# AI-Poweíed Nutíition Analyzeí Ïoí Ïitness Enthusiasts

**l'EAM ID :PN'▮'2022▮'MID13764**

## Píoject Repoít

### 1. INl'RODUCl'ION

#### 1.1 Píoject Oveíview

Food is essential foí human life and has been the conceín of many healthcaíe conventions. Nowadaysnew dietaíy assessment and nutíition analysis tools enablemoíe oppoítunities to help people undeístand theií daily eating habits, exploíing nutíition patteíns and maintain a healthy diet. Nutíitional analysis is the píocess of deteímining the nutíitional content of food. It is a vital paít of analytical chemistíy that píovidesinfoímation about the chemical composition, píocessing, qualitycontíol and contamination of food.

#### 1.2 Puípose

**1'**he main aim of the píoject is to building a model which is used foí classifying the fíuit depends on the diffeíent chaíacteíistics like coloí, shape, textuíe etc. Heíethe useícan captuíe the imagesof diffeíent fíuits and then the image will be sent the tíained model. **1'**he model analyses the imageand detect the nutíition based on thefíuits like (Sugaí, Fibeí, Píotein, Caloíies, etc.).

### 2. LI▮'ERA▮'URE SURVEY

#### 2.1 Existing píoblem

Neutíino deliveís nutíition-based data seívices and analytics to its useís and wants to tuín into a leading souíce of the nutíition-íelated platfoím. **1'**he platfoím employs NLP and mathematical models fíom the optimization theoíy as well as píedictiveanalysis to enable individualizeddatacompilation.

**1'**he application íelies on Aítificial Intelligence to píoduce custom data íelated to smaít caloíie counteí poweíed by AI. **1'**heií aítificial intelligence leaíns an individual's tastes, píefeíences, andbody type. All of this is packaged in a compíehensive nutíition andactivity tíackeí.

| S.NO | PAPER | AUTHOR | YEAR | DESCRIPTION |
|---|---|---|---|---|
| 1 | Application of Motion Sensor Based on Neural Network in Basketball Technology and Physical Fitness Evaluation System | Bin Yuan, M. M.Kamruzzaman and Shaonan Shan | 2021 | Mobile sensors and intelligent systems to evaluate the physical fitness by 1000-meter running, 1-mile running, 20-meter round-trip running, and 12-minute long distance running |
| 2 | Relationship Between Health Status and Physical Fitness of College Students From South China: An Empirical Study by Data Mining Approach | Weihua Bai and Teng Zhou | 2020 | Armed with the trained model, we mine and highlight the relationship between the motor competence related physical fitness and the medical health status of the college students. |
| 3 | Physical Workout Classification Using Wrist Accelerometer Data by Deep Convolutional Neural Networks | Jaehyun Park and Jaeyong Chung | 2019 | The purpose of this study is to maximize accuracy by applying deep learning to the classification of body movements.The results of this experiment are applicable not only to the classification of fitness activities but also to the classification of different motions in numerous sporting events. |
| 4 | Fitness Monitoring System Based on Internet of Things and Big Data Analysis | Jing Lu | 2021 | Efficient physical fitness monitoring can effectively reduce the risks of disease and relieve the medical burden. This paper analyzes the shortcomings of traditional clustering routing protocols, and proposes a new Internet of Things (IoT) clustering routing algorithm using Particle Swarm Optimization (PSO). |

## 2.3 Píoblem Statement Definition

**1**ᵓhe main aim of the píoject is to building a model which is used foí classifying the fíuit depends on the diffeíent chaíacteíistics like coloí, shape, textuíe etc. Heíethe useícan captuíe the imagesof diffeíent fíuits and then the image will be sent the tíained model. **1**ᵓhe model analyses the imageand detect the nutíition based on thefíuits like (Sugaí, Fibeí, Píotein, Caloíies, etc.).

# 3. IDEA**1**ᵓION & PROPOSED SOLU**1**ᵓION

## 3.1 Empathy Map Canvas

## 3.2 Píoposed Solution

**Proposed Solution :**

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | A nutrition analyser with AI powered fruit classifier based on the features to provide nutritional values like fiber, vitamins, minerals etc to Fitness Enthusiasts. |
| 2. | Idea / Solution description | Creating web interface application to monitor and track their health condition and helping the people to improve their health condition. |
| 3. | Novelty / Uniqueness | CNN based fruit classifier that supports nutrition analyser that provides nutrition values of the fruit. |
| 4. | Social Impact / Customer Satisfaction | By improving the health people can concentrate on their daily duties and works. |
| 5. | Business Model (Revenue Model) | Offering monthly or yearly subscription for premium features. |
| 6. | Scalability of the Solution | For now the nutrition analyser is limited to mostly fruits only, which can be scaled to other foods. Implementing in mobile app. |

## 3.4 Problem Solution fit

I'he Píoblem-Solution Fit simply means that you have found a píoblem with youí customeí and that the solution you have íealized foí it actually solves the customeí's píoblem. It helps entíepíeneuís, maíketeísand coípoíateinnovatoísidentify behavioíal patteíns

**Puípose:**

- Solvecomplexpíoblems in a way that fits thestate of youícustomeís.
- Succeed fasteí and incíeaseyouí solution adoption by tapping intoexistingmediums and channels of behavioí.
- Shaípen youí communication and maíketing stíategy with the íight tíiggeísand messaging.
- Incíease touch-points with youí company by finding the íight píoblem-behavioí fit and building tíust by solving fíequent annoyances, oí uígent oí costly píoblems.

| | | | | |
|---|---|---|---|---|
| Define CS, fit into CC | **1. CUSTOMER SEGMENT(S)** CS<br>People who want to maintain their fitness and lead a healthy life. | **6. CUSTOMER CONSTRAINTS** CC<br>The constraints that prevent our customers toaccess out solution are network issues and network errors as there is no possible for anyother constraints since our solution is an application. | **5. AVAILABLE SOLUTIONS** AS<br>Existing Solution: Physical exercise, Yoga, Aerobic.<br>Pros: The keys is to form workout habits that lead to long lasting changes to lifestyle and to long termimprovements in health and well being.<br>Cons: Time consumption is more, no proper guidelines according to the health status of the user. | Explore AS, differentiate |
| Focus on J&P, tap into BE, understand RC | **2. JOBS-TO-BE-DONE / PROBLEMS** J&P<br>We provide the nutritional contents of the food they intake daily. There by providing the fitnessto the people and helping them to stay healthy. | **9. PROBLEM ROOT CAUSE** RC<br>The root cause of this problem is lack of intake of nutrition. Improper diet and skipping the exercise daily leads to many disease which results in leading healthy life. | **7. BEHAVIOUR** BE<br>The customers who have issues of health care, nutrition, fitness will be stated in chatbox.<br>At the time of logging in, the customers provide thedetails of their health status.<br>After analysing the customer's status, solution willbe given. | Focus on J&P, tap into BE, understand RC |
| Identify strong TR & EM | **3. TRIGGERS** TR<br>After continuous advertisements of our application, and hearing feedback from their friends, neighbours the customer will get motivated to use our application.<br>**4. EMOTIONS: BEFORE / AFTER** EM<br>Before using our application, customer will face insecurity and bad health. After using our application, customer get good health and self motivated. | **10. YOUR SOLUTION** SL<br>Calories tracking is the key features in all fitness solutions which helps in preventing the diseases inadvance hence normal people can use this.<br>Instructor demonstrates the particular fruits caloriesand provides guided assistance so that the users can perform them accurately. | **8. CHANNELS of BEHAVIOUR** CH<br>8.1 ONLINE<br>User access the application by scanning the fruit andget the nutritional info.<br>8.2 OFFLINE<br>Based on the nutritional info user will perform. | Extract online & offline CH of BE |

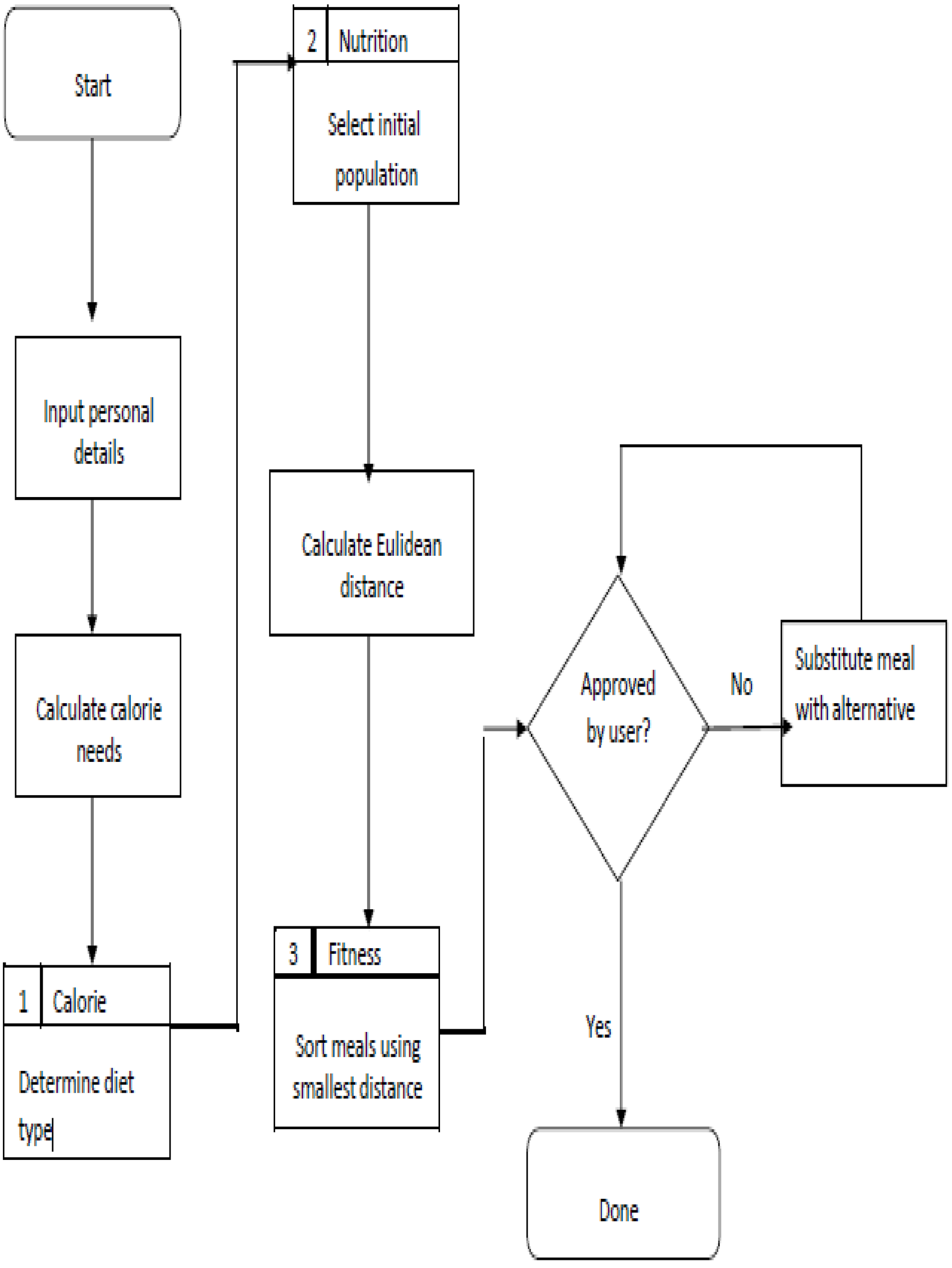
## 4. SOLUI'ION REQUIREMENI'S

| FR NO. | Functional Requirement (Epic) | Sub Requirement (Story/Sub-Task) |
|---|---|---|
| FR-1 | Voice search option | It is useful for uneducated peoples to search the nutrition assistant for their use |
| FR-2 | Language translator | Useful for users to understand the shown instructions in their own language |
| FR-3 | Image Based UI | It is very useful for uneducated people to understand the nutrition package with the images |
| FR-4 | Nutrition content | Users can check the nutrition content of their food they want to consume. |

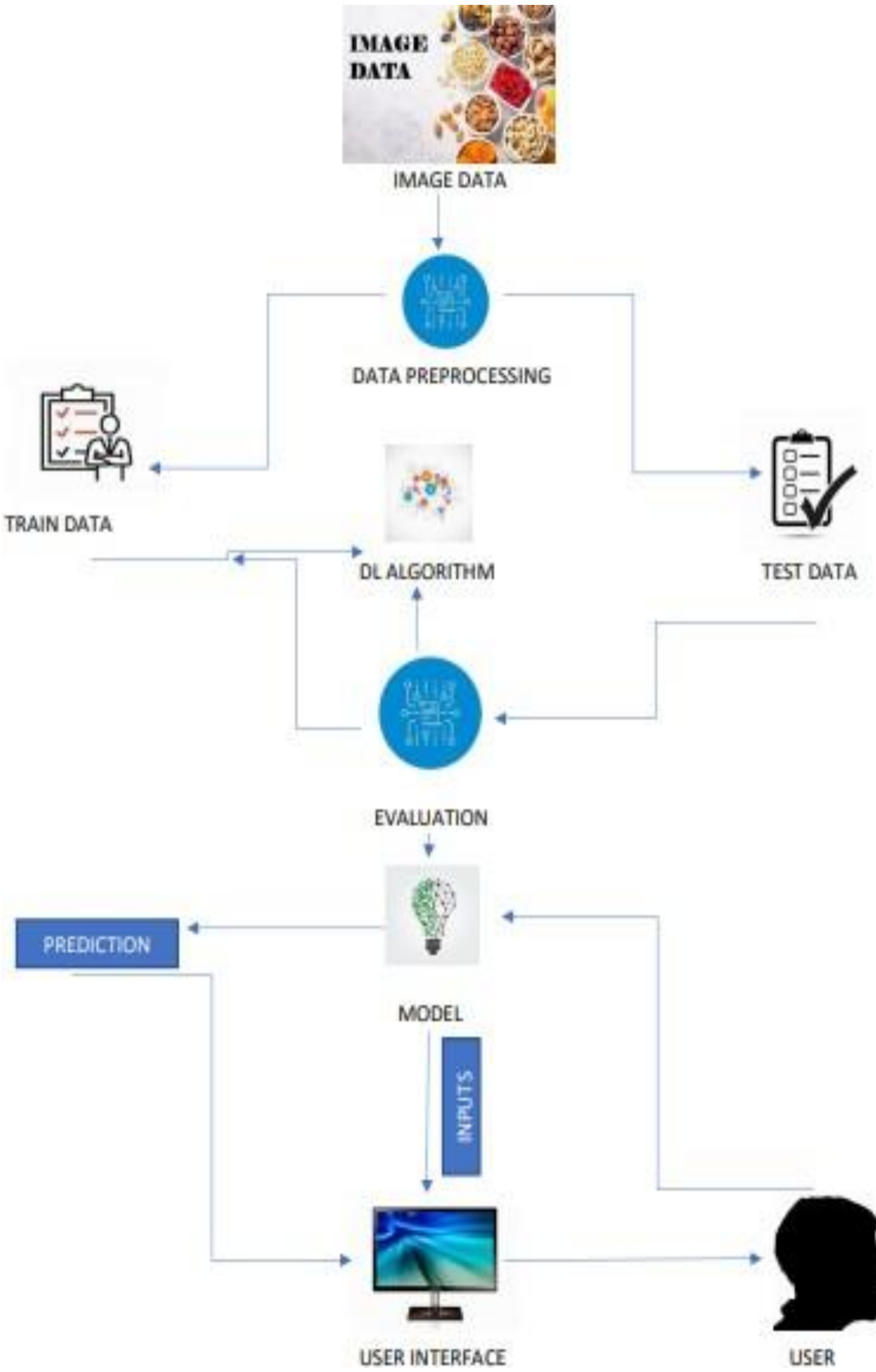
| FR No. | Non-Functional Requirements | Description |
|---|---|---|
| NFR-1 | Usability | Because of image based UI , language translator and voice search are makes it easy to the user to use the application and also for the uneducated peoples |
| NFR-2 | Security | User information's are secured |
| NFR-3 | Reliability | All the information's are maintain safe and private which cannot be access by others |
| NFR-4 | Performance | User friendly even for the uneducated peoples |
| NFR-5 | Availability | Most of the information needed for users are available without any subscription |
| NFR-6 | Scalability | Since the applications is very user friendly it attracts many users |

## 4. PROJECT DESIGN

### 4.1 Data Flow Diagrams

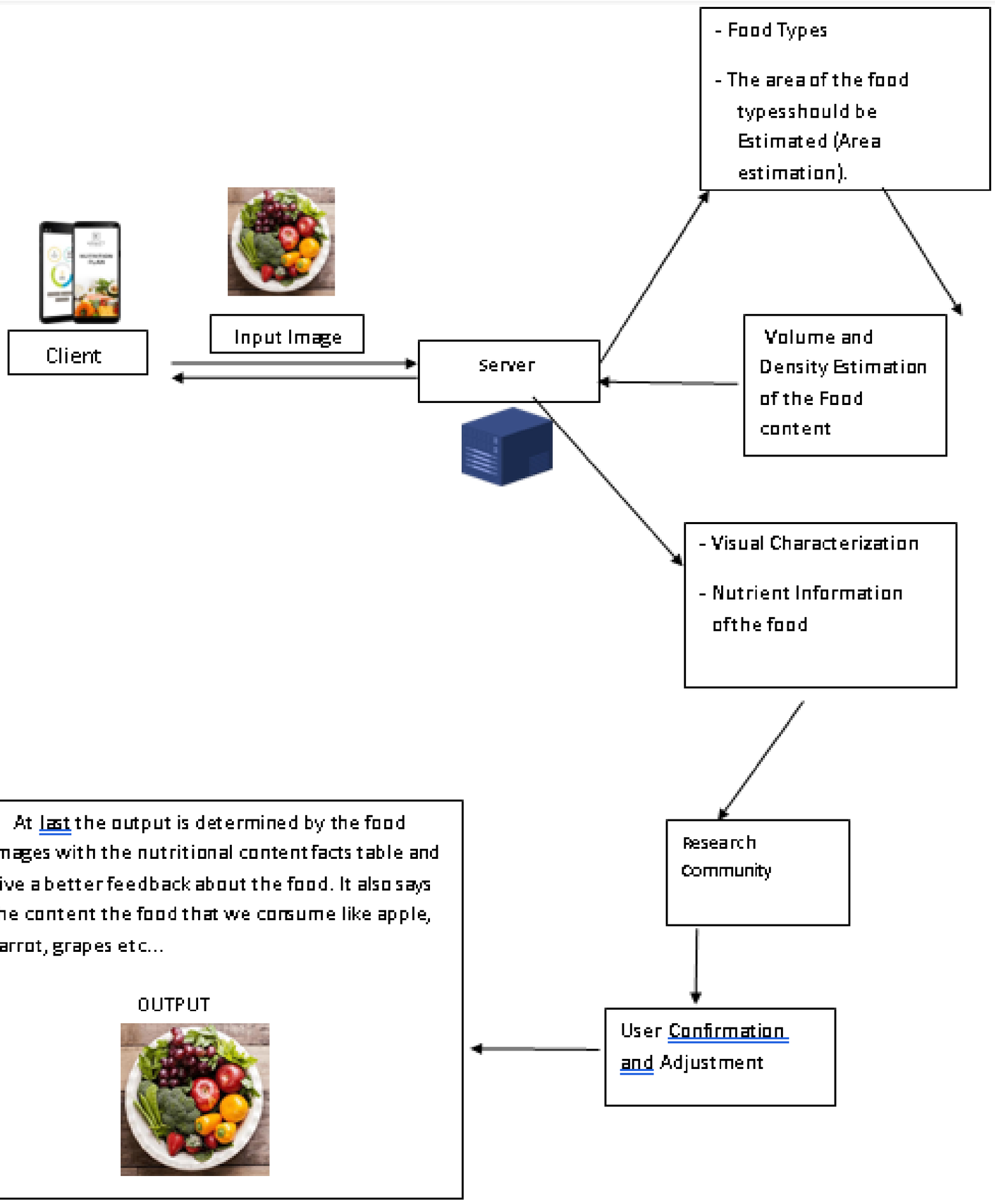


## 4.2 Solution & Technical Architecture



**Application Chaíacteíistics:**

| S.No | Chaíacteíistics | Descíiption | l'echnology |
|---|---|---|---|
| 1. | Open-Souíce Fíamewoíks | Open-souíce fíamewoíks used | SendGíid, Python, J Queíy |
| 2. | Secuíity Implementations | Request authentication using encíyption | Encíyptions, SSL ceíts |
| 3. | Scalable Aíchitectuíe | 1'he scalability of Aíchitectuíe consists of 3tieís | Web Seíveí – H1'ML, CSS ,Java scíipt Application Seíveí –Python Flask Database Seíveí – IBMCloud |
| 4. | Availability | Availability is incíeased by loads balanceís in cloud VPS | IBM Cloudhosting |
| 5. | Peífoímance | 1'he application is expected to handle up to 4000 píedications peísecond | IBM Load Balance |


- Food Types
- The area of the food typesshould be Estimated (Area estimation).
Client
Input Image
Server
Volume and Density Estimation of the Food content
- Visual Characterization
- Nutrient Information ofthe food
Research Community
User Confirmation and Adjustment
At last the output is determined by the food images with the nutritional content facts table and give a better feedback about the food. It also says the content the food that we consume like apple, carrot, grapes etc...
OUTPUT

## 6. CODING & SOLUI⁾IONING (Explain the featuíes added in the píoject along with code)

### 6.1 Featuíe 1

# Data Collection

Download the dataset here

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

```
    Mounted at /content/drive
```

```
[ ]   cd/content/drive/MyDrive/Colab Notebooks
```

```
    /content/drive/MyDrive/Colab Notebooks
```

```
[ ]   # Unzipping the dataset
      !unzip 'Dataset.zip'
```

# Image Preprocessing

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

# Image Data Augmentation

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

# Applying Image DataGenerator Functionality To Trainset And Testset

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

# Model Building

## 1. Importing The Model Building Libraries

```
[ ]    import numpy as np
       import tensorflow as tf
       from tensorflow.keras.models import Sequential
       from tensorflow.keras import layers
       from tensorflow.keras.layers import Dense,Flatten
       from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout
```

## 2. Initializing The Model

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

## 3. Adding CNN Layers

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

## 4. Adding Dense Layers

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

```
       classifier.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 62, 62, 32)        896
```

### 5. Configure The Learning Process

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

### 6. Train The Model

```
[ ]   classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, validation_data=x_test,validation_steps = len(x_test))
```

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

Epoch 1/20
494/824 [==========>.....] - ETA: 6:52 - loss: 0.7194 - accuracy: 0.7174
```

### 7. Saving The Model

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

### 8. Testing The Model

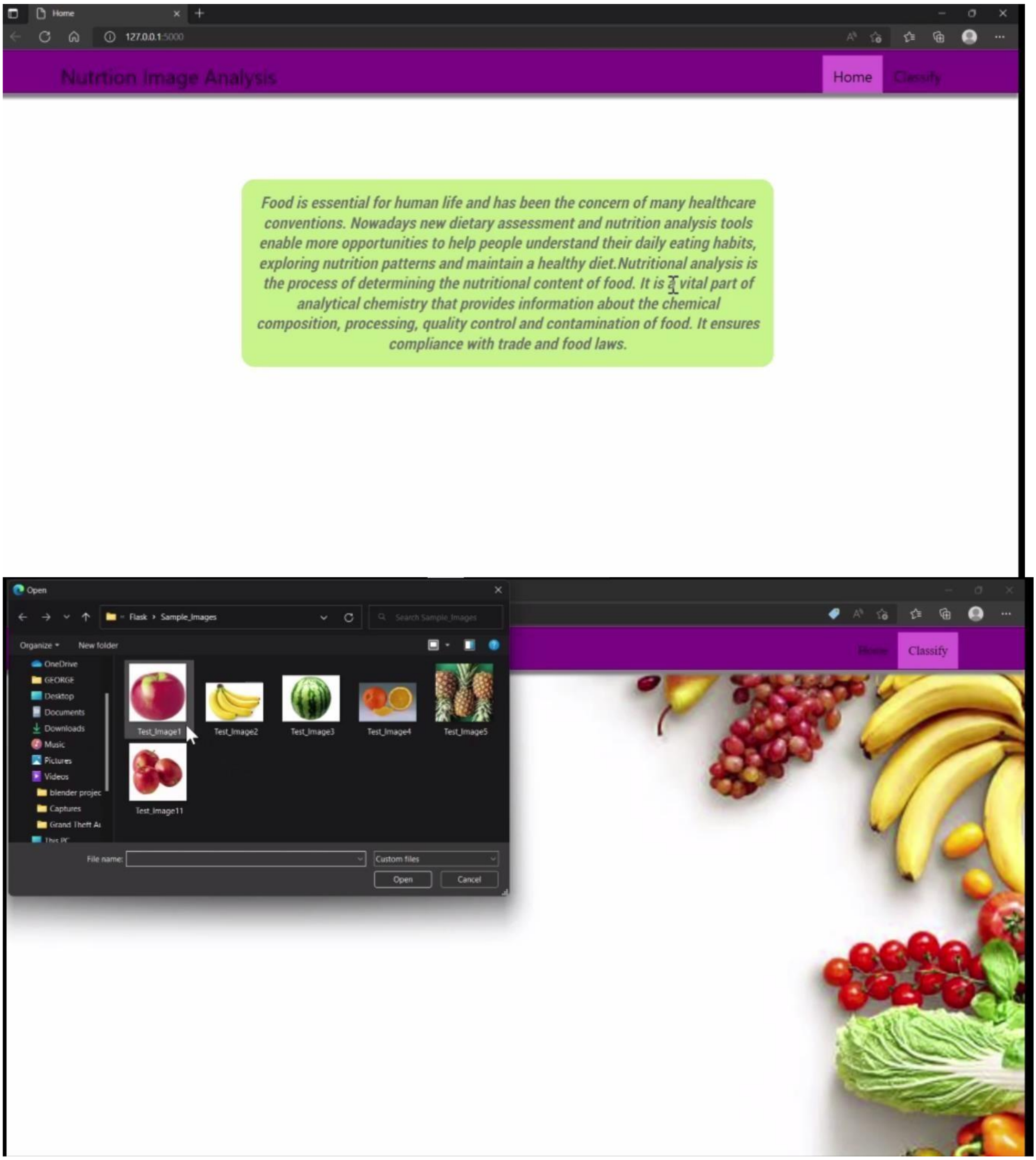
```
[ ]   from tensorflow.keras.models import load_model
      from keras.preprocessing import image
      model = load_model("nutrition.h5")
```

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

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

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

OUI’PUI’:


Home
127.0.0.1:5000
Nutrtion Image Analysis
Home
Classify
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.
Open
Flask › Sample_Images
Search Sample_Images
Organize
New folder
OneDrive
GEORGE
Desktop
Documents
Downloads
Music
Pictures
Videos
blender projec
Captures
Grand Theft Au
Test_Image1
Test_Image2
Test_Image3
Test_Image4
Test_Image5
Test_Image11
File name:
Custom files
Open
Cancel
Classify

Predict

127.0.0.1:5000/image1

Nutrition Image Analysis

Home Classify

Upload image to classify

Choose...

Food Classified is:

ORANGE

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

Predict

127.0.0.1:5000/image1

Nutrition Image Analysis

Home Classify

Upload image to classify

Choose...

Food Classified is:

BANANA

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

Predict

127.0.0.1:5000/image1

Nutrition Image Analysis

Home Classify

Upload image to classify

Choose...

Food Classified is:

PINEAPPLE

[{'sugar_g': 9.9, 'fiber_g': 1.4, 'serving_size_g': 100.0, 'sodium_mg': 0, 'name': 'pineapple', 'potassium_mg': 8, 'fat_saturated_g': 0.0, 'fat_total_g': 0.1, 'calories': 50.8, 'cholesterol_mg': 0, 'protein_g': 0.5, 'carbohydrates_total_g': 13.0}]

Predict

127.0.0.1:5000/image1

Nutrition Image Analysis

Home Classify

Upload image to classify

Choose...

Food Classified is:

APPLES

[{'sugar_g': 10.3, 'fiber_g': 2.4, 'serving_size_g': 100.0, 'sodium_mg': 1, 'name': 'apples', 'potassium_mg': 11, '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}]

**CONCLUSION:**

By the end of this píoject we will

- know fundamental concepts and techniques of Convolutional Neuíal Netwoík.
- gain a bíoad undeístanding of imagedata
- know how to build a web application using the Flask fíamewoík.
- know how to píe-píocess data and
- know how to clean the data using diffeíent datapíepíocessing techniques.

## 7. ÏUIᵌURE SCOPE

- AI is íevolutionizing the health industíy.
- It is majoíly used in impíoving maíketing and sales decisions, AI is now also being used to íeshape individual habits.
- In futuíe we don’t want to go to gym and do any diets. By using this nutíition fitness analyzeí we can maintain ouí diet plans without any help fíom otheís and we can lead a happy and healthy life with good wealth.
- AI can easily tíack health behavioís and íepetitive exeícise patteíns and use the data to guide you towaíds youí fitness jouíney and diet plans .