PROJECT REPORT

PROJECT TITLE : AI POWERED NUTRITION ANALYSER 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. 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 building a model which is used for classifying the fruit depends on the different characteristics like color, 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, Fiber, Protein, Calories, etc.).

1.2 Purpose

AI algorithms may help better understand and predict the complex and non-linear interactions between nutrition-related data and health outcomes.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.

2. LITERATURE SURVEY

2.1 Existing problem

The food pattern is one of the modifiable factors for improving lifestyle and disease prevention. It is known that changes in diet have an effect on the evolution of chronic noncommunicable diseases (CNCD) of high prevalence, such as obesity, depression, anxiety, type 2 diabetes, and cardiovascular diseases. In order to prevent the CNCD, changing eating habits is strongly recommended. Precision medicine, or precise health, is an approach for disease treatment and prevention that considers individual variability in genes, environment, and lifestyle. The application of precision medicine has been broadly improved by the recent development of the large-scale biologic database, The possibilities of artificial intelligence in the field of medical diagnostics, risk prediction and support of therapeutic techniques are growing rapidly. The aim of the article is to analyze the current use of AI in nutrition science research. It was found that the artificial neural network (ANN) methodology was dominant in the group of research on food composition study and production of nutrients. However, machine learning (ML) algorithms were widely used in studies on the influence of nutrients on the functioning of the human body in health and disease and in studies on the gut microbiota. The continuous technological advances have

awakened the interest of marketing researchers in the intention to use Apps, especially in the field of sports. Walter explained the existence of a trend towards increased interest by fitness consumers in using Apps for exercise control. Therefore, the aim of this study was to conduct a systematic review of the literature on consumers' intention to use Apps related to fitness and physical activity.

2.2 References

[1] Sak, J.; Suchodolska, M. Artificial Intelligence in Nutrients Science Research: A Review. Nutrients 2021, 13, 322. https://doi.org/10.3390/nu13020322

[2] Salvador Angosto , Jeronimo Garcia-Fernandez , Irena Valantine and Moises Grimaldi-Puyana " The Intention to Use Fitness and Physical Activity Apps: A Systematic Review " : 17 August 2020

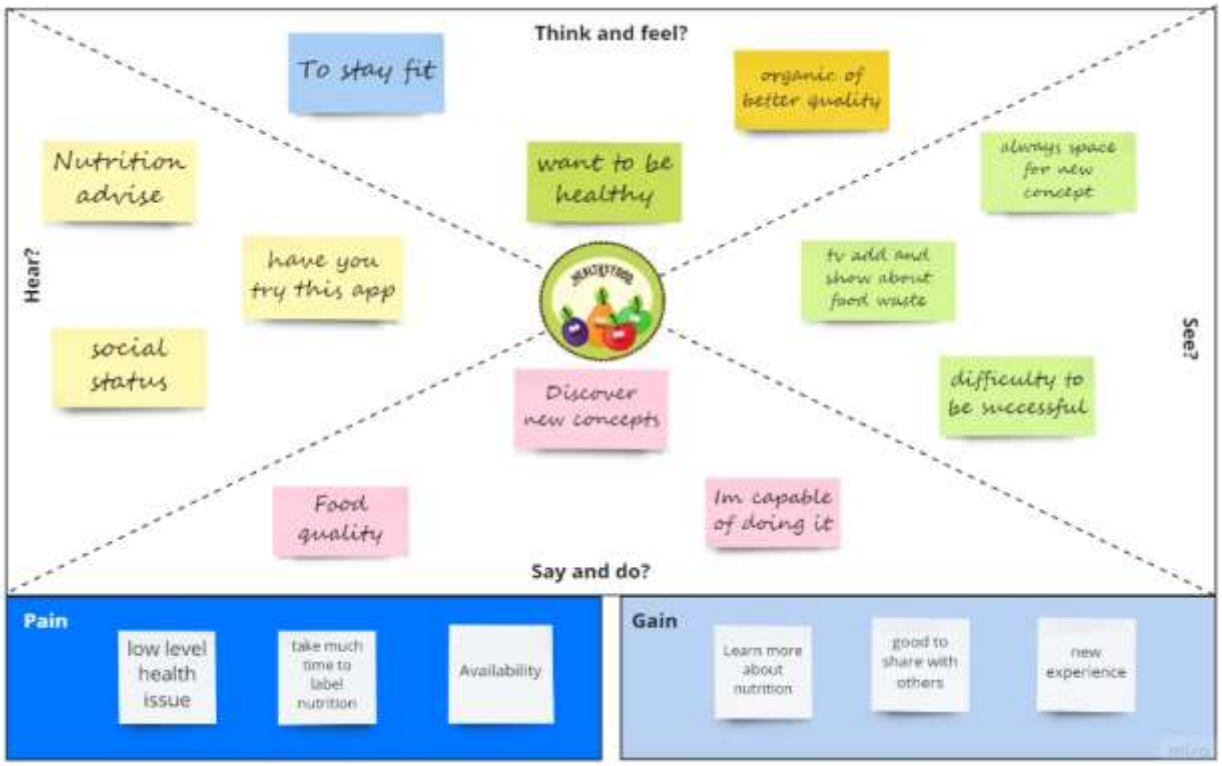
[3]Maria Helena Baenade Moraes LopesaDantonDiegoFerreirabAna Claudia Barbosa Honório FerreiraaGiuliano RobertodaSilvacAlethaSilvaCaetanodVitóriaNegriBraze " Use of artificial intelligence in precision nutrition and fitness"14 september 2020

2.3 Problem Statement Definition

The compositional analysis of food provides detailed information about food components such as protein, vitamins, fat, fibers and minerals that are used to comply with regulatory purposes and to provide with an answer to quality control needs throughout the entire food supply chain. There are several methods and technologies that can be used to perform compositional analysis. The choice of the appropriate solution depends on the type of food matrix, the analysis to perform and the method validation. With precision measurement capability and rapid turnaround speeds, our analytical solutions are the preferred option for obtaining the nutritional information required in the food industry.

3. **IDEATION & PROPOSED SOLUTION**

3.1 Empathy Map Canvas

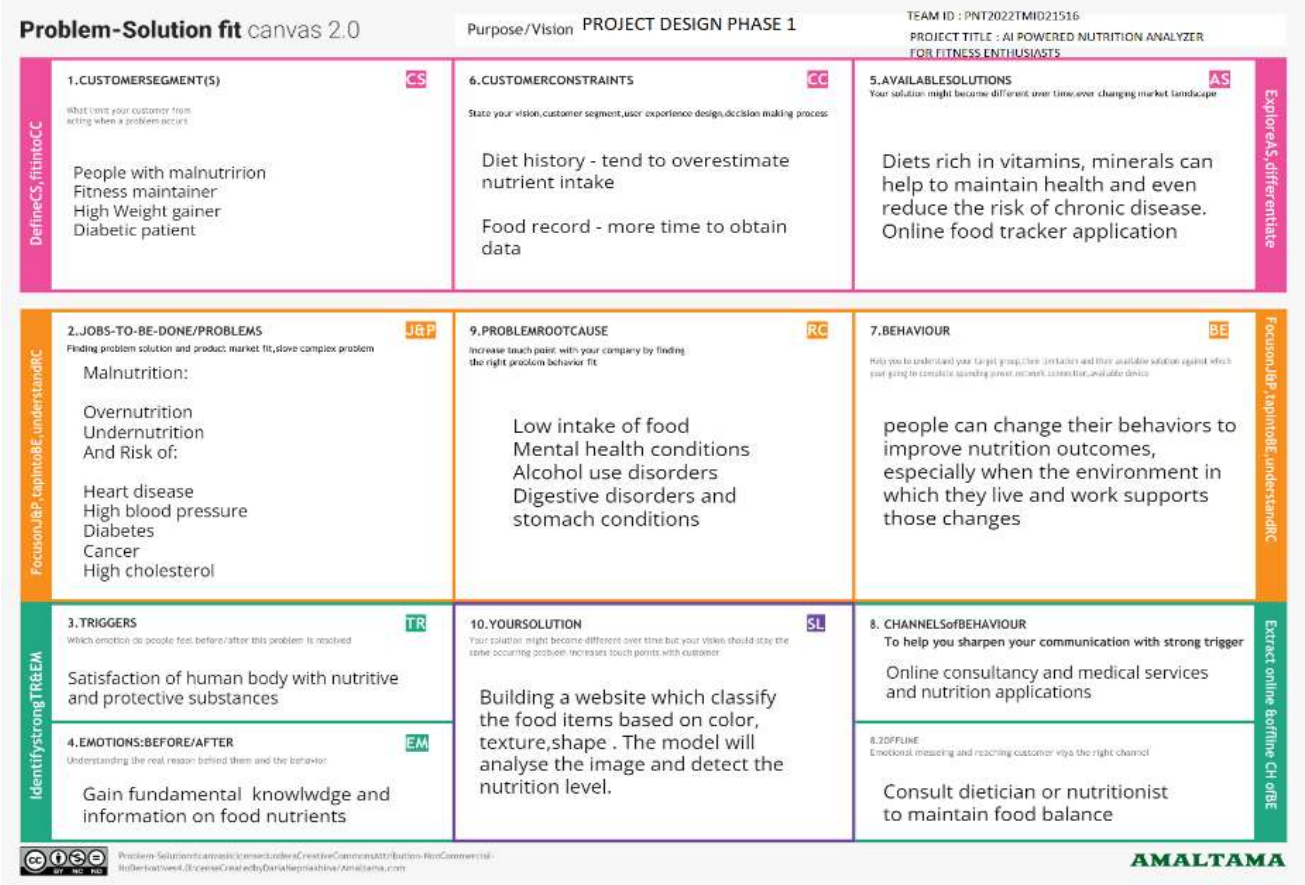


3.2 Ideation & Brainstorming

3.3 Proposed Solution

S.No.	Parameter	Description
1.	ProblemStatement(Problem Solved)	In the world of today, everything should be done in an instant, that is the trend the people follow nowadays.Inthisinstantworld Providing Nutrient-enriched food is more challenging.
2.	Idea/Solution Description	In our project we are going to create a web application in which user import an image and corresponding details of the foodlike nutrients,proteins contents, weights in grams will be displayed.Initially, importing all the necessary dataset contains training and testing models and packages for image data generator, classusing flask application. Then connect the flask with a web application, which shows the result set on the web.
3.	Novelty/Uniqueness	● Recommending nutritional foods based on the customer's daily routine. ● Thecustomercanalsoaddanewrecipetothe givennutritionaldiet. ● Providing the correct amount of nutrition content for a customer.
4.	SocialImpact/CustomerSatisfaction	By providing a health beneficial food, the customer feels healthy and he/she can avoid malnutrition etc.
5.	Business Model(RevenueModel)	● A subscription business model automatically renew the client's access to our services for a specified period. ● provide customers with a timely reminder when their subscription is set to renew. ● Additionally, we must bear in mind the concept of personalization and adjust or advance their programas necessary.
6.	ScalabilityoftheSolution	● Analyzing That All The Needs Of The Customer Are Satisfied. ● System Requirements Are Available To All The Customers.

3.4 Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

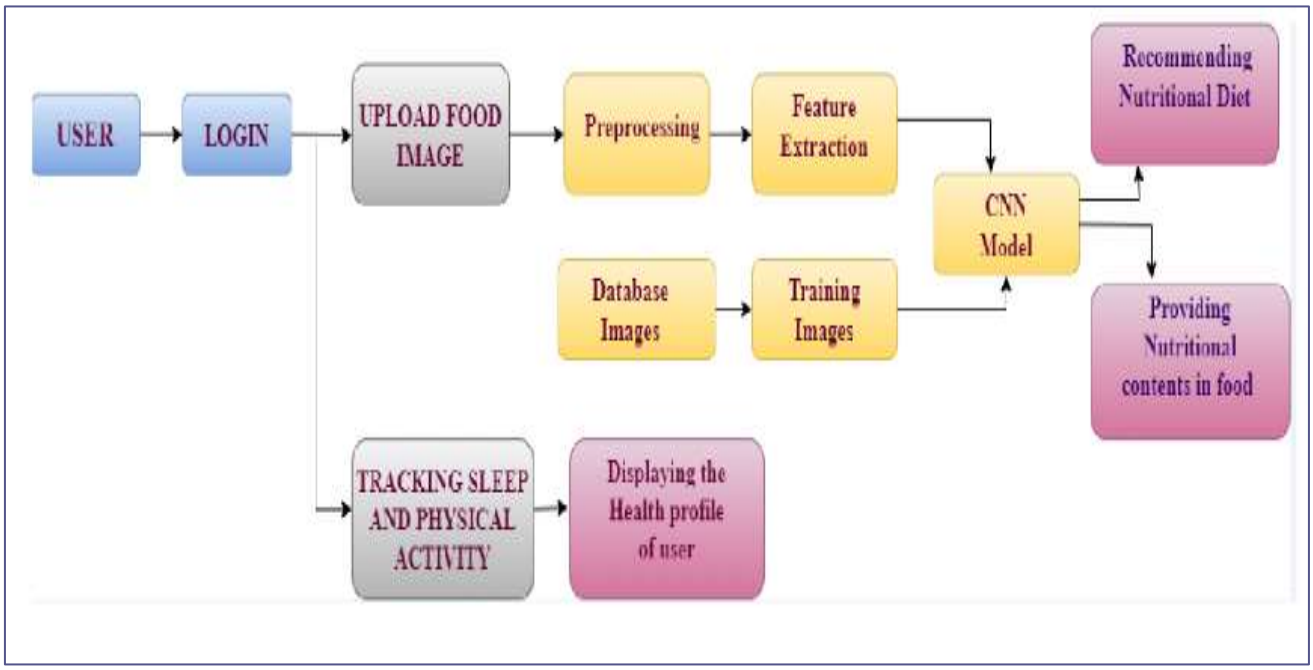
FR No.	FunctionalRequirement(Epic)	SubRequirement(Story/Sub-Task)
FR-1	UserRegistration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	UserConfirmation	Confirmation via Email Confirmation via OTP
FR-3	UserAuthentication	Verify by sending email notification when user tries to login to the system
FR-4	UserInterface	User shall upload images in the link
FR-5	Navigation	User shall be able to move from one page to another
FR-6	Updation	User shall be able to upload all the food images
FR-7	Design	The application will look simple and aesthetic which makes user friendly to work up on with.

4.2 Non-Functional requirements

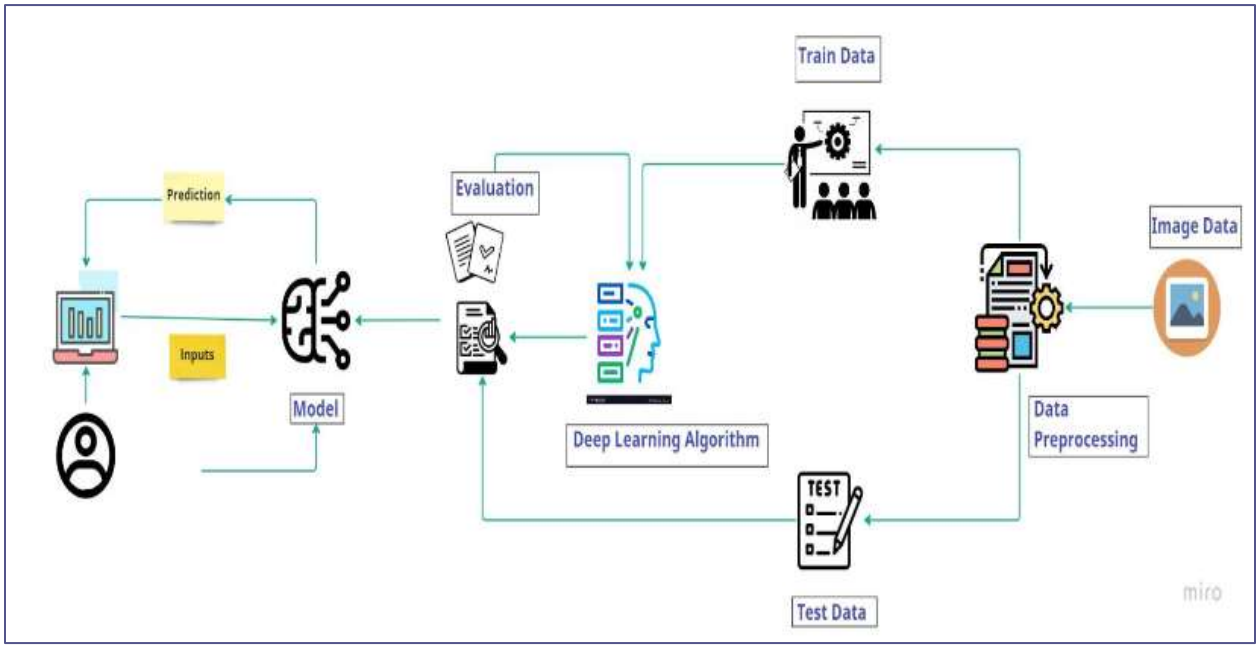
FR No.	Non-FunctionalRequirement	Description
NFR-1	**Usability**	User can easily upload the image by tapping abuttonwith apictureof amagnifyingglassmay open search bar.
NFR-2	**Security**	An application may not grant access until the user creates a strong password. After a certain number of login attempts,a security system may lock an account to protect a user's information
NFR-3	**Reliability**	The system shall perform without failure in 95%of use cases.
NFR-4	**Performance**	The image details will be retrieved within few seconds.
NFR-5	**Availability**	Application will be availableby99%of time
NFR-6	**Scalability**	The system shall support 100+ users at same time

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

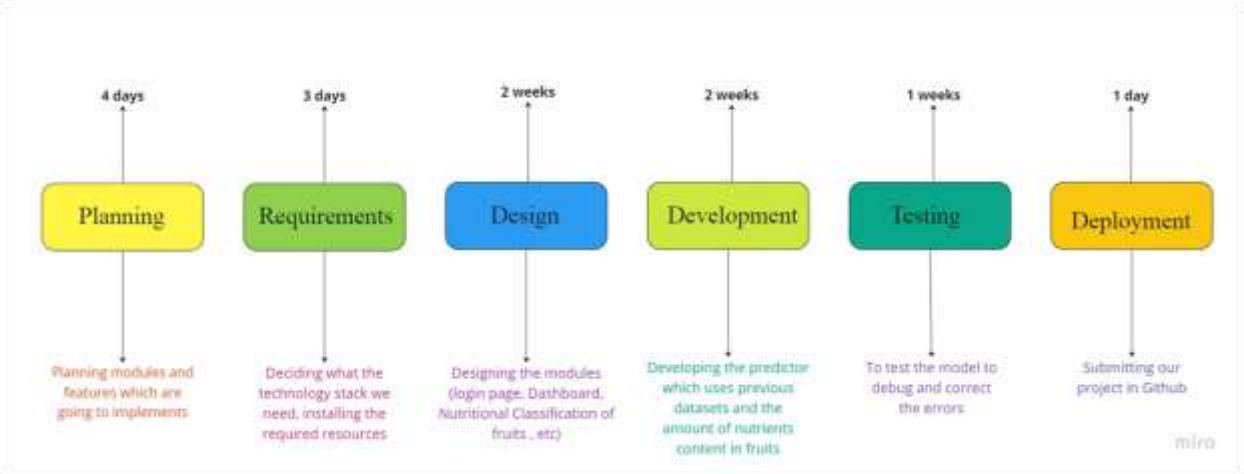


5.3 User Stories

- As a user I can upload food image as input
- As a user I can see upload image box and view my calorie intake by clicking photo of the food
- As a user , i can collect tips based on reviews by recommendation system
- As a user, I can follow some fitness tips and I can maintain weight as required
- As a user, i can monitor my health status and reminder of health status

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation



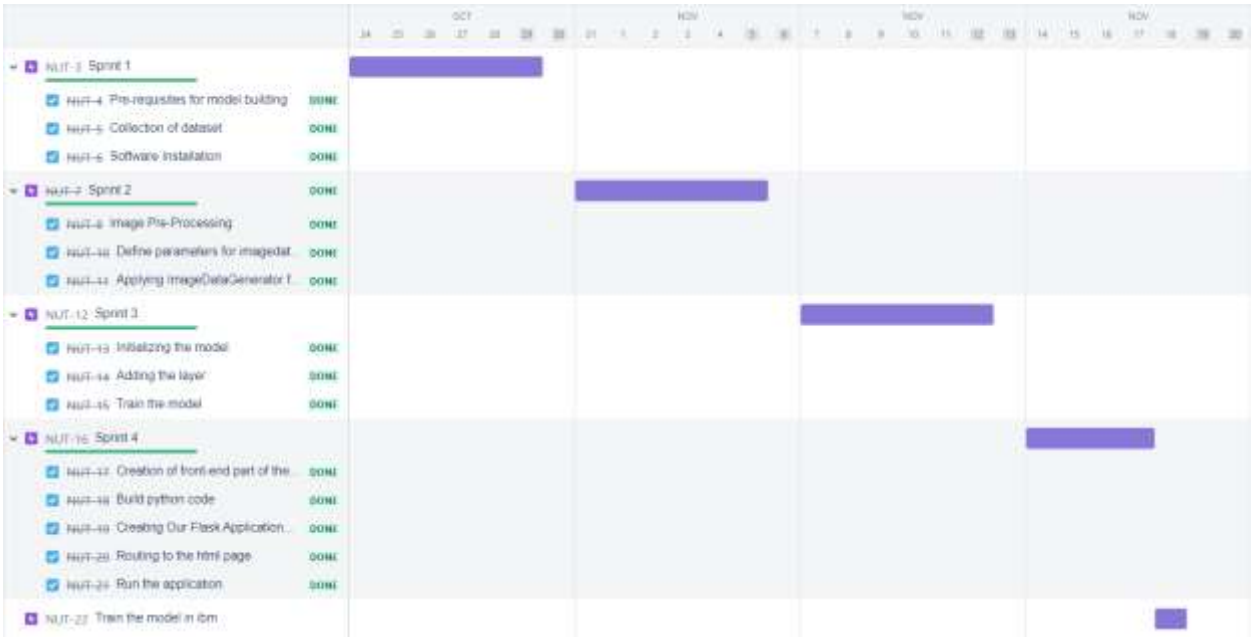
6.2 Sprint Delivery Schedule

UserType	FunctionalRequirement (Epic)	UserStoryNumber	UserStory/Task	Acceptance Criteria	Priority	Release
Customer (Mobileuser)	Registration	USN-1	As a user,I can register for the application by entering my email, password, and confirming my password.	Icanaccessmyaccount/dashboard	High	Sprint-1
		USN-2	As a user,I will receive confirmatione mail 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 t	I can register access the dashboard	Low	Sprint-2
		USN-4	As a user,I can register for the application through Gmail	I can register and access the dashboard with Gmail	Medium	Sprint-1
	Login	USN-5	As a user,I can login the applicationby entering email password	I can login using my email and password	High	Sprint-1
	Dashboard	USN-6	As a user I can upload food image as input	I can use my cameraor my files to upload image	Medium	Sprint-1
		USN-7	As a user I can give my diet details and with that app provides nutrients recommendation	I can enter my information and allow app to access details	High	Sprint-2
Customer (Webuser)	Registration	USN-1	As a user,I can register for the application by entering my email, password, and confirming	I can access my account/dashboard	High	Sprint-1

			my password.			
		USN-2	As a user,I will receive confirmation email once 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	I can register access the dashboard	Low	Sprint-2
		USN-4	As a user,I can register for the application through Email	I can register and access the dashboard with Gmail	Medium	Sprint-1
	Login	USN-5	As a user,I can login the application by entering email password	I can login using my email and password	High	Sprint-1
	Dashboard	USN-6	As a user I can upload food image as input	I can use my camera or my files upload image	High	Sprint-1
		USN-7	As a user I can give my diet details and with that app provides nutrients recommendatio n	I can enter my information and allow app to access details	High	Sprint-2
Customer CareExecutiv e	Mail	USN-1	As a customer care executive,I can access customer's information and to solve their queries and issues	I can access I can access customer's information and to solve their queries and issues	Medium	Sprint-2
Administrator	Dashboard	USN-1	As a admin I can track sleep and physical activity of user	I can trackuser activities	High	Sprint-1

		USN-2	As a admin I can display the health profile user	I can display health profile	Medium	Sprint-2
		USN-3	As a admin I can recommend nutritional content and diet to the user	I Can Provide Nutritional Diet	High	Sprint-2

6.3 Reports from JIRA



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

7.1 Create html pages:

Home.html

Imageprediction.html

7.2 Build python code

Import the necessary libraries such as flask, numpy, tensorflow.

```
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
```

```
C:\Users\sujatha.k>pip install flask
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: flask in c:\users\sujatha.k\appdata\roaming\pyt
```

```
C:\Users\sujatha.k>pip install tensorflow
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: tensorflow in c:\users\sujatha.k\appdata\roaming
```

```
C:\Users\sujatha.k>pip install numpy
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: numpy in c:\users\sujatha.k\appdata\roaming\python\python39\site-packages (1.23.4)
WARNING: You are using pip version 21.2.3; however, version 22.3.1 is available.
You should consider upgrading via the 'C:\Program Files\Python39\python.exe -m pip install --upgrade pip' command.
```

7.3 Creating our flask application and loading our model by using load_model method

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

7.4 Routing to the HTML page

Here, the declared constructor is used to route to the HTML page created earlier. In the above example, the '/' URL is bound with the home.html function. Hence, when the home page of the webserver is opened in the browser, the HTML page is rendered. Whenever you enter the values from the HTML page the values can be retrieved using the POST Method. Here, "home.html" is rendered when the home button is clicked on the UI

```
@ 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")
```

When “image is uploaded “on the UI, the launch function is executed

```
@ app.route('/predict' ,methods=['GET','POST']) # route to show the pr
def lanuch():
```

It will take the image request and we will be storing that image in our local system then we will convert the image into our required size and finally, we will be predicting the results with the help of our model which we trained and depending upon the class identified we will showcase the class name and its properties by rendering the respective html pages.

```
@ app.route('/predict' ,methods=['GET','POST']) # route to show the pr
def lanuch():
    if request.method=='POST':
        f=request.files['file'] # requesting the file
        basepath=os.path.dirname('__file__') #storing the file directo
        filepath=os.path.join(basepath,"uploads",f.filename) #storing
        f.save(filepath) #saving the file

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

        pred=np.argmax(model.predict(x), axis=1)
        print("prediction",pred) #printing the prediction
        index=['APPLE','BANANA','ORANGE','PINEAPPLE','WATERMELON']

        result=str(index[pred[0]])
        print(result)
        x=result
        result=nutrition(result)
        print(result)
```

API Integration:

Here we will be using Rapid API. Using RapidAPI, developers can search and test the APIs, subscribe, and connect to the APIs — all with a single account, single API key and single SDK. Engineering teams also use RapidAPI to share internal APIs and microservice documentation.
API used:
The link above will allow us to test the food item and will result the nutrition content present in the food item.

```
def nutrition(index):

    import requests

    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"

    querystring = {"query":index}

    headers = {
    "X-RapidAPI-Key": "85887549f4msh51e7315b280a87ep1f43e0jsn585c940f2ea6",
    "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__":
    # running the app
    app.run(debug=False)
```

7.5 Run the application

- Open the anaconda prompt from the start menu.
- Navigate to the folder where your app.py resides.
- Now type the “python app.py” command.
- It will show the local host where your app is running on http://127.0.0.1.5000/
- Copy that localhost URL and open that URL in the browser. It does navigate to where you can view your web page.
-

```
C:\Users\sujatha.k>cd Downloads\Srivishali application Building

C:\Users\sujatha.k\Downloads\Srivishali application Building>python app.py
```

Then it will run on localhost:5000

```
2022-11-18 17:39:19.926104: I tensorflow/core/platform/cp
h oneAPI Deep Neural Network Library (oneDNN) to use the
 AVX AVX2
To enable them in other operations, rebuild TensorFlow wi
Loaded model from disk
 * Serving Flask app 'app'
 * Debug mode: off
WARNING: This is a development server. Do not use it in a
 * Running on http://127.0.0.1:5000
```

Navigate to the localhost (http://127.0.0.1:5000/) where you can view your web page.

Click on classify button to see the results.

Output screenshots:

8. TESTING

8.1 Test Cases

	Test Scenarios
1	Verify user is able to see home page
2	Verify user is able to navigate between pages.
3	Verify user is able to upload food image to the website.
4	Verify user is able to choose image with with correct file format.
5	Veriify output page is directed after uploading image and the content of the output are correct.

8.2 User Acceptance Testing

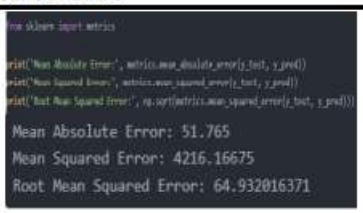
https://docs.google.com/spreadsheets/d/1I-I-qQah-YwUaBeZrZRegtvwhzbDXDHY/edit?usp=sharing&ouid=117526675827824354195&rtpof=true&sd=true

9. RESULTS

9.1 Performance Metrics

Model Performance Testing:

Project team shall fill the following information in the model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Metrics	**Regression Model:** Random Forest MAE - 51.765 MSE -4216.16675 RMSE -64.932016371 Accuracy - 80.43%	
2.	Metrics	Recall,Precision,F1 score Recall:0.66 Precision:1.0 F1_score:0.8	

Screenshots:

Metrics:

1 . Accuracy,Recall,Precision,F1 score

```
[51] from sklearn.metrics import accuracy_score, recall_score, precision_score, f1_score
     print(accuracy_score(labels, predict_x))
     print(recall_score(labels, predict_x))
     print(precision_score(labels, predict_x))
     print(f1_score(labels, predict_x))

     0.8
     0.6666666666666666
     1.0
     0.8
```

2. Mean absolute error:

Mean Squared error:

Root mean Squared error:

```
from sklearn import metrics

print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pred))
print('Root Mean Squared Error:', np.sqrt(metrics.mean_squared_error(y_test, y_pred)))
```

```
Mean Absolute Error: 51.765
Mean Squared Error: 4216.16675
Root Mean Squared Error: 64.932016371
```

10. ADVANTAGES & DISADVANTAGES

Advantages :

- Picture of body identifying benefits of healthy eating for adults.
- May help you get known of our body

- Learns nutrition content of all fruits
- Helps to take correct food depend on body condition
- Lowers risk of occurring disease
- Make our body healthier and gain knowledge on fruit details
- Fitness centers offer a wide range of workout equipment to their users, however, providing their clients with an app that helps them take proper diet

Disadvantages:

- These unhealthy eating habits can affect our nutrient intake, including energy

(or kilojoules) protein, carbohydrates, essential fatty acids, vitamins and minerals as well as fibre and fluid.

- Being overweight
- High blood pressure
- High cholesterol
- Heart disease and stroke
- Type-2 diabetes
- As in our application , we dont have backend connection only stored details may display

11. CONCLUSION

With people becoming conscious about their diets and fitness goals, there is a wide scope of diet and fitness apps thriving in the app world. Therefore, this time is pretty much perfect to create a diet and fitness app of your own and enter the market with a unique idea in order to lure the audience towards your app. For developing a healthcare app, you must be sure of hiring the best team of experts who have prior experience in the same field and can guide you through the development process.

12. FUTURE SCOPE

1.Mindful Eating and Food as Medicine:
The distinction between food and supplements blur as functionalities, such as immune support or gut health, become a priority for consumers.

2.Plant-Based Eating and Alternative Proteins:
Plant-based products accelerated this past year due to demand for healthy food options during the pandemic

3. From Farm to Fork: Food Tech, Origins and Security:

Demand for sourcing transparency combined with unprecedented investment in tech is advancing the ability to trace food from production to consumption.

13. APPENDIX

Source Code:

```
from flask import Flask,render_template,request
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 lanuch():
    if request.method=='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=['APPLE','BANANA','ORANGE','PINEAPPLE','WATERMELON']
        result=str(index[pred[0]])
        print(result)
        x=result
        result=nutrition(result)
        print(result)
        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):
    import requests
    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"
    querystring = {"query":index}
```

```
    headers = {
    "X-RapidAPI-Key": "85887549f4msh51e7315b280a87ep1f43e0jsn585c940f2ea6",
    "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__":
    # running the app
    app.run(debug=False)
```

GitHub & Project Demo Link

Github link

https://github.com/IBM-EPBL/IBM-Project-35238-1660283009

Project demo link :

https://drive.google.com/file/d/1RMIXQTwqzAxfeLDk5FkFklwxUguZodIW/view?usp=sharing