

AI-Powered Nutrition Analyzer For Fitness Enthusiasts

IBM PROJECT REPORT

TEAM ID – PNT2022TMID46153

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1.INTRODUCTION

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 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..).

1.1.PROJECT OVERVIEW

1. Should have a thorough knowledge of picture data as well as the basic principles and methods of convolutional neural networks.

2. To use various data pre-processing techniques to pre-process/clean the data.

3. Utilize the Flask framework to create a web application. The user interacts with the user interface and inputs the image. The input image is then provided to our flask programme, where we categorise the result using the model we built and display it on the user interface.

1.2.PURPOSE

The complicated and non-linear relationship between nutrition-related data and health outcomes may be better understood and predicted with the use of AI algorithms. These nutrition analysis tools provide consumers additional chances to grasp their regular eating behaviours, explore nutrition trends, and keep up a healthy diet.

2.LITERATUTE SURVEY

AI-POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

LITERATURE SURVEY

| SL.NO | TITLE | TECHNIQUES | MERITS | DEMERITS |
|-------|-------------|---|--|---|
| 1 | HealthifyMe | HealthifyMe is a leading Indian health and fitness app whose artificial intelligence powered virtual nutritionist, Ria, helps its users regarding their queries around fitness and nutrition in both audio and text in more than 10 languages. | HealthifyMe's 250 million tracked foods, workouts and 10 million message exchanges between coaches and clients. HealthifyMe supposedly owns the largest data set in this regard and are compatible with popular fitness wearables devices currently available in India | Worst fitness app and services ever provided. Don't value the customer time. Don't even have knowledgeable dietician. |
| 2 | Neutrino | Neutrino delivers nutrition-based data services and analytics to its users and wants to turn into a leading source of the nutrition-related platform. The platform employs NLP and mathematical models from the optimization theory as well as predictive analysis to enable individualized data compilation. | It further enables its partners to purchase data regarding nutrition, using API and SDK integrations, to help improve their product offering and services. | They are only weakly interaction, so it takes about a light year of lead to stop a beam of moderately low energy (-MeV) neutrinos. |
| 3 | FitGenie | The app heavily relies on AI to produce customised data regarding calorie intake and make food suggestions accordingly. | Their advanced diet analysis and combines tools of calorie counter with to make dynamic and adaptive macronutrient adjustments thus providing high-quality nutrient plan each week for its users which is generated from its 1+ million foods. | Don't value the customer time. Don't even have knowledgeable dietician. |

REFERAL LINK: <https://analyticsindiamag.com/5-ai-powered-nutrition-apps-that-help-fitness-enthusiasts-with-their-calorie-intake/>

2.1.EXISTING PROBLEM

One of the most bothersome nutrition issues people face is a loss of appetite or decreased hunger caused by people who are unaware of the nutritional content of the foods they are consuming. This leads to nutritional disorders, diseases connected to nutrition, and illnesses that affect people. They consist of dietary excesses or deficiencies, obesity, eating disorders, and chronic illnesses like diabetes mellitus.

2.2.REFERENCES

[1] KB, Mirra, and R. Rajakumari. "Classification of Fruits Using Deep Learning Algorithms." Available at SSRN 4068366.

[2] Khatun, Mehenag, et al. "Fruits Classification using Convolutional Neural Network." GRD Journals-Global Research and Development Journal for Engineering 5.8 (2020).

[3] Kumar Saini, D.; rabbi, S.; Chhabra, D.; Shukla, P. Phycobiliproteins from *Anabaena variabilis* CCC421 and its production enhancement strategies using combinatory evolutionary algorithm approach. *Bioresource.techno*; 2020,309, 123347.

[4] Rozga M, Latulippe ME, Steiber A. "Advancements in personalized nutrition technologies: guiding principles for registered dietitian nutritionists" *Jornal of the academy of nutrition and dietetics*.

[5] Oka, R.; Nomura, A.; Kometani, M.; Gondoh, Y.; Yoshimura, K.; Yoneda, T. Study protocol for the effects of artificial intelligence { AI } – supported automated nutritional intervention on glycemic control inpatients with 2 diabetes mellitus

2.3.PROBLEM STATEMENT

AI-POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

PROBLEM STATEMENTS

PROBLEM STATEMENT 1



PROBLEM STATEMENT 2

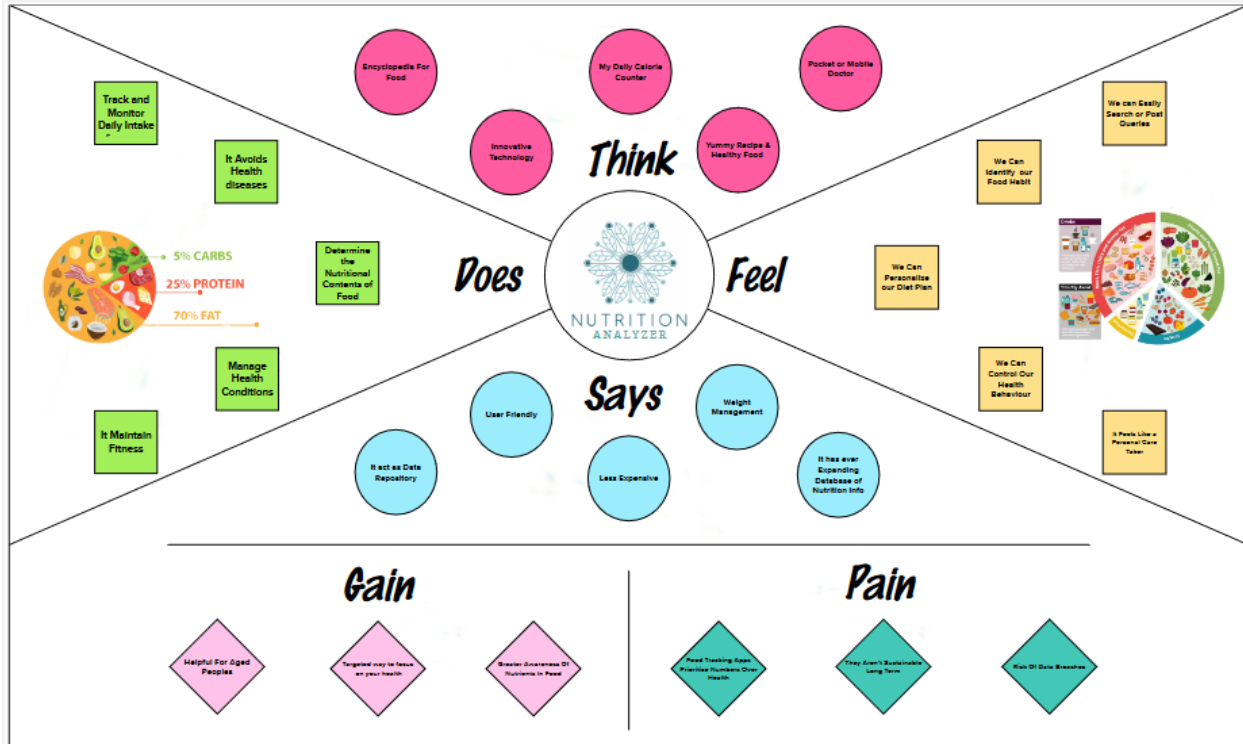


| Problem Statement (PS) | I am (Customer) | I'm trying to | But | Because | Which makes me feel |
|------------------------|-----------------|------------------------------|---|--|-----------------------|
| PS – 1 | Sportsmen | Maintain my physique | I'm unable to concentrate on the nutrition diet | I have more commitments and complexity | Tired & Exhausted |
| PS – 2 | Fitness Freak | Maintain my physical fitness | I don't know how to do it | I don't know about the nutrition content of food | Frustrated & Stressed |

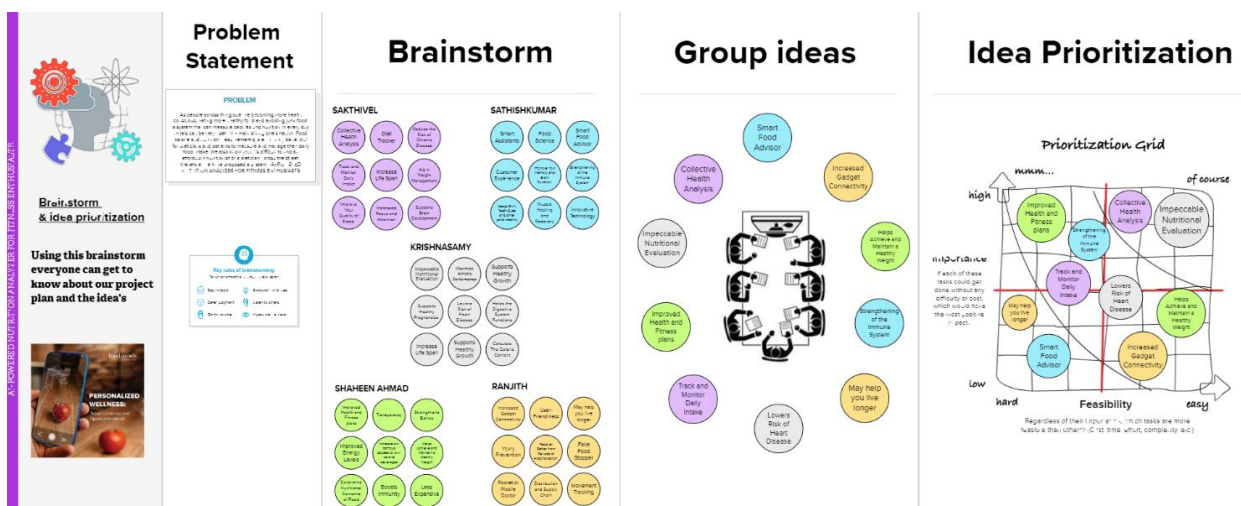
3.IDEATION & PROPOSED SOLUTION

3.1. EMPATHY MAP CANVAS

AI Powered Nutrition Analyzer



3.2.IDEATION & BRAINSTORMING



3.3.PROPOSED SOLUTION

AI-POWERED NUTRITION FOR FITNESS AND ENTHUSIAST

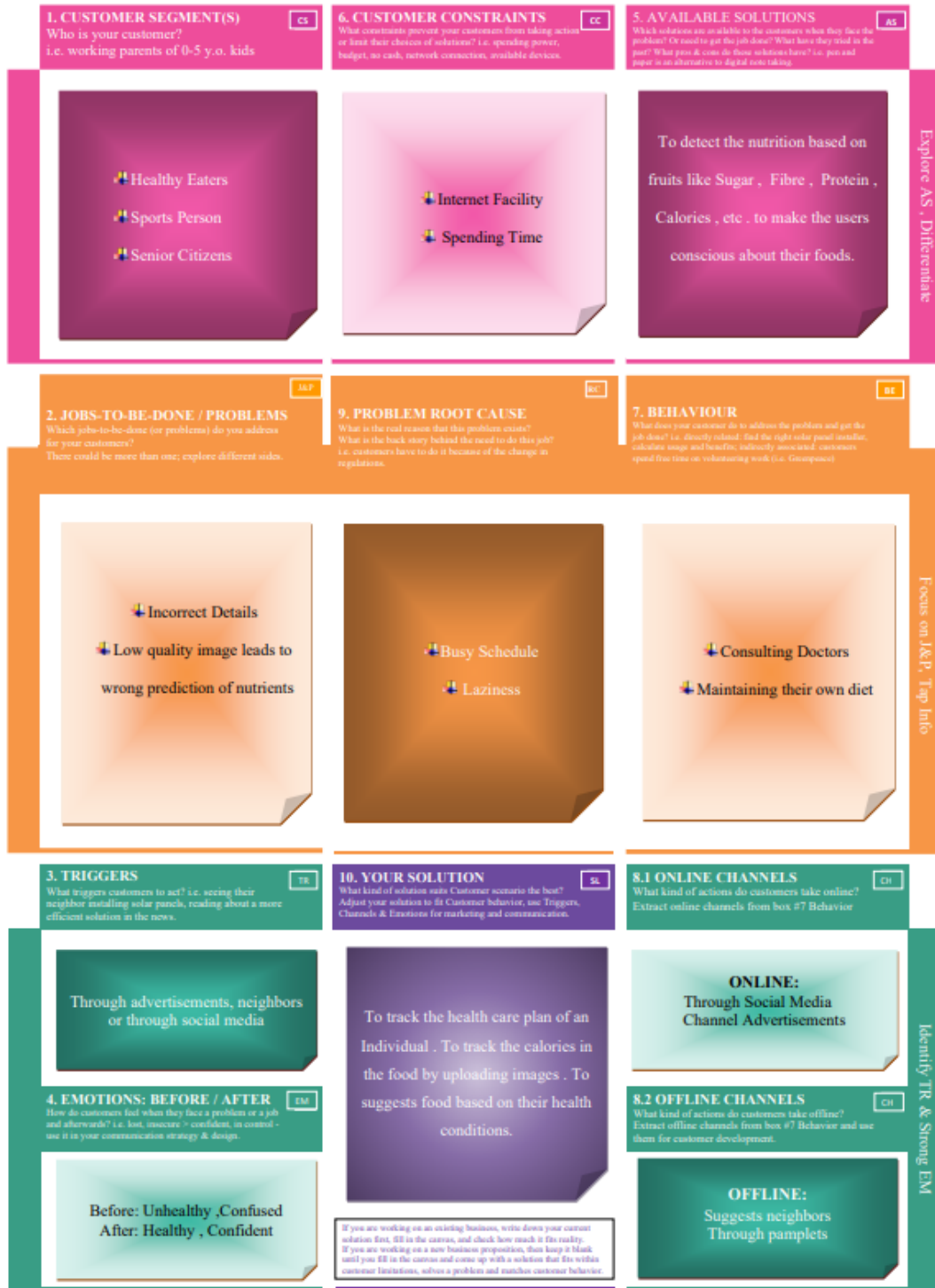
PROPOSED SOLUTION

| S.No. | Parameter | Description |
|-------|---|--|
| 1. | Problem Statement (Problem to be solved) | <p>Poor eating habits include under- or over-eating, not having enough of the healthy foods we need each day, or consuming too many types of food and drink, which are low in fiber or high in fat, salt and/or sugar.</p> <p>These unhealthy eating habits can affect our nutrient intake, including energy (or kilojoules) protein, carbohydrates, essential fatty acids, vitamins and minerals as well as fiber and fluid.</p> |
| 2. | Idea / Solution description | <p>Use AI-Powered Nutrition For Fitness & Enthusiast Application</p> <p>Have a good variety of healthy foods from the five food groups each day. For more information see the Healthy eating for different ages and stages and Healthy Eating tips sections.</p> <p>Aim for two serves of fruit and five serves of vegetables each day. Only occasionally eat sugary, fatty or salty food, and then only in small amounts. Drink fresh, clean tap water instead of sugary drinks.</p> <p>Switch over to healthy recipes that look and taste good. Plan your meals ahead and shop for healthy ingredients. Enjoy cooking and eating healthy food with family or friends and without distractions such as the television.</p> |
| 3. | Novelty / Uniqueness | <p>Nutrition can help enhance athletic performance. An active lifestyle and exercise routine, along with eating well, is the best way to stay healthy. Eating a good diet can help provide the energy you need to finish a race, or just enjoy a casual sport or activity.</p> <p>You are more likely to be tired and perform poorly during sports when you do not get</p> |

| | | |
|----|---------------------------------------|--|
| | | <p>enough:</p> <ul style="list-style-type: none"> • Calories • Carbohydrates • Fluids • Iron, vitamins, and other minerals • Protein |
| 4. | Social Impact / Customer Satisfaction | <p>Largest database available in a diet tracker includes many restaurant foods.</p> <p>Users can download recipes online and calculate the calorie content of each serving.</p> <p>Ability to quick add calories when you don't have time to log the whole meal.</p> |
| 5. | Business Model (Revenue Model) | <p>First, it is a lifestyle tracker calorie counter.</p> <p>Second, is their social feed, which allows the user to find their kind of people with similar goals and problems.</p> <p>The third, and most innovative aspect is technology augmented coaching, which uses a combination of artificial intelligence and human trainers to help users stay healthy and engage with the app.</p> |
| 6. | Scalability of the Solution | <p>The modern AI-based apps are your fitness assistants. They instantly connect you to a nutritionist, provide customized workouts based on your health data, and offer solutions for all your fitness needs.</p> <ol style="list-style-type: none"> 1. Collective health analysis 2. Improved health and fitness plans 3. Increased gadget connectivity 4. Smart Assistants 5. Movement tracking 6. Impeccable nutritional evaluation |

3.4.PROBLEM SOLUTION FIT

Problem Solution Fit-AI Powered Nutrition Analyzer For Fitness Enthusiasts



Explore AS , Differentiate

Focus on J&P , Tap Info

Identify TR & Strong EM

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Functional Requirement :

Following are the functional requirement for the proposed solution

| Fr.no | Functional Requirement | Sub Requirement(Story/subtask) |
|-------|------------------------|--|
| Fr-1 | User Registration | Registration through Form Registration through Gmail |
| Fr-2 | User Confirmation | Confirmation via OTP Confirmation via Gmail |
| Fr-3 | Capturing Image | Capture the image of the food And check the parameter captured image |
| Fr-4 | Image Processing | Upload the image for the prediction of the nutrition in the food |
| Fr-5 | Food Identification | Identify the food and predict the nutrition in the food |
| Fr-6 | Image Description | Suggesting the best food with enriched nutrition to Eat |

4.2.NON-FUNCTIONAL REQUIREMENTS

Non-Functional Requirement :

Following are the Non-Functional requirement for the proposed solution

| Nfr.no | Non-Functional Requirement | Description |
|--------|----------------------------|--|
| Nfr-1 | Usability | Datasets of all the food items is used to detecting the nutrition that present in the food |
| Nfr-2 | Security | The Information belongs to the user and Nutrition are secured highly |
| Nfr-3 | Reliability | The Image Quality of food is important for predicting the Nutrition in the food |
| Nfr-4 | Performance | The performance is based on the Image Quality of food used for nutrition prediction |
| Nfr-5 | Availability | It is available for all user to predict the nutrition in the food |
| Nfr-6 | Scalability | Increasing the prediction of the Nutrition in the food |

5.PROJECT DESIGN

5.1.DATA FLOW DIAGRAM

The classic visual depiction of how information moves through a system is a data flow diagram (DFD). A tidy and understandable DFD may visually represent the appropriate quantity of the system demand. It demonstrates how information enters and exits the system, what modifies the data, and where information is kept.

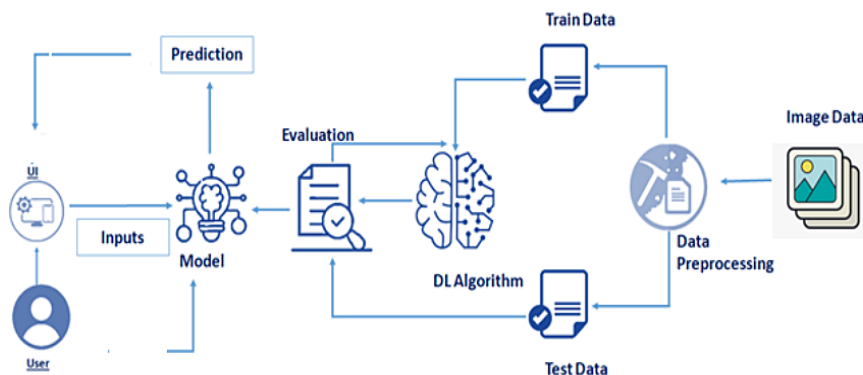
The Data Flow Diagram is presented below:

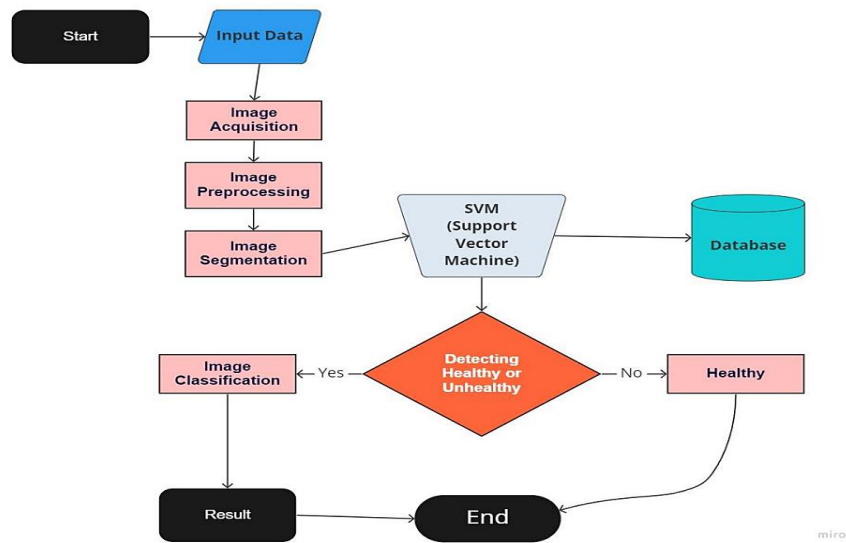
AI-powered Nutrition Analyzer for Fitness Enthusiasts
Data Flow Diagram & User Stories

| | |
|---------------|---|
| Date | 28 October 2022 |
| Team ID | PNT2022TMID46130 |
| Project Name | AI-powered Nutrition Analyzer for Fitness Enthusiasts |
| Maximum Marks | 4 Marks |

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.





User Stories:

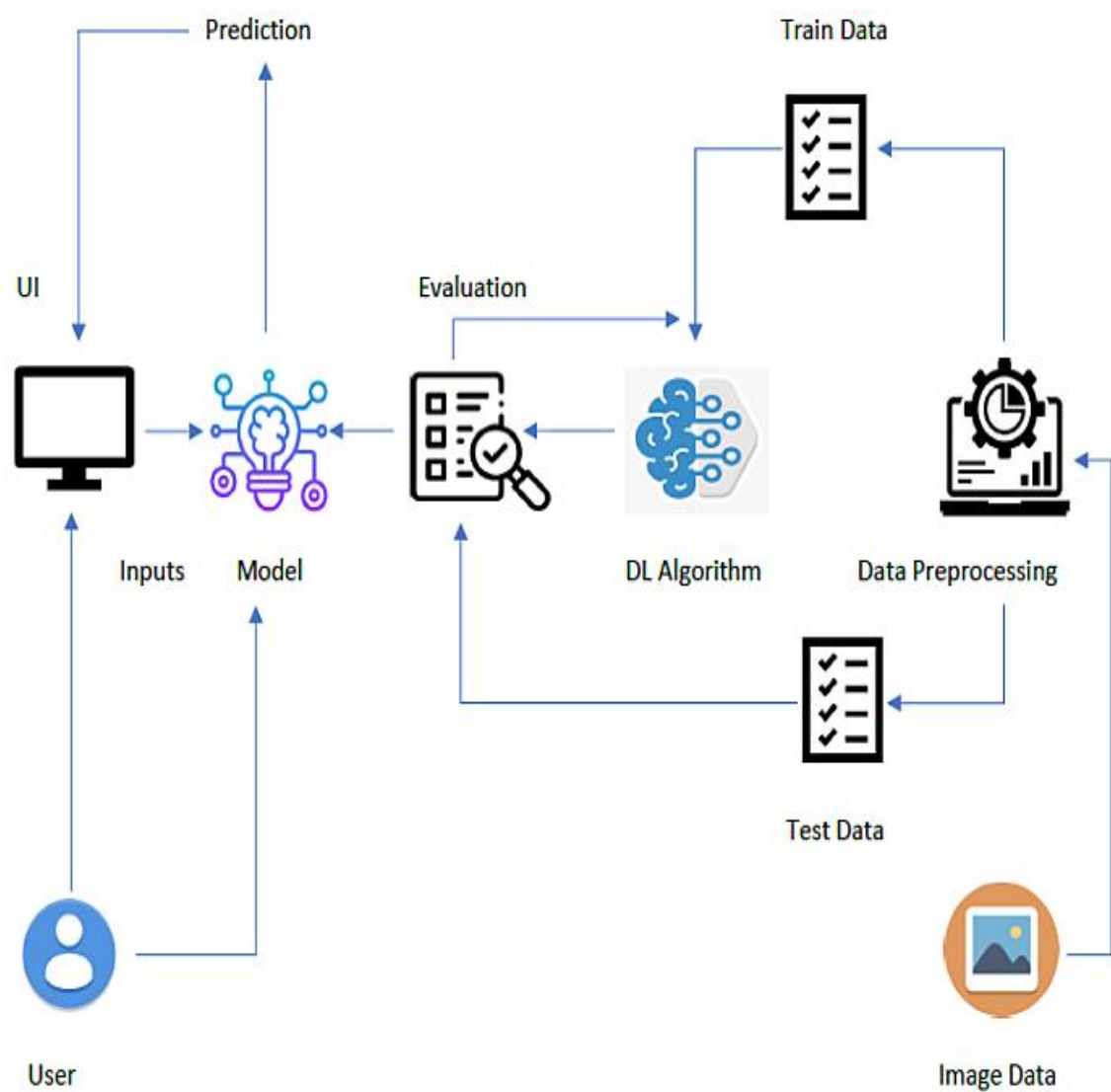
| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|-------------------------|-------------------------------|-------------------|---|--|----------|----------|
| Customer (Web user) | Registration | USN-10 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
| | | USN-11 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High | Sprint-1 |
| | | USN-12 | As a user, I can register for the application through Face book | I can register & access the dashboard with Face book Login | Low | Sprint-3 |
| | | USN-13 | As a user, I can register for the application through Gmail | I can register and access the dashboard with Gmail login | Medium | Sprint-1 |
| | Login | USN-11 | As a user, I can log into the application by entering email & password | I can register and access the dashboard with email and password | High | Sprint-1 |
| | Nutrition Analyzer | USN-15 | As a user, I can view the nutrition level of the fruit by scanning the fruit | I can view the nutrition level of the fruit by scanning the fruit | High | Sprint-2 |
| | | USN-16 | As a user, I can able to calculate the nutritional value of the different fruits at the same time | I can able to calculate the nutritional value of the different fruits at the same time | High | Sprint-2 |
| | | USN-17 | As a user, I can able to view fruits (input data) details by related web site | I can able to view fruits (input data) details by related web site | Medium | Sprint-3 |
| Customer Care Executive | Customer Support | USN-18 | As a customer care executive, I can view the complaints on chat box | I can view the complaints on chat box | Medium | Sprint-4 |
| | | USN-19 | As a customer, I should be able solve and reply for the customers queries | I can reply to customer queries in the chat thread | Low | Sprint-4 |

| | | | | | | |
|---------------|--|--------|--|--|------|----------|
| | | USN-20 | | I can close the complaint after assisting | Low | Sprint-4 |
| Administrator | | USN-21 | As a Administrator, I would take care of registrations and maintenance of accounts | I can take care of registrations and maintenance of accounts | High | Sprint-3 |
| | | USN-22 | As a Administrator, I Would resolve issues on Access | I can resolve issues in Access | High | Sprint-2 |

5.2.SOLUTION AND TECHNOLOGY ARCHITECTURE

SOLUTION ARCHITECTURE

Solution Architecture – AI Powered Nutrition Analyzer For Fitness Enthusiasts



TECHNICAL ARCHITECTURE

Table 1: Components and Technologies

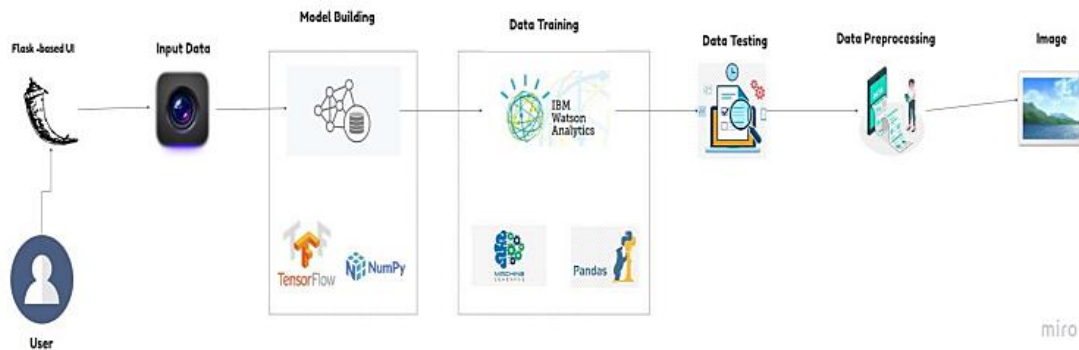
| S. No | Component | Description | Technology |
|-------|---------------------------------|--|----------------------------|
| 1. | User Interface | How the user interacts with application. e.g. Web UI | HTML and CSS |
| 2. | Application Logic-1 | Handle all the user requests done through the Web UI / Display the results after process | Python Flask Server |
| 3. | Application Logic-2 | Process the image provided by the user via Web UI | Python |
| 4. | Application Logic-3 | Train the model and provide the classification result for the image given as input | IBM Watson Studio |
| 5. | Cloud Database | Database Service on Cloud | IBM DB2, IBM Cloudant etc. |
| 6. | File Storage | File storage requirements | Local Filesystem |
| 7. | Machine Learning Model | Purpose of Machine Learning Model | VGG16 Pre-Trained Model |
| 8. | Infrastructure (Server / Cloud) | Application Deployment on Local System | Local |

Table-2: Application Characteristics:

| S. No | Characteristics | Description | Technology |
|-------|--------------------------|--|--|
| 1. | Open-Source Frameworks | List the open-source frameworks used | Flask, TensorFlow, Keras , NumPy, OpenCV |
| 2. | Security Implementations | List all the security / access controls implemented, use of firewalls etc. | IAM Controls |

| | | | |
|----|-----------------------|---|--|
| 3. | Scalable Architecture | Justify the scalability of architecture (3 – tier, Micro-services) | 3-tier type (Web server, App server and DB server). |
| 4. | Availability | Justify the availability of application (e.g. use of load balancers, distributed servers etc.) | Local: Available based on computer's specs. Cloud: Web server, DB server available when requested. App server requires high requirements compared with other 2 servers, thereby availability is bit less but can be compensated by cloud |
| 5. | Performance | Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc. | Accuracy of model: >85% (Expected) Number of requests per second: 250 – 1000 (based on network traffic, 250 is default as targeted user group is moderate) |

Technical Architecture:



5.3.USER STORIES

User Stories:

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|-------------------------|-------------------------------|-------------------|---|--|----------|----------|
| Customer (Web user) | Registration | USN-10 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
| | | USN-11 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High | Sprint-1 |
| | | USN-12 | As a user, I can register for the application through Face book | I can register & access the dashboard with Face book Login | Low | Sprint-3 |
| | | USN-13 | As a user, I can register for the application through Gmail | I can register and access the dashboard with Gmail login | Medium | Sprint-1 |
| | Login | USN-11 | As a user, I can log into the application by entering email & password | I can register and access the dashboard with email and password | High | Sprint-1 |
| | Nutrition Analyzer | USN-15 | As a user, I can view the nutrition level of the fruit by scanning the fruit | I can view the nutrition level of the fruit by scanning the fruit | High | Sprint-2 |
| | | USN-16 | As a user, I can able to calculate the nutritional value of the different fruits at the same time | I can able to calculate the nutritional value of the different fruits at the same time | High | Sprint-2 |
| | | USN-17 | As a user, I can able to view fruits (input data) details by related web site | I can able to view fruits (input data) details by related web site | Medium | Sprint-3 |
| Customer Care Executive | Customer Support | USN-18 | As a customer care executive, I can view the complaints on chat box | I can view the complaints on chat box | Medium | Sprint-4 |
| | | USN-19 | As a customer, I should be able solve and reply for the customers queries | I can reply to customer queries in the chat thread | Low | Sprint-4 |

| | | | | | | |
|---------------|--|--------|--|--|------|----------|
| | | USN-20 | | I can close the complaint after assisting | Low | Sprint-4 |
| Administrator | | USN-21 | As a Administrator, I would take care of registrations and maintenance of accounts | I can take care of registrations and maintenance of accounts | High | Sprint-3 |
| | | USN-22 | As a Administrator, I Would resolve issues on Access | I can resolve issues in Access | High | Sprint-2 |

6.PROJECT PLANNING & SCHEDULING

6.1.SPRINT PLANNING & ESTIMATION

SPRINT PLANNING

Food is a necessity for human life and has been addressed in several medical conventions. Modern dietary evaluation and nutrition analysis technologies provide consumers additional possibilities to explore nutrition patterns, comprehend their daily eating habits, and keep up a balanced diet. Finding out a food's nutritional value is done through nutritional analysis. Information on the chemical make-up, processing, quality assurance, and contamination of food is a crucial component of analytical chemistry.

The primary goal of the project is to develop a model that will be used to categorise fruits according to their many attributes, such as colour, shape, and texture. Here, users may take pictures of various fruits, which are subsequently uploaded to a trained algorithm for analysis. The model examines the picture to determine the nutrient content of fruits

ESTIMATION

1. Planning is a crucial role in project management because it allows team members to schedule their time on the project.

2. This activity demonstrates how the team members assigned and completed various tasks.

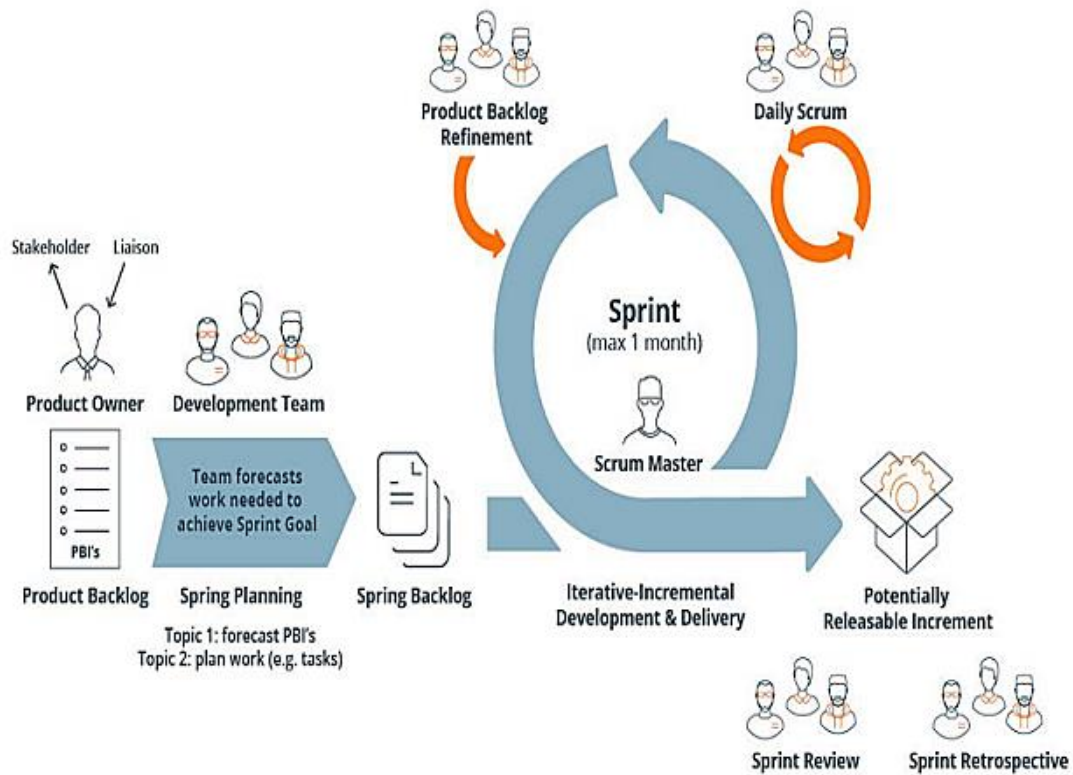
3. In Project we can Split into the Four Step of Phases are

Phase 1: Data Collection & retrieval and Requirement Analysis

Phase 2: Project Planning and Developing Modules

Phase 3: Implementing the High Accuracy Deep Learning Algorithm to
Perform the give task smoothly.

Phase 4: Deploying the Model on Cloud and Testing the Mode



7.CODING & SOLUTION

7.1.FEATURE 1[MODEL BUILDING]

1. Importing The Model Building Libraries

Importing Neccessary Libraries

```
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
```

2. Initializing The Model

Keras has 2 ways to define a neural network:

- Sequential
- Function API

The Sequential class is used to define linear initializations of network layers which then, collectively, constitute a model. In our example below, we will use the Sequential constructor to create a model, which will then have layers added to it using the add() method.

```
model=Sequential()
```

3. Adding CNN Layers

- As the input image contains three channels, we are specifying the input shape as (64,64,3).
- We are adding a two convolution layer with activation function as "relu" and with a small filter size (3,3) and the number of filters (32) followed by a max-pooling layer.
- Max pool layer is used to down sample the input.(Max pooling is a pooling operation that selects the maximum element from the region of the feature map covered by the filter)
- Flatten layer flattens the input. Does not affect the batch size.

Creating the model

```
# Initializing the CNN
classifier = Sequential()

# First convolution Layer and pooling
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Second convolution Layer and pooling
classifier.add(Conv2D(32, (3, 3), activation='relu'))

# input_shape is going to be the pooled feature maps from the previous convolution Layer
classifier.add(MaxPooling2D(pool_size=(2, 2)))

# Flattening the Layers
classifier.add(Flatten())
```

4. Adding Dense Layers

A dense layer is a deeply connected neural network layer. It is the most common and frequently used layer.

```
# Adding a fully connected Layer
classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=5, activation='softmax')) # softmax for more than 2
```

The number of neurons in the Dense layer is the same as the number of classes in the training set. The neurons in the last Dense layer, use softmax activation to convert their outputs into respective

probabilities.

Understanding the model is a very important phase to properly using it for training and prediction purposes. Keras provides a simple method, a summary to get the full information about the model and its layers.

```
classifier.summary()#summary of our model
```

```
Model: "sequential"
```

| Layer (type) | Output Shape | Param # |
|--------------------------------|--------------------|---------|
| conv2d (Conv2D) | (None, 62, 62, 32) | 896 |
| max_pooling2d (MaxPooling2D) | (None, 31, 31, 32) | 0 |
| conv2d_1 (Conv2D) | (None, 29, 29, 32) | 9248 |
| max_pooling2d_1 (MaxPooling2D) | (None, 14, 14, 32) | 0 |
| flatten (Flatten) | (None, 6272) | 0 |
| dense (Dense) | (None, 128) | 802944 |
| dense_1 (Dense) | (None, 5) | 645 |

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

5. Configure The Learning Process

- The compilation is the final step in creating a model. Once the compilation is done, we can move on to the training phase. The loss function is used to find errors or deviations in the learning process. Keras requires loss function during the model compilation process.
- Optimization is an important process that optimizes the input weights by comparing the prediction and the loss function. Here we are using adam optimizer
- Metrics are used to evaluate the performance of your model. It is similar to the loss function, but not used in the training process

Compiling the model

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

6. Train The Model

Now, let us train our model with our image dataset. The model is trained for 20 epochs and after every epoch, the current model state is saved if the model has the least loss encountered till that time. We can see that the training loss decreases in almost every epoch till 20 epochs and probably there is further scope to improve the model.

fit_generator functions used to train a deep learning neural network

Arguments:

- steps_per_epoch: it specifies the total number of steps taken from the generator as soon as one epoch is finished and the next epoch has started. We can calculate the value of steps_per_epoch as the total number of samples in your dataset divided by the batch size.
- Epochs: an integer and number of epochs we want to train our model for.
- validation_data can be either:
 - an inputs and targets list
 - a generator
 - inputs, targets, and sample_weights list which can be used to evaluate the loss and metrics for any model after any epoch has ended.
- validation_steps: only if the validation_data is a generator then only this argument

can be used. It specifies the total number of steps taken from the generator before it is stopped at every epoch and its value is calculated as the total number of validation data points in your dataset divided by the validation batch size.

Fitting the model

```
classifier.fit_generator(  
    generator=x_train, steps_per_epoch = len(x_train),  
    epochs=20, validation_data=x_test, validation_steps = len(x_test)) # No of images in test set
```

7. Save The Model

The model is saved with .h5 extension as follows

An H5 file is a data file saved in the Hierarchical Data Format (HDF). It contains multidimensional arrays of scientific data.

```
### Saving our model

# Save the model
classifier.save('nutrition.h5')
```

8. Test The Model

Evaluation is a process during the development of the model to check whether the model is the best fit for the given problem and corresponding data.

Load the saved model using load_model

```
### Predicting our results

from tensorflow.keras.models import load_model
from keras.preprocessing import image
model = load_model("nutrition.h5") #Loading the model for testing
```

Taking an image as input and checking the results

```
img = image.load_img(r"C:\Users\DELL\Desktop\Desk Files\Nutrition Analysis Using Image Classification\
Sample_Images\Test_Image5.jpg",
                    grayscale=False, target_size= (64,64)) #loading of the image
x = image.img_to_array(img) #image to array
x = np.expand_dims(x, axis = 0) #changing the shape
pred = model.predict_classes(x) #predicting the classes
pred
```

By using the model we are predicting the output for the given input image

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

'PINEAPPLE'
```

The predicted class index name will be printed here.

7.2.FEATURE 2[PYTHON CODE]

7.2 Feature 2[Python Code]:

Build Python Code

1. Importing Libraries

The first step is usually importing the libraries that will be needed in the program.

```
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
```

Importing the flask module into the project is mandatory. An object of the Flask class is our WSGI application. Flask constructor takes the name of the current module (__name__) as an argument Pickle library to load the model file.

2. Creating Our Flask Application And Loading Our Model By Using Load_model Method

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

3. 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 predictions in a web UI
def launch():
```

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 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))
```

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.

[Reference link](#)

API used: [Link](#)

```
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']
```

Finally, Run the application

This is used to run the application in a localhost. The local host runs on port number 5000.(We can give different port numbers)

```
if __name__ == "__main__":  
    # running the app  
    app.run(debug=False)
```

8.TESTING

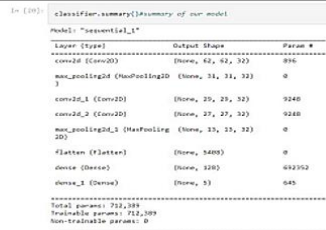
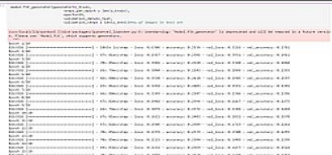
8.1.TEST CASES

| Test case ID | Feature Type | Component | Test Scenario | Pre-Requisite |
|--------------------|--------------|--------------|--|---------------|
| HomePage_TC_OO1 | Functional | Home Page | Verify user is able to see the home page or not. | |
| HomePage_TC_OO2 | UI | Home Page | Verify the UI elements in Home Page | |
| PredictPage_TC_OO3 | Functional | Predict page | Verify user is able to redirect to predict page or not. | |
| PredictPage_TC_OO4 | UI | Predict page | Verify the UI elements in Predict Page | |
| PredictPage_TC_OO5 | Functional | Predict page | Verify user is able to select the dropdown value or not. | |
| PredictPage_TC_OO6 | Functional | Predict page | Verify user is able to upload the image or not. | |
| PredictPage_TC_OO7 | Functional | Predict page | Verify whether the image is predicted correctly or not | |

| Steps To Execute | Test Data | Expected Result | Actual Result | Status |
|--|---|--|---------------------|--------|
| 1.Enter URL and click go 2.verify whether the user is able to see the home page. | Enter URL and click go | User able to see the home page | Working as expected | Pass |
| 1.Enter URL and click go 2.Verify the UI elements in Home Page. | Enter URL and click go | Application should show below UI elements: Home Tab & Classify Tab | Working as expected | pass |
| 1.Enter URL and click go 2.Click on Predict button 3.Verify whether the user to redirect to predict page or not. | Click the predict button in home page | User should navigate to Predict page | Working as expected | pass |
| 1.Enter URL and click go 2.Verify the UI elements in Predict Page. | Click the predict button and redirect to predict page | Application should show below UI elements: Dropdown List , Upload file Button, Predict button. | Working as expected | pass |
| 1.Enter URL and click go 2.Click on Predict button 3.Verify whether the user to redirect to predict page or not. 4.Verify user is able to select the dropdown value or not. | Fruit or Vegetable | Application should show the user, the uploaded image for verification of given specified fruit or vegetable. | Working as expected | pass |
| 1.Enter URL and click go 2.Click on Predict button 3.Verify whether the user to redirect to predict page or not. 4.Verify user is able to select the dropdown value or not. 5.Verify user is able to upload the images or not | Images to be Uploaded | Application should shows the uploaded image. | Working as expected | pass |
| 1.Enter URL and click go 2.Click on Predict button 3.Verify whether the user to redirect to predict page or not. 4.Verify user is able to select the dropdown value or not. 5.Verify user is able to upload the images or not 6. Verify whether the Image is predicted correctly or not | Click the Predict Button | Application shows the nutrition details classified output | Working as expected | pass |

Model Performance Testing

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

| S.No. | Parameter | Values | Screenshot |
|-------|---------------|--|--|
| 1. | Model Summary | Total params: 712,389 Trainable params:712,389 Non-trainable params: 0 |  |
| 2. | Accuracy | Training Accuracy – 96.55 Validation Accuracy – 97.45 |  |

8.2.USER ACCEPTANCE TESTING

1. Purpose of Document: The purpose of this document is to briefly explain the test coverage and open issues of the AI-powered Nutrition Analyzer for Fitness Enthusiasts project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis: This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|----------------|------------|------------|------------|------------|----------|
| By Design | 0 | 0 | 1 | 0 | 1 |
| Duplicate | 1 | 3 | 2 | 2 | 8 |
| External | 2 | 3 | 0 | 0 | 5 |
| Fixed | 4 | 4 | 4 | 4 | 16 |
| Not Reproduced | 0 | 0 | 0 | 1 | 1 |
| Skipped | 0 | 0 | 0 | 0 | 0 |
| Won't Fix | 0 | 0 | 0 | 0 | 0 |
| Totals | 7 | 10 | 7 | 7 | 31 |

3. Test Case Analysis: This report shows the number of test cases that have passed, failed, and untested.

9. RESULTS

9.1.PERFORMANCE METRICS

Software Requirements

To complete this project, you should have the following software and packages.

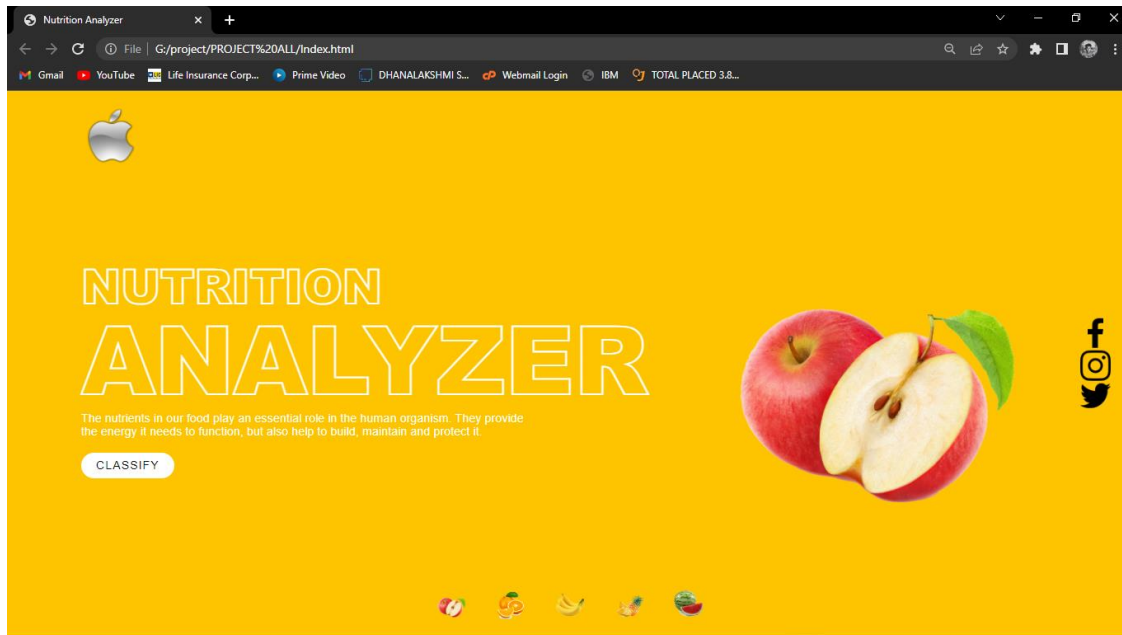
Softwares

- Anaconda Navigator
- py charm
- Visual studio code
- Jupiter notebook

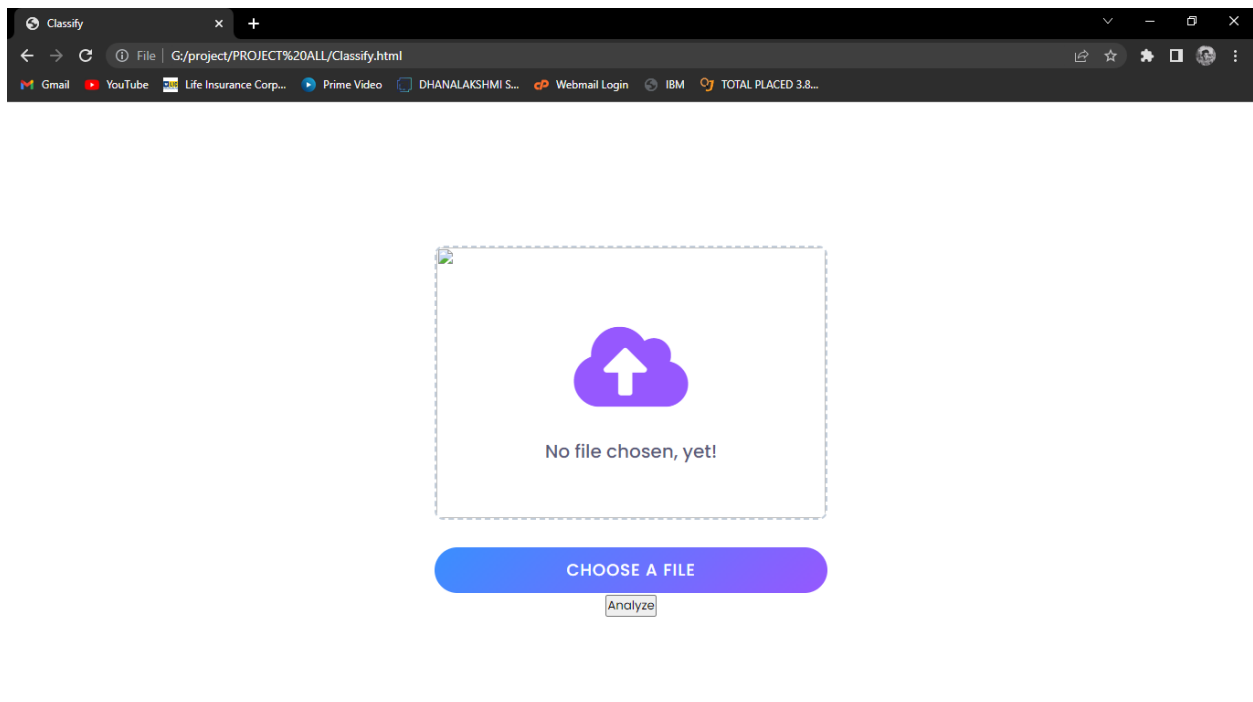
IBM Watson studio Packages

- Tensor flow
- Keras
- Flask
- numpy
- Pandas

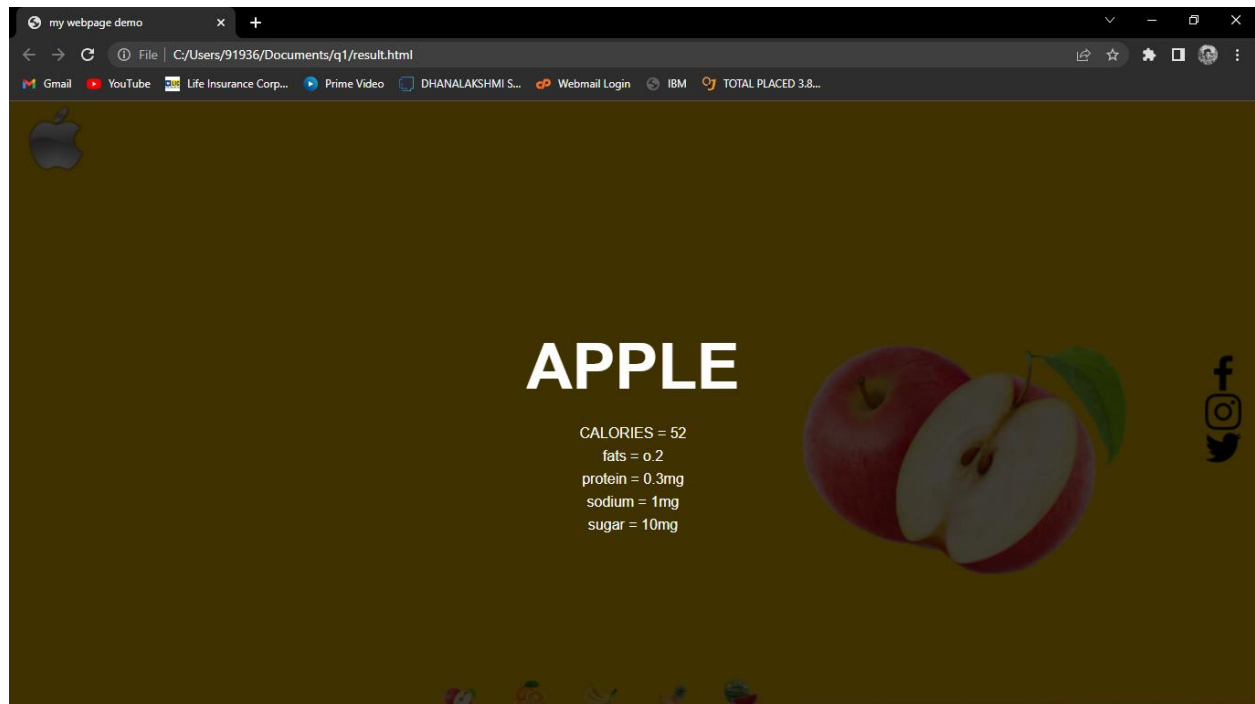
OUTPUT



UPLOAD PAGE



ANALYZER PAGE



10.ADVANTAGES & DISADVANTAGES

ADVANTAGES

- 1.The AI Nutrition Analyzer was designed to direct users toward a balanced diet and help them reach their health objectives.
- 2.A good way to gauge caloric intake
- 3.It guarantees that the meal has the right amount of vitamins and minerals.
- 4.Offer more precise values.
- 5.Cost effectiveness.

DISADVANTAGES

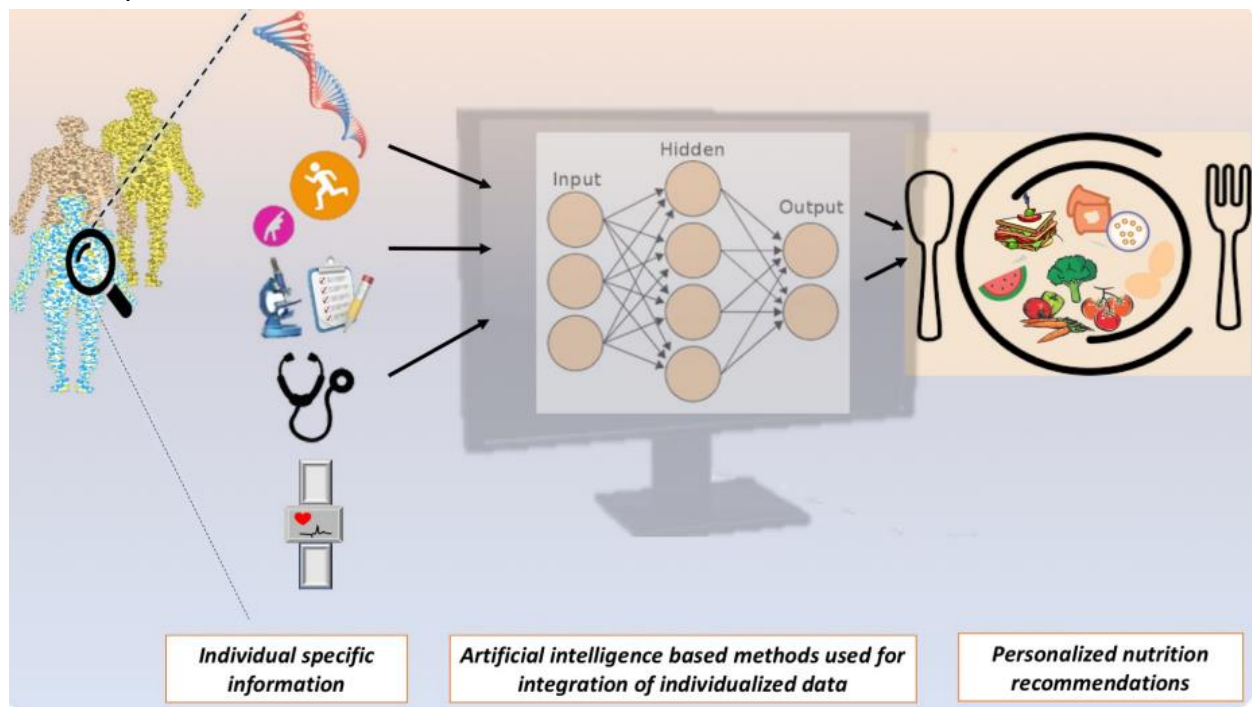
- 1.It has limited applicability to other nutrients like proteins and vitamins.
- 2.Erroneous information
- 3.Takes a lot of time

11.CONCLUSION

We develop a useful deep learning algorithm for fitness enthusiasts based on the AI-driven Nutrition Analyser. In this method, the services are used by a deep learning algorithm-based food picture identification system. We are enhancing the algorithm's performance (in terms of detection accuracy). We will eventually include our technique into a genuine mobile device to improve cloud computing. This method uses the user's submitted image of the meal to classify it and then uses the estimated model to measure the item's properties. The outcomes are improved using flask application, model construction, and picture preprocessing in the IBM cloud. This method of categorization yields precise values. The system's accuracy and usefulness will be enhanced in the future

12.FUTURE SCOPE

Future plans for an AI-powered nutrition analyzer for exercise enthusiasts include handling health issues and difficulties as well as making it simple for regular individuals to accomplish their objectives. Increase the epochs and layer count to gather additional data. We can get more sophisticated features from it, like bespoke searches and better visualisation, for example



13.APPENDIX

Source Code

[Python Code]:

```
#request-for accessing file which was uploaded by the user on our application.
import os
import tensorflow as tf
global graph
graph = tf.compat.v1.get_default_graph()
import numpy as np # used for numerical analysis
from werkzeug.utils import secure_filename
from gevent.pywsgi import WSGIServer

from flask import Flask, render_template, request, url_for
from keras.preprocessing import image
from keras.models import load_model # to load our trained model

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

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

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

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

```

if request.method=='POST':
    f=request.files['image']
    print('current path')#requesting the file
    basepath=os.path.dirname('__file__')
    print('current path',basepath)#storing the file directory
    filepath=os.path.join(basepath,"uploads",f.filename)
    print('upload folder is',filepath)#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

    with graph.as_default():
        pred=model.predict_classes(x)
        print("prediction",pred)#printing the prediction
        index=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']
        text = 'the predicted animal is: ' + str(index[pred[0]])

    return text
else:
    return render_template('Result.html')

if __name__ == "__main__":
    # running the app
    app.run(debug=False)

```

[HTML Code]:

Index Page:

```

<!DOCTYPE html>
<html lang="en">
<head>

```

```

<meta charset="UTF-8">
<title>Nutrition Analyzer</title>
<link rel="stylesheet" href="/static/css/style.css">
</head>
<body>
<section class="sec">
<header>
<a href="#"></a>
</header>
<div class="content">
<div class="textBox">
<h2>Nutrition<br><span>Analyzer</span></h2>
<p>The nutrients in our food play an essential role in the human organism. They provide the
energy it needs to function, but also help to build, maintain and protect it.</p>
<a href="http://localhost:5000/analyser" class="link">Classify</a>
</div>
<div class="imgBox">

</div>
</div>
<ul class="thumb">
<li></li>
<li></li>
<li></li>
<li></li>
<li></li>
</ul>
<ul class="sci">
<li><a href="#"></a></li>
<li><a href="#"></a></li>
<li><a href="#"></a></li>

```



```
</ul>
</section>
<script type="text/javascript">
  function imgSlider(anything){
    document.querySelector('.apple').src = anything;
  }
  function changeBgcolor(color){
    const sec = document.querySelector('.sec');
    sec.style.background = color;
  }
</script>
</body>
</html>
```

Analyzing Page:

Git-Hub Link

<https://github.com/IBM-EPBL/IBM-Project-29505-1660126397>

Project Demonstration Link