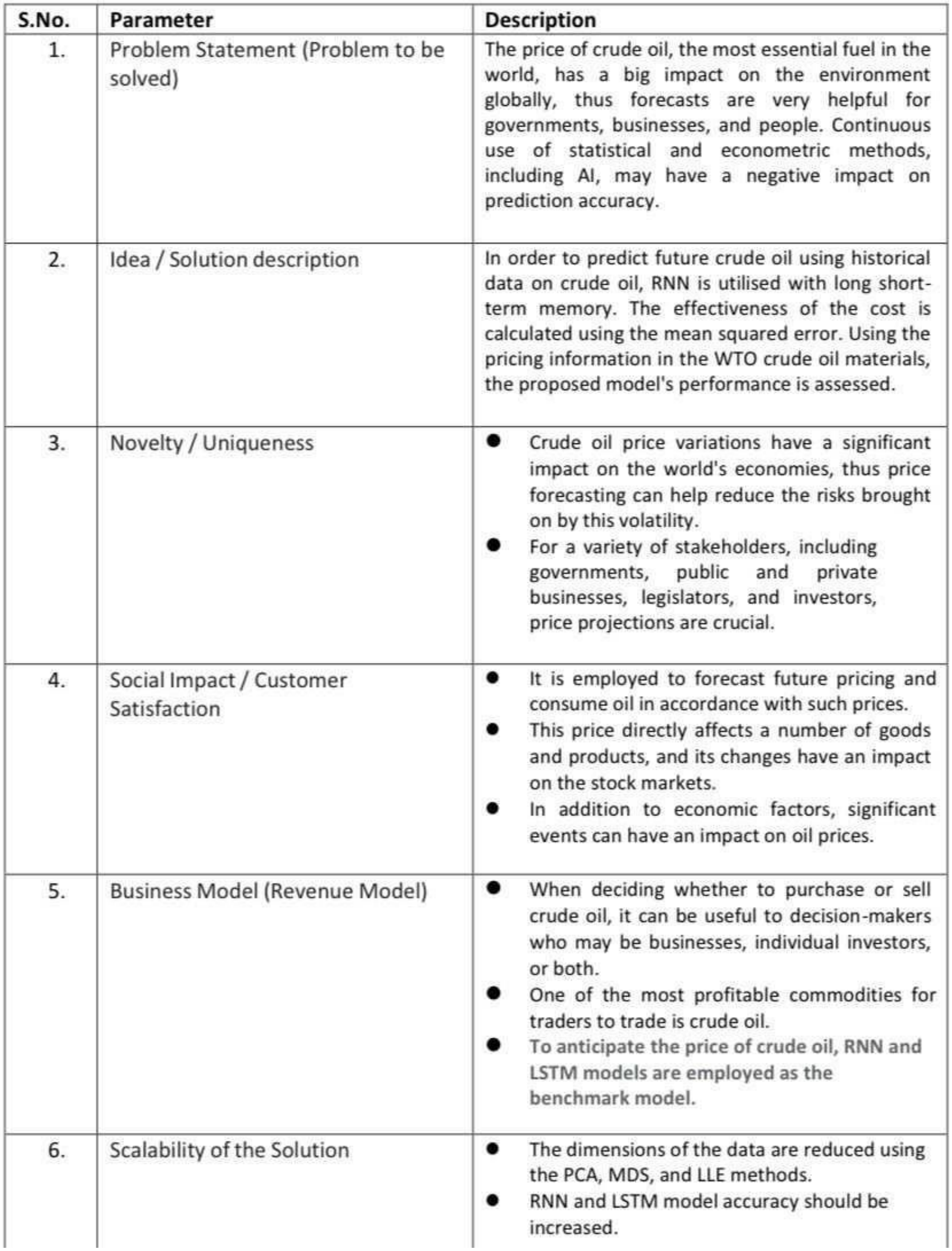
3.1 Empathy map and canvas



3.2 Ideation & Brainstrom

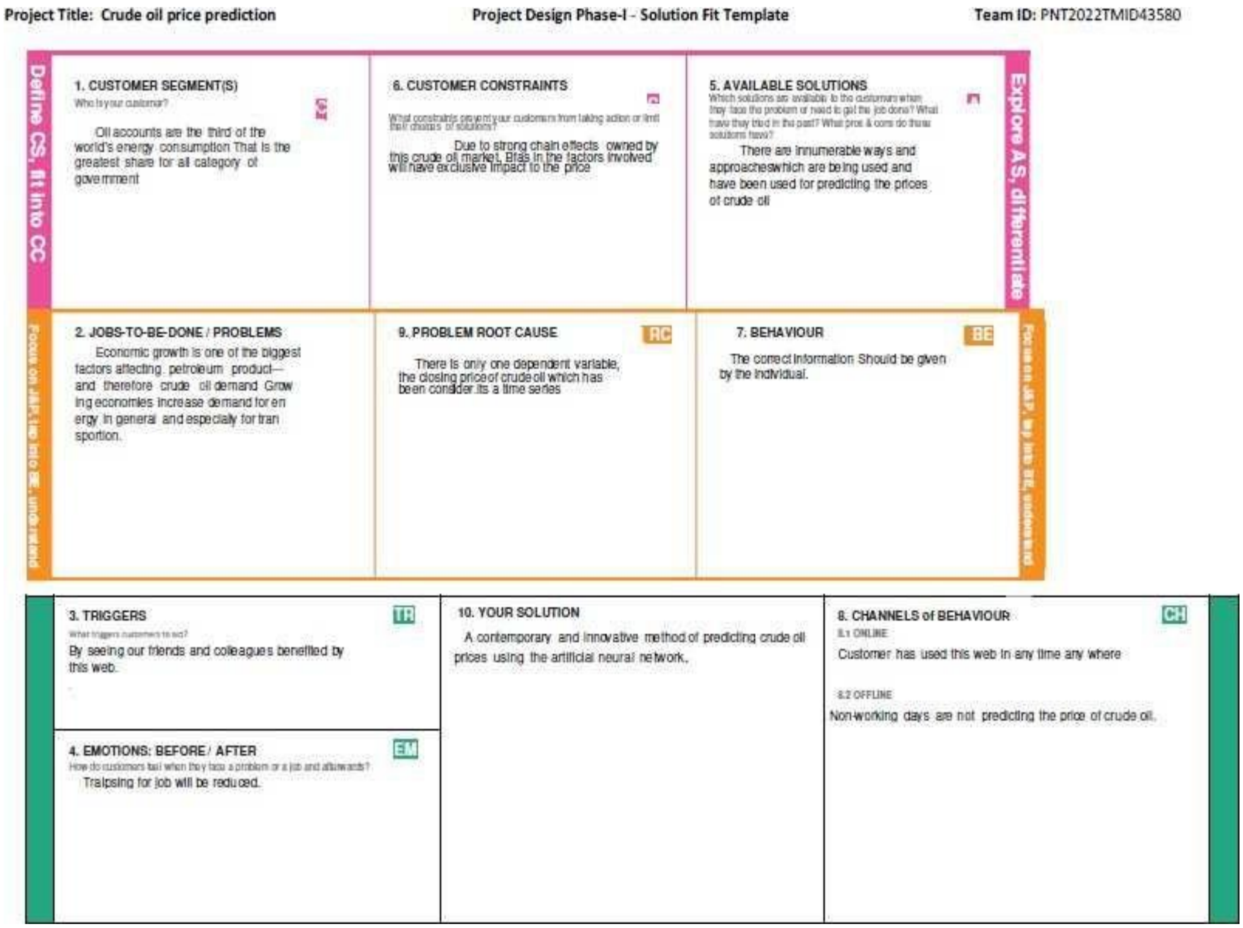

Brainstorm
& idea prioritization
DHYALAN
DINESH KUMAR
JAYAKUMAR
SATHISH
Grouping based on dataset
RNN is effective if dataset is large
It should satisfy all the three models of Time series model
Grouping based on literature survey
Get insights from previous research works
Do a literature survey
Prepare an outline on how to approach the problem
Grouping based on models
Deploy Model
Model Evaluation
Model Evaluation should be performed

3.3 Proposed solution



S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The price of crude oil, the most essential fuel in the world, has a big impact on the environment globally, thus forecasts are very helpful for governments, businesses, and people. Continuous use of statistical and econometric methods, including AI, may have a negative impact on prediction accuracy.
2.	Idea / Solution description	In order to predict future crude oil using historical data on crude oil, RNN is utilised with long short-term memory. The effectiveness of the cost is calculated using the mean squared error. Using the pricing information in the WTO crude oil materials, the proposed model's performance is assessed.
3.	Novelty / Uniqueness	● Crude oil price variations have a significant impact on the world's economies, thus price forecasting can help reduce the risks brought on by this volatility. ● For a variety of stakeholders, including governments, public and private businesses, legislators, and investors, price projections are crucial.
4.	Social Impact / Customer Satisfaction	● It is employed to forecast future pricing and consume oil in accordance with such prices. ● This price directly affects a number of goods and products, and its changes have an impact on the stock markets. ● In addition to economic factors, significant events can have an impact on oil prices.
5.	Business Model (Revenue Model)	● When deciding whether to purchase or sell crude oil, it can be useful to decision-makers who may be businesses, individual investors, or both. ● One of the most profitable commodities for traders to trade is crude oil. ● To anticipate the price of crude oil, RNN and LSTM models are employed as the benchmark model.
6.	Scalability of the Solution	● The dimensions of the data are reduced using the PCA, MDS, and LLE methods. ● RNN and LSTM model accuracy should be increased.

3.4 Problem solution fit



Project Title: Crude oil price prediction

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID43580

1. CUSTOMER SEGMENT(S) CS

Who is your customer?

Oil accounts are the third of the world's energy consumption That is the greatest share for all category of government

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions?

Due to strong chain effects owned by this crude oil market. Bias in the factors involved will have exclusive impact to the price

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have?

There are innumerable ways and approacheswhich are being used and have been used for predicting the prices of crude oil

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

Economic growth is one of the biggest factors affecting petroleum product— and therefore crude oil demand Growing economies increase demand for energy in general and especially for transportion.

9. PROBLEM ROOT CAUSE RC

There is only one dependent variable, the closing priceof crude oil which has been consider.its a time series

7. BEHAVIOUR BE

The correct information Should be given by the individual.

3. TRIGGERS TR

What triggers customers to act?

By seeing our friends and colleagues benefited by this web.

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards?

Traipsing for job will be reduced.

10. YOUR SOLUTION SL

A contemporary and innovative method of predicting crude oil prices using the artificial neural network.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE

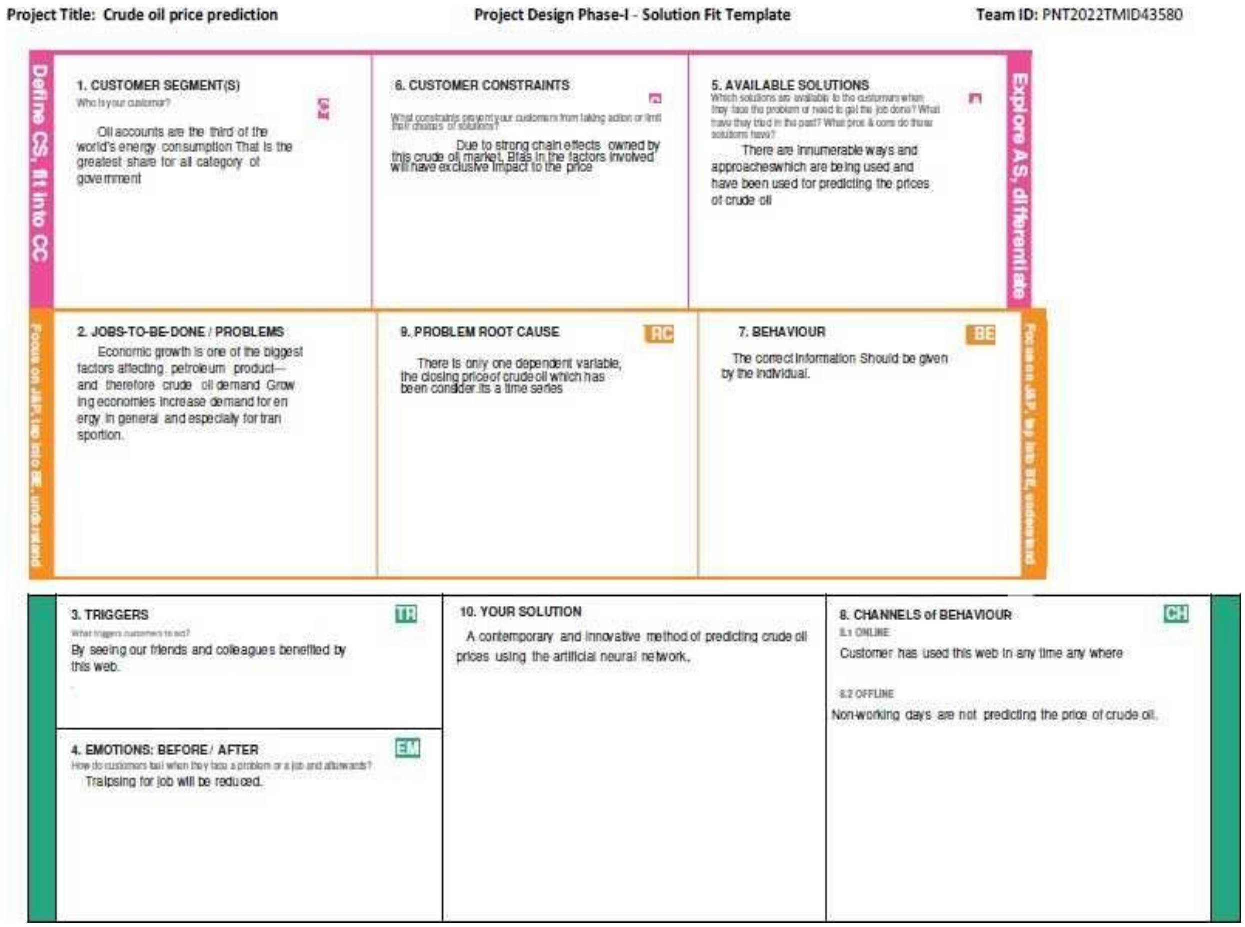
Customer has used this web in any time any where

8.2 OFFLINE

Non-working days are not predicting the price of crude oil.

Define CS, fit into CC
Explore AS, differentiate
Focus on J&P, tap into BE, understand RC
Focus on J&P, tap into BE, understand RC

4.REQUIREMENT ANALYSIS



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CC
AS
Explore AS, differentiate
Focus on J&P, tap into BE, understand
RC
BE
Focus on J&P, tap into BE, understand
TR
EM
CH

4.1 Functional Requirements

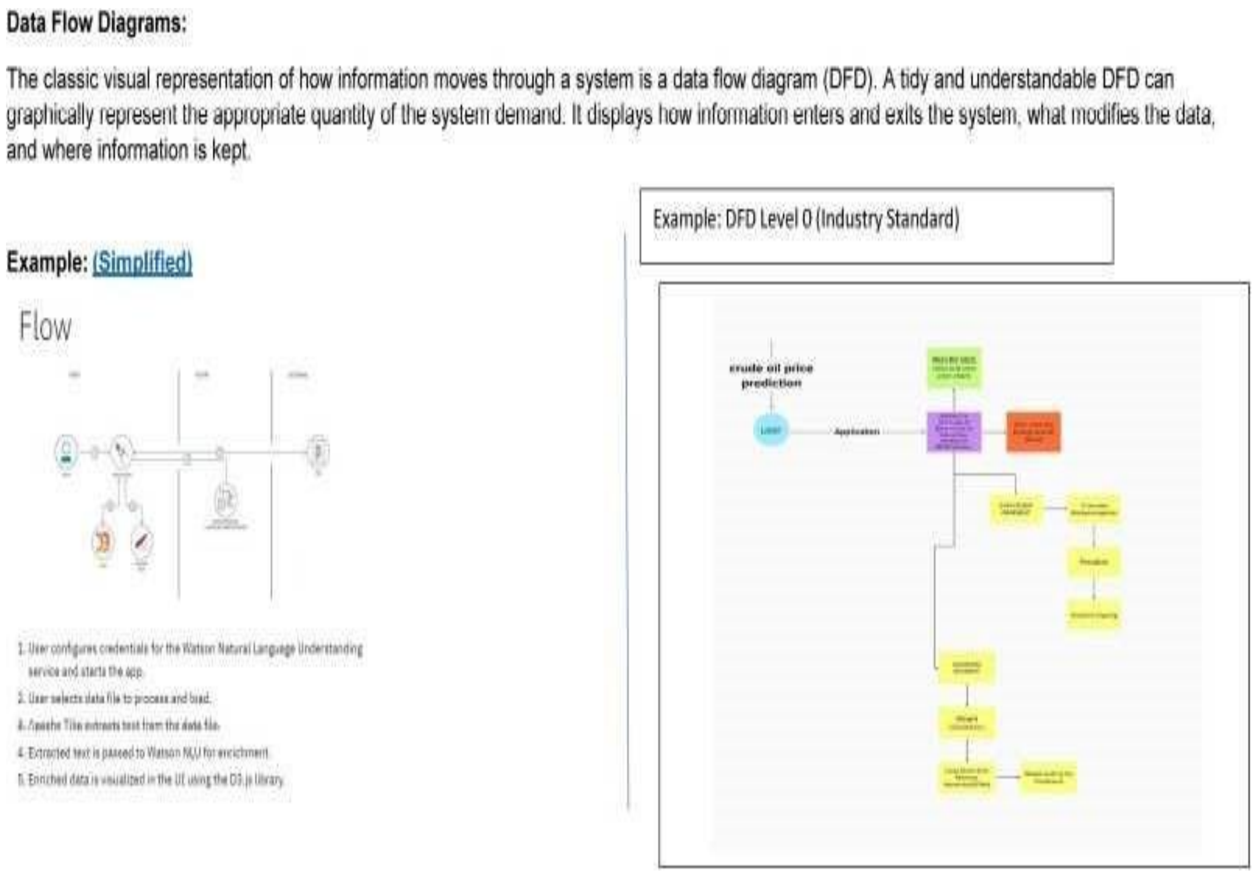
- User Application : The price of crude oil can be downloaded directly from the Google Play Store application by users.
- User Products Available : The Application's User There are numerous products in the Crude Oil Price App, and users can instantly update the energy and oil prices.
- User Additional Features : The user can view oil price charts and the most recent news. Major Energy Quotes User View The user may use various color schemes.
- User Exceptions : The User Can Exchange Rates and Currency Converter.

4.2 Non-Functional Requirements

- Usability : Give the accurate price prediction of crude oil.
- Security : The data of user will be secure and encrypted.
- Reliability : Give the best and accurate price and knowledge to the
- Availability : The application will be available on all the platform.
- Scalability : The scalability will be approximately 95%.

5.PROJECT DESIGN

5.1 Data Flow Diagrams



Data Flow Diagrams:

The classic visual representation of how information moves through a system is a data flow diagram (DFD). A tidy and understandable DFD can graphically represent the appropriate quantity of the system demand. It displays how information enters and exits the system, what modifies the data, and where information is kept.

Example: (Simplified)

1. User configures credentials for the Watson Natural Language Understanding service and starts the app.
2. User selects data file to process and load.
3. Apache Tika extracts text from the data file.
4. Extracted text is passed to Watson NLU for enrichment.
5. Enriched data is visualized in the UI using the D3.js library.

Example: DFD Level 0 (Industry Standard)

5.2 Solution & Technical Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions.

Its goals are to:

- Find the best tech solution to solve existing problems in the organizations – LSTM technique.

- Describe the structure, characteristics, behavior, and other aspects of the software is move to LSTM for predicting more accurate Crude Oil Prices.
- Define features, development phases, and solution requirements of the project.
- Provide specifications according to which the solution is defined, managed, and delivered.

.Solution Architecture Diagram:

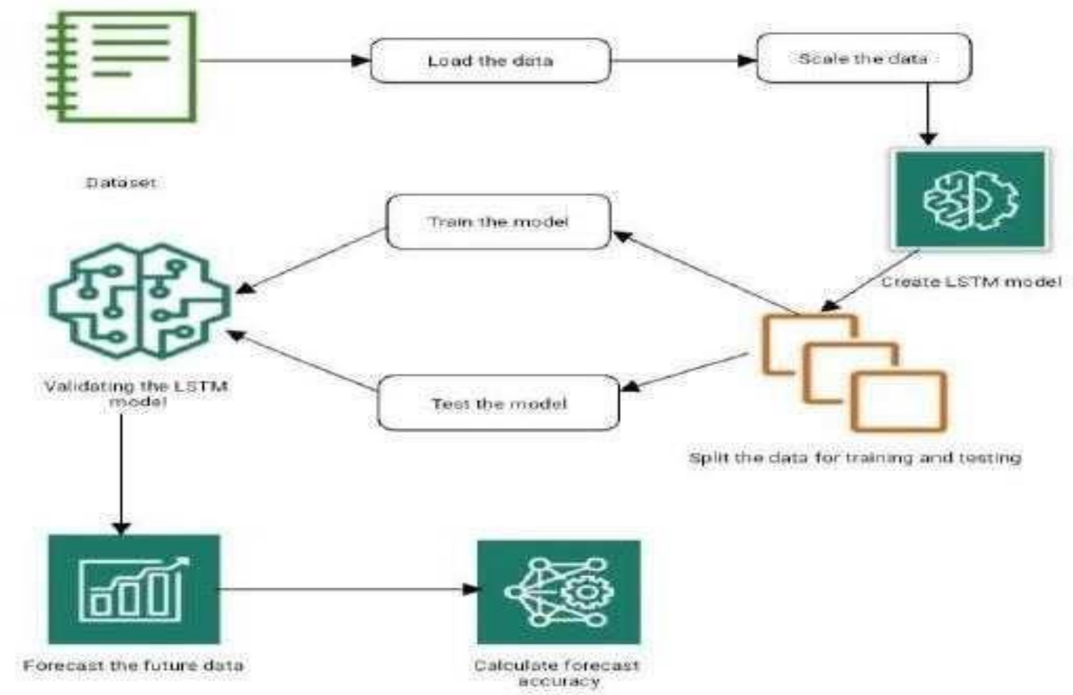
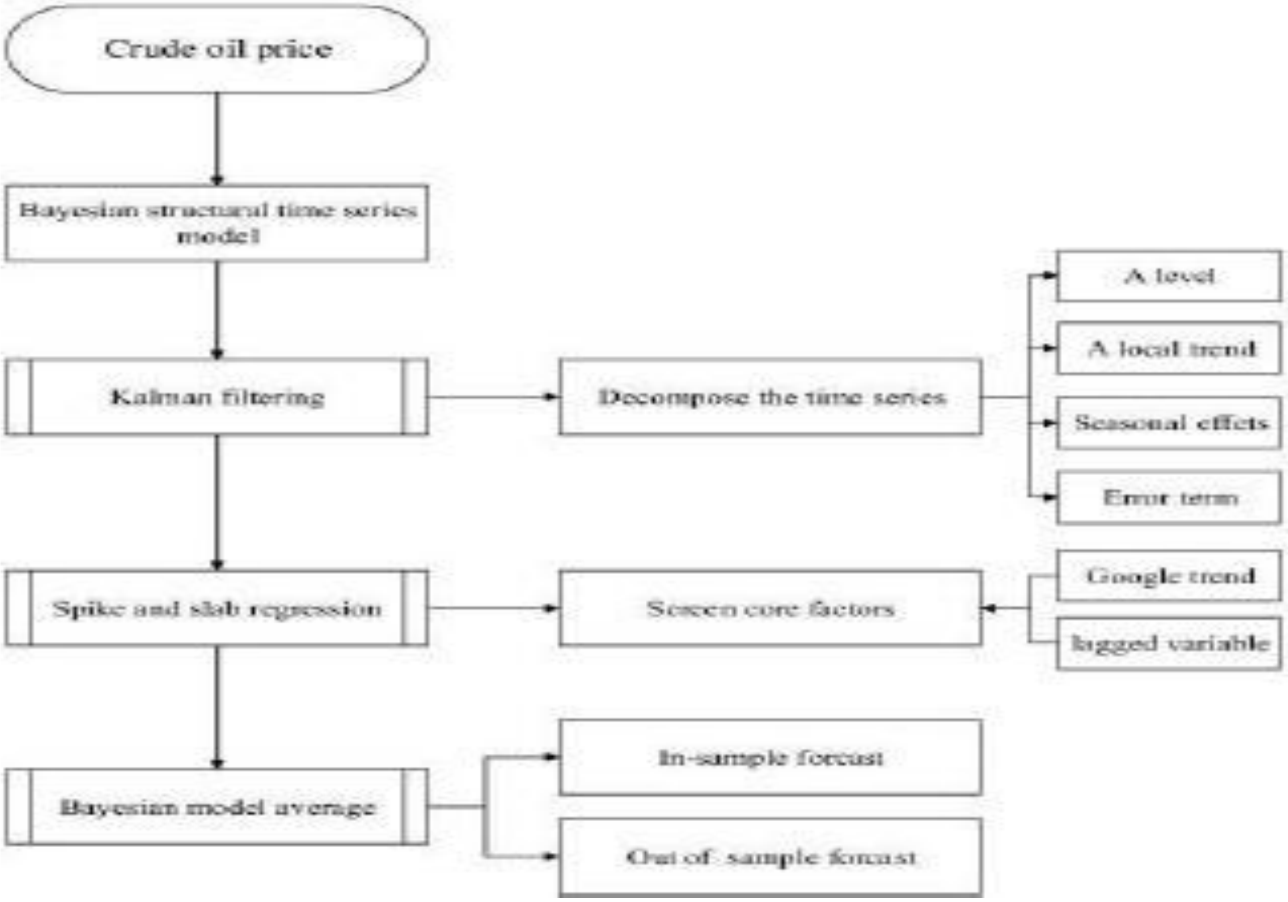
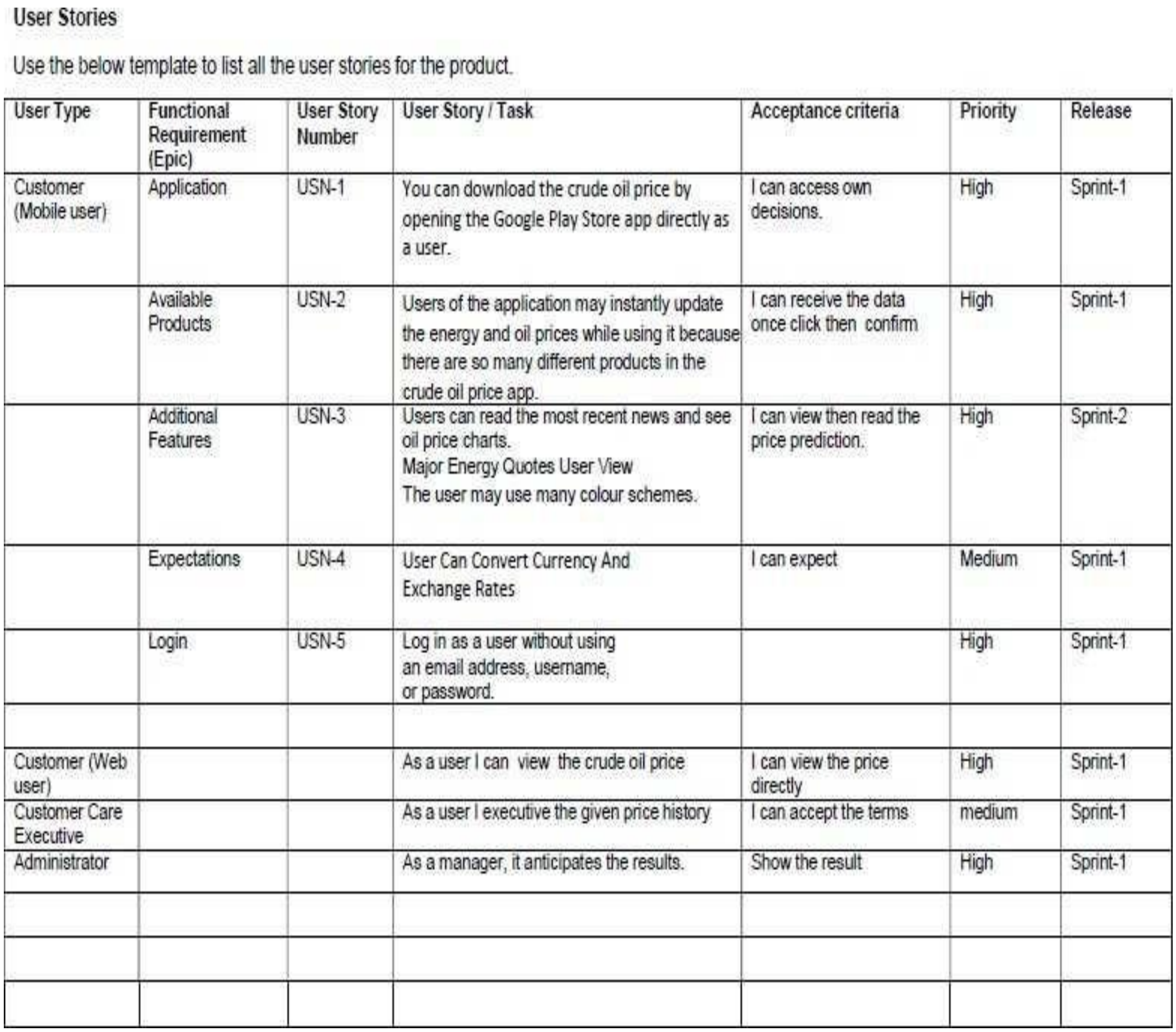


Figure 1: Architecture and data flow of the Crude oil Price Prediction

.Technical Architecture Diagram :



5.3 User Stories



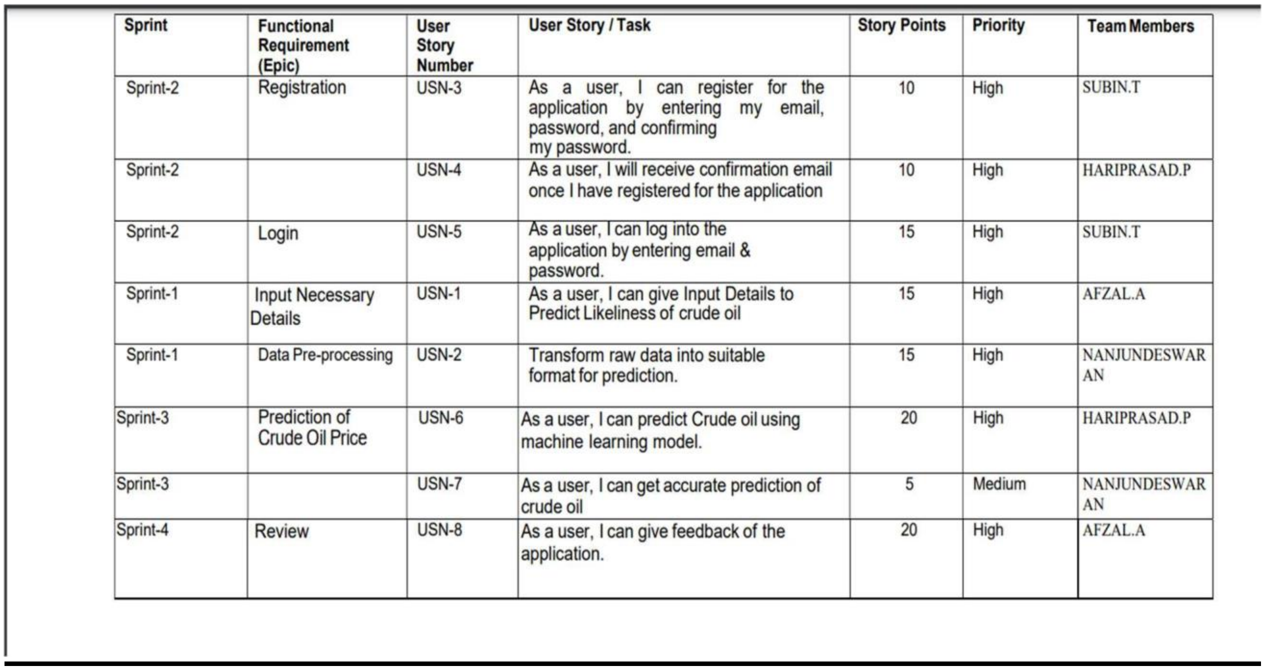
User Stories

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)	Application	USN-1	You can download the crude oil price by opening the Google Play Store app directly as a user.	I can access own decisions.	High	Sprint-1
	Available Products	USN-2	Users of the application may instantly update the energy and oil prices while using it because there are so many different products in the crude oil price app.	I can receive the data once click then confirm	High	Sprint-1
	Additional Features	USN-3	Users can read the most recent news and see oil price charts. Major Energy Quotes User View The user may use many colour schemes.	I can view then read the price prediction.	High	Sprint-2
	Expectations	USN-4	User Can Convert Currency And Exchange Rates	I can expect	Medium	Sprint-1
	Login	USN-5	Log in as a user without using an email address, username, or password.		High	Sprint-1
Customer (Web user)			As a user I can view the crude oil price	I can view the price directly	High	Sprint-1
Customer Care Executive			As a user I executive the given price history	I can accept the terms	medium	Sprint-1
Administrator			As a manager, it anticipates the results.	Show the result	High	Sprint-1

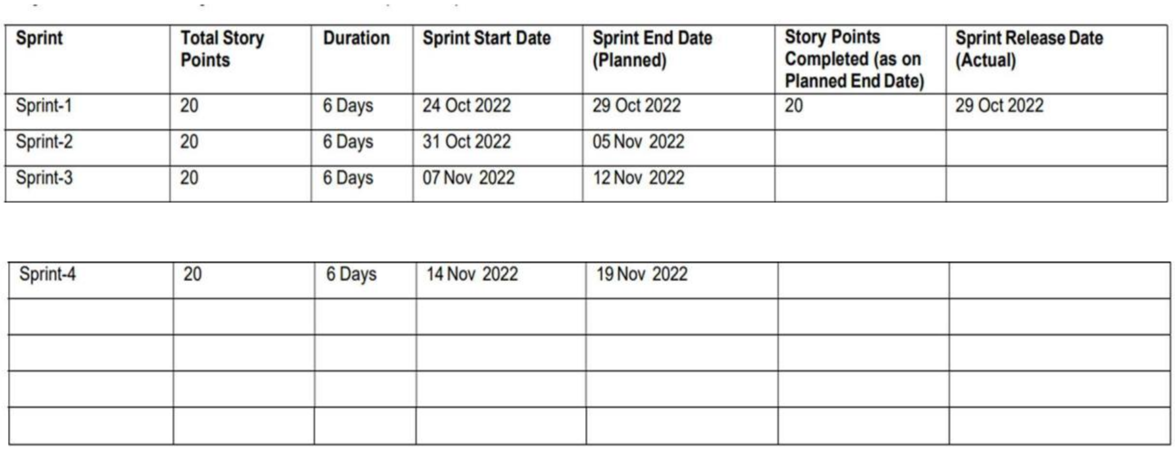
6.PROJECTPLANNING&SCHEDULG

6.1 Sprint Planning & Estimation



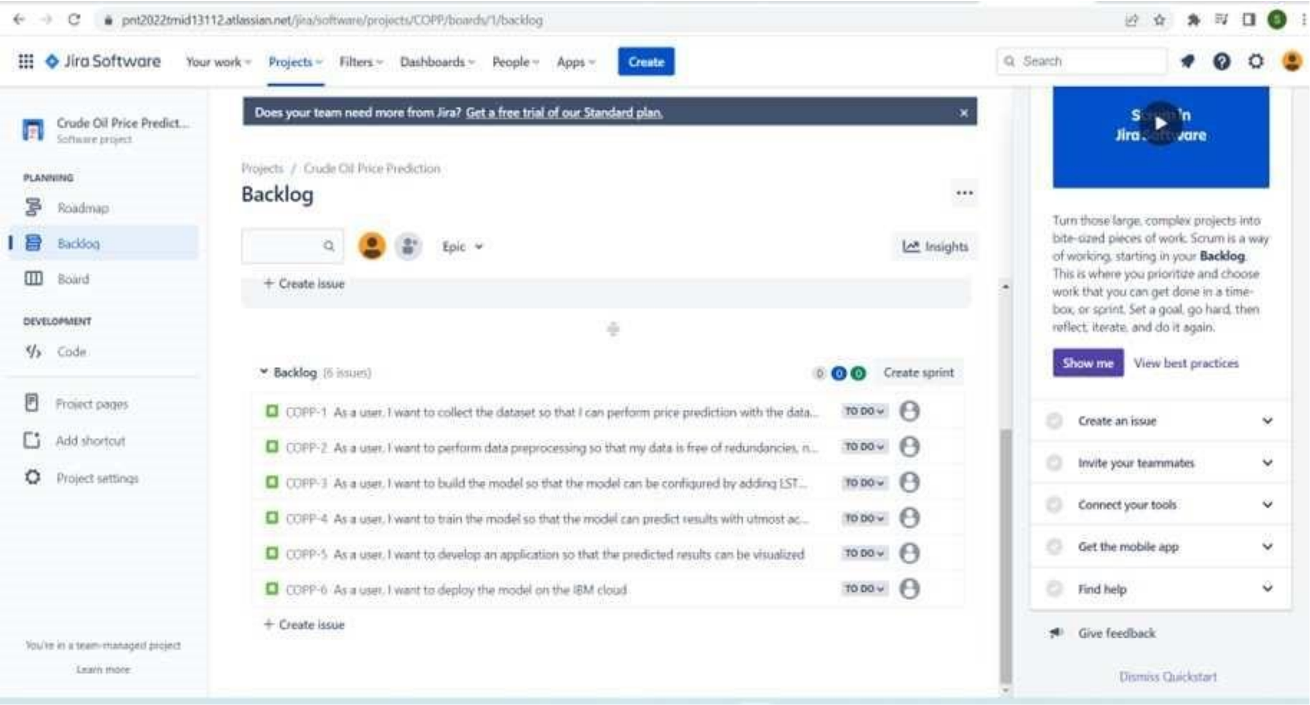
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Registration	USN-3	As a user, I can register for the application by entering my email, password, and confirming my password.	10	High	SUBIN.T
Sprint-2		USN-4	As a user, I will receive confirmation email once I have registered for the application	10	High	HARIPRASAD.P
Sprint-2	Login	USN-5	As a user, I can log into the application by entering email & password.	15	High	SUBIN.T
Sprint-1	Input Necessary Details	USN-1	As a user, I can give Input Details to Predict Likeliness of crude oil	15	High	AFZAL.A
Sprint-1	Data Pre-processing	USN-2	Transform raw data into suitable format for prediction.	15	High	NANJUNDESWARAN
Sprint-3	Prediction of Crude Oil Price	USN-6	As a user, I can predict Crude oil using machine learning model.	20	High	HARIPRASAD.P
Sprint-3		USN-7	As a user, I can get accurate prediction of crude oil	5	Medium	NANJUNDESWARAN
Sprint-4	Review	USN-8	As a user, I can give feedback of the application.	20	High	AFZAL.A

6.2 Sprint Delivery Schedule



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		

6.3 Reports From JIRA

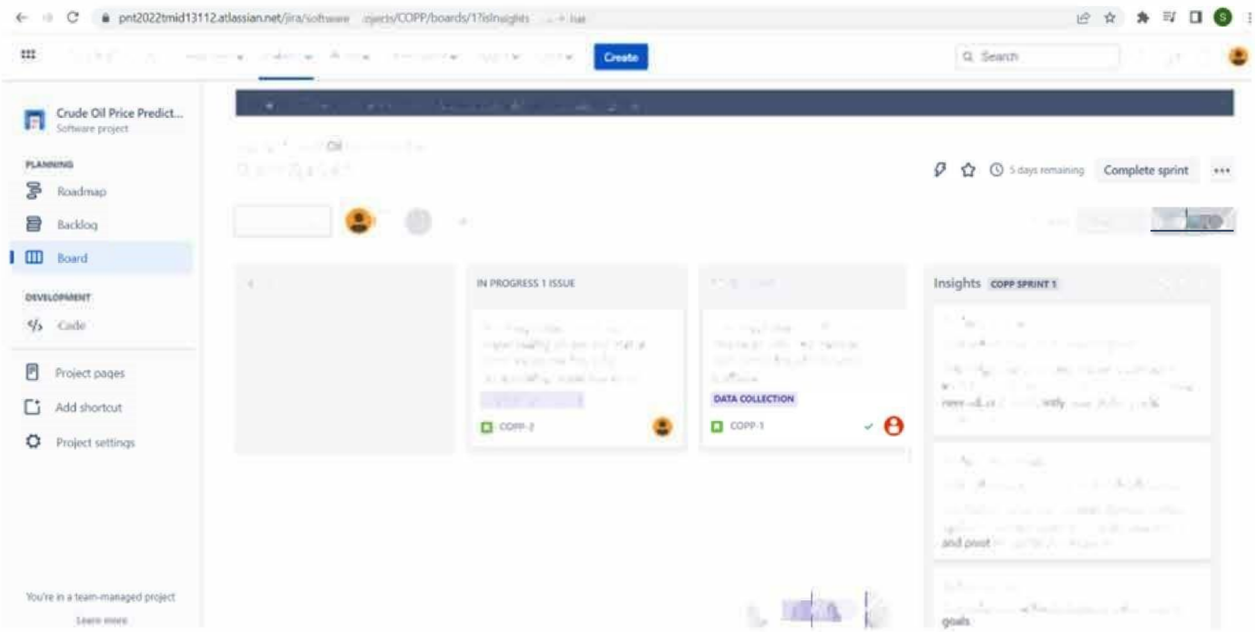


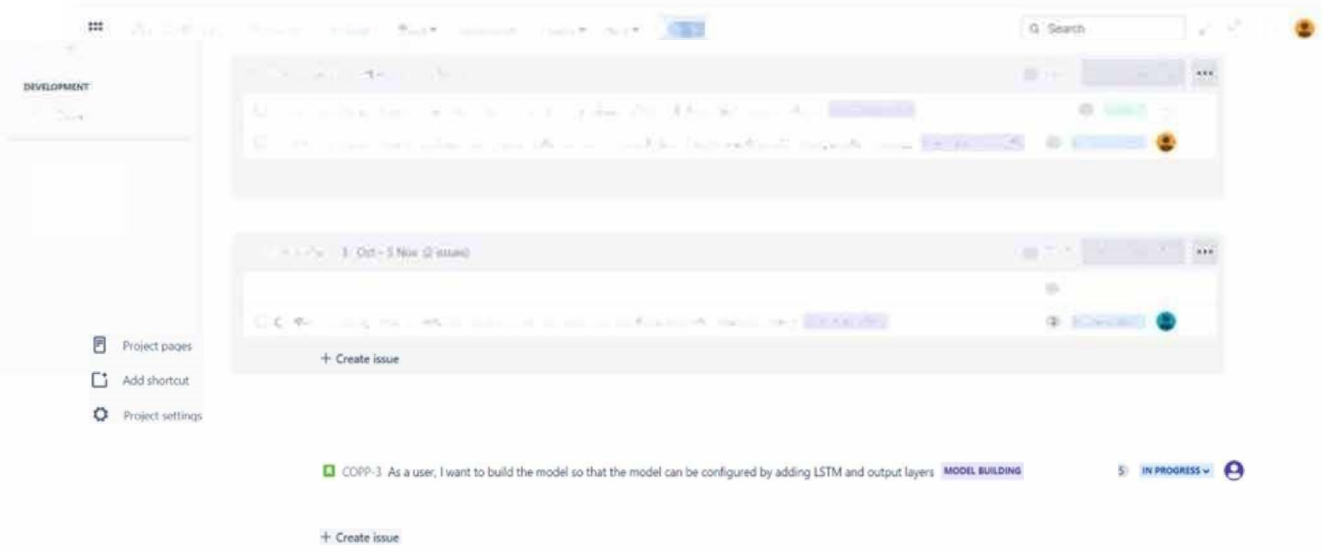
Backlog

Backlog (6 issues) 0 0 0

- COPP-1 As a user, I want to collect the dataset so that I can perform price prediction with the data...
- COPP-2 As a user, I want to perform data preprocessing so that my data is free of redundancies, n...
- COPP-3 As a user, I want to build the model so that the model can be configured by adding LST...
- COPP-4 As a user, I want to train the model so that the model can predict results with utmost ac...
- COPP-5 As a user, I want to develop an application so that the predicted results can be visualized
- COPP-6 As a user, I want to deploy the model on the IBM cloud

Turn those large, complex projects into bite-sized pieces of work. Scrum is a way of working, starting in your **Backlog**. This is where you prioritize and choose work that you can get done in a time-box, or sprint. Set a goal, go hard, then reflect, iterate, and do it again.





COPP-3 As a user, I want to build the model so that the model can be configured by adding LSTM and output layers MODEL BUILDING 5 IN PROGRESS

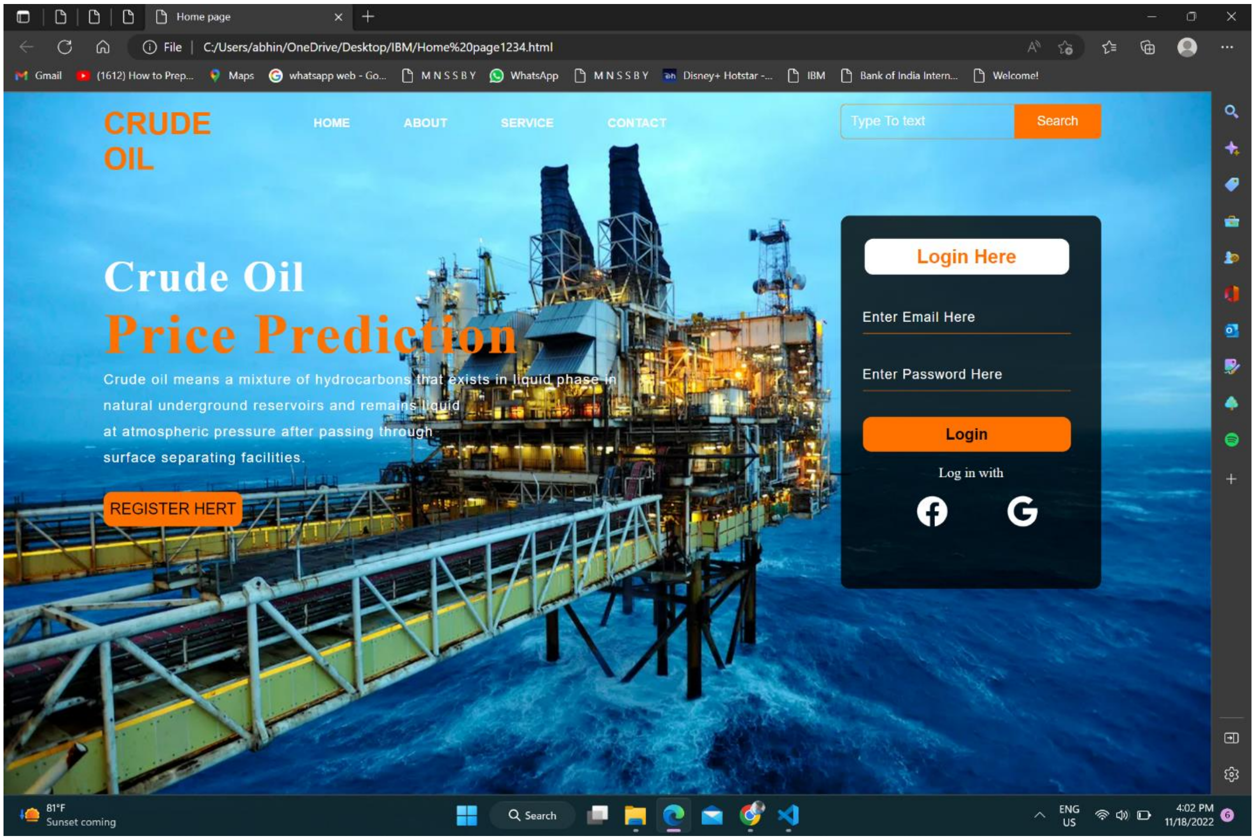
7.CODING AND SOLUTIONING

(explain the features add in the project along with code)

7.1 Feature 1

- ❖ The crude oil prediction website provides two options
  - ➢ Home
  - ➢ predict

- ❖ The home allows the user to have an insight on the importance of crude oil price prediction
- ❖ The predict allows the user to give the 10 days input and arrive at the prediction results

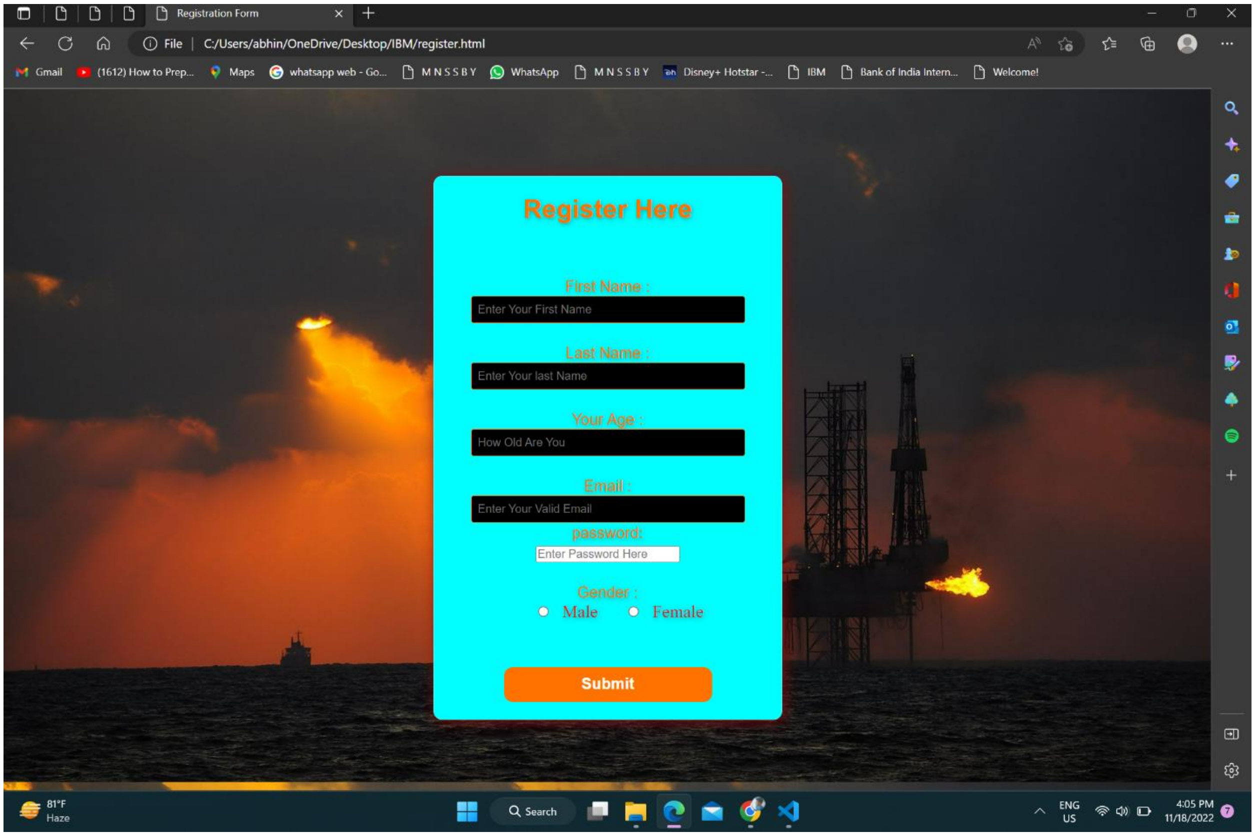


Crude Oil

Price Prediction

Crude oil means a mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities.

Figure 1



Register Here

First Name :
Enter Your First Name

Last Name :
Enter Your last Name

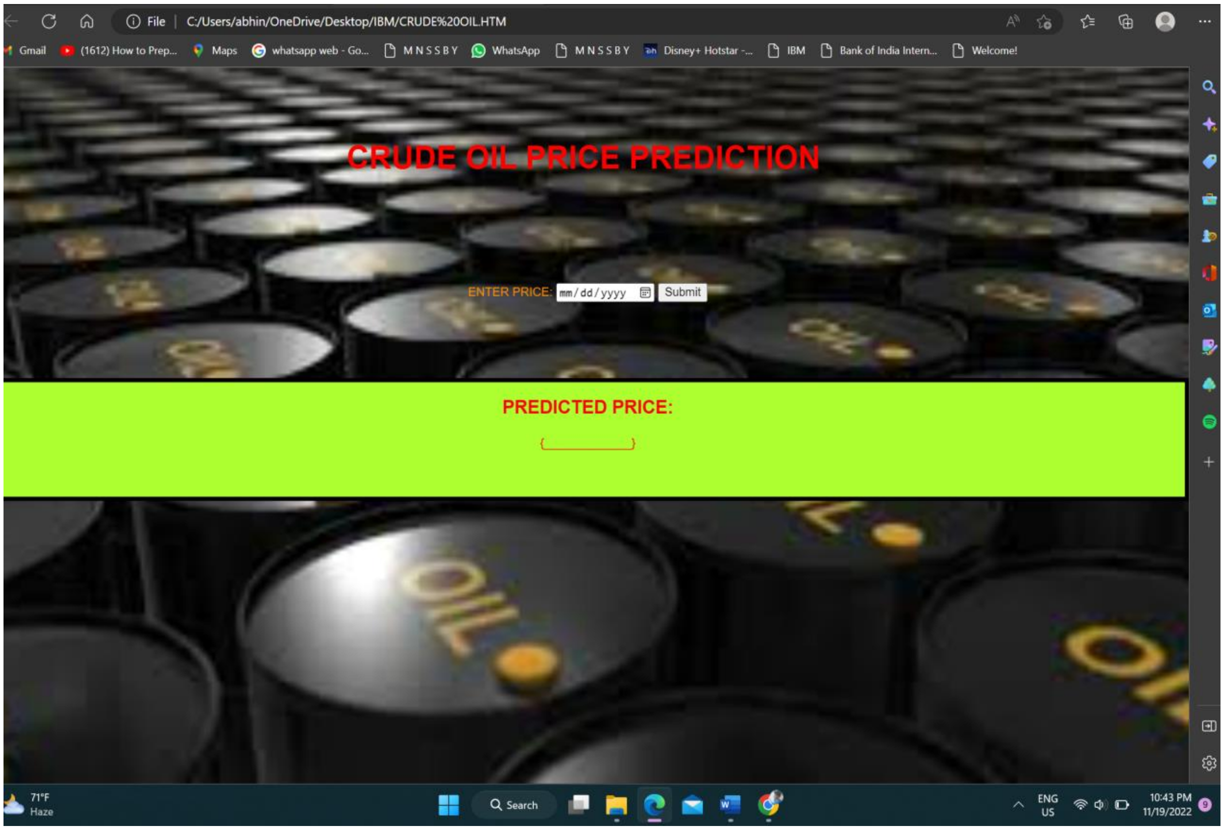
Your Age :
How Old Are You

Email :
Enter Your Valid Email

password:
Enter Password Here

Gender :
○ Male ○ Female

Figure 2

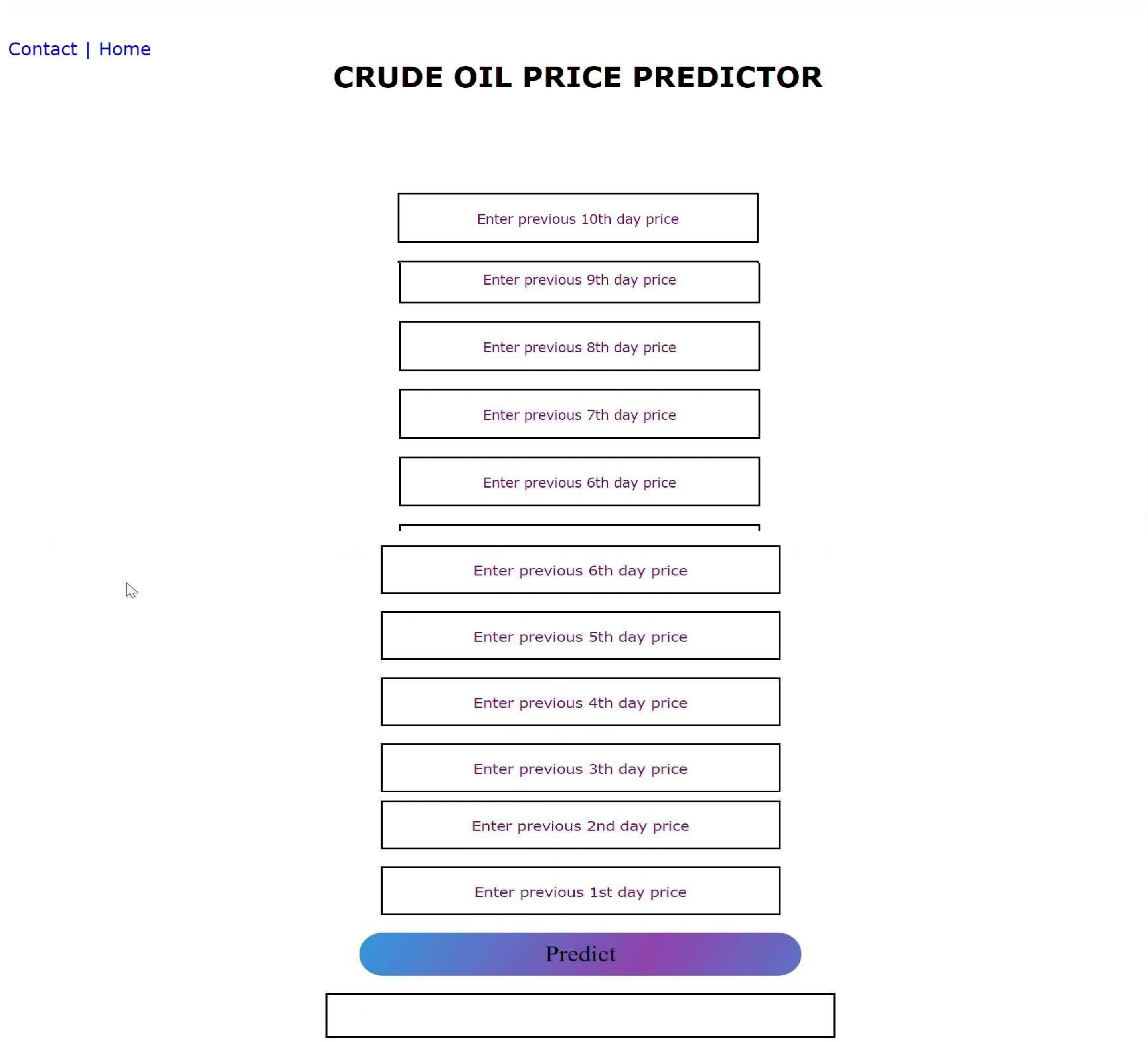


CRUDE OIL PRICE PREDICTION

ENTER PRICE: mm/dd/yyyy Submit

PREDICTED PRICE:

Figure 3



Contact | Home

CRUDE OIL PRICE PREDICTOR

Enter previous 10th day price

Enter previous 9th day price

Enter previous 8th day price

Enter previous 7th day price

Enter previous 6th day price

Enter previous 6th day price

Enter previous 5th day price

Enter previous 4th day price

Enter previous 3th day price

Enter previous 2nd day price

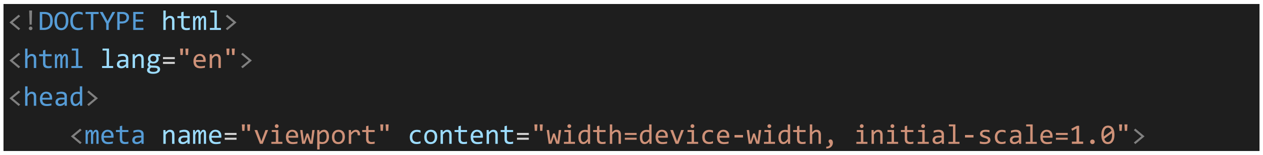
Enter previous 1st day price

Predict

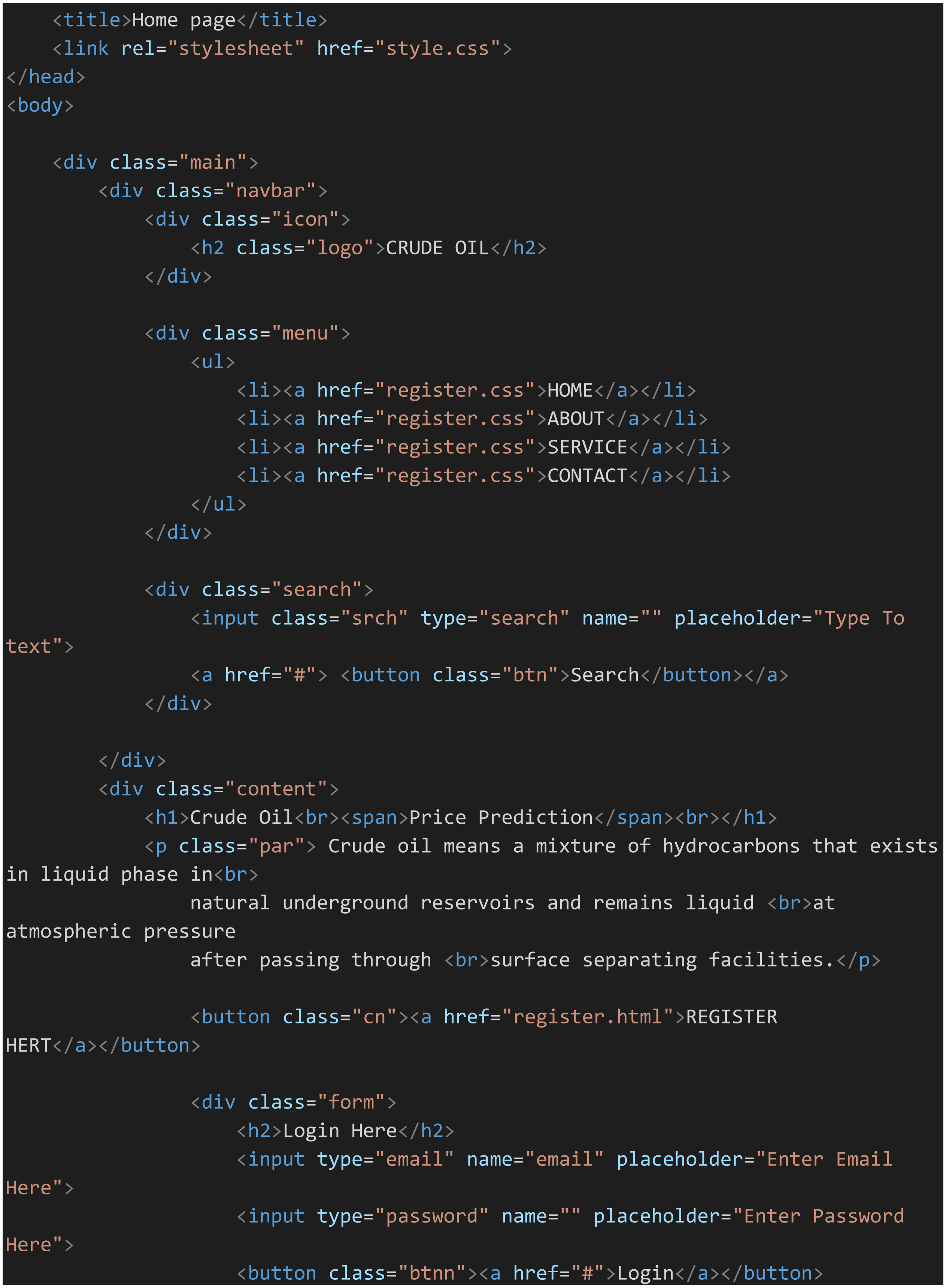
CODE

Home Page:

.HTML



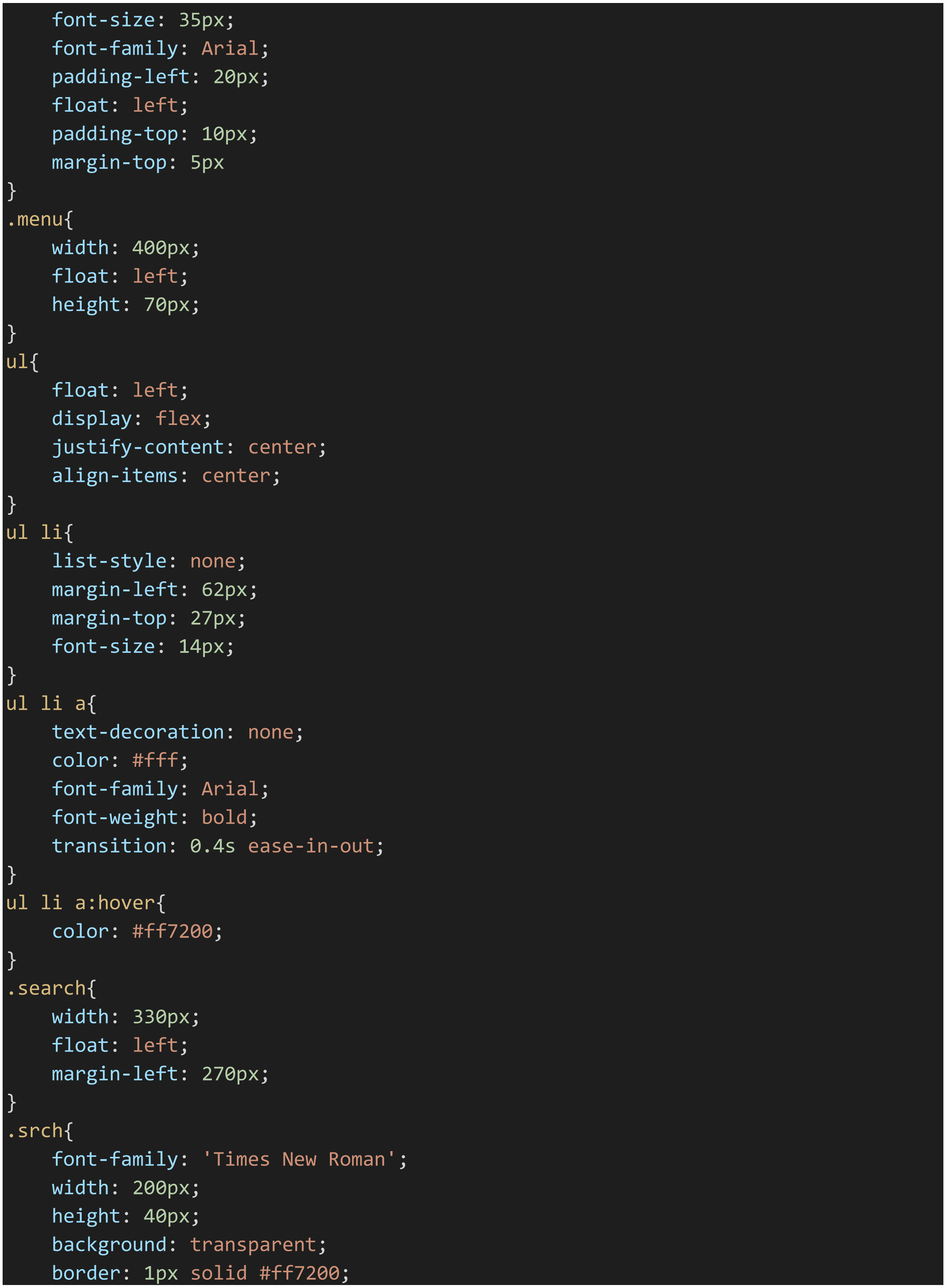
```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
```



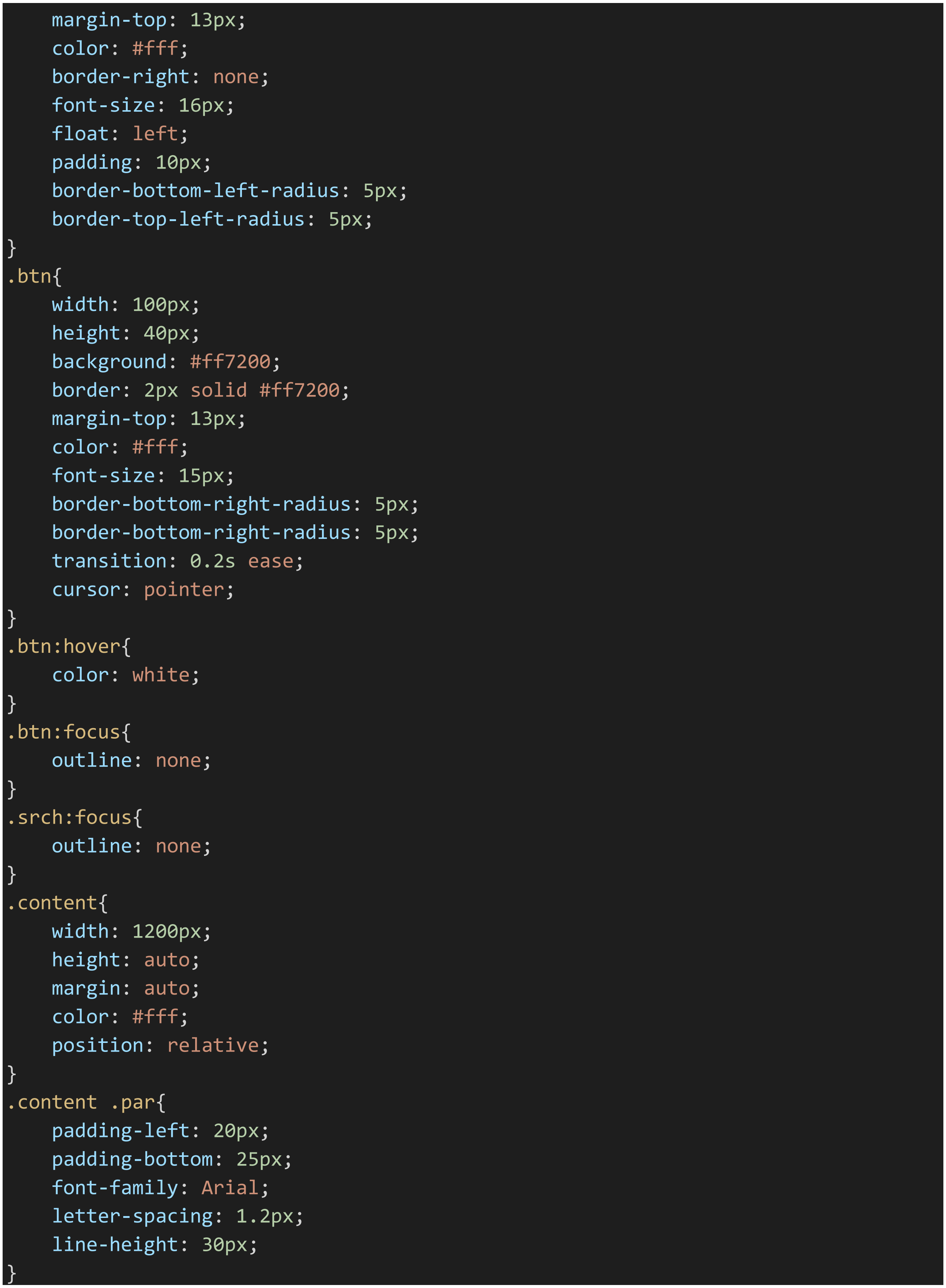
```html
    <title>Home page</title>
    <link rel="stylesheet" href="style.css">
</head>
<body>

    <div class="main">
        <div class="navbar">
            <div class="icon">
                <h2 class="logo">CRUDE OIL</h2>
            </div>

            <div class="menu">
                <ul>
                    <li><a href="register.css">HOME</a></li>
                    <li><a href="register.css">ABOUT</a></li>
                    <li><a href="register.css">SERVICE</a></li>
                    <li><a href="register.css">CONTACT</a></li>
                </ul>
            </div>

            <div class="search">
                <input class="srch" type="search" name="" placeholder="Type To
text">
                <a href="#"> <button class="btn">Search</button></a>
            </div>

        </div>
        <div class="content">
            <h1>Crude Oil<br><span>Price Prediction</span><br></h1>
            <p class="par"> Crude oil means a mixture of hydrocarbons that exists
in liquid phase in<br>
                natural underground reservoirs and remains liquid <br>at
atmospheric pressure
                after passing through <br>surface separating facilities.</p>

                <button class="cn"><a href="register.html">REGISTER
HERT</a></button>

                <div class="form">
                    <h2>Login Here</h2>
                    <input type="email" name="email" placeholder="Enter Email
Here">
                    <input type="password" name="" placeholder="Enter Password
Here">
                    <button class="btnn"><a href="#">Login</a></button>
                    <p class="liw">Log in with</p>

                    <div class="icons">
                        <a href="register.css"><ion-icon name="logo-
facebook"></ion-icon></a>
                        <a href="register.css"><ion-icon name="logo-
google"></ion-icon></a>
                    </div>

                </div>
                    </div>
                </div>
        </div>
    </div>
</body>    <script
src="https://unpkg.com/ionicons@5.4.0/dist/ionicons.js"></script>

</html>
```

.css

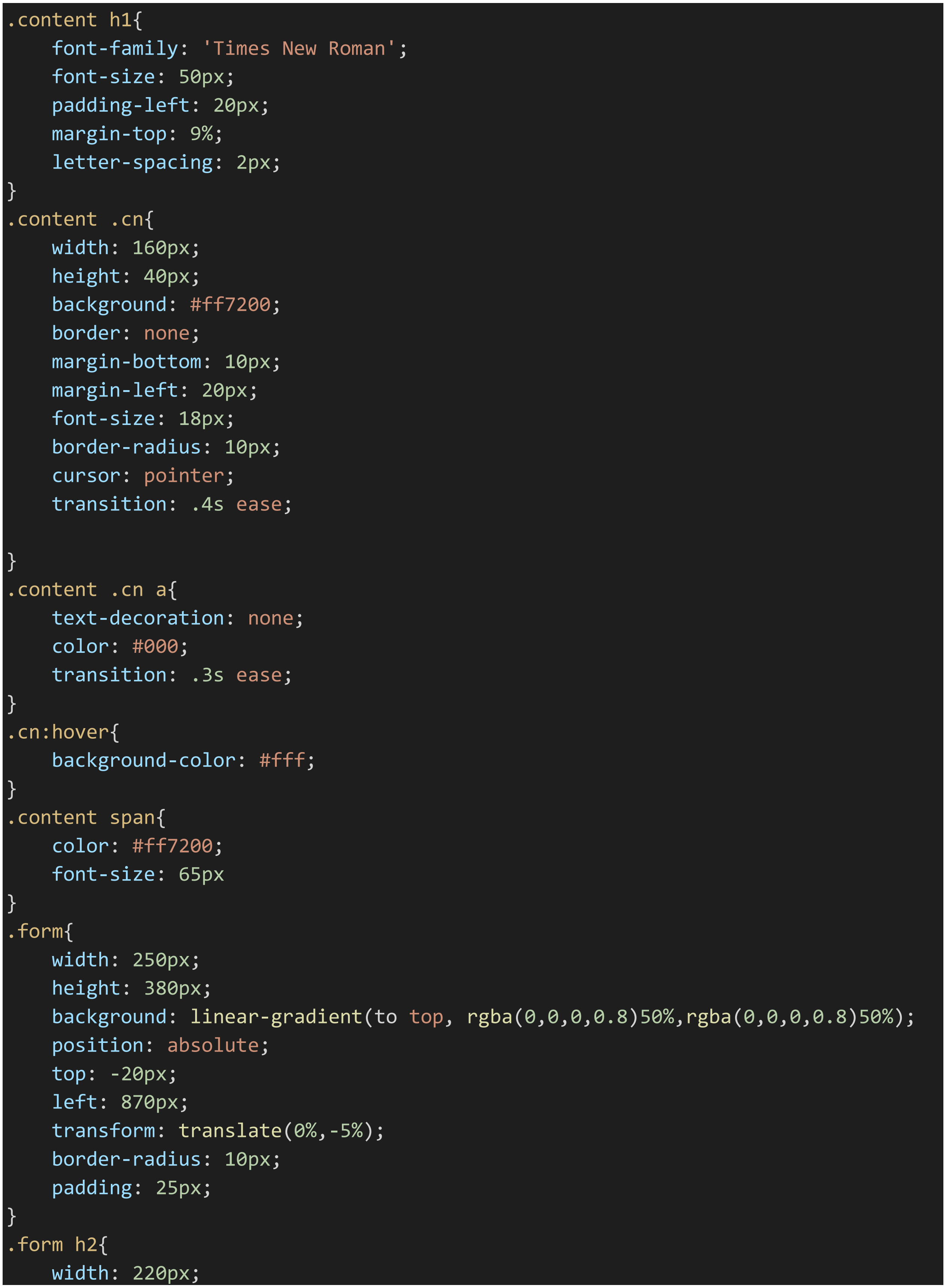
```
*{
    margin: 0;
    padding: 0;
}

.main{
    width: 100%;
    background:url(crud.webp);
    background-position: center;
    background-size: cover;
    height: 100vh;
}
.navbar{
    width: 1200px;
    height: 75px;
    margin: auto;
}
.icon{
    width: 200px;
    float: left;
    height: 70px;
}
.logo{
    color: #ff7200;
```



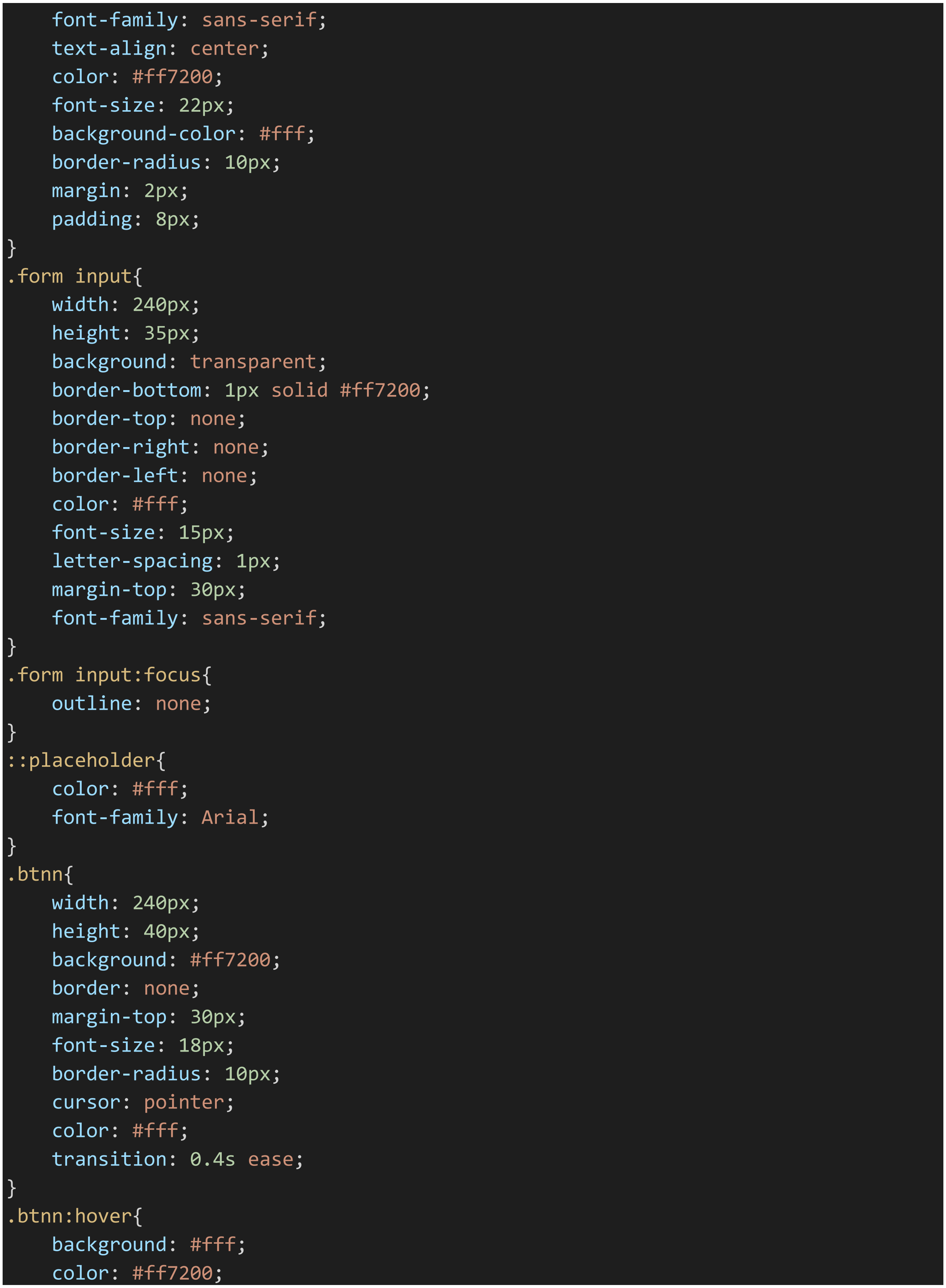
```
    font-size: 35px;
    font-family: Arial;
    padding-left: 20px;
    float: left;
    padding-top: 10px;
    margin-top: 5px
}
.menu{
    width: 400px;
    float: left;
    height: 70px;
}
ul{
    float: left;
    display: flex;
    justify-content: center;
    align-items: center;
}
ul li{
    list-style: none;
    margin-left: 62px;
    margin-top: 27px;
    font-size: 14px;
}
ul li a{
    text-decoration: none;
    color: #fff;
    font-family: Arial;
    font-weight: bold;
    transition: 0.4s ease-in-out;
}
ul li a:hover{
    color: #ff7200;
}
.search{
    width: 330px;
    float: left;
    margin-left: 270px;
}
.srch{
    font-family: 'Times New Roman';
    width: 200px;
    height: 40px;
    background: transparent;
    border: 1px solid #ff7200;
```



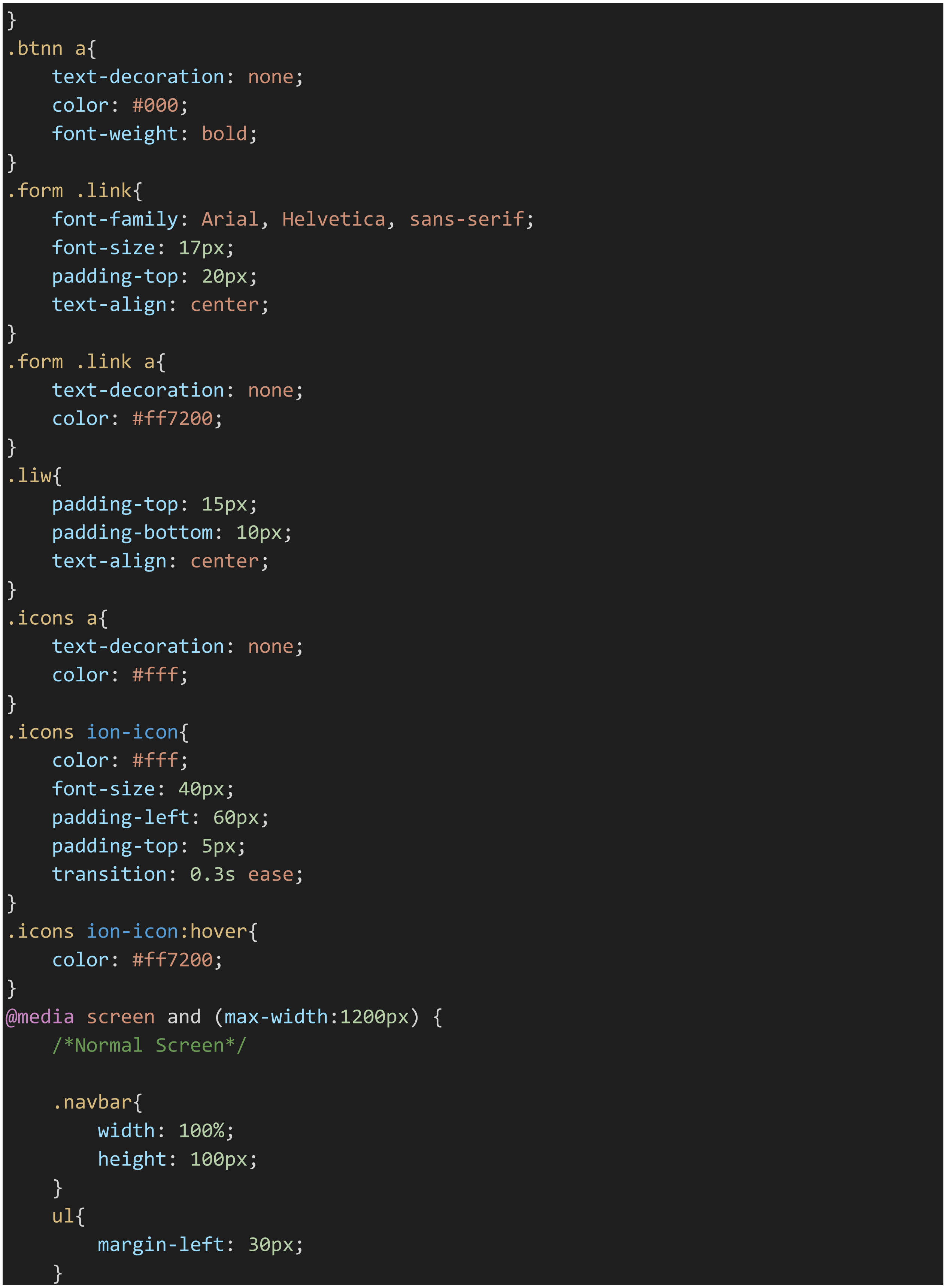
```
    margin-top: 13px;
    color: #fff;
    border-right: none;
    font-size: 16px;
    float: left;
    padding: 10px;
    border-bottom-left-radius: 5px;
    border-top-left-radius: 5px;
}
.btn{
    width: 100px;
    height: 40px;
    background: #ff7200;
    border: 2px solid #ff7200;
    margin-top: 13px;
    color: #fff;
    font-size: 15px;
    border-bottom-right-radius: 5px;
    border-bottom-right-radius: 5px;
    transition: 0.2s ease;
    cursor: pointer;
}
.btn:hover{
    color: white;
}
.btn:focus{
    outline: none;
}
.srch:focus{
    outline: none;
}
.content{
    width: 1200px;
    height: auto;
    margin: auto;
    color: #fff;
    position: relative;
}
.content .par{
    padding-left: 20px;
    padding-bottom: 25px;
    font-family: Arial;
    letter-spacing: 1.2px;
    line-height: 30px;
}
```



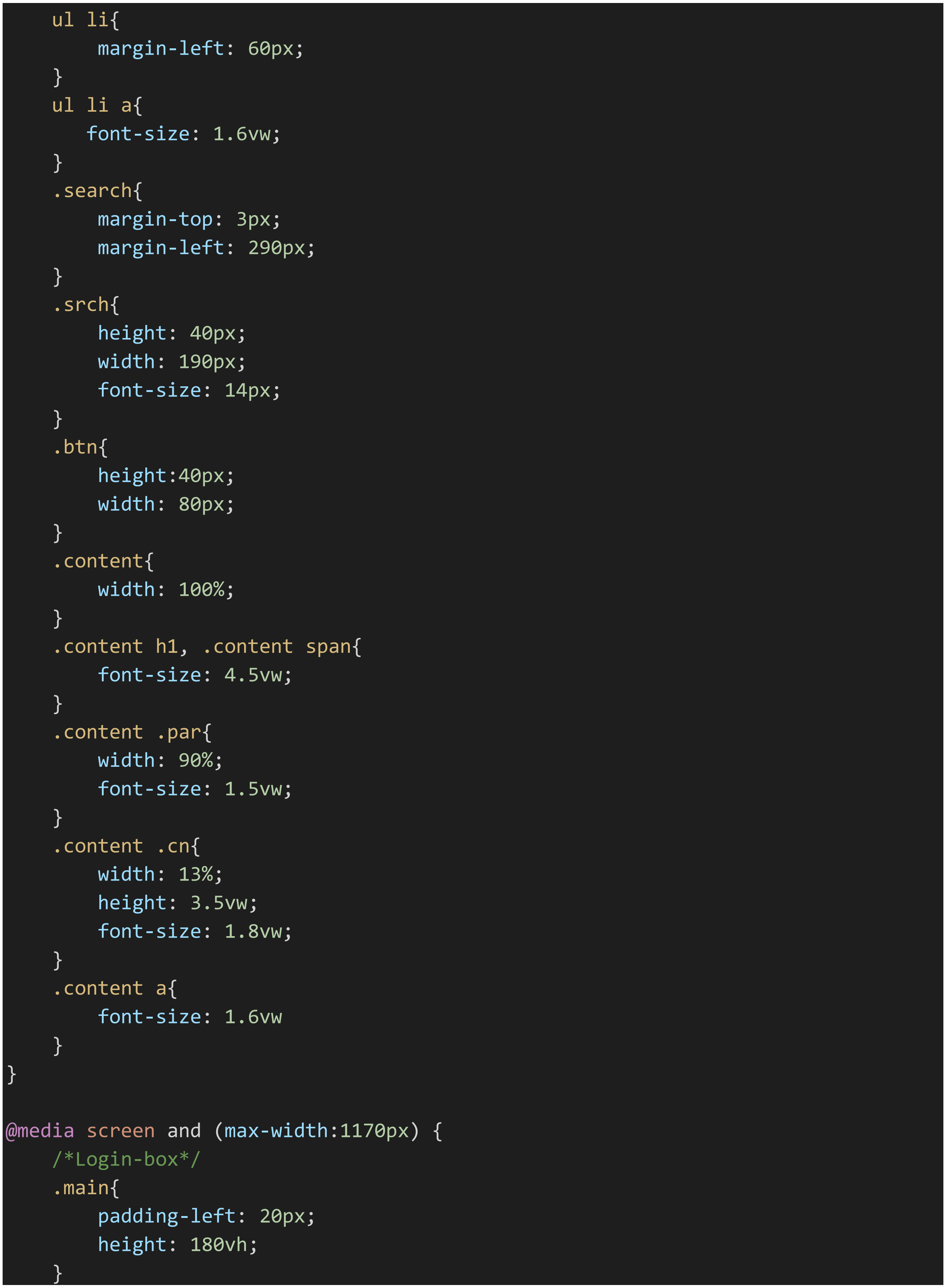
```
.content h1{
    font-family: 'Times New Roman';
    font-size: 50px;
    padding-left: 20px;
    margin-top: 9%;
    letter-spacing: 2px;
}
.content .cn{
    width: 160px;
    height: 40px;
    background: #ff7200;
    border: none;
    margin-bottom: 10px;
    margin-left: 20px;
    font-size: 18px;
    border-radius: 10px;
    cursor: pointer;
    transition: .4s ease;

}
.content .cn a{
    text-decoration: none;
    color: #000;
    transition: .3s ease;
}
.cn:hover{
    background-color: #fff;
}
.content span{
    color: #ff7200;
    font-size: 65px
}
.form{
    width: 250px;
    height: 380px;
    background: linear-gradient(to top, rgba(0,0,0,0.8)50%,rgba(0,0,0,0.8)50%);
    position: absolute;
    top: -20px;
    left: 870px;
    transform: translate(0%,-5%);
    border-radius: 10px;
    padding: 25px;
}
.form h2{
    width: 220px;
```



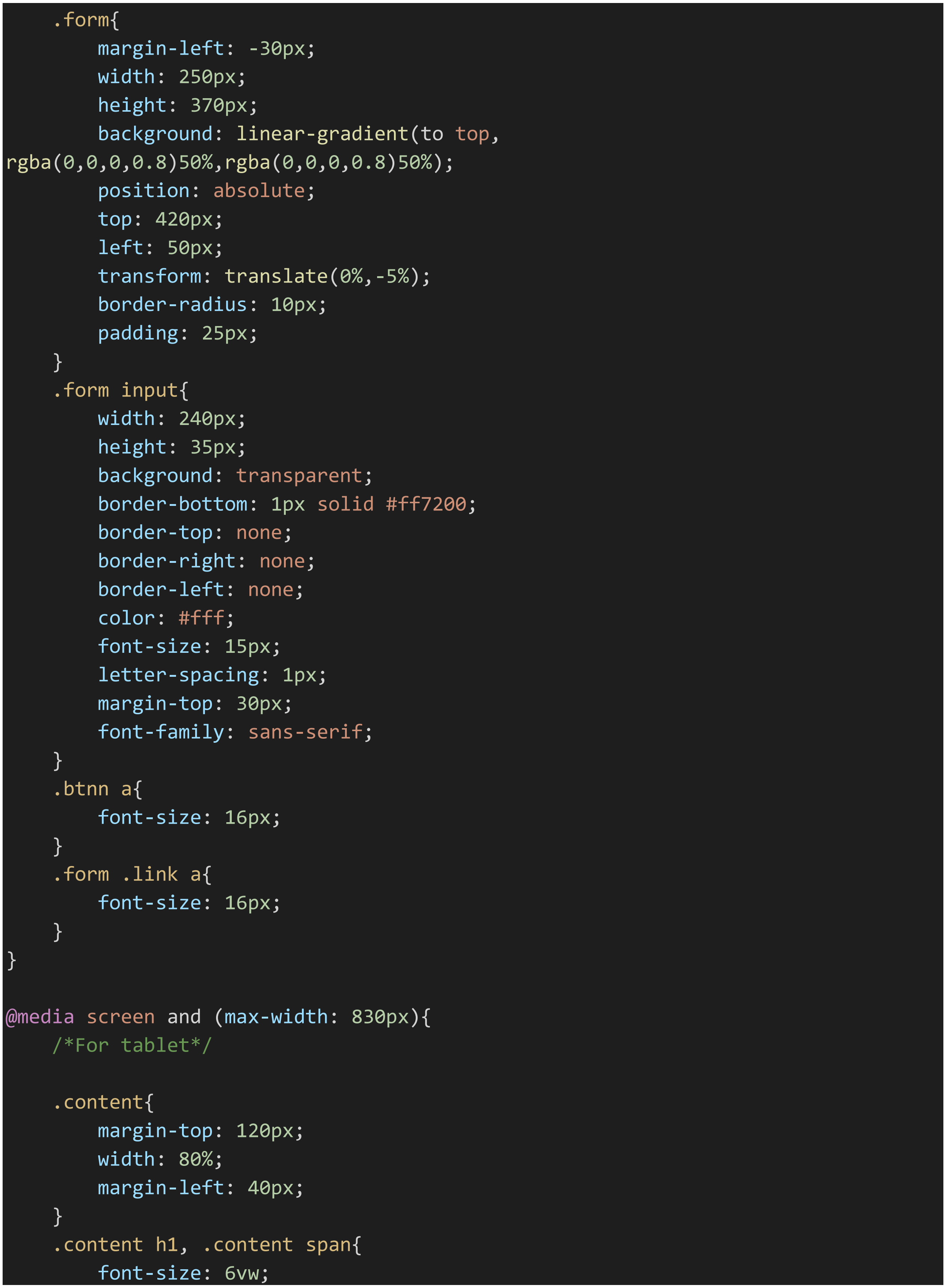
```
    font-family: sans-serif;
    text-align: center;
    color: #ff7200;
    font-size: 22px;
    background-color: #fff;
    border-radius: 10px;
    margin: 2px;
    padding: 8px;
}
.form input{
    width: 240px;
    height: 35px;
    background: transparent;
    border-bottom: 1px solid #ff7200;
    border-top: none;
    border-right: none;
    border-left: none;
    color: #fff;
    font-size: 15px;
    letter-spacing: 1px;
    margin-top: 30px;
    font-family: sans-serif;
}
.form input:focus{
    outline: none;
}
::placeholder{
    color: #fff;
    font-family: Arial;
}
.btnn{
    width: 240px;
    height: 40px;
    background: #ff7200;
    border: none;
    margin-top: 30px;
    font-size: 18px;
    border-radius: 10px;
    cursor: pointer;
    color: #fff;
    transition: 0.4s ease;
}
.btnn:hover{
    background: #fff;
    color: #ff7200;
```



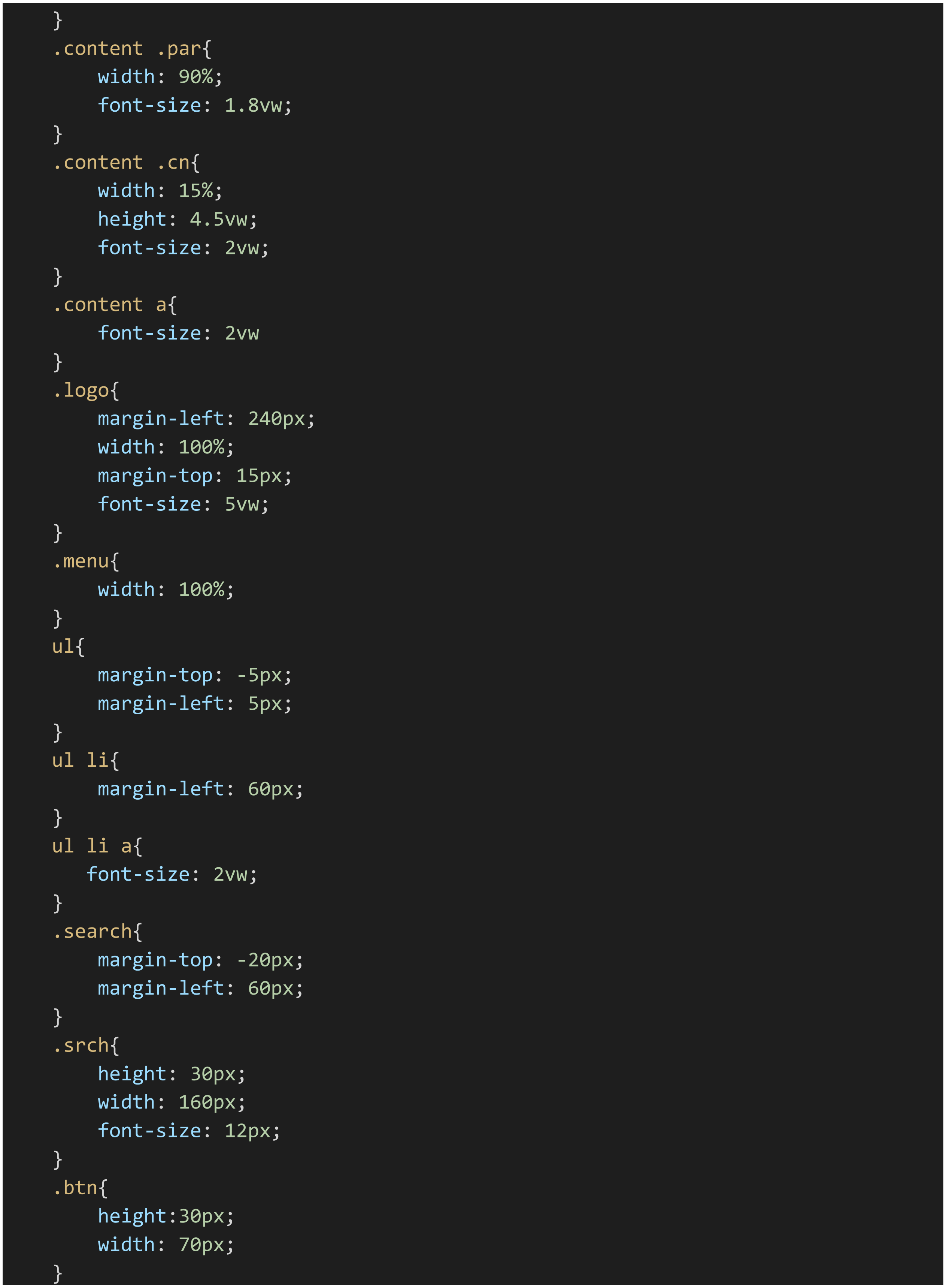
```css
}
.btnn a{
    text-decoration: none;
    color: #000;
    font-weight: bold;
}
.form .link{
    font-family: Arial, Helvetica, sans-serif;
    font-size: 17px;
    padding-top: 20px;
    text-align: center;
}
.form .link a{
    text-decoration: none;
    color: #ff7200;
}
.liw{
    padding-top: 15px;
    padding-bottom: 10px;
    text-align: center;
}
.icons a{
    text-decoration: none;
    color: #fff;
}
.icons ion-icon{
    color: #fff;
    font-size: 40px;
    padding-left: 60px;
    padding-top: 5px;
    transition: 0.3s ease;
}
.icons ion-icon:hover{
    color: #ff7200;
}
@media screen and (max-width:1200px) {
    /*Normal Screen*/

    .navbar{
        width: 100%;
        height: 100px;
    }
    ul{
        margin-left: 30px;
    }
```



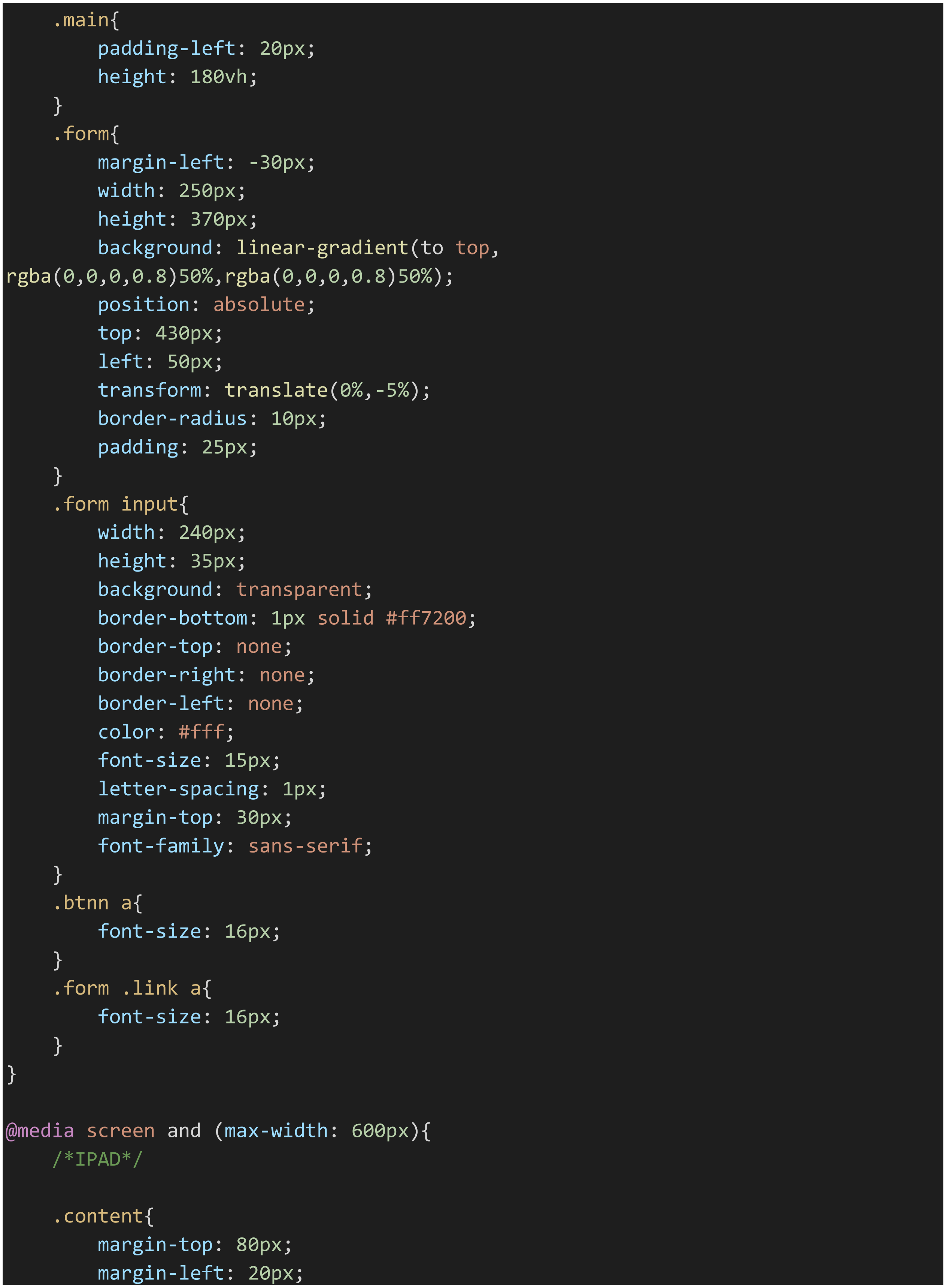
```
    ul li{
        margin-left: 60px;
    }
    ul li a{
       font-size: 1.6vw;
    }
    .search{
        margin-top: 3px;
        margin-left: 290px;
    }
    .srch{
        height: 40px;
        width: 190px;
        font-size: 14px;
    }
    .btn{
        height:40px;
        width: 80px;
    }
    .content{
        width: 100%;
    }
    .content h1, .content span{
        font-size: 4.5vw;
    }
    .content .par{
        width: 90%;
        font-size: 1.5vw;
    }
    .content .cn{
        width: 13%;
        height: 3.5vw;
        font-size: 1.8vw;
    }
    .content a{
        font-size: 1.6vw
    }
}

@media screen and (max-width:1170px) {
    /*Login-box*/
    .main{
        padding-left: 20px;
        height: 180vh;
    }
```



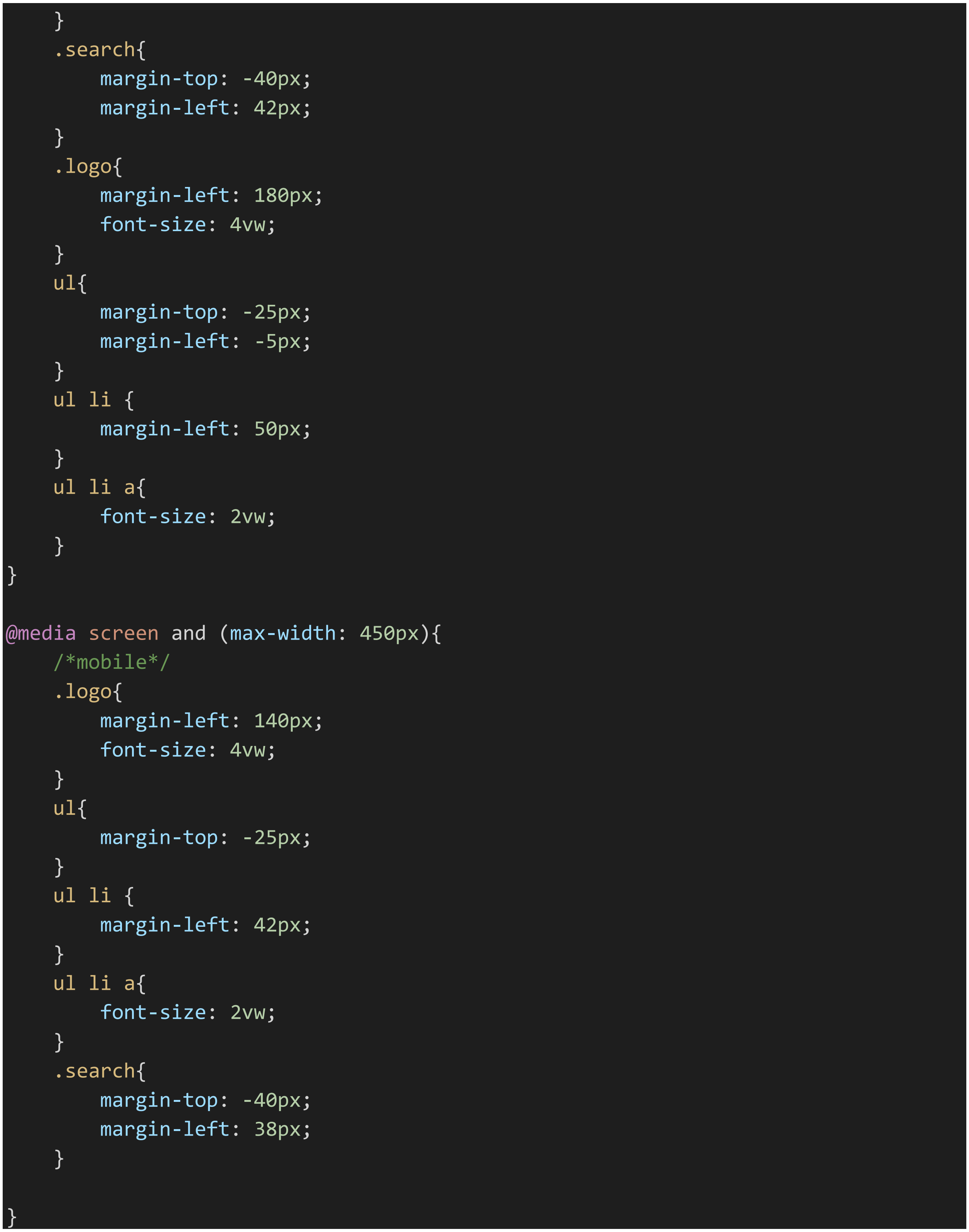
```
    .form{
        margin-left: -30px;
        width: 250px;
        height: 370px;
        background: linear-gradient(to top,
rgba(0,0,0,0.8)50%,rgba(0,0,0,0.8)50%);
        position: absolute;
        top: 420px;
        left: 50px;
        transform: translate(0%,-5%);
        border-radius: 10px;
        padding: 25px;
    }
    .form input{
        width: 240px;
        height: 35px;
        background: transparent;
        border-bottom: 1px solid #ff7200;
        border-top: none;
        border-right: none;
        border-left: none;
        color: #fff;
        font-size: 15px;
        letter-spacing: 1px;
        margin-top: 30px;
        font-family: sans-serif;
    }
    .btnn a{
        font-size: 16px;
    }
    .form .link a{
        font-size: 16px;
    }
}

@media screen and (max-width: 830px){
    /*For tablet*/

    .content{
        margin-top: 120px;
        width: 80%;
        margin-left: 40px;
    }
    .content h1, .content span{
        font-size: 6vw;
```



```
    }
    .content .par{
        width: 90%;
        font-size: 1.8vw;
    }
    .content .cn{
        width: 15%;
        height: 4.5vw;
        font-size: 2vw;
    }
    .content a{
        font-size: 2vw
    }
    .logo{
        margin-left: 240px;
        width: 100%;
        margin-top: 15px;
        font-size: 5vw;
    }
    .menu{
        width: 100%;
    }
    ul{
        margin-top: -5px;
        margin-left: 5px;
    }
    ul li{
        margin-left: 60px;
    }
    ul li a{
       font-size: 2vw;
    }
    .search{
        margin-top: -20px;
        margin-left: 60px;
    }
    .srch{
        height: 30px;
        width: 160px;
        font-size: 12px;
    }
    .btn{
        height:30px;
        width: 70px;
    }
```



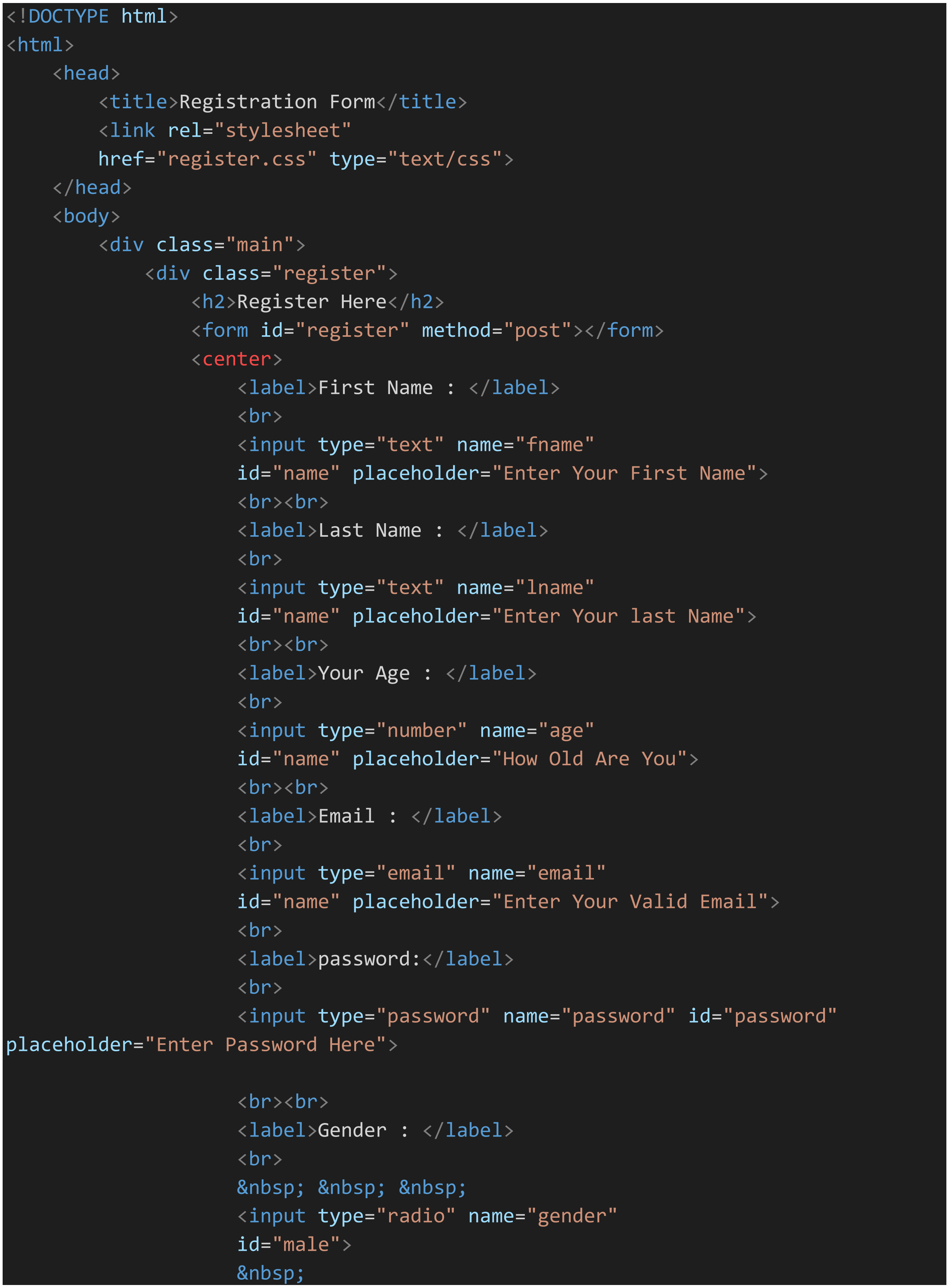
```
    .main{
        padding-left: 20px;
        height: 180vh;
    }
    .form{
        margin-left: -30px;
        width: 250px;
        height: 370px;
        background: linear-gradient(to top,
rgba(0,0,0,0.8)50%,rgba(0,0,0,0.8)50%);
        position: absolute;
        top: 430px;
        left: 50px;
        transform: translate(0%,-5%);
        border-radius: 10px;
        padding: 25px;
    }
    .form input{
        width: 240px;
        height: 35px;
        background: transparent;
        border-bottom: 1px solid #ff7200;
        border-top: none;
        border-right: none;
        border-left: none;
        color: #fff;
        font-size: 15px;
        letter-spacing: 1px;
        margin-top: 30px;
        font-family: sans-serif;
    }
    .btnn a{
        font-size: 16px;
    }
    .form .link a{
        font-size: 16px;
    }
}

@media screen and (max-width: 600px){
    /*IPAD*/

    .content{
        margin-top: 80px;
        margin-left: 20px;
```



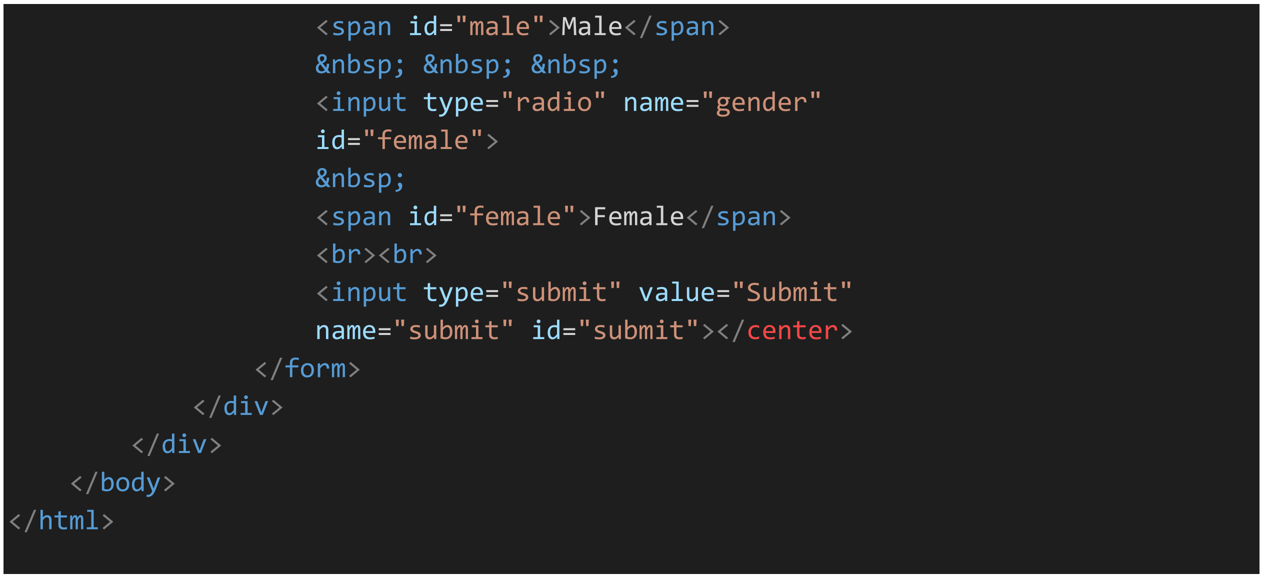
```
    }
    .search{
        margin-top: -40px;
        margin-left: 42px;
    }
    .logo{
        margin-left: 180px;
        font-size: 4vw;
    }
    ul{
        margin-top: -25px;
        margin-left: -5px;
    }
    ul li {
        margin-left: 50px;
    }
    ul li a{
        font-size: 2vw;
    }
}

@media screen and (max-width: 450px){
    /*mobile*/
    .logo{
        margin-left: 140px;
        font-size: 4vw;
    }
    ul{
        margin-top: -25px;
    }
    ul li {
        margin-left: 42px;
    }
    ul li a{
        font-size: 2vw;
    }
    .search{
        margin-top: -40px;
        margin-left: 38px;
    }

}
```

.REGISTER PAGE:

HTML

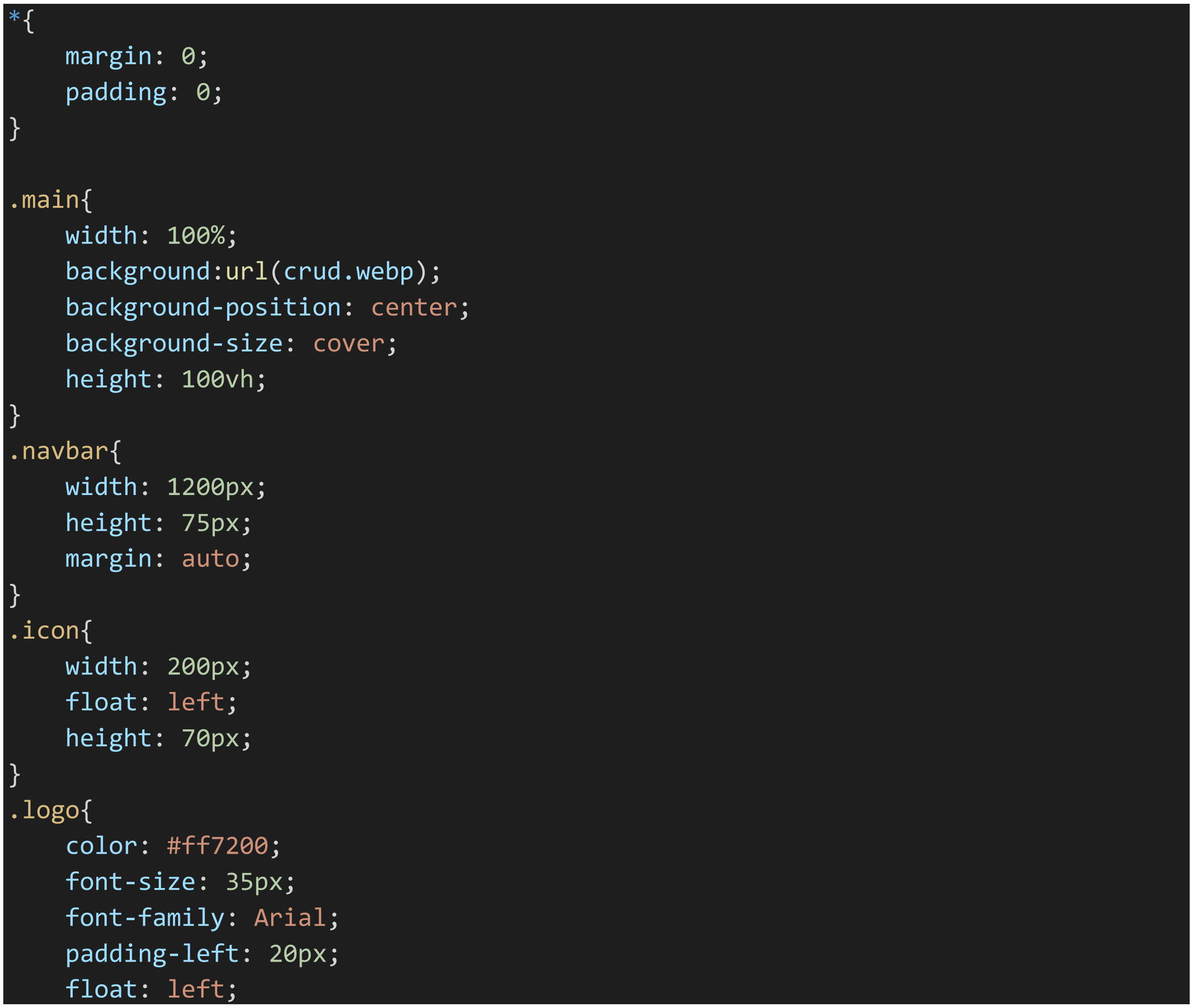


```
<!DOCTYPE html>
<html>
    <head>
        <title>Registration Form</title>
        <link rel="stylesheet"
        href="register.css" type="text/css">
    </head>
    <body>
        <div class="main">
            <div class="register">
                <h2>Register Here</h2>
                <form id="register" method="post"></form>
                <center>
                    <label>First Name : </label>
                    <br>
                    <input type="text" name="fname"
                    id="name" placeholder="Enter Your First Name">
                    <br><br>
                    <label>Last Name : </label>
                    <br>
                    <input type="text" name="lname"
                    id="name" placeholder="Enter Your last Name">
                    <br><br>
                    <label>Your Age : </label>
                    <br>
                    <input type="number" name="age"
                    id="name" placeholder="How Old Are You">
                    <br><br>
                    <label>Email : </label>
                    <br>
                    <input type="email" name="email"
                    id="name" placeholder="Enter Your Valid Email">
                    <br>
                    <label>password:</label>
                    <br>
                    <input type="password" name="password" id="password"
placeholder="Enter Password Here">

                    <br><br>
                    <label>Gender : </label>
                    <br>
                    &nbsp; &nbsp; &nbsp;
                    <input type="radio" name="gender"
                    id="male">
                    &nbsp;
```

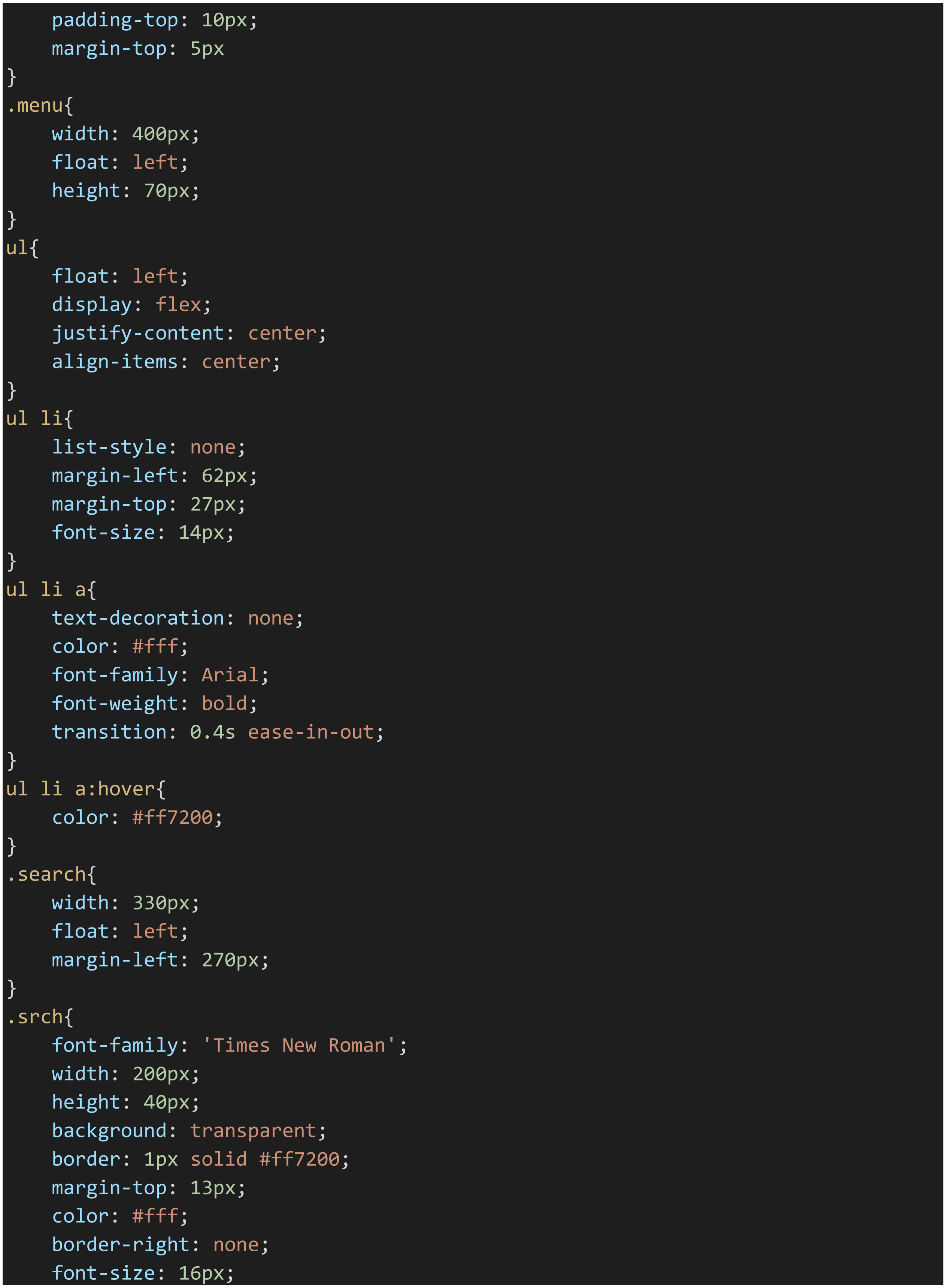


```
                    <span id="male">Male</span>
                    &nbsp; &nbsp; &nbsp;
                    <input type="radio" name="gender"
                    id="female">
                    &nbsp;
                    <span id="female">Female</span>
                    <br><br>
                    <input type="submit" value="Submit"
                    name="submit" id="submit"></center>
                </form>
            </div>
        </div>
    </body>
</html>
```

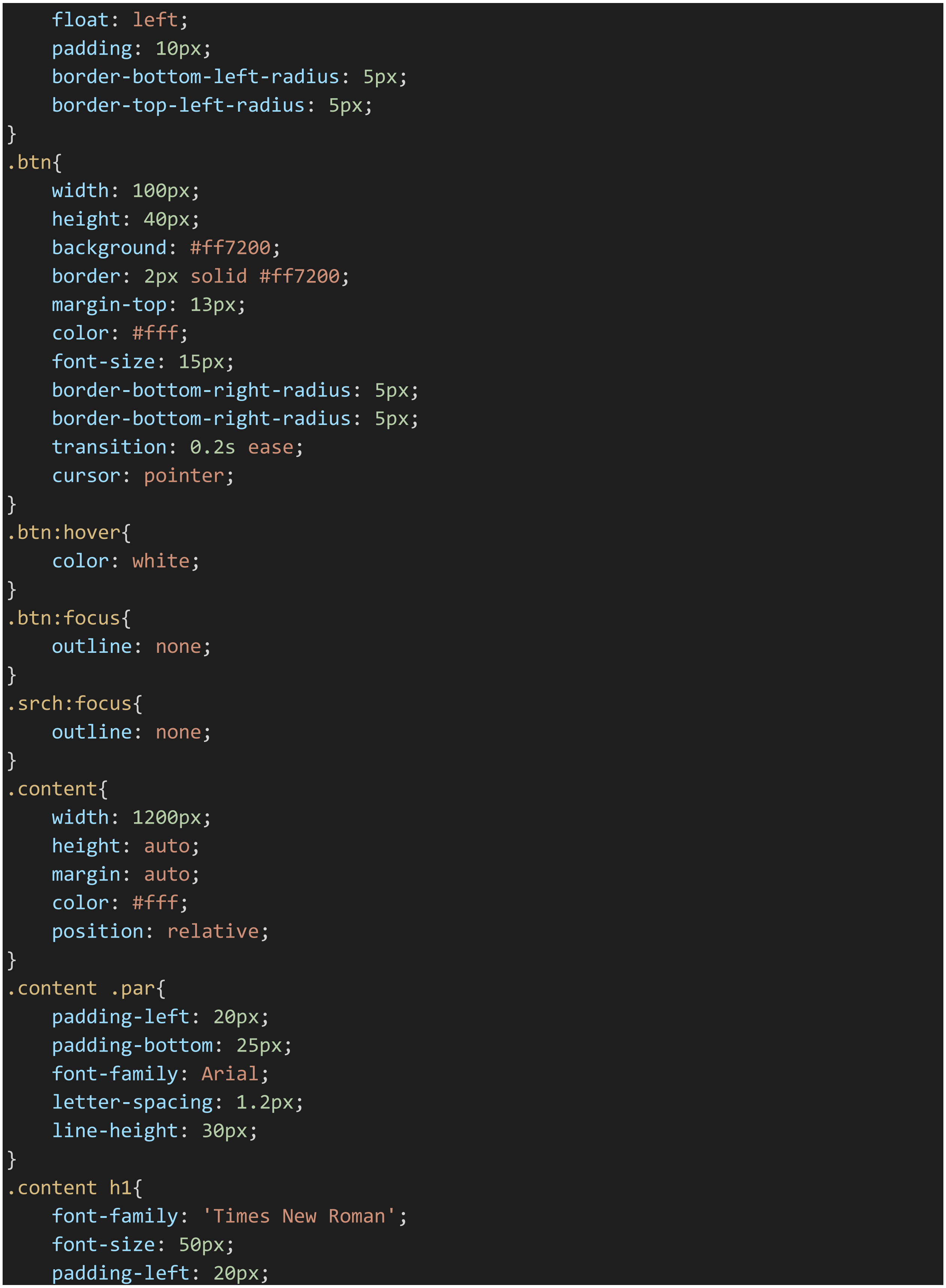
css



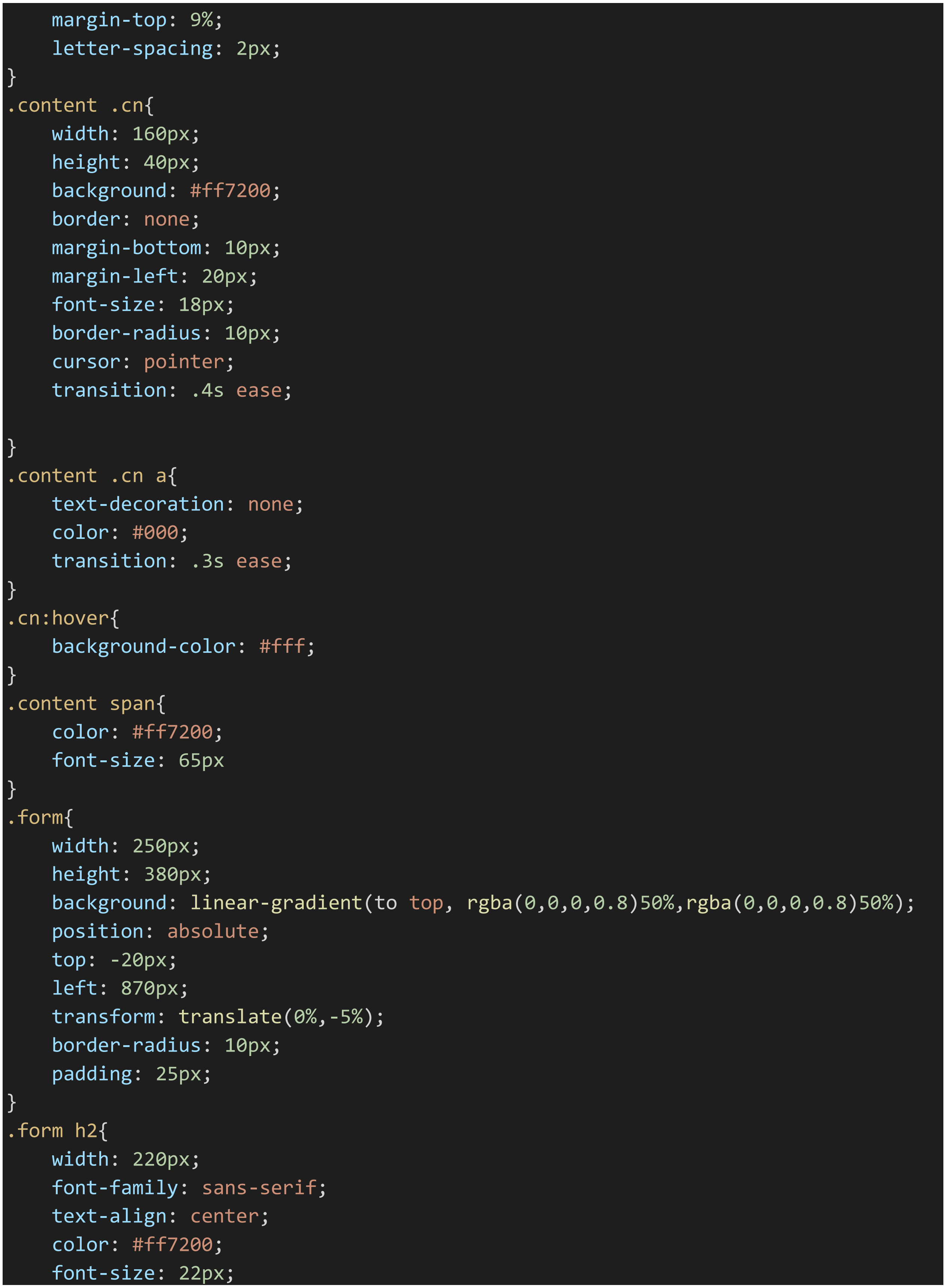
```
*{
    margin: 0;
    padding: 0;
}

.main{
    width: 100%;
    background:url(crud.webp);
    background-position: center;
    background-size: cover;
    height: 100vh;
}
.navbar{
    width: 1200px;
    height: 75px;
    margin: auto;
}
.icon{
    width: 200px;
    float: left;
    height: 70px;
}
.logo{
    color: #ff7200;
    font-size: 35px;
    font-family: Arial;
    padding-left: 20px;
    float: left;
```



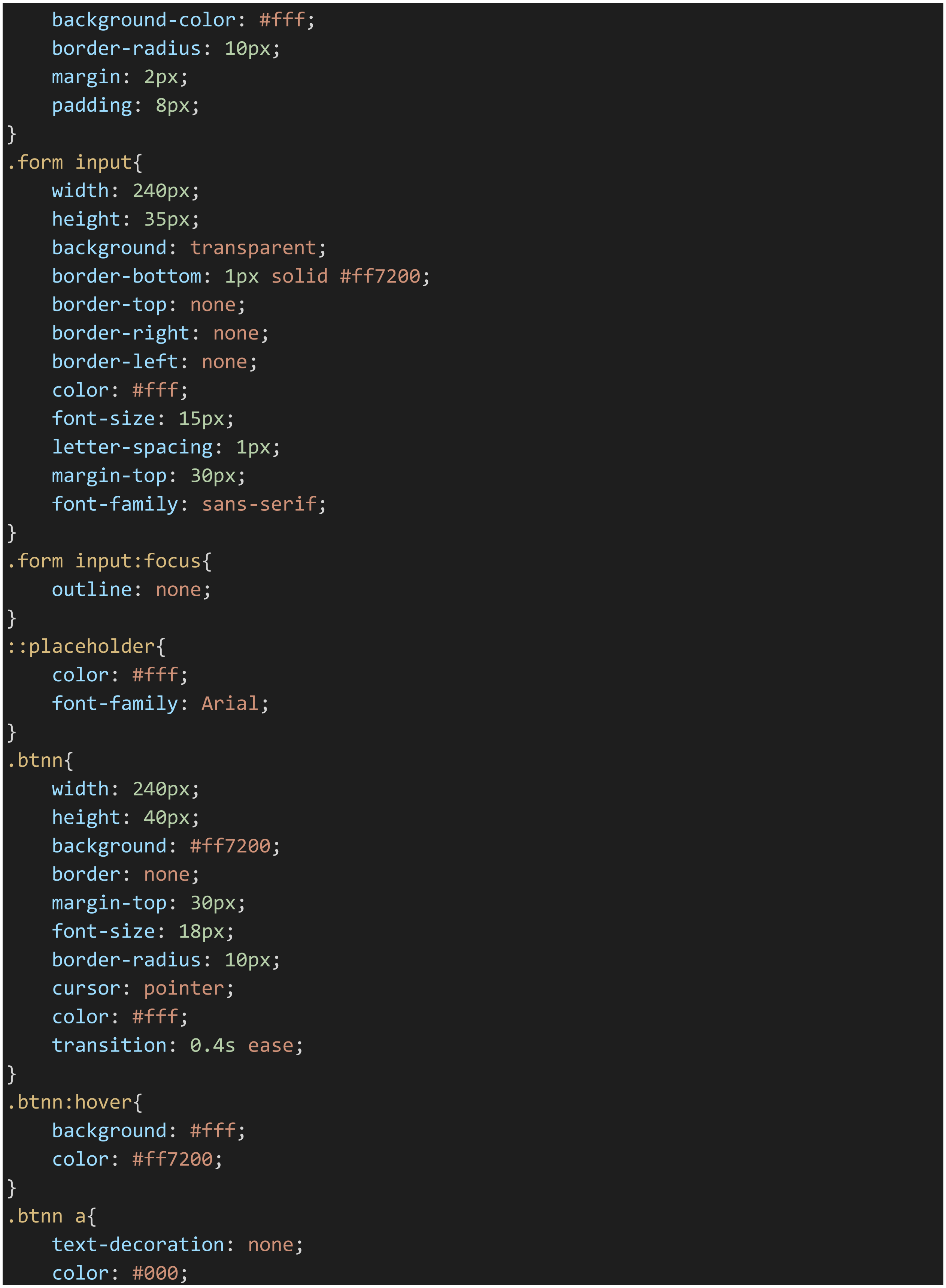
```
    padding-top: 10px;
    margin-top: 5px
}
.menu{
    width: 400px;
    float: left;
    height: 70px;
}
ul{
    float: left;
    display: flex;
    justify-content: center;
    align-items: center;
}
ul li{
    list-style: none;
    margin-left: 62px;
    margin-top: 27px;
    font-size: 14px;
}
ul li a{
    text-decoration: none;
    color: #fff;
    font-family: Arial;
    font-weight: bold;
    transition: 0.4s ease-in-out;
}
ul li a:hover{
    color: #ff7200;
}
.search{
    width: 330px;
    float: left;
    margin-left: 270px;
}
.srch{
    font-family: 'Times New Roman';
    width: 200px;
    height: 40px;
    background: transparent;
    border: 1px solid #ff7200;
    margin-top: 13px;
    color: #fff;
    border-right: none;
    font-size: 16px;
```



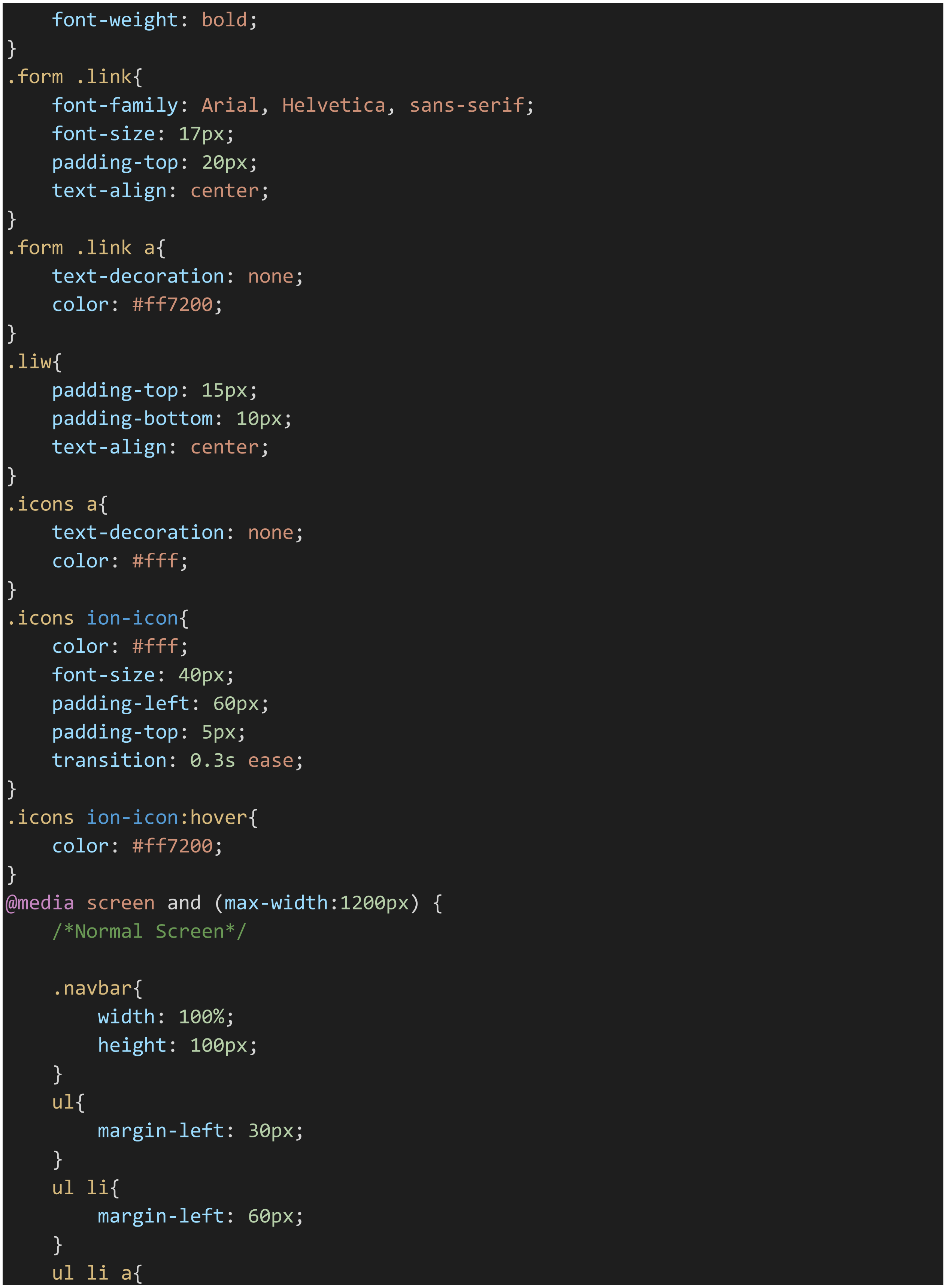
```css
    float: left;
    padding: 10px;
    border-bottom-left-radius: 5px;
    border-top-left-radius: 5px;
}
.btn{
    width: 100px;
    height: 40px;
    background: #ff7200;
    border: 2px solid #ff7200;
    margin-top: 13px;
    color: #fff;
    font-size: 15px;
    border-bottom-right-radius: 5px;
    border-bottom-right-radius: 5px;
    transition: 0.2s ease;
    cursor: pointer;
}
.btn:hover{
    color: white;
}
.btn:focus{
    outline: none;
}
.srch:focus{
    outline: none;
}
.content{
    width: 1200px;
    height: auto;
    margin: auto;
    color: #fff;
    position: relative;
}
.content .par{
    padding-left: 20px;
    padding-bottom: 25px;
    font-family: Arial;
    letter-spacing: 1.2px;
    line-height: 30px;
}
.content h1{
    font-family: 'Times New Roman';
    font-size: 50px;
    padding-left: 20px;
```



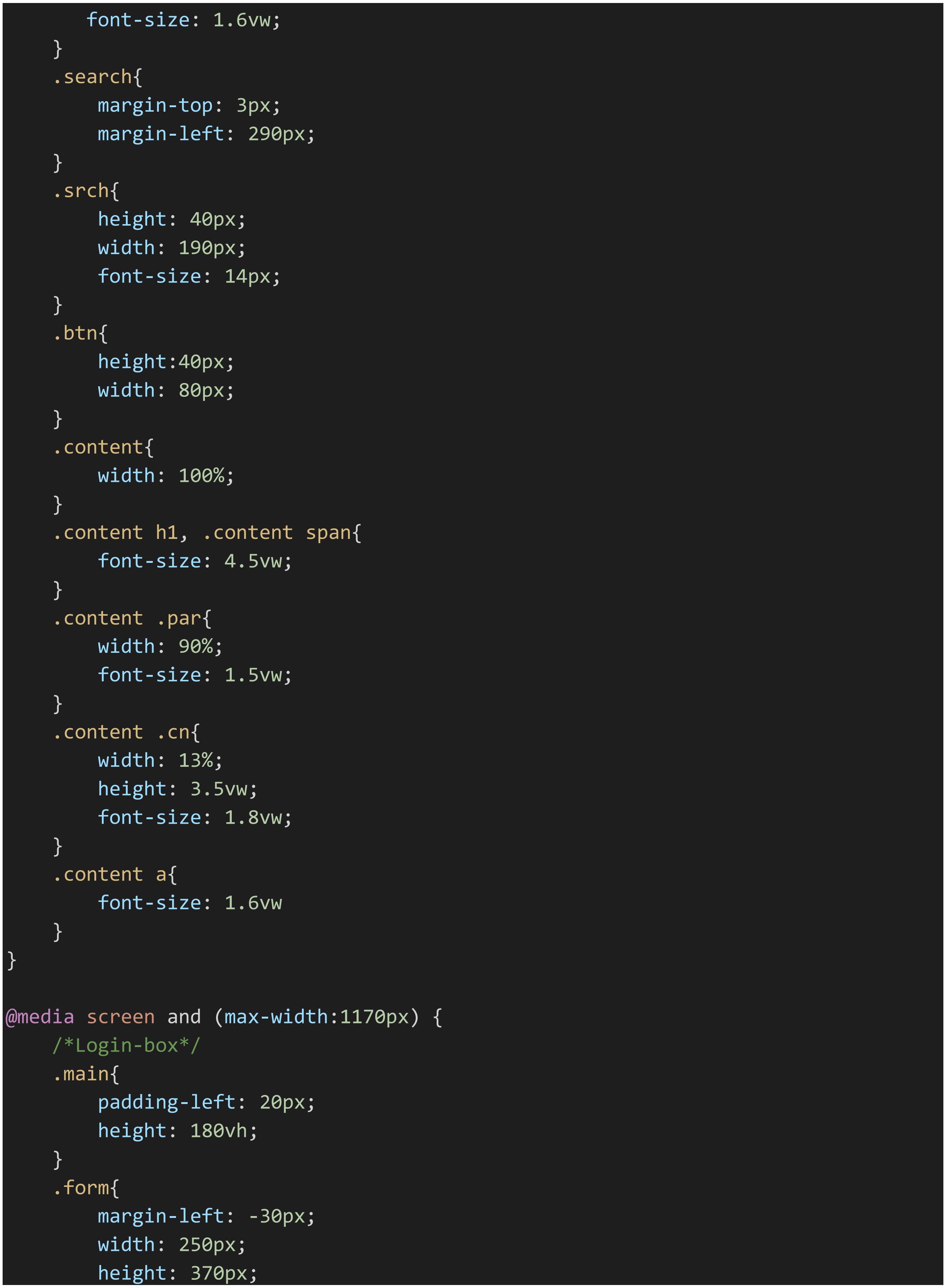
```css
    margin-top: 9%;
    letter-spacing: 2px;
}
.content .cn{
    width: 160px;
    height: 40px;
    background: #ff7200;
    border: none;
    margin-bottom: 10px;
    margin-left: 20px;
    font-size: 18px;
    border-radius: 10px;
    cursor: pointer;
    transition: .4s ease;

}
.content .cn a{
    text-decoration: none;
    color: #000;
    transition: .3s ease;
}
.cn:hover{
    background-color: #fff;
}
.content span{
    color: #ff7200;
    font-size: 65px
}
.form{
    width: 250px;
    height: 380px;
    background: linear-gradient(to top, rgba(0,0,0,0.8)50%,rgba(0,0,0,0.8)50%);
    position: absolute;
    top: -20px;
    left: 870px;
    transform: translate(0%,-5%);
    border-radius: 10px;
    padding: 25px;
}
.form h2{
    width: 220px;
    font-family: sans-serif;
    text-align: center;
    color: #ff7200;
    font-size: 22px;
```



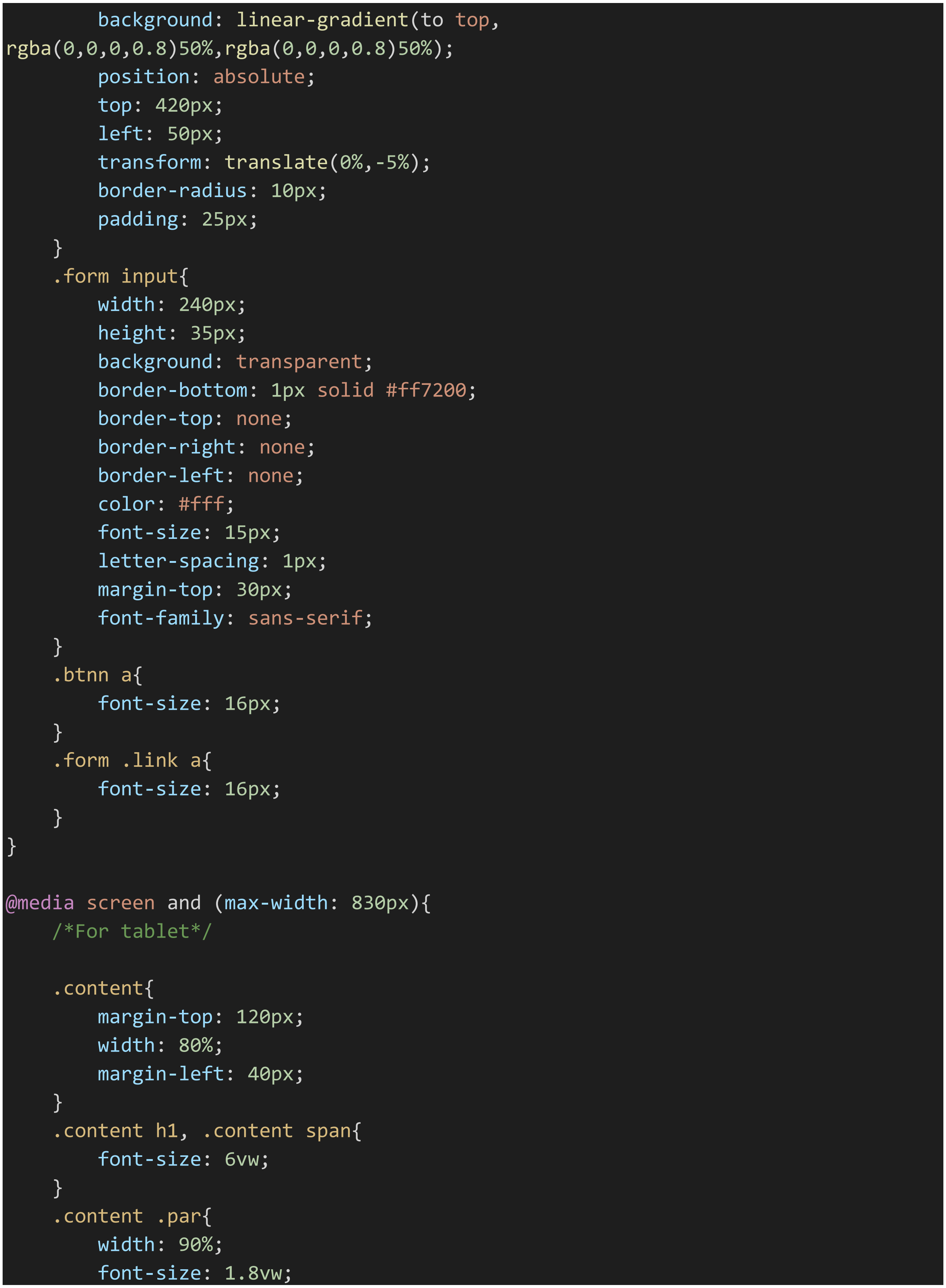
```
    background-color: #fff;
    border-radius: 10px;
    margin: 2px;
    padding: 8px;
}
.form input{
    width: 240px;
    height: 35px;
    background: transparent;
    border-bottom: 1px solid #ff7200;
    border-top: none;
    border-right: none;
    border-left: none;
    color: #fff;
    font-size: 15px;
    letter-spacing: 1px;
    margin-top: 30px;
    font-family: sans-serif;
}
.form input:focus{
    outline: none;
}
::placeholder{
    color: #fff;
    font-family: Arial;
}
.btnn{
    width: 240px;
    height: 40px;
    background: #ff7200;
    border: none;
    margin-top: 30px;
    font-size: 18px;
    border-radius: 10px;
    cursor: pointer;
    color: #fff;
    transition: 0.4s ease;
}
.btnn:hover{
    background: #fff;
    color: #ff7200;
}
.btnn a{
    text-decoration: none;
    color: #000;
```



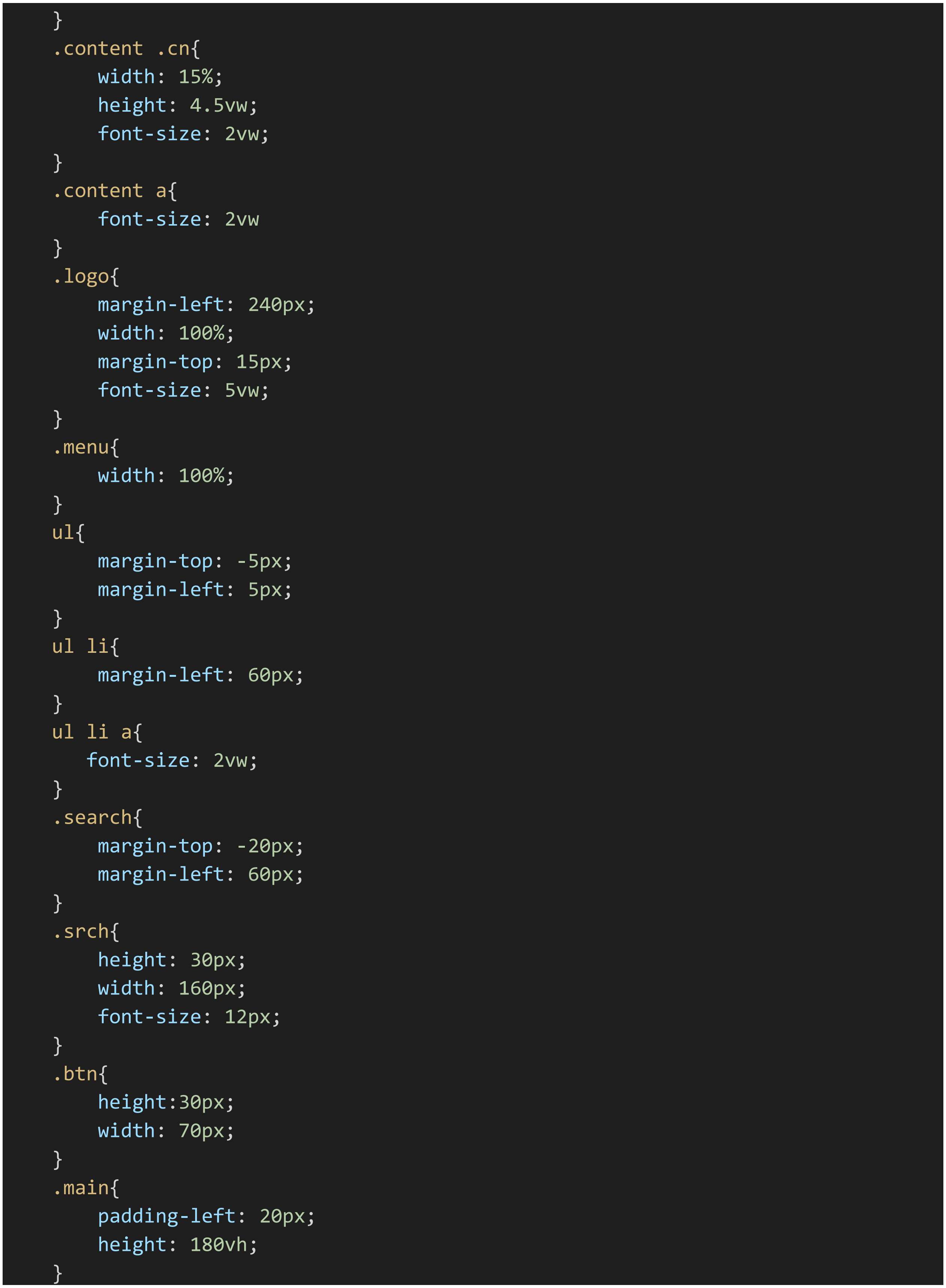
```
    font-weight: bold;
}
.form .link{
    font-family: Arial, Helvetica, sans-serif;
    font-size: 17px;
    padding-top: 20px;
    text-align: center;
}
.form .link a{
    text-decoration: none;
    color: #ff7200;
}
.liw{
    padding-top: 15px;
    padding-bottom: 10px;
    text-align: center;
}
.icons a{
    text-decoration: none;
    color: #fff;
}
.icons ion-icon{
    color: #fff;
    font-size: 40px;
    padding-left: 60px;
    padding-top: 5px;
    transition: 0.3s ease;
}
.icons ion-icon:hover{
    color: #ff7200;
}
@media screen and (max-width:1200px) {
    /*Normal Screen*/

    .navbar{
        width: 100%;
        height: 100px;
    }
    ul{
        margin-left: 30px;
    }
    ul li{
        margin-left: 60px;
    }
    ul li a{
```



```css
        font-size: 1.6vw;
    }
    .search{
        margin-top: 3px;
        margin-left: 290px;
    }
    .srch{
        height: 40px;
        width: 190px;
        font-size: 14px;
    }
    .btn{
        height:40px;
        width: 80px;
    }
    .content{
        width: 100%;
    }
    .content h1, .content span{
        font-size: 4.5vw;
    }
    .content .par{
        width: 90%;
        font-size: 1.5vw;
    }
    .content .cn{
        width: 13%;
        height: 3.5vw;
        font-size: 1.8vw;
    }
    .content a{
        font-size: 1.6vw
    }
}

@media screen and (max-width:1170px) {
    /*Login-box*/
    .main{
        padding-left: 20px;
        height: 180vh;
    }
    .form{
        margin-left: -30px;
        width: 250px;
        height: 370px;
```



```
        background: linear-gradient(to top,
rgba(0,0,0,0.8)50%,rgba(0,0,0,0.8)50%);
        position: absolute;
        top: 420px;
        left: 50px;
        transform: translate(0%,-5%);
        border-radius: 10px;
        padding: 25px;
    }
    .form input{
        width: 240px;
        height: 35px;
        background: transparent;
        border-bottom: 1px solid #ff7200;
        border-top: none;
        border-right: none;
        border-left: none;
        color: #fff;
        font-size: 15px;
        letter-spacing: 1px;
        margin-top: 30px;
        font-family: sans-serif;
    }
    .btnn a{
        font-size: 16px;
    }
    .form .link a{
        font-size: 16px;
    }
}

@media screen and (max-width: 830px){
    /*For tablet*/

    .content{
        margin-top: 120px;
        width: 80%;
        margin-left: 40px;
    }
    .content h1, .content span{
        font-size: 6vw;
    }
    .content .par{
        width: 90%;
        font-size: 1.8vw;
```

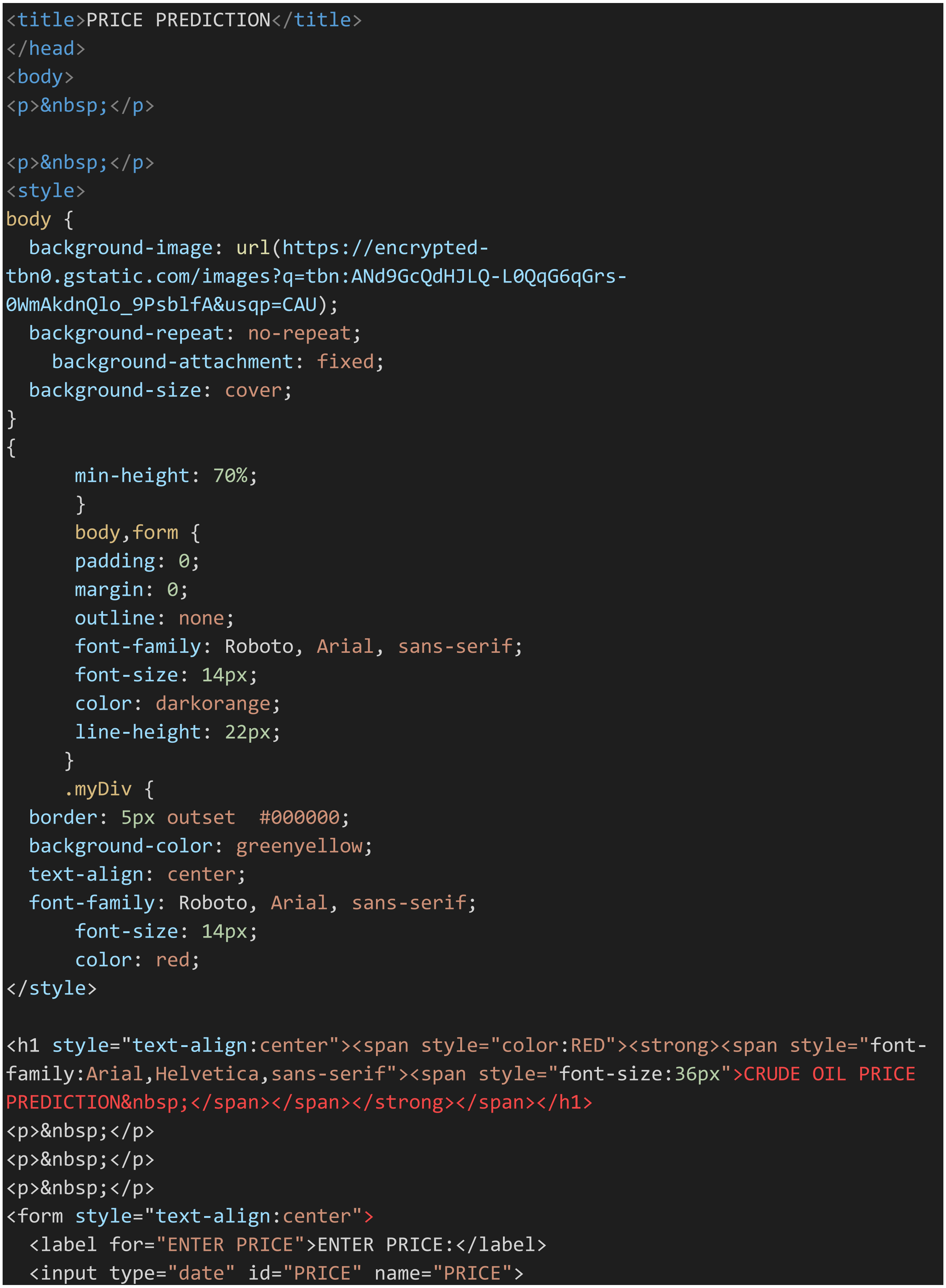


```
    }
    .content .cn{
        width: 15%;
        height: 4.5vw;
        font-size: 2vw;
    }
    .content a{
        font-size: 2vw
    }
    .logo{
        margin-left: 240px;
        width: 100%;
        margin-top: 15px;
        font-size: 5vw;
    }
    .menu{
        width: 100%;
    }
    ul{
        margin-top: -5px;
        margin-left: 5px;
    }
    ul li{
        margin-left: 60px;
    }
    ul li a{
       font-size: 2vw;
    }
    .search{
        margin-top: -20px;
        margin-left: 60px;
    }
    .srch{
        height: 30px;
        width: 160px;
        font-size: 12px;
    }
    .btn{
        height:30px;
        width: 70px;
    }
    .main{
        padding-left: 20px;
        height: 180vh;
    }
```

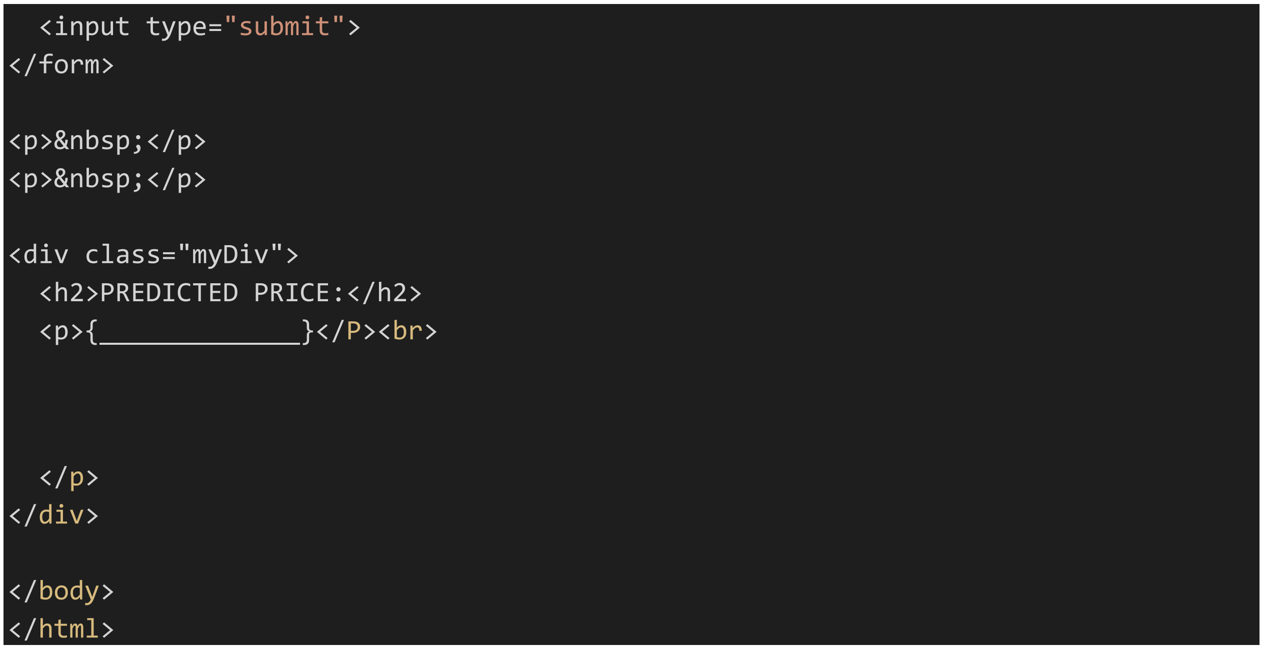
```
    .form{
        margin-left: -30px;
        width: 250px;
        height: 370px;
        background: linear-gradient(to top,
rgba(0,0,0,0.8)50%,rgba(0,0,0,0.8)50%);
        position: absolute;
        top: 430px;
        left: 50px;
        transform: translate(0%,-5%);
        border-radius: 10px;
        padding: 25px;
    }
    .form input{
        width: 240px;
        height: 35px;
        background: transparent;
        border-bottom: 1px solid #ff7200;
        border-top: none;
        border-right: none;
        border-left: none;
        color: #fff;
        font-size: 15px;
        letter-spacing: 1px;
        margin-top: 30px;
        font-family: sans-serif;
    }
    .btnn a{
        font-size: 16px;
    }
    .form .link a{
        font-size: 16px;
    }
}

@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;
    }
}

@media screen and (max-width: 450px){
    /*mobile*/
    .logo{
        margin-left: 140px;
        font-size: 4vw;
    }
    ul{
        margin-top: -25px;
    }
    ul li {
        margin-left: 42px;
    }
    ul li a{
        font-size: 2vw;
    }
    .search{
        margin-top: -40px;
        margin-left: 38px;
    }

}
```

PREDICTED PRICE:

```
<!DOCTYPE html>
<html>
<head>
```



```
<title>PRICE PREDICTION</title>
</head>
<body>
<p>&nbsp;</p>

<p>&nbsp;</p>
<style>
body {
  background-image: url(https://encrypted-
tbn0.gstatic.com/images?q=tbn:ANd9GcQdHJLQ-L0QqG6qGrs-
0WmAkdnQlo_9PsblfA&usqp=CAU);
  background-repeat: no-repeat;
    background-attachment: fixed;
  background-size: cover;
}
{
      min-height: 70%;
      }
      body,form {
      padding: 0;
      margin: 0;
      outline: none;
      font-family: Roboto, Arial, sans-serif;
      font-size: 14px;
      color: darkorange;
      line-height: 22px;
     }
     .myDiv {
  border: 5px outset  #000000;
  background-color: greenyellow;
  text-align: center;
  font-family: Roboto, Arial, sans-serif;
      font-size: 14px;
      color: red;
</style>

<h1 style="text-align:center"><span style="color:RED"><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 style="text-align:center">
  <label for="ENTER PRICE">ENTER PRICE:</label>
  <input type="date" id="PRICE" name="PRICE">
```

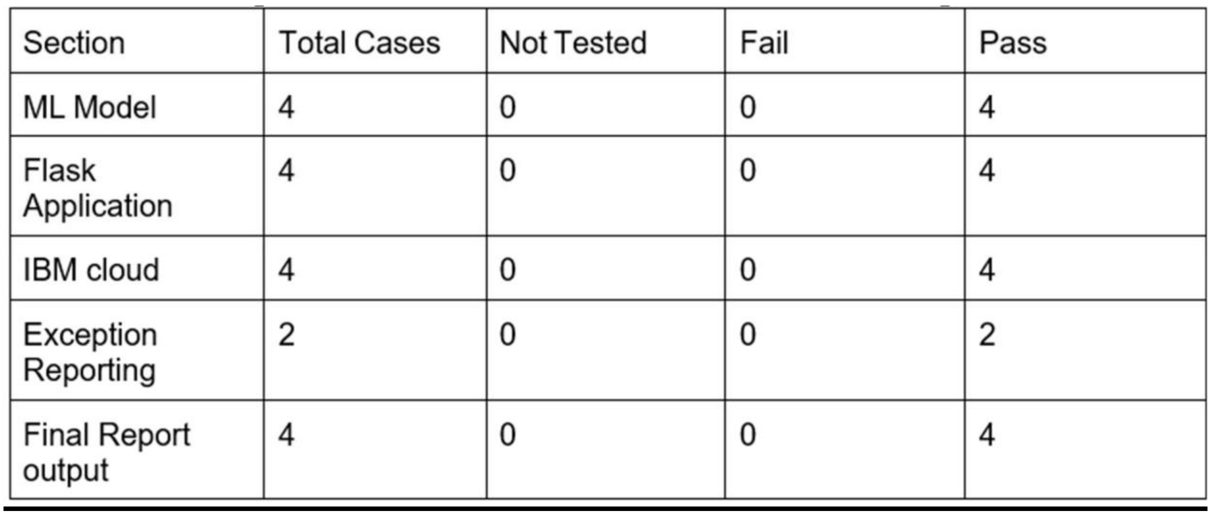


```
  <input type="submit">
</form>

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

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



  </p>
</div>

</body>
</html>
```

8. TESTING

8.1 Test case

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



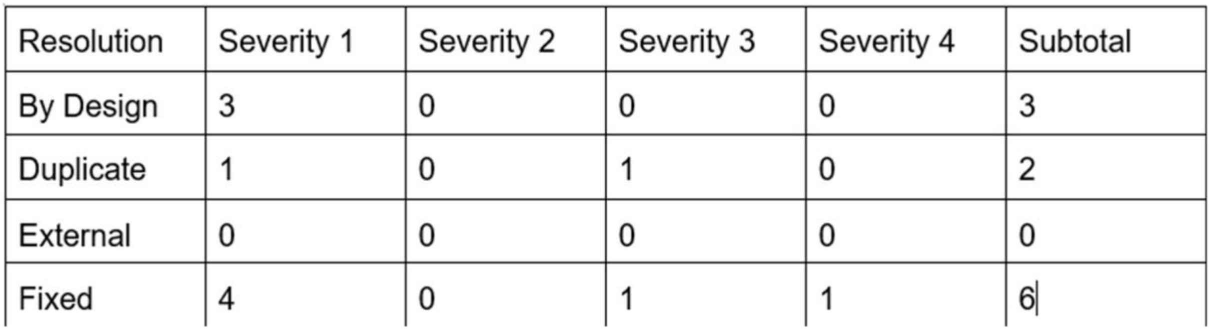
Section	Total Cases	Not Tested	Fail	Pass
ML Model	4	0	0	4
Flask Application	4	0	0	4
IBM cloud	4	0	0	4
Exception Reporting	2	0	0	2
Final Report output	4	0	0	4

8.2 User Acceptance Testing

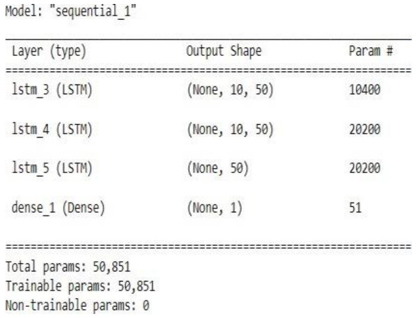
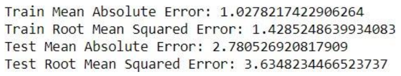
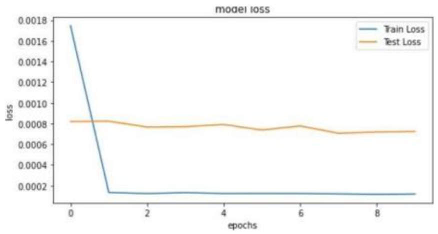
The purpose is to briefly explain the test coverage and open issues of the crude oil price prediction project at the time of the release to user acceptance testing

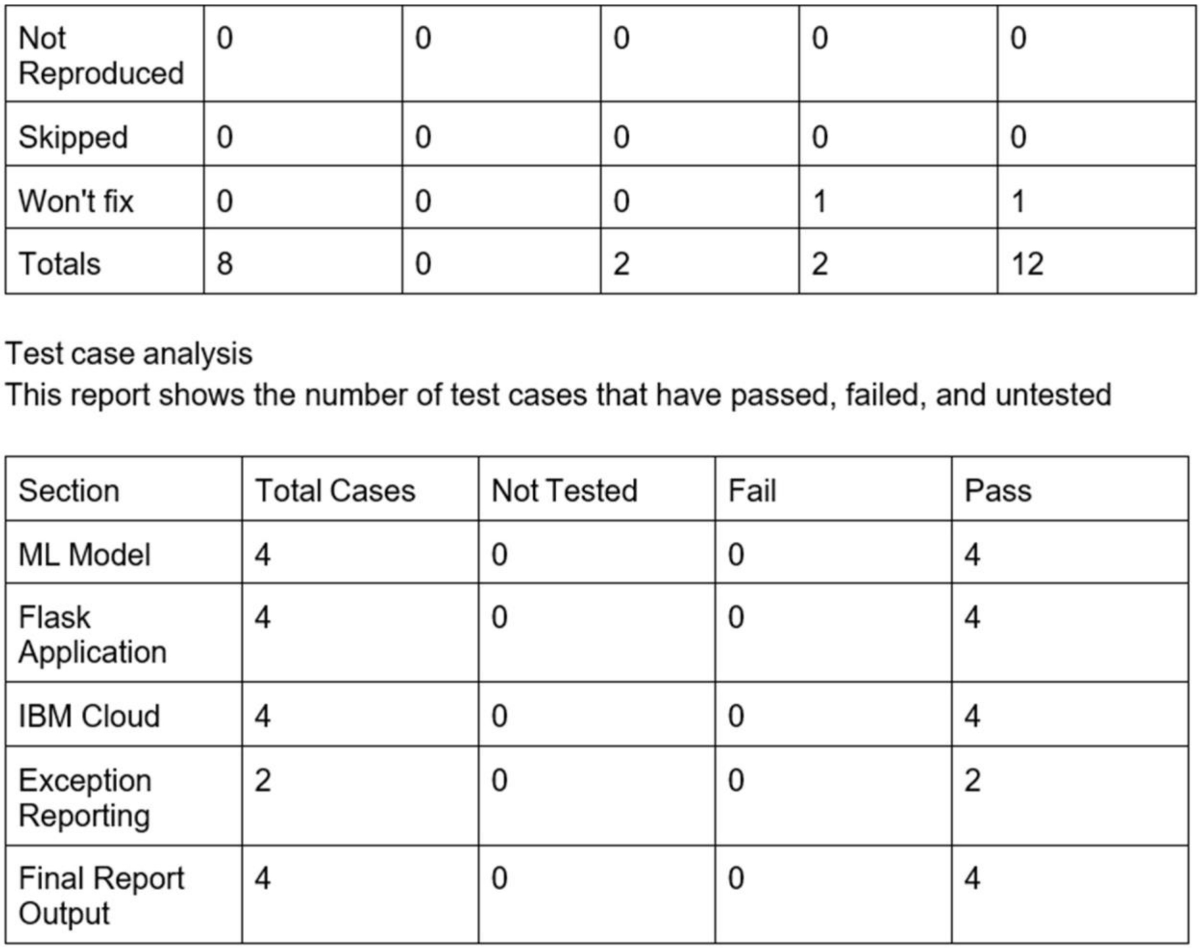
Defect Analysis:

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



Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	3	0	0	0	3
Duplicate	1	0	1	0	2
External	0	0	0	0	0
Fixed	4	0	1	1	6

S.No	Parameters	Values	Screenshot
1.	Model Summary		 Model: "sequential_1" Layer (type) Output Shape Param # === lstm_3 (LSTM) (None, 10, 50) 10400 lstm_4 (LSTM) (None, 10, 50) 20200 lstm_5 (LSTM) (None, 50) 20200 dense_1 (Dense) (None, 1) 51 === Total params: 50,851 Trainable params: 50,851 Non-trainable params: 0
2.	Accuracy		 Train Mean Absolute Error: 1.0278217422906264 Train Root Mean Squared Error: 1.4285248639934083 Test Mean Absolute Error: 2.780526920817909 Test Root Mean Squared Error: 3.6348234466523737 



Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't fix	0	0	0	1	1
Totals	8	0	2	2	12

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

Section	Total Cases	Not Tested	Fail	Pass
ML Model	4	0	0	4
Flask Application	4	0	0	4
IBM Cloud	4	0	0	4
Exception Reporting	2	0	0	2
Final Report Output	4	0	0	4

9.RESULT

9.1 Performance Metrics

10.ADVANTAGES & DISADVANTAGES

ADVANTAGES

- Prediction of crude oil price can help the importers to choose the right time to buy as they wait for the prices to fall down
- Prediction of crude oil prices can help the exporters to increase the demand
- It can even help in shifting the political powers
- can assist in minimizing the risks associated with volatility in oil prices

DISADVANATGES

- The prediction results may lack accuracy
- Volatility in prices may be misleading

11.CONCLUSION

LSTM network is better than other traditional neural networks for forecasting prices as it aims in using a back propagation model. Traditional neural networks such as CNN on the other hand predicts the next outgoing but doesn't necessarily save the previous data or connection which is based on feedforwarding, in the sense the previous data is not necessary to predict the future data. LSTM focuses on storing the previous data and prediction which is rather encouraging and more approximate. The outcomes derived are relatively encouraging. The results show that large lookups do not necessarily improve the accuracy of the predictions of crude oil prices. Hence it can be concluded, the model with a single LSTM model is definitely the most accurate

12.FUTURE SCOPE

The project's future potential is enormous. The project can be implemented with the real-time functionalities that are necessary.Because it is quite versatile in terms of expansion, the project can be upgraded in the near future as and when the need arises. The complete prediction value can be increased in a much better, accurate, and error-free manner with the proposed approach. The project can be enhanced with real time data.

APPENDIX

SOURCE CODE

MODEL:

```
#DATA PREPROCESSING


#IMPORTING THE LIBRARIES
{
  "nbformat": 4,
  "nbformat_minor": 0,
  "metadata": {
    "colab": {
      "provenance": []
    },
    "kernelspec": {
```

```
   "name": "python3",
   "display_name": "Python 3"
  },
  "language_info": {
   "name": "python"
  }
 },
 "cells": [
  {
   "cell_type": "code",
   "execution_count": null,
   "metadata": {
    "id": "P39WdS_RH_ol"
   },
   "outputs": [],
   "source": [
    "import
pandas as pd\n",
"import numpy
as np\n",
    "import matplotlib.pyplot as plt"
   ]
  }
 ]
}
```

#HANDLING MISSING VALUES

```
{
  "nbformat": 4,
  "nbformat_minor": 0,
  "metadata": {
    "colab": {
      "provenance": []
    },
    "kernelspec": {
      "name": "python3",
      "display_name": "Python 3"
    },
    "language_info": {
      "name": "python"
    }
  },
  "cells": [
    {
      "cell_type": "code",
      "source": [
        "import
pandas as pd\n",
"import numpy
as np\n",
        "import matplotlib.pyplot as plt"
```

```
   ],
   "metadata": {
    "id": "GiRQ27X4JRcH"
   },
   "execution_count": 1,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data=pd.read_excel(\"/content/Crude Oil Prices Daily.xlsx\")"       ],
   "metadata": {
    "id": "dbaHUfMiJW8I"
   },
   "execution_count": 2,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data.isnull().any()"
   ],
   "metadata": {
    "colab": {
     "base_uri": "https://localhost:8080/"
    },
    "id": "RAUyZB0-Jp0t",
    "outputId": "9f1ec869-c35f-4764-8989-0d5d82646e18"
   },
   "execution_count": 3,
   "outputs": [
    {
     "output_type": "execute_result",
     "data": {
      "text/plain": [
       "Date             False\n",
       "Closing Value     True\n",
       "dtype: bool"
      ]
     },
     "metadata": {},
     "execution_count": 3
    }
   ]
  },
  {
   "cell_type": "code",
   "source": [
    "data.isnull().sum()"
   ],
   "metadata": {
    "colab": {
      "base_uri": "https://localhost:8080/"
     },
     "id": "yorF39lCJsyV",
     "outputId": "4001984b-54cc-4b54-f73b-926ff03ac00f"
    },
    "execution_count": 4,
    "outputs": [
     {
      "output_type": "execute_result",
      "data": {
       "text/plain": [
        "Date             0\n",
        "Closing Value    7\n",
        "dtype: int64"
       ]
      },
      "metadata": {},
      "execution_count": 4
     }
    ]
   },
   {
    "cell_type": "code",
    "source": [
     "data.dropna(axis=0,inplace=True)"
    ],
   "metadata": {
    "id": "g3FWuWVPJwms"
   },
   "execution_count": 5,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data.isnull().sum()"
   ],
   "metadata": {
    "colab": {
     "base_uri": "https://localhost:8080/"
    },
    "id": "vIHbyOs4JzIf",
    "outputId": "47f79e73-6c7b-4d04-a0bd-09ae39d18bcf"
   },
   "execution_count": 6,
   "outputs": [
    {
     "output_type": "execute_result",
     "data": {
      "text/plain": [
       "Date             0\n",
       "Closing Value    0\n",
     "dtype: int64"
    ]
   },
   "metadata": {},
   "execution_count": 6
  }
 ]
},
{
 "cell_type": "code",
 "source": [
  "data_oil=data.reset_index()['Closing Value']\n",
  "data_oil"
 ],
 "metadata": {
  "id": "IoxUNwrvJ2b6",
  "outputId": "2011717f-466c-4af2-973c-3980b6229a4d",
  "colab": {
   "base_uri": "https://localhost:8080/"
  }
 },
 "execution_count": 7,
 "outputs": [
  {
   "output_type": "execute_result",
   "data": {
      "text/plain": [
       "0       25.56\n",
       "1       26.00\n",
       "2       26.53\n",
       "3       25.85\n",
       "4       25.87\n",
       "        ...  \n",
       "8211    73.89\n",
       "8212    74.19\n",
       "8213    73.05\n",
       "8214    73.78\n",
       "8215    73.93\n",
       "Name: Closing Value, Length: 8216, dtype: float64"
      ]
     },
     "metadata": {},
     "execution_count": 7
    }
   ]
  }
 ]
}
```

```
#FEATURE SCALING
```

```
{
 "nbformat": 4,
  "nbformat_minor": 0,
  "metadata": {
    "colab": {
      "provenance": []
    },
    "kernelspec": {
      "name": "python3",
      "display_name": "Python 3"
    },
    "language_info": {
      "name": "python"
    }
  },
  "cells": [
    {
      "cell_type": "code",
      "source": [
        "import
pandas as pd\n",
"import numpy
as np\n",
        "import matplotlib.pyplot as plt"
      ],
      "metadata": {
        "id": "GiRQ27X4JRcH"
      },
   "execution_count": 1,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data=pd.read_excel(\"/content/Crude Oil Prices Daily.xlsx\")"
   ],
   "metadata": {
    "id": "dbaHUfMiJW8I"
   },
   "execution_count": 2,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data.isnull().any()"
   ],
   "metadata": {
    "colab": {
     "base_uri": "https://localhost:8080/"
    },
    "id": "RAUyZB0-Jp0t",
    "outputId": "9f1ec869-c35f-4764-8989-0d5d82646e18"
   },
   "execution_count": 3,
   "outputs": [
    {
     "output_type": "execute_result",
     "data": {
      "text/plain": [
       "Date             False\n",
       "Closing Value     True\n",
       "dtype: bool"
      ]
     },
     "metadata": {},
     "execution_count": 3
    }
   ]
  },
  {
   "cell_type": "code",
   "source": [
    "data.isnull().sum()"
   ],
   "metadata": {
    "colab": {
     "base_uri": "https://localhost:8080/"
    },
    "id": "yorF39lCJsyV",
  "outputId": "4001984b-54cc-4b54-f73b-926ff03ac00f"
 },
 "execution_count": 4,
 "outputs": [
  {
   "output_type": "execute_result",
   "data": {
    "text/plain": [
     "Date             0\n",
     "Closing Value    7\n",
     "dtype: int64"
    ]
   },
   "metadata": {},
   "execution_count": 4
  }
 ]
},
{
 "cell_type": "code",
 "source": [
  "data.dropna(axis=0,inplace=True)"
 ],
 "metadata": {
  "id": "g3FWuWVPJwms"
 },
   "execution_count": 5,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data.isnull().sum()"
   ],
   "metadata": {
    "colab": {
     "base_uri": "https://localhost:8080/"
    },
    "id": "vIHbyOs4JzIf",
    "outputId": "47f79e73-6c7b-4d04-a0bd-09ae39d18bcf"
   },
   "execution_count": 6,
   "outputs": [
    {
     "output_type": "execute_result",
     "data": {
      "text/plain": [
       "Date             0\n",
       "Closing Value    0\n",
       "dtype: int64"
      ]
     },
   "metadata": {},
   "execution_count": 6
  }
 ]
},
{
 "cell_type": "code",
 "source": [
  "data_oil=data.reset_index()['Closing Value']\n",
  "data_oil"
 ],
 "metadata": {
  "colab": {
   "base_uri": "https://localhost:8080/"
  },
  "id": "IoxUNwrvJ2b6",
  "outputId": "2011717f-466c-4af2-973c-3980b6229a4d"
 },
 "execution_count": 7,
 "outputs": [
  {
   "output_type": "execute_result",
   "data": {
    "text/plain": [
     "0      25.56\n",
     "1      26.00\n",
       "2      26.53\n",
       "3      25.85\n",
       "4      25.87\n",
       "       ...  \n",
       "8211    73.89\n",
       "8212    74.19\n",
       "8213    73.05\n",
       "8214    73.78\n",
       "8215    73.93\n",
       "Name: Closing Value, Length: 8216, dtype: float64"
      ]
     },
     "metadata": {},
     "execution_count": 7
    }
   ]
  },
  {
   "cell_type": "code",
   "source": [
    "from sklearn.preprocessing import MinMaxScaler\n",
    "scaler=MinMaxScaler(feature_range=(0,1))\n",
    "data_oil=scaler.fit_transform(np.array(data_oil).reshape(-1,1))"
   ],
   "metadata": {
    "id": "5m-DUFI9J_WN"
```

```
 },
 "execution_count": 8,
 "outputs": []
},
{
 "cell_type": "code",
 "source": [
  "data_oil"
 ],
 "metadata": {
  "id": "fyMwOo1jKLqL",
  "outputId": "6e2bdf01-77aa-4e93-f117-6ab963e21c0a",
  "colab": {
   "base_uri": "https://localhost:8080/"
  }
 },
 "execution_count": 9,
 "outputs": [
  {
   "output_type": "execute_result",
   "data": {
    "text/plain": [
     "array([[0.11335703],\n",
     "       [0.11661484],\n",
     "       [0.12053902],\n",
     "       ...,\n",
              "       [0.46497853],\n",
              "       [0.47038353],\n",
              "       [0.47149415]])"
            ]
          },
          "metadata": {},
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        }
      ]
    }
  ]
}
```

# DATA VISUALIZATION

```
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      "display_name": "Python 3"
    },
    "language_info": {
```

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"import numpy
as np\n",
    "import matplotlib.pyplot as plt"
   ],
   "metadata": {
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   "execution_count": 1,
   "outputs": []
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    "data=pd.read_excel(\"/content/Crude Oil Prices Daily.xlsx\")"
   ],
   "metadata": {
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  ],
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   "outputId": "9f1ec869-c35f-4764-8989-0d5d82646e18"
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      "Closing Value     True\n",
      "dtype: bool"
     ]
     },
     "metadata": {},
     "execution_count": 3
    }
   ]
  },
  {
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   "source": [
    "data.isnull().sum()"
   ],
   "metadata": {
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    },
    "id": "yorF39lCJsyV",
    "outputId": "4001984b-54cc-4b54-f73b-926ff03ac00f"
   },
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     "data": {
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       "Closing Value    7\n",
         "dtype: int64"
        ]
       },
       "metadata": {},
       "execution_count": 4
      }
     ]
    },
    {
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    },
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     ],
     "metadata": {
      "colab": {
```

```
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    "data": {
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      "Closing Value    0\n",
      "dtype: int64"
     ]
    },
    "metadata": {},
    "execution_count": 6
   }
  ]
 },
 {
  "cell_type": "code",
  "source": [
   "data_oil=data.reset_index()['Closing Value']\n",
   "data_oil"
```

```
],
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  },
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"execution_count": 7,
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    "data": {
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        "1      26.00\n",
        "2      26.53\n",
        "3      25.85\n",
        "4      25.87\n",
        "       ...  \n",
        "8211    73.89\n",
        "8212    74.19\n",
        "8213    73.05\n",
        "8214    73.78\n",
        "8215    73.93\n",
        "Name: Closing Value, Length: 8216, dtype: float64"            ]
```

```
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    }
   ]
  },
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    "from sklearn.preprocessing import MinMaxScaler\n",
    "scaler=MinMaxScaler(feature_range=(0,1))\n",
    "data_oil=scaler.fit_transform(np.array(data_oil).reshape(-1,1))"
   ],
   "metadata": {
    "id": "5m-DUFI9J_WN"
   },
   "execution_count": 8,
   "outputs": []
  },
  {
   "cell_type": "code",
   "source": [
    "data_oil"
   ],
   "metadata": {
    "colab": {
```

```
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  "outputId": "6e2bdf01-77aa-4e93-f117-6ab963e21c0a"
 },
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   "data": {
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     "       [0.11661484],\n",
     "       [0.12053902],\n",
     "       ...,\n",
     "       [0.46497853],\n",
     "       [0.47038353],\n",
     "       [0.47149415]])"
    ]
   },
   "metadata": {},
   "execution_count": 9
  }
 ]
},
{
```

```
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"source": [
 "plt.plot(data_oil)"
],
"metadata": {
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 "outputId": "0640d4b9-abe5-4e76-a910-871af84bc19c",
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   ]
  },
  "metadata": {},
  "execution_count": 10
 },
 {
  "output_type": "display_data",
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              "<Figure size 432x288 with 1 Axes>"
            ],
            "image/png":
```

#CREATING A DATA SET WITH SLIDING WINDOWS

```
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  "nbformat_minor": 0,
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      "provenance": []
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      "name": "python3",
      "display_name": "Python 3"
    },
    "language_info": {
      "name": "python"
    }
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    {
      "cell_type": "code",
      "source": [
    "import
pandas as pd\n",
"import numpy
as np\n",
    "import matplotlib.pyplot as plt"
   ],
   "metadata": {
    "id": "GiRQ27X4JRcH"
   },
   "execution_count": 1,
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  {
   "cell_type": "code",
   "source": [
    "data=pd.read_excel(\"/content/Crude Oil Prices Daily.xlsx\")"
   ],
   "metadata": {
    "id": "dbaHUfMiJW8I"
   },
   "execution_count": 2,
   "outputs": []
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  {
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   "source": [
  "data.isnull().any()"
 ],
 "metadata": {
  "colab": {
   "base_uri": "https://localhost:8080/"
  },
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  "outputId": "9f1ec869-c35f-4764-8989-0d5d82646e18"
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     "Closing Value     True\n",
     "dtype: bool"
    ]
   },
   "metadata": {},
   "execution_count": 3
  }
 ]
},
{
```

```
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  "data.isnull().sum()"
],
"metadata": {
  "colab": {
    "base_uri": "https://localhost:8080/"
  },
  "id": "yorF39lCJsyV",
  "outputId": "4001984b-54cc-4b54-f73b-926ff03ac00f"
},
"execution_count": 4,
"outputs": [
  {
    "output_type": "execute_result",
    "data": {
      "text/plain": [
        "Date             0\n",
        "Closing Value    7\n",
        "dtype: int64"
      ]
    },
    "metadata": {},
    "execution_count": 4
  }
]
```

```
},
{
  "cell_type": "code",
  "source": [
    "data.dropna(axis=0,inplace=True)"
  ],
  "metadata": {
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  },
  "execution_count": 5,
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},
{
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  "source": [
    "data.isnull().sum()"
  ],
  "metadata": {
    "colab": {
      "base_uri": "https://localhost:8080/"
    },
    "id": "vIHbyOs4JzIf",
    "outputId": "47f79e73-6c7b-4d04-a0bd-09ae39d18bcf"
  },
  "execution_count": 6,
  "outputs": [
  {
   "output_type": "execute_result",
   "data": {
    "text/plain": [
     "Date             0\n",
     "Closing Value    0\n",
     "dtype: int64"
    ]
   },
   "metadata": {},
   "execution_count": 6
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},
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  "data_oil=data.reset_index()['Closing Value']\n",
  "data_oil"
 ],
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  "colab": {
   "base_uri": "https://localhost:8080/"
  },
  "id": "IoxUNwrvJ2b6",
  "outputId": "2011717f-466c-4af2-973c-3980b6229a4d"
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 "outputs": [
  {
   "output_type": "execute_result",
   "data": {
    "text/plain": [
     "0       25.56\n",
     "1       26.00\n",
     "2       26.53\n",
     "3       25.85\n",
     "4       25.87\n",
     "        ...  \n",
     "8211    73.89\n",
     "8212    74.19\n",
     "8213    73.05\n",
     "8214    73.78\n",
     "8215    73.93\n",
     "Name: Closing Value, Length: 8216, dtype: float64"          ]
   },
   "metadata": {},
   "execution_count": 7
  }
 ]
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{
   "cell_type": "code",
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    "from sklearn.preprocessing import MinMaxScaler\n",
    "scaler=MinMaxScaler(feature_range=(0,1))\n",
    "data_oil=scaler.fit_transform(np.array(data_oil).reshape(-1,1))"
   ],
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   },
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  {
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   "source": [
    "data_oil"
   ],
   "metadata": {
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     "base_uri": "https://localhost:8080/"
    },
    "id": "fyMwOo1jKLqL",
    "outputId": "6e2bdf01-77aa-4e93-f117-6ab963e21c0a"
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   "execution_count": 9,
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   "data": {
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     "       [0.11661484],\n",
     "       [0.12053902],\n",
     "       ...,\n",
     "       [0.46497853],\n",
     "       [0.47038353],\n",
     "       [0.47149415]])"
    ]
   },
   "metadata": {},
   "execution_count": 9
  }
 ]
},
{
 "cell_type": "code",
 "source": [
  "plt.plot(data_oil)"
 ],
 "metadata": {
  "colab": {
   "base_uri": "https://localhost:8080/",
    "height": 282
  },
  "id": "GdNJartuKUfk",
  "outputId": "0640d4b9-abe5-4e76-a910-871af84bc19c"
},
"execution_count": 10,
"outputs": [
  {
    "output_type": "execute_result",
    "data": {
      "text/plain": [
        "[<matplotlib.lines.Line2D at 0x7f5a0c7b5850>]"
      ]
    },
    "metadata": {},
    "execution_count": 10
  },
  {
    "output_type": "display_data",
    "data": {
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      ],
      "image/png":
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     }
    }
   ]
  },
  {
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    "training_size=int(len(data_oil)*0.65)\n",
    "test_size=len(data_oil)-training_size\n",
"train_data,test_data=data_oil[0:training_size,:],data_oil[training_size:len(data_oil),:1]"
   ],
   "metadata": {
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   },
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   ],
   "metadata": {
```

```
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  "outputId": "5142d0f7-21d1-46bb-e69e-bd71c69ef729"
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    ]
   },
   "metadata": {},
   "execution_count": 12
  }
 ]
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{
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    "outputId": "b23a9806-135a-424d-f65b-6029116ad975"
   },
   "execution_count": 13,
   "outputs": [
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     "data": {
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      ]
     },
     "metadata": {},
     "execution_count": 13
    }
   ]
  },
  {
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    "  dataX,dataY=[],[]\n",
    "  for i in range(len(dataset)-time_step-1):\n",
    "    a=dataset[i:(i+time_step),0]\n",
    "    dataX.append(a)\n",
    "    dataY.append(dataset[i+time_step,0])\n",
    "  return np.array(dataX),np.array(dataY)"
   ],
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   },
   "execution_count": 14,
   "outputs": []
  },
  {
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    "x_train,y_train=create_dataset(train_data,time_step)\n",
    "x_test,y_test=create_dataset(test_data,time_step)"
   ],
   "metadata": {
    "id": "dv2OIjslLA3v"
   },
   "execution_count": 15,
   "outputs": []
  },
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"source": [
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],
"metadata": {
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  },
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      "(5329,)\n"
    ]
  },
  {
    "output_type": "execute_result",
    "data": {
      "text/plain": [
        "(None, None)"
      ]
```

```
     },
     "metadata": {},
     "execution_count": 16
    }
   ]
  },
  {
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   "source": [
    "print(x_test.shape),print(y_test.shape)"
   ],
   "metadata": {
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    },
    "id": "iLQiXr21LE35",
    "outputId": "3dca6c25-95ed-4b85-bb1a-d2e218179c5d"
   },
   "execution_count": 17,
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     "name": "stdout",
     "text": [
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      "(2865,)\n"
   ]
  },
  {
   "output_type": "execute_result",
   "data": {
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    ]
   },
   "metadata": {},
   "execution_count": 17
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 ]
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 "source": [
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       "       [0.11661484, 0.12053902, 0.11550422, ..., 0.1089886 ,
0.11054346,\n",
       "        0.10165852],\n",
       "       [0.12053902, 0.11550422, 0.1156523 , ..., 0.11054346,
0.10165852,\n",
       "        0.09906708],\n",
       "       ...,\n",
       "       [0.36731823, 0.35176958, 0.36080261, ..., 0.36391234,
0.37042796,\n",
       "        0.37042796],\n",
       "       [0.35176958, 0.36080261, 0.35354657, ..., 0.37042796,
0.37042796,\n",
       "        0.37879461],\n",
       "       [0.36080261, 0.35354657, 0.35295424, ..., 0.37042796,
0.37879461,\n",
       "        0.37916482]])"
      ]
     },
     "metadata": {},
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    },
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      "source": [
        "x_train=x_train.reshape(x_train.shape[0],x_train.shape[1],1)\n",
"x_test=x_test.reshape(x_test.shape[0],x_test.shape[1],1)"
      ],
      "metadata": {
        "id": "59VQDX1LLL3D"
      },
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      "outputs": []
    }
  ]
}
```

# MODEL BUILDING

# Importing the model building libraries from tensorflow.keras.models import Sequential from tensorflow.keras.layers import Dense

```
from
tensorflow.kera
s.layers import
LSTM #
Initializing the
model
model=Sequen
tial()
```

```
# Adding LSTM Layers
model.add(LSTM(50,return_sequences=True,input_shape=(10,
1)
)) model.add(LSTM(50,return_sequences=True))
model.add(LSTM(50))
```

```
# Adding Output Layers
model.add(Dense(1))
```

```
# Configure The Learning Process
model.compile(loss='mean_squared_err
or',optimizer='ad am')
```

```
# Train The Model
model.fit(X_train,y_train,validation_data=(X_test,y_test),epoch
s=10,batch_size=6 4,verb ose=1)
```

```
# Model Evaluation
train_predict=model.predict(X
_train)
test_predict=model.predict(X_t
est)
```

```
train_predict=scalar.inverse_tr
ansform(train_predict )
test_predict=scalar.inverse_tra
nsform(test_predict) import
math from sklearn.metrics
import mean_squared_error

math.sqrt(mean_squared_error(y_train,train_predict))
```

# Save The Model

```
from
tensorflow.keras.models
import load_model
model.save("crudeoilprediction.h5")
```

# Test The Model

```
look_back= 10 trainPredictPlot =
np.empty_like(data_oil) trainPredictPlot[:, :]=
np.nan
trainPredictPlot[look_back:len(train_predict)+look
_back, :]= train_predict testPredictPlot
=np.empty_like(data_oil) testPredictPlot[:, :]=
np.nan
testPredictPlot[len(train_predict)+(look_back*2)+
1:len(data_oil)-1, :]= test_predict
plt.plot(scalar.inverse_transform(data_oil))
plt.plot(trainPredictPl ot) plt.plot(testPredictPlo t)
plt.show() len(test_data)
x_input=test_data[2866:].reshape(1,-
1)
x_input.sh
ape
temp_inpu
t=list(x_in
put)
```

```
temp_inpu
t=temp_in
put[0].toli
st()
temp_inpu
t
lst_output
=
[]
n
_
s
t
e
p
s
=
1
0
i
=
0
w
h
i
l
e
(
i
<
1
0
)
:
    if(len(temp_input)>10):
```

```
#print(temp input)
        x_input=np.array(te
        mp_input[1:])
        print("{} day input
        {}".format(i,x_input)
        )
        x_input=x_input.res
        hape(1,-1)
        x_input=x_input.res
        hape((1, n_steps,
        1))
        #print(x_i
        nput)  yhat
        =
        model.pre
        dict(x_inp
        ut,
        verbose=0
        )  print("{}
        day output
        {}".format(i,
        yhat))
        temp_input.ex
        tend(yhat[0].to
        list())
        temp_input=te
        mp_input[1:]
        #print(temp_i
        nput)
        lst_output.exte
        nd(yhat.tolist()
        ) i=i+

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

print (lst_output)
day_new=np.arange(1,
11)
day_pred=np.arange(1
1,2
1) len(data_oil)
plt.plot(day_new,scalar.inverse_transform(data_oil[
8206:]
)) plt.title("Review of prediction")
plt.plot(day_pred,scalar.inverse_tr
ansform(lst_output)) plt.show()
df3=data_oil.tolist()

df3.extend(lst_outpu
t)
plt.title("Past data nad next 10
days output prediction")
plt.plot(df3[8100:])
df3=scalar.inverse_transform(df3)
.tolist()
plt.title("Past data nad next 10 days output prediction after reversing the
scaled values")
```

Index.html:

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8">
    <title>Crudeoil price prediction</title>
    <!--<link rel="stylesheet" href="in.css">
    <link
href="https://fonts.googleapis.com/css2?family=Poppins:wght
@300;400;500;600;
700&d isplay=swap"rel="stylesheet">
    <link rel="stylesheet"
    href="https://www.w3schools.com/w3css/4/w3.css">
<link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/4.7.0/css/fontawesome.min.c ss">-->
   <style
     >
 ul
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 n
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```

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e;
m
ar
gi
n:
0;
p
a
d
di
n
g:
0;
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w
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hi
d
d
e
n;
b
o
r
d
er
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  ol
  id
  #
  e
  7
  e
  7
  e
  7;
  b
  a
  c
  k
  g
  r
  o
  u
  n
  d
  c
  ol
  o
  r:
  #
  0
  5
  7
  5
  1
  4;
}

l
```

```
i
{
  float: left;

}

li a {
  display:
  inlineblock;
  color: rgb(78,
  3, 3); text-
  align: center;
  padding: 14px
  16px;
  textdecoration
  : none;
  background-
  color:rgb(18,
  116, 5) ;
}
l
i
a
:
h
o
v
e
r
{
   border:1px
solid;
background-
color:
lightseagreen; }
     </style>
   </head>
   <body>
      <nav class="navbar navbar-inverse">
         <div class="container-fluid">
            <ul>
              <li class="parts"><a href="#">Home</a></li>
              <li class="parts"><a
           href="predict.html">predict</a></li> </ul>
         </div>
        </nav>

      <h1 >Crudeoil price prediction</h1>

      <
         s
         t
         y
         l
         e
         >
         b
         o
         d
         y
         {
           background-image:
           url('static/css/image.j
           peg');
           backgroundrepeat:
           no-repeat;
```

```
          background-
          attachment:
         fixed; background-size: 100%
         100%;

         }
         </style>

        <h3 style="font-family:system-ui;">
          Demand for oil is inelastic, therefore the rise in price
is good news for producers because they will see an increase
in their revenue. Oil importers, however, will experience
increased costs of purchasing oil. Because oil is the largest
traded commodity, the effects are quite significant. A rising
oil price can even shift economic/political power from oil
importers to oil exporters. The crude oil rice movements are
subject to diverse
         influencing
         factors</h3
         >
      </body>
      </html>
```

Predict.html:

```
<html>
   <head>
      <link rel="stylesheet" href="static/css/style.css">
      <
         s
         t
         y
         l
      e
      >
      b
      o
      d
      y
      {
       background-image:
       url('static/css/image3.
       jpg');
       backgroundrepeat:
       no-repeat;
       background-
       attachment:
      fixed; background-size: 100%
      100%;

      }
      </style>

  </head>
  <script>
    document.getElementByID("demo
    ").innerHTML =
document.getElementB
  yId("ten"); </script>
<body>
<form action="/method" method="POST" enctype =
"multipart/form-data">
<div class="container">
  <!--<div class="brand-logo"></div>-->
  <div class="brand-title">predict the oil price</div>
  <div class="inputs">
   <label>Enter Price</label>
   <input type="text" placeholder="Enter ten days price"
   id="ten" name="val"/> <button
```

```
        type="submit">Predict</b
        utton><br><br> The next
        day price is :
        {{prediction}}
    </div>
  </div>
</form>
</body>
</html>
```

App.py:

```
from flask import Flask,
render_template, request, redirect
import numpy as np
# from tensorflow.k
```

```
          from keras.saving.save import load_model
          app = Flask(_name_,template_folder='template')

          @app.route('/'
          ,
          methods=["G
          ET"]) def
          index():
return render_template('index.html')

          @app.route('/predict.html', methods=["POST",
          "GET"]) @app.route('/method', methods=["POST",
          "
          G
          E
          T
          "
          ]
          )
          d
          e
          f
          m
          e
          t
          h
          o
          d
          (
          )
          :
             if request.method
                == "POST":
                string =
                request.form['v
                al'] string =
string.split(',')
temp_input =
[eval(i) for i in
string]

x_input = np.zeros(shape=(1,
10)) x_input.shape

lst_output =
[
]
n
_
s
t
e
p
s
=
1
0
i
=
0
w
h
i
l
e
(
i
<
1
0
)
:
```

```
if
   (len(temp_
   input) >
   10):
   x_input =
   np.array(te
   mp_input[
   1:])
   x_input =
   x_input.res
   hape(1, -
   1) x_input =
   x_input.reshape((
   1, n_steps, 1))
   yhat =
   model.predict(x_i
   nput, verbose=0)
   temp_input.exten
   d(yhat[0].tolist())
   temp_input =
   temp_input[1:]
   lst_output.extend
   (yhat.tolist())
   i = i + 1

e
l
s
e
:
   x_input =
   x_input.reshape((1,
   n_steps, 1)) yhat =
   model.predict(x_inpu
   t, verbose=0)
```

```
            temp_input.extend(yhat[0].tolist())
            lst_output.extend(yhat.tolist())
           i = i + 1
             val =
         lst_output[9]
     return render_template('predict.html', prediction=val)
    if request.method == "GET":
       return render_template('predict.html')

  if name____== "_main_":
    model =
    load_model(r'crudeoilpr
    ediction.h5')
    app.run(debug=True)
```

#cloud deployment code in ml model

```
!pip install ibm_watson_machine_learning

from
ibm_watson_machine_learning
import APIClient
wml_credentials = {
        "url" : "https://us-south.ml.cloud.ibm.com",
                                                               "apikey" :
"cRkqykhsnLO1Ogs_xoYjgLkNTtTS1Qxyi0Mn1GSlQ1P5"
} client =
APIClient(wml
_credentials)

#for creating a
deployment
phase def
guid_from_spac
```

```
e_name(client,
space_name):
space=client.spa
ces.get_details()
   #print(space) return(next(item
for item in space['resources'] if
item['entity']['name'] ==
space_name)['metadata']['id'])
space_uid =
guid_from_space_name(client,
'models') print("Space UID =
"+space_uid)
client.set.default_space(space_ui
d)
client.software_specifications.list
() software_spec_uid=
client.software_specifications.get_uid_by_name("tenso
rflow_rt22.1py3.9") software_spec_uid
```

GitHub & Project Demo Link:
https://github.com/IBM-EPBL/IBM-Project-47745-1660801886