

NALAIYA THIRAN PROGRAM

AI-POWERED NUTRITIONANALYZER FORFITNESS ENTHUSIASTS PROJECT REPORT

SUBMITTED BY

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1. INTRODUCTION

a. PROJECT OVERVIEW

As the world becomes more health-conscious, there is an increasing need for technical solutions to meet this growing need. Numerous firms and websites that target this market have benefited in India from this global trend. These platforms have made use of AI and its different subsets to calculate calorie consumption and provide food suggestions for a balanced diet. The majority of the time, what we observe is that these platforms serve as a data repository, making real-time information available to many clients that work in this industry in exchange for a set of fees. In this article, we examine the top deep learning and artificial intelligence (AI)-based online services that offer real-time reports on dietary intake. The primary goal of the project is to construct a model that will be used to categorize fruits according to their various properties, such as color and form.

b. PURPOSE

Fruit features include color, shape, texture, and others. Here, users can take pictures of various fruits, which are subsequently uploaded to a trained algorithm for analysis. The main goal of the project is to construct a model that is used for classifying the fruit depending on the different nutrients. The model analyses the image and detects the nutrients based on the fruits, including glucose, fiber, protein, etc.

2. LITERATURE SURVEY

2.1. EXISTING PROBLEM

Over time, poor nutrition can increase the risk of contracting certain diseases and other health issues, including being overweight or obese, tooth decay, and high blood pressure. In the short term, it can increase tension, fatigue, and our capacity to function. Low intakes of specific nutrients are now strongly linked to the risk of acquiring chronic illnesses, such as various malignancies, heart disease, diabetes, osteoporosis, and depression. Inadequate vitamin consumption during pregnancy may have long-term effects on the unborn child's health.

a. REFERENCES

1. T. Akram, H. H. Rizvi, S. A. Ali, S. M. Hamza and A. Ifthikhar, "OCR and Barcode based Halal and Health Analyzer," *2020 International Conference on Information Science and Communication Technology (ICISCT)*, 2020, pp. 1-5
2. R. Sugawara and M. Nakata, "Theoretical Analysis of Accuracy-Based Fitness on Learning Classifier Systems," in *IEEE Access*, vol. 10, pp. 64862-64872, 2022
3. Y. Qiu, X. Zhu and J. Lu, "Fitness Monitoring System Based on Internet of Things and Big Data Analysis," in *IEEE Access*, vol. 9, pp. 8054-8068, 2021

b. PROBLEM STATEMENT DEFINITION

Your specific fitness objectives and current level of fitness will determine how much exercise you require. It's crucial to begin within your capabilities and pay attention to your body's signals regarding pain and injury. Being overweight, which is characterised by a high percentage of body fat, is a widespread health problem. Your risk of dying from hypertension, coronary heart disease, sleep apnea, endometrial, breast, prostate, and colon cancer increases if you are overweight or obese. Junk food has a

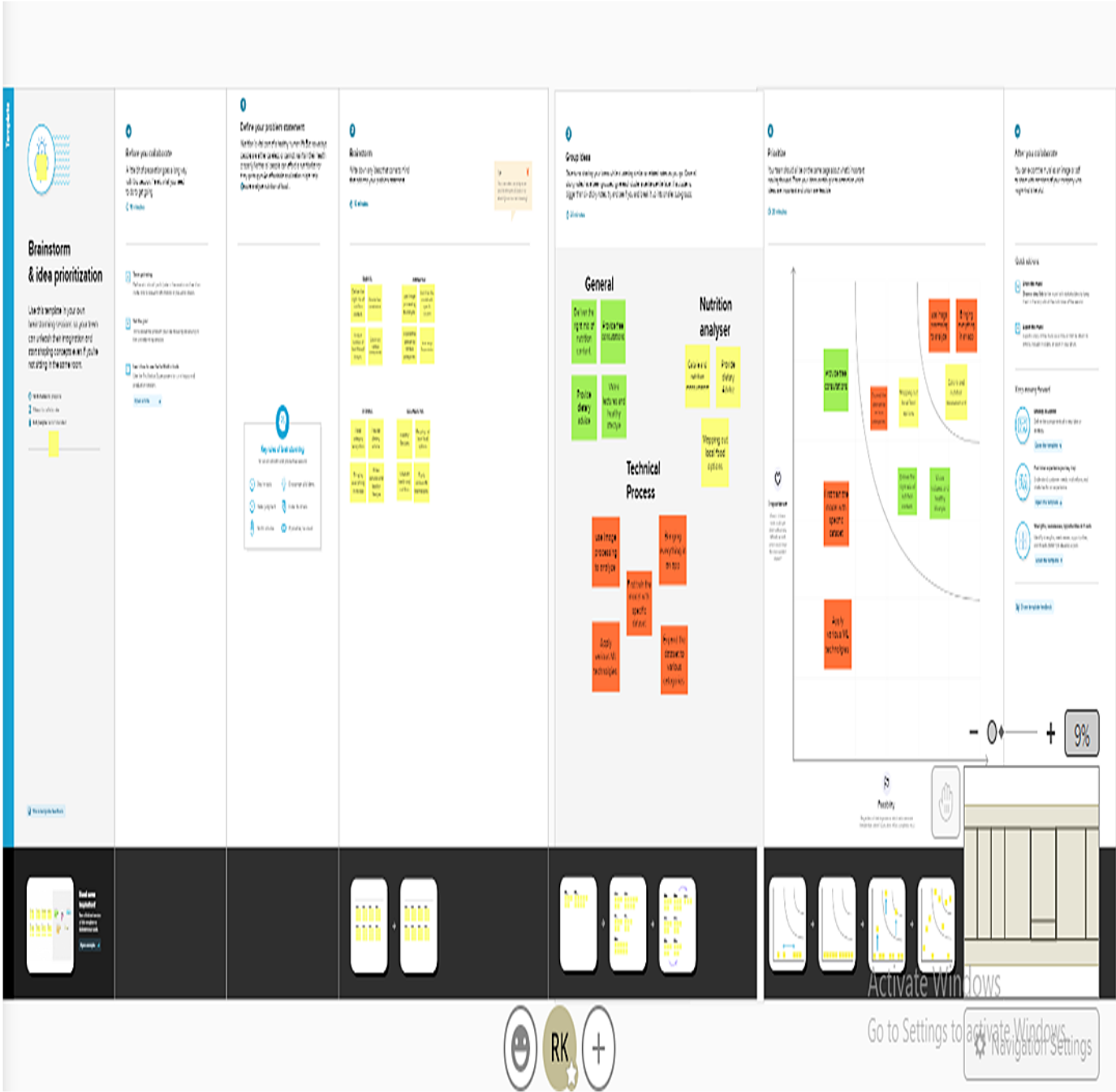
high caloric content but little nutritional value, which causes obesity by increasing metabolic weight. A person who is obese is more likely to develop serious illnesses, including stroke and NCDs, in addition to the serious illnesses like diabetes or high cholesterol. The immune system could become compromised by overtraining. It makes the heart work harder. Inadequate exercise may result in fractures, sprains, strains, and other painful injuries.

3. IDEATION AND PROPOSED SOLUTION

a. EMPATHY MAP CANVAS



b.IDEATION AND BRAINSTORMING



C.PROPOSED SOLUTION

Problem Statement: To identify the amount of nutrition present in the food and to help for their nutrient fitness. 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 color, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fiber, Protein, Calories, etc.).

Idea / Solution Description: In this project we are going to identify amount of calories present in the food and recommend the nutrition food for their fitness. Providing accurate identification of the input data and nutritional information based on the data collected in accordance with the user's physical circumstances

Novelty / Uniqueness: It uses AI for classifying various nutrients in the fruit which will provide various recommendations as per the person's BMI. These days, additional opportunities exist to assist people in understanding their daily eating habits, examining nutrition patterns, and maintaining a balanced diet thanks to new dietary evaluation and nutrition analysis technologies.

1. Food contamination, composition processing, and quantity control are all provided by analytical chemistry, which includes the process of analyzing the nutritional content of food. We just eat on a diet during the day. And a balanced diet is one that has the right amount of each vitamin we need each day. • A lifetime of healthy eating is necessary for optimal health. The risk of obesity, coronary heart disease, stroke, some malignancies, type 2 diabetes, high blood pressure, osteoporosis, and tooth decay can all be decreased by eating a balanced diet.

Social Impact / Customer Satisfaction: It doesn't require individuals to afford their own fitness trainer. It is cost efficient and they can very well maintain their fitness. An individual's nutritional status and social, psychological, and cultural circumstances are related in a cause-and-effect manner. One's eating habits are influenced by cultural norms, economic stability, and views toward health and disease. • A nutritious diet lowers children's chance of developing chronic diseases and promotes healthy growth and development. Adults who follow a healthy diet have a lower risk of obesity, heart disease, type 2 diabetes, and several malignancies. • In addition, diet culture influences the rising prevalence of anorexia, bulimia, binge eating disorder,

and avoidant/restrictive food intake disorder, even though negative cultural standards are only one of many factors that contribute to the development of mental health issues and eating disorders.

Business Model: Business model for this application is to reduce the people weight with healthy nutrition. Consultation with local nutritionists and trainers for customized strategies. Adopt a particular diet under the guidance of a professional. Promote nutritional supplements and fitness equipment. Advertising for health clubs and hospitals.

Scalability: Scalability of the application is high as it can be used by all age group of people and people with any kind of co-morbidities. Make at least half of the grains you eat each day whole grains. Whole grain products are a significant source of fibre and energy. A healthy diet can help you avoid many chronic, non-communicable diseases like cancer, diabetes, and heart disease. A balanced diet that limits salt, sugar, saturated fats, and trans fats from industrial production is crucial for good health.

D.PROBLEM SOLUTION FIT

Project Title: AI-Powered Nutrition Analyzer for Fitness Enthusiasts			Project Design Phase-I - Solution Fit Template			Team ID: PNT2022TMD19729		
Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS <small>Who is your customer? i.e. working parents of 0-5yo. kids</small> <p>Everyone over the age of 18 who wants to maintain their fitness and lead a healthy lifestyle. It also applies to both men and women.</p>	6. CUSTOMER CONSTRAINTS CC <p>Customers can't access our website owing to network problems and network flaws, as there are no further restrictions.</p>	5. AVAILABLE SOLUTIONS AS <p>Physical exercises and yoga are the existing practical solutions but most of the people are not ready to take up the solutions by themselves.</p>	Explore AS, differentiate				
	2. JOBS-TO-BE-DONE / PROBLEMS J&P <p>Not every people can afford an individual trainer or nutritionist in order to maintain fitness/healthy lifestyle. An application with all the features of a nutritionist is a better solution for this problem.</p>	9. PROBLEM ROOT CAUSE RC <p>People never worried about their health until a pandemic like COVID hit them. In this era, people are becoming weak due to the kind of food habits followed by them.</p>	7. BEHAVIOUR BE <p>Customers with questions about exercise, nutrition, or health will be listed in the Chatbox Once the customers are logged in, they provide details regarding their current</p>					
Focus on J&P, tap into BE, understand RC	3. TRIGGERS TR <p>Creating awareness to people through social media platforms. In-person awareness will help us get more users. Creating videos with the benefits of this app will trigger people to use our app.</p>	10. YOUR SOLUTION SL <p>We are planning to create an application which will be instructing the user regarding the amount of nutrition content in their food through image processing and we also suggest them few fitness activities based on their body conditions like taking account of their BMI, etc.</p>	8. CHANNELS of BEHAVIOUR CH #1 ONLINE <p>Initially customers will scan the fruit/any other food item and our app in return will provide the analysis of the nutrition content in that food item.</p>	Focus on J&P, tap into BE, understand RC				
	4. EMOTIONS: BEFORE / AFTER EM <p>Prior to using our program, customers would face insecurity and poor health. Customers who use our app report better health and higher levels of self-esteem.</p>		#2 OFFLINE <p>The user will follow physical exercises based on their body condition.</p>					
Identify strong TR & EM			Identify strong TR & EM					

4. REQUIREMENT ANALYSIS

a. FUNCTIONAL REQUIREMENTS

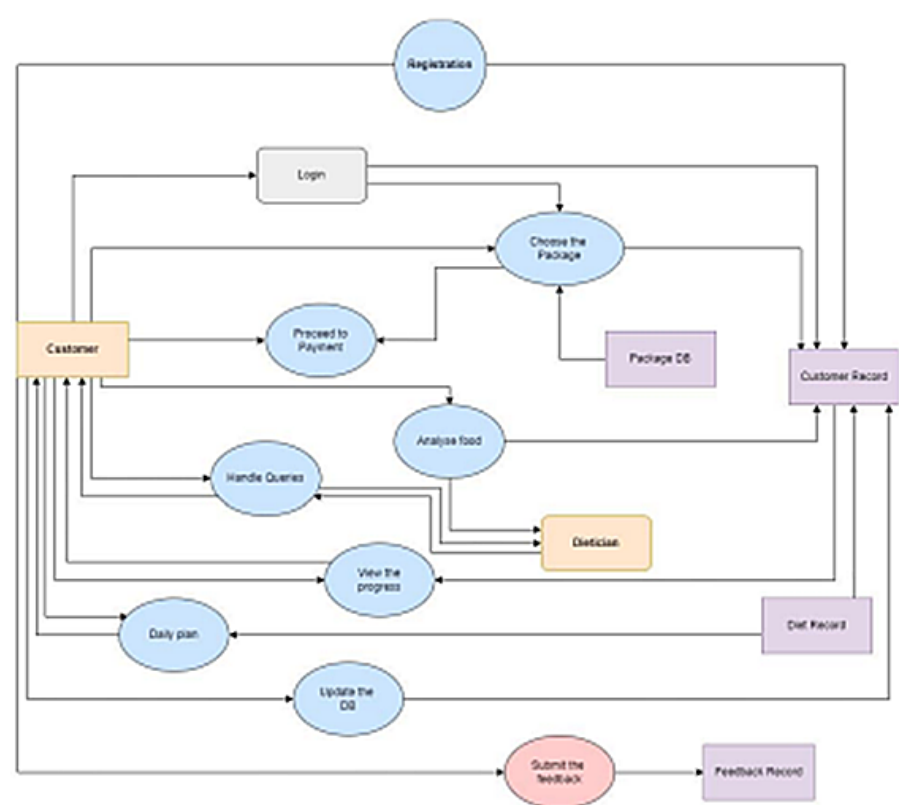
- i. User Registration
- ii. User Confirmation
- iii. User Login
- iv. Choose package
- v. Generate the daily plan
- vi. Query

b. NON-FUNCTIONAL REQUIREMENTS

- i. Usability
- ii. Security
- iii. Efficiency
- iv. Portability
- v. Scalability
- vi. Reliability

5. PROJECT DESIGN

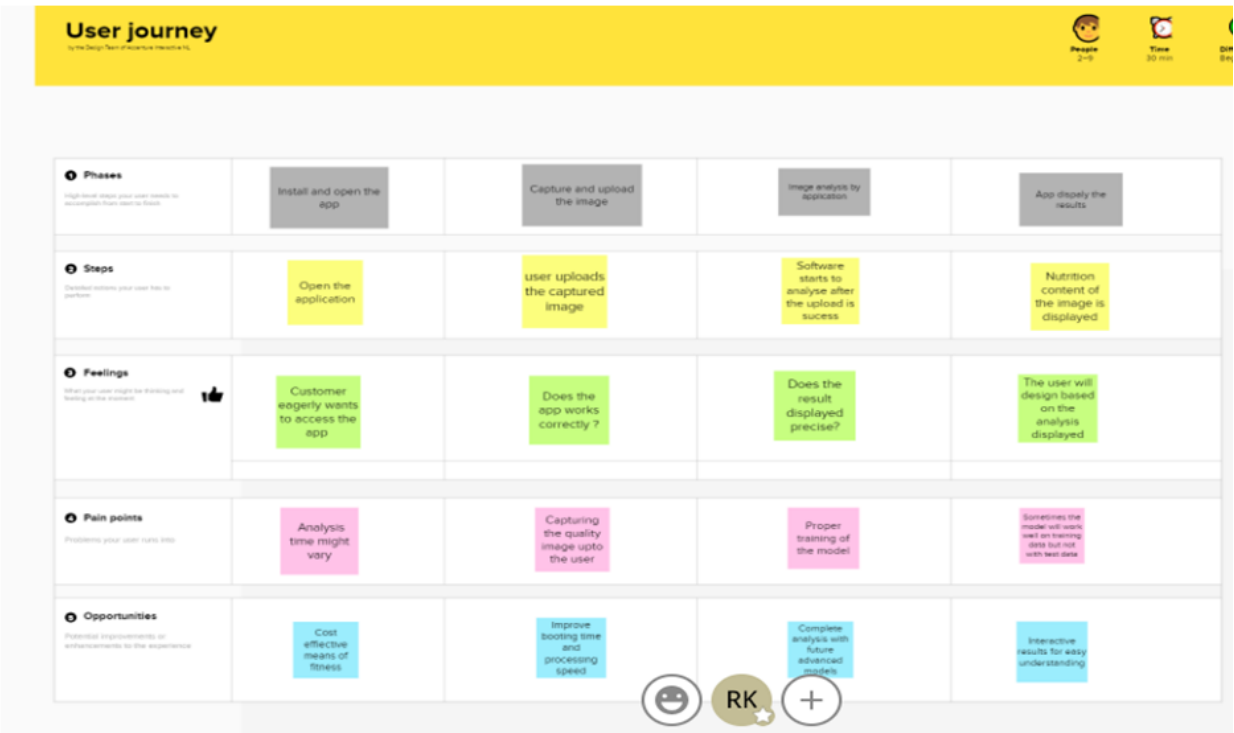
a. DATA FLOW DIAGRAMS



b. SOLUTION AND TECHNICAL ARCHITECTURE

We are planning to create an application which will be instructing the user regarding the amount of nutrition content in their food through image processing and we also suggest them few fitness activities based on their body conditions like taking account of their BMI, etc. Initially, User will give the image of the food item as input. Our model will process the image and predict the nutrition in the food item. To do this process without any errors, we will be training our model with more reliable training and testing dataset.

c. USERSTORIES



6. SPRINT PLANNING AND SCHEDULING

a. SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story/ Task	Story Points	Priority	Team Members
Sprint-1	Upload Images	USN-1	Dataset - Collecting images of food items apples , banana, orange, pineapple, watermelon for analysis	2	High	1.Abdul Ashiq A R2.Akshay M 3.Harini S 4.Santhosh V
Sprint-1	Image Preprocessing	USN-2	Image data augmentation - Increasing the amount of data by generating new data points from existing data.	3	High	1.Abdul Ashiq A R2.Akshay M 3.Harini S 4.Santhosh V

Sprint	Functional Requirement (Epic)	User Story Number	User Story/ Task	StoryPoints	Priority	Team Members
Sprint-1	Image Preprocessing	USN-3	Image DataGenerator Class -Used for getting the input of the original data	2	Low	1.Abdul Ashiq 2.Akshay M 3.Harini S 4.Santhosh V
Sprint-1	Image Preprocessing	USN-4	Applying image data generator functionality to train setand test set	2	High	1.Abdul Ashiq 2.Akshay M 3.Harini S 4.Santhosh V
Sprint-2	Model Building	USN-5	Defining the model architecture - Building the model using deep learning approach and adding CNNLayers	2	High	1.AbdulAshiq 2.Akshay M 3.Harini S 4.Santhosh V
Sprint-2	Model Building	USN-6	Training , saving,testing and predicting the model	3	High	1.Abdul Ashiq A R 2.Akshay M 3.Harini S 4.Santhosh V
Sprint-3	Application Building	USN-7	Home page creation - It showsoptions of the applicationLogin and registration page creation - User canregister and	2	Medium	1.Abdul Ashiq 2.Akshay M 3.Harini S 4.Santhosh V

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
			login through gmailwith Idandpassword Login and registration page creation - User can register andlogin through gmail with Id and password			
Sprint-3	Application Building	USN-8	Analysis and prediction page creation - It shows the prediction of given user input Creation of about us , feedbackand rating page – It showsapplication history and feedback pageto users	2	High	1.Abdul Ashiq A R2.Akshay M 3.Harini S 4.Santhosh V
Sprint-4	Train theMod el	USN-9	Cloud deployment – Deployment of application byusing IBM cloud server. Functional testing – Checkingusability and accessibility	3	High	1.Abdul Ashiq A R2.Akshay M 3.Harini S 4.Santhosh V

b. SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Durati on	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned EndDate)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct2022	29 Oct2022	20	29 Oct2022
Sprint-2	20	6 Days	31 Oct2022	05 Nov2022	20	05 Nov2022
Sprint-3	20	6 Days	07 Nov2022	12 Nov2022	20	12 Nov2022
Sprint-4	20	6 Days	14 Nov2022	19 Nov2022	20	14 Nov2022

7. CODING AND SOLUTIONING

a. FEATURE 1

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

In [ ]: # Unzipping the dataset
!unzip '/content/drive/MyDrive/Dataset.zip'

Archive: /content/drive/MyDrive/Dataset.zip
replace Dataset/TEST_SET/APPLES/151_100.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename:
```

Image Preprocessing

```
In [6]: #Importing The ImageDataGenerator Library
from keras.preprocessing.image import ImageDataGenerator
```

Image Data Augmentation

```
In [7]: #Configure ImageDataGenerator Class
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

```
In [8]: #Applying Image DataGenerator Functionality To Trainset And Testset
x_train = train_datagen.flow_from_directory(
    r'/content/Dataset/TRAIN_SET',
    target_size=(64, 64), batch_size=5, color_mode='rgb', class_mode='sparse')
#Applying Image DataGenerator Functionality To Testset
x_test = test_datagen.flow_from_directory(
    r'/content/Dataset/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 [9]: #checking the number of classes
print(x_train.class_indices)

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

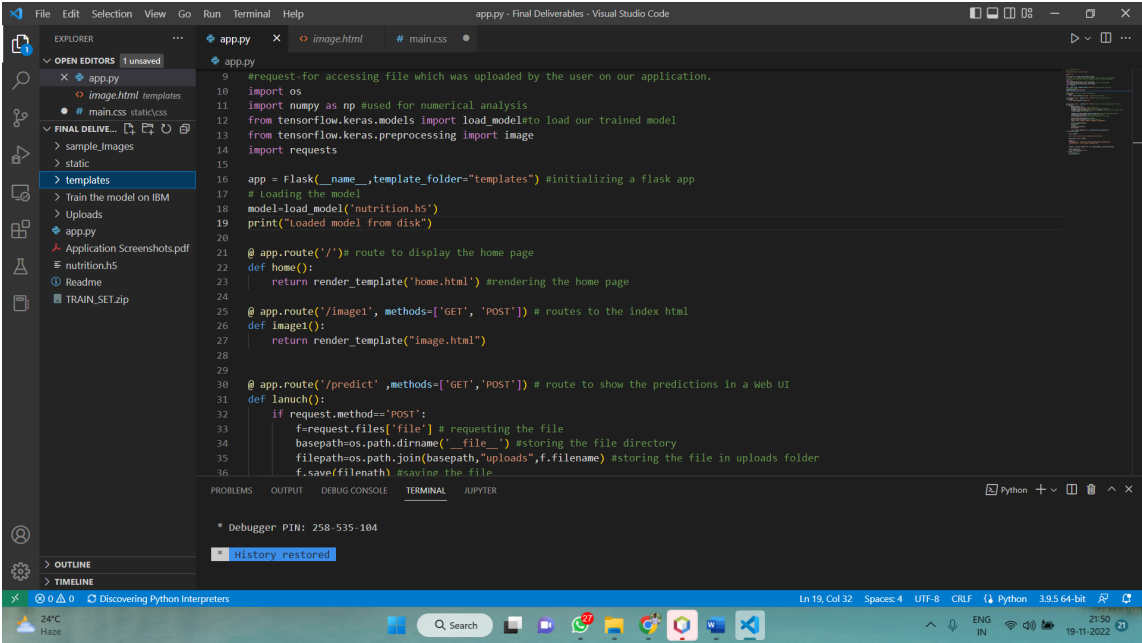
In [10]: #checking the number of classes
print(x_test.class_indices)

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

In [11]: from collections import Counter as c
c(x_train.labels)

Out[11]: Counter({0: 606, 1: 445, 2: 479, 3: 621, 4: 475})
```

b. FEATURE 2



8. TESTING

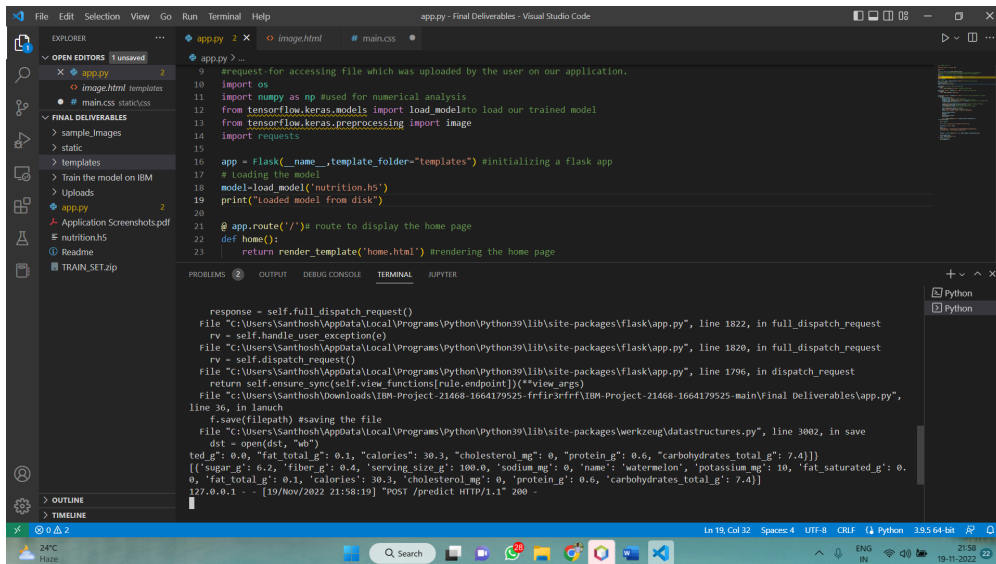
a. TESTCASES



b. USERACCEPTANCE TESTING



9. RESULTS



10. ADVANTAGES

Nutritional analysis is the process of determining the nutritional content of food.

Nowadays, new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, explore nutrition patterns, and maintain a healthy diet. The advantages of using this application include easy maintenance of our daily diet. It helps us maintain our health in proper condition. It replaces a physical trainer without compromising quality, at a lower cost, and with even more efficiency.

11. CONCLUSION

Good nutrition has been shown to support cognitive growth and academic performance in addition to enhanced physical health and a decreased risk of disease. This powered nutrition analyzer for fitness enthusiasts. If left to their own devices, kids won't always choose healthful food. Healthy body and mind depend on a balanced diet and proper meal scheduling. Nowadays, the majority of nations employ health education programs in schools that involve student nutrition, vitamin and mineral supplements.

12. FUTURE SCOPE

AI is transforming the health sector. AI is currently being used to change people's habits, in addition to being primarily utilized to improve marketing and sales decisions. In the future, this application can be implemented with even more specialized features like recommending dietary just by looking at a person's image, analyzing a person using person's body parts or organs image. Image processing techniques can be very well exploited along with this application.

13. APPENDIX

Source code:

app.py:

```
# -*- coding: utf-8 -*-
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 lanuch():
    if request.method=='POST':
        f=request.files['file'] # requesting the file
        basepath=os.path.dirname('__file__') #storing the file directory
        filepath=os.path.join(basepath,"uploads",f.filename) #storing the file in uploads folder
        f.save(filepath) #saving the file

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

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

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

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

    import requests

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

    querystring = {"query":index}

    headers = {
```

```
"X-RapidAPI-Key": "226fdb7ca6mshc43f1bfd5e9705dp164933jsn6809eaf3d5e3",
"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=True)
```

home.html

```
<!DOCTYPE html>
<head>
<meta charset="utf-8">
<title>Nutrition Image Analysis</title>
<meta name="viewport" content="width=device-width, initial-scale=1">
<link rel="stylesheet" type="text/css" href="{{ url_for('static', filename='css/main.css') }}">
<link href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTWfSpd3yD65VohhpuuCOmLASjC" crossorigin="anonymous">
</head>
<style>p{margin: 0px;padding:25px;background-color:#a4d356;width: 630px;opacity:0.8;color:#000000;font-family:Georgia, 'Times New Roman', Times,
serif;font-style:initial;border-radius:20px;font-size:17px;}
a{a:hover{background-color:#00ffe5;border-radius: 10px;padding: 5px 15px; } </style>
<body >
  <nav class="navbar navbar-light" style="background-color: #48a9fda5;">
    <span class="navbar-brand mb-0 h1" style="float: right; padding-left: 80px;">Nutrition Image Analysis</span>
    <div style="padding-right:100px ;">
      <a class="navbar-brand" style="float: right; " href="{{ url_for('image1')}}">Classify</a>
      <a class="navbar-brand" style="float: right; " href="{{ url_for('home')}}">Home</a>
    </div>
  </nav>
  <div class="home1">
    <center>
      <div>
        <br><br><br><br><br>
        <p>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.</p>
      </div></center>
    </div>
  </div>
</body>

</html>
```

Imageprediction.html

```
<!DOCTYPE html>
<head>
<meta charset="utf-8">
<title>Nutrition Image Analysis</title>
<meta name="viewport" content="width=device-width, initial-scale=1">
<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="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTWfFspd3yD65VohhpuuCOmLASjC" crossorigin="anonymous">
</head>
<style>
.home2{ background-image: url('static/css/2.png');height: 100%;background-repeat: no-repeat;background-size: cover;height:545px ;width: 1280px;margin-top:
0px;padding-top: 0px;padding: 0px;margin: 0px;
}.upload-label{display: inline-block;border: none;border-radius: 10px;padding: 10px 25px;background: #48a9fda5;color: #fff;cursor: pointer;
}.upload-label:hover{background: #48a9fda5;border: none;color: #ffffff;}@keyframes spin { 0% { transform: rotate(0deg); }100% { transform: rotate(360deg); }}
a{a:hover{background-color:#00ffe5;border-radius: 10px;padding: 5px 15px; }}</style>
<body>
<nav class="navbar navbar-light" style="background-color: #48a9fda5;">
  <span class="navbar-brand mb-0 h1" style="float: right; padding-left: 80px;">Nutrition Image Analysis</span>
  <div style="padding-right:100px ;">
    <a class="navbar-brand" style="float: right; " href="{{ url_for('image1')}}">Classify</a>
    <a class="navbar-brand" style="float: right; " href="{{ url_for('home')}}">Home</a>
  </div>
</nav>

<div class="home2">

  <div class="container">
    <center>
<div id="content">{% block content %}{% endblock %}</div></center>

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

Main.js

```
$(document).ready(function () {
  // Init
  $('.image-section').hide();
  $('.loader').hide();
  $('#result').hide();

  // Upload Preview
  function readURL(input) {
    if (input.files && input.files[0]) {
      var reader = new FileReader();
      reader.onload = function (e) {
        $('#imagePreview').css('background-image', 'url(' + e.target.result + ')');
        $('#imagePreview').hide();
        $('#imagePreview').fadeIn(650);
      }
      reader.readAsDataURL(input.files[0]);
    }
  }
  $("#imageUpload").change(function () {
    $('.image-section').show();
    $('#btn-predict').show();
    $('#result').text("");
    $('#result').hide();
    readURL(this);
  });

  // Predict
  $('#btn-predict').click(function () {
    var form_data = new FormData($('#upload-file')[0]);
```

```
// Show loading animation
$(this).hide();
$('.loader').show();

// Make prediction by calling api /predict
$.ajax({
  type: 'POST',
  url: '/predict',
  data: form_data,
  contentType: false,
  cache: false,
  processData: false,
  async: true,
  success: function (data) {
    // Get and display the result
    $('.loader').hide();
    $('#result').fadeIn(600);
    $('#result').html(data);
    console.log('Success!');
  },
});
});

});
```

GITHUB link

<https://github.com/IBM-EPBL/IBM-Project-6261-1658825319>

DEMO LINK:

<https://www.youtube.com/watch?v=AFG79R5hf5o>