AI POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

DOMAIN: ARTIFICIAL INTELLIGENCE
TEAM ID: PNT2022TMID23315

PROJECT REPORT
submitted by

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1. INRODUCTION

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.

The main aim of the project is to build 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.).

1.2 Purpose

Nutrition Analyzer helps in the detailed and perfect determination of the component nutrients present in any food item. Food components have vast bio metabolic roles and could affect human health severely.

Purpose of the AI powered Nutrition Analyzer is to help individuals who needs a proper nutrition assistant to achieve fitness, to cure diseases through foods or to lead a healthy lifestyle. With the help of Artificial Intelligence, it was possible to achieve a proper nutrition analyser which is capable of showing the nutrition content of the food when we give the picture of it.

2.LITERATURE SURVEY

2.1 Existing Problem

Controlled intake of nutrition is recommended as a condition forbeing a healthy individual. Knowing and monitoring how much food is consumed during the day, following the calorie and nutrition of these foods helps tocontrol healthy nutrition. However, there is no proper assistance to achieve it. Nutritional intake is fundamental to human growth and health, and the intake of different types of nutrients and micro-nutrients can affect health. The content of the diet affects the occurrence of disease, with the incidence of many diseases increasing each year while the age group at which they occur is gradually decreasing. The consumption of a wide variety of food items is necessary in order for the human body to obtain the right amounts of nutrients. Failing to follow such a well- balanced diet, in combination with a generally unhealthyway of living, has been shown to increase the risk for cardiovascular disease, type II diabetes and some forms of cancer.

2.2 References

1."Approximate Estimation of the Nutrition's of Consumed Food by Deep Learning" by İbrahim Berkan Aydilek Published in 2017 International Conference on Computer Science and Engineering (UBMK), IEEE, 2017.

2."Validation of a deep learning system for the full automation of bite and meal duration analysis of experimental meal videos"D Konstantinidis, K Dimitropoulos, B Langlet, PDaras… - Nutrients, 2020

3."Precision Nutrient Management Using Artificial Intelligence Based on Digital Data Collection Framework" by Hsiu-An Lee, Tzu-Ting Huang, Lo-Hsien Yen, Pin-Hua Wu, Kuan-Wen Chen, Hsin-Hua Kung, Chen-Yi Liu and Chien-Yeh Hsu Appl.Sci.2022,12,4167

4."AI Nutrition Recommender System" by Thamos Theodoridis, Vassilios Solachidis, Kosmos Dimitropoulos, Lazaros Gymnopoulos and Petros Daras in the 12th Pervasive Technologies Related to Assistive Environments Conference

2.3 Problem Statement Definition

Ideal situation:

Ideally, a Nutrition Analyzer is available which will help people in assisting the nutrition analysis and help them in maintaining good health.

Reality:

Currently there is no ideal nutrition analyzer is available. Those which are available, fails to satisfy the needs of the people. Some are not personalized while some are very complicated to be accessed by everyone. Hence, there is no Nutrition analyzer to guide and assist people.

Consequences:

People tend to consume food without the knowledge of nutrition content of the food. This results in nutrition imbalance leading to nutrition deficiencies and diseases.

Proposal:

Our project of Nutrition Analyzer for Fitness Enthusiasts Focus on Developing a simple Nutrition Analyzer which is capable of analyze the nutrition in the food by giving the picture of the food. This is achieved by Artificial Intelligence with Python, Deep learning ,CNN etc..

3.IDEATION AND PROPOSED SOLUTIONS

3.1 Empathy Map Canvas

Empathy mapping is a simple yet effective workshop that can be conducted with a variety of different users in mind, anywhere from stakeholders, individual use cases, or entire teams of people. It can be conducted by many different teams such as design teams, sales, product development or customer service. Essentially, it is an exercise that seeks to get inside the head of the customer as they interact with your product/service.

Nutrition Analyzer does the process of determining the nutritional contet of the food that provides information about chenical composition , processing, quality conntrol and containation of food

The following empathy map helped us to understand the customer needs and their expections and to develop our Nutrition Analyser.

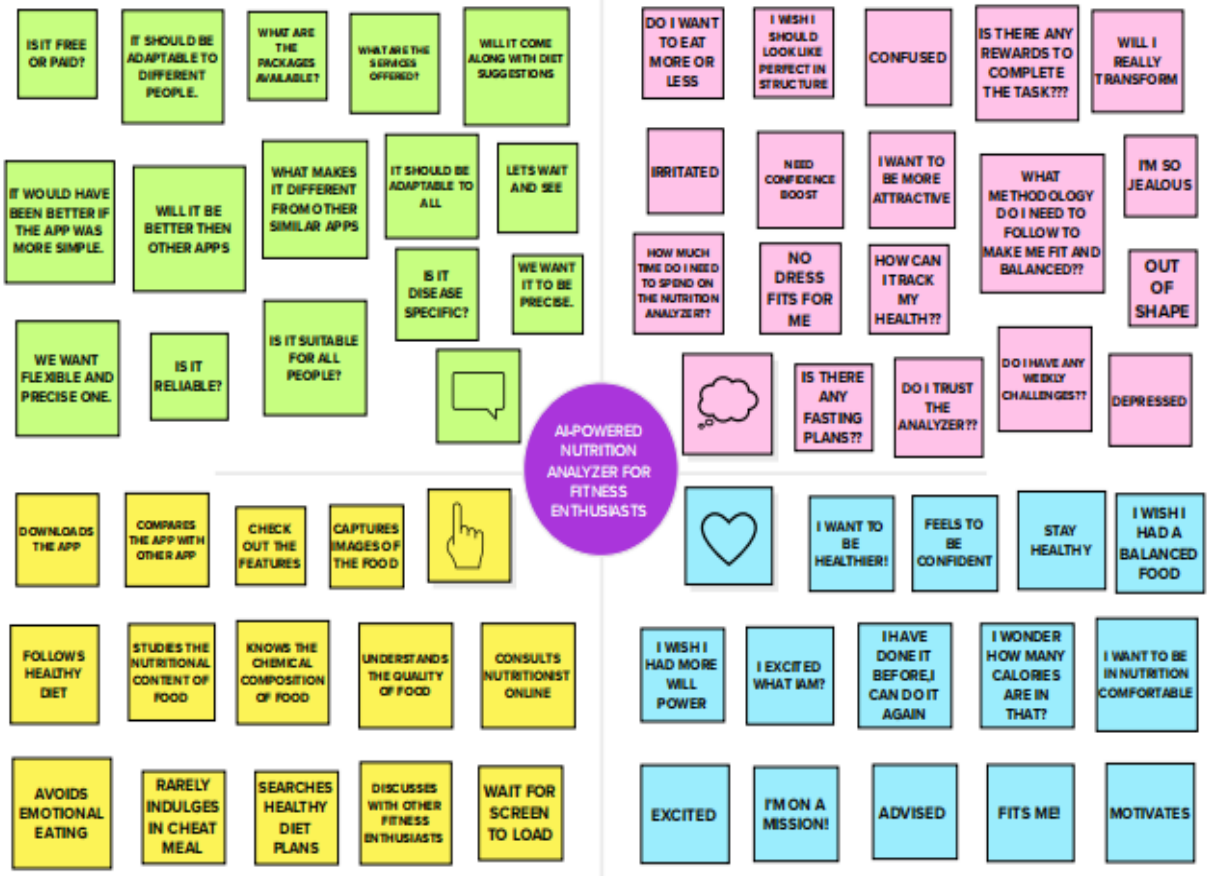
EMPATHY MAP

Says

What have we heard them say? What can we imagine them saying?

Thinks

What are their wants, needs, hopes, and dreams? What other thoughts might influence their behavior?



Does

What behavior have we observed? What can we imagine them doing?

Feels

What are their fears, frustrations, and anxieties? What other feelings might influence their behavior?

3.2 Ideation and Brainstorming

Brainstorming

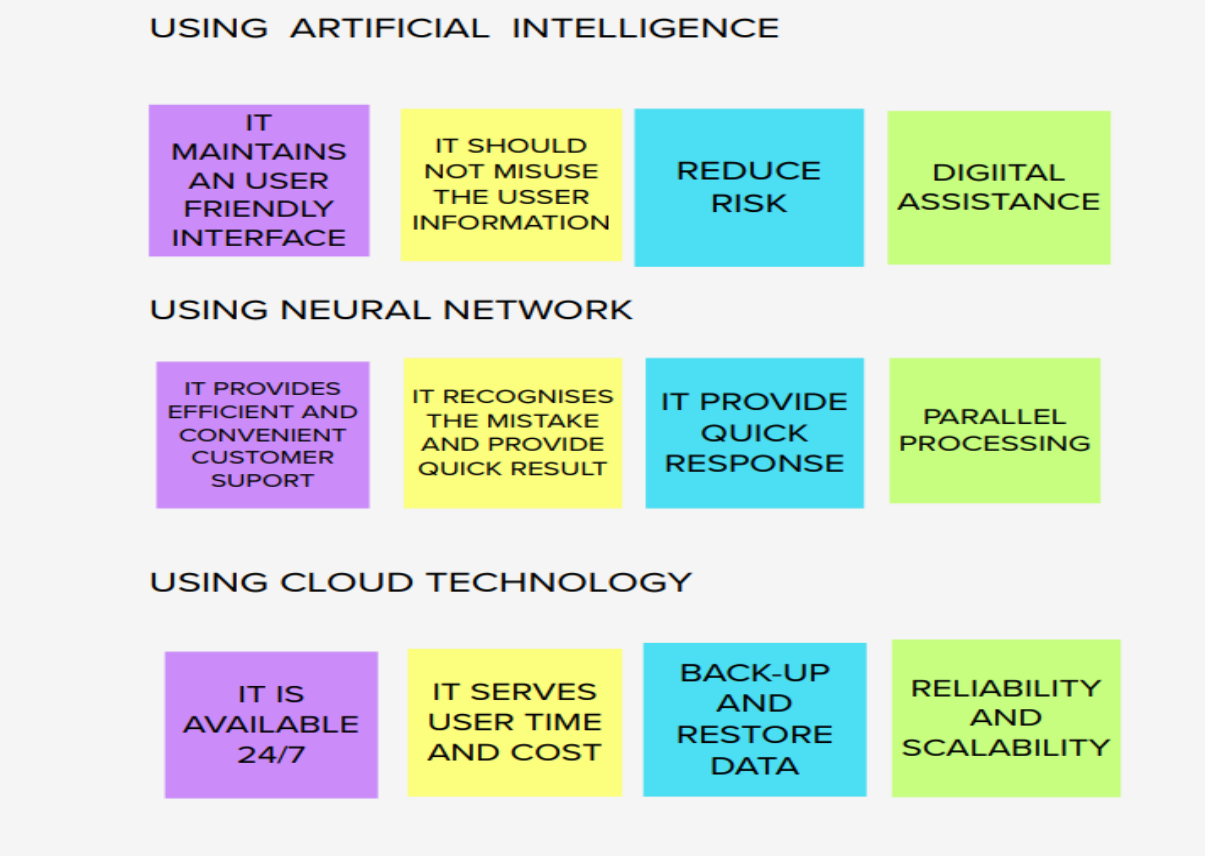
Harish M

Logeshwaran A

Anbarasu A

JanakiRaman R

Group Ideas


USING ARTIFICIAL INTELLIGENCE
IT MAINTAINS AN USER FRIENDLY INTERFACE
IT SHOULD NOT MISUSE THE USSER INFORMATION
REDUCE RISK
DIGIITAL ASSISTANCE
USING NEURAL NETWORK
IT PROVIDES EFFICIENT AND CONVENIENT CUSTOMER SUPORT
IT RECOGNISES THE MISTAKE AND PROVIDE QUICK RESULT
IT PROVIDE QUICK RESPONSE
PARALLEL PROCESSING
USING CLOUD TECHNOLOGY
IT IS AVAILABLE 24/7
IT SERVES USER TIME AND COST
BACK-UP AND RESTORE DATA
RELIABILITY AND SCALABILITY

Priorities


PALEO DIET.
CROSS FIT ENDURANCE TRAINING.
CUSTOMISED GYM WEARS.
GROUP FITNESS COMMUNITY
FITNESS BLOGS.
AWARENESS FOR HEALTHY EATING.
FUN FITNESS GAME
TAKE ENOUGH AMOUNT OF SLEEP.
HEALTHY MEAL KIT DELIVERY SERVICE
JOIN TEAM SPORT.
Build your own Workout
PRACTICE YOGA.
DELICIOUS DIET MEAL RECIPES.
TRACK CYCLIST TRAINING.
AEROBICS TRAININGS.
FITNESS BLOGS.
WEEKLY DETOX.
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Feasibility
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 Proposed Solution

1.Problem Statement

Food is essential for human life and has been the concern of many healthcare conventions. Nowadays it has become even more difficult for people to understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet.

2.Solution Description

In order to guide people to follow healthier eating habits nutrition analyzer has to be introduced. Nutritional analyzer does 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.

3.Novelty/Uniqueness

Consult Online Doctor/ Nutritionist, Research on some websites based on the nutrition and Chat- bots in which we can able to answer all our queries based on importantly in Calories, Nutritional Food content, Diet plans, Balanced food based charts etc.. This also gives the correct solution and answer for the Nutrition to get fit in our life.

4. Social Impact/ Customer Satisfaction

Being Healthy is very important and our project will help those who are trying to maintain their health. There are different food available and there are many undesirable contents in the food. Many people consume them unconsciously. Our project paves way for conscious eating and to control what we eat. This will help many people who are trying to eat according to their body needs like people with health conditions or some people who likes to consume healthy content. This can create a great awareness among the people and help them in many ways.

5.Business Model

The person using nutrition analyzer may avoid spending time and money for nutrition analyst instead by paying the less premium amount can communicate with nutritional specialists and get benefited.

6.Scalability of Solution

AI powered Nutrition Analyzer for fitness provides the clear procedure daily consumption of food maintain a healthy diet. According to their tracking system for the person nutrients intake can increased or decreased.

3.4 Problem-Solution Fit

1.Customer Segments:

Consults on Nutrition

2.Jobs-to-be-done:

- ✓ Healthy diet plan
- ✓ Quality control of food
- ✓ Nutrition rich food recommendations
- ✓ Different nutrition pattern exploration
- ✓ Classification of food based on its nutrients

3.Triggers

To maintain good heath and to regulate their eating. Good intake of foods

4.Emotion Before/After

Before: Depressed, Exhausted, Confused, Tense on body shape
After : Confidence, Delightful, Encouraged, Motivated, Customer became mentally and physically fit

5.Available Solutions

- ➤ They can hire a personal nutritionist.
- ➤ They can consult dietitians
- ➤ They can use apps such as My Fitness Pal, Chronometer, Life Sum, etc...

6.Customer

Lack of kowledge on understanding everything and go beyond onn calorie counting, scared on getting help from the resources on anlayzer, whether the premiun amount for the premium is acceptable for the customers.

7. Behaviour

Consulting doctors or utritionist, enquiuries about the food to be consumed, refer articles such as magazine, newsapaper, watching excercises and yoga , searching it in websites ,etc.....

8. Channels of Behavior

Refering Articles, Checking websites related on nutrition, Consulting nutritionist on online, etc....

9. Problem Rootcause

- Fast paced lifestyle
- Availability of low quality food
- Nutrition less food
- Improper diet plan
- Lack of health related awareness
- Emotional Eating
- Improper food timings

10. Solution

Food has the power to influence metabolismm and health directly. If food is the reason nutrition is the result, Hence we should give high importance to proper nutritiion. Our project "AI Powered Nutrition Analyzer" helpspeople to get to know the nutrition content in their food and improve body health.

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

Following are the functional requirements for the proposed solution.

<table>
<tr><td>FR NO.</td><td>FUNCTIONAL REQUIREMENTS(EPIC)</td><td>SUB REQUIREMENT(STORY/SUBTASK)</td></tr>
<tr><td>FR-1</td><td>USER REGISTRATION</td><td>□ Registration through Gmail
□ Registration through Mobile Number
□ Registration through Face-book</td></tr>
<tr><td>FR-2</td><td>USER CONFIRMATION</td><td>□ Confirmation via Email
□ Confirmation via OTP</td></tr>
<tr><td>FR-3</td><td>USER DETAILS</td><td>PERSONAL DETAILS FOOD DETAILS<table><tr><td>Age</td><td>Food</td></tr><tr><td>Height</td><td>Recipe</td></tr><tr><td>Weight</td><td>Added ingredients</td></tr><tr><td>Diseases if any</td><td>Age</td></tr><tr><td>Conditions is any</td><td></td></tr><tr><td>Allergies is any</td><td></td></tr></table></td></tr>
<tr><td>FR-4</td><td>USER REQUIREMENTS</td><td>□ The user simply inputs your recipe ingredients and amounts. The software will instantly produce an accurate readout of your dish in terms of nutritional analysis in a readable format that consumers are familiar with.
□ With already given details the system can alert the consumer if any content of their allergies ,it can alert the consumer</td></tr>
</table>

4.2 Non Functional Requiurements

Following are the functional requirements for the proposed solution.

FR.NO	NON-FUNCTIONAL REQUIREMENTS	DESCIPTION
NFR-1	USABILITY	➤ No training is required to access the Nutrition Analyzer. ➤ The results should be loaded within 30 seconds. ➤ It should be user friendly and comfortable. ➤ It should be simple and easy to use. ➤ The results should be self explanatory so that it can be understood by common people.
NFR-2	SECURITY	➤ AI powered nutrition analyzer for fitness should contain more security in which our data which entered or maintained should be more security. ➤ With the help of the username and password it provides more security in which it can access more securable and the data are private. ➤ It should be social-economic which should access to sufficient and safe to use.
NFR-3	RELIABILITY	➤ It is Important that the AI powered nutrition analyzer for fitness provides should Must reliable. ➤ How a person can find it is reliable? It is easy to find that is he/she can compare the

		nutrition based food with other nutrition related application so, it can easily rectify whether it is reliable or not. ➤ But it take too much time, to avoid this a reliable application should made in which it itself produces whether we can get correct solution or not. So, it is necessary that the AI powered nutrition analyzer for fitness should have proper data and information in which we can get a correct information about it and also get a proper guidance about it. ➤ With the proper guideness and proper information in which we can get a nutrition properly and we can have get a proper fitness plan. ➤ It should also provides the information on nutrition and health which it should prevent from health information on diseases, health risks and prevention guidelines. It should also provides an extension a research based online learning network with several resource areas, so it provides more reliability in that area. For more reliable it can also contains the calorie information, balanced diet plans, what type food can consumed at what time etc..... So, by this way it can reliable.
NFR-4	PERFORMANCE	➤ It should provide more number of users to consume at any time and at any place. ➤ It should provide Reliability, Scalability, Security and Usability. ➤ It should contain minimum data while over-paging the websites or application and it is necessary that it should not exceed more than 20mb.

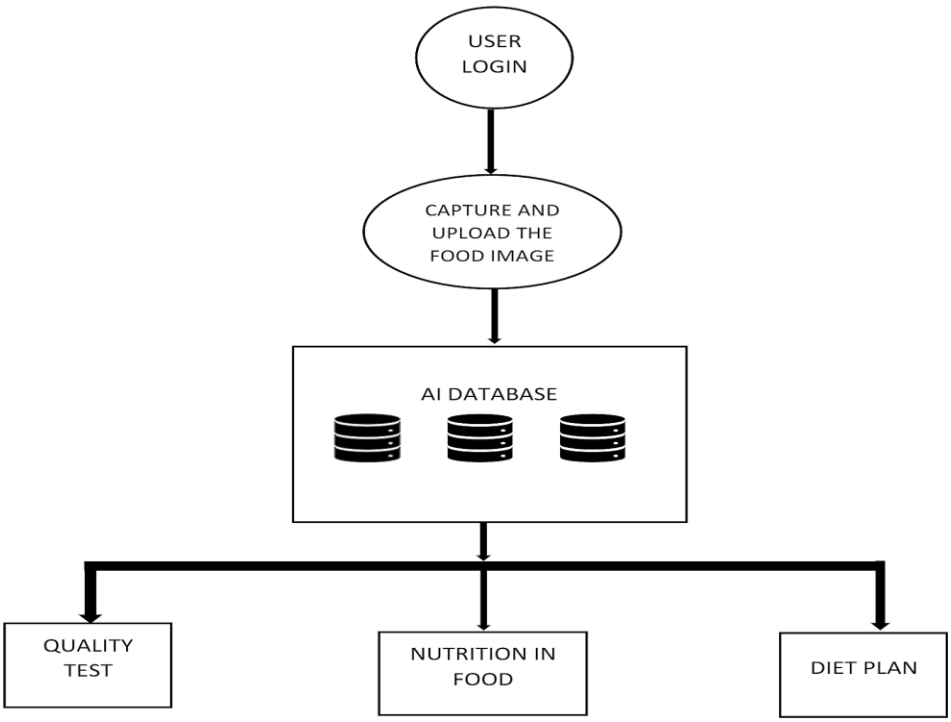
		➤ While consuming the page it should provide the response as much as possible without any delay or time traffic. ➤ The connection should e properly maintained so that it can use while travelling or in remote places. ➤ The nutritious food to meet their dietary needs and the food preferences for an active and healthy life. ➤ It should be consistently access, availability and affordability of foods and beverages that promote well-being and prevent from diseases. ➤ It should suitable in all situations that exists to all people, at all times.
NFR-5	AVAILABILITY	➤ Easy to access Data. ➤ Avoids Data redundancy and inconsistency. ➤ Fast and Efficient. ➤ User Friendly.

NFR-6	SCALABILITY	➤ The architecture for AI powered Nutrition Analyzer for fitness provides the clear procedure daily consumption of food and helps the user to maintain a healthy diet. ➤ According to their tracking system implemented in architecture provide the proper mechanism to the every individual of their nutrients intake which can be increased or decreased.The premium amount for analyzer is very much optimum.

5. PROJECT DESIGN

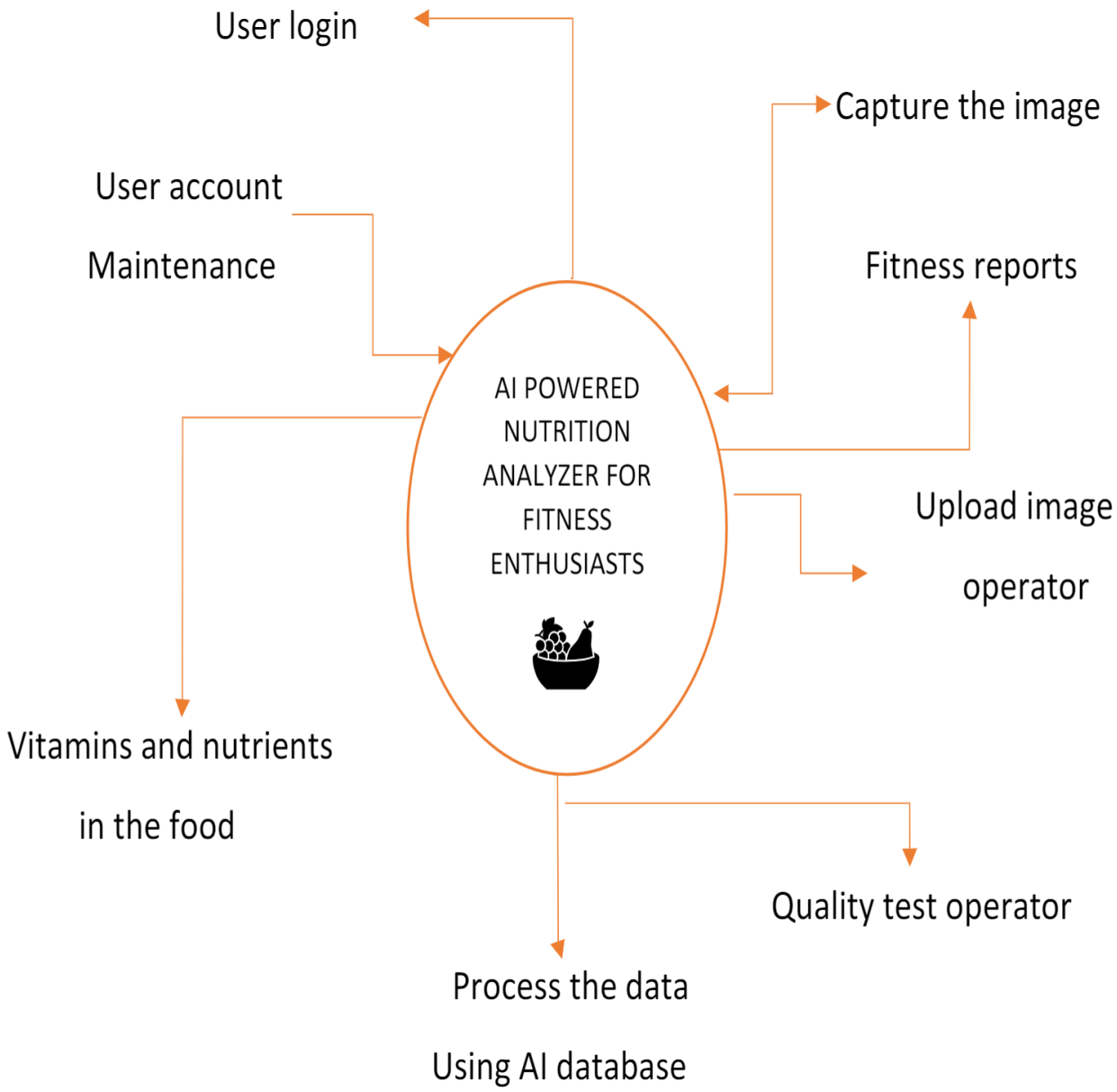
5.1 Data flow diagrams

Simplified Data flow:



1. The applictaion starts from the user login. the user must enter their mail id and the password to use the nutrition analyzer
2. The next step is user shoud capture the food and upload the food in the specified capture image icon.
3. The third step is click the "Analyze Food" and wait for sometime. The AI database process the image.
4. The tool fuguring out image and page automatically give the information about food such that the quality off the food, Nutrition , then issue the diet and fitness plan for the user.

DATA FLOW DIAGRAM LEVEL 0



5.2 Technical and Solution Architecture

Technical Architecture:

ABSTRACT :

- The main aim of the project is to building a model which is used for classifying the fruit, vegetables, spinach, fish, meat, Green leafy vegetables etc….. depends on the different characteristics like colour, shape, texture etc.

- Here the user can capture the images of different fruits, vegetables, spinach, Green leafy vegetables, fish, meat , etc.. 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.).

- 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.

- This solution helps fitness enthusiasts to do Nutritional analysis of food which provides information about the chemical composition, processing, and quality control of food.

- The chance of occurrence of error is minimal since the model provides more precise reports of the analysis.

OBJECTIVES:

- Being healthy should be an integral component of your life. A Healthy intake of food can assist in the prevention of chronic diseases and long-term ailments.

- What you eat is closely related to your health. Eating a healthy diet can help boost your immune systems, help you maintain a healthy weight and can improve your overall health.

- The importance of diet can't be overstated for a healthy lifestyle. People get the vitamins, minerals and nutrients they need to function and thrive from the foods they eat, so choosing foods that offer the most of those components helps improve quality of life.

- It's just as important to limit foods that are high in fat, sugar, sodium and cholesterol as it is to choose healthy foods.

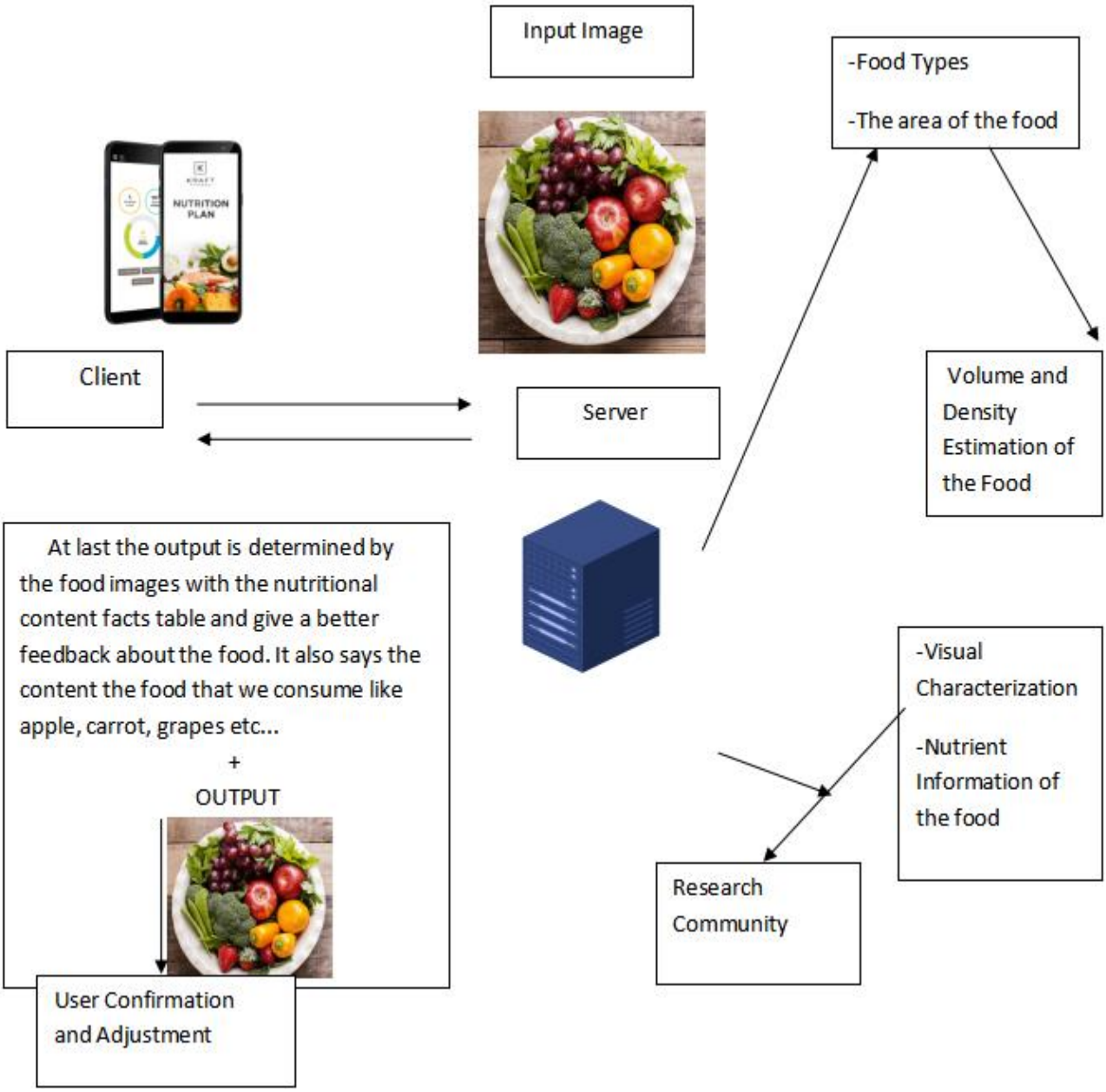
- Nutrition helps in functioning, maintaining, or improving important bio metabolisms like building muscles, producing energy, thriving body cells, improving body health, replenish malnourishment, and strengthening immunity. If food is the reason, Nutrition is the result.

- Consumers have become more concerned over the quality and compositions of their food purchases, the contained ingredients, and the presence of additives and contaminants. Therefore, knowledge of the chemical and biochemical composition of foods is important to the health, well-being, and safety of the consumers.

- We consume food so that we can obtain proper nutrition. Hence it is very important for us to know the composition of nutrients in our food.

- Through a nutrition analyzer we can measure the nutrients and with that information we can make a healthy diet by adding nutrients required for our body and excluding which is not good for health.

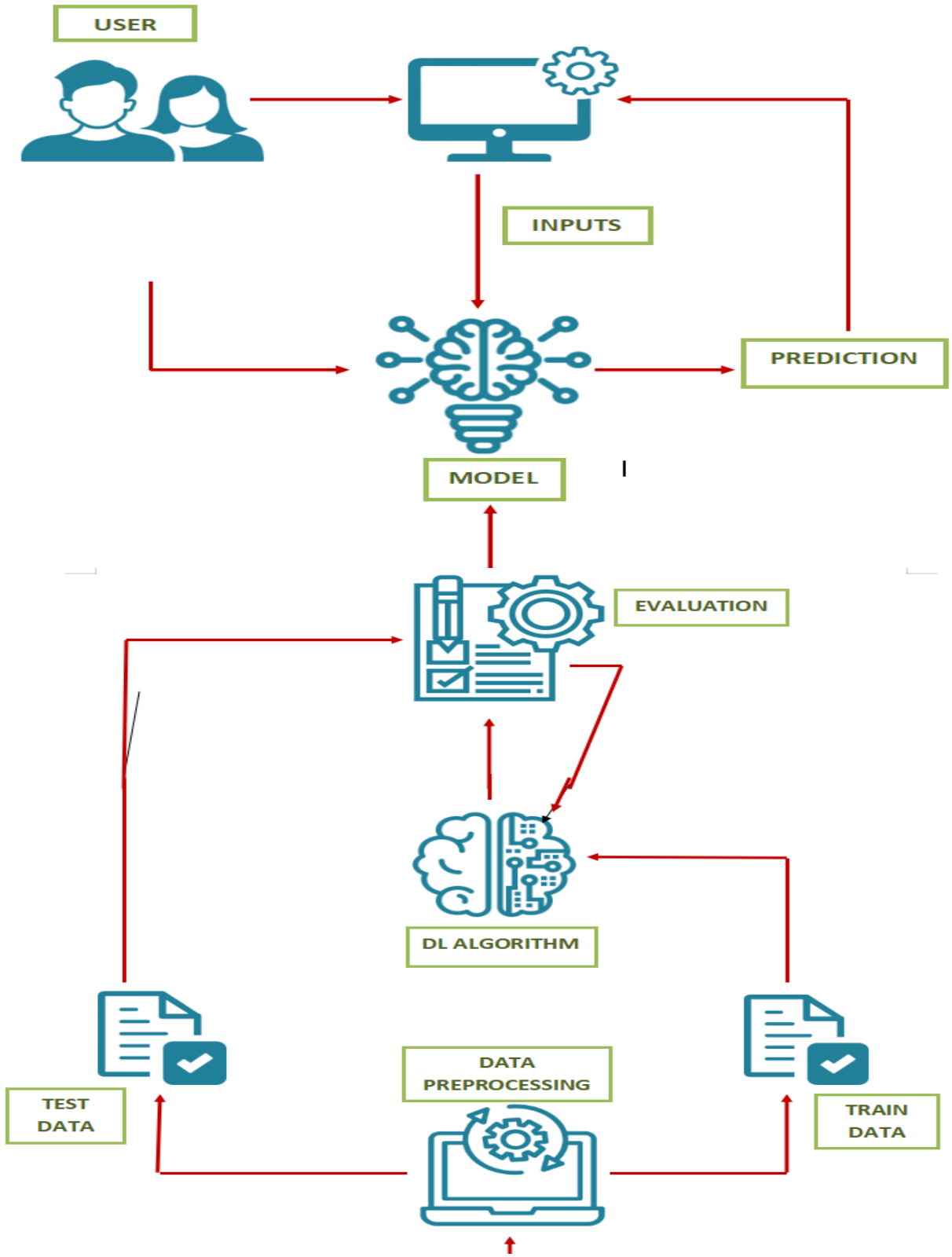
TECHNOLOGY ARCHITECTURE



Solution Architecture:

Being healthy should be an integral component of your life. A Healthy intake of food can assist in the prevention of chronic diseases and long-term ailments. What you eat is closely related to your health. Eating a healthy diet can help boost your immune systems, help you maintain a healthy weight and can improve your overall health. The importance of diet can't be overstated for a healthy lifestyle. People get the vitamins, minerals and nutrients they need to function and thrive from the foods they eat, so choosing foods that offer the most of those components helps improve quality of life. It's just as important to limit foods that are high in fat, sugar, sodium and cholesterol as it is to choose healthy foods.Nutrition helps in functioning, maintaining, or improving important bio metabolisms like building muscles, producing energy, thriving body cells, improving body health, replenish malnourishment, and strengthening immunity. If food is the reason, Nutrition is the result. Consumers have become more concerned over the quality and compositions of their food purchases, the contained ingredients, and the presence of additives and contaminants. Therefore, knowledge of the chemical and Biochemical composition of foods is important to the health, well-being, and safety of the consumers. We consume food so that we can obtain proper nutrition. Hence it is very important for us to know the composition of nutrients in our food. Through a nutrition analyzer we can measure the nutrients and with that information we can make a healthy diet by adding nutrients required for our body and excluding which is not good for health.

- This solution helps fitness enthusiasts to do Nutritional analysis of food which provides information about the chemical composition, processing, and quality control of food.
- The chance of occurrence of error is minimal since the model provides more precise reports of the analysis.
- First, the user captures the images of the food and uploads it.
- Next, the image will be sent to the trained model.
- The model will classify the food based on the different characteristics like colou



RELIABILITY:

- It is Important that the AI powered nutrition analyzer for fitness provides should Must reliable.
- How a person can find it is reliable? It is easy to find that is he/she can compare the nutrition based food with other nutrition related application so, it can easily rectify whether it is reliable or not.
- But it take too much time, to avoid this a reliable application should made in which it itself produces whether we can get correct solution or not. So, it is necessary that the AI powered nutrition analyzer for fitness should have proper data and information in which we can get a correct information about it and also get a proper guidance about it.
- With the proper guidness and proper information in which we can get a nutrition properly and we can have get a proper fitness plan.
- It should also provides the information on nutrition and health which it should prevents from health information on diseases, health risks and prevention guidelines. It should also provides an extension a research based online learning network with several resource areas, so it provides more reliability in that area. For more reliable it can also contains the calorie information, balanced diet plans, what type food can consumed at what time etc..... So, by this way it can reliable.

SCALABILITY:

- The architecture for AI powered Nutrition Analyzer for fitness provides the clear procedure daily consumption of food and helps the user to maintain a healthy diet.
- According to their tracking system implemented in architecture provide the proper mechanism to the every individual of their nutrients intake which can be increased or decreased.
- The premium amount for analyzer is very much optimum.

PERFORMANCE:

- It should provide more number of users to consume at any time and at any place.
- It should provide Reliability, Scalability, Security and Usability.
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- While consuming the page it should provide the response as much as possible without any delay or time traffic.
- The connection should e properly maintained so that it can use while travelling or in remote places.
- The nutritious food to meet their dietary needs and the food preferences for an active and healthy life.
- It should be consistently access, availability and affordability of foods and beverages that promote well-being and prevent from diseases.

- It should suitable in all situations that exists to all people, at all times.

SECURITY:

- AI powered nutrition analyzer for fitness should contain more security in which our data which entered or maintained should be more security.
- With the help of the username and password it provides more security in which it can access more securable and the data are private.
- It should be social-economic which should access to sufficient and safe to use.

USABILITY:

- No training is required to access the Nutrition Analyzer.
- The results should be loaded within 30 seconds.
- It should be user friendly and comfortable.
- It should be simple and easy to use.
- The results should be self explanatory so that it can be understood by common people.

5.3 User Stories

Functional Requirement (Epic)	User Story Number	User Story / Task
Data Collection & Image Processing		
	USN-1	Collect images of different food items organized into subdirectories based on their respective names
	USN-2	Import and configure the Image data generator library from Keras
	USN-3	Apply Image data generator functionality to training set and testing set
	USN-4	Improving the image data that suppresses unwilling distortions or enhances some image features important for further processing
Model Building & Testing		
	USN-5	Importing the model building libraries and Initializing the model
	USN-6	Adding CNN layers, Dense layers & other necessary layers and Compile the model
	USN-7	Train & Test the model based on the image dataset
Application building		
	USN-8	Create HTML pages to design the front-end part of the web page
	USN-9	Create the flask application and loading the model file
	USN-10	Routing to the HTML page and Running the application
Cloud integration		
	USN-11	Train the model on Cloud

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

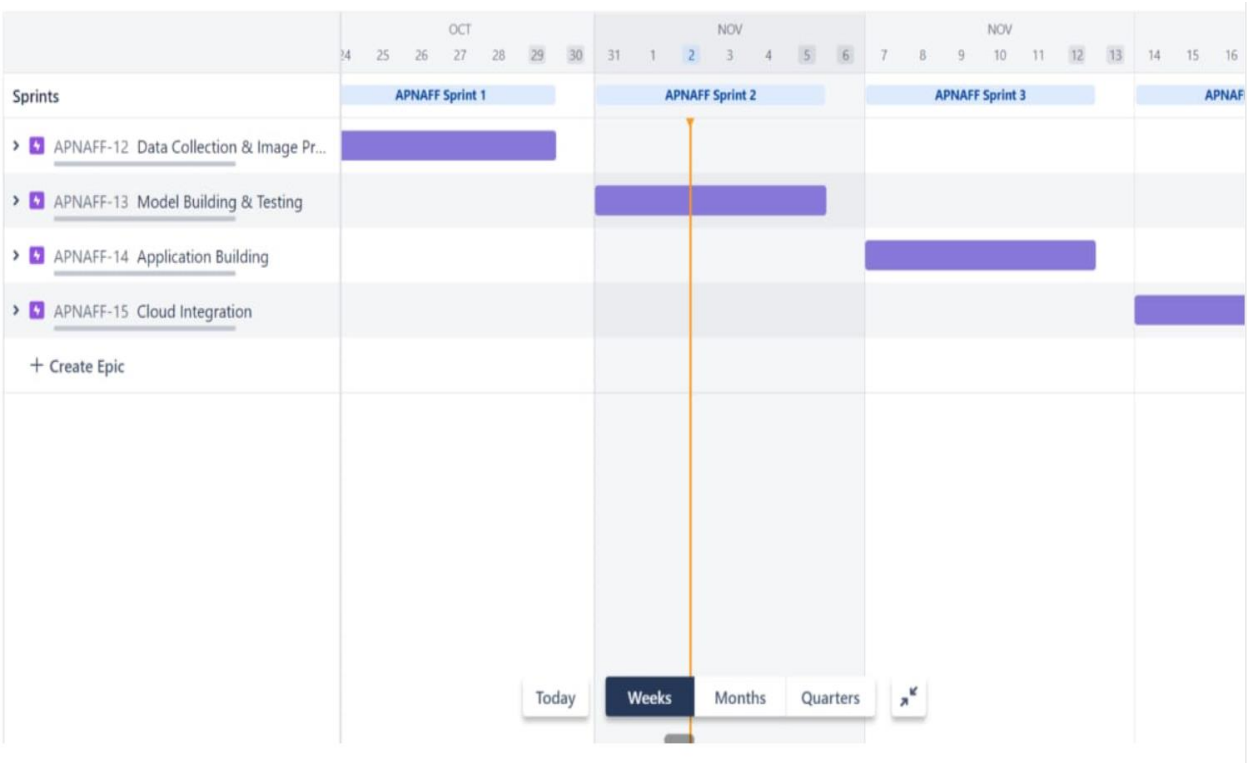
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	**Data Collection &** **Image Processing**					
Sprint-1		USN-1	Collect images of different food items organized into subdirectories based on their respective names	3	Medium	Thenmozhi
Sprint-1		USN-2	Import and configure the Image data generator library from Keras	3	Medium	Subhashini
Sprint-1		USN-3	Apply Image data generator functionality to training set and testing set	5	High	Sneha
Sprint-1		USN-4	Improving the image data that suppresses unwilling distortions or enhances some image features important for further processing	3	Medium	Sumithrajothi
Sprint-2	**Model Building & testing**					
Sprint-2		USN-5	Importing the model building libraries and Initializing the model	5	High	Thenmozhi

Sprint-2		USN-6	Adding CNN layers, Dense layers & other necessary layers and Compile the model	5	High	Subhashini
Sprint-2		USN-7	Train & Test the model based on the image dataset	3	Medium	Sneha
Sprint-3	**Application building**					
Sprint-3		USN-8	Create HTML pages to design the front-end part of the web page	5	High	Sumithrajothi
Sprint-3		USN-9	Create the flask application and loading the model file	5	High	Thenmozhi
Sprint-3		USN-10	Routing to the HTML page and Running the application	5	High	Subhashini
Sprint-4	**Cloud integration**					
Sprint-4		USN-11	Train the model on Cloud	5		Sneha, Sumithrajothi

6.2 Sprint Delivery Schedule

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA



7. CODING & SOLUTIONING

7.1. Feature 1

- AI-powered Nutrition Analyzer for Fitness Enthusiasts
- 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.).
- Languages: Python
- Tools/IDE: Google Collaboratory, JupyterNotebook
- Libraries: Recommendation

```
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.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=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']

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

        x=result
        print(x)
        result=nutrition(result)
        print(result)

        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):


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

    querystring = {"query":index}

    headers = {
        'x-rapidapi-key': "5d797ab107mshe668f26bd044e64p1ffd34jsnf47bfa9a8ee4",
        '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)
```

7.1. Feature 2

home.html

```
<!DOCTYPE html>
                    <html>
                    <head>
                    <meta charset="UTF-8">
                    <meta name="viewport" content="width=device-width, initial-scale=1.0">
                    <meta http-equiv="X-UA-Compatible" content="ie=edge">
                    <title>Home</title>
                    <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
<script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js">
</script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
                    <script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
                    <link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
                    <style>
                    body
                    {
                    background-image: url("https://img.freepik.com/free-photo/top-view-healthy-balanced-vegetarian-food_1150-37023.jpg?si
                    background-size: cover;
                    background-repeat: no-repeat;
                    background-attachment: fixed;
                    background-size: 100% 100% ;
                    }
                    .bar
                    {
                    margin: 0px;
                    padding:5px;
                    background-color: #c0df84;
                    color:black;
                    font-family:'Roboto',sans-serif;
                    font-style: italic;
                    border-radius:20px;
                    font-size:25px;
                    text-align:center;
                    width: 400px;
                    }
                    h3
                    {
                    margin: 0px;
```

```
padding:5px;
background-color:#c0df84;
width: 400px;
color:#00000;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:15px;
}
a
{
color:#c0df84;
float:center;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
}
.div1{
  background-color: lightgrey;
  width: 500px;
  border: 10px solid peach;
  padding: 20px;
  margin: 20px;
  height: 500px;
}




.header {position: relative;
                                    top:0;
                                    margin:0px;
                                    z-index: 1;
                                    left: 0px;
                                    right: 0px;
```

```
                                position: fixed;
                                background-color: #8B008B ;
                                color: white;
                                box-shadow: 0px 8px 4px grey;
                                overflow: hidden;
                                padding-left:20px;
                                font-family: 'Josefin Sans'
                                font-size: 2px;
                                width: 100%;
                                height:8%;
                                text-align: center;
                        }
                        .topnav {
  overflow: hidden;
  background-color: #FCAD98;
}

.topnav-right a {
  float: left;
  color: black;
  text-align: center;
  padding: 14px 16px;
  text-decoration: none;
  font-size: 10px;
}

.topnav-right a:hover {
  background-color: #FF69B4;
  color: black;
}

.topnav-right a.active {
  background-color: #DA70D6;
  color: black;
}

.topnav-right {
  float: right;
  padding-right:100px;
}
</style>
</head>
<body>
```

```
<!--Brian Tracy-->


<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:black; padding-top:1%;
padding-left:5%;">Nutrtion Image Analysis</div>
  <div class="topnav-right"style="padding-top:0.5%;">


  <a class="active" href="{{ url_for('home')}}">Home</a>
  <a   href="{{ url_for('image1')}}">Classify</a>
  </div>
</div>
</div>
<br>
<br>
<br>
<br>
<br>
<br>
<br>
<br>
<h1>

<center>


<h3>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. It ensures compliance with trade and food laws.</h3>

</center>



</h1>
</body>
</html>
```

image.html

```
<div style="float:left">
                                        <br>
                                        <br>
                                        <h5><font color="black" size="3" font-family="sans-serif">
                                        <b>Upload image to classify</b></font></h5><br><br>

                                        <div>
                                        <form id="upload-file" method="post" enctype="multipart/form-data">
                                        <label for="imageUpload" class="upload-label">
                                                Choose...
                                            </label>
                                        <input type="file" name="file" id="imageUpload" accept=".png, .jpg, .jpeg">
                                           </form>


                                          <center> <div class="image-section" style="display:none;">
                                          <div class="img-preview">
                                          <div id="imagePreview">
                                          </div></center>
                                          </div>
                                          <center><div>
                                          <button type="button" class="btn btn-primary btn-lg "
                                        id="btn-predict">Classify</button>
                                          </center></div>
                                          </div>


                                          <div class="loader" style="display:none;margin-left: 450px;"></div>


                                          <h3 id="result">


                                          <span><p style="padding-top: 25px;"><h4>Food Classified is : <h4><b><u>{{showcase}}{{showcase1}}<
                                           </h3>


                                        </div>
                                        </div>
```

ɪmagePrediction.html

```
!DOCTYPE html>
                                <html>
```

```
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>Predict</title>
<link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
<script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js">
</script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
<script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js">
</script>
<link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
<style>
body
{
   background-image: url("https://i.pinimg.com/originals/be/21/1a
/be211ad5043a8d05757a3538bdd8f450.jpg");
   background-size: cover;
}
.bar
{
margin: 0px;
padding:20px;
background-color:white;
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:15px;
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
```

```
padding-left:10px;
}
.div1{
  background-color: lightgrey;
  width: 500px;
  border: 10px solid peach;
  padding: 20px;
  margin: 20px;
  height: 500px;
}




.header { position: relative;
                                    top:0;
                                    margin:0px;
                                    z-index: 1;
                                    left: 0px;
                                    right: 0px;
                                    position: fixed;
                                    background-color: #8B008B ;
                                    color: white;
                                    box-shadow: 0px 8px 4px grey;
                                    overflow: hidden;
                                    padding-left:20px;
                                    font-family: 'Josefin Sans';
                                    font-size: 2vw;
                                    width: 100%;
                                    height:8%;
                                    text-align: center;
                          }
                          .topnav {
  overflow: hidden;
  background-color: #FCAD98;
}

.topnav-right a {
  float: left;
  color: black;
  text-align: center;
  padding: 14px 16px;
```

```
  text-decoration: none;
  font-size: 18px;
}

.topnav-right a:hover {
  background-color: #FF69B4;
  color: black;
}

.topnav-right a.active {
  background-color: #DA70D6;
  color: black;
}

.topnav-right {
  float: right;
  padding-right:100px;
}
</style>
</head>
<body>
<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:black; padding-top:1%;padding-left:5%;">Nutrtion Imag
  <div class="topnav-right"style="padding-top:0.5%;">

    <a href="{{ url_for('home')}}">Home</a>
    <a  class="active" href="{{ url_for('image1')}}">Classify</a>
  </div>
</div>
<br>


</div>
<div class="container">
<center>
<div id="content" style="margin-top:2em"></div></center>
</div>
</body>

<footer>
<script src="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
</footer>
</html>
```

0.html

```
<html lang="en" dir="ltr">
                                        <head>
                                        <style>


                                        </style>
                                        <meta charset="utf-8">
                                        <title>Nutrition Image Analysis</title>
                                        <link rel="shortcut icon" href="{{ url_for('static',
filename='diabetes-favicon.ico') }}">
<link rel="stylesheet" type="text/css" href="{{ url_for('static',
filename='style.css') }}">
<script src="https://kit.fontawesome.com/5f3f547070.js"
crossorigin="anonymous"></script>
<link href="https://fonts.googleapis.com/css2?family=
Pacifico&display=swap" rel="stylesheet">
                                                </head>


                                                        <!-- Result -->
                                                        <div class="results">
<p style="padding-top: 150px; color:blue;"><h4
style="color:blue;">Food Classified is: <h4><b><h4
style="color:red;"><u>{{showcase1}}<h4><br><h4
style="color:red;"><u>{{showcase}}<h4></p>


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

8. TESTING

```
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model=load_model('train.h5')
model=load_model('dataset.h5')
model=load_model('nutrition.h5')
img=image.load_img(r"/content/drive/MyDrive
/CNN/Dataset/TEST_SET/PINEAPPLE/125_100.jpg")
img
```

```
img=image.load_img(r"/content/drive/MyDrive
/CNN/Dataset/TEST_SET/PINEAPPLE/125_100.jpg",
target_size=(64,64))
img
```

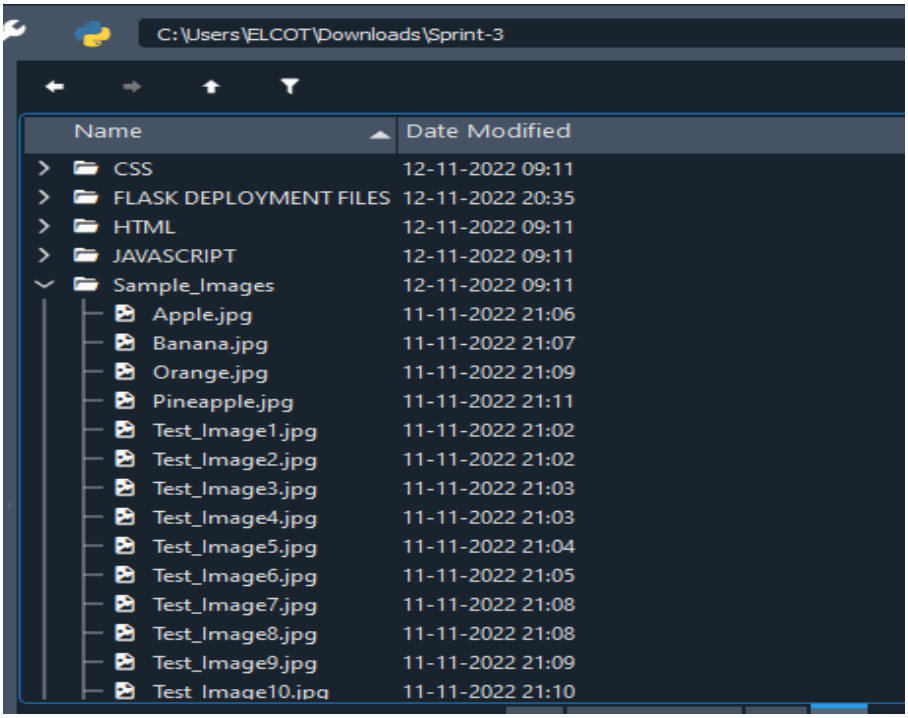
```
x=image.img_to_array(img)
x
array([[[[255., 255., 255.],
         [255., 255., 255.],
         [255., 255., 255.],
         ...,
         [255., 255., 255.],
         [255., 255., 255.],
         [255., 255., 255.]],

        [[255., 255., 255.],
         [255., 255., 255.],
        [255., 255., 255.],
         ...,
```

```
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],
...,

       [[255., 255., 255.],
  [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

  [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]]]], dtype=float32)
x=np.expand_dims(x,axis=0)
```

```
[[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]]], dtype=float32)
pred = model.predict
pred
array
([[[0.25227112, 0.17414774, 0.15219809, 0.20493415, 0.21644896],
 [0.26760292, 0.1759095 , 0.15206912, 0.19424875, 0.21016978],
 [0.26474723, 0.165203  , 0.14452063, 0.20434381, 0.2211853 ],
       ...,
 [0.24550524, 0.1721549 , 0.16282505, 0.21065485, 0.20885986],
 [0.25395462, 0.1735253 , 0.16055605, 0.20655352, 0.20541045],
 [0.24495909, 0.15889102, 0.16927534, 0.20705006, 0.21982446]],
  dtype=float32
<bound method Model.predict of <keras.engine.
sequential.Sequential object at 0x7f94abfd7c10>>
predict_x=model.predict(x_test)


classes_x=np.argmax(predict_x,axis=1)
classes_x
array([0, 0, 0, ..., 0, 0, 0])
x_test.class_indices
index=['APPLE','BANANA','ORANGE','WATERMELON','PINEAPPLE']
result=str(index[classes_x[0]])
result
```

'Pineapple'

8.1 TEST CASES



8.2 USER ACCEPTANCE TESTING






APPLE BANANA ORANGE PINEAPPLE WATERMELON TEST_IMAGE1





TEST_IMAGE2 TEST_IMAGE3 TEST_IMAGE4 TEST_IMAGE5 TEST_IMAGE6

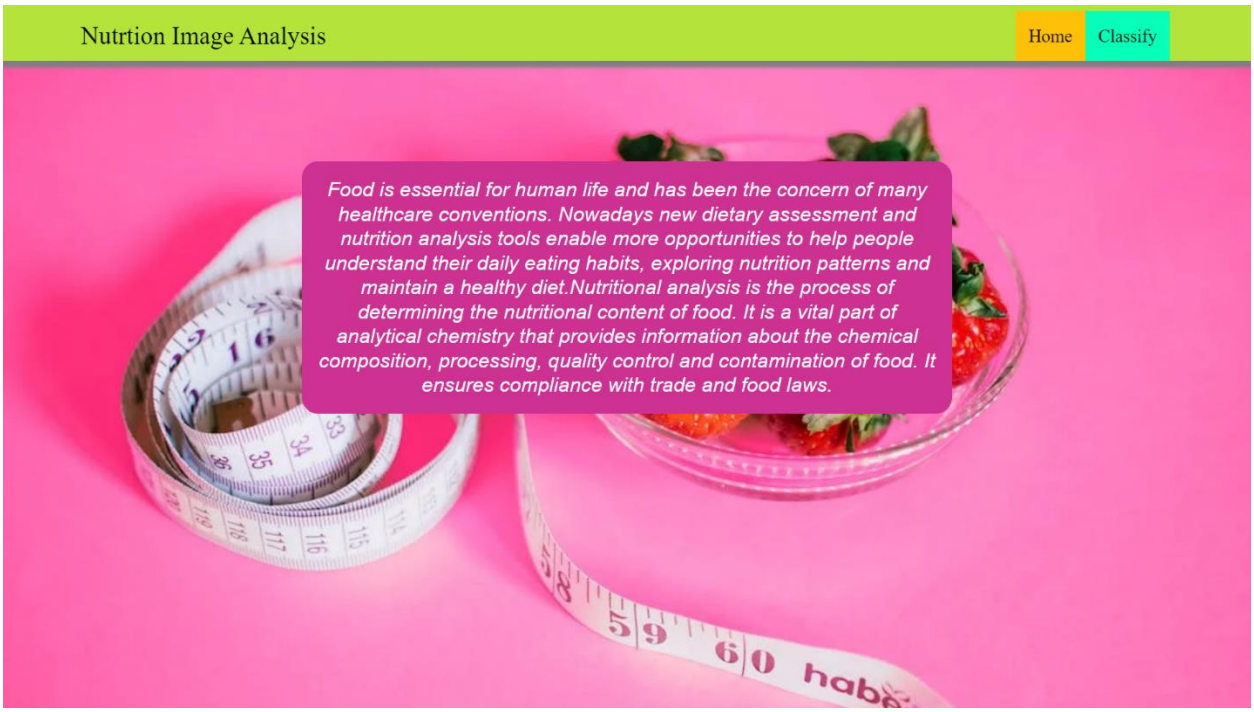
PERFORMANCE TESTING:

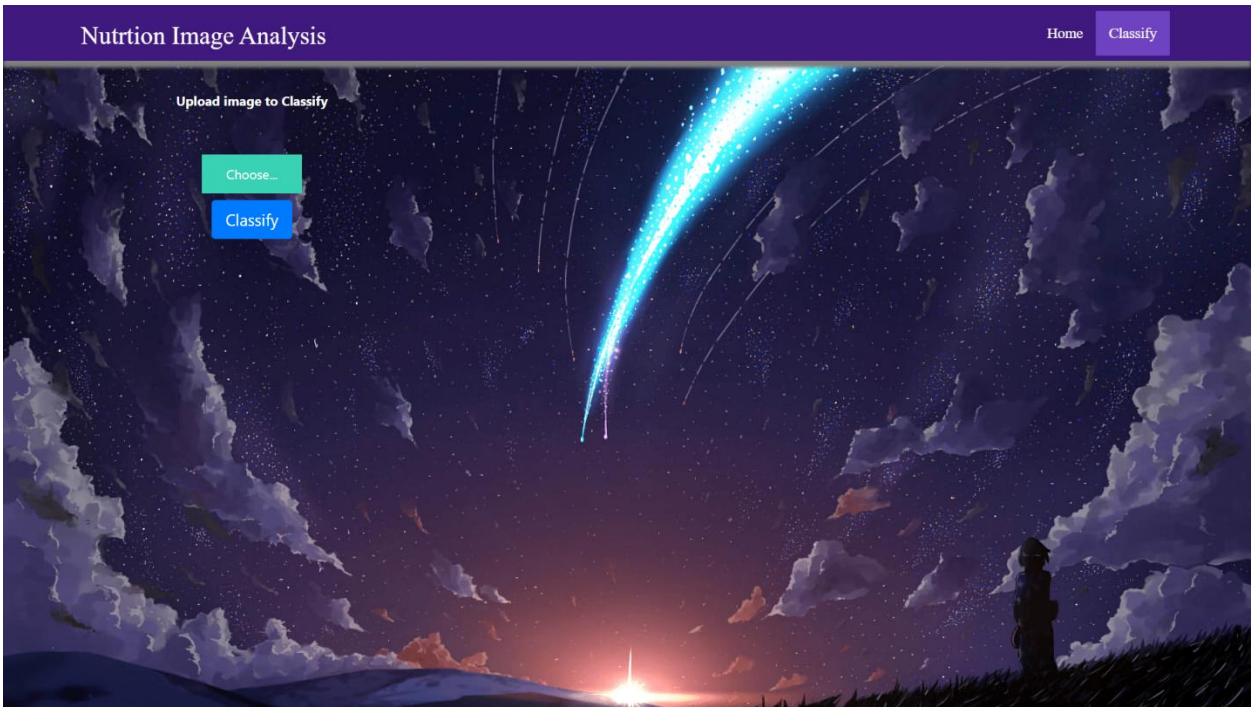
Epoch 1/10
110/110 [==============================] - 27s 242ms/step - loss: 0.4205 - accuracy: 0.8861 - val_loss: 48.9065 - val_accuracy: 0.1488
Epoch 2/10
110/110 [==============================] - 27s 245ms/step - loss: 0.0082 - accuracy: 0.9989 - val_loss: 62.1670 - val_accuracy: 0.1280
Epoch 3/10
110/110 [==============================] - 28s 255ms/step - loss: 0.0014 - accuracy: 1.0000 - val_loss: 66.6759 - val_accuracy: 0.1488
Epoch 4/10
110/110 [==============================] - 27s 242ms/step - loss: 3.3364e-04 - accuracy: 1.0000 - val_loss: 70.6794 - val_accuracy: 0.1488
Epoch 5/10
110/110 [==============================] - 27s 248ms/step - loss: 1.9990e-04 - accuracy: 1.0000 - val_loss: 74.1865 - val_accuracy: 0.1488
Epoch 6/10
110/110 [==============================] - 26s 236ms/step - loss: 4.5090e-04 - accuracy: 1.0000 - val_loss: 75.5190 - val_accuracy: 0.1308
Epoch 7/10
110/110 [==============================] - 27s 248ms/step - loss: 1.0600e-04 - accuracy: 1.0000 - val_loss: 78.4789 - val_accuracy: 0.1488
Epoch 8/10
110/110 [==============================] - 26s 237ms/step - loss: 7.9529e-05 - accuracy: 1.0000 - val_loss: 80.7918 - val_accuracy: 0.1403
Epoch 10/10
110/110 [==============================] - 29s 266ms/step - loss: 9.1324e-05 - accuracy: 1.0000 - val_loss: 83.0943 - val_accuracy: 0.1393
<keras.callbacks.History at 0x7fbcb5cb4b10>

9.RESULTS:

9.1 Performance Metrics

Output link : https://github.com/IBM-EPBL/IBM-Project-22500-1659853290/blob/main/OUTPUTS.pdf




Nutrtion Image Analysis
Home
Classify
Upload image to Classify
Choose...
Classify


Nutrtion Image Analysis
Home
Classify
Upload image to Classify
Choose...
Food Classified as:
APPLES
[{'sugar_g': 10.3, 'fiber_g': 2.4, 'serving_size_g': 100.0, 'sodium_mg': 1, 'name': 'apples', 'potassium_mg': 1, 'fat_saturated_g': 0.0, 'fat_total_g': 0.2, 'calories': 53.4, 'cholesterol_mg': 0, 'protein_g': 0.3, 'carbohydrates_total_g': 13.8}]

10. ADVANTAGES AND DISADVANTAGES

Advantages:

- Food and food habits are ever-changing and evolving. People and professionals need to quickly adapt to new food products, diets, and changing preferences. The best way to instantly adapt to these changes is to have software that changes and adapts with you.
- Using automated nutrition analysis software will allow you to free up more time to innovate or grow your business. If you find a nutrition analysis software that has all the features you need, you can create much more time to focus on improving your business.
- Features such as a quick preview of nutrients while adding foods to diets, menus, and recipes give you the ability to save time when new recipes and food products are introduced.
- Having quick and easy software to help them plan their meals will save you tons of time.

Disadvantages:

- This methodology is still limited by its dependency on time-consuming and error-prone manual video annotations,with many studies resorting to the use of multiple human annotators.
- Often suffers from reliability issues.
- It is extremelyexpensive due to semantics analysismodel andnutritional analysis model.
- In order to make recommendations, the system needs tocollect nutritional needs from users. Most of the information is only provided through continuous interactions with users. However, in reality, recording nutritional intake from users cannot avoid faults because users usually forget or give wrong informationabout the foodsthey have consumed.
- Moreover deep learningrequires expensive GUIs andhundreds of machines. This increases the cost to the users.

11. CONCLUSION

Food is essential for human life and has been the concern of many health care conventions. In this project we have built a nutrition analysis model that classifies the nutritional content of the food through the image uploaded by the user. Such Nutritional analysis helps people understand their daily eating habits, exploring nutrition patterns and maintaining a healthy diet. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

The nutritional analysis model is implemented using Convolutional neural network and the web application is built and implemented using Flask framework. As for the future work, the model can be trained and tested on more datasets to provide accurate results and better performance.

12. FUTURE SCOPE

The future scope of this project is very brod. Few of them are:

- The model could be trained using vast database in order to increase the accuracy of results.
- The Backend framework of the web application can be improved so that the uploaded images can be handled appropriately.
- In addition to the nutrition analysis, the application can also be designed to provide recipes that can be prepared using the nutrient-rich foods
- A database can also be implemented for the system so that users can save their data and relook into it later.
- The Web application can be further developed and launched as an Android App so that anyone anywhere with or without internet connection can access it and get benefited from its use cases.

13. APPENDIX

Source Code:

App.py

```
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.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=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']

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

        x=result
        print(x)
        result=nutrition(result)
        print(result)

        return render_template("0.html",showcase=(result),showcase1=(x))
def nutrition(index):


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

    querystring = {"query":index}

    headers = {
        'x-rapidapi-key': "5d797ab107mshe668f26bd044e64p1ffd34jsnf47bfa9a8ee4",
        '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)
```

MODEL BUILDING AND DEPLOYEMENT

Preprocessing

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

In [52]:

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

In [53]:

Importing data into ibm Platform

```
import os, types
import pandas as pd
from botocore.client import Config
```

```
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
cos_client = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='WImD1lYFgLr7ETzVUrUheKzW-cdRHnZBTZU5S49O9gq3',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')

bucket = 'imageclassification-donotdelete-pr-ohyztlr8kisyqz'
object_key = 'Nutrition classifier_zipped.zip'

streaming_body_1 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']

# Your data file was loaded into a botocore.response.StreamingBody object.
# Please read the documentation of ibm_boto3 and pandas to learn more about the possibilities to load the data.
# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/
# pandas documentation: http://pandas.pydata.org/
```

In [54]:

```
if not hasattr(streaming_body_1,"__iter__"):streaming_body_1.__iter__ = types.MethodType(__iter__,streaming_body_1)
```

In [55]:

```
from io import BytesIO
from zipfile import ZipFile
unzip = ZipFile(BytesIO(streaming_body_1.read()),'r')
file_paths = unzip.namelist()
for path in file_paths:
    unzip.extract(path)
```

In [56]:

```
import os
filenames = os.listdir('/home/wsuser/work/Nutrition classifier/TEST_SET')
```

Applying preprocessing to train and test set

In [57]:

```
x_train=train_datagen.flow_from_directory(r'/home/wsuser/work/Nutrition classifier/TRAIN_SET',target_size=(64,64),batch_size=5,color_mode='rgb',class_mode='sparse')
x_test = train_datagen.flow_from_directory(r'/home/wsuser/work/Nutrition classifier/TEST_SET',target_size=(64,64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

```
Found 2626 images belonging to 5 classes.
Found 1055 images belonging to 5 classes.
```

In [58]:

```
print(x_test.class_indices)
```

```
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}
```

In [59]:

```
from collections import Counter as c
c(x_train.labels)
```

Out[59]:

```
Counter({0: 606, 1: 445, 2: 479, 3: 621, 4: 475})
```

In [60]:

```
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
```

Model Creation

In [61]:

```
model=Sequential()
classifier=Sequential()
```

In [62]:

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

In [63]:

```
classifier.summary()
```

```
Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_2 (Conv2D)           (None, 62, 62, 32)        896

 max_pooling2d_2 (MaxPooling  (None, 31, 31, 32)       0
 2D)

 conv2d_3 (Conv2D)           (None, 29, 29, 32)        9248

 max_pooling2d_3 (MaxPooling  (None, 14, 14, 32)       0
 2D)

 flatten_1 (Flatten)         (None, 6272)              0
```

```
 dense_2 (Dense)          (None, 128)           802944

 dense_3 (Dense)          (None, 5)             645

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

In [64]:

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

In [65]:

```
classifier.fit_generator(generator=x_train,steps_per_epoch=len(x_train),epochs= 2
,validation_data=x_test,validation_steps=len(x_test))
  classifier.fit_generator(generator=x_train,steps_per_epoch=len(x_train),epochs= 2 ,validation_
data=x_test,validation_steps=len(x_test))
Epoch 1/2
526/526 [==============================] - 32s 59ms/step - loss: 0.1204 - accuracy: 0.
9539 - val_loss: 0.0825 - val_accuracy: 0.9611
Epoch 2/2
526/526 [==============================] - 32s 61ms/step - loss: 0.0455 - accuracy: 0.
9863 - val_loss: 0.0702 - val_accuracy: 0.9754
```

Out[65]:

```
<keras.callbacks.History at 0x7fc5ba836e80>
```

In [17]:

```
classifier.save('/home/wsuser/work/nutrition.h5')
```

In [18]:

```
!tar -zcvf image-classification-model_new.tgz nutrition.h5
nutrition.h5
```

In [19]:

```
ls -1
image-classification-model_new.tgz
'Nutrition classifier'/
nutrition.h5
```

Creating Cloud Deployment Space

In [20]:

```
! pip install watson-machine-learning-client --upgrade


from ibm_watson_machine_learning import APIClient
wml_credintials = {
   "url" : "https://us-south.ml.cloud.ibm.com",
   "apikey" : "3EMrL-7wESBZLFCk0abidBdj4Pnlz-7Hsiqd3E39NCQX"
}
```

```
client = APIClient(wml_credintials)
```

In [22]:

```
def guid_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'])
```

In [23]:

```
space_uid = guid_from_space_name(client , 'imageclassification')
print("Space UID = "+ space_uid)
Space UID = 68f147b7-3c13-4157-be5a-85a5c50f29ee
```

In [24]:

```
client.set.default_space(space_uid)
```

Out[24]:

```
'SUCCESS'
```

In [25]:

```
software_spec_uid = client.software_specifications.get_uid_by_name("tensorflow_rt22.1-
py3.9")
software_spec_uid
```

Out[25]:

```
'acd9c798-6974-5d2f-a657-ce06e986df4d'
```

Deploying Model into Deployment Space

```
model_details = client.repository.store_model(model = 'image-classification-
model_new.tgz' , meta_props = {
   client.repository.ModelMetaNames.NAME:"CNN",
   client.repository.ModelMetaNames.TYPE : "tensorflow_2.7",
   client.repository.ModelMetaNames.SOFTWARE_SPEC_UID : software_spec_uid
})

model_id = client.repository.get_model_uid(model_details)
```

In [28]:

```
model_id
```

Out[28]:

```
'bbd12864-53fb-4b64-ab1f-11d45246f865'
```

Downloading the model

In [29]:

```
client.repository.download(model_id, 'nutrition_analyzer2_model.h5')
```

GitHub Link : https://github.com/IBM-EPBL/IBM-Project-22500-1659853290

Project Demo Link : https://youtu.be/wYnc33Mjd4o