

PROJECT REPORT

AI-POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

Submitted by

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CHAPTER-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 maintain a healthy diet. Nutritional analysis is the process of determining the nutritional content of food. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

1.2 PURPOSE

The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyses the image and detects the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).

CHAPTER-2

LITERATURE SURVEY

2.1 EXISTING PROBLEM

Neutrino delivers nutrition-based data services and analytics to its users and wants to turn into a leading source of the nutrition-related platform. The platform employs NLP and mathematical models from the optimization theory as well as predictive analysis to enable individualized data compilation.

The application relies on Artificial Intelligence to produce custom data related to smart calorie counter powered by AI. Their artificial intelligence learns an individual's tastes, preferences, and body type. All of this is packaged in a comprehensive nutrition and activity tracker.

2.2 REFERENCES

<https://www.nutrinohealth.com/>

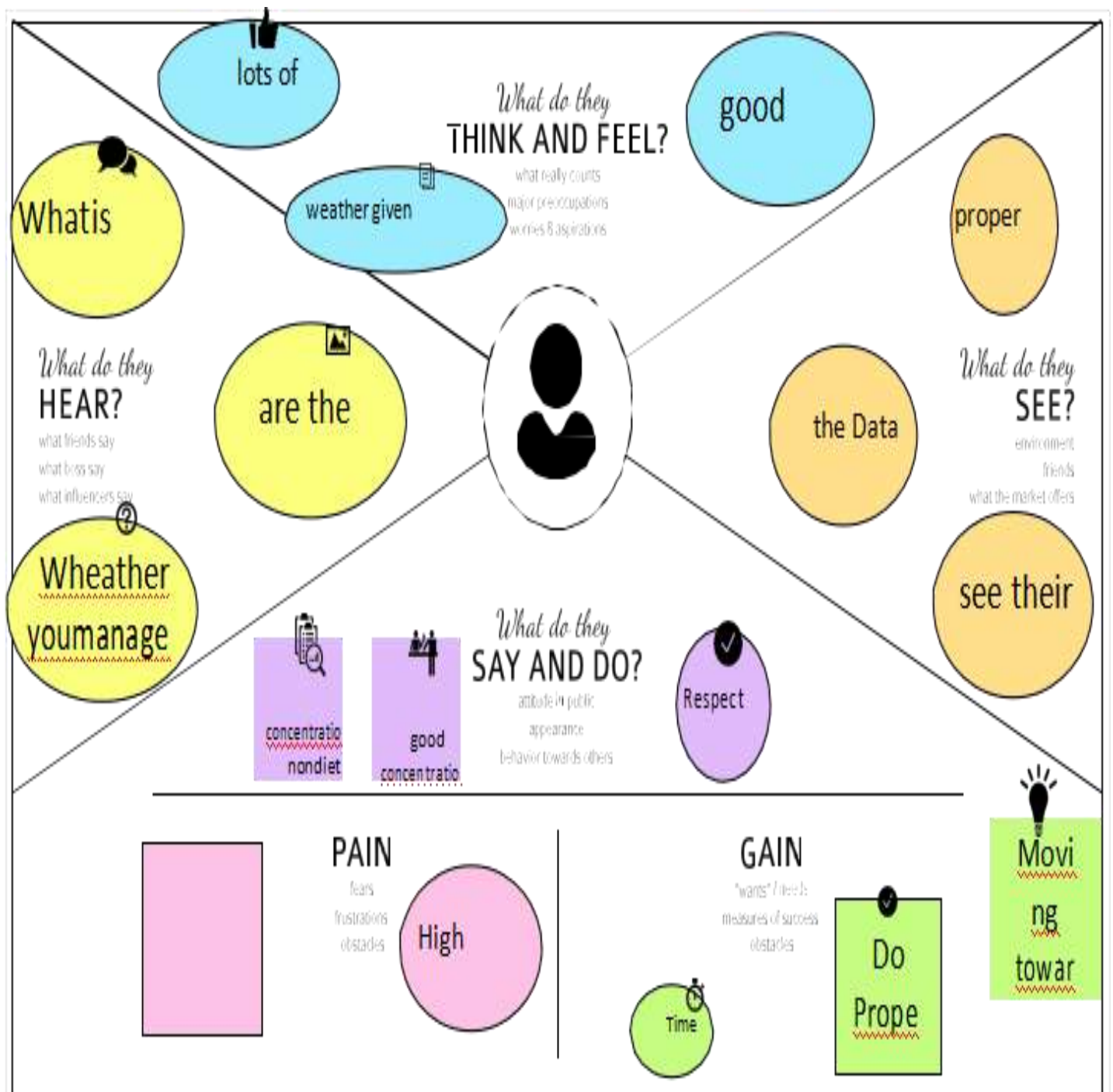
2.3 PROBLEM STATEMENT DEFINITION

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 to the trained model. The model analyses the image and detects the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.).

CHAPTER-3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING

M.SURESH KUMAR



A.JLAYARAJA



M.VASANTHI



S.SAVITHA



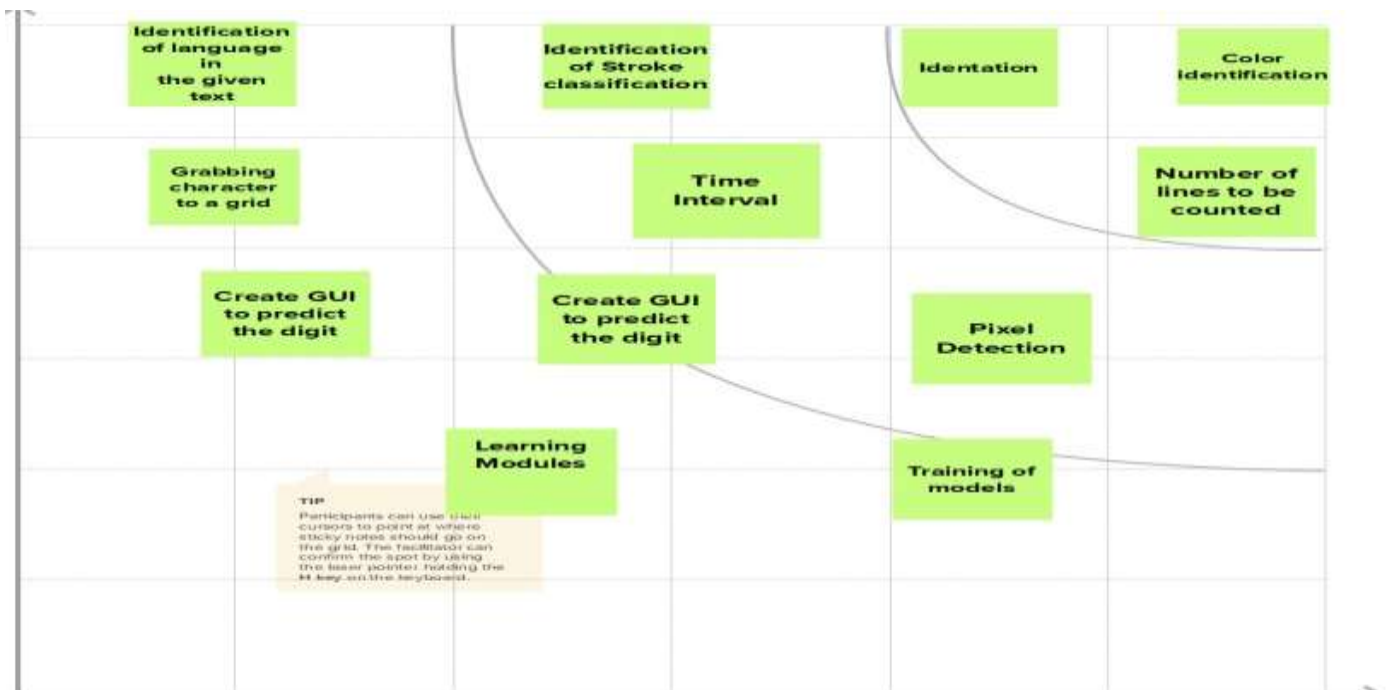
IDENTIFICATION



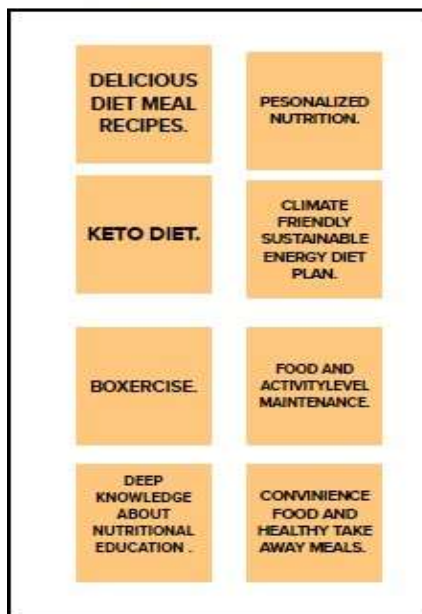
TIP

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





NUTRITIONAL



WORKOUT



PROGRAMS



3.3 PROPOSED SOLUTION

S.NO	PARAMETERS	SOLUTIONS
1.	Problem Statement	<ul style="list-style-type: none"> • Main objective is to detect the nutrition in a fruit from camera captured image. • The identification of nutrition and calories from a image is quite an interesting field. • Since nutrition monitoring plays an important role in leading healthy lifestyle, this product has the potential to become an essential in our day to day life.
2.	Idea / Solution description	<ul style="list-style-type: none"> • The solution is to develop AI-powered nutrition analyzer application. • By giving the image of the fruit as the input to the application, it will display the nutrition content in it. • By training the model with various inputs, image processing can be improved as well as the accuracy of the result.
3.	Novelty / Uniqueness	<ul style="list-style-type: none"> • Personalized nutrition for individuals. • Providing science based guidance for healthy living. • Balanced food diet and measured intake. • 24/7 support. • Serving size.
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> • Economically stable product. • Change one's view towards health and fitness. • Quality of service. • High fiber food. • Accurate amount of nutrition.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> • User friendly interface which improves the constant use of the product. • Hence, Economical growth improves. • Product will be delivered in pocket size which results in consuming low memory. • Nutrition and fitness related ads to earn profit
6.	Scalability of the Solution	<ul style="list-style-type: none"> • Offers ingredients substance detail in food • Suggest best health solution and meal plans for different criteria proposed by different individuals. • Virtualization of your long term plan to provide motivation to the customer.

3.4 PROBLEM SOLUTION FIT

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns

Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behavior fit and building trust by solving frequent annoyances, or urgent or costly problems.

CHAPTER-4

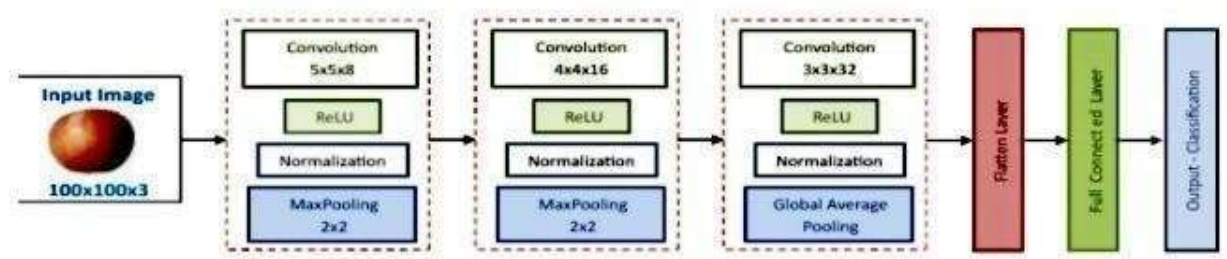
REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

- It will generate the diet plan as well as monitor the user's health to classify the category of the disease and to create the diet plan. It will also reduce the cost of consulting the person nutritionist.
- The task of food detection/classification is not easy as it seems. All possible options related to the given Image.
- Image classification, object detection, segmentation, face recognition.
- Classification of crystal structure using a convolutional neural network
- Nutrition is vital to the growth of the human body. Nutritional analysis guarantees that the meal meets the appropriate vitamin and mineral requirements, and the examination of nutrition in food aids in understanding the fat proportion, carbohydrate dilution, proteins, fiber, sugar, and so on. Another thing to keep in mind is not to exceed our daily calorie requirements
- Computer-Assisted Nutritional Recognize Food Images – In order to solve this issue, a brand-new Convolutional Neural Network (CNN)- based food picture identification system was created, as described in this study. We utilized our suggested strategy on two sets of actual food picture data.
- 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.)

- The Ultimate Workout at Home Solution This fitness AI software is designed with personalized training regimens for each individual. It began as “gym only software,” but has now improved its system to satisfy “at home fitness” expectations.
- You take a picture, dial in data such as whether you are eating breakfast or lunch and add a quick text label, and the app estimates the calorie content.
- This software collaborated with IBM’s natural language capability to provide 24-hour assistance and dietary recommendations.

For Example:



- 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.
- A generic model for the dietary protein requirement (as with any nutrient) defines the requirement in terms of the needs of the organism,
- i.e. metabolic demands, and the dietary amount which will satisfy those needs, i.e. efficiency of utilization, thus: dietary requirement = metabolic demand/efficiency of utilization.

FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Users can create an account to use the application. This can be done by creating a persona on the application with a username and password or by making use of an existing email ID.
FR-2	User Confirmation	Once a user registers onto the application, they receive a confirmation to their email id which they provide for registration. OTP authentication is integrated to ensure identity theft does not occur.
FR-3	Calorie Calendar Creation	On creation of a user profile, a calendar is generated in association with the account. This calendar is private to the user and keeps track of the calories consumed in a day and related statistics.
FR-4	Image Capturing and Processing	The application allows users to capture images of the ingredients they consume. These are given to the model for 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	Calorie Value Computation	Once the labels of the ingredients and their quantity have been found, the net calorie value of the meal is calculated by summing up the calories of each ingredient in their respective amounts. The calorie values are fetched from the internet while that of frequently used items are fetched from a database.
FR-6	Storage of Data	Data about the user and their log in details are stored in a backend database. Apart from these, calorific information of frequently consumed ingredients are also stored to minimize overhead and complexity.
FR-7	Calorie Over-Consumption Notification	When a user exceeds their permissible calorie consumption amount for the day, the application issues a notification for the same. The application then suggests low-calorie diets to ensure minimum over-consumption.

4.2 NON-FUNCTIONAL REQUIREMENTS

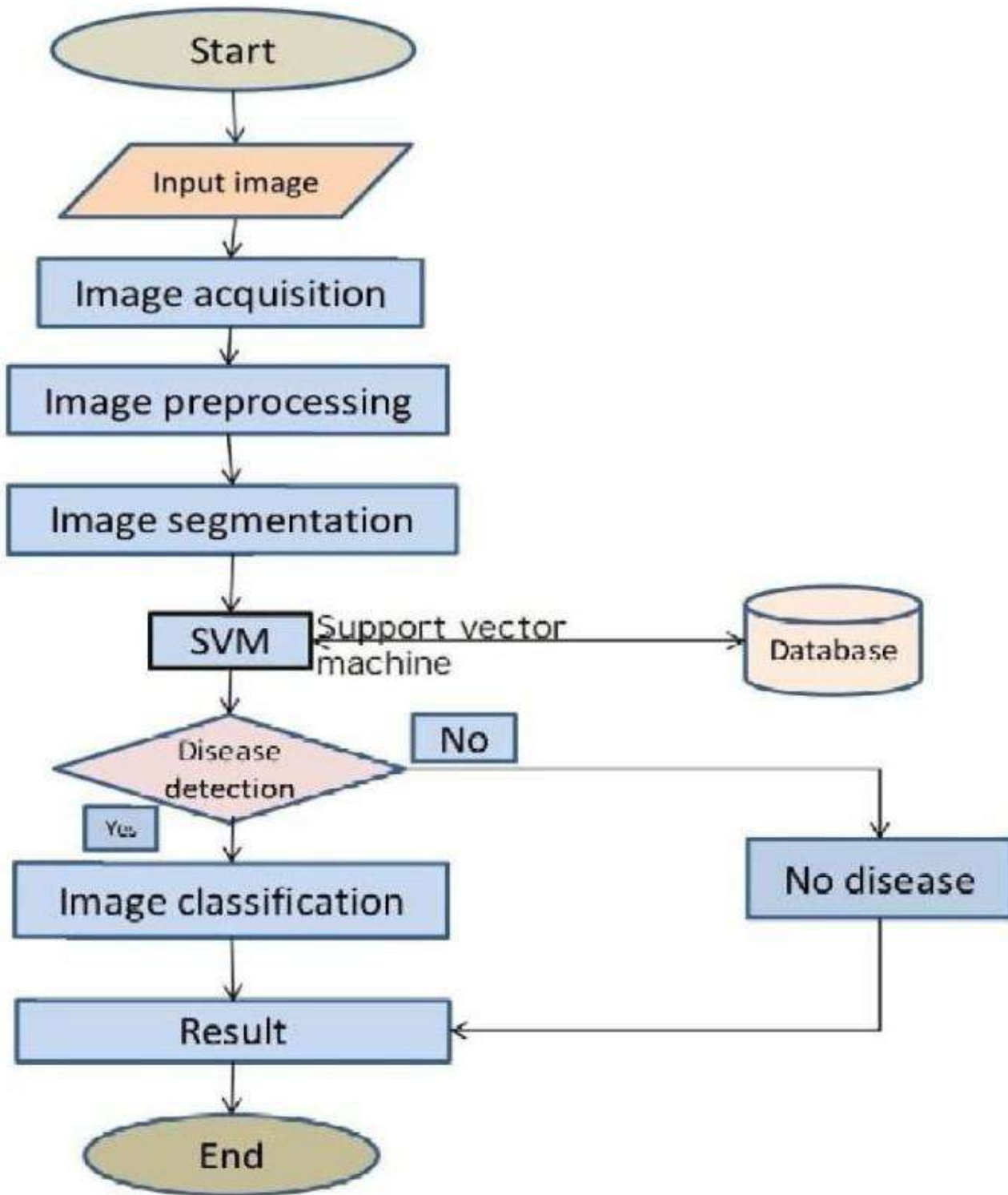
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The users should be able to use the application without any difficulties. The interface should be easy to use and understand. The image capture process should be smooth and not tedious.
NFR-2	Security	Details of the users and their personal 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.

CHAPTER-5

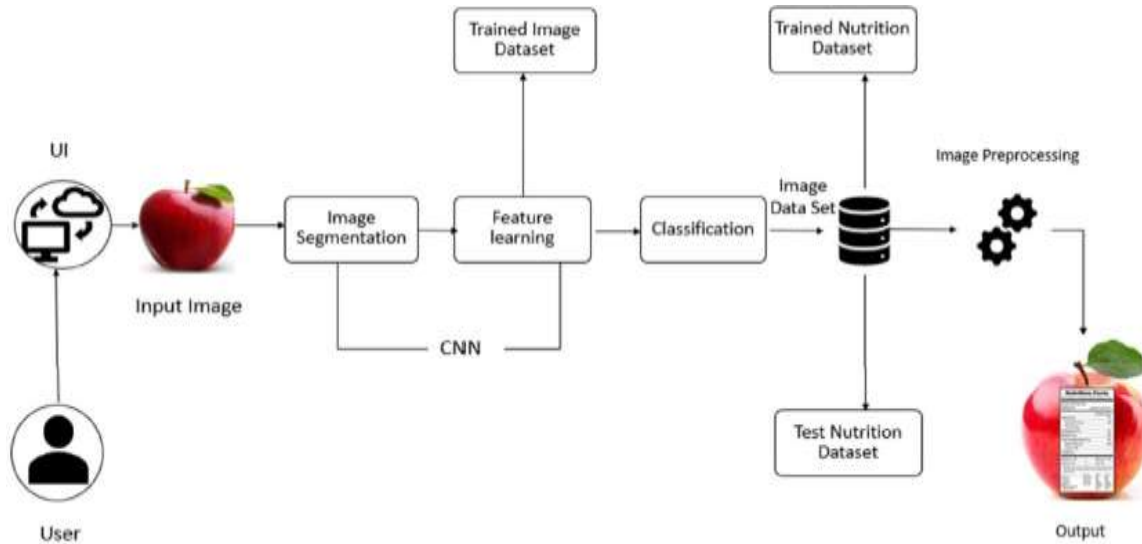
PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

2



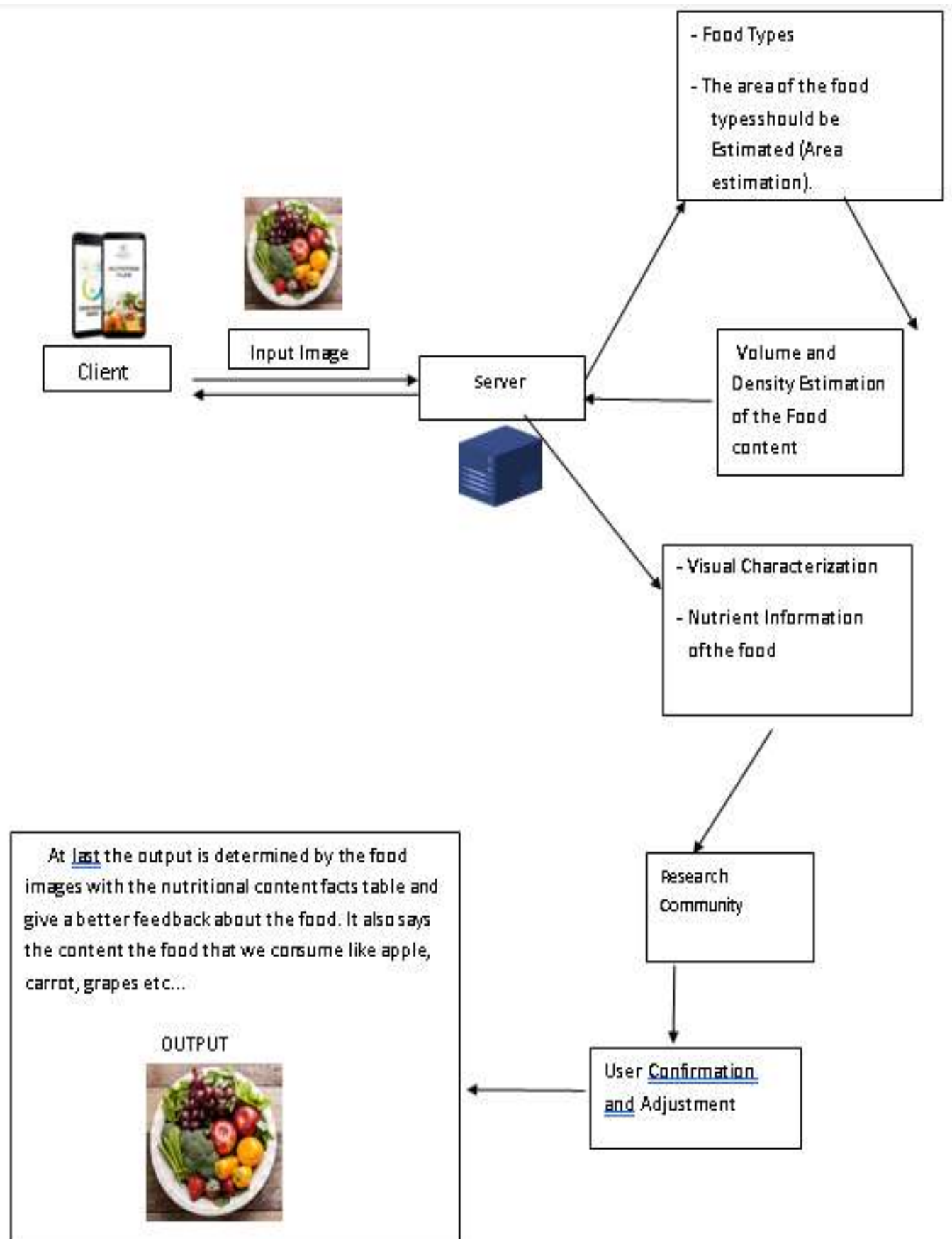
5.2 SOLUTION & TECHNICAL ARCHITECTURE



S.No	Component	Description	Technology
1.	App	User interacts with application for the prediction of Nutrition	Python, Java, HTML, SQLite, Android studio
2.	Database	Data Type, Configurations and data will be stored	MySQL, JS
3.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
4.	File Storage	File storage requirements	Cloud -- > drive
5.	Machine Learning Model	Purpose of Machine Learning Model	ANN, CNN, RNN
6.	Notification	Notification will be sent from the server	Send Grid

Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source frameworks used	SendGrid, Python, JQuery
2.	Security Implementations	Request authentication using encryption	Encryptions, SSL certs
3.	Scalable Architecture	The scalability of architecture consists of 3 tiers	Web Server – HTML, CSS ,Javascript Application Server – Python Flask Database Server – IBM Cloud
4.	Availability	Availability is increased by loads balancers in cloud VPS	IBM Cloud hosting
5.	Performance	The application is expected to handle up to 4000 predications per second	IBM Load Balance



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
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-5	As a user, I can Access my Dashboard		Medium	Sprint - 1
Customer (Webuser)	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 Care Executive	Solution	USN-5	Responding to each email you receive can make a lasting impression on customers.	Offer a solution for how your company can improve the customer experience	High	Sprint-1
Administrator	Manage	USN-5	Do-it yourself service for delivery Everything	Set of predefined requirements that must be met to mark a user story complete	High	Sprint-1

CHAPTER-6

6.1 SPRINT PLANNING & ESTIMATION

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Dataset - Collecting images of food items apples , banana, orange, pineapple, watermelon for analysis	5	High	Sureshkumkar.M
Sprint-1	Image Preprocessing	USN-2	Image data augmentation - Increasing the amount of data by generating new data points from existing data	5	medium	Ilayaraja.A
Sprint-1		USN-3	Image Data Generator Class - Used for getting the input of the original data	5	medium	Vasanthi.M
Sprint-1		USN-4	Applying image data generator functionality to train set and test set	5	Medium	Savitha.S
Sprint-2	Modeling Phase	USN-5	Defining the model architecture - Building the model using deep learning approach and adding CNN layers	4	High	Sureshkumkar.M
Sprint-2		USN-6	Training , saving, testing and predicting the model	4	High	Ilayaraja.A
Sprint-2		USN-7	Database creation for the input classes	4	High	Vasanthi.M

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Development phase	USN-8	User database creation - It contains the details of users	3	Medium	Savitha.S
Sprint-2		USN-9	Home page creation - It shows options of the application	3	Low	Sureshkumkar.M
Sprint-2		USN-10	Login and registration page creation - User can register and login through g mail with Id and password	2	Low	Ilayaraja.A
Sprint-3		USN-11	Dashboard creation - Dashboard contains the information of user profile and features of the application	4	Low	Vasanthi.M
Sprint-3		USN-12	User Input Page Creation - It is for the user to feed the input images	4	medium	Savitha.S
Sprint-3		USN-13	Analysis and prediction page creation - It shows the prediction of given user input	4	Medium	Sureshkumkar.M
Sprint-3		USN-14	Creation of about us , feedback and rating page - It shows application history and feedback page to users	4	medium	Ilayaraja.A
Sprint-3	Application Phase	USN-15	Building the python code and importing the flask module into the Project	4	high	Vasanthi.M
Sprint-4		USN-16	Create the Flask application and loading the model	5	high	Savitha.S
Sprint-4		USN-17	API integration - Connecting front end and back end and perform routing and run the application	5	high	Sureshkumkar.M
Sprint-4	Deployment Phase	USN-18	Cloud deployment - Deployment of application by using IBM cloud	5	high	Ilayaraja.A

3/4

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Testing Phase	USN-19	Functional testing - Checking usability and accessibility	4	medium	Vasanthi.M
		USN-20	Non Functional testing - Checking scalability and performance of the application	4	medium	Savitha.S

6.2 SPRINT DELIVERY SCHEDULE

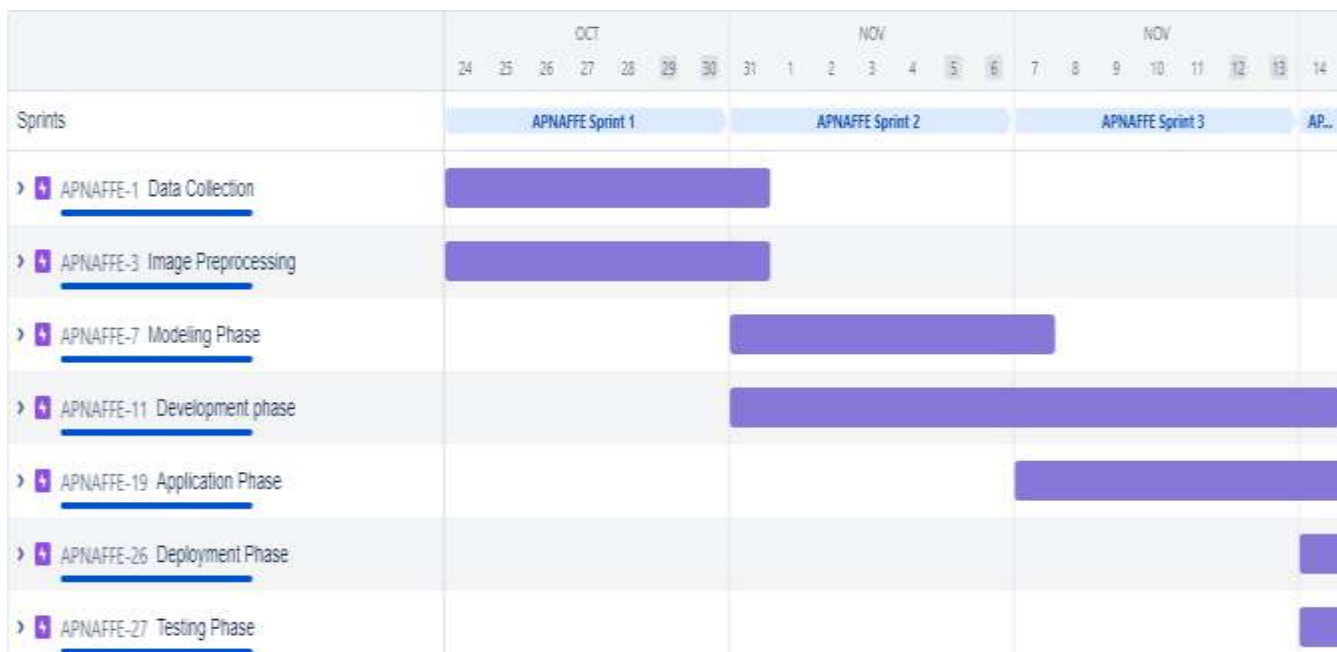
Project Tracker, Velocity & Burn down Chart: (4 Marks)

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	30 Nov 2022	20	30 Nov 2022
Sprint-2	20	6 Days	31 Oct 2022	06 Nov 2022	20	06 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	13 Nov 2022	20	13 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

Average Velocity= $12/6 = 3.33$

6.3 REPORTS FROM JIRA



CHAPTER-7

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

7.1 FEATURE 1

Data Collection

Download the dataset [here](#)

```
[ ] 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'
```

Image Preprocessing

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

Image Data Augmentation

```
[ ] 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

```
▶ x_train = train_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Colab Notebooks/Dataset/TRAIN_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
x_test = test_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Colab Notebooks/Dataset/TEST_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

Model Building

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

```
[ ] classifier = Sequential()
```

3. Adding CNN Layers

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

4. Adding Dense Layers

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



```
classifier.summary()
```

Model: "sequential_1"

Layer (type)	Output Shape	Param #
=====		
conv2d (Conv2D)	(None, 62, 62, 32)	896

5. Configure The Learning Process

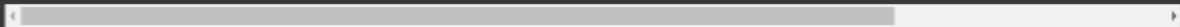
```
[ ] classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

6. Train The Model

```
[ ] classifier.fit_generator(generator=x_train, steps_per_epoch = len(x_train), epochs=28, validation_data=x_test, validation_steps = len(x_test))
```

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

Epoch 1/28
494/824 [=====] - ETA: 6:52 - loss: 0.7194 - accuracy: 0.7174



7. Saving The Model

```
[ ] classifier.save("nutrition.h5")
```


8. Testing The Model

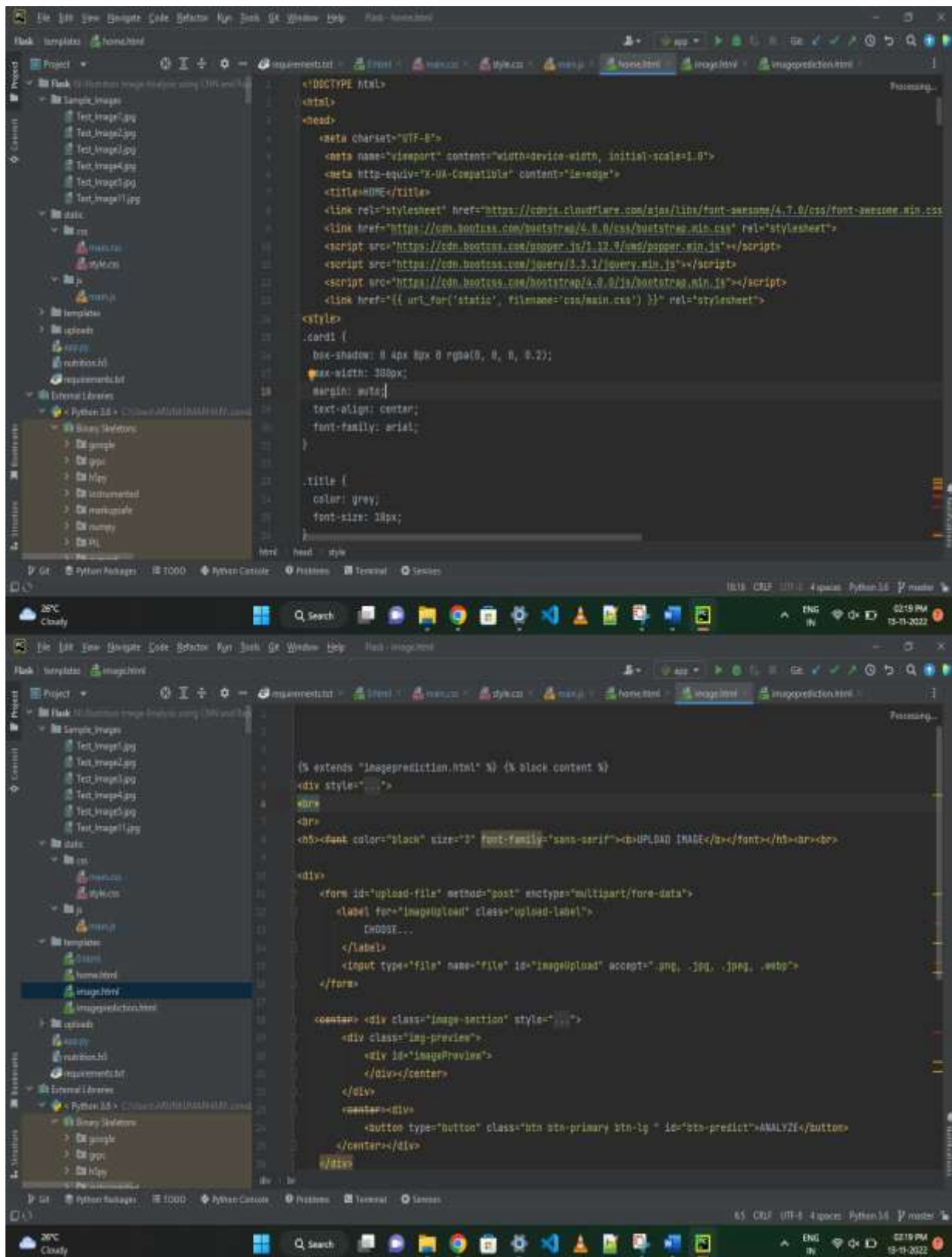
```
[ ] from tensorflow.keras.models import load_model
    from keras.preprocessing import image
    model = load_model("nutrition.h5")
```

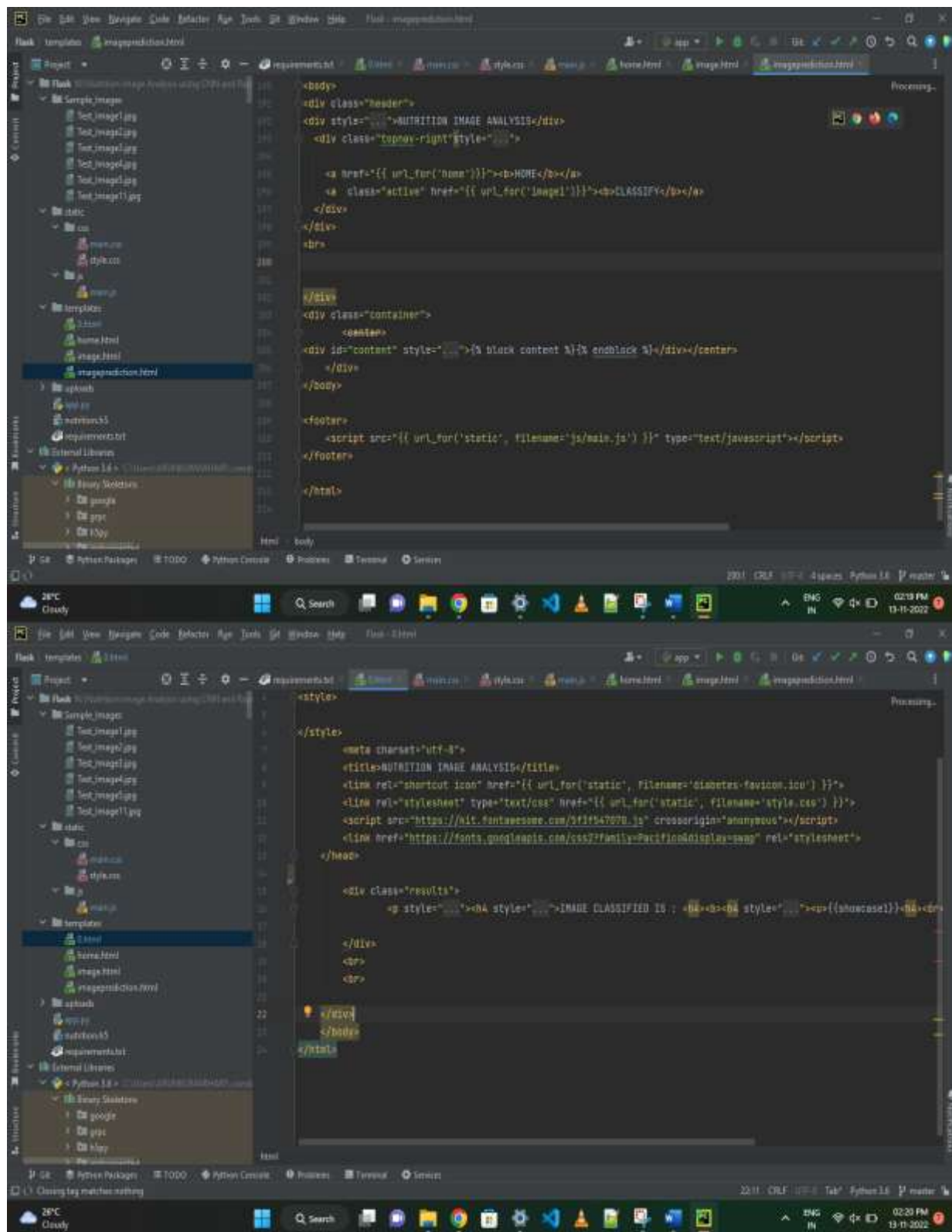
```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model("nutrition.h5")
img = image.load_img(r'/content/drive/MyDrive/Colab Notebooks/Sample_Images/Test_Image1.jpg', grayscale=False, target_size= (64,64))
x = img_to_array(img)
x = np.expand_dims(x,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

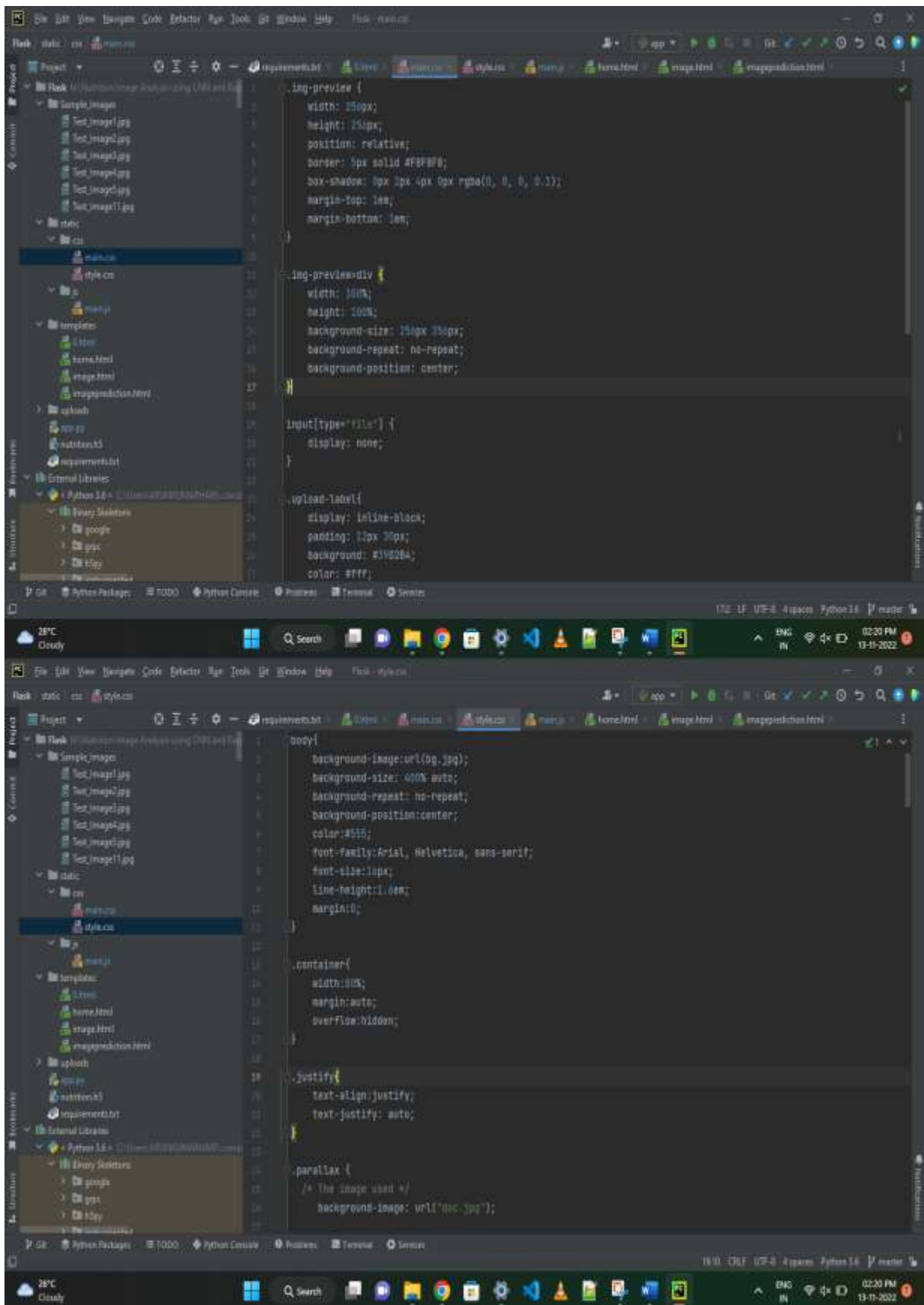
```
1/1 [=====] - 0s 62ms/step
array([0])
```

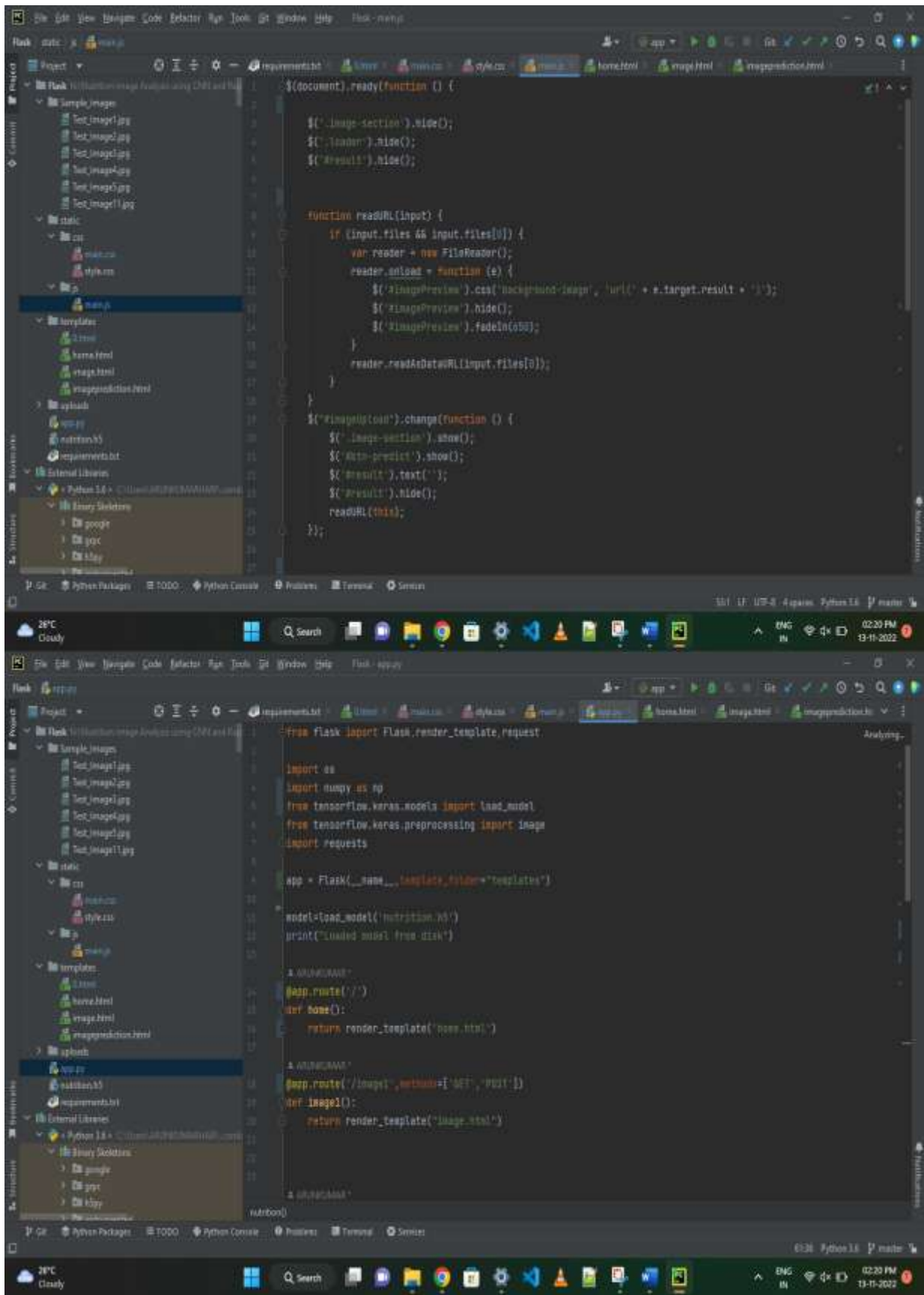
```
[ ] index=['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE', 'WATERMELON']
    result=str(index[classes_x[0]])
    result
```

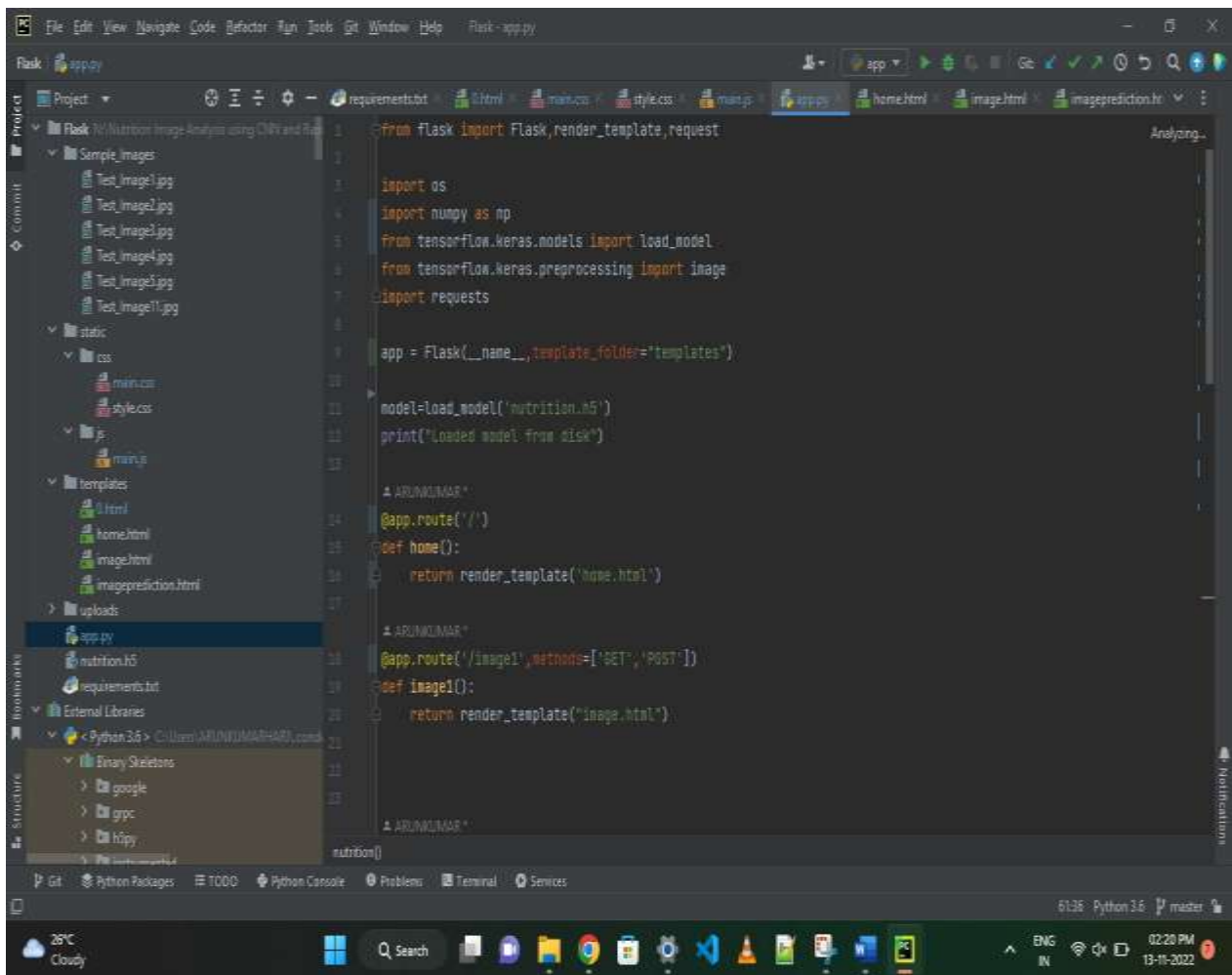
7.2 FEATURE 2







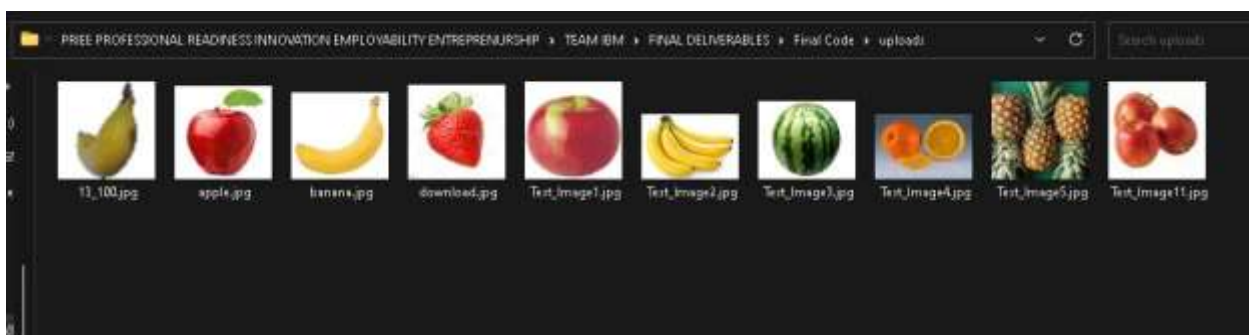
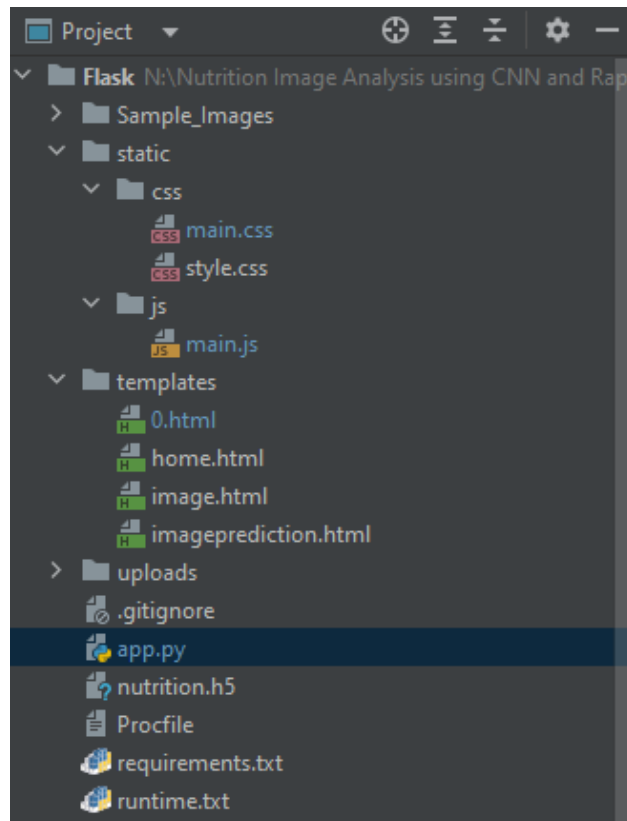




CHAPTER-8

TESTING

8.1 TEST CASES



8.2 USER ACCEPTANCE TESTING



CHAPTER-9

RESULTS

9.1 Performance Metrics


```
Flask - app.py
model=load_model('nutrition.h5')
print("Loaded model from disk")

To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
Loaded model from disk
+ Restarting with stat
+ Serving Flask app 'app' (lazy loading)
+ Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
+ Debug mode: on
2022-11-13 14:47:13.521839: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_118.dll'; dlerror: cudart64_118.dll not found
2022-11-13 14:47:13.523308: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine.
Loaded model from disk
2022-11-13 15:03:52.874487: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlerror: nvcuda.dll not found
2022-11-13 15:03:52.769818: W tensorflow/stream_executor/cuda/cuda_driver.cc:269] failed call to cuInit: UNKNOWN ERROR (303)
2022-11-13 15:05:54.946275: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: LAPTOP-E5IM4603
2022-11-13 15:05:54.619299: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: LAPTOP-E5IM4603
2022-11-13 15:05:57.862699: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
+ Debugger is active!
+ Debugger PIN: 589-305-535
+ Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

HOME
127.0.0.1:5000
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NUTRITION IMAGE ANALYSIS
HOME CLASSIFY

OBJECTIVE OF THE PROJECT




- 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.

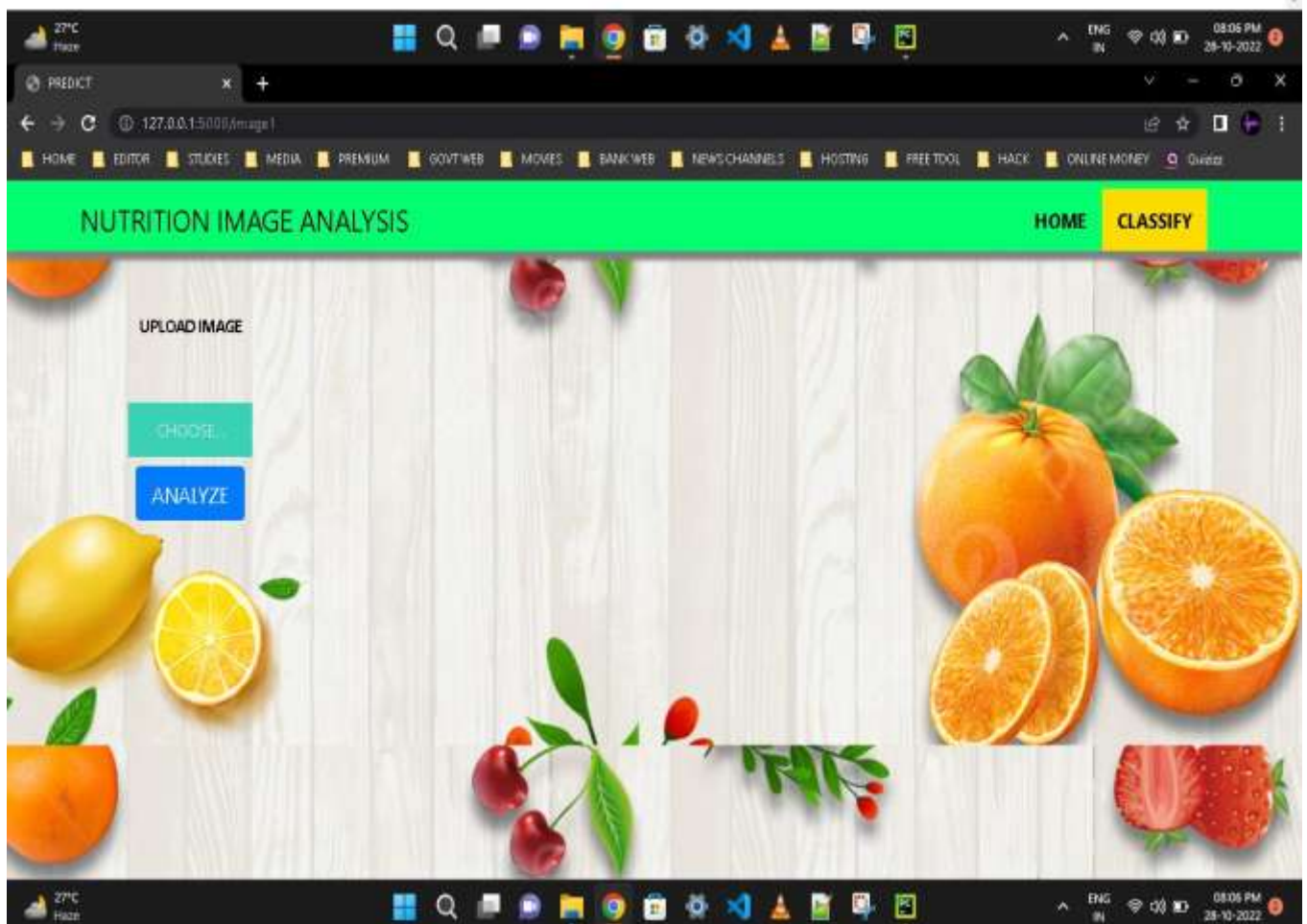
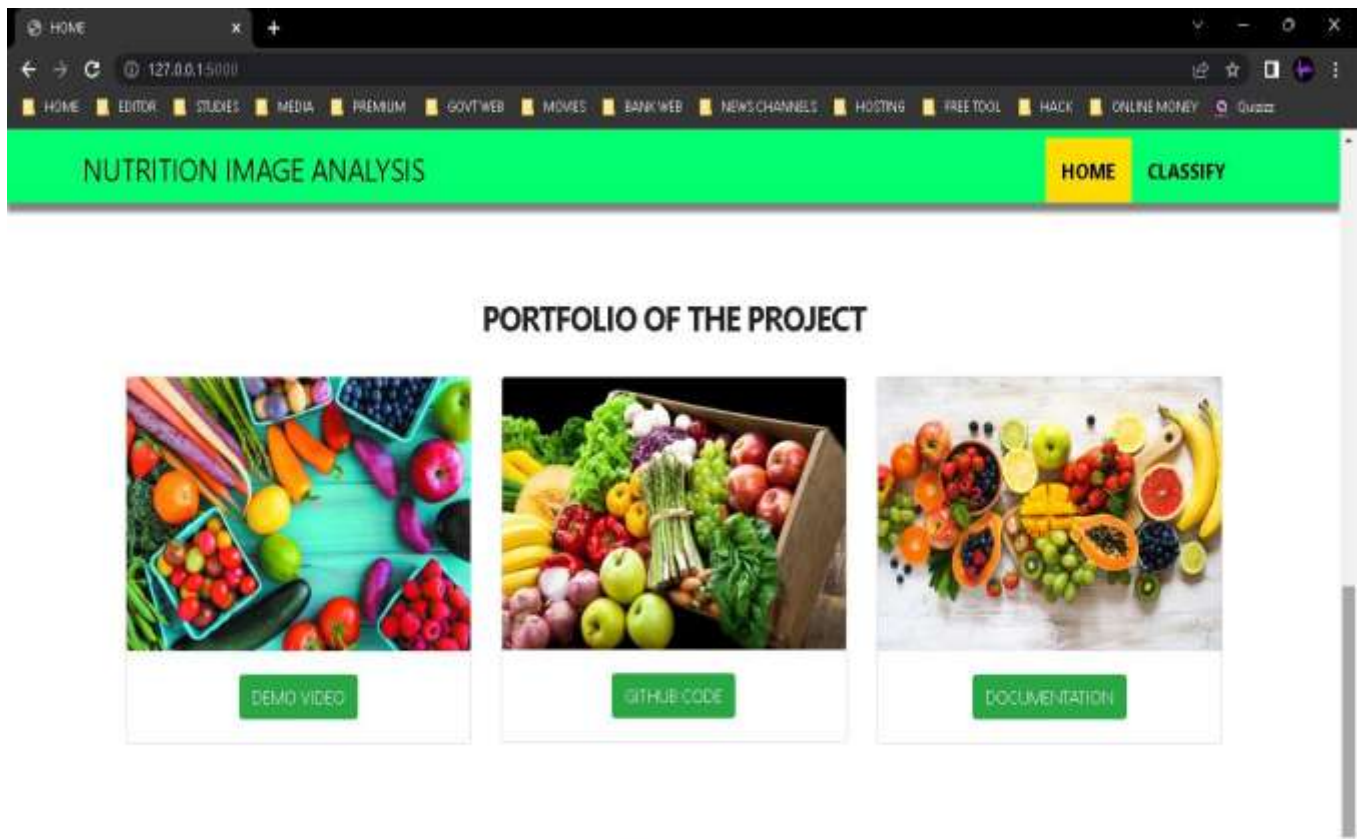
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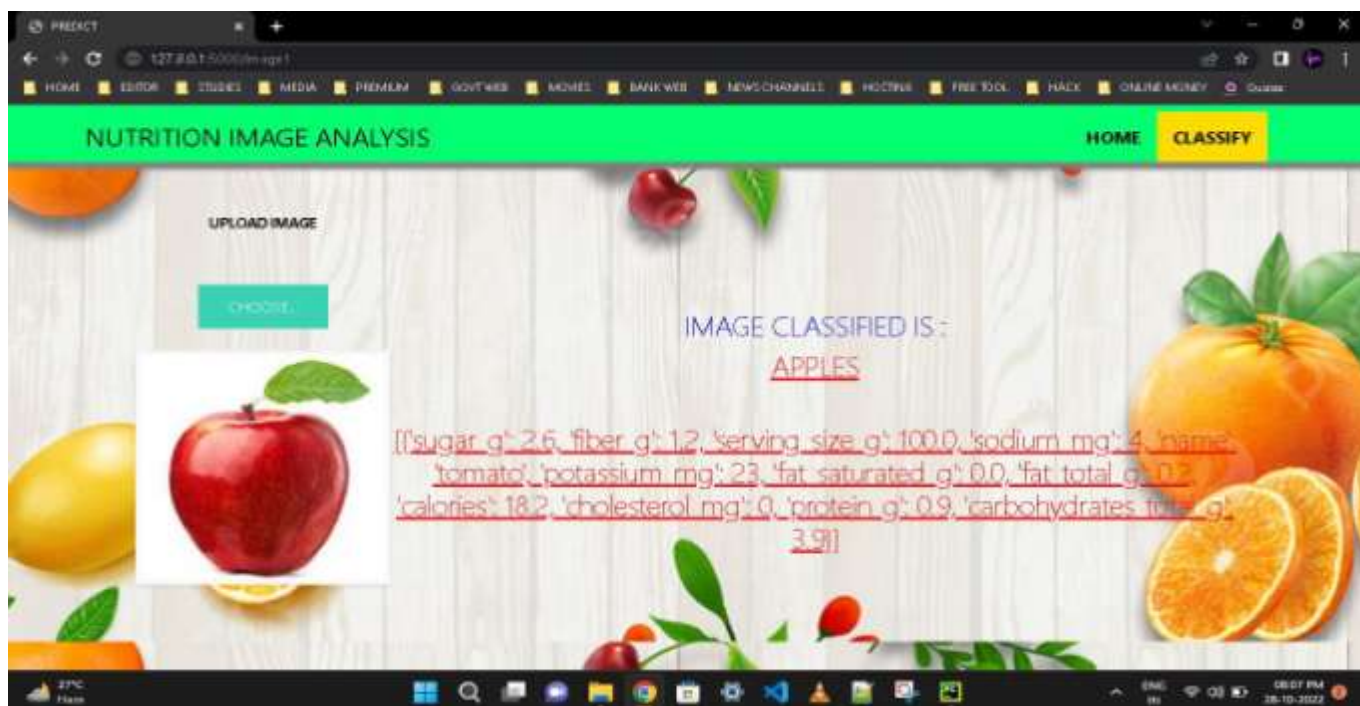
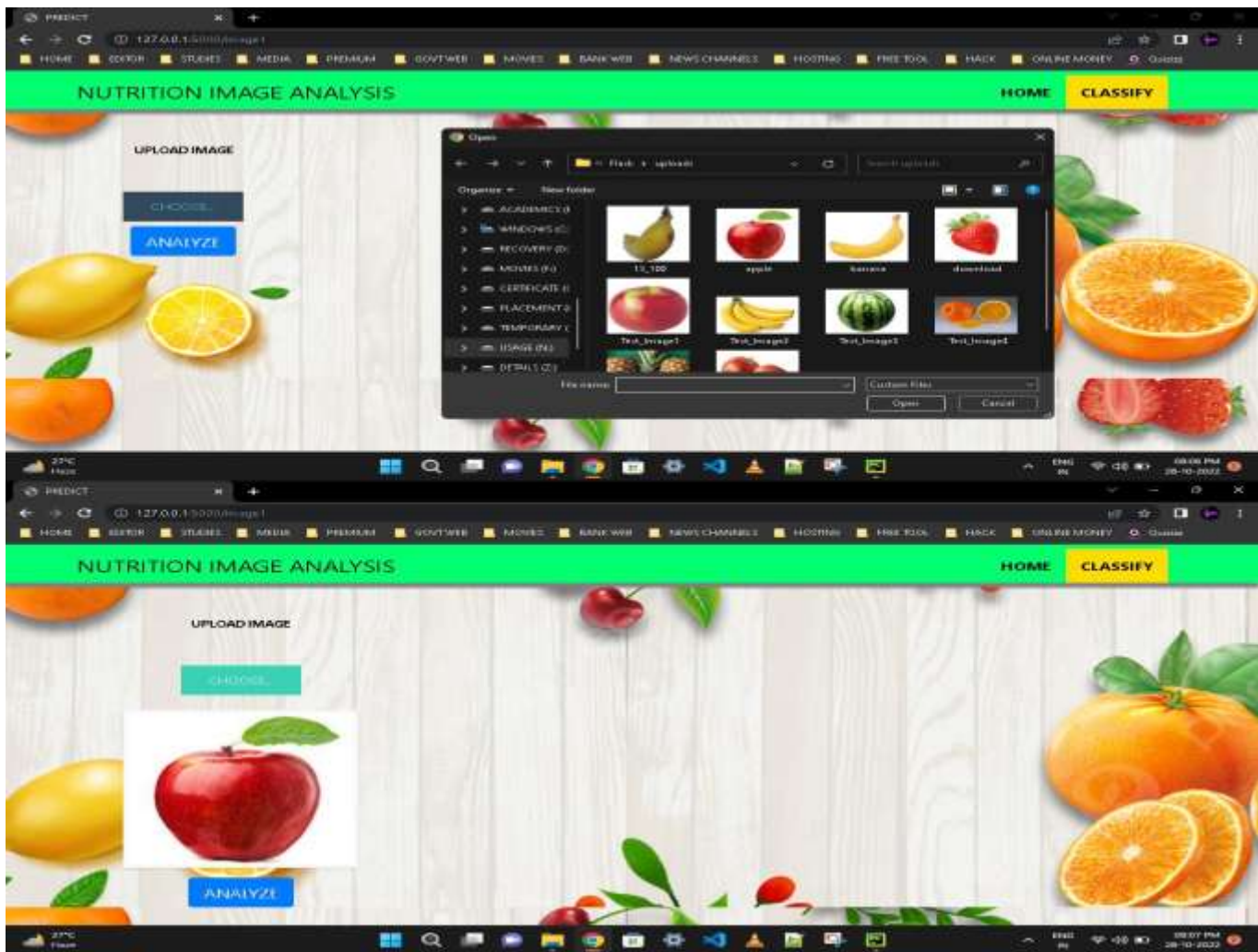
NUTRITION IMAGE ANALYSIS
HOME CLASSIFY

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.).





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ADVANTAGES & DISADVANTAGES

ADVANTAGES

- The new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits
- It helps in exploring the nutrition patterns in their daily routines and this is very useful for people to maintain a healthy diet balance.
- The nutritional analysis is used to determine the nutritional content of food.
- This application eliminates the travelling cost in visiting a dietician.
- The usage of this application greatly reduces the time required to get the best diet plan

DISADVANTAGES

- The android mobile user will not be able to insert or view details if the server goes down. Thus there is a disadvantage of single point failure.

CHAPTER-11

CONCLUSION

By the end of this project we will

- know fundamental concepts and techniques of Convolutional Neural Network.
- gain a broad understanding of image data
- know how to build a web application using the Flask framework.
- know how to pre-process data and
- know how to clean the data using different data preprocessing techniques.

CHAPTER-12

FUTURE SCOPE

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

CHAPTER-13

APPENDIX

Source Code - https://drive.google.com/drive/folders/1NvXv_n1aNOCT0mnB7Mxtc2VJR4jSvskf?usp=share_link

GitHub - <https://github.com/IBM-EPBL/IBM-Project-35710-1660287765>

Demo Link : <https://drive.google.com/drive/folders/1OdRzfn5-mhDJJrvibrfVqpRrvh8QrZHz>