Vel Tech Multi Tech Dr. Rangarajan Dr. Sakunthala Engineering College

An Autonomous Institution

AI-powered Nutrition Analyzer for Fitness Enthusiasts

TEAM ID: PNT2022TMID22479

TEAM MEMBERS:

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1. INTRODUCTION

1.1 Project Overview

Artificial Intelligence in medical care is the application of machine learning (ML) algorithms and other cognitive technologies in medical settings. AI offers many advantages over traditional analytics and clinical decision-making techniques. In the primordial sense, AI is when computers and other machines imitate human acknowledgement, and are capable of learning, thinking, and making decisions or taking actions. Precisely, AI in medical care is the use of machines to analyse and act on medical data, usually with the aim to predicting a particular outcome. Most of the technologies along with AI have immediate relevance to the health care field, but the specific processes and tasks they support vary widely. AI-based approaches, including image recognition, may also improve dietary assessment by maximizing efficiency and addressing systematic and random errors associated with self-reported measurements of dietary intakes. Finally, AI applications can extract, structure and analyse large amounts of data from social media platforms to understand dietary behaviours better and perceptions among the population.

1.2 Purpose

The main aim of the project is to build a model which is used for classifying the fruit depending on the different characteristics like colour, shape, texture etc. In this model, the user interacts with the UI (User Interface) and captures the images of different fruits and then the image will be sent to the trained model. The model analyses the image by improving the image data that suppresses unwilling distortions or enhances some image features important for further processing, although performing some geometric transformations of images like rotation, scaling, translation, etc. and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.)

2. LITERATURE SURVEY

2.1 Existing problem

Numerous studies have been conducted on Image categorization. Rutuja Rewane et al. presented a paper ‘Food Nutritional Detection, Visualization and Recommendation for Health Monitoring’ using Image Processing which gave the solution for the recognition of multiple food items but with very low recognition rate. The paper is a CNN based application to help medical experts as well as their patients in assisting with diet related issues. M. Sundarramurthi et al. Framed a model entitled as ‘Personalized Food Classifier and Nutrition Interpreter Multimedia Tool’ using Deep Learning. In this model, they successfully designed, developed and tested a compact and cost-effective Food Classifier and Nutrition Interpreter Tool (FCNI) which provided an accuracy of 96.81% is achieved. Zhu et al. proposed

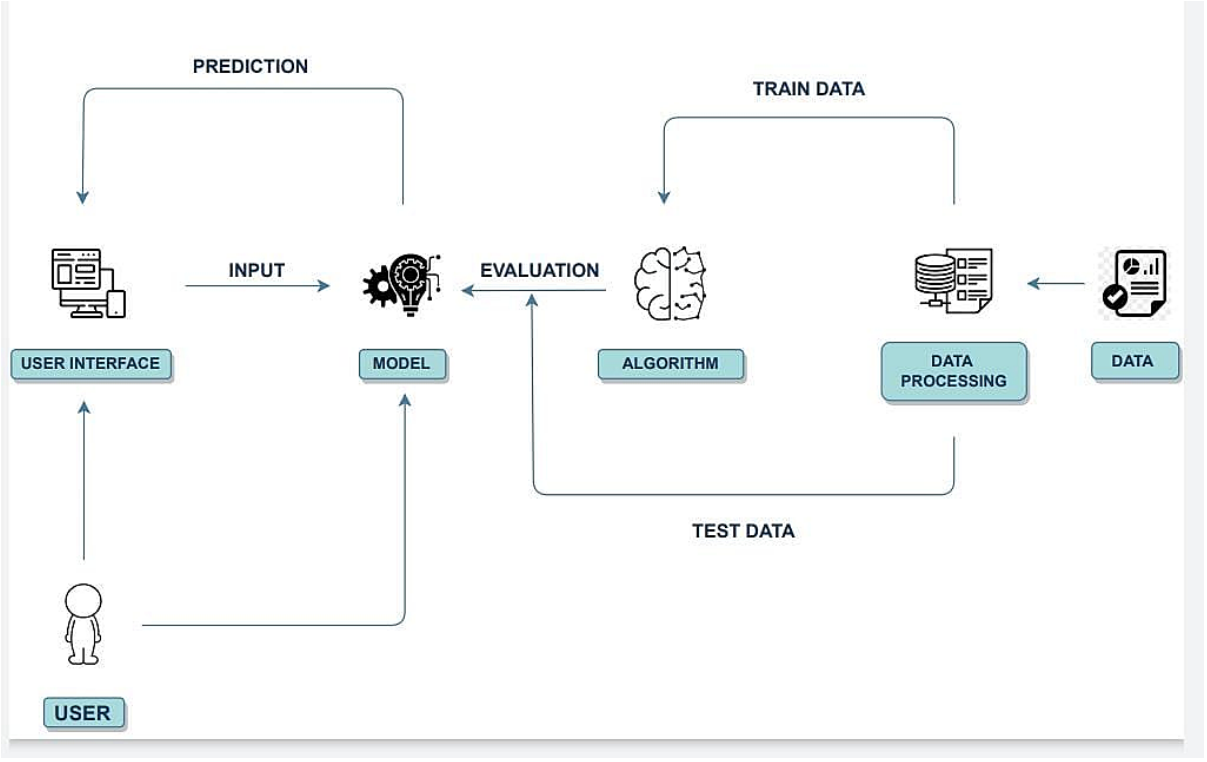
‘‘Segmentation assisted food classification for dietary assessment’, a segmentation-based food classification method for dietary assessment. They aimed to determine the regions where a particular food is located in an image where a particular food is located and correctly identify them by using computer vision techniques. Meng-Lin Chiang, Chia-An Wu work ‘Food Calorie and Nutrition Analysis System’ was based on Mask R-CNN. The study uses food images as input to the system, to detect and recognize food class and food masks. The proportion of food in the image is obtained through the food mask, and the weight of the food is estimated by linear regression. V. Hemalatha Reddy et al. in their work 'Food Recognition and Calorie Measurement using Image Processing and Convolutional Neural Network' gave an accuracy of about 70% (when images are noisy) to 99% (when the images used are plain and without noise). Their model results on food recognition showed 78.7% testing accuracy with 93.29% training accuracy. Dharani Devi P and Iyanar D came up with the paper entitled 'CNN based Nutrient Extraction from Food Images'.The implementation of the paper was done by using MATLAB software which showed an average accuracy of 93.

2.2 References

- Rutuja Rewane, P. M. Chouragade, 2019, 'Food Nutritional Detection, Visualization and Recommendation for Health Monitoring using Image Processing',IEEE Xplore Part Number: CFP19J32-ART; ISBN: 978-1-5386-9439-8
- M. Sundarramurthi, Nihar. M, Anandi Giridharan, 2020, 'Personalised Food Classifier and Nutrition Interpreter Multimedia Tool Using Deep Learning', IEEE REGION 10 CONFERENCE (TENCON)
- Diya Li, Mohammed J. Zaki, Ching-Hua Chen, 2021,'Nutrition Guided Recipe Search via Pre-trained Recipe Embeddings', IEEE 37th International Conference on Data Engineering Workshops (ICDEW)
- Dharani Devi P, Iyanar D, 2020, 'CNN based Nutrient Extraction from Food Images', Fourth International Conference on I-SMAC IEEE Xplore Part Number:CFP20OSV-ART
- Hsien-Yu Kao, Yih-Jiun Lee, 2021,'Design and Implement a Mobile Fitness Application based on Realtime Image Detection', IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW)
- Diya Garg, Chakshita Gupta, Mishika Rawat, 2021, 'Swasthya: The Virtual Dietician'
- V. Hemalatha Reddy, Soumya Kumari, Vinitha Muralidharan, Karan Gigoo, Bhushan S. Thakare, 2019, 'Food Recognition and Calorie Measurement using Image Processing and Convolutional Neural Network', 4th International Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT)
- R. Kohila, R. Meenakumari, 2017, 'Predicting Calorific Value for Mixed Food Using Image Processing', International Conference on Innovations in information Embedded and Communication Systems (ICIIECS)

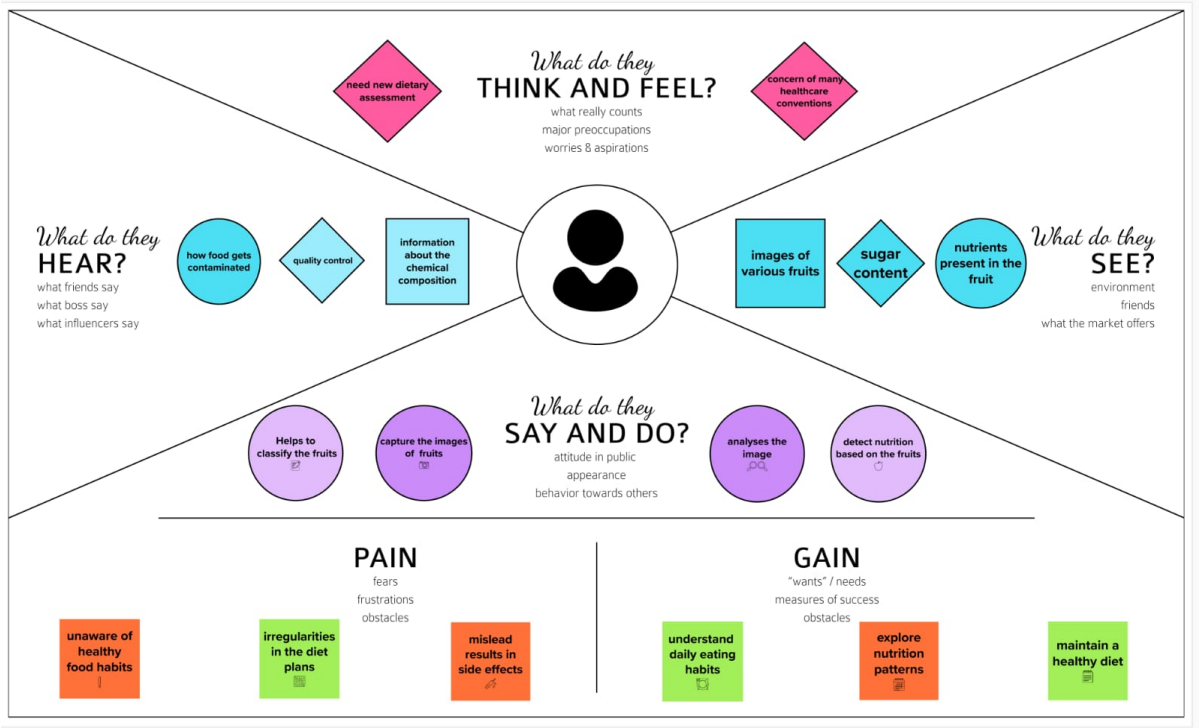
2.3 Problem Statement Definition

Food is the substance we eat every day in order to gain energy and strength. There are various types of food, such as fruits, vegetables, wheat, rice, pulses and so on. We need to eat a wide variety of foods to make sure whether our body receives all the essential nutrients. Precisely, Food is essential for human life. Healthier lifestyle requires record of what a person is consuming. Certainly, Ignorance and unawareness of what is being consumed may lead to severe destructions. Due to the modern lifestyle that we follow, our body is subjected to fall sick and weak as a result of inadequate intake of essential nutrients. To overcome this dilemma and cope up with their busy lifestyle, new dietary assessment and nutrition analysis tools are required to enable more opportunities for helping people understand their daily eating habits, explore 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. With the help of the proposed system, users can take advantage of exploring nutritional values of a wide range of food items. This can be achieved by primely capture the images of the fruits and then send the trained model. The model analyses the image with the help of convolutional neural network classification techniques and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).



3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

Group Ideas

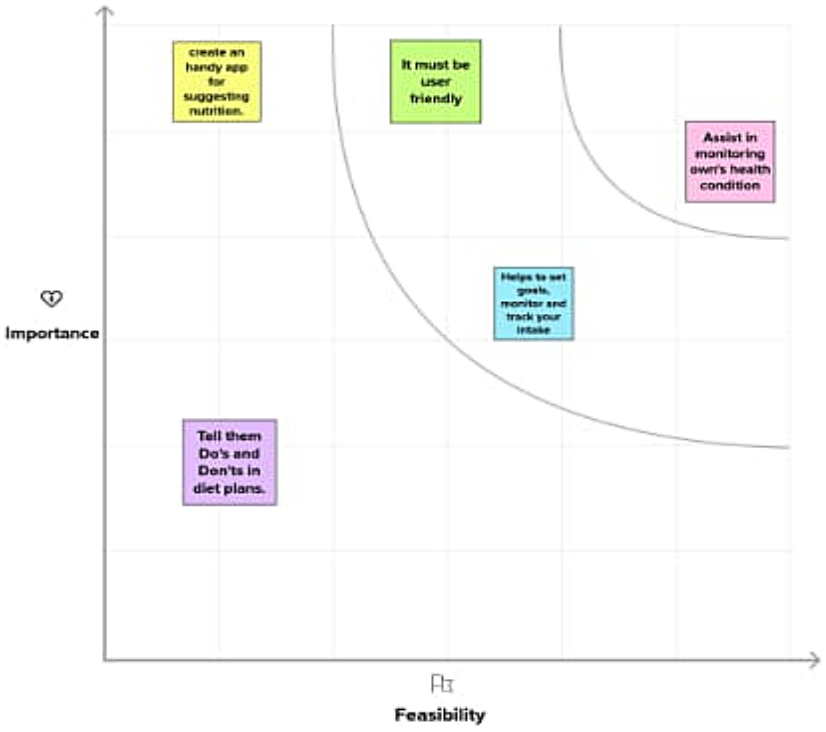
Helps to set goals, monitor and track your intake

Compare the results between successive weeks

display all the nutrition content present in the food

Provide health tips based on their body needs

Able to make better choices and see the best results

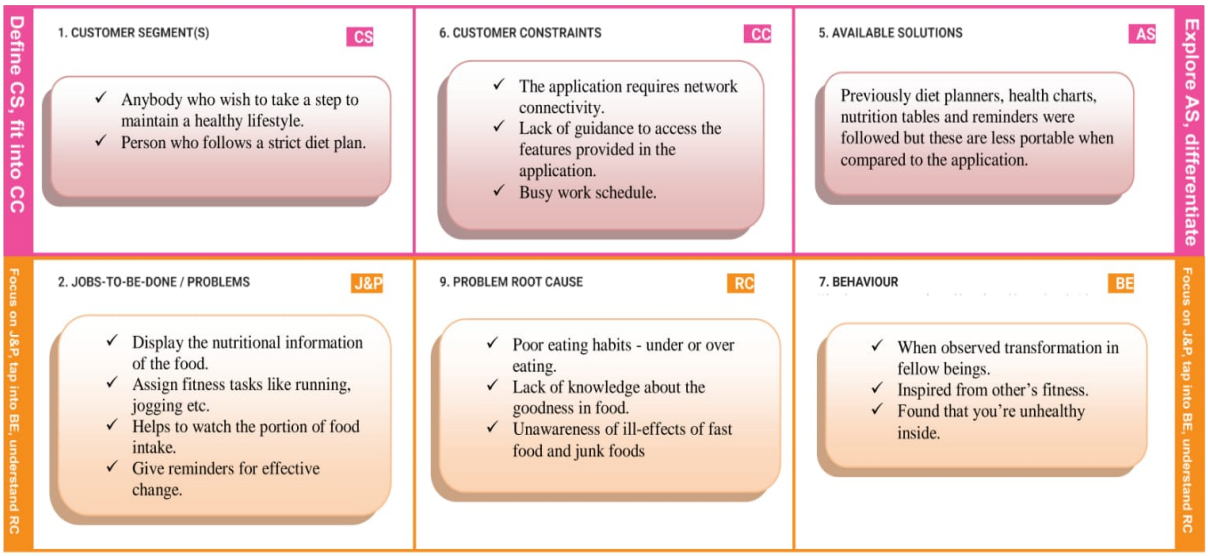


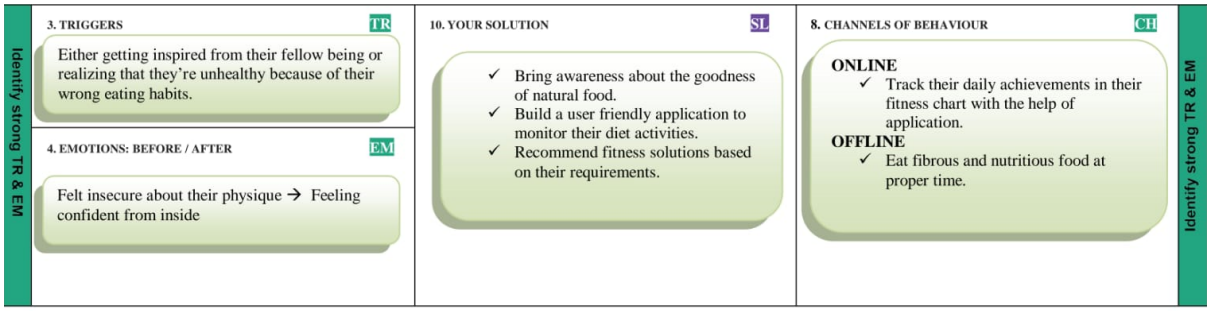
3.3 Proposed Solution

S.no.	Parameter	Description
1.	Problem Statement (Problem to be solved)	● Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits. ● To explore nutrition patterns and maintain a healthy diet. ● People are unaware of nutrition content and undergoing improper diet plans.
2.	Idea / Solution description	● Building a system to be aware of nutrients in the food. ● To monitor our diet easily. ● To provide more support around improving our wellness by allowing us to track health and fitness achievements from anywhere. ● Gives free health and fitness tips.
3.	Novelty / Uniqueness	● Nutrition apps can help make life easier for individuals who need to track their food intake for health reasons. ● This model analyses the image and detect the nutrition based on the fruits like Sugar, Fibre, Protein, Calories. ● This system provide feedback on strategies for changing one’s relationship with food. ● Promoting healthier food activities.

4.	**Social Impact / Customer Satisfaction**	• Given better result by providing diet chart. • It ultimately leads to save time and money with beneficial outcomes. • Certified before approaching customers.
5.	**Business Model (Revenue Model)**	• It provides healthy food recommendation with calorie tracking features. • Provides suggestion from medical Professionals. • It works on Android , iOS or any other mobile operating system.
6.	**Scalability of the Solution**	• Can be used any number of times without affecting the user experience and the app's performance. • It Uses Asynchronous Communication. • It is user friendly and free of charge for all user's.

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 Gmail Registration through Phone Number
FR-2	User Confirmation	Confirmation via Verification Code Confirmation via OTP
FR-3	User Login	**Input data:** E-mail id or phone number and password. **Processing step:** User can now login in the app. **Output Data:** The user can use the application and get to home screen.
FR-4	Choose Package	**Input data:** Name, features, duration of the package, offers. **Processing step:** The user will select the desired package. **Output Data:** Proceed to payment gateway.
FR-5	Payment	**Input data**: Credit card number, month, year, CVV, amount. **Processing step**: The payment has to be made for the selected package. **Output data:** Status of package and confirmation message
FR-6	Generate the daily plan	**Input data**: Day of the week. **Processing step**: Suitable diet and exercise plan will be predicted for the user. **Output Data**: Diet and exercise plan will be provided to the user.

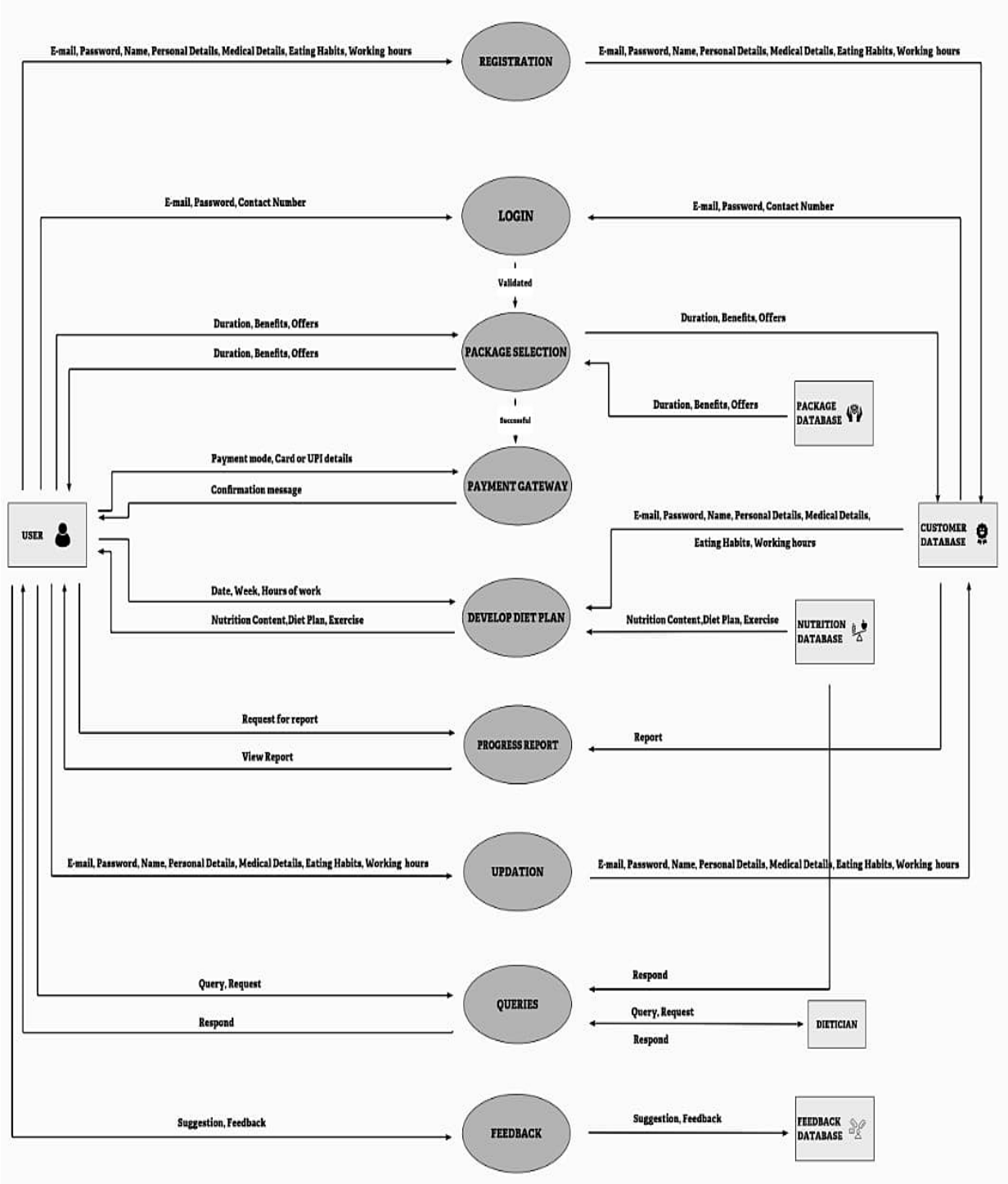
FR-7	Manage progress report	**Input data**: Height, weight, working hours, eating habits, medical history **Processing step**: Gathering information from database and generating report **Output Data**: Progress report.
FR-8	Query	**Input data**: User query. **Processing step**: The user can ask for changes in plan. **Output Data**: Updated plan.
FR-9	Update the details	**Input data**: Height, weight, working hours, eating habits, medical history. **Processing step**: The details will be updated in the database. **Output data**: Updated details of the user.
FR-10	Feedback	**Input data**: Reviews/suggestions. **Processing step**: Storing in the corresponding database. **Output data**: Feedback submitted.

4.2 Non-Functional requirements

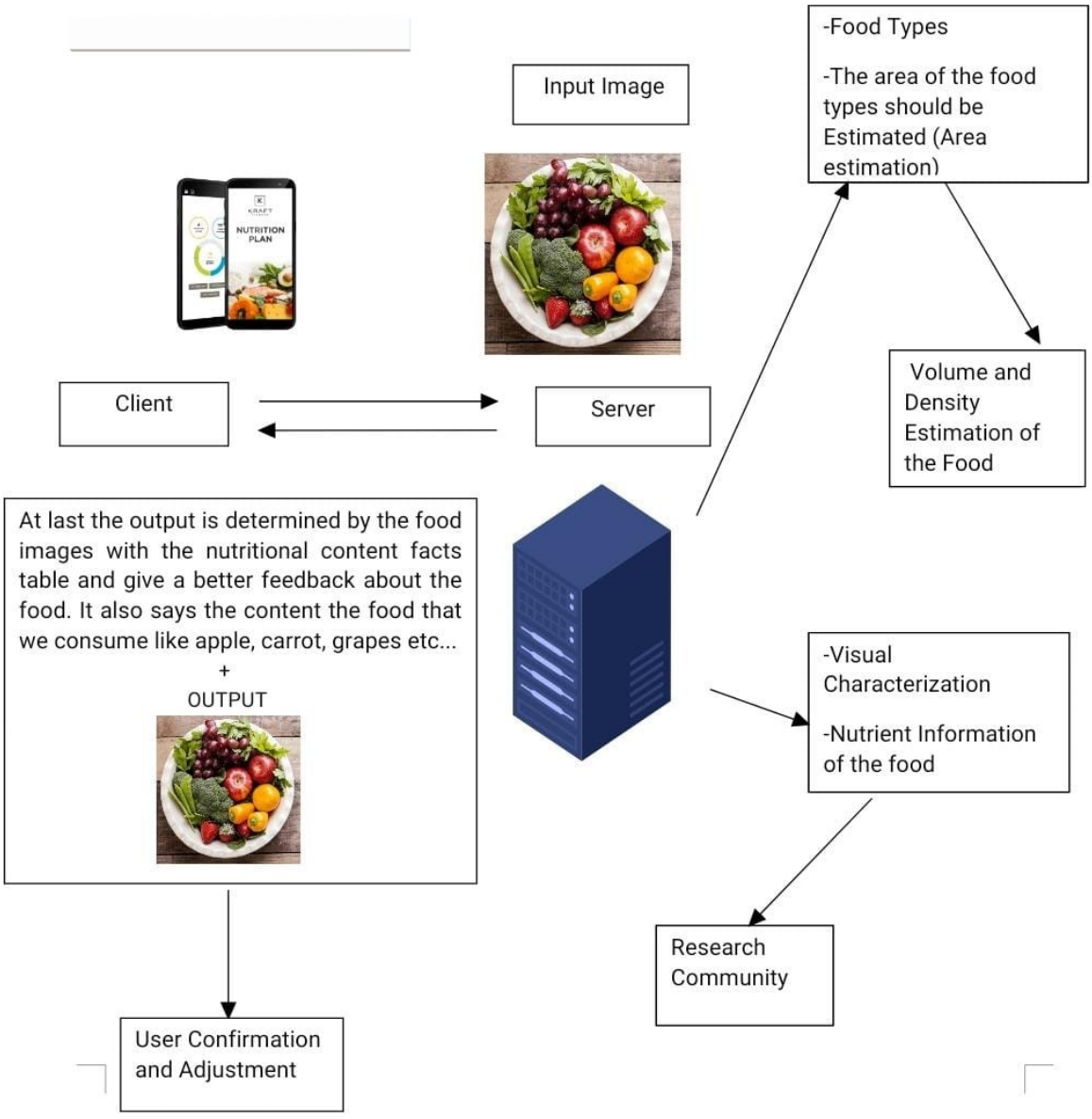
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To define a user's nutritional status and to define clinically relevant malnutrition.
NFR-2	**Security**	Sharing and misusing of data is unattainable.
NFR-3	**Reliability**	Determines the accurate food content and produces same result everytime.
NFR-4	**Performance**	The aim of the Nutrition Analyzer to provide set of routine suggestion for food intake.
NFR-5	**Availability**	Nutrient Content is readily available for all types of food.
NFR-6	**Scalability**	Handy Application for all user’s.

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
Customer (Mobile user)	Registration	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
Customer (Mobile user)	Registration	USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
Customer (Mobile user)	Registration	USN-4	As a user, I can register for the application through Gmail	I can register through mail	Medium	Sprint-1
Customer (Web user)	Login	USN-5	As a user, I can log into the application by entering email & password	I can login through mail by some security purpose	High	Sprint-1
Customer (Web user)	Dashboard	USN-6	As a user, I can access all the options through Mobile Applications	I can access through mobile applications	High	Sprint-1
Customer (Web user)	Quires	USN-7	As a user, is there any queries part in the web page	I can clear my queries	Medium	Sprint-1
Customer Care Executive	Rechecking	USN-8	As a user, I can recheck the previous report which was submitted before one month	I can recheck my previous report	Low	Sprint-2
Administrator	Registration	USN-9	As a user, I can access the web page for or premium	I can access the web page as free	Medium	Sprint-1
Administrator	Registration	USN-10	As a user, It is premium how much I want to pay to visit the web page	I can access the web page as free	High	Sprint-1
Administrator	Network Speed	USN-11	As a user, is there any speed limitation for access/visit the web page	I can also use speed of network below 1mbps	Medium	Sprint-1
Administrator	Application	USN-12	As a user,I can download these app in play store or Google	I can download applications through playstore	Low	Sprint-2

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	17	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	18	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	17	19 Nov 2022

Velocity:
Imagine we have 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

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

6.2 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.	5	High	Sandya M, Priyadharshini M
Sprint-2		USN-2	As a user, I will receive confirmation email once I have registered for the application	4	High	Pragathi P, Sushmitha D
Sprint-1		USN-3	As a user, I can register for the application through Gmail	5	Medium	Sandya M, Priyadharshini M
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email & password	5	High	Pragathi P, Priyadharshini M
Sprint-1	Dashboard	USN-5	As a user I can access the dashboard able to see options to view contents chart, select diet plans, and exercise	5	High	Sandya M, Sushmitha D
Sprint-2		USN-6	As a user I can see my profile	4	Medium	Pragathi P, Sushmitha D
Sprint-3		USN-7	As a user I can update my profile	3	Low	Pragathi P, Sushmitha D
Sprint-2		USN-8	As a user I can change my password	4	Medium	Sandya M
Sprint-1	Service Request	USN-9	As a user I can request to display nutrition content of food items	5	High	Priyadharshini M Sushmitha D
Sprint-2		USN-10	As a user I can request to suggest a diet plan according to my medical details	4	High	Priyadharshini M
Sprint-2		USN-11	As a user I can request to suggest exercise routines according to my medical details	4	Medium	Pragathi P, Sandya M
Sprint-3	Notification	USN-12	track the status of diet targets through a dashboard or email services	3	Low	Priyadharshini M Sandya M
Sprint-3		USN-13	As a user get an email about revised exercise routines based on recent records.	3	Medium	Pragathi P, Sushmitha D
Sprint-1		USN-14	A user noticed after successfully achieved the target workout	5	High	Sushmitha D, Sandya M
Sprint-3		USN-15	Upload Progress Reports	3	Low	Pragathi P, Priyadharshini M
Sprint-4		USN-16	Making UI more interactive	2	Low	Sandya M
Sprint-2		USN-17	As a user I give feedback	4	High	Sushmitha D

7. CODING & SOLUTIONING

Nutrition Tracker/main.css

```
.img-preview {
   width: 256px;
   height: 256px;
   position: relative;
   border: 5px solid #F8F8F8;
   box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
   margin-top: 1em;
   margin-bottom: 1em;
}
.img-preview>div {
   width: 100%;
   height: 100%;
   background-size: 256px 256px;
   background-repeat: no-repeat;
   background-position: center;
}
input[type="file"] {
   display: none;
}
.upload-label{
   display: inline-block;
   padding: 12px 30px;
   background: #39D2B4;
   color: #fff;
   font-size: 1em;
   transition: all .4s;
   cursor: pointer;
}
.upload-label:hover{
   background: #34495E;
   color: #39D2B4;
}
.loader {
   border: 8px solid #f3f3f3; /* Light grey */
   border-top: 8px solid #3498db; /* Blue */
   border-radius: 50%;
   width: 50px;
   height: 50px;
   animation: spin 1s linear infinite;
}
@keyframes spin {
   0% { transform: rotate(0deg); }
```

```
   100% { transform: rotate(360deg); }
}
```

Style.css

```
body{
  background-image:url(bg.jpg);
    background-size: 400% auto;
  background-repeat: no-repeat;
  background-position:center;
  color:#555;
  font-family:Arial, Helvetica, sans-serif;
  font-size:16px;
  line-height:1.6em;
  margin:0;
}
.container{
  width:80%;
  margin:auto;
  overflow:hidden;
}
.justify{
   text-align:justify;
   text-justify: auto;
}
.parallax {
  /* The image used */
    background-image: url("doc.jpg");
  /* Set a specific height */
  min-height: 750px;
  /* Create the parallax scrolling effect */
  background-attachment: fixed;
  background-position: center;
  background-repeat: no-repeat;
  background-size: cover;
}
html {
  scroll-behavior: smooth;
}
#section2 {
  height: 500px;
  background: ;
}
div.background {
  background: url("static/bgg2.jpg");
  min-height: 5px;
 background-attachment: fixed;
```

```
  background-position: center;
  background-repeat: no-repeat;
  background-size: cover;
}
#navbar{
  background-color:#fff;
  color:#333;
}
#navbar ul{
  padding:0;
  list-style: none;
}
#navbar li{
  display:inline;
}
#navbar a{
  color:#fff;
  text-decoration: none;
  font-size:18px;
  padding-right:15px;
}
#showcase{
  min-height:300px;
  margin-bottom:30px;
}
#showcase h1{
    width: 100%;
  color:#333;
  font-size:40px;
  text-align: center;
  line-height: 1em;
  padding-top:10px;
}
#showcase h2{
    width: 100%;
  color:#333;
  font-size:30px;
  text-align: center;
  line-height: 1.6em;
  padding-top:10px;
}
#main{
  float:left;
  color:#fff;
  width:65%;
  padding:0 30px;
```

```
  box-sizing: border-box;
}
#sidebar{
  float:right;
  width:35%;
  background-color: #ffcccc;
  color:#000;
  padding-left:10px;
  padding-right:10px;
  padding-top:1px;
  box-sizing: border-box;
}
.img-preview {
    width: 10px;
    height: 10px;
    position: relative;
    border: 5px solid #F8F8F8;
    box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
    margin-top: 1em;
    margin-bottom: 1em;
}
.img-preview>div {
    width: 10%;
    height: 10%;
    background-size: 100px 10px;
    background-repeat: no-repeat;
    background-position: center;
}
input[type="file"] {
    display: none;
}
.upload-label{
    display: inline-block;
    padding: 12px 30px;
    background: #39D2B4;
    color: #fff;
    font-size: 1em;
    transition: all .4s;
    cursor: pointer;
}
.upload-label:hover{
    background: #34495E;
    color: #39D2B4;
}
.myButton {
  border: none;
```

```
  text-align: center;
  cursor: pointer;
  text-transform: uppercase;
  outline: none;
  overflow: hidden;
  position: relative;
  color: #fff;
  font-weight: 700;
  font-size: 12px;
  background-color: #ff0000;
  padding: 10px 15px;
  margin: 0 auto;
  box-shadow: 0 5px 15px rgba(0,0,0,0.20);
}
.myButton span {
  position: relative;
  z-index: 1;
}
.myButton:after {
  content: "";
  position: absolute;
  left: 0;
  top: 0;
  height: 310%;
  width: 150%;
  background: #f2f2f2;
  -webkit-transition: all .5s ease-in-out;
  transition: all .5s ease-in-out;
  -webkit-transform: translateX(-98%) translateY(-25%) rotate(45deg);
  transform: translateX(-98%) translateY(-25%) rotate(45deg);
}
.myButton:hover:after {
  -webkit-transform: translateX(-9%) translateY(-25%) rotate(45deg);
  transform: translateX(-9%) translateY(-25%) rotate(45deg);
}
.loader {
   border: 8px solid #f3f3f3; /* Light grey */
   border-top: 8px solid #ff0000; /* Red */
   border-radius: 50%;
   width: 50px;
   height: 50px;
   animation: spin 1s linear infinite;
}
@keyframes spin {
   0% { transform: rotate(0deg); }
   100% { transform: rotate(360deg); }
```

```
}
#main-footer{
  background: #333;
  color:#fff;
  text-align: center;
  padding:1px;
  margin-top:0px;
}
@media(max-width:600px){
  #main{
    width:100%;
    float:none;
  }
  #sidebar{
    width:100%;
    float:none;
  }
}
```

Main.py

```
from flask import Flask,render_template,request,redirect
import os
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import requests
app=Flask(_name_,template_folder="templates")
model=load_model('newanalyser.h5')
print("Loaded model from disk")
@app.route('/')
def index():
return redirect("/home",code=200)
@app.route('/home')
def home():
return render_template("home.html")
@app.route('/image1',methods=['GET','POST'])
def image1():
return render_template("image.html")
@app.route('/predict',methods=['GET','POST'])
def predict():
if request.method=='POST':
```

```
f=request.files['file']
basepath=os.path.dirname('_file_')
filepath=os.path.join(basepath,'static',f.filename)
f.save(filepath)
img=image.load_img(filepath,target_size=(64,64))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred=np.argmax(model.predict(x),axis=1)
print("prediction",pred)
index=["APPLES","BANANA","ORANGE","PINEAPPLE","WATERMELON
"]
result=str(index[pred[0]])
x=result
result=nutrition(result)
print(result)
return
render_template("0.html",scase=(index[pred[0]]),showcase=(result),showcase1
=(f.filename))
def nutrition(index):
url="https://calorieninjas.p.rapidapi.com/v1/nutrition"
querystring={"query":index}
headers={
"X-RapidAPI-Key":"228bc54e2bmsh125425366c0edcdp11af24jsn5f87cef4e48
e",
"X-RapidAPI-Host": "calorieninjas.p.rapidapi.com"
response=requests.request("GET",url,headers=headers,params=querystring)
print(response.json())
return response.json()['ite]
```

Home.html

```
{% extends 'base.html' %}
{% block content %}
<div class="homeview">
<p>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.</p>
</div>
{% endblock %}
{% extends 'base.html' %}
```

Image.html

```
{% block content %}
<div class="uploadview">
<form class="formView" method="post" action="/predict"
enctype="multipart/form-data">
<h2>Upload your image</h2>
<input id="choose-file" type="file" name="file" required>
<input class="submit" type="Submit" value="Check and tell!">
</form>
</div>
{% endblock %}
```

0.html

```
{% extends 'base.html' %}
{% block content %}
<div class="ansView">
<div class="ans-left">
<h1>Image Uploaded:</h1>
<img class="image-cont" src={{ url_for('static', filename=showcase1 ) }}
</div>
<div class="ans-right">
<h1 style="color: black;">Nutritional Values: </h1>
<div class="flex" style="color: black;">
<h3>Food detected:</h3>
<p class="pr5">{{ scase }}</p>
</div>
{% for k in showcase[0] %}
<p><b style="color: black;">{{ k }}</b> : {{ showcase[0].get(k) }}</p>
{% endfor %}
</div>
</div>
{% endblock %}
```

8. TESTING

8.1 Test Cases

S.No	Test Cases	Passed/ Failed
1.	Input image data	Passed
2.	Upload data	Passed
3.	Model integration	Passed
4.	Prediction	Passed
5.	Nutrition values	Passed

8.2 User Acceptance Testing

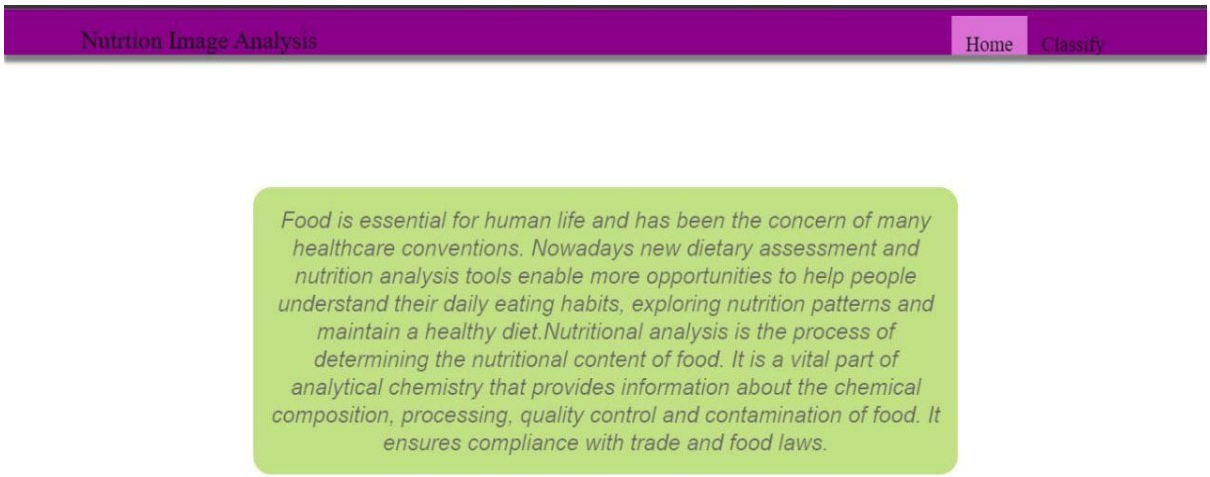
S.No	Test Cases	Yes/No
1.	Keyword driven	Yes
2.	Responds in manually drafted rules	Yes
3.	Conversational Paradign	Yes
4.	Learned from real interactions	No
5.	Training via historical data	No
6.	Has decision-making skills	No

9. RESULTS

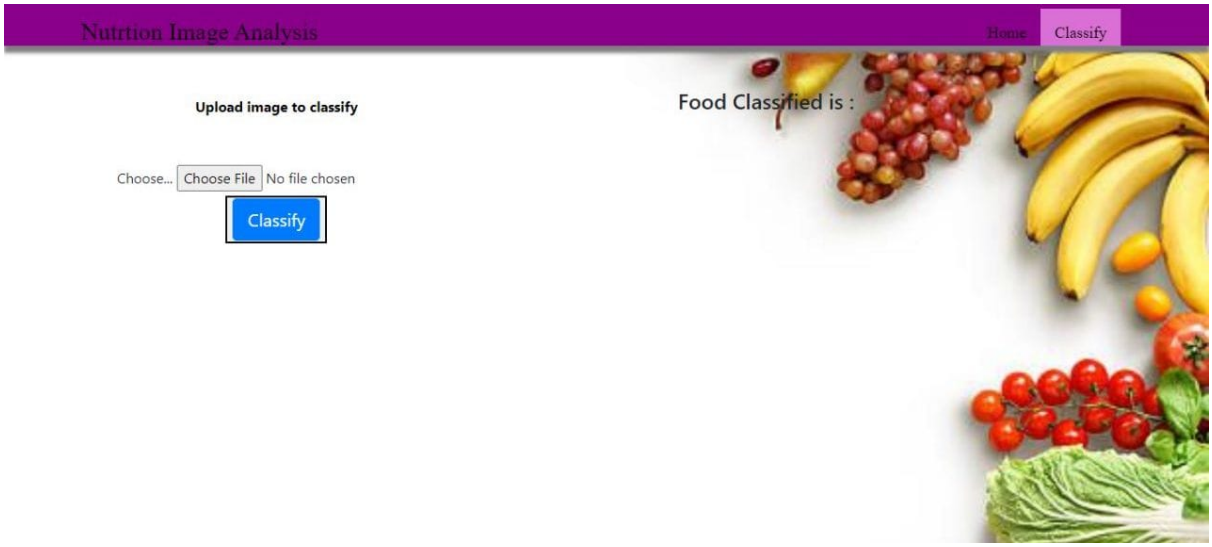
9.1 Performance Metrics

In this project, we have collected images of 5 types of food items apples, 'banana', 'orange', 'pineapple' and 'watermelon', they are saved in the respective subdirectories with their respective names. The accuracy of the proposed model was 98.74 %. The comparison of the proposed model with the conventional models shows that the results of this model are exceptionally good and promising to use in real-world applications. This sort of higher accuracy and precision will work to boost the machine’s general efficiency in fruit recognition more appropriately.

FIRST PAGE:



SECOND PAGE:



THIRD PAGE:

10. ADVANTAGES & DISADVANTAGES

Advantages:

- Classification of fruits is a needful exercise to differentiate the particular variety of fruits of the same family. Most of the case, the variety of fruits of the same family differ in the sense of colour and size only.
- The use of image processing for the grading of fruits involves categorization of fruits, with consideration of the severity of the disease, defects, and contamination on fruits. Grading is an important step in the post-harvest process. Grading of fruits manually is a time taking and unreliable process. Therefore, it is needful to adapt the automated faster system in this regard.
- Some of the other associated benefits include speed operation, production consistent, greater product stability and safety.

Disadvantages:

- Most of the research conducted by taking the one-side view of fruits. In addition, by considering the one-side image of fruit, it is challenging to evaluate the quality fruits.
- It does not provide stable recognition in adverse imaging condition.

11. CONCLUSION

A fruit classification system may be used to help a supermarket cashier identify the fruit species and prices. It may also be used to help people decide whether specific fruit species meet their dietary requirements. It may also help children and visually impaired people, and improve supermarket grocery self-checkouts. During this project, we had the option to investigate some portion of the profound learning algorithms and find qualities and

shortcomings. We picked up information on deep learning, and we got a product that can perceive fruits from pictures. A new method for classifying fruits using convolutional neural network algorithm is proposed. The above algorithm was coded and tested using anaconda software. Different fruits varieties that had different backgrounds were taken for training and testing. The proposed algorithm gave 98% accuracy rate. This project explores a fruits classification based on CNN algorithm. The accuracy and loss curves were generated by using various combinations of hidden layers for five cases using fruits. CNN gave better performance to attain better fruit classification. We trust that the outcomes and strategies introduced in this project can be additionally extended to a greater task.

12. FUTURE SCOPE

From our perspective, one of the principal goals is to improve the precision of the neural system. This includes further exploring different avenues regarding the structure of the system. Hopefully, in the future, this project can be extended with a larger dataset having more categories of fruits & vegetables. We will also have the plan to implement some other CNN based models to compare the accuracy on the same dataset, can also work on some more features for grading and classification, which can identify types of disease and/or texture structure of fruits. All these are future direction.

13. APPENDIX

GitHub Link

https://github.com/IBM-EPBL/IBM-Project-20838-1659764703

Project Demo Link

https://nutrition-app33.herokuapp.com/