# PANIMALAR ENGINEERING COLLEGE

## AI POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSISTS

A PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree

of

**BACHELOR OF ENGINEERING**

in

**COMPUTER SCIENCE AND ENGINEERING**

# Project Report

# AI POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSISTS

## 1.INTRODUCTION

### 1.1 Project Overview

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 maintaining 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.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. Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyses the image and detects the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).

### 1.2 Purpose

The purpose of Nutrition analysis is to allow healthcare providers to systematically assess the overall nutritional status of patients, diagnose malnutrition, identify underlying pathologies that lead to malnutrition, and plan necessary interventions. It detects the exact nutritional value of any given food item. It determines the percentage of macro and micronutrients present in that food item as well as the presence of inhibitors, toxic chemicals, or any other new component.

## 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


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9. Hessler G., Baringhaus K.-H. Artificial intelligence in drug design. *Molecules.* 2018;23:2520. doi: 10.3390/molecules23102520. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
10. Heydarian H., Adam M.T.P., Burrows T., Collins C.E., Rollo M.E. Assessing eating behaviour using upper limb mounted motion sensors: A systematic review. *Nutrients.* 2019;11:1168. doi: 10.3390/nu11051168. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
11. Demirci F., Akan P., Kume T., Sisman A.R., Erbayraktar Z., Sevinc S. Artificial neural network approach in laboratory test reporting: Learning algorithms. *Am. J. Clin. Pathol.* 2016;146:227–237. doi: 10.1093/ajcp/aqw104. [PubMed] [CrossRef] [Google Scholar]

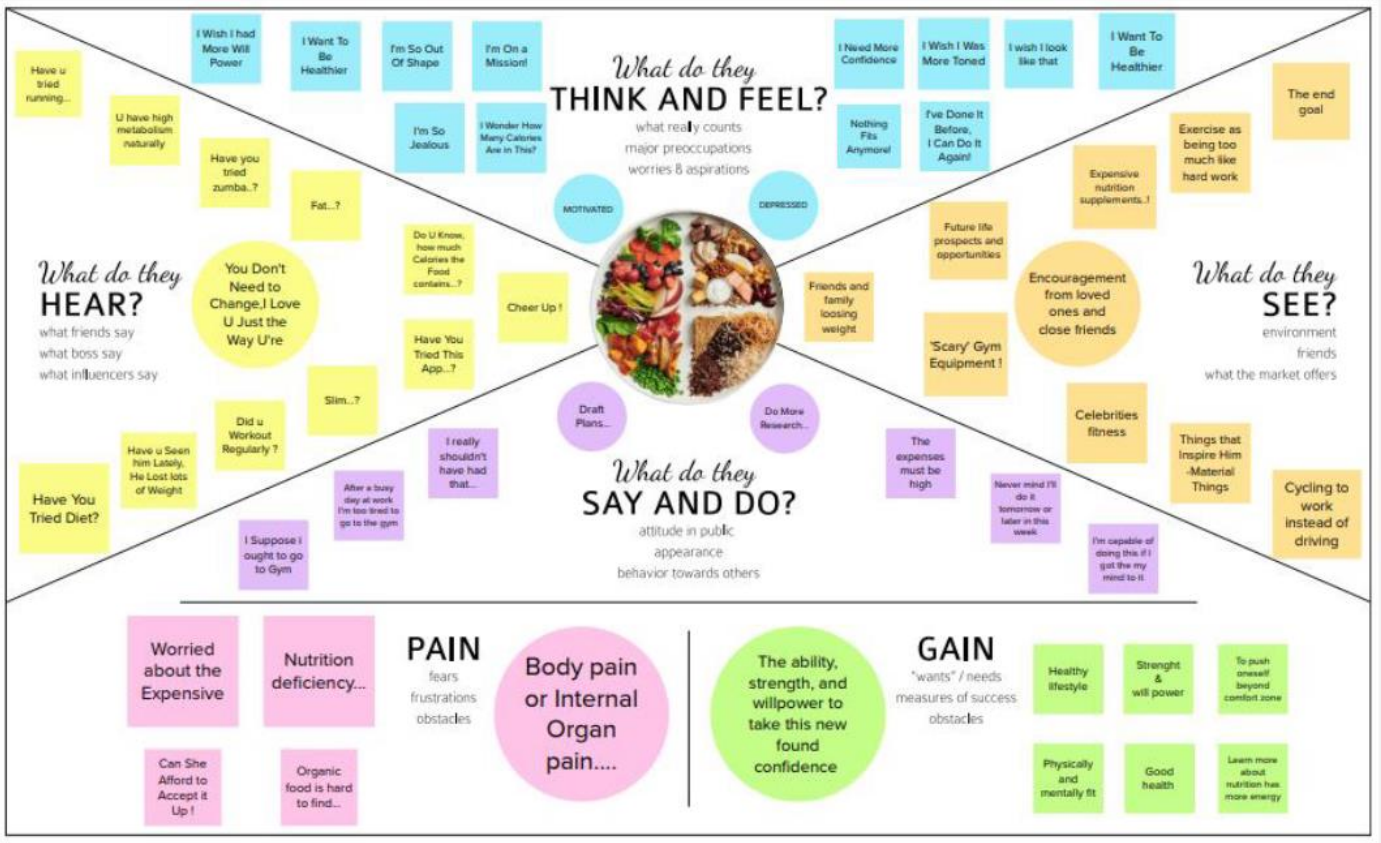
### 2.3 Problem Statement Definition

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. Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyses the image and detects the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).The User interacts with the UI(User Interface) and the image is provided as input.The model will classify the result and show the output.

## 3. IDEATION & PROPOSED SOLUTION

### 3.1 Empathy Map Canvas

An empathy map is a visualisation tool used to articulate what a product team knows about a user. This tool helps product teams build a broader understanding of the “why” aspect behind user needs and wants. This tool forces product teams to practise empathic design, which shifts the focus from the product they want to build to the people who will use this product. As a team identifies what they know about the user and places this information on a chart, they gain a more holistic view of the user's world and his or her problems, or opportunity space. The Empathy map for AI-powered Nutrition Analyzer for Fitness Enthusiasts is as follows.




### 3.2 Ideation & Brainstorming

Brainstorming is a method of generating ideas and sharing knowledge to solve a particular commercial or technical problem, in which participants are encouraged to think without interruption. Brainstorming is a group activity where each participant shares their ideas as soon as they come to mind. Everyone in a design team should have a *clear* definition of the target problem. They typically gather for a brainstorming session in a room with a large board/wall for pictures/PostIts. A good mix of participants will expand the experience pool and therefore broaden the idea space.

Template

# Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- **10 minutes** to prepare
- **1 hour** to collaborate
- **2-8 people** recommended

Share template feedback

## Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

**Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

**Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.

**Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

## Define your problem statement

People with high prevalence of physical inactivity and high rates of preventable health conditions and fitness inability increased participation in fitness and wellness activities can improve their overall health and wellbeing. Our purpose is to Maintain a healthy, balanced, and sustainable diet helps to build wellness across many areas of health.

How might we [your problem statement]?

## Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

VIJAY P K

- Extract specific nutritional variables.
- Graphically represent nutrition content.
- Suggest food.
- Predict nutrition pattern.

SYED SOHAIL AHMED H

- Get image input/ Static image upload.
- Train model specifically for fruits.
- Promote healthy eating.
- Track calories.

VIJAY P K

- Create a dynamic webpage.
- Provide misc. nutritional facts.
- Include Diet plans.
- List potential ailments.

THARUN E

- FAQs
- Add search functionality.
- Provide a clean and hassle-free interface.
- Create diet plans.

3

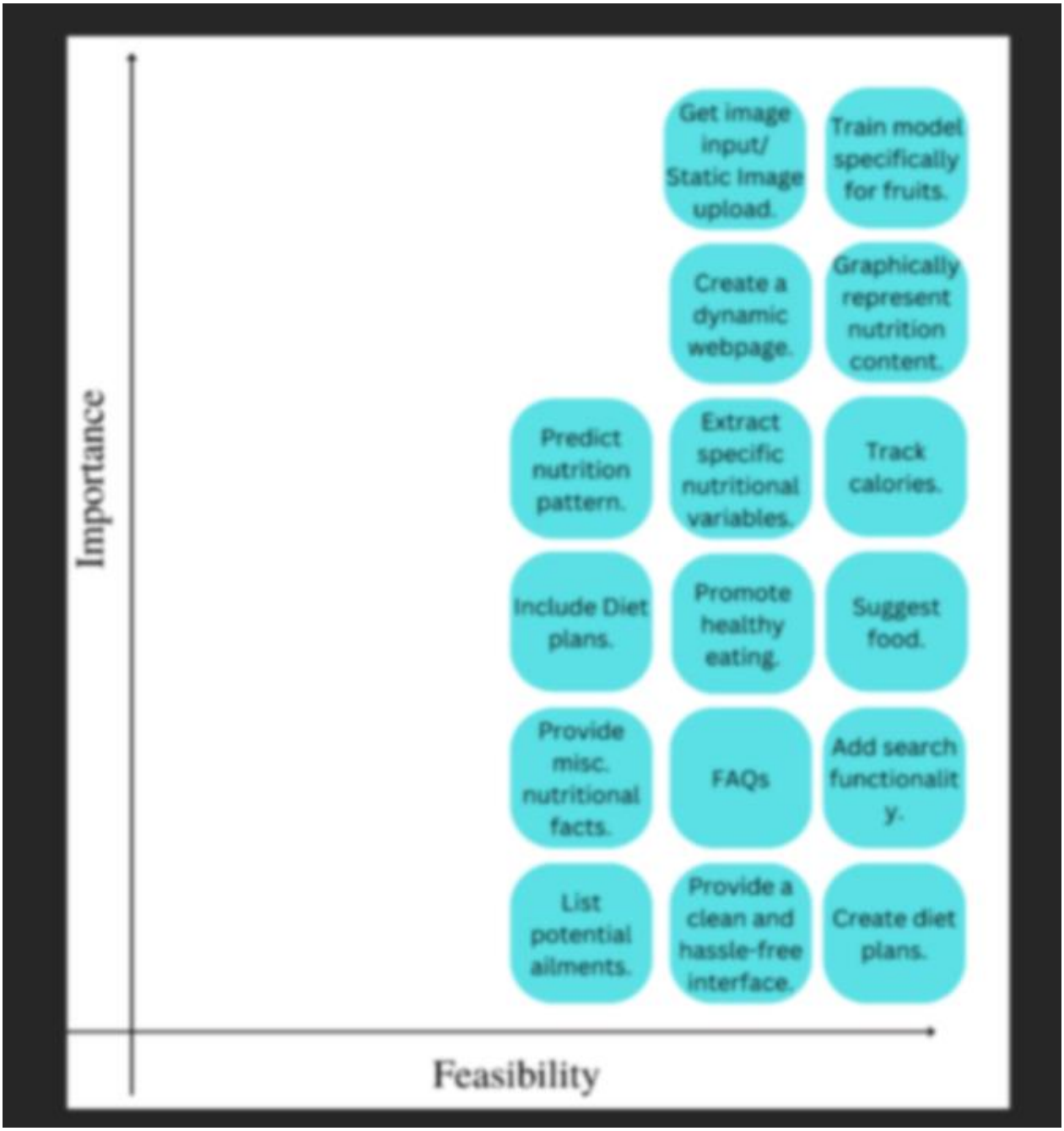
## Group ideas

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

20 minutes


**TIP**

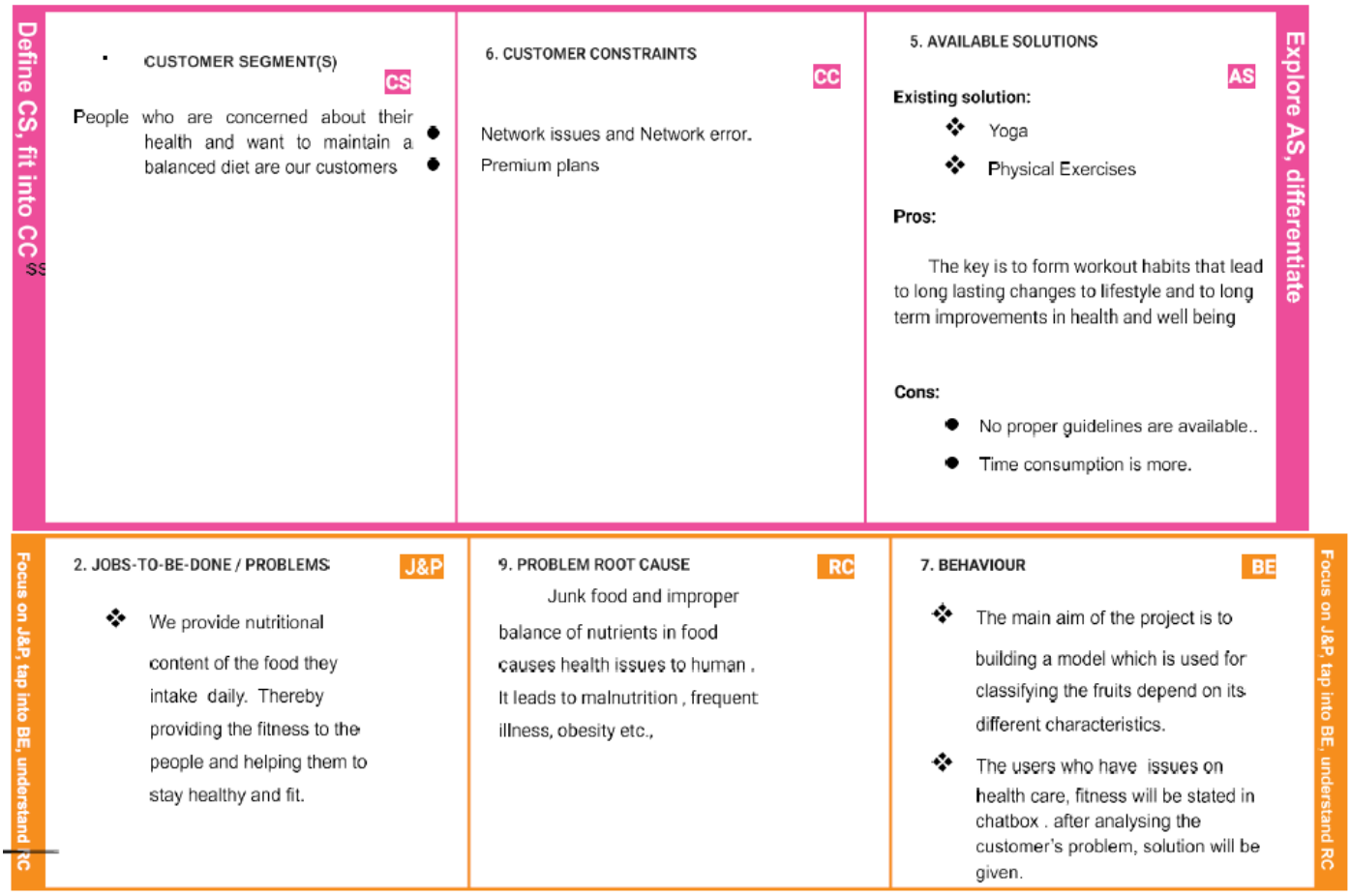
Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.


Importance
Feasibility
Get image input/ Static Image upload.
Train model specifically for fruits.
Create a dynamic webpage.
Graphically represent nutrition content.
Predict nutrition pattern.
Extract specific nutritional variables.
Track calories.
Include Diet plans.
Promote healthy eating.
Suggest food.
Provide misc. nutritional facts.
FAQs
Add search functionality.
List potential ailments.
Provide a clean and hassle-free interface.
Create diet plans.

### 3.3 Proposed Solution

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | People are not consuming sufficient amount of food to provide them with the necessary calories, fats, proteins, vitamins and minerals for them to maintain an optimal health. While on the other hand, a section of people consume food that's plentiful than needed for them. |
| 2. | Idea / Solution description | The main aim of this Nutrition Analyzer is to determine the perfect amount of nutrition needed for the user and for doing so it gives precise measurements of the nutrient contents of the food they consume. |
| 3. | Novelty / Uniqueness | This is available as both webpage and as an application for users convenient with easy accessibility. It makes sure that the user's water intake is up to their requirement along with the nutrition intake. |
| 4. | Social Impact / Customer Satisfaction | Not every people can afford a nutritionist, but this Analyzer gives them access to explore their nutrition journey. By monitoring the nutrition disorders related to it can be considerably reduced. |
| 5. | Business Model (Revenue Model) | The application can be deployed for access by the general public. The application would draw the attention of several users who are determined to lead a healthy lifestyle and wish to undergo a physical transformation. The application could be built in such a way that features are progressively unlocked based on the subscription amount paid by the user starting from the generic nutrition analyzer feature to charting out personal plans for users. |
| 6. | Scalability of the Solution | The proposed application hasseveral features. It can be further enhanced to integrate more features based on feedback from users and ratings. |

## 3.4 Problem Solution fit



### 3. TRIGGERS

TR

Because of the problem of nutritional deficiency and obesity thereby people getting suggestions from nutritional and fitness experts.

### 4. EMOTIONS: BEFORE / AFTER

EM

**Emotions before:**

They don't have the fitness wellness in them and they don't live a healthy life and also they get depressed and worried about their health.

**Emotions after:**

They can analyze the food which they are eatingand make healthy life.

### 10. YOUR SOLUTION

SL

Calories tracking is the key features in all fitness solutions which helps in preventing the diseases in advance hence normal people can usethis.

Instructor demonstrates the particular fruits calories and provides guided assistance so that the users can perform them accurately.

### 8.CHANNELS of BEHAVIOUR

CH

**Online:**

User can access the application by scanning the fruitAnd get the nutritional info.

**Offline:**

Based on the Nutritional info user will perform.

Traditional method of nutritional therapy can also bedone via offline.

## 4. REQUIREMENT ANALYSIS

### 4.1Functional requirements

To develop this project we need to install the following software/packages:

•**Anaconda Navigator**

Anaconda Navigator is a free and open-source distribution of the python and R programming languages for data science and machine learning-related applications. It can be installed on Windows, Linux, and macOS .Conda is an open-source, cross-platform, package management system, Anaconda comes with great tools like Jupiter Lab, Jupiter Notebook, Spyder, Orange, R studio,Visual Studio Code.

• **Flask**

Web framework used for building web applications. For anaconda navigator, follow the below steps to download the required packages open anaconda prompt as administrator. If you are using Pycharm IDE, you can install the packages through the command prompt and follow the same syntax as above.

• **Python packages**

- ➢ Open anaconda prompt as administrator
- ➢ Type “pip install num py” and click enter.
- ➢ Type “pip install pandas” and click enter.
- ➢ Type “pip install scikit-learn” and click enter.
- ➢ Type “pip install tensorflow==2.3.0” and click enter.
- ➢ Type “pip install keras==2.4.0” and click enter.
- ➢ Type “pip install Flask” and click enter.

• **Deep learning concepts**

It is a subset of machine learning, deep learning algorithms are perhaps best exemplified by multi-layer neural networks (NN), which uses multi-layer neural networks to get an idea of imputed unsorted data based on learnt in its. Uses basics concepts from brain biology. Useful when there is a quality of input data.

**• Artificial Neural Networks**

ANN is an efficient computing system whose central them is borrowed from the analogy of biological neural networks. ANN is a real so named as “artificial neural systems”, or parallel distributed systems”, or “connectional systems”. ANN acquires a large collection of units that are interconnected in some pattern to allow communication between the units. These units, also referred to as nodes or neurons, are simple processors which operate in parallel.

**• Convolution Neural Networks**

A convolutional neural network is a class of deep neural networks, most commonly applied to analysing visual imagery. The construction of convolutional neural network is a multi-layered feed-forward neural network, made by assembling many unseen layers on top of each other in a particular order. It is the sequential design that gives permission to CNN to learn hierarchical attributes. In CNN, some of them are followed by grouping layers and hidden layers

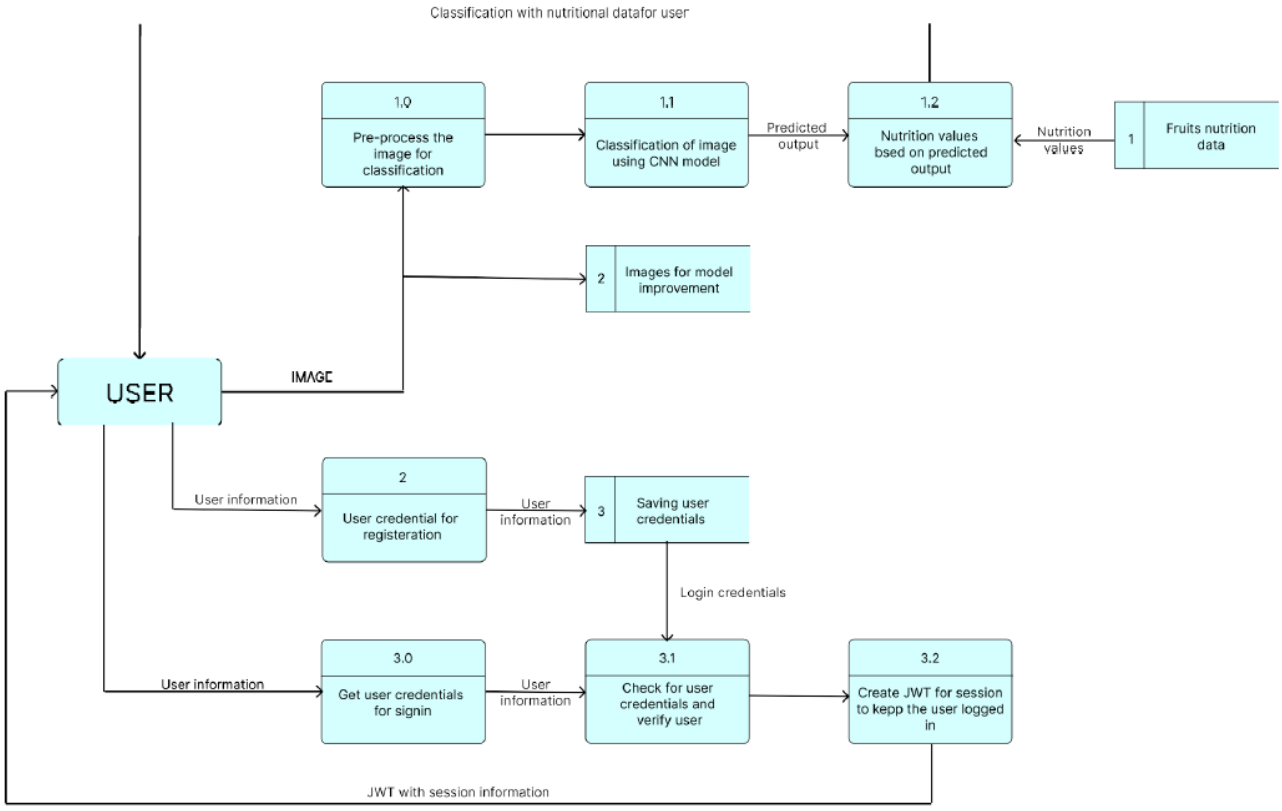
| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | Home page | The home page shows the Objective and Aim of the project |
| FR-2 | Classify | The classify page has choose and Analyze buttons |
| FR-3 | Upload Image | Select the image by clicking the choose button and pick the image from the files |
| FR-4 | Image Capturing and Processing | The application allows users to capture images of the ingredients they consume. These are given to the modelfor predicting their labels, i.e. identify the fruits. Further,the quantity of the fruits should be discerned. The application should be able to work with images of low quality and low resolution as well. |
| FR-5 | Analyze | The choosen picture is analyzed and tells the sugar level, protein, calories, fiber, fat and carbohydrates |

### 4.2 Non-Functional requirements

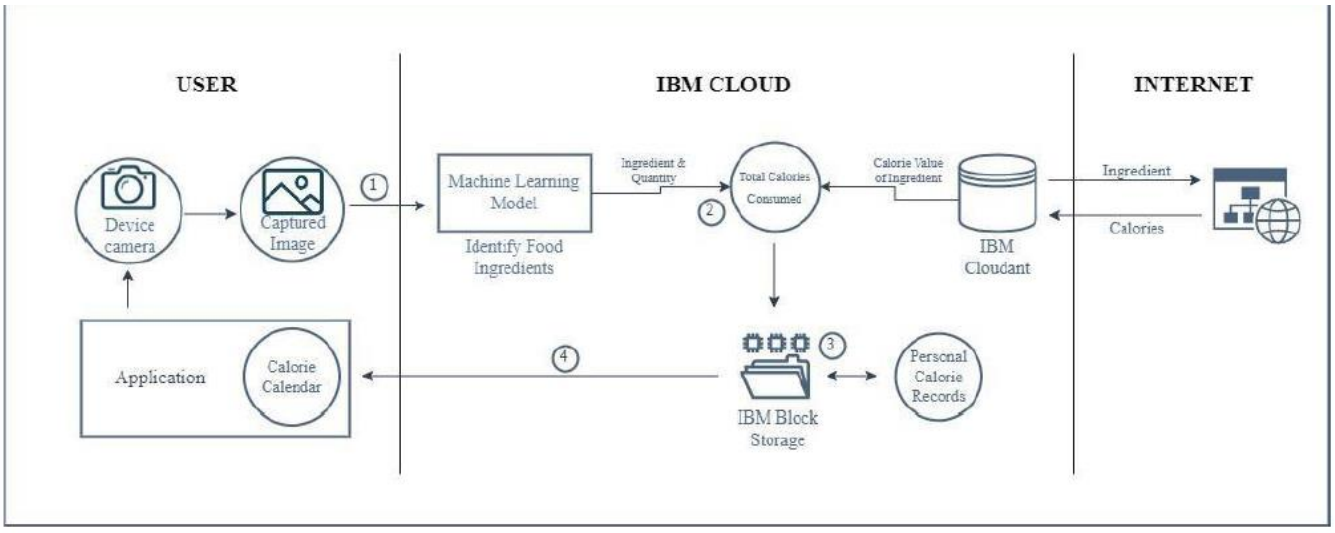
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | The users should be able to use the application without any difficulties. The interface should be easy to use and understand. The image capture process should be smooth and not tedious. |
| NFR-2 | **Security** | Details of the users and their personal calories calendar should not be disclosed or shared to other users. Privacy of data should be ensured. |
| NFR-3 | **Reliability** | The application should correctly identify the fruits from the captured image and fetch its nutritional value. The count and calculation of the calories should be done accurately. |
| NFR-4 | **Performance** | The application should be built on a highly efficient prediction model such that the results are accurate.It should keep in mind time and space complexity. |
| NFR-5 | **Availability** | The application should be available to its users at all times and should work efficiently. It should not suffer from issues such as application crashes. |
| NFR-6 | **Scalability** | The application should be able to support updates in terms of features and functionality. The system should be built such that it can upgrade using the existing underlying architecture.. |

# 5. PROJECT DESIGN

## 5.1 Data Flow Diagrams



## 5.2 Solution & Technical Architecture




## 5.3 User Stories

A user story is an informal, general explanation of a software feature written from the perspective of the end user. Its purpose is to articulate how a software feature will provide value to the customer. It's tempting to think that user stories are, simply put, software system requirements. But they're not.

A key component of agile software development is putting people first, and a user story puts end users at the center of the conversation. These stories use non-technical language to provide context for the development team and their efforts. After reading a user story, the team knows why they are building, what they're building, and what value it creates. User stories are one of the core components of an agile program. They help provide a user-focused framework for daily work — which drives collaboration, creativity, and a better product overall.

# 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 | 14 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 | Data Collection | USN-1 | Download Food Nutrition Dataset | 2 | Medium | VIJAY M P |
| Sprint-1 | Data Preprocessing | USN-2 | Importing The Dataset into Workspace | 1 | Low | VIJAY P K |
| Sprint-1 | | USN-3 | Handling Missing Data | 3 | Medium | THARUN E |
| Sprint-1 | | USN-4 | Feature Scaling | 3 | Low | SYED SOHAIL AHMED B |
| Sprint-1 | | USN-5 | Data Visualization | 3 | Medium | VIJAY P K |
| Sprint-1 | | USN-6 | Splitting Data into Train and Test | 4 | High | VIJAY M P |
| Sprint-1 | | USN-7 | Creating A Dataset with Sliding Windows | 4 | High | THARUN E |
| Sprint-2 | Model Building | USN-8 | Importing The Model Building Libraries | 1 | Medium | VIJAY P K |
| Sprint-2 | | USN-9 | Initializing The Model | 1 | Medium | VIJAY M P |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sprint-2 | | USN-10 | Adding LSTM Layers | 2 | High | THARUN E |
| Sprint-2 | | USN-11 | Adding Output Layers | 3 | Medium | VIJAY P K |
| Sprint-2 | | USN-12 | Configure The Learning Process | 4 | High | SYED SOHAIL AHMED B |
| **Sprint** | **Functional Requirement (Epic)** | **User Story Number** | **User Story / Task** | **Story Points** | **Priority** | **Team Members** |
| Sprint-2 | | USN-13 | Train The Model | 2 | Medium | THARUN E |
| Sprint-2 | | USN-14 | Model Evaluation | 1 | Medium | VIJAY P K |
| Sprint-2 | | USN-15 | Save The Model | 2 | Medium | SYED SOHAIL AHMED B |
| Sprint-2 | | USN-16 | Test The Model | 3 | High | VIJAY M P |
| Sprint-3 | Application Building | USN-17 | Create An HTML File | 4 | Medium | VIJAY P K |
| Sprint-3 | | USN-18 | Build Python Code | 4 | High | SYED SOHAIL AHMED B |
| Sprint-3 | | USN-19 | Run The App in Local Browser | 4 | Medium | SYED SOHAIL AHMED B |
| Sprint-3 | | USN-20 | Showcasing Prediction On UI | 4 | High | VIJAY P K |
| Sprint-4 | Train The Model On IBM | USN-21 | Register For IBM Cloud | 4 | Medium | VIJAY M P |
| Sprint-4 | | USN-22 | Train The ML Model On IBM | 8 | High | VIJAY P K |
| Sprint-4 | | USN-23 | Integrate Flask with Scoring End Point | 8 | High | THARUN E |

# 7. CODING & SOLUTIONING

## 7.1 Features:

**DATA COLLECTION:**

from google.colab import drive

drive.mount('/content/drive') Mounted at /content/drive

cd/content/drive/MyDrive/Colab Notebooks

/content/drive/MyDrive/Colab Notebooks

```
# Unzipping the dataset
!unzip 'Dataset.zip'
```

Streaming output truncated to the last 5000 lines.

```
inflating: Dataset/TEST_SET/APPLES/n07740461_13800.jpg
inflating: Dataset/TEST_SET/APPLES/n07740461_13851.jpg
inflating: Dataset/TEST_SET/APPLES/n07740461_13901.jpg
```

**Image Preprocessing**

```
#Importing The ImageDataGenerator Library
from keras.preprocessing.image import ImageDataGenerator
```

**Image Data Augmentation**

```
#Configure ImageDataGenerator Class

train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizont
test_datagen=ImageDataGenerator(rescale=1./255)
```

**Applying Image DataGenerator Functionality To Trainset And Testset**

```
#Applying Image DataGenerator Functionality To Trainset And Testset
x_train =
train_datagen.flow_from_directory(r'/content/Dataset/TRAIN_SET',
target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse') #Applying
Image DataGenerator Functionality To Testset
x_test = test_datagen.flow_from_directory(
```

```
r'/content/Dataset/TEST_SET',
        target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

**Model Bulding**

## 1. Importing The Model Building Libraries

import numpy as np import tensorflow as tf

from tensorflow.keras.models import Sequential from tensorflow.keras import layers

from tensorflow.keras.layers import Dense,Flatten
from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout

## 2. Initializing The Model

```
model = Sequential()
```

## 3. Adding CNN Layers

```
# Initializing the
CNN
classifier =
Sequential()

# First convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Second convolution layer and pooling
classifier.add(Conv2D(32, (3, 3),
activation='relu'))
```

```
# input_shape is going to be the pooled feature maps from the previous convolution layer
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Flattening the layers
classifier.add(Flatten())
```

**4. Adding Dense Layers**

```
classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax'))
#summary of our model
classifier.summary()
```

```
=================================================================
==
Total params: 813,733
Trainable params: 813,733
Non-trainable params: 0
```

**5. Configure The Learning Process**

```
# Compiling the CNN
# categorical_crossentropy for more than 2
classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics
```

## 6.Train The Model

```
#Fitting the model
classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, valid
```

#Fitting the model classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, valid Epoch 1/20 /usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model. 824/824 [==============================] Epoch 2/20 - 21s 16ms/step - loss: 0.6172 - accuracy: 824/824 [==============================] - 13s 15ms/step - loss: 0.4115 - accuracy: Epoch 3/20 824/824 [==============================] - 13s 16ms/step - loss: 0.3766 - accuracy: Epoch 4/20 824/824 [==============================] - 13s 16ms/step - loss: 0.3484 - accuracy: Epoch 5/20 824/824 [==============================] Epoch 6/20 - 13s 16ms/step - loss: 0.3243 - accuracy: 824/824 [==============================] - 13s 16ms/step - loss: 0.3240 - accuracy: Epoch 7/20 824/824 [==============================] - 13s 16ms/step - loss: 0.2887 - accuracy: Epoch 8/20 824/824 [==============================] - 13s 16ms/step - loss: 0.2728 - accuracy: Epoch 9/20 824/824 [==============================] - 13s 16ms/step - loss: 0.2717 - accuracy: Epoch 10/20 824/824 [==============================] - 14s 17ms/step - loss: 0.2365 - accuracy: Epoch 11/20 824/824 [==============================] - 13s 15ms/step - loss: 0.2301 - accuracy: Epoch 12/20 824/824 [==============================] - 13s 15ms/step - loss: 0.2083 - accuracy: Epoch 13/20 824/824 [==============================] - 13s 15ms/step - loss: 0.2049 - accuracy: Epoch 14/20 824/824 [==============================] - 12s 15ms/step - loss: 0.1930 - accuracy: Epoch 15/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1807 - accuracy: Epoch 16/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1712 - accuracy: Epoch 17/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1599 - accuracy: Epoch 18/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1619 - accuracy: Epoch 19/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1505 - accuracy: Epoch 20/20 824/824 [==============================] - 12s 15ms/step - loss: 0.1211 - accuracy:

## 7. Saving The Model

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

**8. Testing The Model**

```
#Predict the results
from tensorflow.keras.models
import load_model from keras.preprocessing import image
model = load_model("nutrition.h5")
from tensorflow.keras.utils import img_to_array
#loading of the image
img = load_img(r'/content/Sample_Images/Test_Image1.jpg',grayscale=False,target_size=
(64, 64)
#image to array
x = img_to_array(img)
#changing the shape
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 18ms/step array([0])
index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
result=str(index[classes_x[0]])
result 'APPLES
```

## 7.2Features:

### Python code

```
from flask import Flask,render_template,request

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('nutrition.h5')
print("Loaded model from disk")

@app.route('/')
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 launch():
    if request.method=='POST':
        f=request.files['file']
        basepath=os.path.dirname('_file_')
        filepath=os.path.join(basepath,"uploads",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
        print(x)
        result=nutrition(result)
        print(result)

        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):
    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"

    querystring = {"query": "tomato"}

    headers = {
        "X-RapidAPI-Key": "f2179b0ee2msh46dd220682815e1p1e6122jsnaea9bb30dd96",
        "X-RapidAPI-Host": "calorieninjas.p.rapidapi.com"
    }

    response = requests.request("GET", url, headers=headers, params=querystring)

    print(response.text)
    return response.json()['items']
if_name_== "_main_":



    app.run(debug=True
```

## Html pages

### 0.HTML

```
          <html lang="en" dir="ltr">
<head>
<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="padding-top: 150px; color:blue;"><h4 style="color:blue;">IMAGE CLASSIFIED IS :
 <h4><b><h4 style="color:red;"><u>{{showcase1}}<h4><br><h4 style="color:red;"><u>{{showcase}}<h4></p>

    </div>
    <br>
    <br>

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

**Home.HTML**

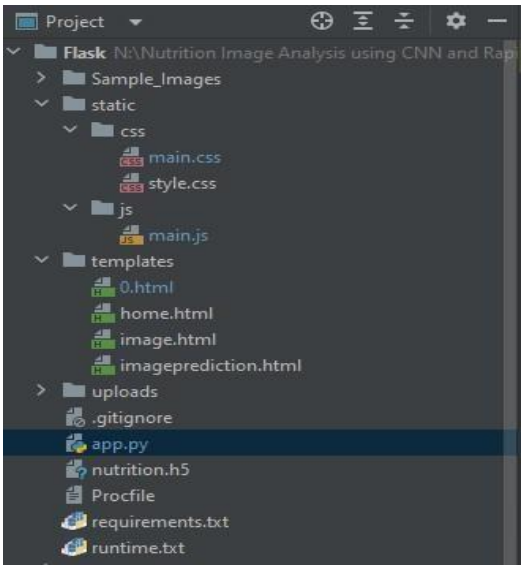
```
<!DOCTYPE html>
<html>
<head>
  <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <meta http-equiv="X-UA-Compatible" content="ie=edge">
   <title>HOME</title>
  <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-
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">
</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%;">NUTRITION IMAGE ANALYSIS</div>
 <div class="topnav-right"style="padding-top:0.5%;">

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

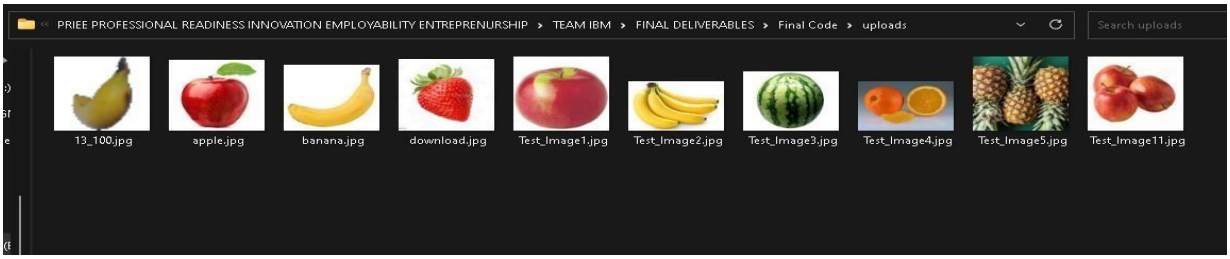
```
</div>
<br>
<br>




<section id="about">
      <div class="container mt-4 pt-4">
    <br><br><br>
        <h1 class="text-center"><center><b> OBJECTIVE OF THE PROJECT</center></b></h1>
        <div class="row mt-4">
          <div class="col-lg-4">
            <img src="https://cdn.pixabay.com/photo/2017/05/07/19/32/strawberry-2293337_960_720.jpg" class=
"imageAboutPage"alt="">
          </div>

          <div class="col-lg-8">
        <br>

          <ul>
<li>Food is essential for human life and has been the concern of many healthcare conventions. </li>
<li>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. </li>
<li>Nutritional analysis is the process of determining the nutritional content of food. </li>
<li>It is a vital part of analytical chemistry that provides information about the chemical composition, processing,
quality control and contamination of food.</li>
</ul>



          </div>
        </div>
  </section>
<br>
            <br>
            <br><br>
<section id="about">
      <div class="container mt-4 pt-4">
    <br><br><br>
        <h1 class="text-center"><b>AIM OF THE PROJECT</b></h1>
        <div class="row mt-4">
          <div class="col-lg-4">
            <img src="https://www.cdc.gov/foodsafety/images/comms/features/GettyImages-1247930626-
500px.jpg?_=00453" class= "imageAboutPage" alt="">
          </div>
```

```
            <div class="col-lg-8">
          <br>
                        <ul>
<li>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.  </li>
<li>Here the user can capture the images of different fruits and then the image will be sent the trained model.</li>
<li>The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).</li>
</ul>
            </div>
          </div>
</section>
<br>
<br>
<br>
<br>
 <br>
</body>
</html>
```

# 8.TESTING

## 8.1 Test Cases



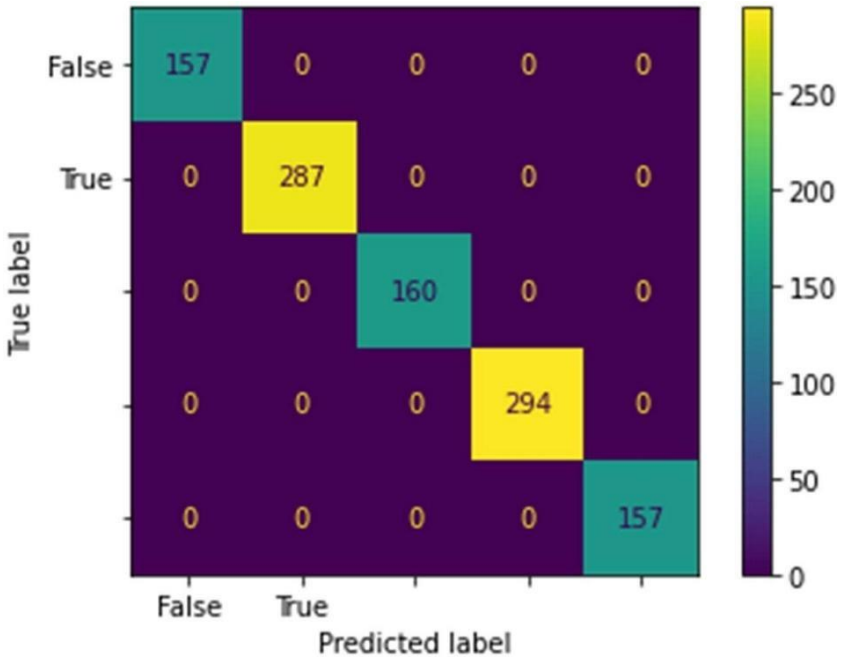



## 8.2 User Acceptance Testing

# 9.RESULTS

## 9.1 Performance Metrics

1. Confusion Matrix




```
print(metrics.classification_report(test_data['label'].values, test_data['model_preds'].values))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00       157
           1       1.00      1.00      1.00       287
           2       1.00      1.00      1.00       160
           3       1.00      1.00      1.00       294
           4       1.00      1.00      1.00       157

    accuracy                           1.00      1055
   macro avg       1.00      1.00      1.00      1055
weighted avg       1.00      1.00      1.00      1055
```

2.Accuracy – 100 %

```
[8]  print(f"the accuracy is {metrics.accuracy_score(test_data['label'].values, test_data['model_preds'].values)}")

     the accuracy is 1.0
```

3.Precision – 100 %

```
[11] print(f"the precision is {metrics.precision_score(test_data['label'].values, test_data['model_preds'].values, average = 'weighted')}")

     the precision is 1.0
```

4.Recall – 100 %

```
[12] print(f"the recall is {metrics.recall_score(test_data['label'].values, test_data['model_preds'].values, average = 'weighted')}")
     the recall is 1.0
```

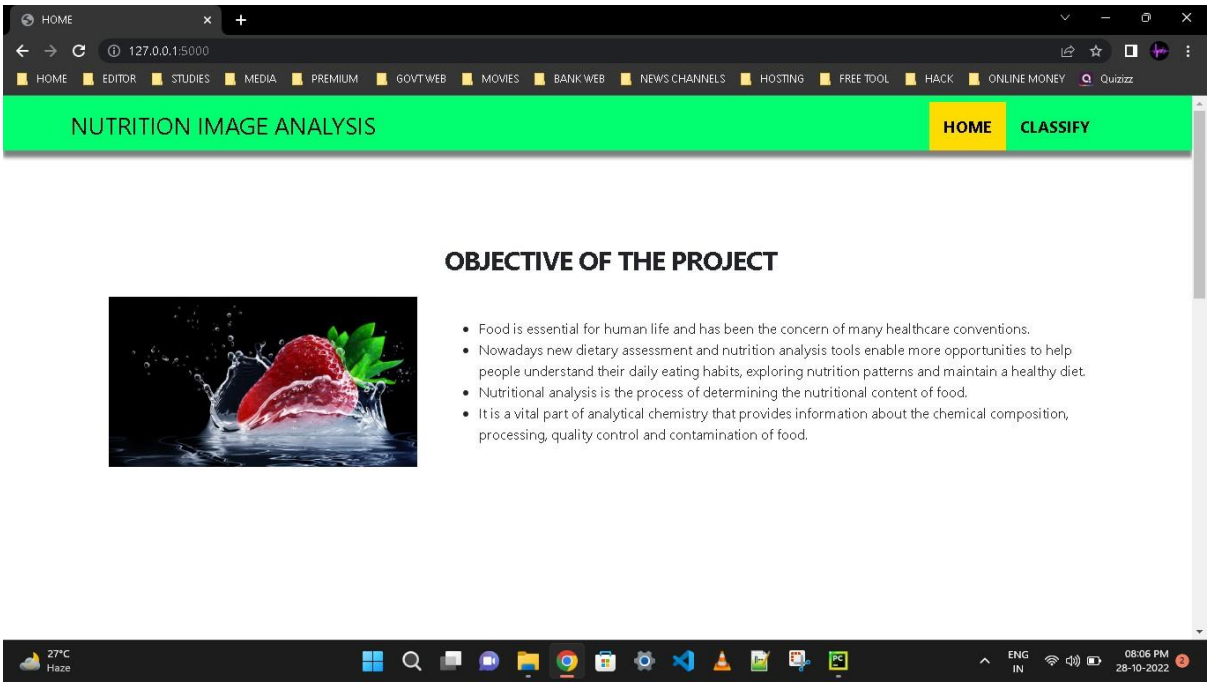
5.Specificity – 100 %

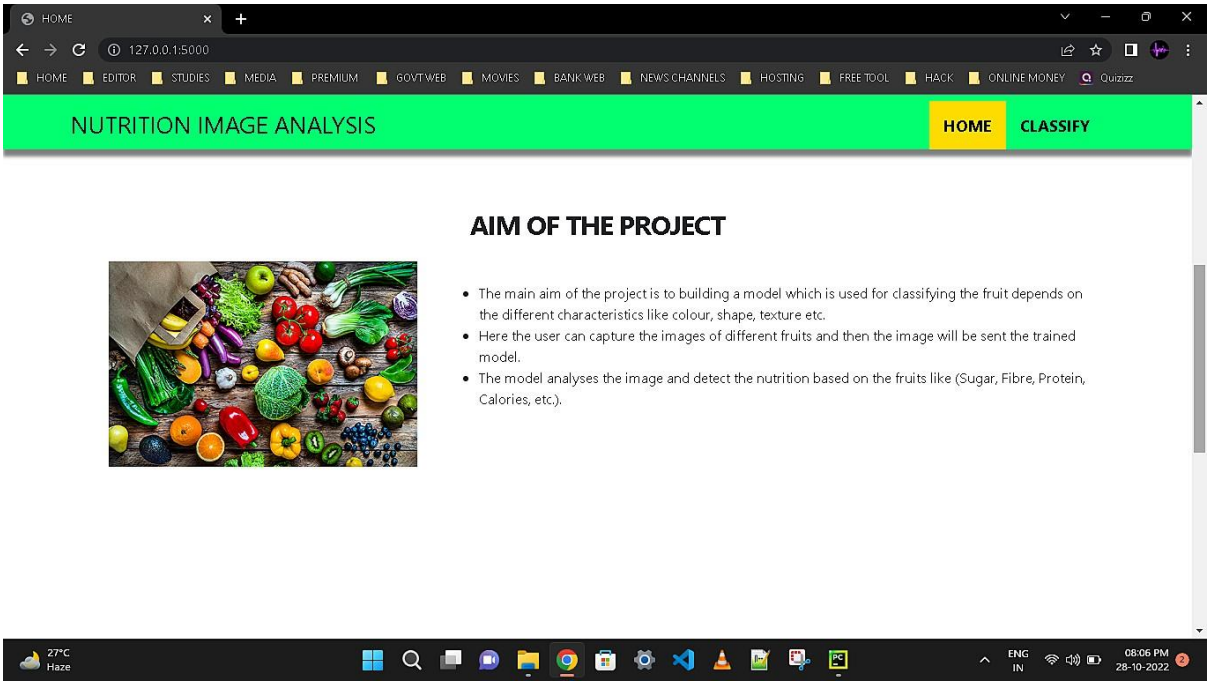
```
print(f"the specificity is {metrics.recall_score(test_data['label'].values, test_data['model_preds'].values, pos_label=0,average = 'weighted')}")
the specificity is 1.0
```

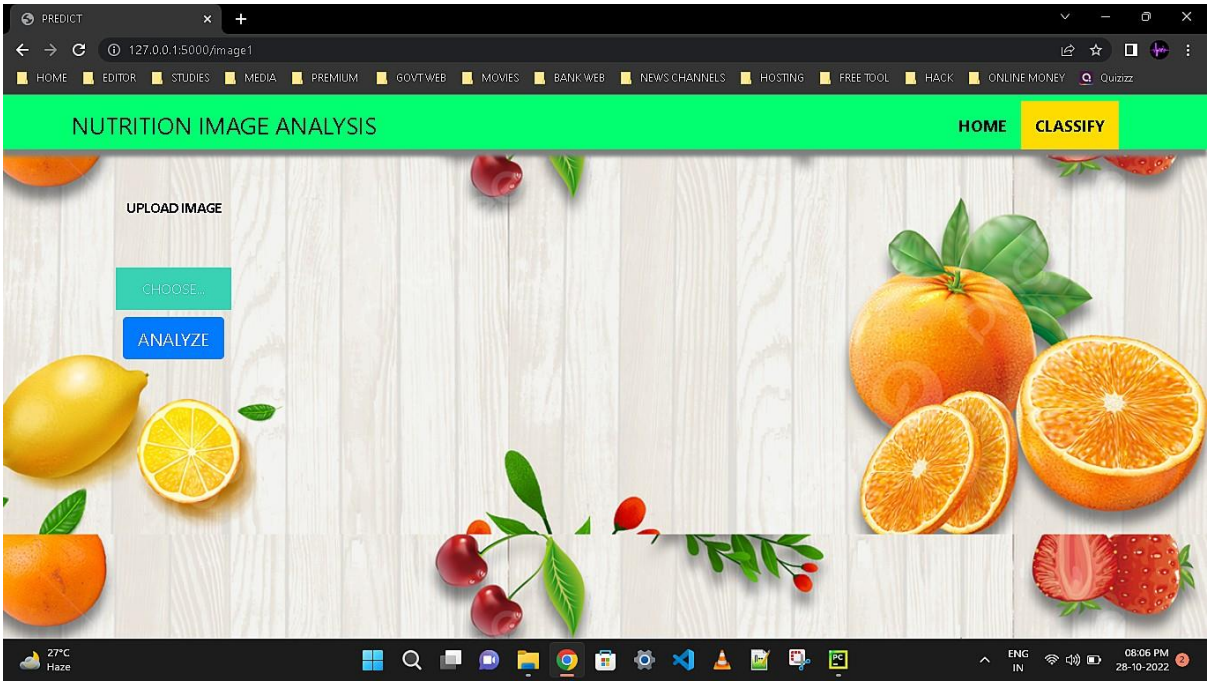
6.F1-Score – 100 %

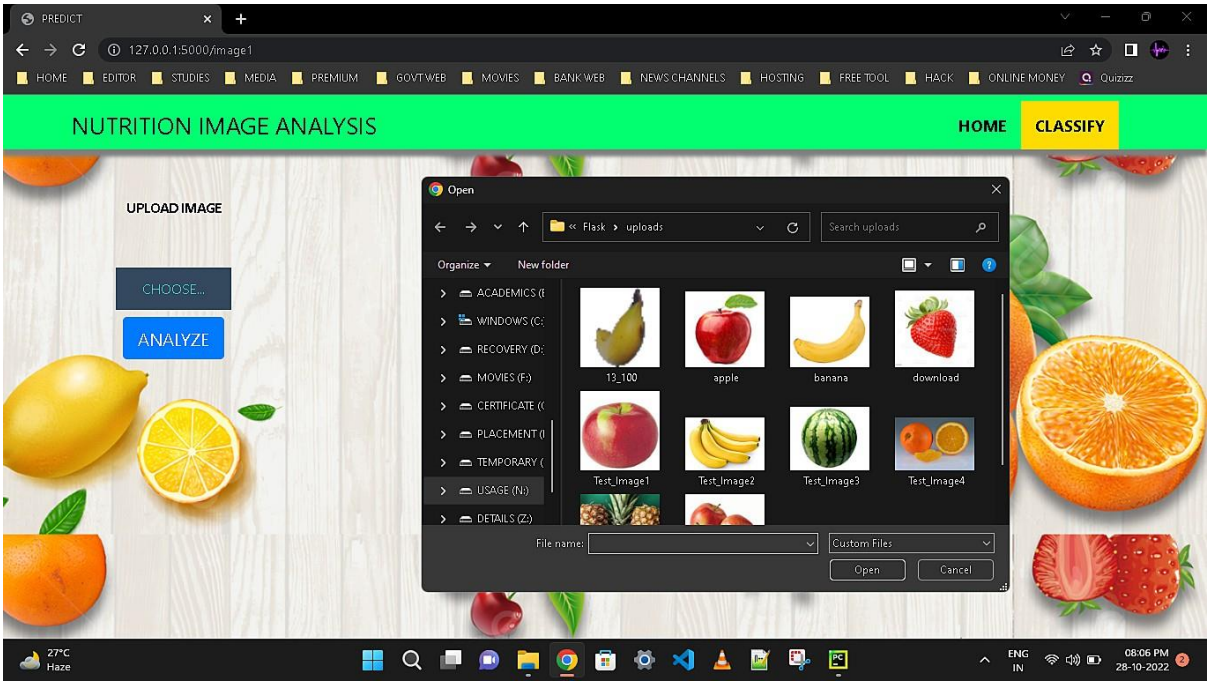
```
[13] print(f"the f1 score is {metrics.f1_score(test_data['label'].values, test_data['model_preds'].values,average = 'weighted')}")
     the f1 score is 1.0
```

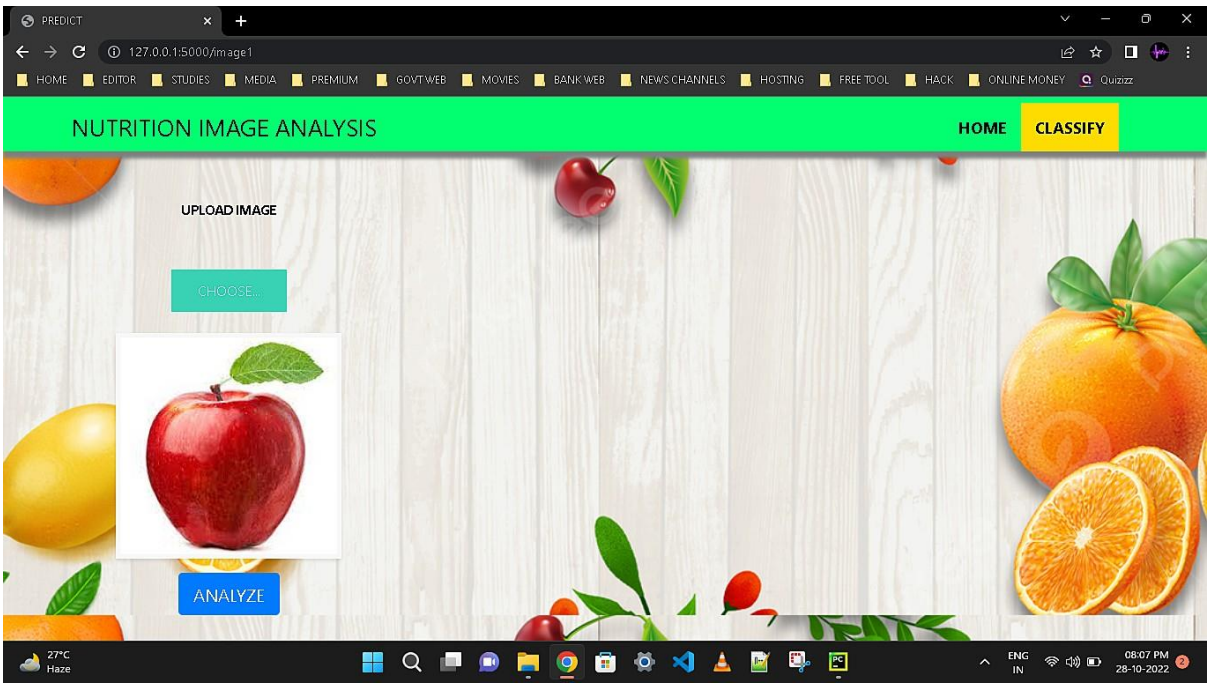
## 9.2 Output Screenshot

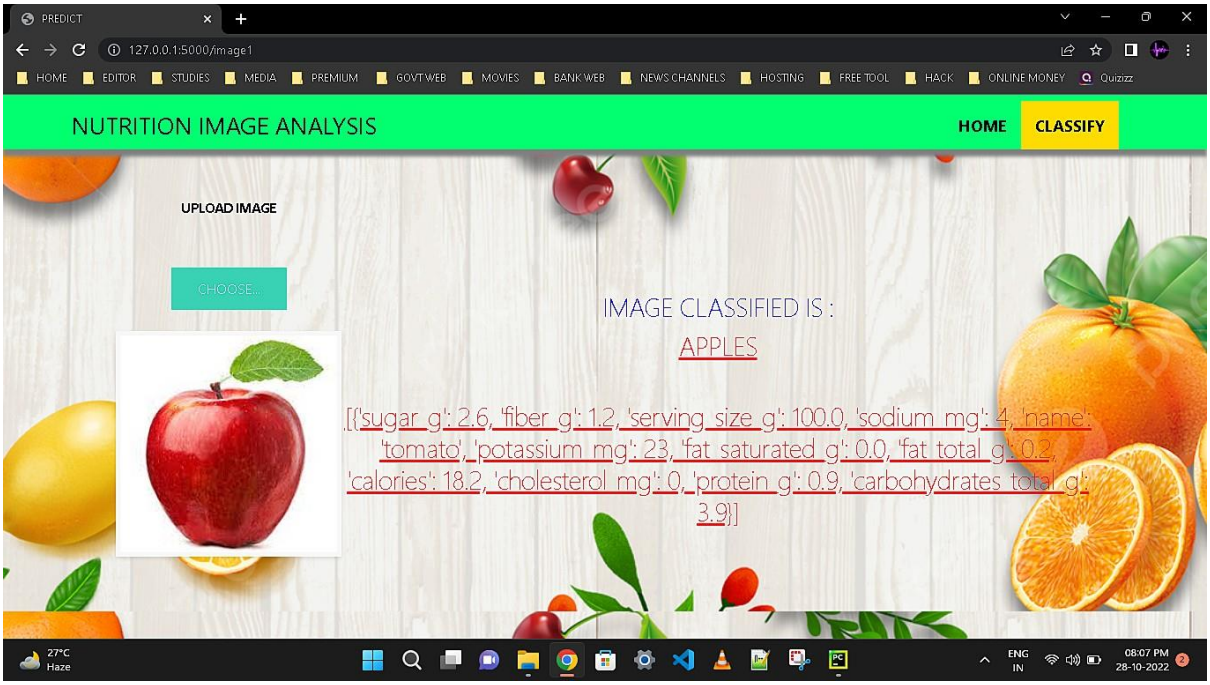



HOME
127.0.0.1:5000
HOME EDITOR STUDIES MEDIA PREMIUM GOVT WEB MOVIES BANK WEB NEWS CHANNELS HOSTING FREE TOOL HACK ONLINE MONEY Quizizz
NUTRITION IMAGE ANALYSIS
HOME
CLASSIFY
AIM OF THE PROJECT
The main aim of the project is to building a model which is used for classifying the fruit depends on the 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.).
27°C
Haze
ENG
IN
08:06 PM
28-10-2022


PREDICT
127.0.0.1:5000/image1
HOME EDITOR STUDIES MEDIA PREMIUM GOVT WEB MOVIES BANK WEB NEWS CHANNELS HOSTING FREE TOOL HACK ONLINE MONEY Quizizz
NUTRITION IMAGE ANALYSIS
HOME
CLASSIFY
UPLOAD IMAGE
CHOOSE...
ANALYZE
27°C
Haze
ENG
IN
08:06 PM
28-10-2022


PREDICT
127.0.0.1:5000/image1
NUTRITION IMAGE ANALYSIS
HOME
CLASSIFY
UPLOAD IMAGE
CHOOSE...
ANALYZE
Open
Flask › uploads
Search uploads
Organize
New folder
13_100
apple
banana
download
Test_Image1
Test_Image2
Test_Image3
Test_Image4
File name:
Custom Files
Open
Cancel
27°C
Haze
ENG
IN
08:06 PM
28-10-2022


PREDICT
127.0.0.1:5000/image1
NUTRITION IMAGE ANALYSIS
HOME
CLASSIFY
UPLOAD IMAGE
CHOOSE...
ANALYZE
27°C
Haze
ENG
IN
08:07 PM
28-10-2022




## 10. ADVANTAGES & DISADVANTAGES

### ADVANTAGES

- Food pattern is an important factor to prevent diseases and improve lifestyle. Studies show that changes in diet affect the evolution of chronic non-communicable diseases (CNCD) like cardiovascular diseases, obesity, and depression. It is highly recommended to change eating habits to prevent non-communicable diseases. Artificial Intelligence in nutrition is becoming popular for prevention and treatment.

- Analysis of personal health metrics has become possible because of advances in Artificial Intelligence.

- While artificial intelligence is increasing its part in our daily lives, AI-based diet planning could be created where it will be dependent on user's data and machine learning to create a comprehensive meal plan for every user based on their actual metabolic need.

**DISADVANTAGES**

- If the dataset has not been properly uploaded ,then the detection of images can be difficult.
- If the images are not clear, the nutrition analysis can be difficult.
- The user's health condition are not described.

## 11. CONCLUSION

Thus the AI powered nutrition analyzer for fitness enthusiasts has been implemented. Presented system includes a home page and classify page respectively.In the home page,The aim and objective of the project has been provided. In the classify page,the user has to upload the image of the food and click the classify option .The various nutritions present in the image will be provided.With this project we will analyze the image and nutrients has been provided as output.

### 12. FUTURE SCOPE

There are some other ongoing efforts in the field as well. In certain nutrition studies, smartphone photos of individuals' plates of food are being analyzed by deep learning, a subtype of Artificial Intelligence, to streamline the food logging process as well as eliminating the risk of human error. However, for obtaining a comprehensive data set, factors like activity levels, sleep patterns, medication consumption, and microbiome functioning require to be integrated into the data set. This can be achieved via the implementation of advanced algorithms that track the important health metrics for the development of a personalized diet.

## 13. APPENDIX

### Source Code

**DATA COLLECTION:**

```
from google.colab import drive
drive.mount('/content/drive') Mounted at /content/drive
cd/content/drive/MyDrive/Colab Notebooks
/content/drive/MyDrive/Colab Notebooks
```

```
# Unzipping the dataset
!unzip 'Dataset.zip'
Streaming output truncated to the last 5000 lines.

inflating: Dataset/TEST_SET/APPLES/n07740461_13800.jpg
inflating: Dataset/TEST_SET/APPLES/n07740461_13851.jpg
inflating: Dataset/TEST_SET/APPLES/n07740461_13901.jpg
```

**Image Preprocessing**

```
#Importing The ImageDataGenerator Library
from keras.preprocessing.image import ImageDataGenerator
```

**Image Data Augmentation**

```
#Configure ImageDataGenerator Class

train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizont
test_datagen=ImageDataGenerator(rescale=1./255)
```

**Applying Image DataGenerator Functionality To Trainset And Testset**

```
#Applying Image DataGenerator Functionality To Trainset And Testset
x_train =
train_datagen.flow_from_directory(r'/content/Dataset/TRAIN_SET',
target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse') #Applying
Image DataGenerator Functionality To Testset
x_test = test_datagen.flow_from_directory(
r'/content/Dataset/TEST_SET',
target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

**Model Bulding**

## 1. Importing The Model Building Libraries

import numpy as np import tensorflow as tf

from tensorflow.keras.models import Sequential from tensorflow.keras import layers

from tensorflow.keras.layers import Dense,Flatten

from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout

## 2. Initializing The Model

model = Sequential()

## 3. Adding CNN Layers

```
# Initializing the
CNN
classifier =
Sequential()

# First convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Second convolution layer and pooling
classifier.add(Conv2D(32, (3, 3),
activation='relu'))

# input_shape is going to be the pooled feature maps from the previous convolution layer
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Flattening the layers
classifier.add(Flatten())
```

## 4. Adding Dense Layers

```
classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax'))
#summary of our model
classifier.summary()
```

```
==========
==
Total params: 813,733
Trainable params: 813,733
Non-trainable params: 0
```

## 5. Configure The Learning Process

```
# Compiling the CNN
# categorical_crossentropy for more than 2
classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics
```

## 6. Train The Model

```
#Fitting the model
classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, valid
```

#Fitting the model classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, valid Epoch 1/20 /usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model. 824/824 [==========] Epoch 2/20 - 21s 16ms/step - loss: 0.6172 - accuracy: 824/824 [==========] - 13s 15ms/step - loss: 0.4115 - accuracy: Epoch 3/20 824/824 [==========] - 13s 16ms/step - loss: 0.3766 - accuracy: Epoch 4/20 824/824 [==========] - 13s 16ms/step - loss: 0.3484 - accuracy: Epoch 5/20 824/824 [==========] Epoch 6/20 -

13s 16ms/step - loss: 0.3243 - accuracy: 824/824 [==============================] - 13s 16ms/step - loss: 0.3240 - accuracy: Epoch 7/20 824/824 [==============================] - 13s 16ms/step - loss: 0.2887 - accuracy: Epoch 8/20 824/824 [==============================] - 13s 16ms/step - loss: 0.2728 - accuracy: Epoch 9/20 824/824 [==============================] - 13s 16ms/step - loss: 0.2717 - accuracy: Epoch 10/20 824/824 [==============================] - 14s 17ms/step - loss: 0.2365 - accuracy: Epoch 11/20 824/824 [==============================] - 13s 15ms/step - loss: 0.2301 - accuracy: Epoch 12/20 824/824 [==============================] - 13s 15ms/step - loss: 0.2083 - accuracy: Epoch 13/20 824/824 [==============================] - 13s 15ms/step - loss: 0.2049 - accuracy: Epoch 14/20 824/824 [==============================] - 12s 15ms/step - loss: 0.1930 - accuracy: Epoch 15/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1807 - accuracy: Epoch 16/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1712 - accuracy: Epoch 17/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1599 - accuracy: Epoch 18/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1619 - accuracy: Epoch 19/20 824/824 [==============================] - 13s 15ms/step - loss: 0.1505 - accuracy: Epoch 20/20 824/824 [==============================] - 12s 15ms/step - loss: 0.1211 - accuracy:

**7. Saving The Model**

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

**8. Testing The Model**

```
#Predict the results
from tensorflow.keras.models
import load_model from keras.preprocessing import image
model = load_model("nutrition.h5")
from tensorflow.keras.utils import img_to_array
#loading of the image
img = load_img(r'/content/Sample_Images/Test_Image1.jpg',grayscale=False,target_size=(64, 64)
```

```
#image to array
x = img_to_array(img)
#changing the shape
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 18ms/step array([0])
index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
result=str(index[classes_x[0]])
result 'APPLES
```

## Python code

```
from flask import Flask,render_template,request

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('nutrition.h5')
print("Loaded model from disk")

@app.route('/')
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 launch():
    if request.method=='POST':
        f=request.files['file']
        basepath=os.path.dirname('_file_')
        filepath=os.path.join(basepath,"uploads",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
        print(x)
        result=nutrition(result)
        print(result)

        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):
    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"

    querystring = {"query": "tomato"}

    headers = {
        "X-RapidAPI-Key": "f2179b0ee2msh46dd220682815e1p1e6122jsnaea9bb30dd96",
        "X-RapidAPI-Host": "calorieninjas.p.rapidapi.com"
    }

    response = requests.request("GET", url, headers=headers, params=querystring)

    print(response.text)
    return response.json()['items']
if_name_== "_main_":



    app.run(debug=True
```

## Html pages

### 0.HTML

```
          <html lang="en" dir="ltr">
<head>
<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="padding-top: 150px; color:blue;"><h4 style="color:blue;">IMAGE CLASSIFIED IS :
<h4><b><h4 style="color:red;"><u>{{showcase1}}<h4><br><h4 style="color:red;"><u>{{showcase}}<h4></p>

    </div>
    <br>
    <br>

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

**Home.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">
</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%;">NUTRITION IMAGE ANALYSIS</div>
 <div class="topnav-right"style="padding-top:0.5%;">

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

```
<section id="about">
      <div class="container mt-4 pt-4">
    <br><br><br>
        <h1 class="text-center"><center><b> OBJECTIVE OF THE PROJECT</center></b></h1>
        <div class="row mt-4">
            <div class="col-lg-4">
                <img src="https://cdn.pixabay.com/photo/2017/05/07/19/32/strawberry-2293337_960_720.jpg" class=
"imageAboutPage"alt="">
            </div>

            <div class="col-lg-8">
        <br>

            <ul>
<li>Food is essential for human life and has been the concern of many healthcare conventions. </li>
<li>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. </li>
<li>Nutritional analysis is the process of determining the nutritional content of food. </li>
<li>It is a vital part of analytical chemistry that provides information about the chemical composition, processing,
quality control and contamination of food.</li>
</ul>



            </div>
        </div>
   </section>
 <br>
                <br>
                <br><br>
<section id="about">
      <div class="container mt-4 pt-4">
    <br><br><br>
        <h1 class="text-center"><b>AIM OF THE PROJECT</b></h1>
        <div class="row mt-4">
            <div class="col-lg-4">
                <img src="https://www.cdc.gov/foodsafety/images/comms/features/GettyImages-1247930626-
500px.jpg?_=00453" class= "imageAboutPage" alt="">
            </div>

            <div class="col-lg-8">
        <br>
                        <ul>
```

```
<li>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.  </li>
<li>Here the user can capture the images of different fruits and then the image will be sent the trained model.</li>
<li>The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).</li>
</ul>
            </div>
          </div>
</section>
<br>
<br>
<br>
<br>
 <br>
</body>
</html>
```

**Demo Link**

**https://drive.google.com/file/d/1P9PC6z7GuXqqtQQWfD2TMb-3ZOtvfzuz/view?usp=drivesdk**

**GitHub Link**

**https://github.com/IBM-EPBL/IBM-Project-5719-1658813516**