AI - POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

IBM-Project-46884-1660794237

NALAIYA THIRAN PROJECT BASED ON LEARNING PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

Project Report

TEAM ID: PNT2022TMID47872

TEAM MEMBERS:

1. RUBINI M - 911719106024
2. KHAUSHALYA M – 911719106015
3. SNEKA S - 911719106027
4. JASHMA S – 911719106013

BACHELOR OF ENGINEERING IN ELECTRONICS AND COMMUNICATION ENGINEERING

MOUNT ZION COLLEGE OF ENGINEERING AND TECHNOLOGY

ANNA UNIVERSITY, CHENNAI – 600 025

INDEX

1. INTRODUCTION

Food is essential for human life and has been the concern of many healthcare conventions. Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet. It is vital part of analytical chemistry that provides information about the chemical composition, processing quality control and contamination of food. Here the user can capture the image will be sent the trained model. The model analyses the image and detect the nutrition based on fruits like (sugar, Protein, Calories, etc.).

1.1 Project Overview

As the world grows more fitness-conscious with passing time, the demand for technological solutions to cater to this burgeoning demand is diversifying. In India, this global trend has had a positive impact on scores of startups and websites catering to this segment. AI and its various subsets have been leveraged by these platforms to identify the calorie intake and also to make food recommendations for a healthy diet. In most cases, what we see is that these platforms act as a data repository where while providing real-time information to its users, it also makes available to numerous clients who work in this field for a determined rate. In this article, we take a look at the top AI-based online platforms which make use of AI and other deep learning technologies to provide a real-time updates about nutrition intake. The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like color, shape.

1.2 Purpose

Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fib-re, Protein, Calories, etc.).

2. LITERATURE SURVEY

2.1 Existing Problem

In the short term, poor nutrition can contribute to stress, tiredness and our capacity to work, and over time, it can contribute to the risk of developing some illnesses and other health problems such as: being overweight or obese. Tooth decay, high blood pressure. There are now strong links between low intakes of particular nutrients and the risk of developing chronic disease including some cancers, heart disease, diabetes, osteoporosis and depression. During pregnancy, insufficient nutrient intake can have long-term health implications for the health of the child.

2.2 References

1. Oka, R.; Nomura, A.; Kometani, M.; Gondoh, Y.; Yoshimura, K.; Yoneda, T.Study protocol for the effects of artificial intelligence { AI } – supported automated nutritional intervention onglycemic control in patients with 2 diabetes mellitus.

2. Kumar Saini, D.; rabbi, S.; Chhabra, D.; Shukla, P.Phycobiliproteins from Anabaena variabilis CCC421 and its production enhancement strategies using combinatory evolutionary algorithm approach.Bioresource.techno;.2020,309,123347.

3. Rozga M, Latulippe ME, Steiber A. “Advancements in personalized nutrition technologies: Guiding principles for registered dietitian nutritionists’’ Jornal of the acdemy of nutrition anddietetics.

4. Haung, S.- M.; Li, H.-J.; Liu,Y.-C.; Kuo, C.;H.; Shieh,C.J An efficient approach for lipase – caralyzed synthesis of retinl laurate nutraceutical by combining ultrasound assistance and artificial neural network ----- Genatic algorithm to optimize wheat germ fermentation condition: Application to the production of two anti – tumor benzoquinones.

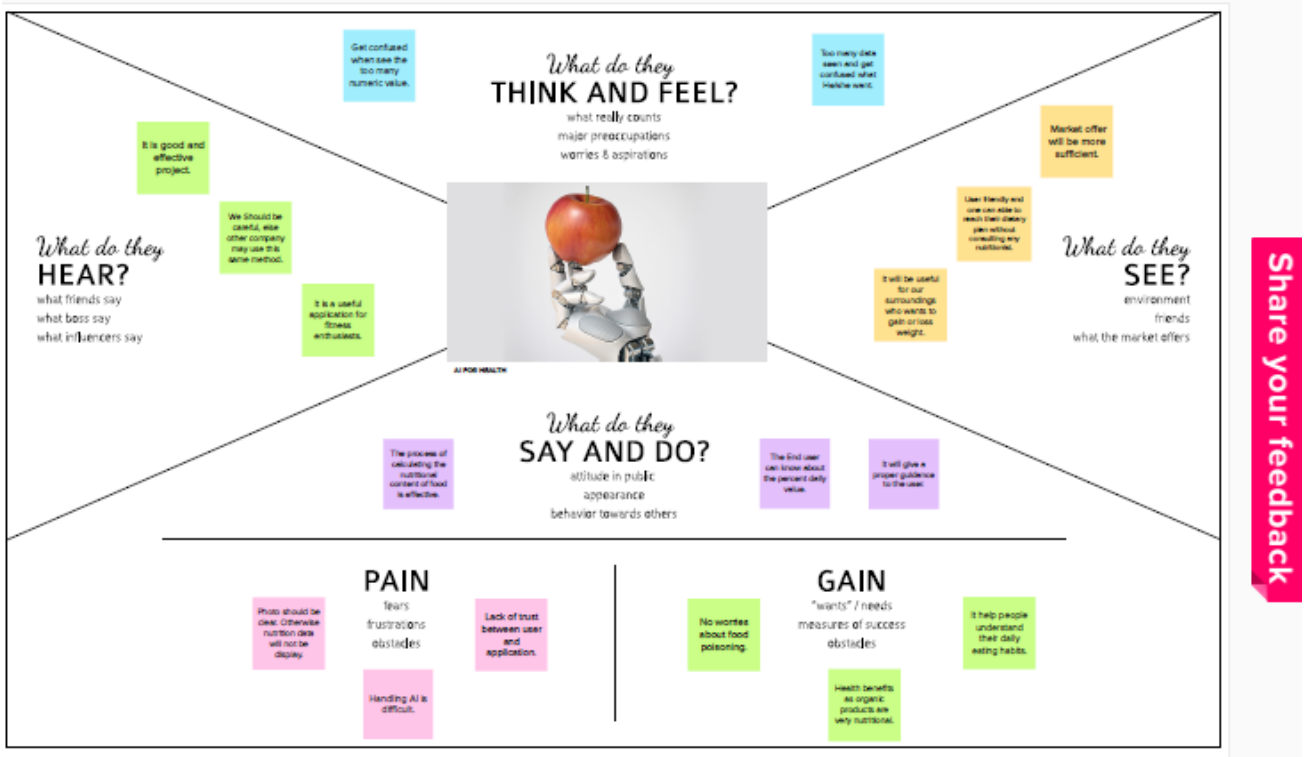
2.3 Problem Statement Definition

The amount of physical activity you need depends on your individual fitness goals and your current fitness level. It’s important to start within your abilities and listen to your body’s cues in terms of pain and injury. Obesity is a common health issue that is defined by having a high percentage of body fat. Being overweight or obese increases your chances of dying from hypertension, coronary heart disease, sleep neap, and endometrial, breast, prostate, and colon

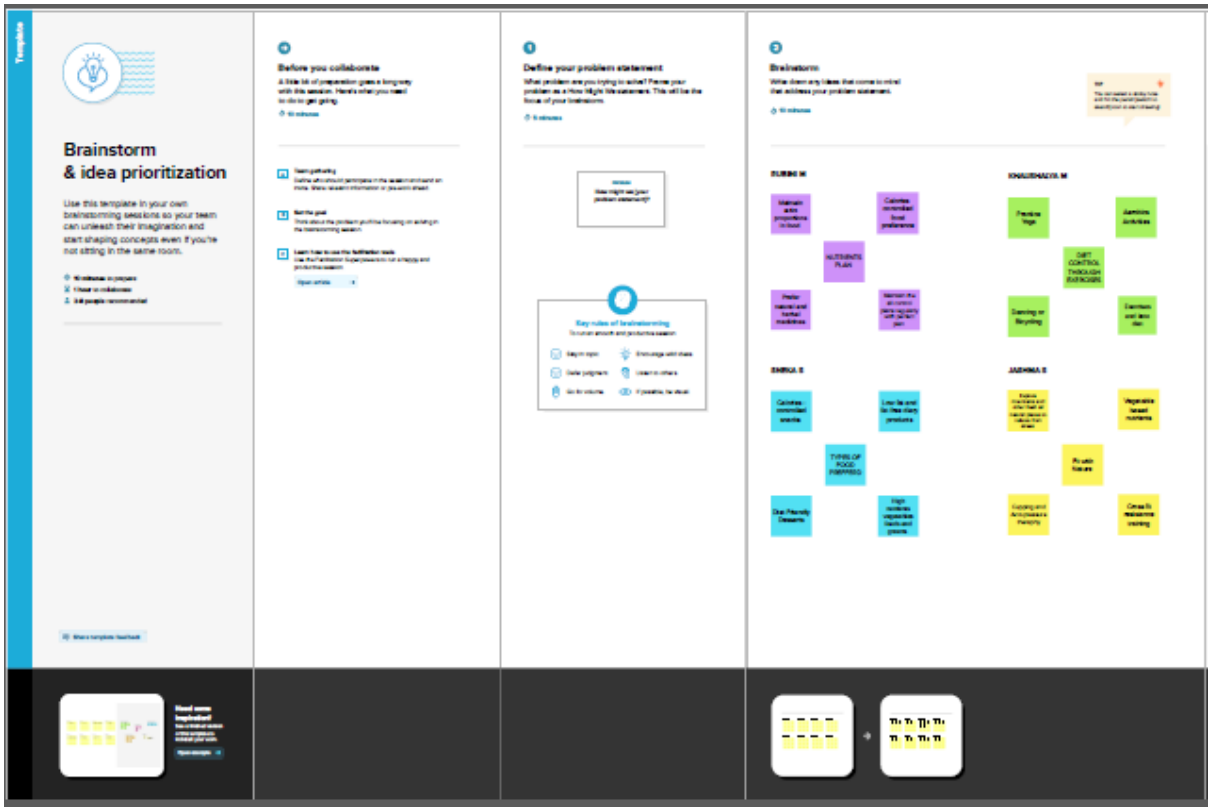
cancers. Junk foods are high in calorie but low in nutrition value and lead to an excess metabolic weight leading to obesity. An obese individual is prone to life-threatening diseases which are not only limited to cholesterol or diabetes but also can cause stoke and NCDs. Overtraining may wear down the immune system. It Increases cardiovascular stress. Incorrect workouts may cause sprains, strains, fracture and other painful injury.

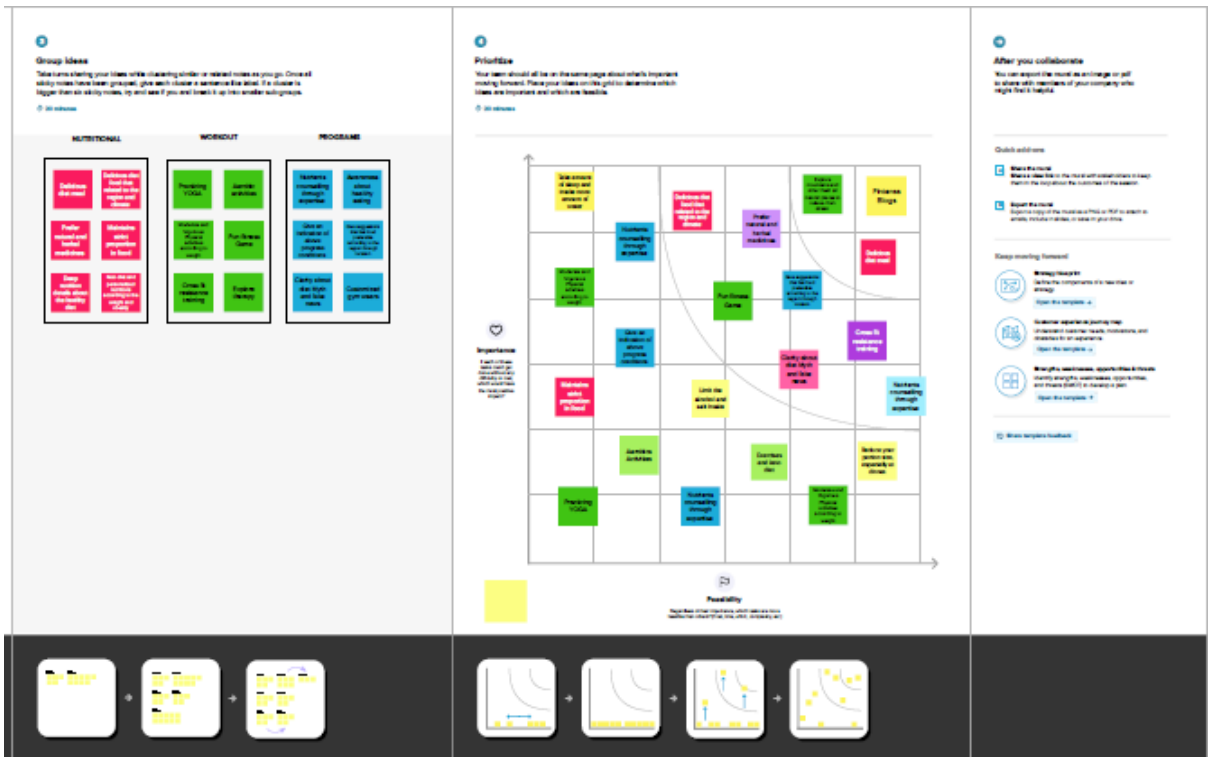
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



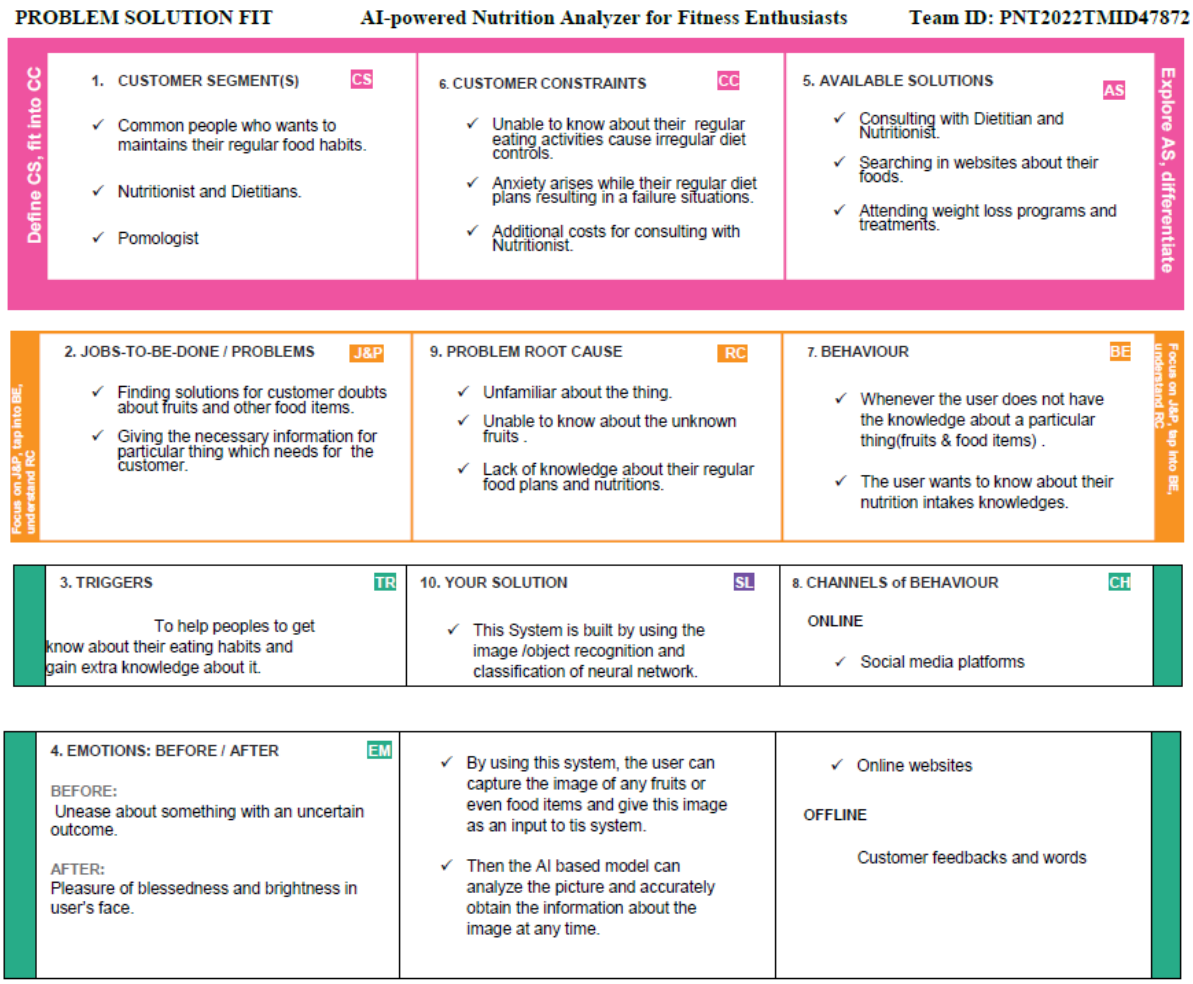


3.3 Proposed Solution

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	To build an efficient AI based model which is used for dietary assessments and provide the following constraints: • To capture the fruits using the AI tool. • The model analyses the images and give the nutrition based on the fruits.
2.	Idea / Solution description	The AI based model is built by using the Image/object recognition and classification using CNN. By using this, • The user interacts with the UI and give the image as input. • Then the image will pass to our flask application. • Finally, our model classify the result and showcase it on the UI.
3.	Novelty / Uniqueness	• This Nutrition Analyzer system is User Friendly and 24*7.So the user can access it anywhere at any time. • This system uses AI and Image classification technology to identify the fruit correctly and accurately give the analysis
4.	Social Impact / Customer Satisfaction	• The customer can easily identify the fruits nutrition patterns just from the picture. • They can maintain their dietary plan on their own via this system. • It will give a proper guidance and accurate analysis to the end users. • It should act as a bridge towards achieving high accuracy on predicting and analysing the image taken as input and to deliver the output with respective to the input image.
5.	Business Model (Revenue Model)	This AI based system can attract a lot of customers who want to maintain their dietary plan and get to know about their eating habits. So it is useful for many peoples across the

		world. And also more users can increase the revenue.
6.	Scalability of the Solution	By this system, the user can efficiently and effectively understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet.

3.4 Problem Solution Fit



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	User Interface	Intuitive and easy to navigate
FR - 4	Business Model	Business Model
FR - 5	Dataset Collection	Daily intake of calories and food physical activities
FR - 6	Training and Testing	Providing necessary information with great accuracy

4.2 Non-Functional Requirement

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

NFR NO	Non-Functional Requirement	Description
	Usability	➢ Effective in changing eating behavior and diet-related health risk factors ➢ Factors influencing engagement with mobile weight loss and weight maintenance interventions. ➢ These factors include personalization, simplicity, entertainment, usability, social support, and the presence of certain features such as self-monitoring, and prompts. ➢ However, it can be used for a variety of goals, including self-monitoring, eating healthier, or even gaining weight, which again may reflect a variety of

		underlying motivations including health status and specific needs and expectations
	Security	➢ User friendly. ➢ Protect and maintain the security of the details of users. ➢ Data piracy and cyber threats are prevented. ➢ Detects any intrusions and ➢ Prevent unwanted advertisements during the progress and process of the consulting
	Reliability	➢ The app promotes self-efficacy by allowing users to track their diet progress and work toward simple personal goals. ➢ Trustworthy ➢ Ensure permission and got qualifications from the articles according to the nutrient app maintenance and treating people. ➢ Updates the app periodically to make comfort people.
	Performance	The AI-based model is built by using Image/object recognition and classification using CNN. By using this, ➢ The user interacts with the UI and gives the image as input. ➢ Then the image will pass to our flask application. ➢ Finally, our model classifies the result and showcases it on the UI
	Availability	➢ Consulting with Dietitian and Nutritionist. ➢ Searching websites about their foods. ➢ Attending weight loss programs and treatments.
	Scalability	Through this system, the user can efficiently and effectively understand their: ➢ Daily eating habits ➢ Explore nutrition patterns

		➢ Maintain a healthy diet. ➢ Best for meal planning ➢ Best for finding a diet-friendly restaurant ➢ Best for creating custom grocery lists ➢ Best for pregnant people's health ➢ Best for meeting healthy eating goals ➢ Best for those with food intolerances ➢ Best for counting calories ➢ Best for forming healthy eating habits ➢ Best for promoting a healthy body image ➢ Best for intuitive eating

5. PROJECT DESIGN

5.1 Project Structure

Create a Project folder that contains files as shown below

- Dataset folder contains the training and testing images for training our model.
- We are building a Flask Application that needs HTML pages stored in the templates folder and a pythonscriptapp.py for server side scripting
- We need the model which is saved and the saved model in this content is anutrition.h5
- Templates folder contains home.html, image.html, image prediction. Html pages.
- Statis folder had the css and js files which are necessary for styling the html page and for executing the actions.
- Uploads folder will have the uploaded images (which are already tested).
- Sample images will have the images which are used to test or upload.
- Training folder contains the trained model file.

5.1 Project flow

- The user interacts with the UI (User Interface) and give the image as input.
- Then the input image is then pass to our flask application,

- And finally with the help of the model which we build we will classify the resultand showcase it on the UI.
- To accomplish this, we have to complete all the activities and tasks listed below

Data Collection

Collect the dataset or Create the dataset

Data Preprocessing

- Import the Image Data Generator library
- Configure Image Data Generator class

Apply Image Data Generator functionality to Trainset and

Test set

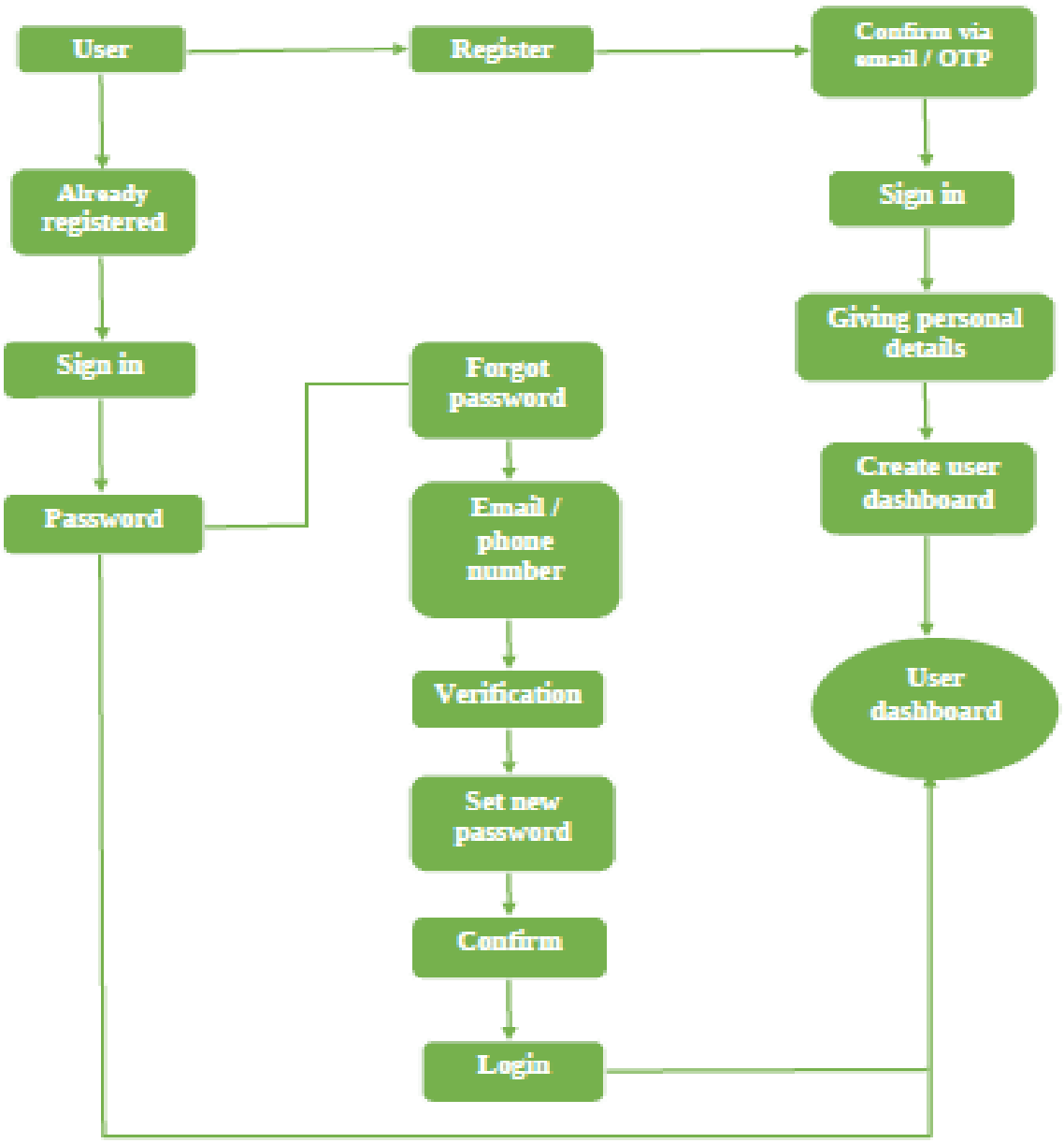
Model Building

- Import the model building Libraries
- Initializing the model
- Adding Input Layer
- Adding Hidden Layer
- Adding Output Layer
- Configure the Learning Process
- Training and testing the model
- Save the Model

Application Building

- Create an HTML file
- Build Python Code

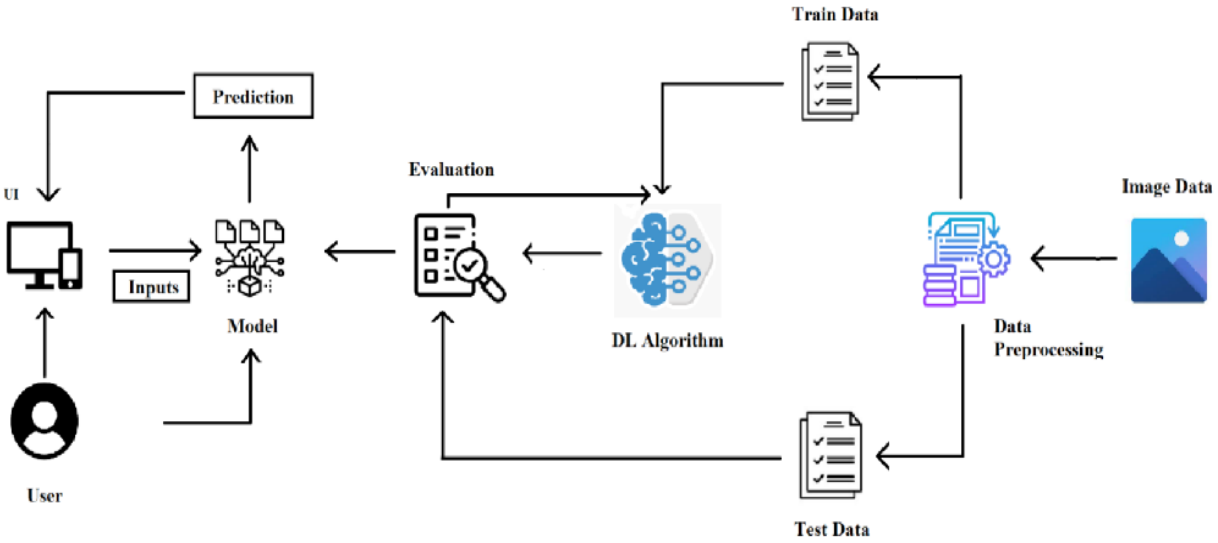
5.2 Data Flow Diagram



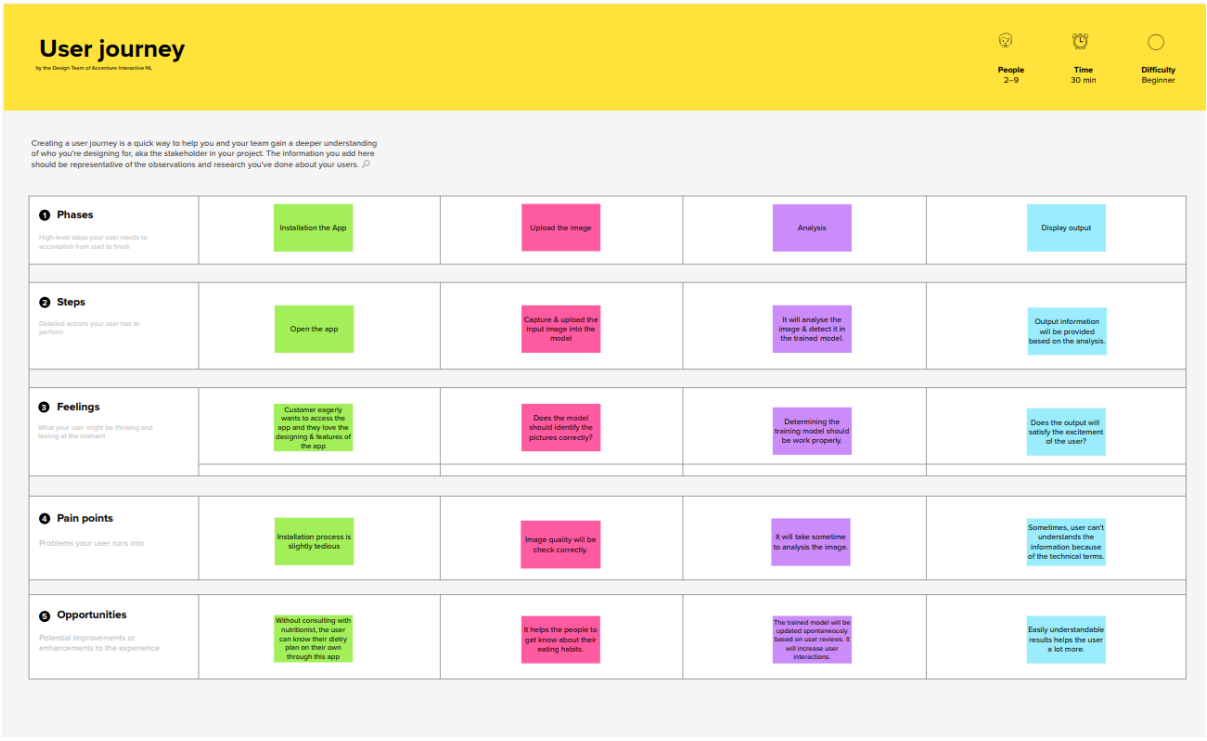
5.3 Solution & Technical Architecture

• Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet.
• Nutritional analysis is the process of determining the nutritional content of food.
• The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc.
• Food is essential for human life and has been the concern of many healthcare conventions.

• It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.



5.4 Customer Journey



6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

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	20	03 Nov 2022
Sprint-3	20	6 days	07 Nov 2022	12 Nov 2022	20	10 Nov 2022
Sprint-4	20	6 days	19 Nov 2022	19 Nov 2022	20	17 Nov 2022

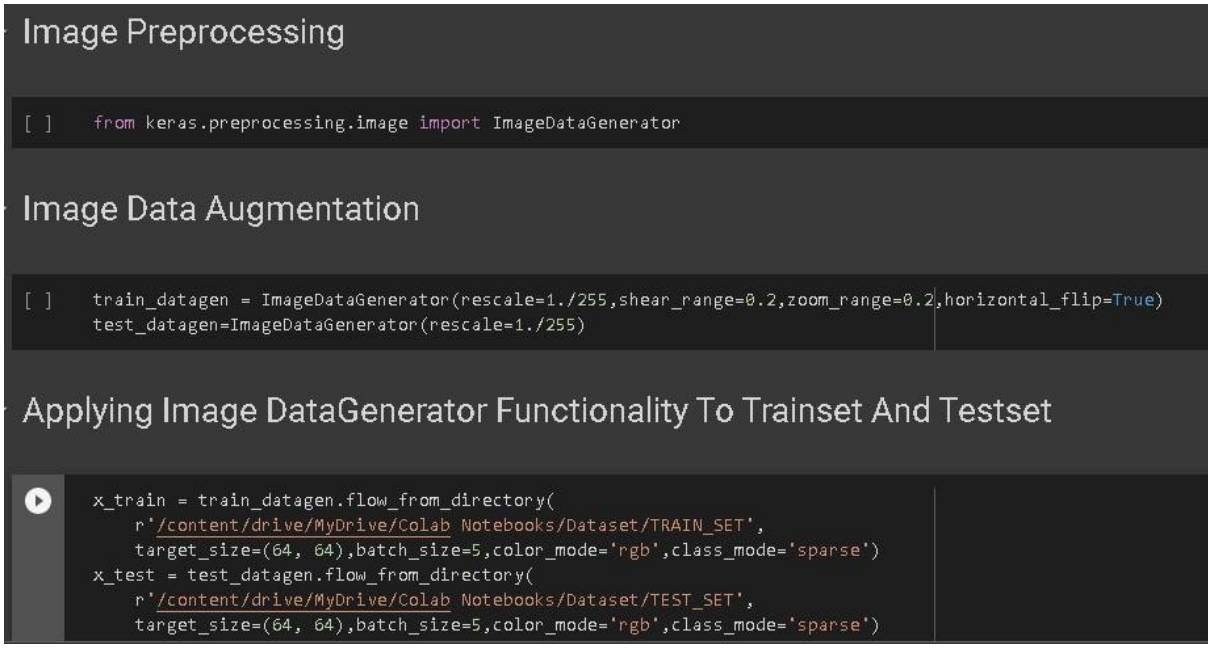
6.2 Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint 1	Registration	USN -1	As a user, I can register for the application by entering my email, password and confirming my password.	2	High	Khaushalya M Rubini M
Sprint 1		USN-2	As a user, I can register for the application through Gmail, Linkedln.	1	High	Jashma S Sneka S
Sprint 2	Login	USN-2	As a user, I can login by using valid user name	2	High	Khaushalya M Rubini M

			and password.			Jashma S Sneka S
Sprint 3	Dashboard	USN-3	As a user, I can view the garbage storage level.	2	Medium	Sneka S Khaushalya M Rubini M Jashma S

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Features



3. Adding CNN Layers

```
classifier = Sequential()
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))
classifier.add(Conv2D(32, (3, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))
classifier.add(Flatten())
```

4. Adding Dense Layers

```
classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax'))
```

```
classifier.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 62, 62, 32)        896
```

5. Configure The Learning Process

```
classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

6. Train The Model

```
classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, validation_data=x_test,validation_steps = len(x_test))
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Pl

Epoch 1/20
494/824 [================>.............] - ETA: 6:52 - loss: 0.7194 - accuracy: 0.7174
```

7. Saving The Model

```
classifier.save('nutrition.h5')
```

8. Testing The Model

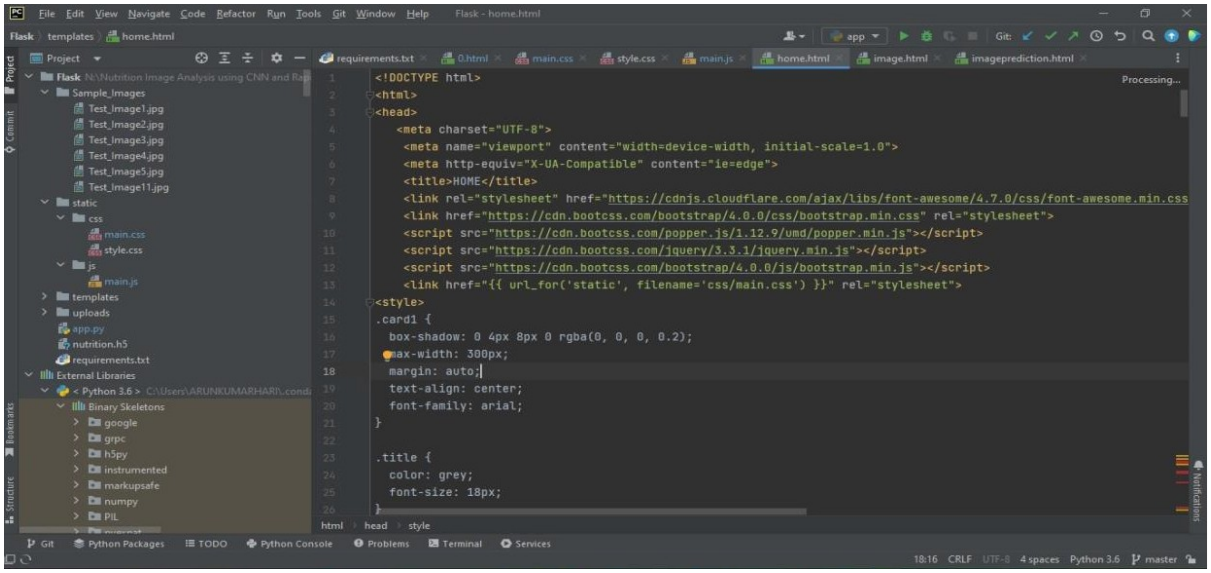
```
from tensorflow.keras.models import load_model
from keras.preprocessing import image
model = load_model("nutrition.h5")
```

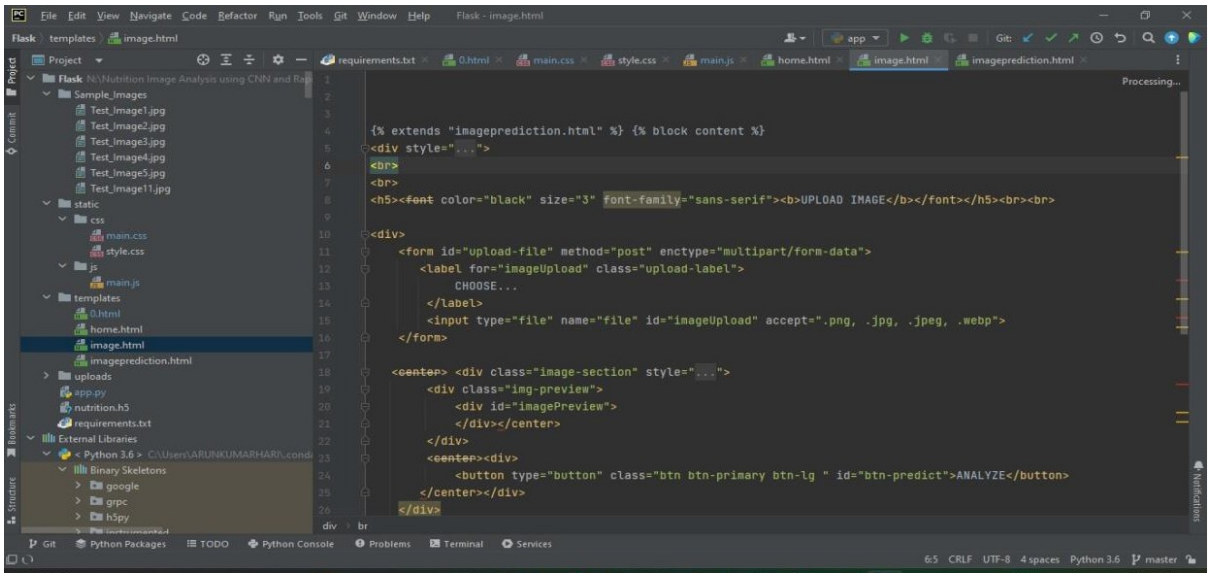
```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model("nutrition.h5")
img = image.load_img(r'/content/drive/MyDrive/Colab Notebooks/Sample_Images/Test_Image1.jpg',grayscale=False,target_size= (64,64))
x = img_to_array(img)
x = np.expand_dims(x,axis = 0)
predict_x=model.predict(x)
classes_x=np.argmax(predict_x,axis=-1)
classes_x
```

```
1/1 [==============================] - 0s 62ms/step
array([0])
```

```
index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
result=str(index[classes_x[0]])
result
```

7.2 Feature 2


File Edit View Navigate Code Refactor Run Tools Git Window Help
Flask - home.html
Flask templates home.html
requirements.txt 0.html main.css style.css main.js home.html image.html imageprediction.html
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>HOME</title>
<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css
<link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
<script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
<script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
<link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
<style>
.card1 {
box-shadow: 0 4px 8px 0 rgba(0, 0, 0, 0.2);
max-width: 300px;
margin: auto;
text-align: center;
font-family: arial;
}
.title {
color: grey;
font-size: 18px;
}
Processing...
html head style
Git Python Packages TODO Python Console Problems Terminal Services
18:16 CRLF UTF-8 4 spaces Python 3.6 master

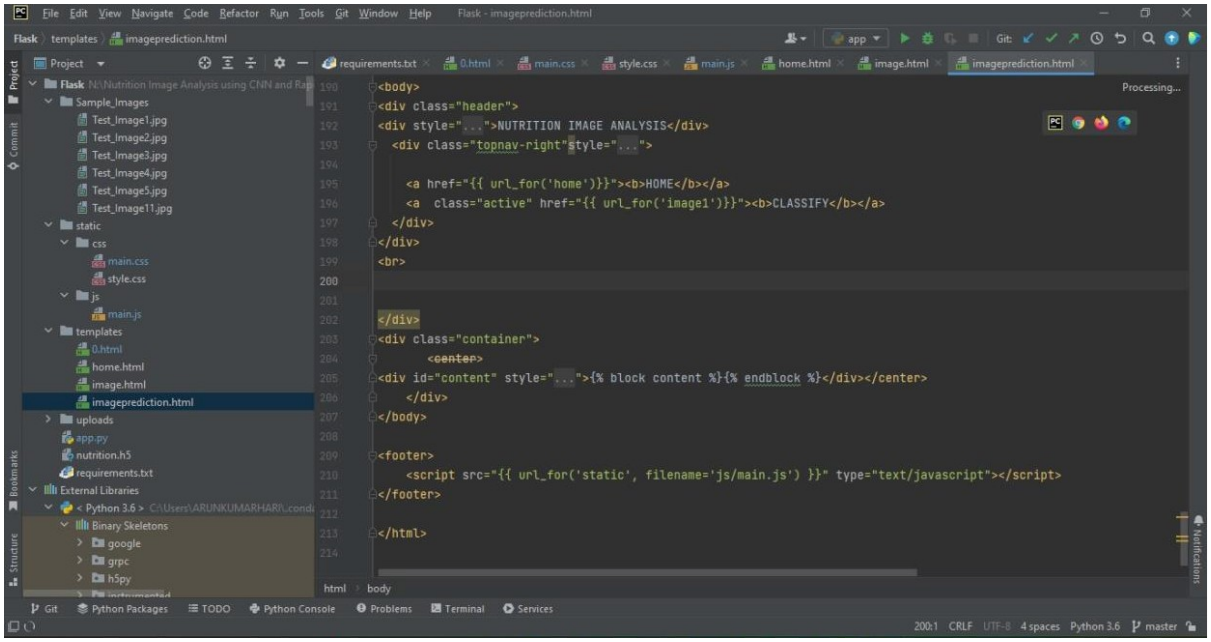

File Edit View Navigate Code Refactor Run Tools Git Window Help
Flask - image.html
Flask templates image.html
requirements.txt 0.html main.css style.css main.js home.html image.html imageprediction.html
{% extends "imageprediction.html" %} {% block content %}

<h5>UPLOAD IMAGE</h5>

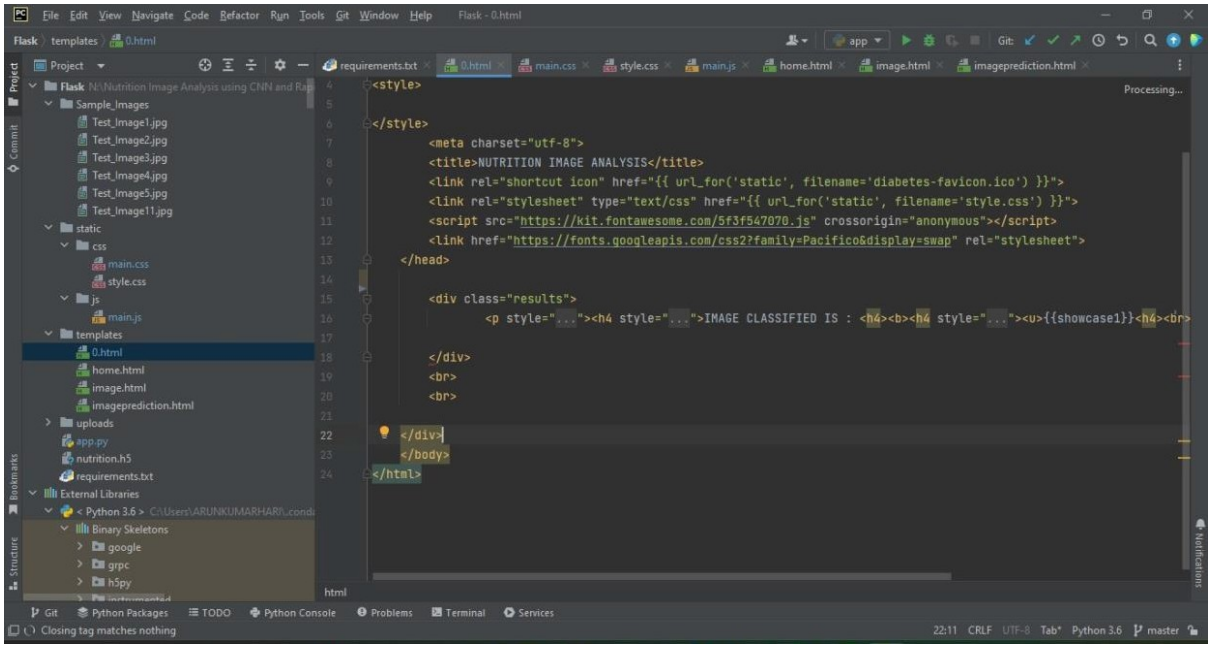
<form id="upload-file" method="post" enctype="multipart/form-data">
<label for="imageUpload" class="upload-label">
CHOOSE...
</label>
<input type="file" name="file" id="imageUpload" accept=".png, .jpg, .jpeg, .webp">
</form>

<button type="button" class="btn btn-primary btn-lg " id="btn-predict">ANALYZE</button>

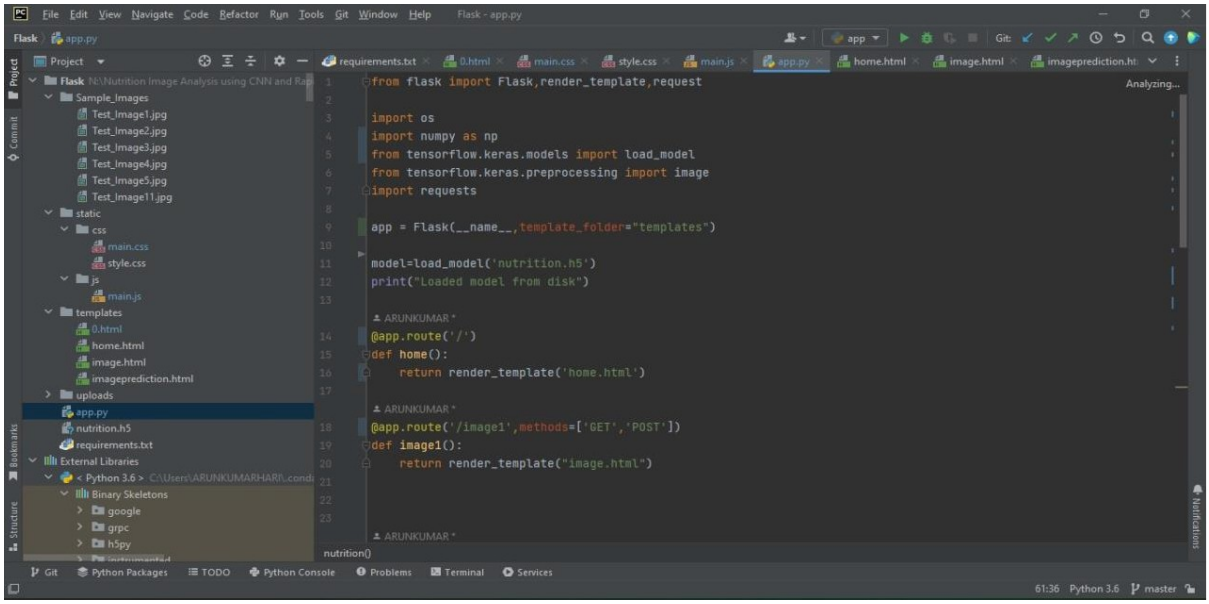
templates
0.html
home.html
image.html
imageprediction.html
Processing...
div br
Git Python Packages TODO Python Console Problems Terminal Services
6:5 CRLF UTF-8 4 spaces Python 3.6 master



```
<body>
<div class="header">
 <div style="...">NUTRITION IMAGE ANALYSIS</div>
  <div class="topnav-right"style="...">

    <a href="{{ url_for('home')}}"><b>HOME</b></a>
    <a  class="active" href="{{ url_for('image1')}}"><b>CLASSIFY</b></a>
  </div>
</div>
 <br>


 </div>
<div class="container">
      <center>
<div id="content" style="...">{% block content %}{% endblock %}</div></center>
    </div>
</body>

<footer>
    <script src="{{ url_for('static', filename='js/main.js') }}" type="text/javascript"></script>
</footer>

</html>
```

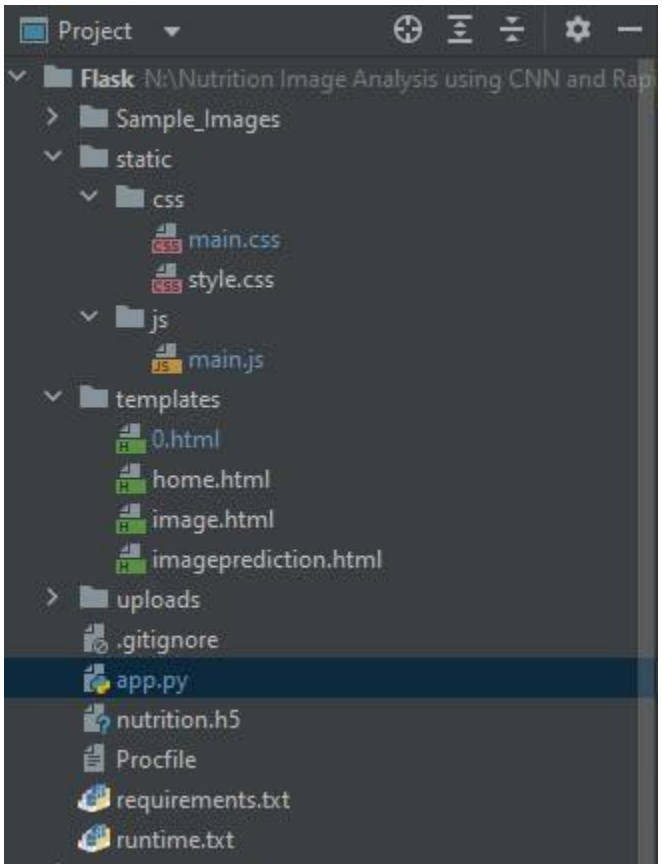


```
<style>

</style>
       <meta charset="utf-8">
       <title>NUTRITION IMAGE ANALYSIS</title>
       <link rel="shortcut icon" href="{{ url_for('static', filename='diabetes-favicon.ico') }}">
       <link rel="stylesheet" type="text/css" href="{{ url_for('static', filename='style.css') }}">
       <script src="https://kit.fontawesome.com/5f3f547070.js" crossorigin="anonymous"></script>
       <link href="https://fonts.googleapis.com/css2?family=Pacifico&display=swap" rel="stylesheet">
   </head>

       <div class="results">
             <p style="..."><h4 style="...">IMAGE CLASSIFIED IS : <h4><b><h4 style="..."><u>{{showcase1}}<h4><br>

       </div>
       <br>
       <br>

 </div>
    </body>
</html>
```

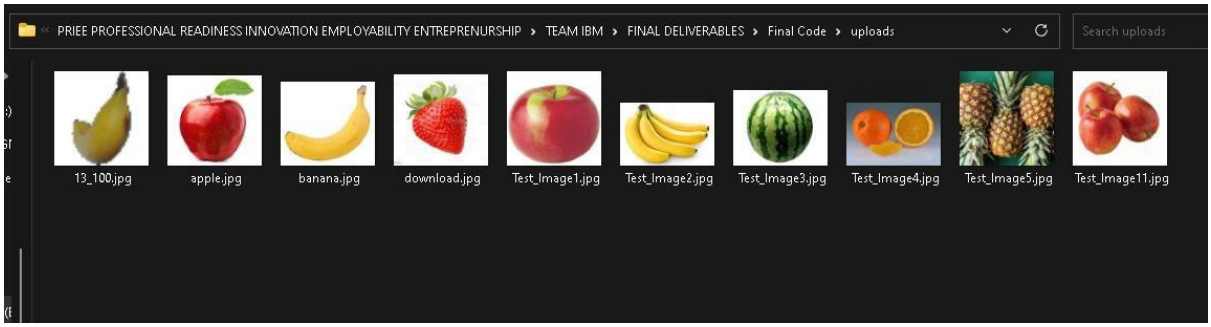


8. TESTING

8.1Test Cases



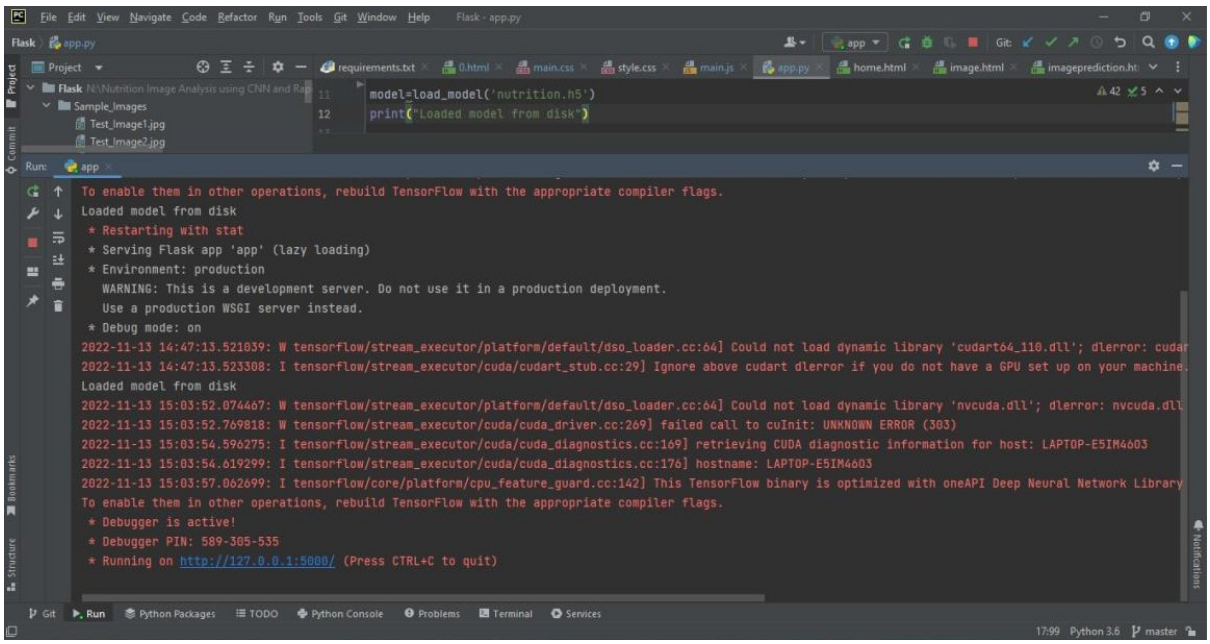
8.1Test Cases



8.2User Acceptance Testing

9. RESULTS

9.1Performance Metrics



10. ADVANTAGES

Advantages-Nowadays new dietary assessment and nutrition analysis tools **enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet**. Nutritional analysis is the process of determining the nutritional content of food.

11. CONCLUSION

Thus powered nutrition analyzer for fitness enthusiasts good nutrition promotes not only better physical healthy and reduced susceptibility to disease, but has also been demonstrated to contribute to cognitive development and academic success. Left to their own devices, children will not automatically select healthy food. A balance diet and appropriate meal timings are important for healthy body and mind. Most countries nowadays implement health education program in schools which include feeding to students, vitamin and mineral supplementation.

12. FUTURE SCOPE

AI is revolutionizing the health industry. It is majorly used in improving marketing and sales decisions, AI is now also being used to reshape individual habits. In future we don’t want to go to gym and do any diets. By using this nutrition fitness analyzer we can maintain our diet plans without any help from others and we can lead a happy and healthy life with good wealth.AI can easily track health behaviours and repetitive exercise patterns and use the data to guide you towards your fitness journey and diet plans.

13. APPENDIX

GitHub & Project Demo Link

GitHub Link

https://github.com/IBM-EPBL/IBM-Project-46884-1660794237

Demo link

https://drive.google.com/drive/folders/1RyrMW81L_8dTu1DEAt_F92SnoBK4ZX2a?usp=share_link