PROJECT REPORT

AI-POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

TEAM ID: PNT2022TMID27357

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

Food is essential for human life and has been the concern of many healthcare conventions. As the world grows more fitness-conscious with passing time, the demand for technological solutions to cater to this burgeoning demand is diversifying. Nowadays new dietary assessment and nutrition analysis tools using predictive analytics artificial intelligence and natural language processing 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. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

1.2 PURPOSE

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. 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, Fibre, Protein, Calories, etc.).

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

[1] Deep Food: Food Image Analysis and Dietary Assessment via Deep Model

This system will analyse the nutritional ingredients based on the recognition results and generate a dietary assessment report by calculating the number of calories, fat, carbohydrate and protein.

ALGORITHMS USED:

- Region-based
- Convolutional Neural Network
- Non-maximum suppression
- Bounding Box Regression
- Deep learning techniques

CHALLENGES:

Three main challenges in real food image recognition and analysis are addressed as follows:

1. Region of Interest
2. The Delay of Food Recognition

3. Insufficient Information of Nutrition Content for dietary assessment.

[2] A New Deep Learning-based Food Recognition System for Dietary Assessment on An Edge Computing Service Infrastructure

It is a design of food recognition system employing edge computing-based service computing paradigm to overcome some inherent problems of traditional mobile cloud computing paradigm, such as unacceptable system latency and low battery life of mobile devices.

ALGORITHMS USED:

- K-means clustering algorithms
- Convolutional Neural Network
- Bounding Box Regression
- Deep learning

CHALLENGES:

Using this simple cropping-based approach will not work well if the food is scattered on different parts of the image.

[3] Precision Nutrient Management Using Artificial Intelligence Based on Digital Data Collection Framework

Nutritional intake is fundamental to human growth and health, and the intake of different types of nutrients and micronutrients can affect health. The content of the diet affects the occurrence of disease, with the incidence of many diseases increasing each year while the age group at which they occur is gradually decreasing.

ALGORITHM USED:

- Okapi BM25
- TF-IDF
- Levenshtein
- Jaccard
- Synonyms

CHALLENGES:

This model has very little error and can significantly improve the efficiency of the analysis.

[4] Calculating Nutrition Facts with Computer Vision

People are becoming more health-conscious than before. However, there is a lack of knowledge about different fitness and wellness aspects of food. Thus, I come up with Foodify. AI-a deep learning-based application that detects food from the image and provides information of food such as protein, vitamins, calories, minerals, carbs, etc

ALGORITHM USED:

- Deep learning
- Machine learning
- Image Processing

CHALLENGES:

1. This is to collect images to create a huge dataset.

2. This is related to training the deep learning model. It is an extremely computationally expensive and time-consuming task to train the model again and again. This can be solved by using cloud-based services

2.2 REFERENCES

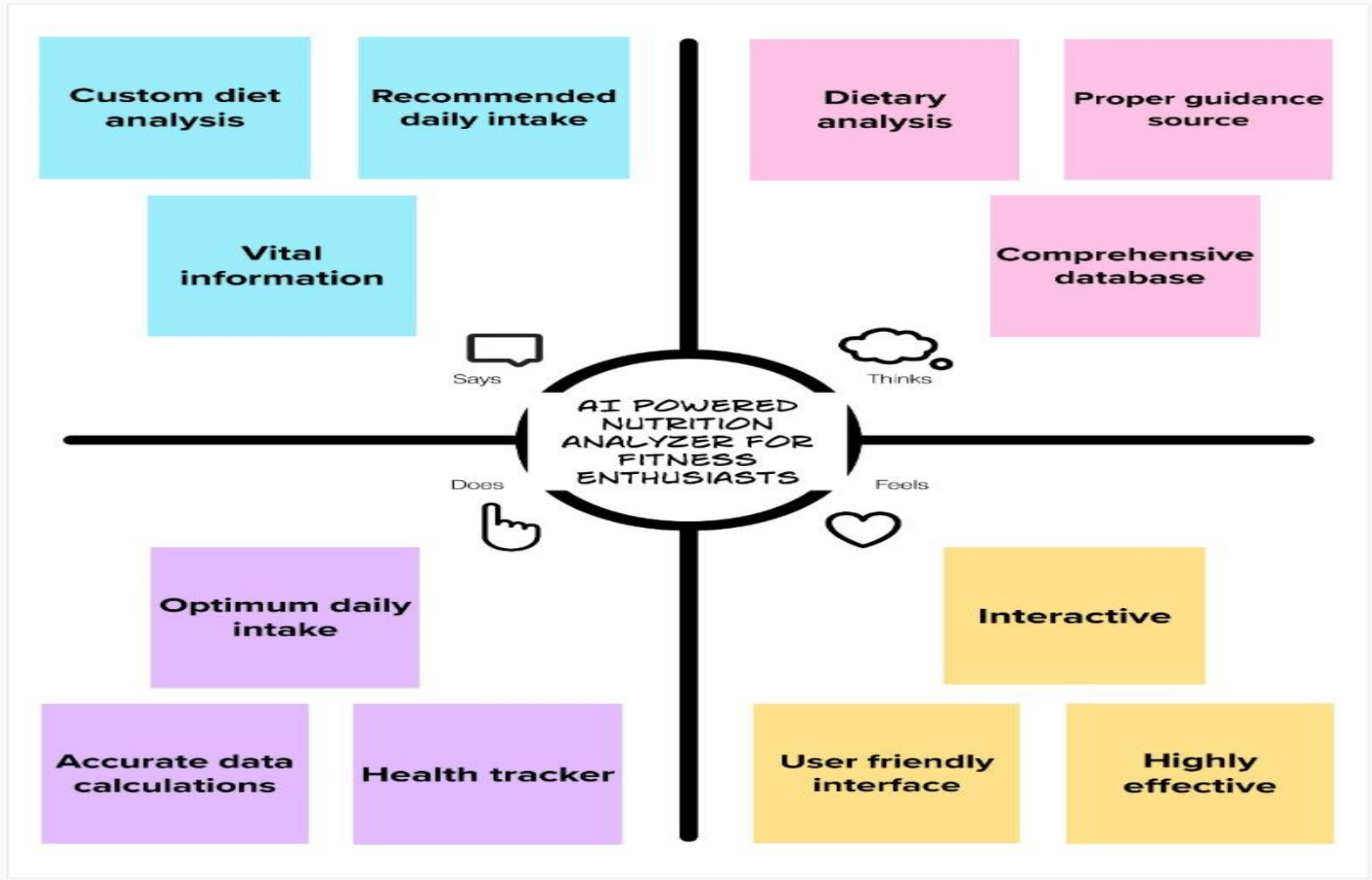
- https://ieeexplore.ieee.org/document/8998172
- https://scholar.google.co.in/scholar_url?url=https://ieeexplore.ieee.org/ielaam/4629386/8332642/7837725-aam.pdf&hl=en&sa=X&ei=df14Y6_5CZCXywTpjZ64Bw&scisig=AAGBfm30mwcC1DJ2XAFNUqxS-Jb7uSlfRg&oi=scholarr
- https://www.researchgate.net/publication/360084522_Precision_Nutrient_Management_Using_Artificial_Intelligence_Based_on_Digital_Data_Collection_Framework
- https://www.google.com/amp/s/towardsai.net/p/l/calculating-nutrition-facts-with-computer-vision%25E2%2580%258A-%25E2%2580%258Afoodify-ai%3famp=1

2.3 PROBLEM STATEMENT DEFINITION

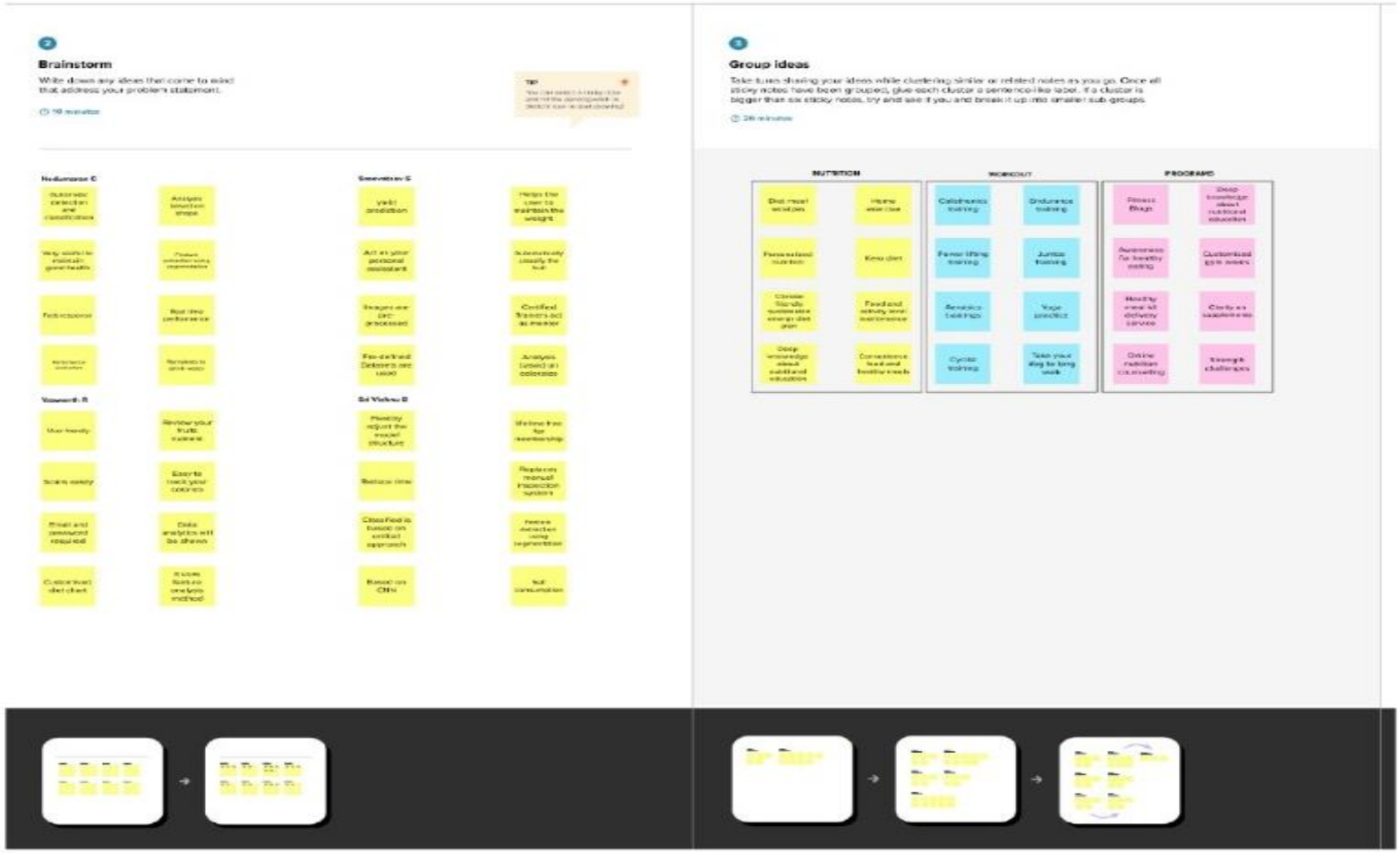
In India, the global trend on the technological solutions have a positive impact on scores of start-ups and websites catering on the providing the nutritional intake. AI and its various subsets have been leveraged by these platforms to identify the calorie intake and also to make food recommendations for a healthy diet. In most cases, the platforms act as a data repository where while providing real-time information to its users. AI-based online platforms which make use of AI and other deep learning technologies to provide a real-time update about nutrition intake. The platform also further breaks down the nutrition information calories, macro and micronutrients as well as ingredients.

3. IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP



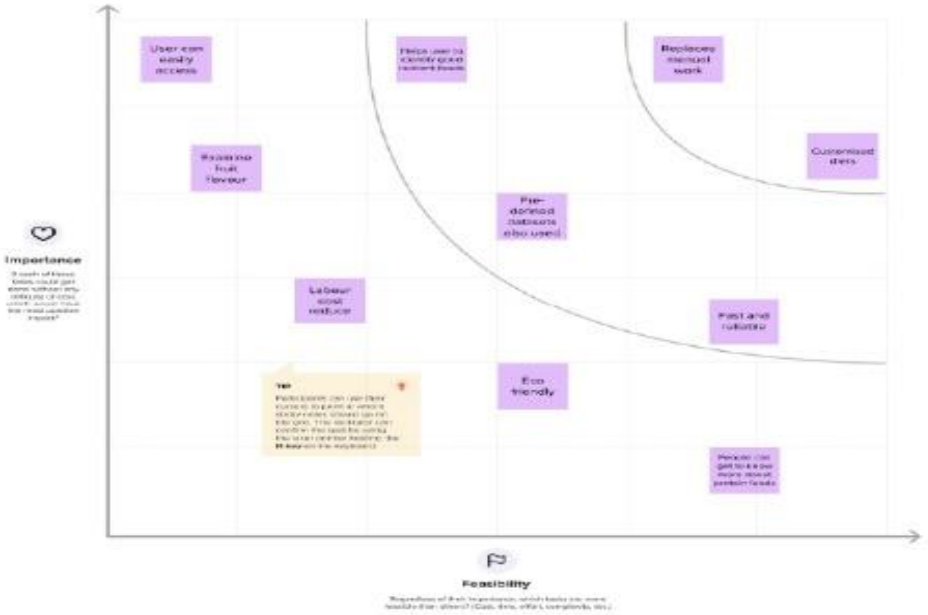
3.2 IDEATION AND BRAINSTORMING



Prioritize

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

20 minutes



After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

Export the mural
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open this template

Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open this template

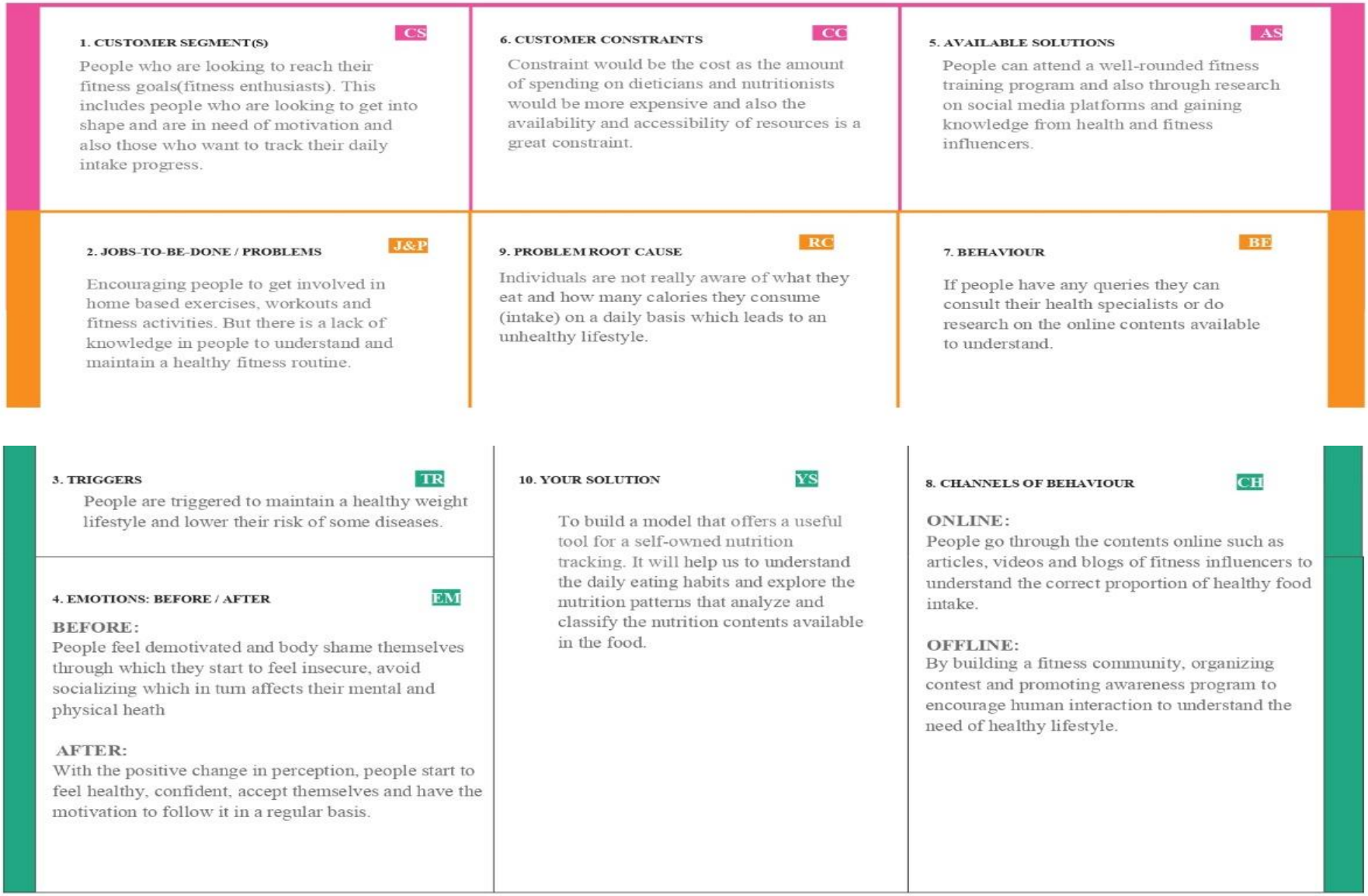
Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open this template

Show template feedback

3.3 PROPOSED SOLUTION

S. No.	Parameter	Description
1	Problem Statement (Problem to be solved)	To help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet.
2	Idea / Solution description	Building a model which classifies and analyses the image and detect the nutrition.
3	Novelty / Uniqueness	This model classifies the food depends on the different characteristics like color, shape, texture etc.
4	Social Impact / Customer Stisfaction	The Nutrition Analyzer can be applied in more than one sphere of life and used not only by athletes. It would be a great companion for those of us who decided to build a perfect body and can be successfully used in medicine and daily life as well.
5	Business model (Revenue Model)	This business model is restricted to a single owner. This model is a platform that is self-owned nutrition tracking mobile application.
6	Scalability of the Solution	The main advantage of this project is its scalability. It is very compact in size so that it will be very easy to use.

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

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 Login	Login through Google Login through Email
FR-4	Choose package	Selection of desired package
FR-5	Generate the daily plan	Daily plans will be generated by dietician
FR-6	Manage progress report	Gathering information from database and generating report
FR-7	Query	The user can ask for changes in plan.

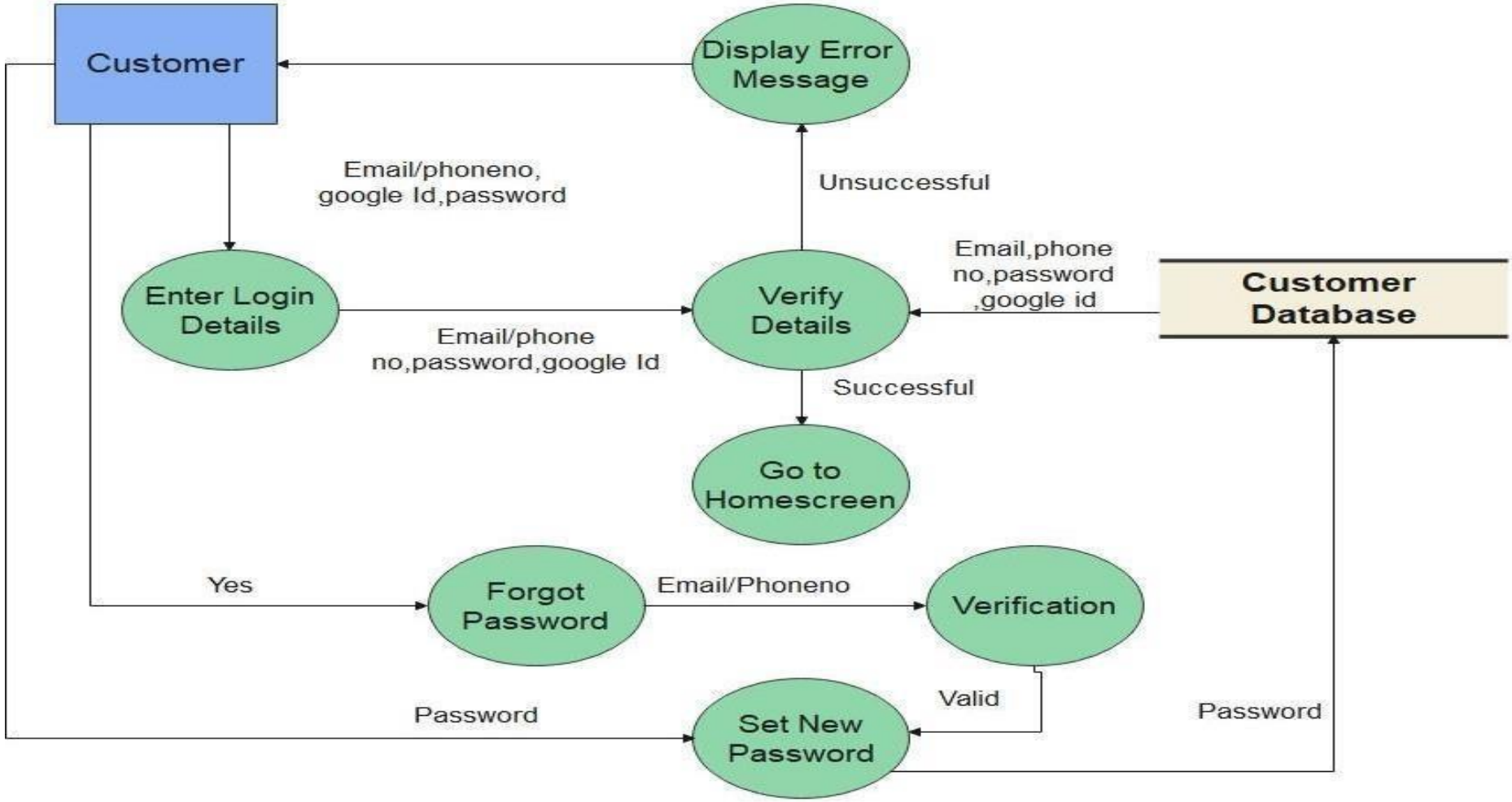
4.2 NON FUNCTIONAL REQUIREMENT

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Easy to use with interactive User Interface
NFR-2	Security	User can access only their personal information and not that of other users.
NFR-3	Reliability	The average time of failure shall be 7 days
NFR-4	Performance	The results has to be shown within 10 sec
NFR-5	Availability	The dietician shall be available to users 24 hours a day, 7 days a week.
NFR-6	Scalability	Supports various food items

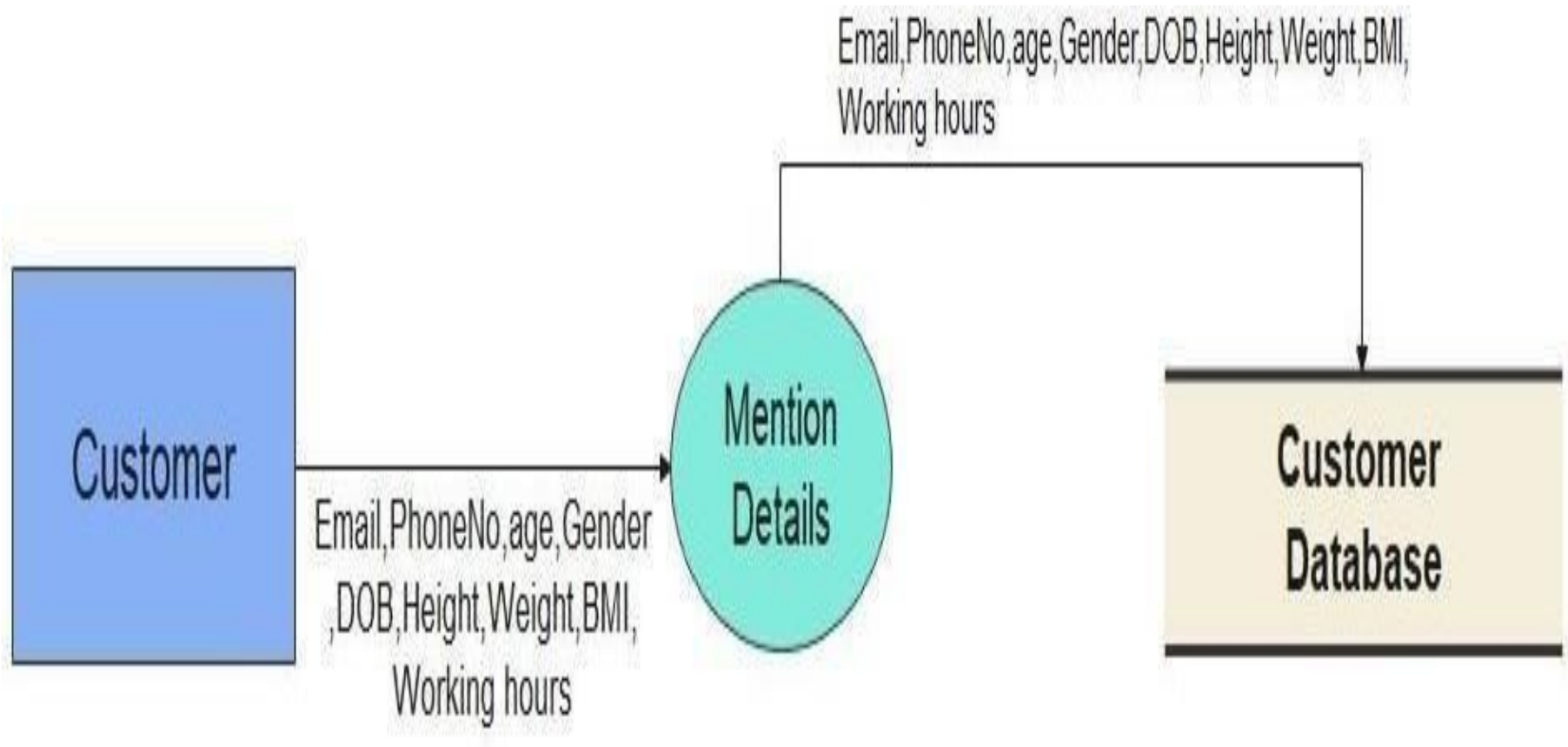
5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

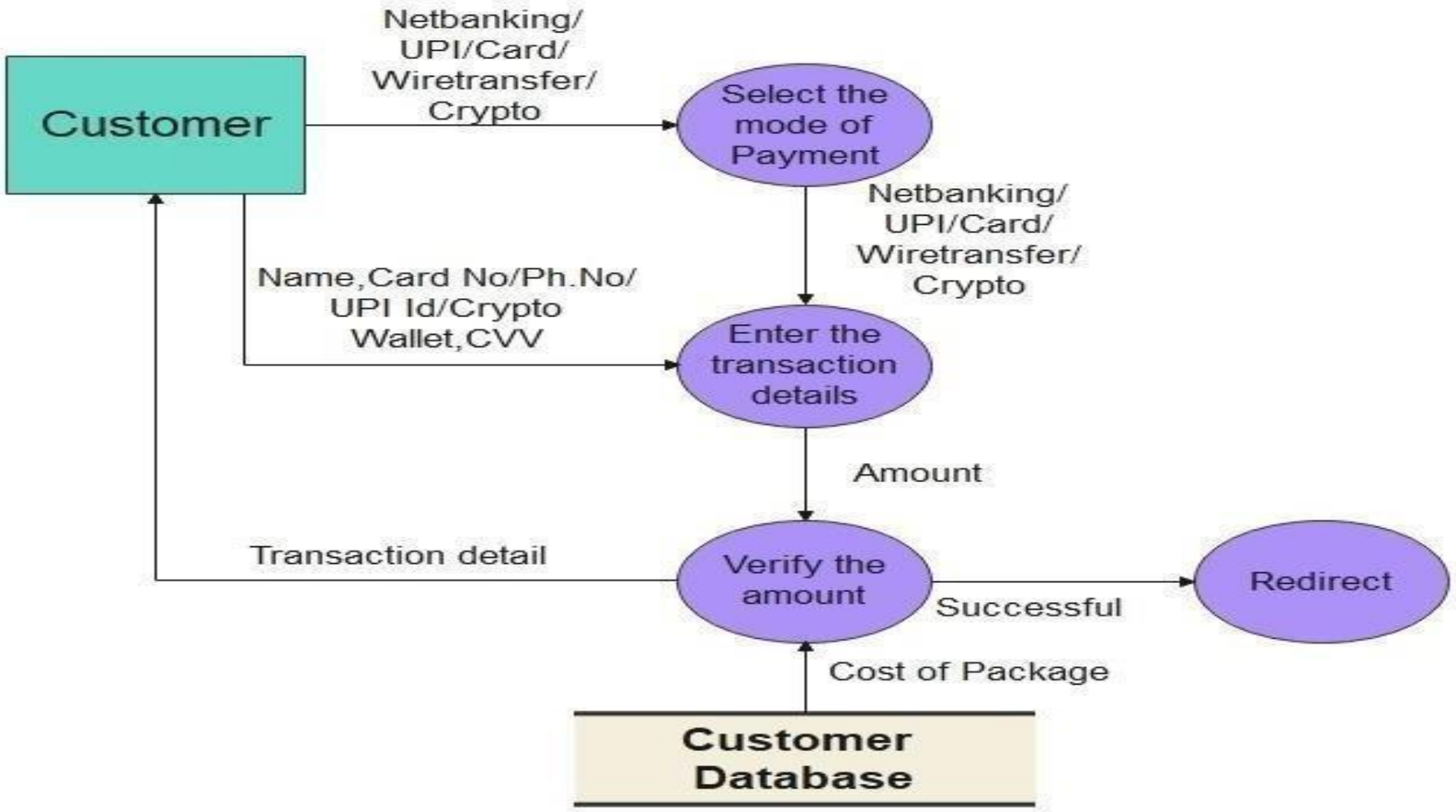
DFD-1 (Login):



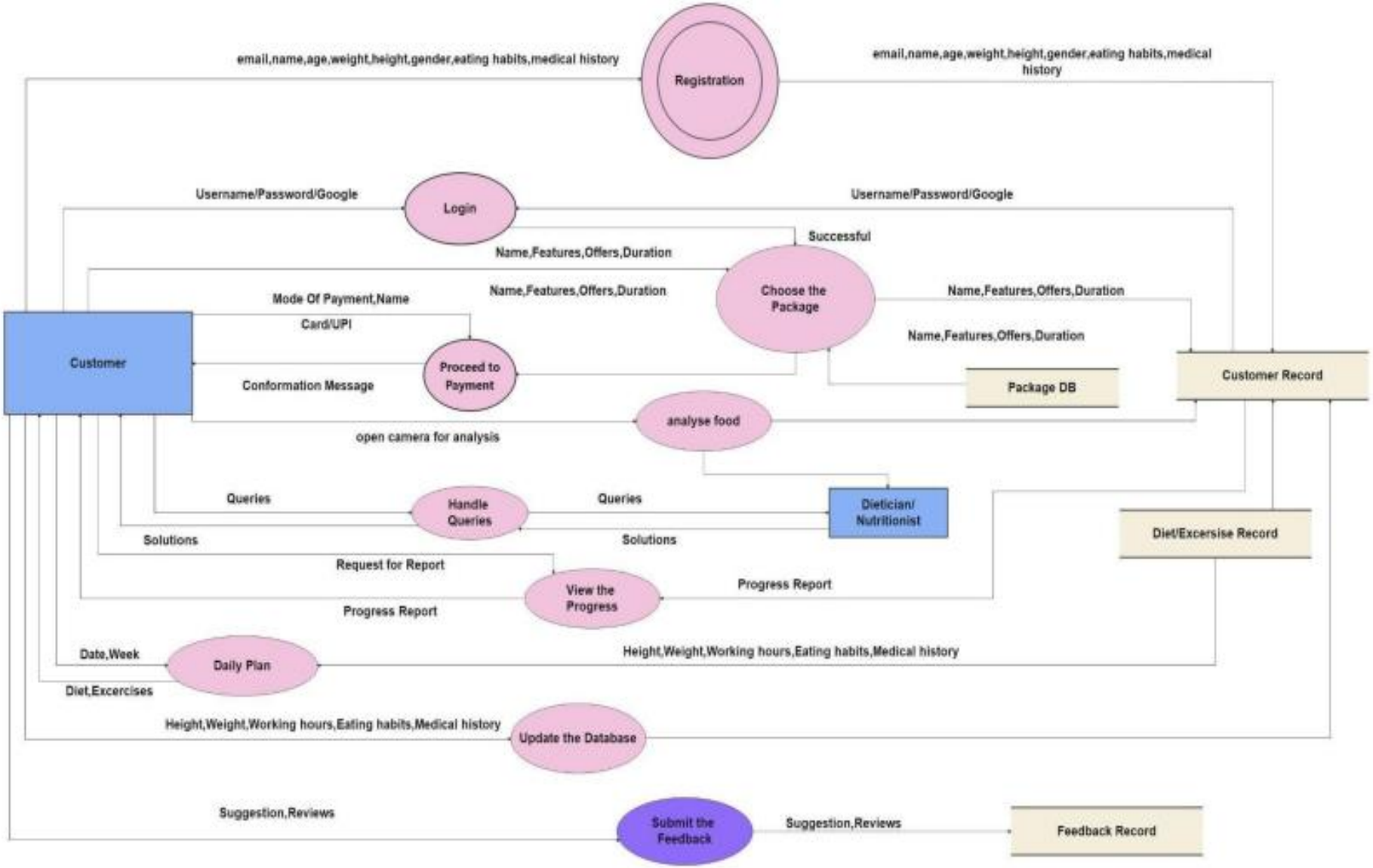
DFD-2 (Registration):



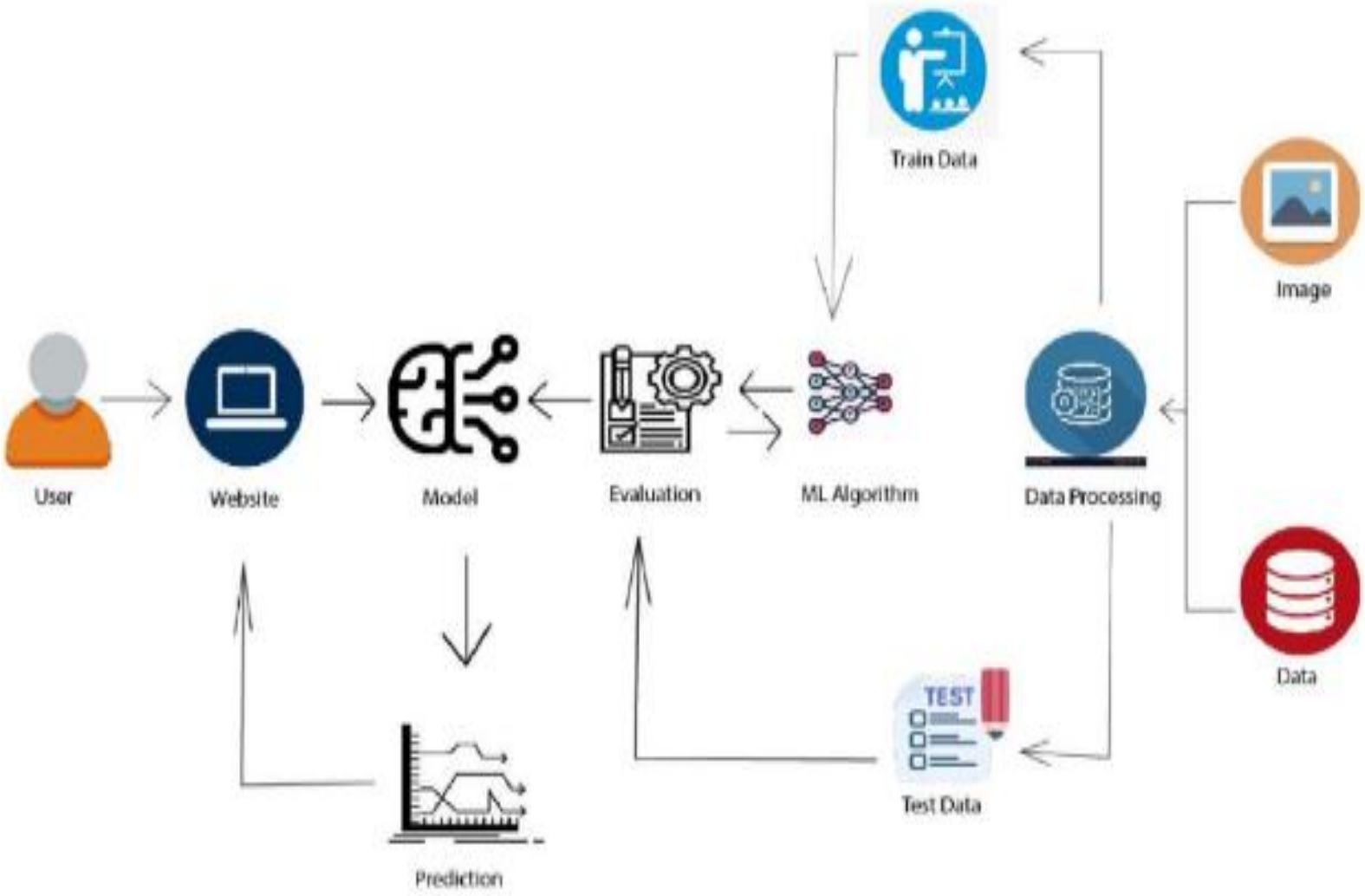
DFD-3(Payment):



DFD-4(Overall):



5.2 SOLUTION AND TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Google	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Microsoft	I can access the Dashboard with Microsoft.	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login the Application by entering password	High	Sprint-1
	Main Interface	USN-6	As a user I can view my calorie intake by clicking photo of the food I eat	Access the proper information about the nutrition and the calorie intake	High	Sprint-2
	Package DB, Dashboard	USN-7	As a user I can choose variety of packages based on my requirement	Selecting an appropriate package	Medium	Sprint-2
Customer Care Executive	Feedbacks DB , Tollfree number, chat bot	USN-8	As a customer care executive, I collect feedbacks from customers	Maintaining proper environment for the customers	High	Sprint-2
Dietitian	Customer Record	USN-9	As a dietitian I provide daily plans for the betterment of the user	Positive results from user	High	Sprint-2
Administrator	Dashboard	USN-10	As an administrator I take care of all the operations which takes place in the app	Zero issues from the user	High	Sprint-2

6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Dataset - Collecting images of food items like apple, orange, grapes, banana for analysis	4	High	Nisha Rasaili
Sprint-1	Image Preprocessing	USN-2	Image data augmentation - Increasing the amount of data bygenerating new data points from existing data	3	Medium	Malini R
Sprint-1		USN-3	Image Data Generator Class - Used for getting the input of theoriginal data	3	Medium	Mathangi Sriraman
Sprint-1		USN-4	Applying image data generator functionality to train-set and test-set	5	Medium	Sriman Narayanan P G
Sprint-1	Modeling Phase	USN-5	Defining the model architecture - Building the model using deep learning approach and adding CNN layers	5	High	Malini R
Sprint-2		USN-6	Training , saving, testing and predicting the model	5	High	Sriman Narayanan P G

Sprint-2		USN-7	Database creation for the input classes	3	High	Mathangi Sriraman
Sprint-2	Development Phase	USN-8	Home page creation - It shows options of the application	4	Medium	Nisha Rasaili
Sprint-2		USN-9	User database creation - It contains the details of users	3	Low	Sriman Narayanan P G
Sprint-2		USN-10	Login and registration page creation - User can register and login through g mail with Id and password	5	Low	Mathangi Sriraman
Sprint-3		USN-11	Dashboard creation - Dashboard contains the information of user profile and features of the application	3	Low	Nisha Rasaili

Sprint-3	Development Phase	USN-12	User Input Page Creation - It is for the user to feed the input images	4	Low	Sriman Narayanan P G
Sprint-3		USN-13	Analysis and prediction page creation - It shows the prediction of given user input	4	Medium	Malini R
Sprint-3		USN-14	Creation of about us, feedback and rating page – It shows application history and feedback page to users	4	Medium	Nisha Rasaili
Sprint-3	Application Phase	USN-15	Building the python code and importing the flask module into the project	5	Medium	Malini R

Sprint-4		USN-16	Create the Flask application and loading the model	4	High	Mathangi Sriraman
Sprint-4		USN-17	API integration - Connecting front end and back end and perform routing and run the application	4	High	Sriman Narayanan P G
Sprint-4	Deployment Phase	USN-18	Cloud deployment – Deployment of application by using IBM cloud	4	High	Malini R
Sprint-4	Testing Phase	USN-19	Functional testing – Checking usability and accessibility	4	High	Mathangi Sriraman
Sprint-4		USN-20	Non Functional testing – Checking scalability and performance of the application	4	High	Nisha Rasaili

6.2 SPRINT DELIVERY PLAN

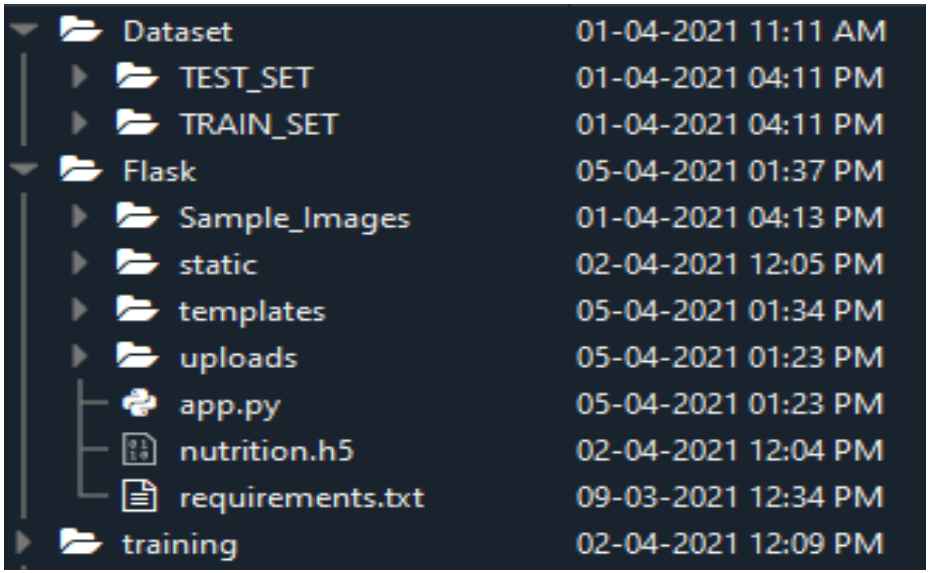
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	20	5 Days	17 Oct 2022	21 Oct 2022	20	21 Oct 2022
Sprint-2	20	5 Days	22 Oct 2022	26 Oct 2022	20	26 Oct 2022
Sprint-3	20	5 Days	27 Oct 2022	31 Oct 2022	20	31 Oct 2022
Sprint-4	20	5 Days	01 Nov 2022	05 Nov 2022	20	05 ov 2022

7. PROJECT OBJECTIVES

7.1 PROJECT FLOW

- Data Collection.
  - Collect the dataset or Create the dataset
- Data Pre-processing.
  - Import the Image Data Generator library
  - Configure Image Data Generator class
  - Apply Image Data Generator functionality to Train set 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

7.2 PROJECT STRUCTURE



- 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 python script app.py for server side scripting
- we need the model which is saved and the saved model in this content is a nutrition.h5
- Templates folder contains home.html, image.html, imageprediction.html pages.
- Static 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.

8. CODING

8.1 FEATURE-1

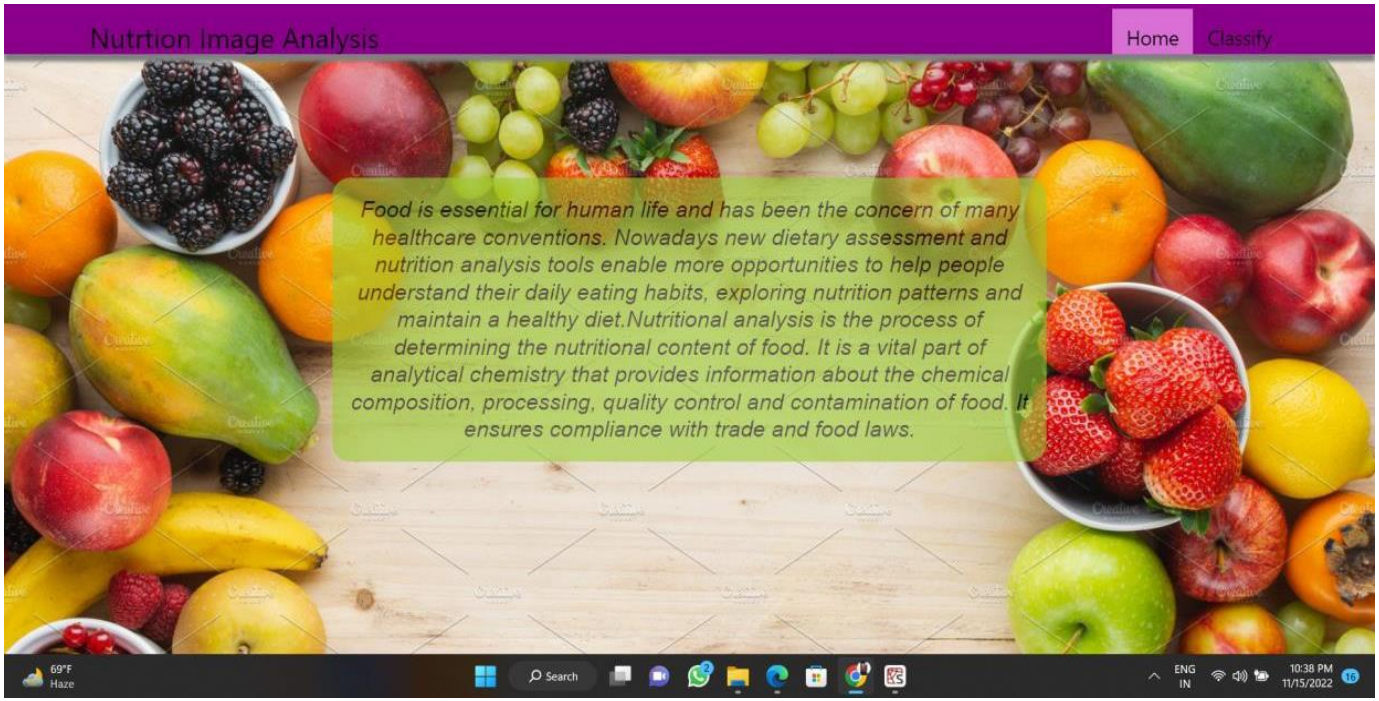
```
<!DOCTYPE html>
<html>
<head>
   <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Home</title>
    <link
href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
    <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"></scrip
t>
    <link href="{{ url_for('static', filename='css/main.css') }}"
rel="stylesheet">
<style>
body
{
    background-image:
url("https://images.creativemarket.com/0.1.0/ps/5922218/1820/1213/ml/fpnw/
wml/dkhgrbur2yjigh5c6ntckuvl13d3tj511hdgeltvbvimrz8rxeowes5cgxouncpw-
.jpg?1550695378&s=f4d72732390bb22d2d08897e02e1834e");
    background-size: cover;
}
.bar
{
margin: 0px;
padding:20px;
background-color:white;
```

```
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
}
h3
{
margin: 0px;
padding:20px;
background-color:#9ACD32;
width: 800px;
opacity:0.6;
color:#000000;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
}
.div1{
```

```
  background-color: lightgrey;
  width: 500px;
  border: 10px solid peach;
  padding: 20px;
  margin: 20px;
  height: 500px;
}

.header { position: relative;
        top:0;
        margin:0px;
        z-index: 1;
        left: 0px;
        right: 0px;
        position: fixed;
        background-color: #8B008B ;
        color: white;
        box-shadow: 0px 8px 4px grey;
        overflow: hidden;
        padding-left:20px;
        font-family: 'Josefin Sans'
        font-size: 2vw;
        width: 100%;
        height:8%;
        text-align: center;
     }
     .topnav {
  overflow: hidden;
  background-color: #FCAD98;
}

.topnav-right a {
  float: left;
  color: black;
  text-align: center;
  padding: 14px 16px;
```

```
  text-decoration: none;
  font-size: 22px;
}

.topnav-right a:hover {
  background-color: #FF69B4;
  color: black;
}
.topnav-right a.active {
  background-color: #DA70D6;
  color: black;
}
.topnav-right {
  float: right;
  padding-right:100px;
}
</style>
</head>
<body>
<!--Brian Tracy-->
<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:black;
padding-top:1%;padding-left:5%;">Nutrtion Image Analysis</div>
  <div class="topnav-right"style="padding-top:0.5%;">

    <a class="active" href="{{ url_for('home')}}">Home</a>
    <a   href="{{ url_for('imagel')}}">Classify</a>
  </div>
<br>
<h1>
<center>
<h3>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.Nutritional analysis is the
```

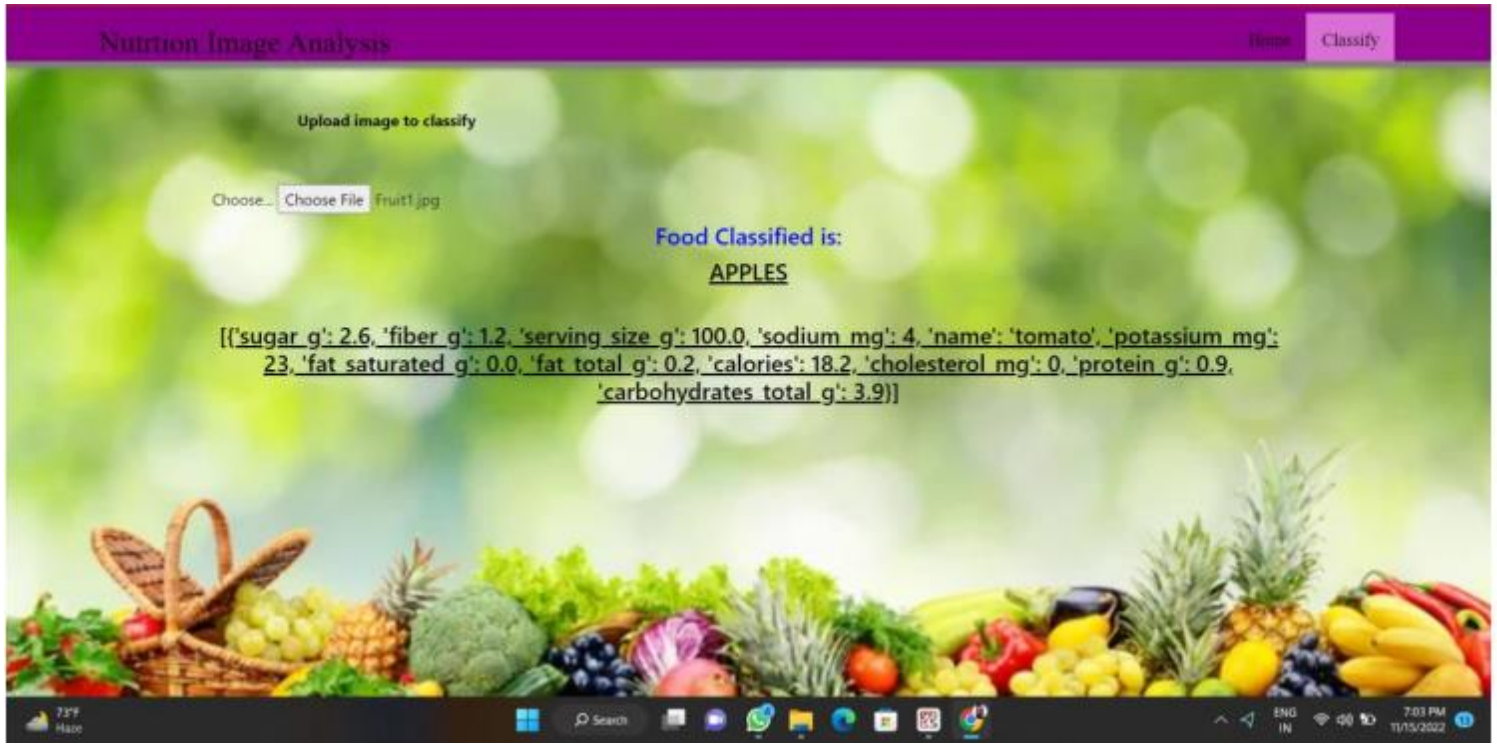
```
process of determining the nutritional content of food. It is a
vital part of analytical chemistry that provides information about
the chemical composition, processing, quality control and contamination
of food. It ensures compliance with trade and food laws.</h3>
</center>
</h1>
</body>
</html>
```



8.2 FEATURE-2

```
{% extends "imageprediction.html" %} {% block content %}
<div style="float:left">
<br>
<br>
<h5><font color="black" size="3" font-family="sans-serif"><b>Upload image
to classify</b></font></h5><br><br>

<div>
    <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">
    </form>

   <center> <div class="image-section" style="display:none;">
         <div class="img-preview">
 <div id="imagePreview">
             </div></center>
         </div>
         <center><div>
             <button type="button" class="btn btn-primary btn-lg " id="btn-
predict">Classify</button>
        </center></div>
    </div>

    <div class="loader" style="display:none;margin-left: 450px;"></div>

    <h3 id="result">

         <span><p style="padding-top: 25px;"><h4>Food Classified is :
<h4><b><u>{{showcase}}{{showcase1}}</p> </span>
    </h3>
</div>
```



8.3 PREDICTION

```
<!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>Predict</title>
    <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"></scrip
t>
    <link href="{{ url_for('static', filename='css/main.css') }}"
```

```
rel="stylesheet">
<style>
body
{
    background-image:
url("https://t3.ftcdn.net/jpg/02/69/04/64/360_F_269046465_Dd3aF7jYIZqdHhRU
atkpG39RYkRpOHpR.webp");
    background-size: cover;
}
.bar
{
margin: 0px;
padding:20px;
background-color:white;
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
}
```

```
  background-color: lightgrey;
  width: 500px;
  border: 10px solid peach;
  padding: 20px;
  margin: 20px;
  height: 500px;
}
.header { position: relative;
        top:0;
        margin:0px;
        z-index: 1;
        left: 0px;
        right: 0px;
        position: fixed;
        background-color: #8B008B ;
        color: white;
        box-shadow: 0px 8px 4px grey;
        overflow: hidden;
        padding-left:20px;
        font-family: 'Josefin Sans';
        font-size: 2vw;
        width: 100%;
        height:8%;
        text-align: center;
      }
      .topnav {
  overflow: hidden;
  background-color: #FCAD98;
}

.topnav-right a {
  float: left;
  color: black;
  text-align: center;
  padding: 14px 16px;
```

```
  text-decoration: none;
  font-size: 18px;
}

.topnav-right a:hover {
  background-color: #FF69B4;
  color: black;
}

.topnav-right a.active {
  background-color: #DA70D6;
  color: black;
}

.topnav-right {
  float: right;
  padding-right:100px;
}
</style>
</head>
<body>
<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:black;
padding-top:1%;padding-left:5%;">Nutrtion Image Analysis</div>
  <div class="topnav-right"style="padding-top:0.5%;">
    <a href="{{ url_for('home')}}">Home</a>
    <a  class="active" href="{{ url_for('image1')}}">Classify</a>
  </div>
</div>
<br>
</div>
<div class="container">
       <center>
<div id="content" style="margin-top:2em">{% block content %}{% endblock
%}</div></center>
    </div>
```

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

9. ADVANTAGES AND DISADVANTAGES

9.1 ADVANTAGES

- Monitors the progress and diet easily.
- Gives free health and fitness tips.

9.2 DISADVANTAGES

- Does not provide effective decision making.
- Sometimes it may not be 100% accurate.

10. FUTURE SCOPE

If adopted and implemented correctly, it will be useful to the general public as well as providing an analytical tool for specialists (including nutritionists, historians, chefs, educators, and policymakers).

11.CONCLUSION

The prime objective of the app is to list all the possible diet plans along with the nutrient value of the food items for the user in accordance with his/her lifestyle by taking their height, weight, working hours, and eating hours and practices also the image of the food as inputs. The app is especially for the fitness enthusiasts and also beneficial for the young generation.

- ✓ The user interacts with the User Interface (UI) and gives the image as input.
- ✓ The input image is then passed to the flask application.
- ✓ Finally with the help of the model it will classify the result and showcase it on the UI.

This app provides them with alternatives to manage the balance. The another yet distinguishable aim of our App is to provide solutions on how to gain more with minimum affordable eateries, a basic

plan that suggests a diet that can fulfil the essential needs of the body and not only it replenishes the loss but also helps to gain energy.

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-19822-1659707195.git

VIDEO LINK:

https://drive.google.com/file/d/1fBWDnKYeGBRkN5BMnpT3wPDuBf87gPgf/view?usp=sharing