

AI-Powered Nutrition Analyzer For Fitness Enthusiasts

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1. INTRODUCTION

1.1 Project Overview

Food is essential for human life and has been the concern of many healthcare conventions. 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 health 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 Aim :

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 image of different fruits and then the image will be sent the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories,etc.)

2. LITERATURE SURVEY

2.1 Existing problem

An artificial intelligence application in the field of nutrition and dietetics is a fairly new and important field. Different apps related to nutrition are offered to the use of individuals. The importance of individual nutrition has also triggered the increase in artificial intelligence apps. It is thought that different apps such as food preferences and dietary intake can play an important role in health promotion. Researchers may have some difficulties such as remembering the frequency or amount of intake in assessment of dietary intake. Some applications used in the assessment of food consumption contribute to overcoming these difficulties. The apps to be used in the field of nutrition and dietetics should be developed by considering the disadvantages. It is thought that artificial intelligence applications will contribute to both the improvement of health and the assessment and monitoring of nutritional status.

2.2 References

1. NutritionalDiagnosis, Christian Quesada, Marcelo Jenkins Centerfor ICT Research, University of Costa Rica, San Pedro, Costa
2. A New approach for developing Diagnostic Expert systems on mobile phones, communications information science and management Engineering
3. Development a nutrition and diet experts systemprototype, conference paper.
4. A diet expert system utilizing linear programmings models in a rule based inference engine
5. Building a case based diet recommendation system without a knowledge engineer Abdus salam khan*, Achim Hoffmann school of computer science and engineering, the university of new south wales, Sydney 2054, Australia received 14 feb 2002; received in revised form 12 september 2002; accepted 9 october 2002.

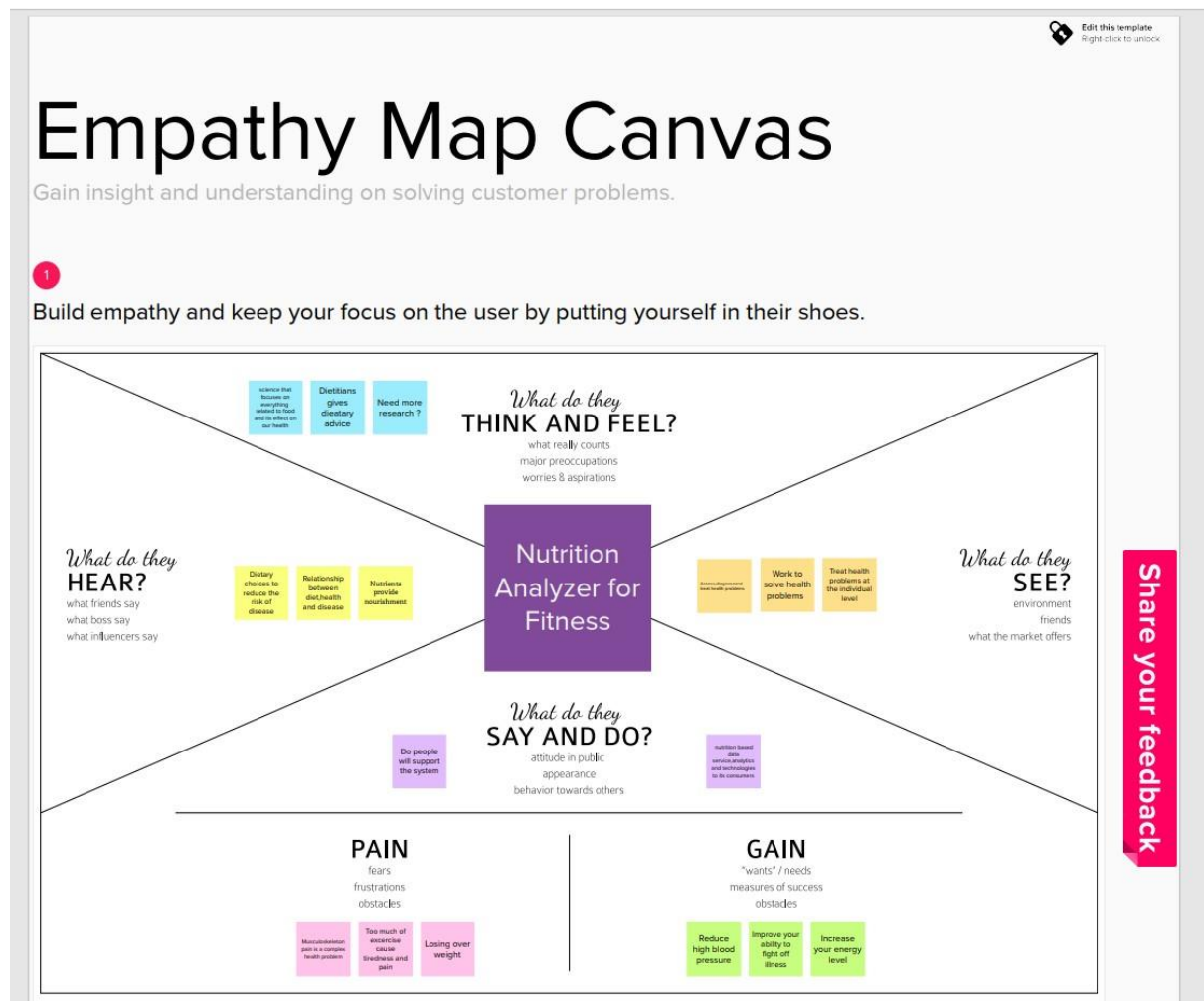
2.3Problem Statement Definition

Statement of the problem Diabetes is a chronic health problem with devastating, yet preventable consequences. It is characterized by high blood glucose levels resulting from defects in insulin

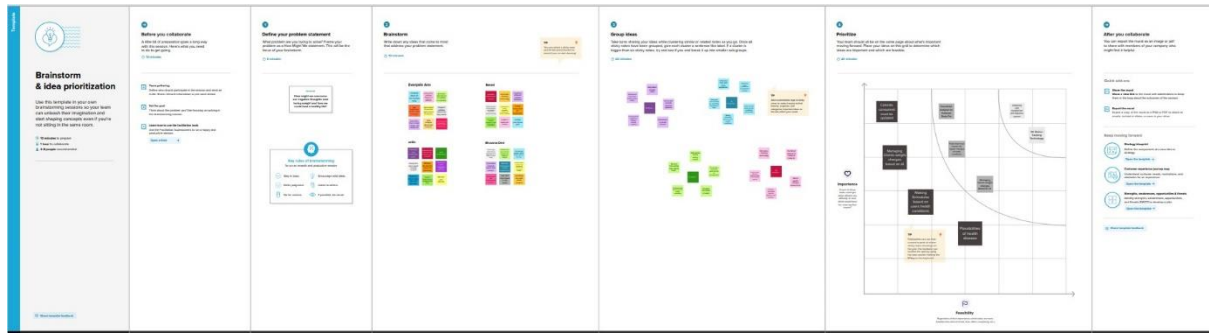
production, insulin action, or both. 1,2 Globally, rates of type 2 diabetes were 15.1 million in 2000, 3 the number of people with diabetes worldwide is projected to increase to 36.6 million by 2030.4 In 2007, 23.6 million people, or 7.8% of the United States population had type 2 diabetes. Of these, 90-95% of these cases were adults with type 2 diabetes. Type 2 diabetes impacts men and women proportionately; there are over 12 million men with diabetes and 11.5 women with diabetes. In adult patients, 6.6% were non Hispanic White National Institutes of Health (NIH) urging patients to “Take Charge of Your Diabetes”5 and “Conquer Diabetes”.6 One of the main goals of USDHHS’s report, Healthy People 2010, is to improve the quality of life for persons with diabetes.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy map canvas



3.2 Ideation & brainstorming



3.3 Proposed solution

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	<ul style="list-style-type: none"> • Consume food with low added sugar, saturated fats, and sodium content. • Consume food that are rich in nutrients rather than food that is rich in energy . • Select protein sources and complete grains, dairy products, etc. • Put all four workout types into practise, such as Strength, stamina, coordination, and flexibility.
2.	Idea/Solution description	<ul style="list-style-type: none"> • Provide dietary advice based on the person's health condition. • Evaluation and maintenance of fitness according to the user's physical circumstances. • A review of daily dietary intake requirements daily, precise measurement. • Nutrition consumption.
3.	Novelty/Uniqueness	<ul style="list-style-type: none"> • The offering of training programmes with bonuses. • Natural remedies and quick solutions for common problems are raised.

		<ul style="list-style-type: none"> ● A customised diet for each individual and state of health. ● Dietary flexibility is encouraged to a healthy, productive lifestyle & Eating schedule.
4.	Social impact/Customer Satisfaction	<ul style="list-style-type: none"> ● Development of a healthy lifestyle. ● Continuous calorie counting results in a fitness mindset. ● Makes them healthy physically and mentally
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> ● Consultation with local trainers and nutritionists for personalised plans. ● One approach to make money with your app is to let third-party sellers use adverts to promote their goods. It is much better if the goods are marketed through advertisements. ● Offering Both Limited and Premium Services.
6.	Scalability of the solution	<ul style="list-style-type: none"> ● Using data from user input, expanding data collection, and improving accuracy. ● The ideal approach to preserve a particular meal. ● Everyone can benefit from it and use it. ● It is due of the UI user-friendliness.

3.4 Problem solution fit

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS <ul style="list-style-type: none">Everyone, from young children to older folks, needs to engage in regular exercise in order to maintain optimum health.Fitness and sports enthusiasts who are strongly committed to their well-being and who see nutrition as an essential part of it.Individuals who suffer from chronic and infectious conditions.	6. CUSTOMER CONSTRAINTS CC <ul style="list-style-type: none">Lack of motivation brought on by various elements.The food's nutritional facts and availability of information are both inadequate.Lacking a suitable instrument for consistently tracking and recording their nutritious diet.To get a personalized health recommendation, you must pay more money.	5. AVAILABLE SOLUTIONS AS <ul style="list-style-type: none">With the help of Artificial intelligence, customers may now receive individualized fitness suggestions at a far lower cost than they had before. Fitness development has served as a crucial component of the fitness business for decades.In contrast to dietitians, who may not always be accessible, customers can have the nutritional of their food evaluated at any time.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P <ul style="list-style-type: none">Educating themselves is something that people must actively pursue. They must examine the components and keep an eye out for items to stay away of.Keeping a healthy meal pattern in order to safeguard your condition.	9. PROBLEM ROOT CAUSE RC <ul style="list-style-type: none">Consumers don't proactively endeavor to educate themselves. They must examine the components and keep an eye out for items to stay away of.Neither getting individualized dietary advice nor regular updates.Most individuals don't know the contents of the foods they intake.	7. BEHAVIOUR BE <ul style="list-style-type: none">Consumers must snap a photo of the meal by pointing their smart phones at it, create a frame around it, and then enable food image analysis within that frame.To achieve good dietary habits, consumers must adhere to the recommendations made.	
Focus on J&P, tap into BE, understand RC	3. TRIGGERS TR <ul style="list-style-type: none">Observing people who are in good physical and mental health.Studying and discovering about the benefits of good health and the potential effects of a poor diet. Using articles from the web and on social media to become more aware of one.	10. YOUR SOLUTION SL <ul style="list-style-type: none">This software gives users access to real-time information regarding their caloric and nutrient intake. The software employs artificial intelligence (AI) and image classification technologies to recognize the meal precisely and compute the number of calories based on the image.Using a Smartphone camera, the user must first point it at food before drawing a frame and turning on food image analysis for that area. On the screen, the leading contenders for the frame are displayed. When a user taps one of the potential items, the name of the food group and an image are added to the system's daily meal record. The program recognizes foods and then shows the user their nutrition based on several attributes including colour, shape, and so on. Unparalleled prospects for advancement and use are provided by artificial intelligence.	8. CHANNELS of BEHAVIOUR CH <ul style="list-style-type: none">ONLINE: Evaluating the nutritional information in comparison to online resources. Additionally, you may use tools like social media to educate yourself on the advantages of maintaining a healthy diet.OFFLINE: Before purchasing, consumers should familiarise themselves with the advice or recommendations and make an effort to heed them.	Focus on J&P, tap into BE, understand RC
	4. EMOTIONS: BEFORE / AFTER EM <ul style="list-style-type: none">BEFORE: Uncertain about how to keep better track of or maintain a nutritious diet. Concern over the amount, quality, components, ingestion amounts, and potential impacts of the ingredients.AFTER: Knowledgeable about the intake, quantity, and components utilized in order to avoid those that might harm their health.			
Identify strong TR & EM	Extract online & offline CH of BE			

4.REQUIREMENT ANALYSIS

4.1 Functional requirement

2.2 Non-Functional requirements

Functional Requirements:

Following are the functional requirements of the proposed system

FR No.	Non-Functional Requirement	Description
NFR-1	Reliability	During a month, this application must run flawlessly in 95% of use scenarios. Trusted details from server.
NFR-2	Security	Provides assurance that any data inside the system will be secure against malware assaults and illegal access. In the face of attacks, this application must maintain its resilience. The application's behaviour will be accurate and predictable.
NFR-3	Usability	Efficient for a large user base. Users are delighted with the system since they can quickly comprehend what the application does.
NFR-4	Performance	Using the provided data, they determine their nutritional status and will accompany over all day. Less Response time recorded.
NFR-5	Scalability	The application must be scalable enough to accommodate 10,000 concurrent visitors while still performing at its best. Each Customer must Receive a Healthy Life and the right diet maintenance based on Calorie prediction.
NFR-6	Availability	Users an access every time. Email and chat-bot accessible

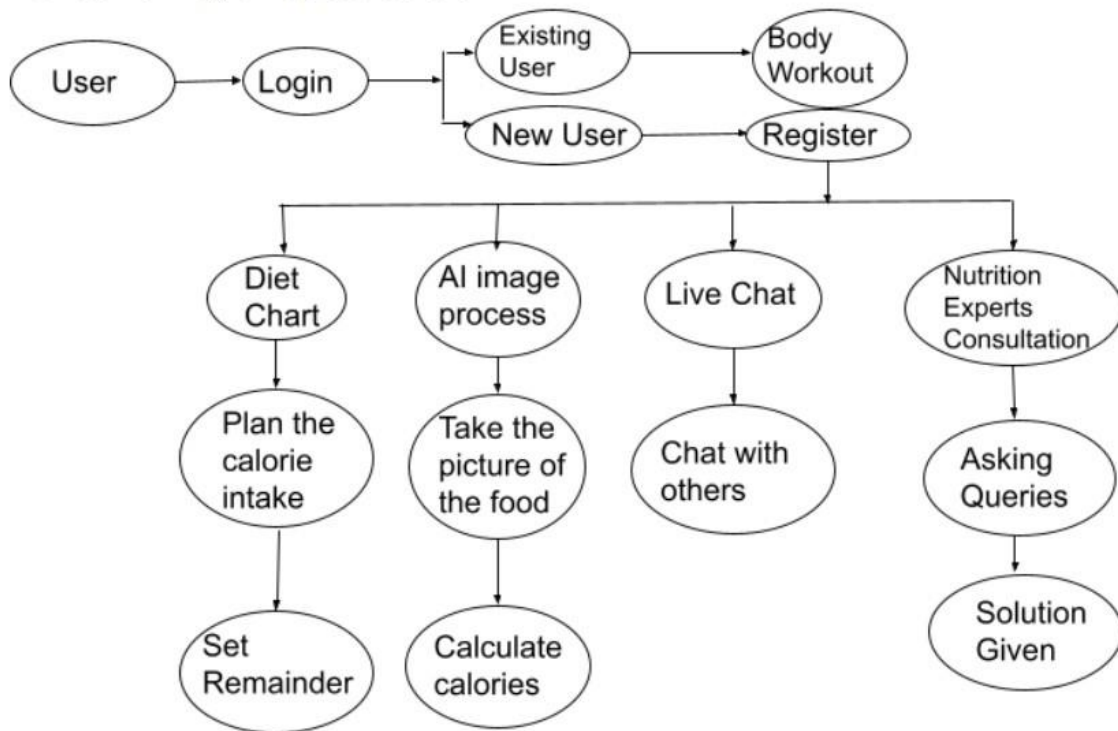
5.PROJECT DESIGN

5.1 Data flow diagram

Data Flow Diagrams:

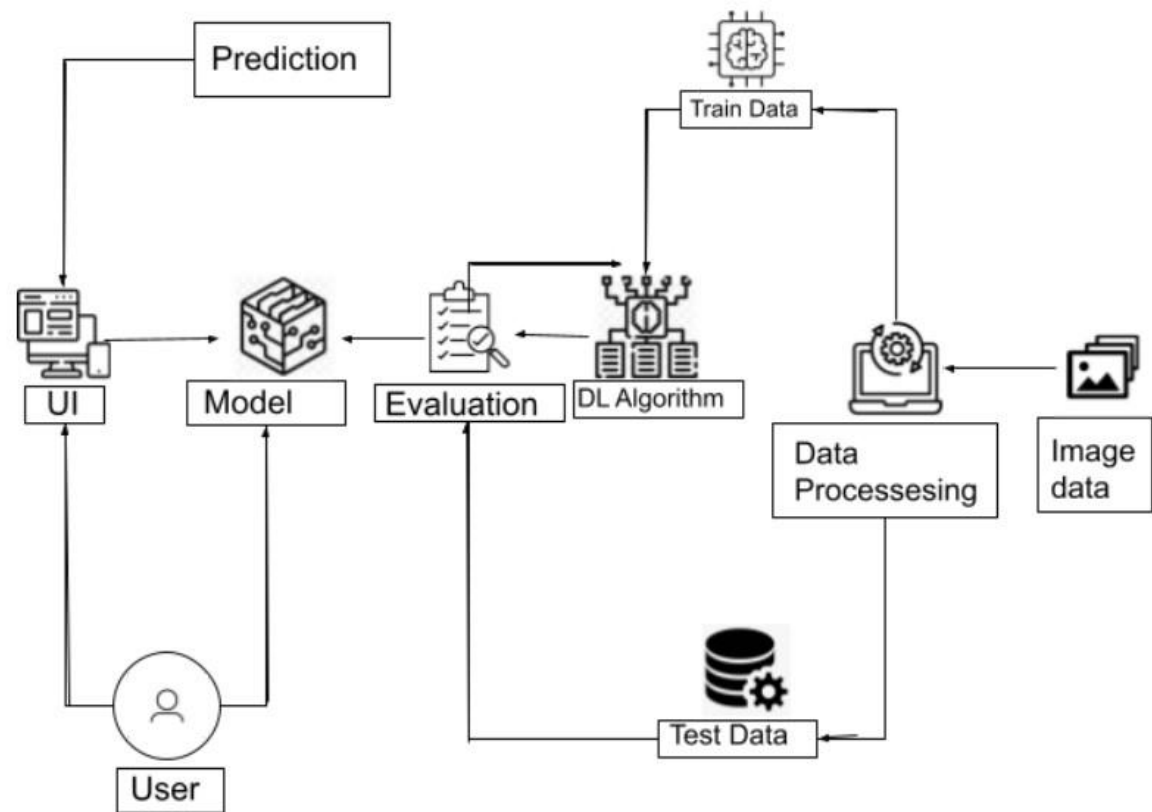
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

The Data Flow Diagram is presented below



5.2 Technical Architecture

Technical Architecture:



6. PROJECT PLANNING & SCHEDULING

6.1 milestone activity planning

Sprint	Functional Requirement	User story Number	User story/stack	Story Point	Priority	Team Members
Sprint-1	Registration	USN-1	User can register for the application by entering user name and entering a strong password.	2	High	Evanjalin Ann
Sprint-1	Login	USN-2	User can login to the application by entering user name and password	2	High	Besmi
Sprint-2	Upload images of digital document	USN-3	User can input the food images into the application's document	1	Moderate	Bhuvana
Sprint-2	Prediction	USN-4	User can predict the image	1	Moderate	Anlin
Sprint-3	Upload the fruit images dataset	USN-5	User can input the fruit of their choice that they want to know about	1	High	Evanjalin Ann
Sprint-3	Recognize fruit	USN-6	User can choose their fruit type	1	Moderate	Besmi
Sprint-4	Recognize Fruit type	USN-7	User can recognize their selected fruit in the output, and recognize it and its benefits	2	High	Bhuvana
Sprint-4	Recognize fruit colour	USN-8	User can recognize the fruit colour in the dataset and differentiate it with others	2	High	Anlin

Project Tracker, Velocity & Burndown Chart: (4 Marks):

Sprint	Total Story point	Duration	Sprint Start Date	Sprint End Date	Story Points completed	Story release date
Sprint-1	2	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	2	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	2	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	2	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

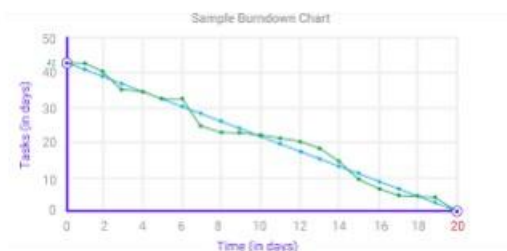
Velocity:

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

$$AV = \frac{\text{Sprint Duration}}{\text{Velocity}} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



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

7.1 Model building

The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing, although geometric transformations of images (e.g. rotation, scaling, translation) are classified among pre-processing methods here since similar techniques are used.

Code:

```
from google.colab import drive
drive.mount('/content/drive')

cd//content/drive/MyDrive/Colab Notebooks/Dataset

import numpy as np#used for numerical analysis
import tensorflow #open source used for both ML
and DL for computation
from tensorflow.keras.models import Sequential #it is a plain stack of
layers
from tensorflow.keras import layers #A layer consists of a tensor-in tensor-out computation
function
#Dense layer is the regular deeply connected neural network layer
from tensorflow.keras.layers import Dense,Flatten

#Flatten-used for flattening the input or change the dimension
from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout #Convolutional layer
#MaxPooling2D-for
downsampling the image
from keras.preprocessing.image import ImageDataGenerator

#setting parameter for Image Data agumentation to the training data
train_datagen = ImageDataGenerator(rescale=1./255,
shear_range=0.2,zoom_range=0.2,horizontal_flip
=True)

#Image Data agumentation to the testing data
test_datagen=ImageDataGenerator(rescale=1./255)

#performing data agumentation to train data
x_train = train_datagen.flow_from_directory(
    r'/content/drive/MyDrive/content/TRAIN_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',
class_mode='sparse') #performing data agumentation to test data
x_test = test_datagen.flow_from_directory(
    r'/content/drive/MyDrive/content/TEST_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',
class_mode='sparse')

print(x_train.class_indices)#checking the number of classes
print(x_test.class_indices)#checking the number
of classes
from collections import Counter
as c(x_train .labels)
```

7.2.Feature 2 model training on IBM Watson Studio

```
!pip install watson-machine-learning-client
from ibm_watson_machine_learning import APIClient

wml_credentials = {
    "url" : "https://us-south.ml.cloud.ibm.com",
    "apikey" : "o49g8_rjLtMfFOxWPrBuja8eQPmNZtIK-
uGy3_MzolZp" }
client = APIClient(wml_credentials)

client = APIClient(wml_credentials)
def giud_from_space_name(client,space_name):
space = client.spaces.get_details()
```

```

return(next(item for item in space['resources'] if
item['entity']['name'] ==
space_name)['metadata']['id'])
space_uid = giud_from_space_name(client,'Nutrition
Analyzer') print("Space UID = "+ space_uid)

```

```

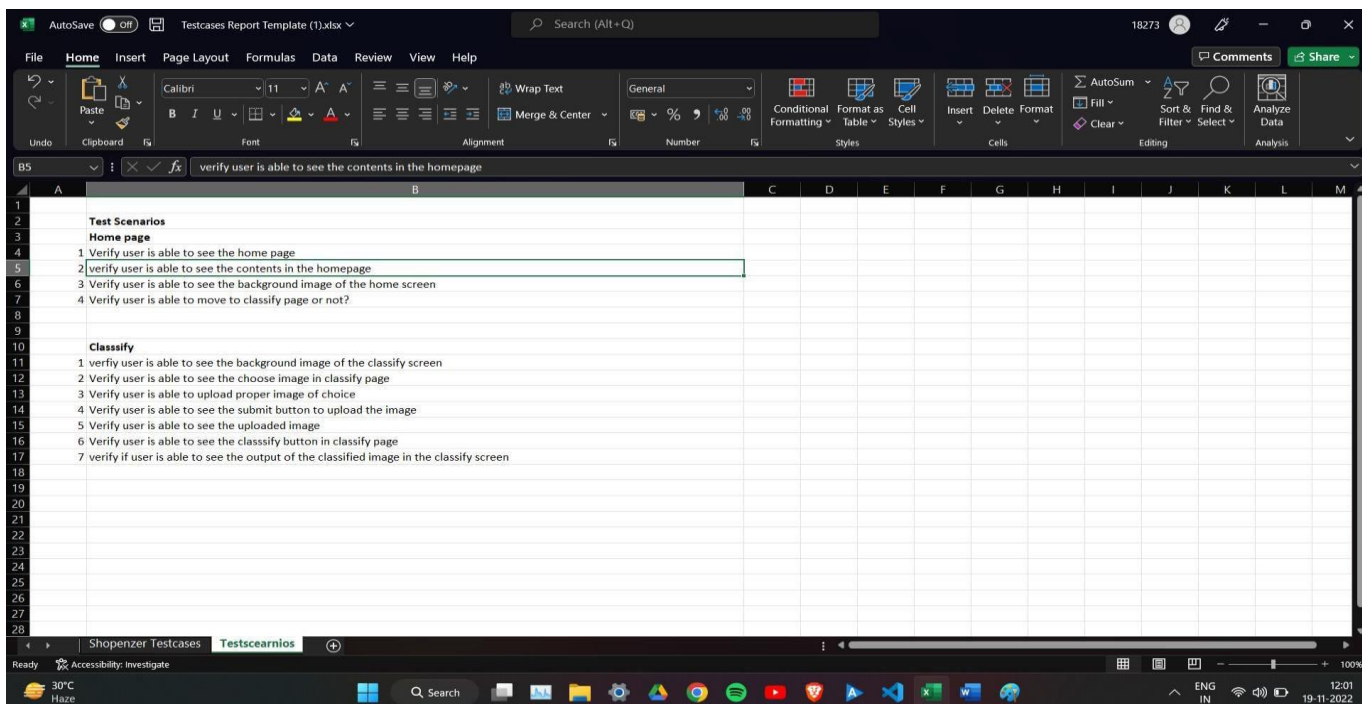
client.set.default_space(space_uid) client.repository.download('4e26aed0-bb0c-4b3d-
8476-9630f3617dc2', 'my_model.tar.gz')

```

8. TESTING

8.1. Test Cases

A test case is a set of actions performed on a system to determine if it satisfies software requirements and functions correctly. A test case is a document, which has a set of test data, preconditions, expected results and postconditions, developed for a particular test scenario.



AutoSave Off Testcases Report.xlsx Search (Alt+Q) 182/73

File Home Insert Page Layout Formulas Data Review View Help

Calibri 11 A A⁺ Wrap Text General Conditional Formatting Format as Table Cell Styles Insert Delete Format AutoSum Fill Sort & Filter Find & Select Analyze Data

Undo Clipboard Font Alignment Number Styles Cells Editing Analysis

H10 user should be able to view the details of the processed image

Feature Type	Component	Test Scenario	Pre-Req	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation (Y/N)	BUG ID	Executed By
UI	Home Page	Verify user is able to see the contents in the homepage		1. Enter URL and click go	http://127.0.0.1:5000/	The contents of the homepage must be visible in a box.	Working as expected	Pass				Karthikeyan
Functionality	classify page	Verify user is able to click on classify button		1. Enter URL and click go 2. Click on classify	http://127.0.0.1:5000/	User should be able to click the upload image button	Working as expected	Pass				Velan
UI	classify page	Verify user is able to preview the image uploaded		1. Enter URL and click go 2. Click on classify 3. press upload image button	http://127.0.0.1:5000/	User should be able to preview the image uploaded	Working as expected	Pass				Deepak
UI	classify page	Verify user is able to see the content after the image is processed		1. Enter URL and click go 2. Click on classify 3. press upload image button 4. click classify	http://127.0.0.1:5000/	User should be able to view the details of the processed image	Working as expected	Pass				Vijayamurugesan

Shopenzer Testcases Testscenarios

Ready Accessibility: Investigate 29°C Haze Search 13:31 19-11-2022

8.2. User Acceptance Testing

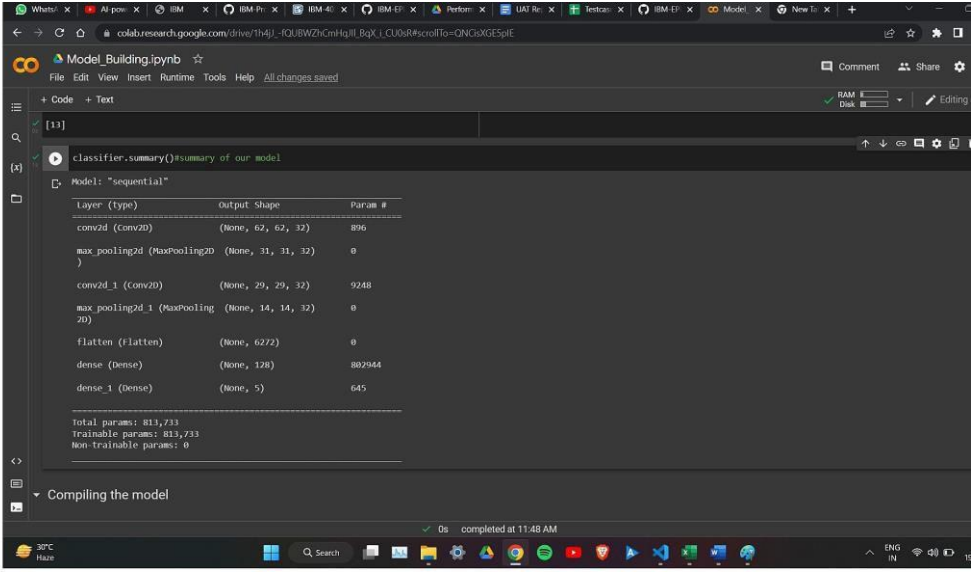
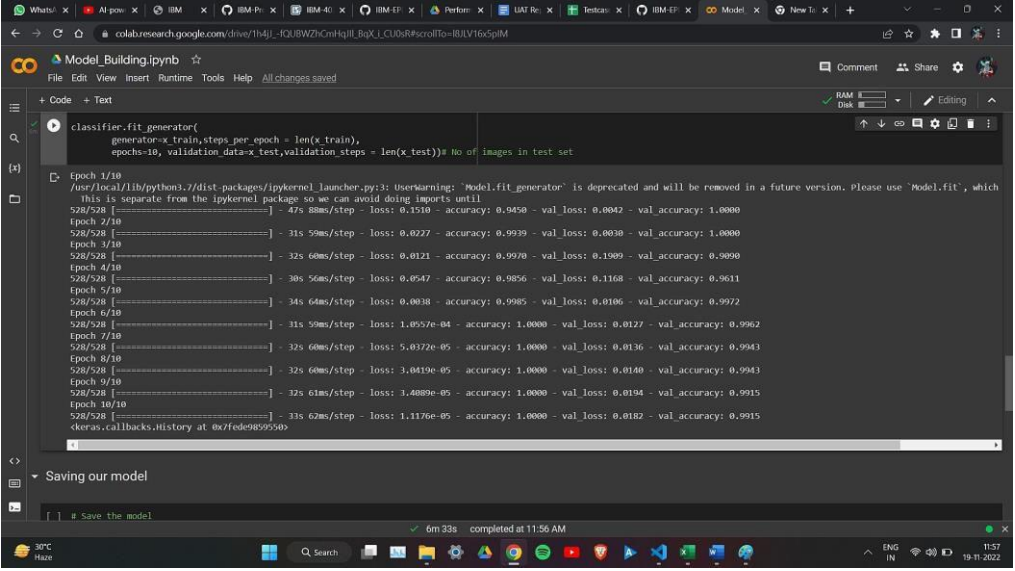
User acceptance testing (UAT), also called application testing or end-user testing, is a phase of software development in which the software is tested in the real world by its intended audience. UAT is often the last phase of the software testing process and is performed before the tested software is released to its intended market. The goal of UAT is to ensure software can handle real-world tasks and perform up to development specifications. In UAT, users are given the opportunity to interact with the software before its official release to see if any features have been overlooked or if it contains any bugs. UAT can be done in-house with volunteers, by paid test subjects using the software or by making the test version available for download as a free trial. The results from the early testers are forwarded to the developers, who make final changes before releasing the software commercially. UAT is effective for ensuring quality in terms of time and software cost, while also increasing transparency with users.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
No background image	6	3	2	3	20
Image not uploaded	2	0	3	0	4
Output not visible	3	2	0	1	6
Fixed	9	4	4	20	37
No preview of uploaded image	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	20	14	13	26	77

Section	Total Cases	Not Tested	Fail	Pass
Homepage	2	0	0	2
Contents of homepage	5	0	0	51
Background image in homepage	4	0	0	2
Moving to classify page	6	0	0	3
Choose image	4	0	0	9
Uploaded image preview	4	0	0	4
Contents of the output	3	0	0	2

9. RESULTS

9.1. Performance Metrics

S.No.	Parameter	Values	Screenshot
1.	Model Summary	Total params: 813,733 Trainable params: 813,733 Non-trainable params: 0	
2.	Accuracy	Training Accuracy - 99.2% Valida on Accuracy – 98.3%	

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

There are many advantages to using an AI-powered nutrition analyzer for fitness enthusiasts. Some of these advantages include:

1. The software is powerful and can be used for a long time

The software is easy to operate, powerful, and can be used for a long time. Provide customers with free software upgrades for life.

2. Automated analysis of nutrient content

The instrument is equipped with a spectrum of nutrient analysis software for automatic analysis of nutrient content.

3. It is suitable for food research and development, clinical nutrition, dietitian and other departments

It is suitable for food research and development, clinical nutrition, dietitian and other departments. According to the analysis results, the nutrition of the human body is improved, and the weight loss effect is obvious.

4. To solve the problem of food nutrition labeling

The instrument can quickly and accurately analyze the nutrient content of food, and is an indispensable instrument for solving food nutrition labeling.

5. The instrument is easy to operate, accurate and reliable

The instrument is easy to operate, accurate and reliable. It is an ideal instrument for food analysis, quality control and food research.

DISADVANTAGES

Some of the potential disadvantages of an AI-powered nutrition analyzer for fitness enthusiasts

include:

1. They can be expensive.
2. They require you to have a specific food item in order to get accurate results.
3. They can be time-consuming to use.
4. The results can be difficult to interpret.
5. They are not always accurate.
6. They can be frustrating to use.
7. You may not get the results you want.
8. You may not be able to find the right food item.
9. You may not be able to use the results.
10. You may not be able to find the right nutritional analyzer.

11. CONCLUSION

Overall, we believe that the AI-powered nutrition analyzer is a great tool for fitness enthusiasts. It can help them track their diet and ensure that they are getting the nutrients they need.

Additionally, it can help them identify areas where they may need to make changes in their diet

12. FUTURE SCOPE

Further enhancement can be made in the future advancement, to develop personalized nutrition plans. The plans could be based on an individual's age, weight, height, gender, activity level, and other factors. The plans could also be customized for specific medical conditions. There is a lot of potential for the Nutritional Analyzer to be used in a variety of settings. For example, it could be used in restaurants to help customers make healthier choices. It could also be used in schools to help students learn about nutrition. Additionally, the Nutritional Analyzer could be used in hospitals and other healthcare settings to help patients make better choices about their diet.

13. APPENDIX

Source Code:

```
from flask import Flask,render_template,request

# Flask-It is our framework which we are going to use to run/serve our
application. #request-for accessing file which was uploaded by the user on
our application. import os import numpy as np #used for numerical
analysis from tensorflow.keras.models import load_model#to load our
trained model from tensorflow.keras.preprocessing import image import
requests

app = Flask(__name__,template_folder="templates") # initializing a flask app
# Loading the model
model=load_model('nutrition.h5') print("Loaded
model from disk")

@app.route('/')# route to display the home
page def home():
    return render_template('home.html')#rendering the home page

@app.route('/image1',methods=['GET','POST'])# routes to the index
html def image1():
```

```
return render_template("image.html")
```

```
@app.route('/predict',methods=['GET', 'POST'])# route to show the predictions  
in a web
```

```
UI def
```

```
launch(): if
```

```
request.meth
```

```
od=='POST':
```

```
    f=request.files['file'] #requesting the file
```

```
    basepath=os.path.dirname('__file__')#storing the file directory
```

```
    filepath=os.path.join(basepath,"uploads",f.filename)#storing the file in  
    uploads folder    f.save(filepath)#saving the file
```

```
    img=image.load_img(filepath,target_size=(64,64)) #load and reshaping the  
    image    x=image.img_to_array(img)#converting image to an array  
    x=np.expand_dims(x,axis=0)#changing the dimensions of the image
```

```
    pred=np.argmax(model.predict(x), axis=1)
```

```
    print("prediction",pred)#printing the prediction
```

```
    index=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELO  
    N']
```

```
    result=str(index[pred[0]])
```

```
x=result
```

```
print(x)
```

```
result=nutr
```

```
ition(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":index}
headers = {
    'x-rapidapi-key':
"5d797ab107mshe668f26bd044e64p1ffd34jsnf47bfa9a8ee4",    'xrapidapi-
host': "calorieninjas.p.rapidapi.com"
    }

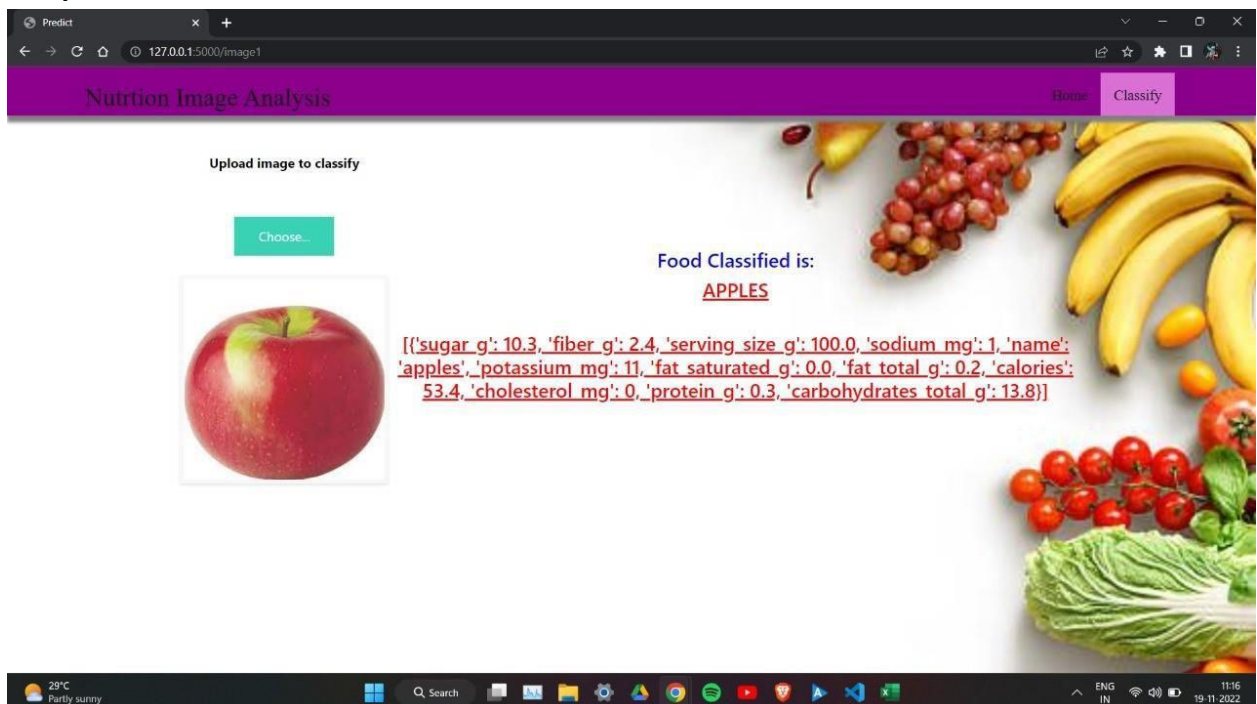
    response = requests.request("GET", url, headers=headers,
params=querystring)

    print(response.text)    return
response.json()['ite
ms'] if __name__ ==
"__main__": #
running the app
    app.run(debug=False)

```

Output:

sample 1:



sample 2:


Predict x +

← → ↻ ⌂ 127.0.0.1:5000/image1

Nutrition Image Analysis Home **Classify**

Upload image to classify

Choose...



Food Classified is:
ORANGE

[{'sugar_g': 8.4, 'fiber_g': 2.2, 'serving_size_g': 100.0, 'sodium_mg': 1, 'name': 'orange', 'potassium_mg': 23, 'fat_saturated_g': 0.0, 'fat_total_g': 0.1, 'calories': 50.4, 'cholesterol_mg': 0, 'protein_g': 0.9, 'carbohydrates_total_g': 12.4}]

23°C Partly sunny 11:18 19-11-2022

sample 3:


Predict x +

← → ↻ ⌂ 127.0.0.1:5000/image1

Nutrition Image Analysis Home **Classify**

Upload image to classify

Choose...

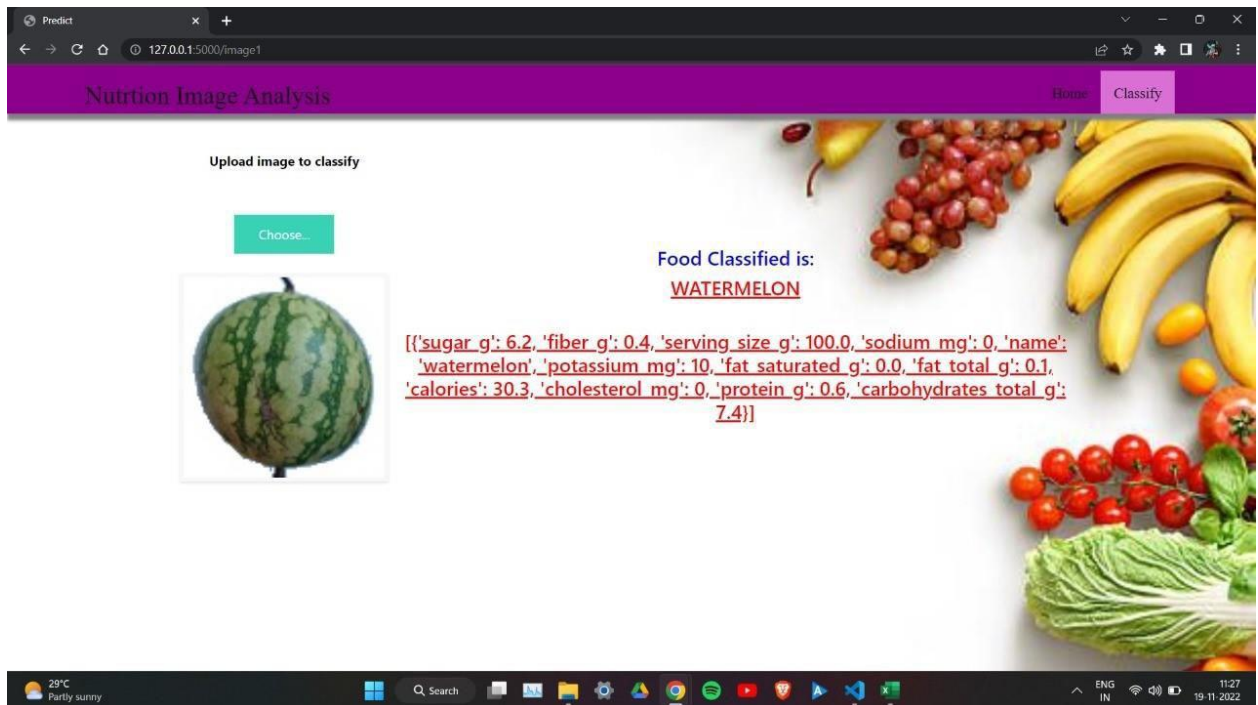


Food Classified is:
BANANA

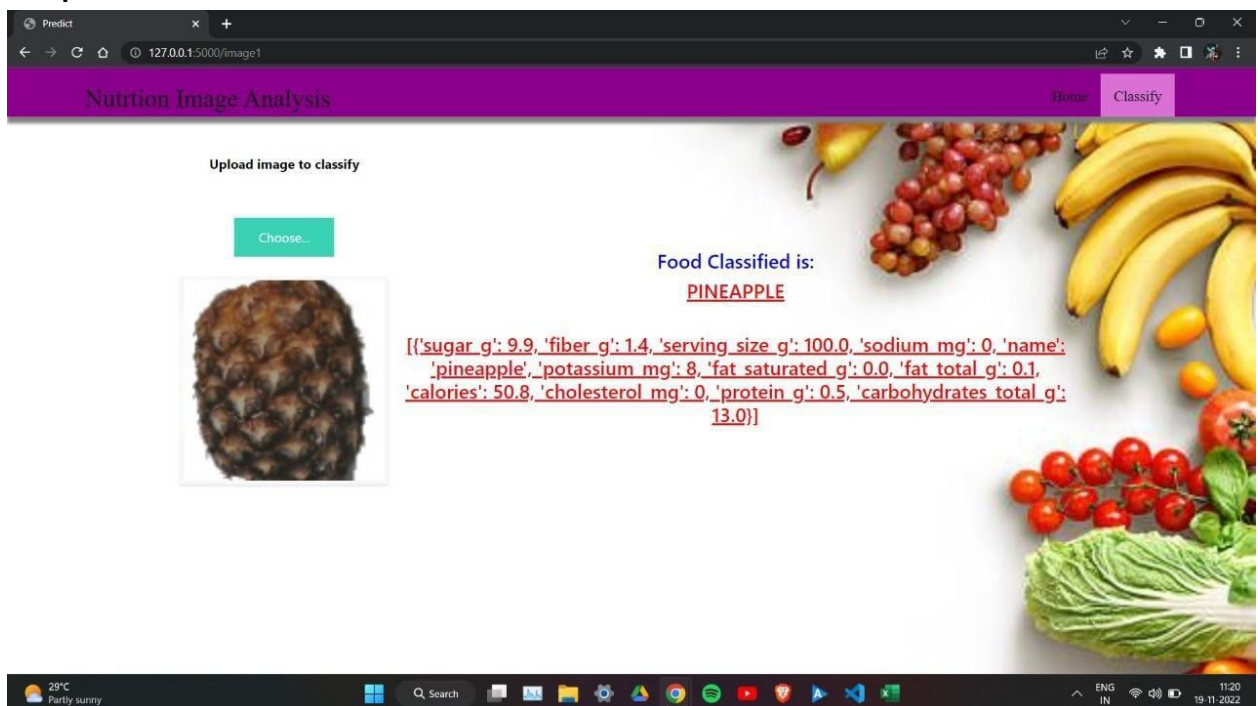
[{'sugar_g': 12.3, 'fiber_g': 2.6, 'serving_size_g': 100.0, 'sodium_mg': 1, 'name': 'banana', 'potassium_mg': 22, 'fat_saturated_g': 0.1, 'fat_total_g': 0.3, 'calories': 89.4, 'cholesterol_mg': 0, 'protein_g': 1.1, 'carbohydrates_total_g': 23.2}]

23°C Partly sunny 11:19 19-11-2022

sample 4:



sample 5:



GitHub Link: <https://github.com/IBM-EPBL/IBM-Project-40719-1660633327>

Project Demo Link: <https://youtu.be/F8WHFTWDHj4>