Project Report

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1. INTRODUCTION

The most crucial factor in living a healthy life is eating a balanced, healthy diet. It supports healthy outcomes, aging, normal growth, and the growth of a sense of well-being. Additionally, it lowers the chance of developing cardiac and heart disorders and aids in maintaining a healthy body weight. Age, way of life, culture, gender, and a host of other factors all affect a balanced diet. Therefore, there is a need for nutritionists that can analyze each and every person based on their unique culinary culture and way of life. Artificial intelligence fills a requirement in the current, developing society for identity and nutrition studies. When a huge amount of data is required for structuring and integrating the metabolomics, AI algorithms will help forecast the complicated non-linear relationships in fitness related data sets. Every person needs to be aware of how many calories they are consuming in their fruits because society as a whole is becoming more diet concerned. It encourages better digestion and helps you feel full on less food. One can become more aware of their food choices by making a few minor adjustments to their eating routine. This analyser will give users an assistant that will advise them on what to eat, how much to consume, and all of the fruit's calories and nutrients. Additionally, it aids in lowering birth weight, malnutrition, and other issues.

1.1. PROJECT OVERVIEW

The idea is to ensure that the food has an optimal requirement of vitamins and minerals wherein the examination of nutrition in food helps in understanding about the fat proportion, carbohydrates dilution, proteins, fiber, sugar, etc. And thereafter the appropriate presence of nutritional value assists in fulfilling the compliance regulations matched by the national and international bodies. Food nutritional analysis is a compulsory requirement for food products manufacturing industries as it's a necessary complaint for the products to get launched. Thus have the scanning of the food product's nutritional value and be rest assured.

1.2. PURPOSE

The purpose of nutritional assessment, however, is to define a patient's nutritional status, to define clinically relevant malnutrition and to monitor changes in nutritional status.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

A Study of Calorie Estimation in Pictures of Food by Jun Zhou, Dane Bell, Sabrina Nusrat, Melanie Hingle, Mihai Surdeanu, Stephen Kobourov findings offer fresh knowledge on the method for estimating calories from food photographs, which may be used to improve analysis and software development. As a function of respondent characteristics and food features, their study aims to assess the accuracy of crowdsourced annotations of calorie content in food photographs as well as to identify and quantify sources of bias and noise. They distributed a custom-made webpage that conducts an online test and encouraged adult social media users to offer calorie estimates for 20 food photos (for which actual calorie data were known). The pictures were chosen to show different meal varieties and energy densities. Participants might have disclosed their height, weight, and gender. The identical data was also annotated by five nutrition specialists to serve as a basis for comparison. Using linear mixed effects models with participant and image index as random variables, they investigated estimated accuracy on the basis of competence, demographic information, and meal quality. They also looked at the benefit of combining estimates from different sources. [1] An analysis of calorie estimation accuracy by Hannah Mixon and Matthew E. Davis is obesity monitoring and controlling by understanding the risk factors of every individual. Understanding risk factors is crucial to comprehend the role that individual differences in cognitive abilities play in the nutritional decision-making process, from the assessment of calories to the influence of any cognitive biases or miscalculations that may occur. In the current study, researchers looked into how dietary aspects like limited eating and cognitive factors like cognitive reflection and numeracy affect biases and miscalculations about calories. Additionally, it primarily focuses on packaged goods and calculates risk and calories for them. [2] Popular Nutrition-Related Mobile Apps: A Feature Assessment by Rodrigo Zenun Franco, Rosalind Fallaize, Julie A Lovegrove, Faustina Hwang is a model proposed in 2016, is to examine and contrast the approaches and technologies used by the most widely used nutrition apps for dietary assessment and user feedback. 13 apps in total were deemed popular enough to be included in the analysis. Nine applications included a food diary function for prospectively documenting

food intake. There were barcode scanners and text search capabilities for food selection. Selection of the portion size was only textual (ie, without images or icons). All nine of these apps have the ability to gather data on physical activity (PA) through wearable integrations, self-report, or GPS tracking. Their work mainly concentrated on achieving a healthy energy balance between dietary intake and PA. None of these nine applications provided elements specifically linked to meal plans and coaching for motivation. The remaining four of the 13 apps, however, concentrated on these prospects without including food diaries. Another cutting-edge feature of one app, Fat Secret, allowed users to communicate with medical experts, and S Health offered a nutrient balance score. [3] Artificial Intelligence Applications in Nutrition and Dietetics is a model that provides the advantages and disadvantages. Both dieticians and clients should track dietary assessments of individuals when assessing nutritional status. Artificial intelligence applications are becoming more prevalent in the fields of dietetics and nutrition, according to observations. For instance, the food consumption logs, which are assessed by photographing the meals ingested, are helpful in determining the nutritional status. These smartphone-shot images demonstrate how useful and adaptable the application is. The dietician can follow the suggested diet plan using these apps, and the clients can take responsibility for their own diet adaption. In order to lower the danger in this approach, hospitalized patients' usual food consumption must be closely monitored. [4]

2.2 REFERENCES

[1] A Study of Calorie Estimation in Pictures of Food by Jun Zhou, Dane Bell, Sabrina Nusrat, Melanie Hingle, Mihai Surdeanu, Stephen Kobourov

[2] An analysis of calorie estimation accuracy by Hannah Mixon and Matthew E. Davis

[3] Popular Nutrition-Related Mobile Apps: A Feature Assessment by Rodrigo Zenun Franco, Rosalind Fallaize, Julie A Lovegrove, Faustina Hwang

[4] Artificial Intelligence Applications in Nutrition and Dietetics is a model provides the advantages and disadvantages

2.3 PROBLEM STATEMENT

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 analyzes the image and detects the nutrition based on the fruits like (Sugar, Fiber, Protein, Calories, etc.

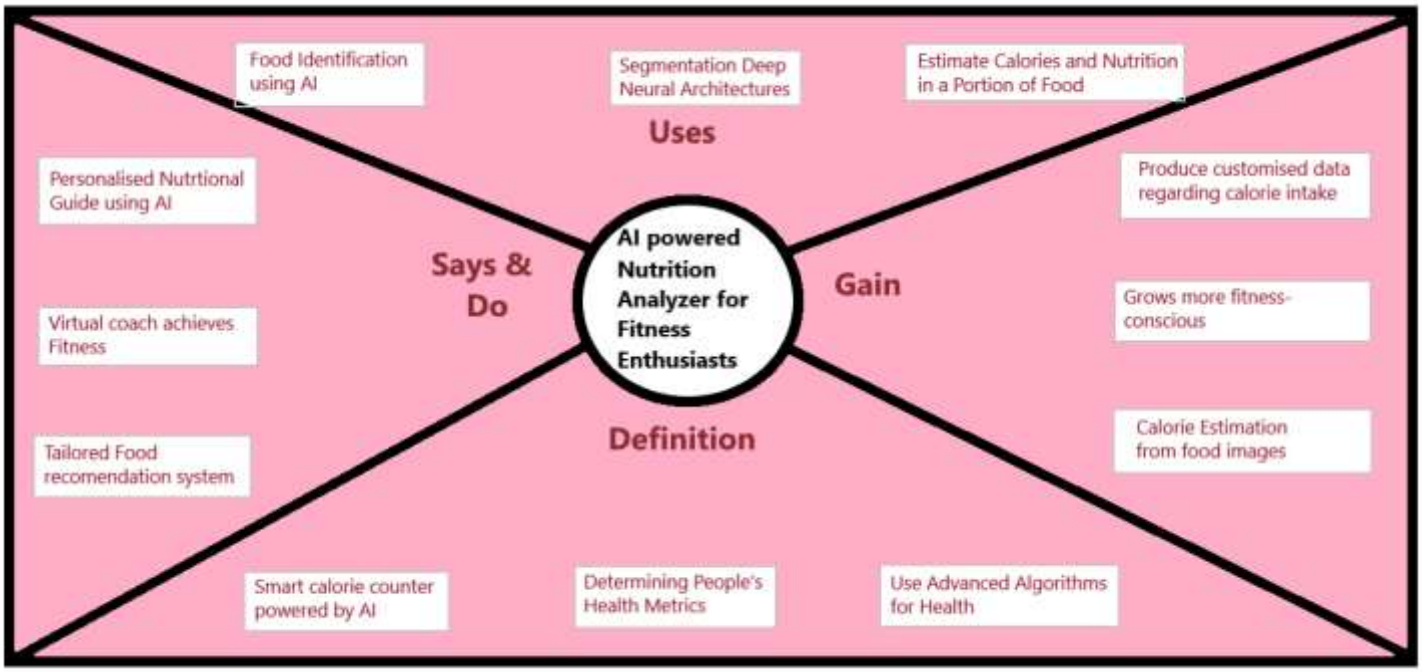
To accomplish this, we have to complete all the activities and tasks listed below

- Data Collection.
    - Collect the dataset or Create the dataset
- Data Preprocessing.
- Import the ImageDataGenerator library
- Configure ImageDataGenerator class
- ApplyImageDataGenerator 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

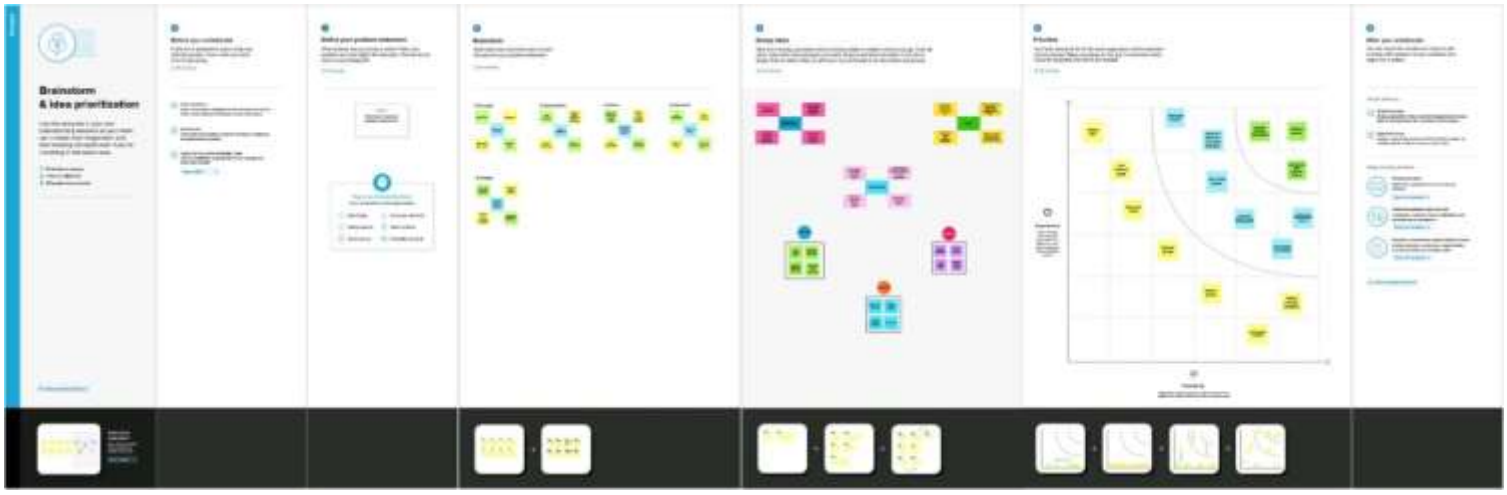
3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 IDEATION & BRAINSTORMING



3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem solved)	A nutrition analyser with AI powered fruit classifier based on the features to provide nutritional values like fiber, vitamins, minerals etc to Fitness Ethusiasts.
2.	Idea / Solution description	Creating web interface application to monitor and track health condition and helping the people to improve their health condition.
3.	Novelty / Uniqueness	Artificial Intelligence offers unparalleled opportunities of progress and applications in nutrition. There remain gaps to address to potentialize this emerging field
4.	Social Impact / Customer Satisfaction	The relationship between an individual's social, psychological, and cultural environment and his or her nutritional status is one of both cause and effect. With use of this application one can keep track of how much nutrients they can balance in their diet.

5.	Business Model (Revenue Model)	Offering monthly or yearly subscription for premium features. Monetizing data from the application.
6.	Scalability of the Solution	For now the nutrition analyser is limited to mostly fruits only, which can be scaled to other foods, Implementing in mobile app.

3.4 PROBLEM SOLUTION FIT

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

AI-Powered Nutrition Analyzer for Fitness Enthusiasts

Function Requirements

FR. No	Functional Requirement	Sub Requirement
FR-1	User Registration	Registration through Form
FR-2	User Confirmation	Confirmation via Email
FR-3	User Profile	Filling the profile page after logging in
FR-4	Scan the Image	Capture the images of the fruits or food
FR-5	Data Processing	Provide the nutrition contents of the food

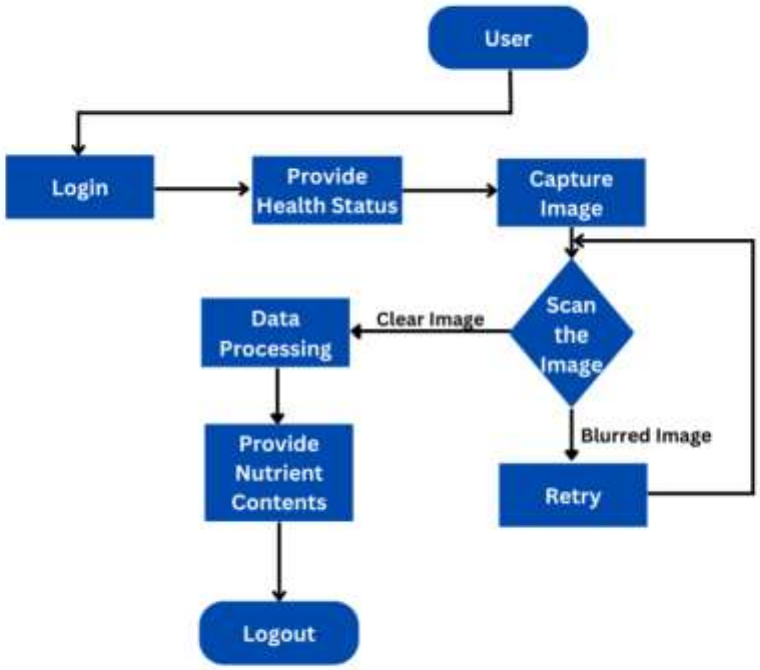
Non-Functional Requirement

NFR. No	Non-Functional Requirement	Description

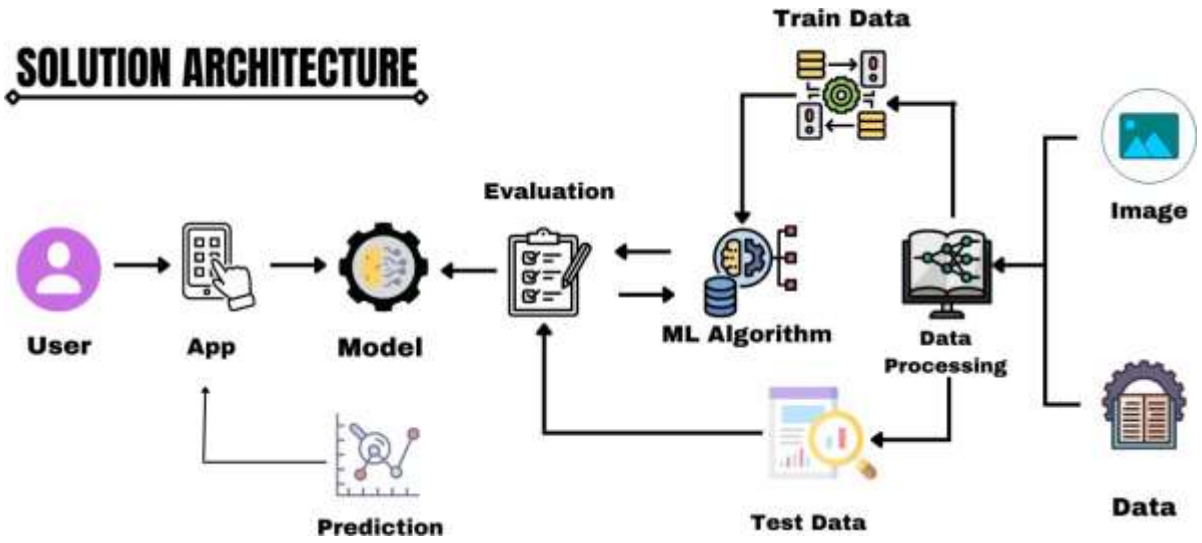
NFR-1	Usability	The system allows the user to perform the tasks easily and efficiently and effectively
NFR-2	Security	Assuring all data inside the system or parts will be protected against malware attacks or unauthorized attacks
NFR-3	Reliability	The website does not recover from failure quickly , it takes time as the application is running in single server
NFR-4	Performance	Response time and Net processing time is fast
NFR-5	Availability	The system will be available up to 95% of the time
NFR-6	Scalability	The website is scalable

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE



5.3 USER STORIES

USER TYPE	FUNCTIONAL REQUIREMENTS	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 Name, Age, Gender, E-mail, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the application.	I can receive confirmation email & click confirm.	High	Sprint-1
	Profile Updating	USN-3	As a user, I have to enter my height, weight and daily activity details	I can update these information on Dashboard.	High	Sprint-1

	Login	USN-4	As a user, I can login to the application by entering Email and password.	I can access my account/ dashboard.	High	Sprint-1
	Dashboard	USN-5	As a user, I can login to the application by entering Email and password.	I can get the nutritional value of that particular meal.	High	Sprint-2
		USN-6	As a user, I can track my daily calorie intake.	I can access my account/ Dashboard	Medium	Sprint-2
Applic ation	Maintain Application	USN-7	Maintaining details for users.	I can access the database.	High	Sprint-3

6. PROJECT PLANNING & SCHEDULING

6.1. SPRINT PLANNING & ESTIMATION

SPRINT	FUNCTIONAL REQUIREMENT	USER STORY N0	USER STORY/TASK	STORY POINTS	PRIORITY	TEAM MEMBERS
1	Registration	USN-1	As a user, I can register for the application by entering name, email/mobile number and a strong password.	2	High	Harini T, Akhila B
1	Login	USN-2	As a user, I can login to the application by entering email/mobile number and password.	2	High	Hemalatha M A, Kaneshka Sre R S
2	Upload images	USN-3	As a user, I can input the fruit images into the application's document	1	Medium	Harini T, Hemalatha M A
2	Prediction	USN-4	As a user, I can predict the image	1	Low	Akhila B
3	Upload the fruit image dataset	USN-5	As a user, I can input the fruit of my choice that I want to know	1	Medium	Harini T, Kaneshka Sre R S

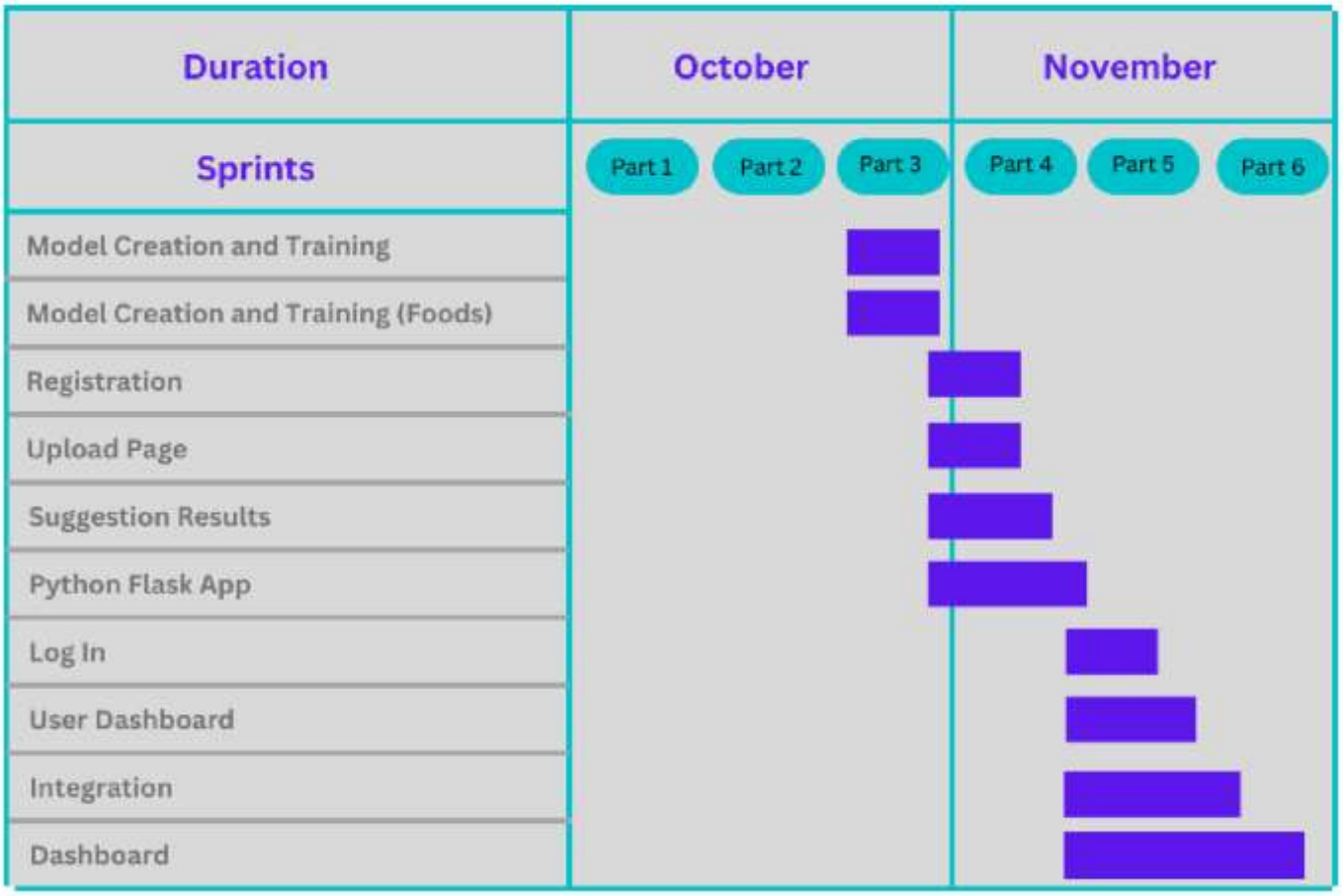
			about			
3	Recognise fruit	USN-6	As a user, I can choose the fruit type	1	Low	Hemalatha M A
4	Recognise fruit type	USN-7	As a user, I can recognize the selected fruit in the output and recognize its benefits.	2	High	Harini T, Akhila B
4	Recognise fruit color	USN-8	As a user, I can recognize the fruit color in the dataset and differentiate it with others.	2	High	Hemalatha M A, Kaneshka Sre R S

6.2 SPRINT DELIVERY SCHEDULE

SPRINT	TOTAL STORY POINTS	DURATION	SPRINT START DATE	SPRINT END DATE	STORY POINTS COMPLETED	SPRINT RELEASE DATE
1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
2	20	6 Days	31 Oct 2022	05 Nov 2022	20	2 Nov 2022
3	20	6 Days	07 Nov 2022	12 Nov 2022	20	8 Nov 2022

4	20	6 Days	14 Nov 2022	19 Nov 2022	20	15 Nov 2022

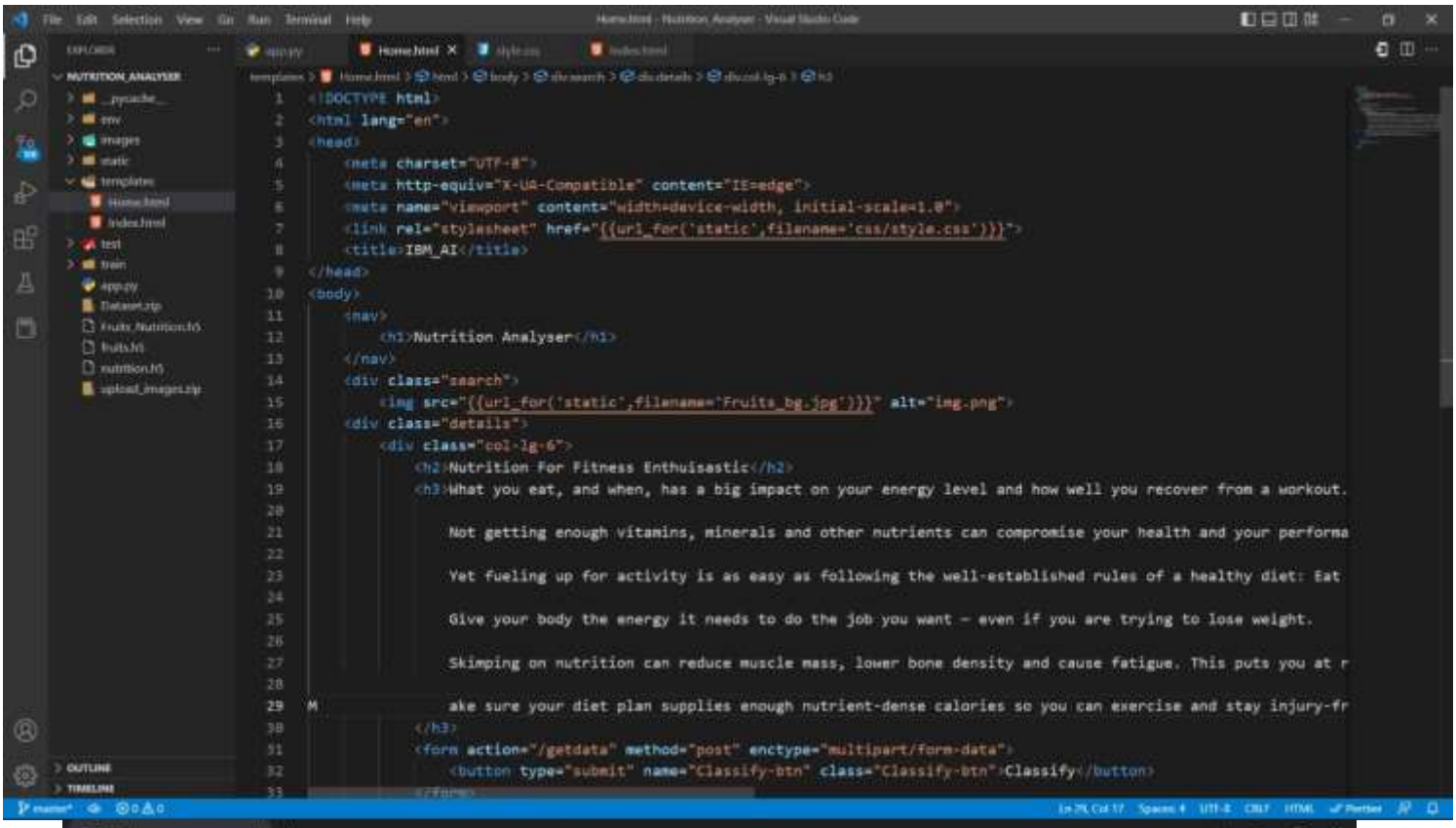
6.3 REPORTS FROM JIRA

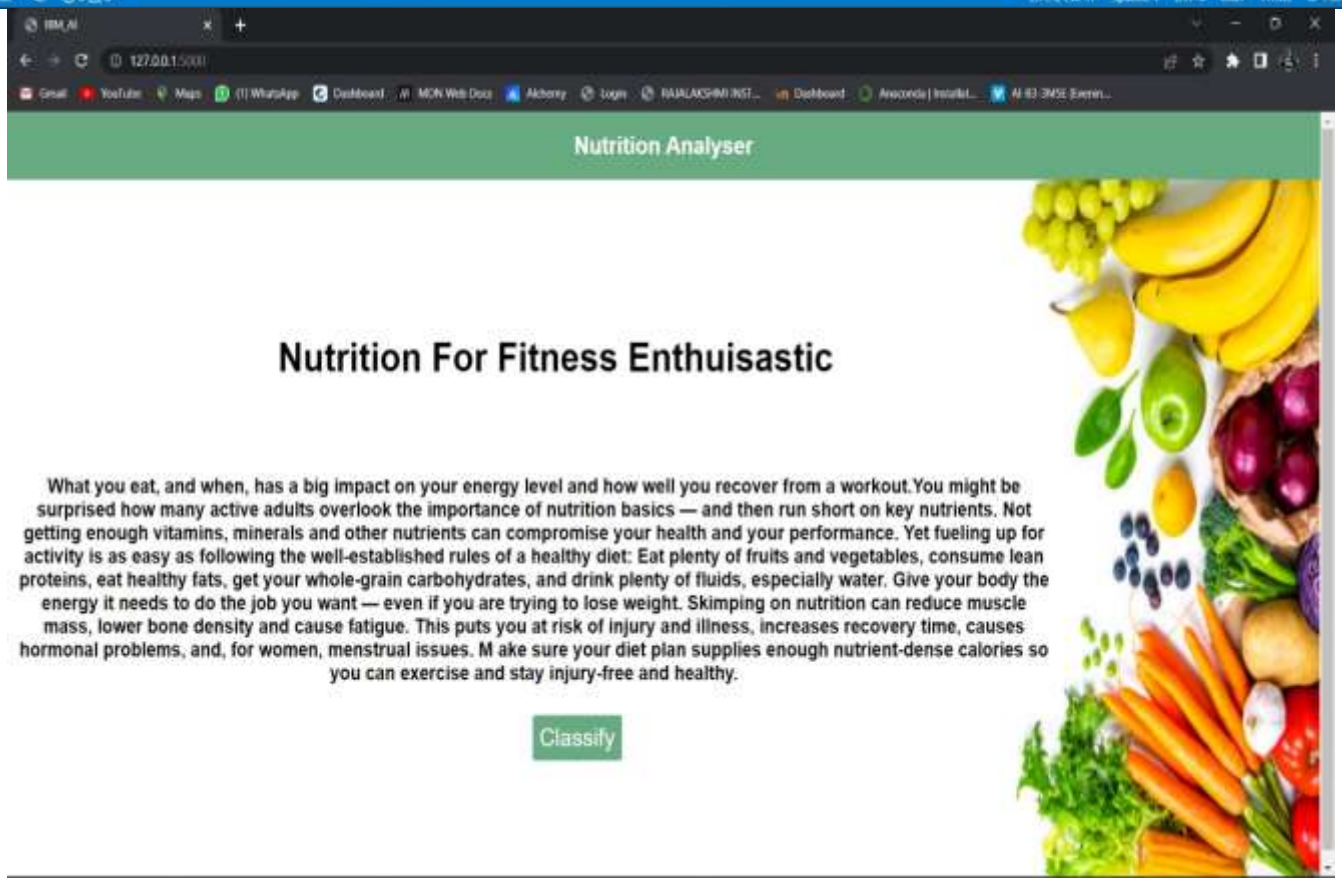


7. CODING & SOLUTIONING

7.1 FEATURE 1

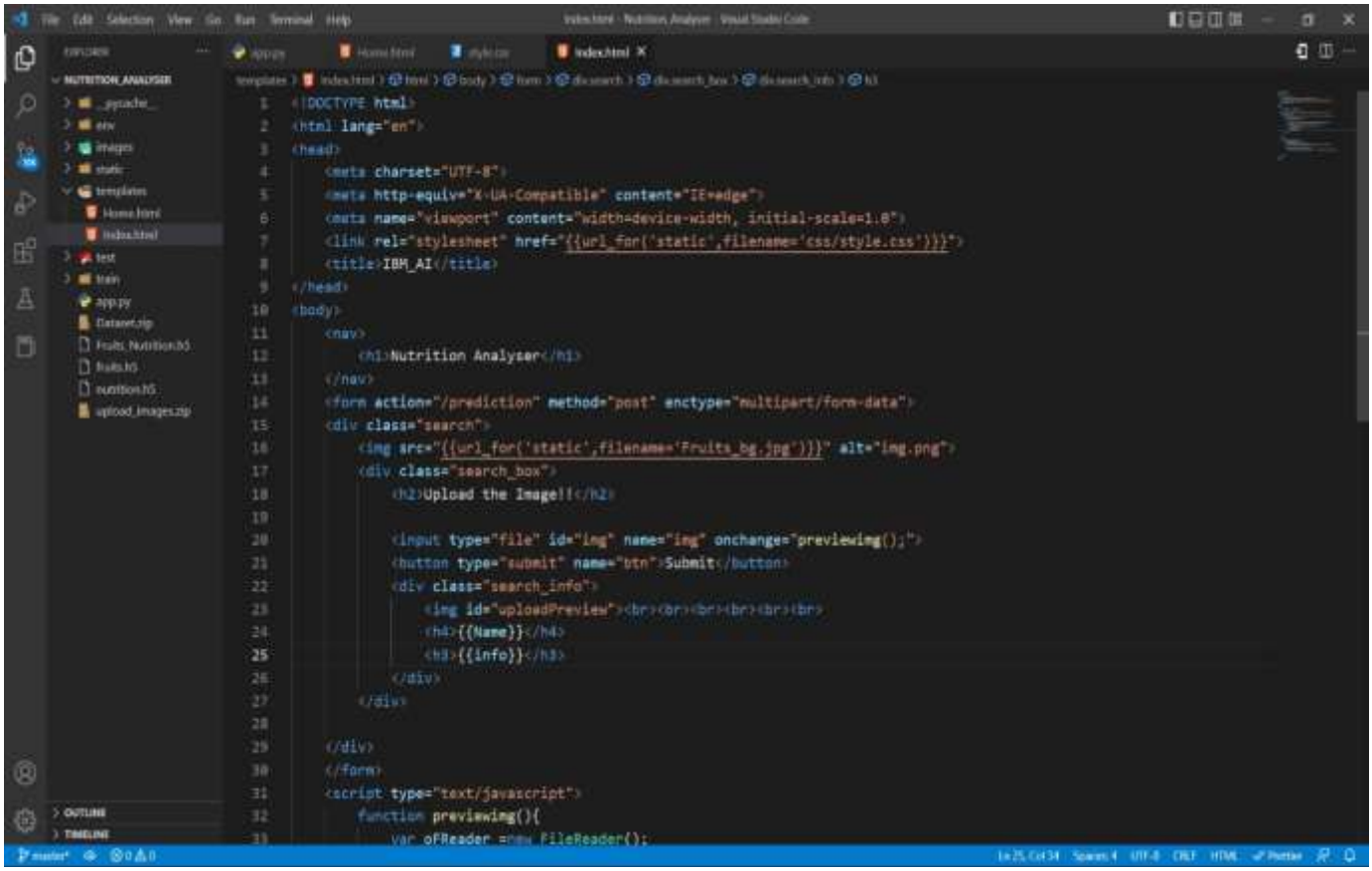
Home.html


Home.html - Nutrition_Analyser - Visual Studio Code
NUTRITION_ANALYSER
templates > Home.html > html > body > div.search > div.details > div.col-lg-6 > h3
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4 <meta charset="UTF-8">
5 <meta http-equiv="X-UA-Compatible" content="IE=edge">
6 <meta name="viewport" content="width=device-width, initial-scale=1.0">
7 <link rel="stylesheet" href="{{url_for('static',filename='css/style.css')}}">
8 <title>IBM_AI</title>
9 </head>
10 <body>
11 <nav>
12 <h1>Nutrition Analyser</h1>
13 </nav>
14
15 <img src="{{url_for('static',filename='Fruits_bg.jpg')}}" alt="img.png">
16
17
18 <h2>Nutrition For Fitness Enthuisastic</h2>
19 <h3>What you eat, and when, has a big impact on your energy level and how well you recover from a workout.
21 Not getting enough vitamins, minerals and other nutrients can compromise your health and your performa
23 Yet fueling up for activity is as easy as following the well-established rules of a healthy diet: Eat
25 Give your body the energy it needs to do the job you want – even if you are trying to lose weight.
27 Skimping on nutrition can reduce muscle mass, lower bone density and cause fatigue. This puts you at r
29 ake sure your diet plan supplies enough nutrient-dense calories so you can exercise and stay injury-fr
30 </h3>
31 <form action="/getdata" method="post" enctype="multipart/form-data">
32 <button type="submit" name="Classify-btn" class="Classify-btn">Classify</button>
OUTLINE
TIMELINE


IBM_AI
127.0.0.1:5000
Nutrition Analyser
Nutrition For Fitness Enthuisastic
What you eat, and when, has a big impact on your energy level and how well you recover from a workout.You might be surprised how many active adults overlook the importance of nutrition basics — and then run short on key nutrients. Not getting enough vitamins, minerals and other nutrients can compromise your health and your performance. Yet fueling up for activity is as easy as following the well-established rules of a healthy diet: Eat plenty of fruits and vegetables, consume lean proteins, eat healthy fats, get your whole-grain carbohydrates, and drink plenty of fluids, especially water. Give your body the energy it needs to do the job you want — even if you are trying to lose weight. Skimping on nutrition can reduce muscle mass, lower bone density and cause fatigue. This puts you at risk of injury and illness, increases recovery time, causes hormonal problems, and, for women, menstrual issues. M ake sure your diet plan supplies enough nutrient-dense calories so you can exercise and stay injury-free and healthy.
Classify

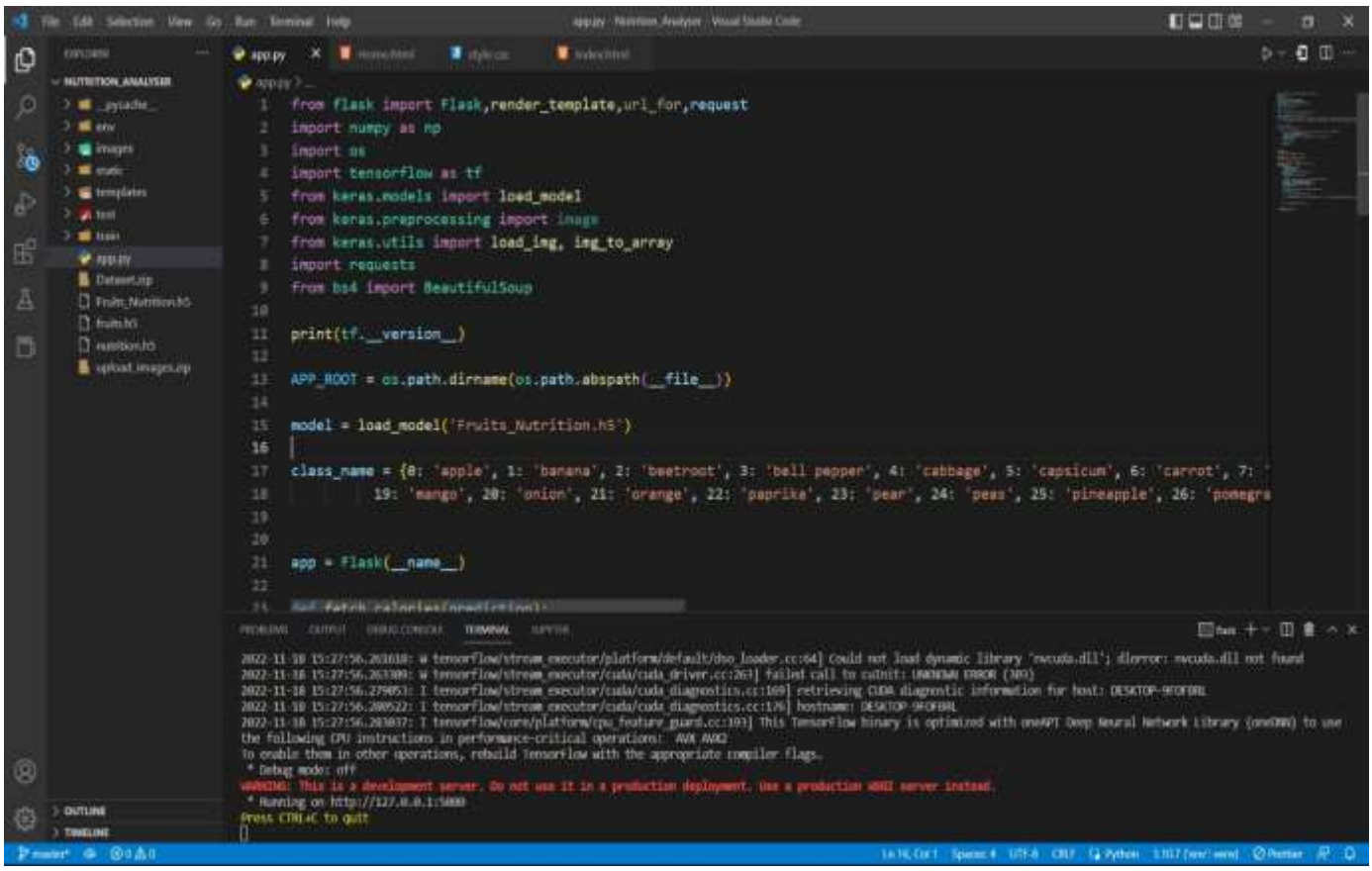
Feature 2

Index.html



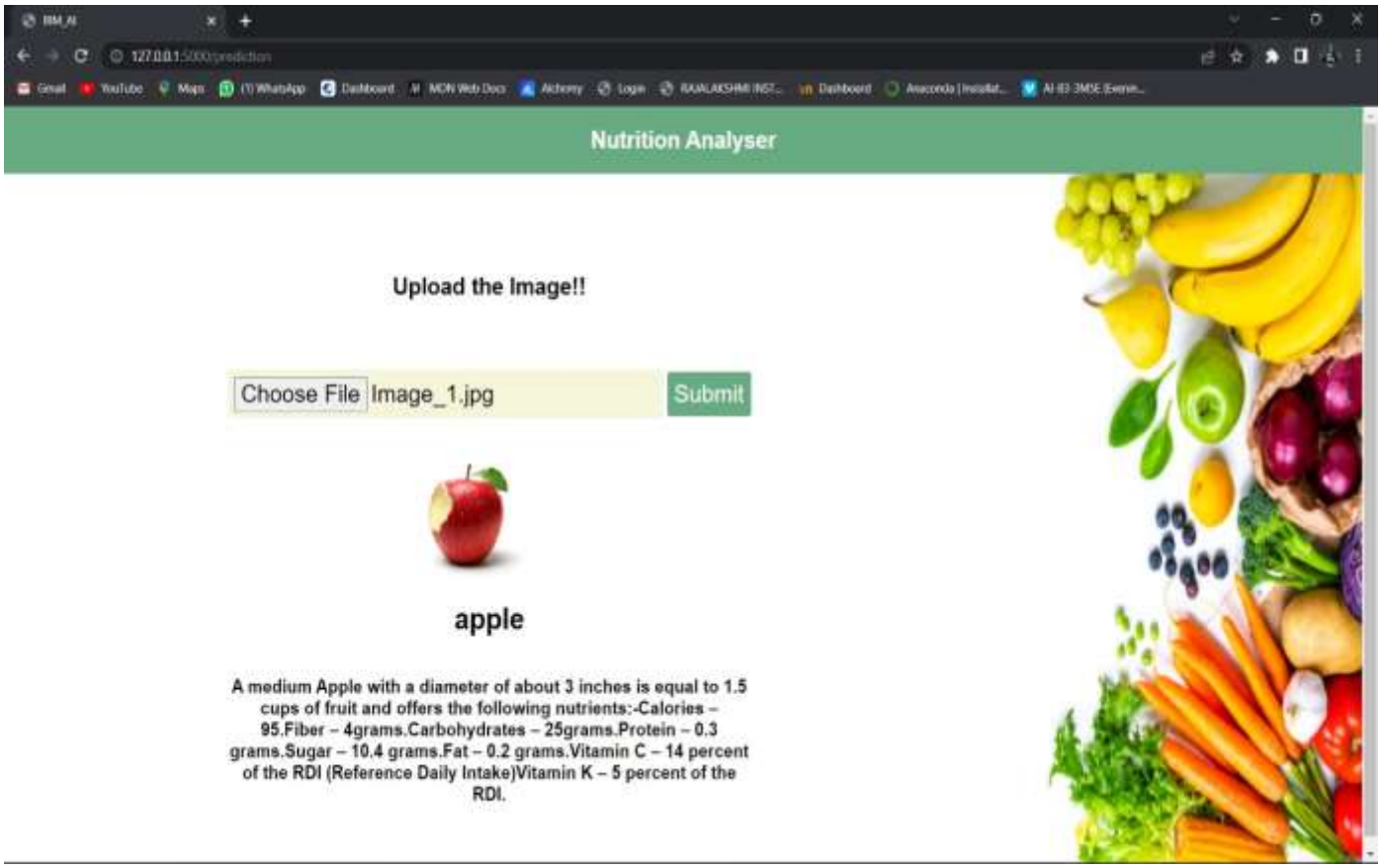
```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <link rel="stylesheet" href="{{url_for('static',filename='css/style.css')}}">
    <title>IBM_AI</title>
</head>
<body>
    <nav>
        <h1>Nutrition Analyser</h1>
    </nav>
    <form action="/prediction" method="post" enctype="multipart/form-data">
    <div class="search">
        <img src="{{url_for('static',filename='Fruits_bg.jpg')}}" alt="img.png">
        <div class="search_box">
            <h2>Upload the Image!!</h2>

            <input type="file" id="img" name="img" onchange="previewimg();">
            <button type="submit" name="btn">Submit</button>
            <div class="search_info">
                <img id="uploadPreview"><br><br><br><br><br><br>
                <h4>{{Name}}</h4>
                <h3>{{info}}</h3>
            </div>
        </div>

    </div>
    </form>
    <script type="text/javascript">
        function previewimg(){
            var oFReader =new FileReader();
```

App.py



```
from flask import Flask,render_template,url_for,request
import numpy as np
import os
import tensorflow as tf
from keras.models import load_model
from keras.preprocessing import image
from keras.utils import load_img, img_to_array
import requests
from bs4 import BeautifulSoup

print(tf.__version__)

APP_ROOT = os.path.dirname(os.path.abspath(__file__))

model = load_model('Fruits_Nutrition.h5')

class_name = {0: 'apple', 1: 'banana', 2: 'beetroot', 3: 'bell pepper', 4: 'cabbage', 5: 'capsicum', 6: 'carrot', 7:
         19: 'mango', 20: 'onion', 21: 'orange', 22: 'paprika', 23: 'pear', 24: 'peas', 25: 'pineapple', 26: 'pomegra


app = Flask(__name__)
```

```
2022-11-10 15:27:56.261618: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlerror: nvcuda.dll not found
2022-11-10 15:27:56.261780: W tensorflow/stream_executor/cuda/cuda_driver.cc:263] failed call to cuInit: UNKNOWN ERROR (303)
2022-11-10 15:27:56.279053: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: DESKTOP-9EOFBBL
2022-11-10 15:27:56.280522: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: DESKTOP-9EOFBBL
2022-11-10 15:27:56.283037: I tensorflow/core/platform/cpu_feature_guard.cc:193] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use
the following CPU instructions in performance-critical operations:  AVX AVX2
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
```



Data Collection

Drive Link : https://drive.google.com/drive/folders/1Fs-MwaF5qmHZi6xn_IHNMLiuBYuWVn0

Download the dataset using the above given link

Unzipping the dataset

!unzip '/content/Dataset.zip'

inflating: Dataset/TRAIN_SET/PINEAPPLE/33_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/34_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/35_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/36_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/37_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/38_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/39_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/40_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/41_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/42_100.jpg

inflating: Dataset/TRAIN_SET/PINEAPPLE/43_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/44_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/45_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/46_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/47_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/48_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/49_100.jpg
inflating: Dataset/TRAIN_SET/PINEAPPLE/4_100.jpg

Image ProProcessing

Importing the ImageDataGenerator Library

```
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
from keras.preprocessing.image import ImageDataGenerator
```

Config ImageDataGenerator Class

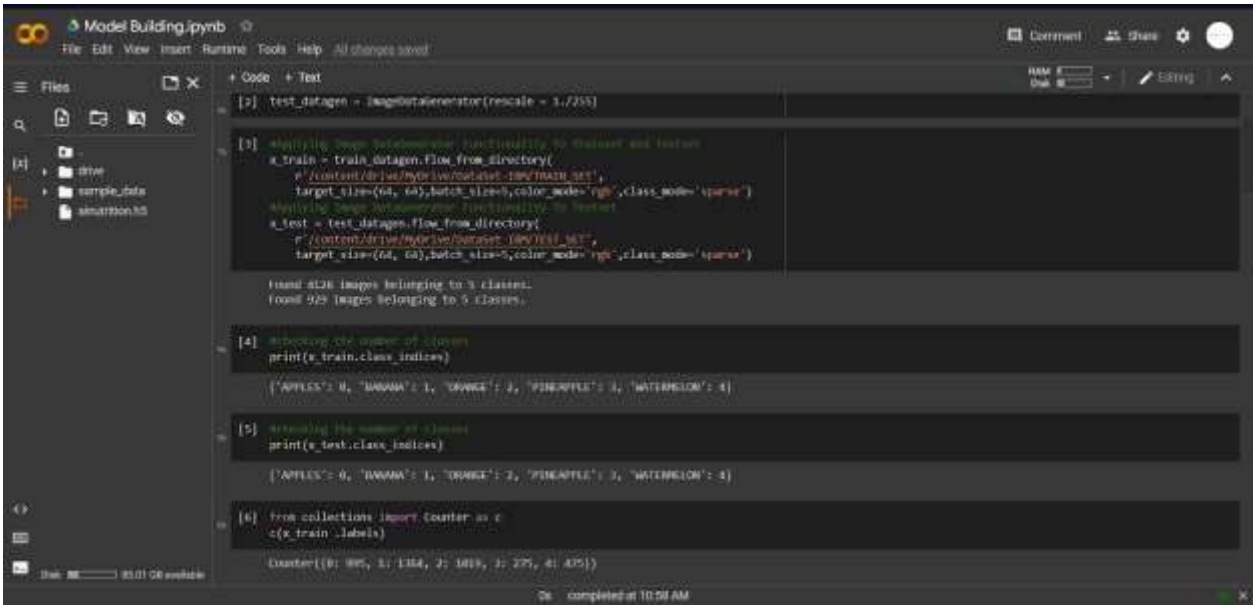
```
train_datagen = ImageDataGenerator(rescale = 1./255,shear_range=0.2, zoom_range=0.2,
horizontal_flip= True)
test_datagen = ImageDataGenerator(rescale = 1./255)
```

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/drive/MyDrive/DataSet-
IBM/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/drive/MyDrive/DataSet-
IBM/TEST_SET', target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

```
Found 4128 images belonging to 5 classes.
Found 929 images belonging to 5 classes.
```

Image PreProcessing



Model Creation

Importing 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
from keras.preprocessing.image import ImageDataGenerator
```

Initializing the Model

```
model = Sequential()
```

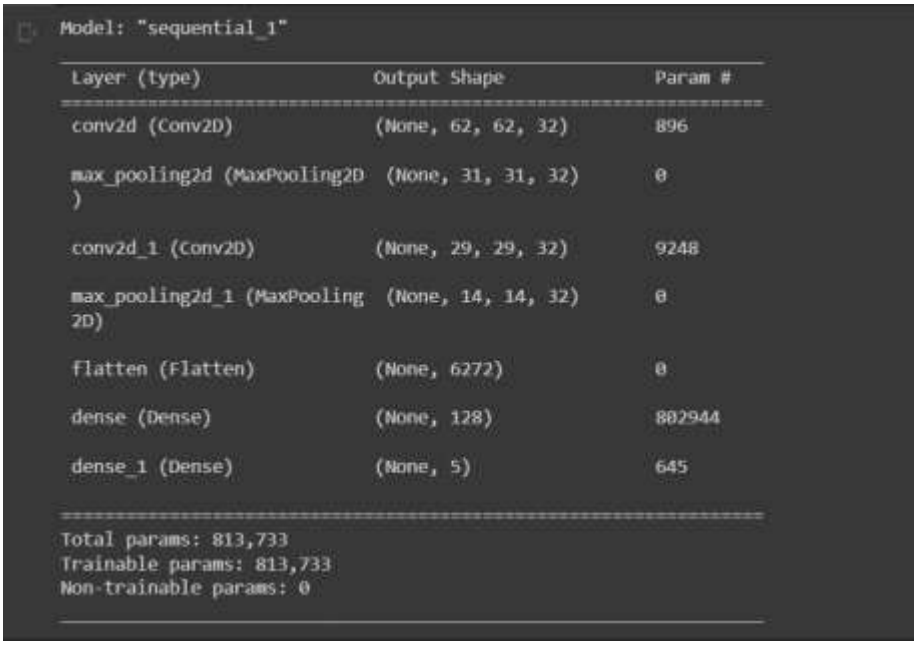
Adding CNN Layers

```
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())

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

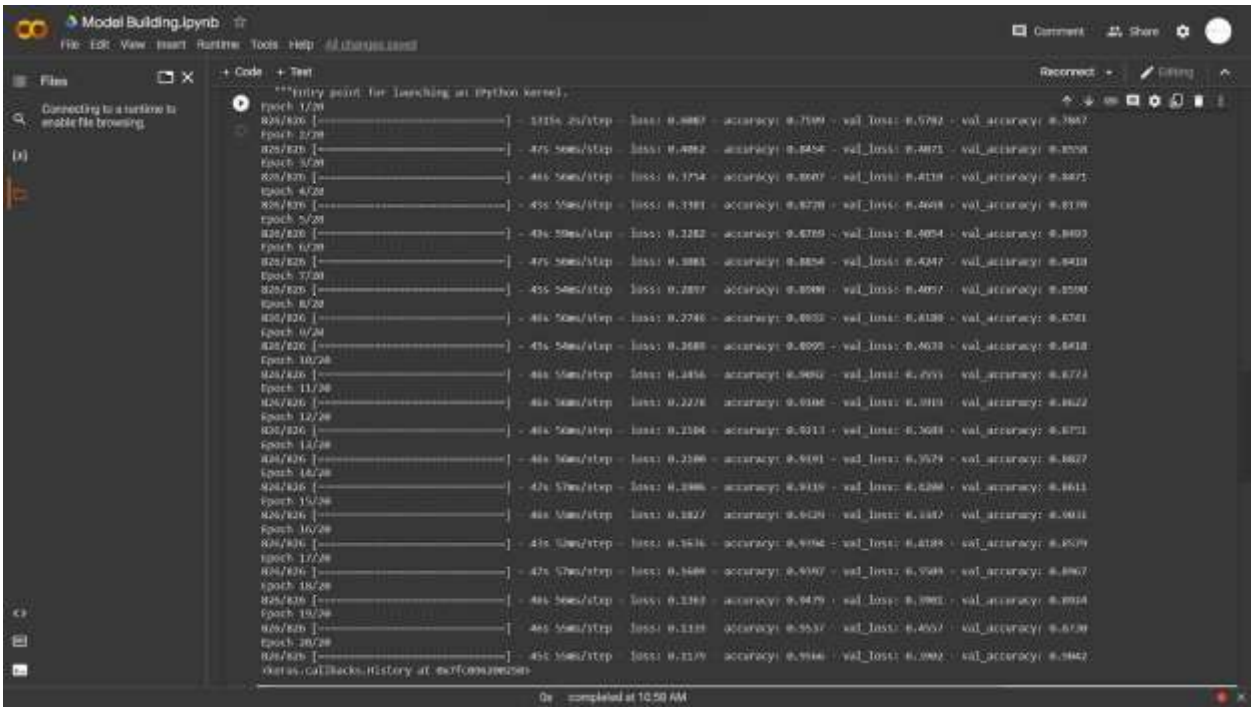
classifier.summary()



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

max_pooling2d (MaxPooling2D  (None, 31, 31, 32)        0
)

conv2d_1 (Conv2D)            (None, 29, 29, 32)        9248

max_pooling2d_1 (MaxPooling  (None, 14, 14, 32)        0
2D)

flatten (Flatten)            (None, 6272)              0

dense (Dense)                (None, 128)               802944

dense_1 (Dense)              (None, 5)                 645

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

Configure the Learning Process
# Compiling the CNN
# categorical_crossentropy for more than 2
classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])

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



Save the Model

classifier.save('ainutrition.h5')

8. TESTING

8.1 TEST CASES & USER ACCEPTANCE TESTING

Test the Model

#Predict the results
from tensorflow.keras.models import load_model
from keras.preprocessing import image
from keras_preprocessing.image import load_img
model = load_model("ainutrition.h5")

from tensorflow.keras.utils import img_to_array
#loading of the image
img = load_img(r'/content/drive/MyDrive/DataSet-IBM/TEST_SET/ORANGE/n07749192_1251.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 107ms/step
array([2])
```

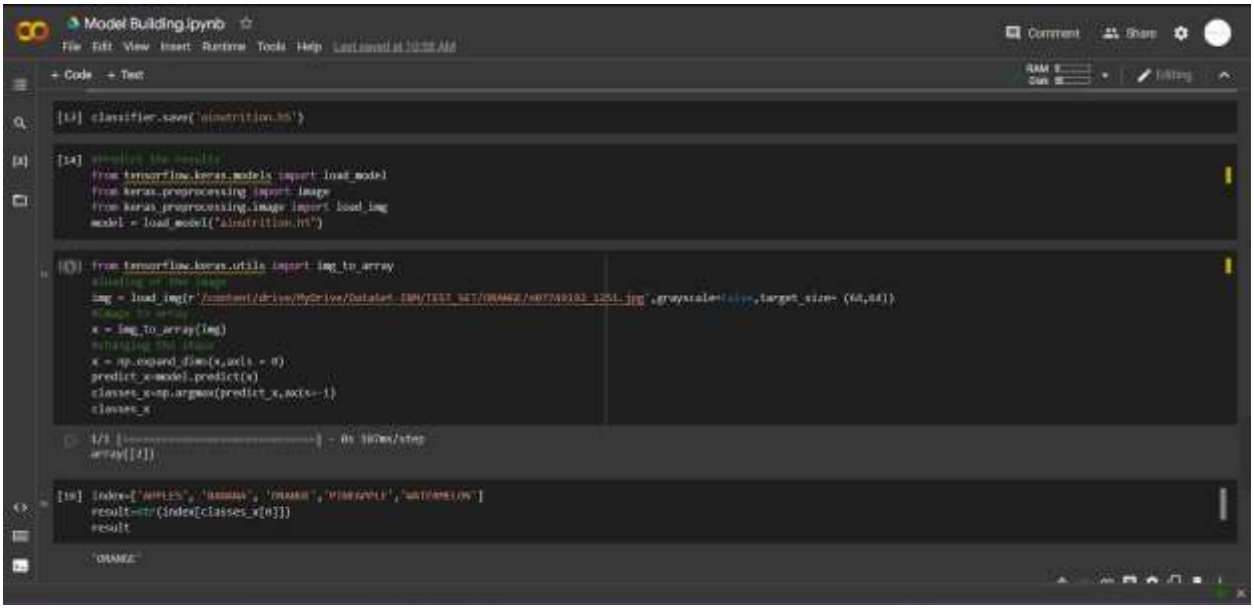
```
index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
result=str(index[classes_x[0]])
result
```

```
'ORANGE'
```

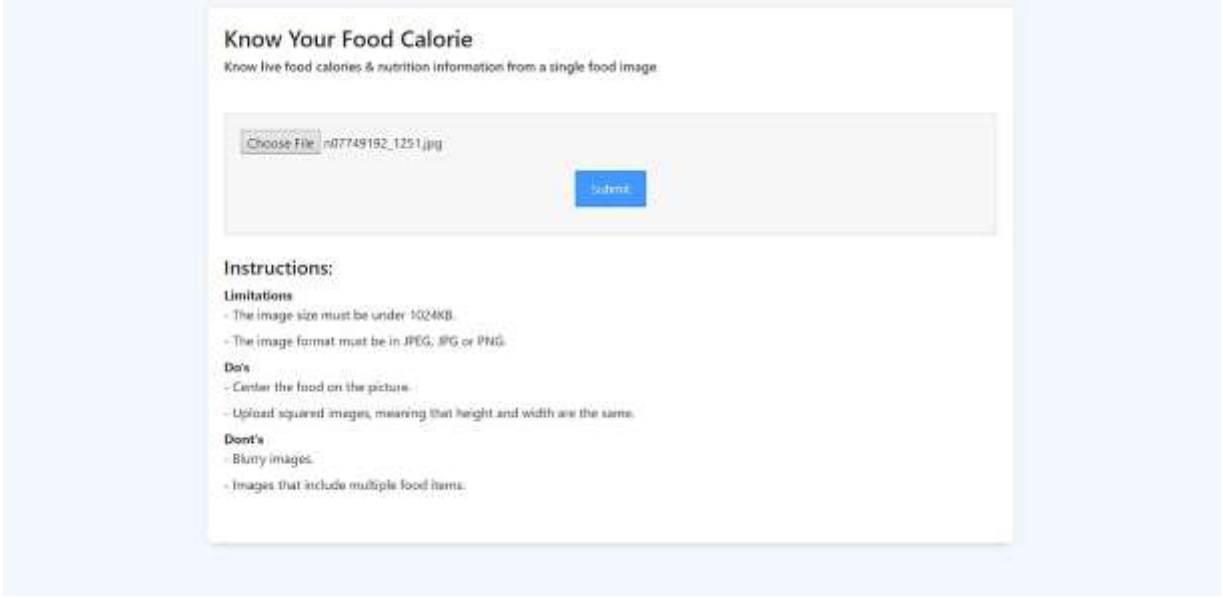
```
print(result)
if result == 'APPLES':
  print("One serving, or one medium apple, provides about 95 calories, 0 gram fat, 1 gram protein, 25 grams carbohydrate, 19 grams sugar (naturally occurring), and 3 grams fiber.")
elif result == 'BANANA':
  print("One serving, or one medium ripe banana, provides about 110 calories, 0 gram fat, 1 gram protein, 28 grams carbohydrate, 15 grams sugar (naturally occurring), 3 grams fiber, and 450 mg potassium.")
elif result == 'ORANGE':
  print("60 calories, No fat or sodium, 3 grams of fiber, 12 grams of sugar, 1 gram of protein, 14 micrograms of vitamin A, 70 milligrams of vitamin C, 6% of your daily recommended amount of calcium.")
elif result == 'PINEAPPLE':
  print("Calories: 83, Fat: 1.7 grams, Protein: 1 gram, Carbs: 21.6 grams, Fiber: 2.3 grams, Vitamin C: 88% of the Daily Value (DV), Manganese: 109% of the DV, Vitamin B6: 11% of the DV.")
elif result == 'WATERMELON':
```

print("Calories: 46, Carbs: 11.5 grams, Fiber: 0.6 grams, Sugar: 9.4 grams, Protein: 0.9 grams, Fat: 0.2 grams, Vitamin A: 5% of the Daily Value (DV), Vitamin C: 14% of the DV.")

Model Building



Webpage



9. RESULTS

9.1 PERFORMANCE METRICS

```
loss: 0.2104 - accuracy: 0.9213 - val_loss: 0.3689 - val_accuracy: 0.8751

loss: 0.2100 - accuracy: 0.9191 - val_loss: 0.3579 - val_accuracy: 0.8827

loss: 0.1906 - accuracy: 0.9319 - val_loss: 0.4280 - val_accuracy: 0.8611

loss: 0.1827 - accuracy: 0.9329 - val_loss: 0.3347 - val_accuracy: 0.9031

loss: 0.1636 - accuracy: 0.9394 - val_loss: 0.4189 - val_accuracy: 0.8579

loss: 0.1609 - accuracy: 0.9397 - val_loss: 0.3509 - val_accuracy: 0.8967

loss: 0.1363 - accuracy: 0.9479 - val_loss: 0.3901 - val_accuracy: 0.8924

loss: 0.1339 - accuracy: 0.9537 - val_loss: 0.4557 - val_accuracy: 0.8730

loss: 0.1179 - accuracy: 0.9566 - val_loss: 0.3902 - val_accuracy: 0.9042
```

10. ADVANTAGES & DISADVANTAGES

Advantages :

- Easily detect and Estimate the food nutrition
- Most Accurate
- Flexible Model which can give maximized outcome
- No Specific Requirements needed to implement the model

Disadvantages :

- Training model is a time consuming process.
- Change in uploading image size or format will throw error

11. CONCLUSION

Thus we have constructed a model that can identify the fruit variety and it can analyze its nutrition by advanced AI techniques and CNN Algorithm, then the Prediction model is checked. Then the entire model is deployed to the IBM Cloud account that we have created with the studies we have done.

12. FUTURE SCOPE

- It can be developed as a Web or Android Application.
- In future Alternate Advanced technologies can be Implemented.
- The Identification and tracking system can be implemented if possible

13. APPENDIX

Source Code:

Github : https://github.com/IBM-EPBL/IBM-Project-22580-1659854181