

AI-POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

Food is essential for human life and has been the concern of many healthcare conventions. 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.

In this paper, we set to address these issues from the following two aspects: (1) to develop novel deep learning-based visual fruit recognition algorithms to achieve the best-in-class recognition accuracy; (2) to design a fruit recognition system employing edge computing-based service computing paradigm to overcome some inherent problems of traditional mobile cloud computing paradigm, such as unacceptable system latency and low battery life of mobile devices. We have conducted extensive experiments with real-world data. Our results have shown that the proposed system achieved three objectives: (1) outperforming existing work in terms of fruit recognition accuracy; (2) reducing response time that is equivalent to the minimum of the existing approaches; and (3) lowering energy consumption which is close to the minimum of the state-of-the-art.

1.2 PURPOSE

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.).

2. LITERATURE SURVEY

2.1 Existing problem

Neutrino provides nutrition-based data services and analytics to its users and aims to become the leading source of nutrition-related platform. The platform uses NLP and mathematical models from optimization theory as well as predictive analytics to enable individualized data compilation. The app relies on artificial intelligence to generate its own data related to the AI-powered smart calorie counter. Their artificial intelligence learns individual tastes, preferences and body type. It's all wrapped up in comprehensive nutrition and activity tracking.

2.2 REFERENCES

<https://www.nutrinohealth.com/>

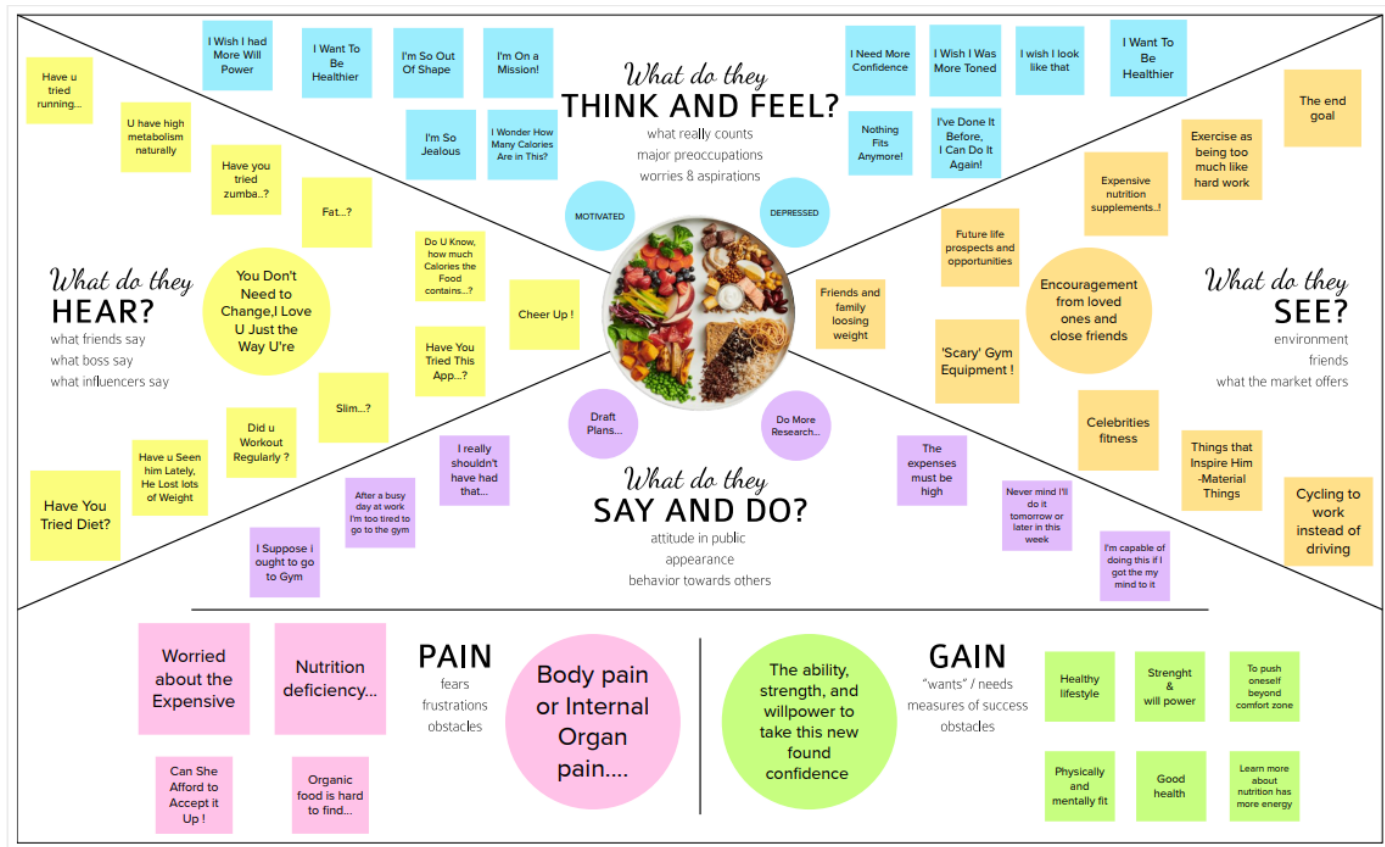
2.3 Problem Statement Definition

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.).

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

- An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes.
- It is a useful tool to help teams better understand their users.
- Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

10 minutes to prepare

1 hour to collaborate

2-8 people recommended

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

Team gathering

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

Set the goal

Think about the problem you'll be focusing on solving in the brainstorming session.

Learn how to use the facilitation tools

Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#)

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

Jack is a student who needs to join in an university. His profile is good for joining the university. He wants to join according to his marks and his eligibility

Key rules of brainstorming

To run a smooth and productive session

Stay in topic.

Encourage wild ideas.

Defer judgment.

Listen to others.

Go for volume.

If possible, be visual.

Step-2: Brainstorm, Idea Listing and Grouping

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

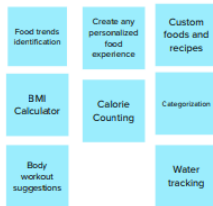
TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Ugendhar.U



Pavan kumar.N



Jeeva.S



Thirumugil.T



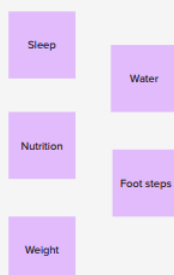
3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

🕒 20 minutes

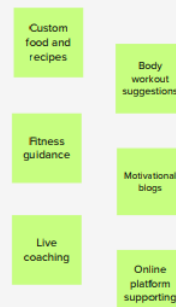
Tracking



Detections



User recommendations



4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes



5

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

- Show the mural**
Share a view link in the mural with stakeholders to keep them in the loop about the outcomes of the session.
- Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

- Strategy blueprint**
Define the components of a new idea or strategy.
[Open the template →](#)
- Customer experience journey map**
Understand customer needs, motivations, and obstacles for an experience.
[Open the template →](#)
- Strengths, weaknesses, opportunities & threats**
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
[Open the template →](#)

[Share template feedback](#)

3.3 Proposed Solution:

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	<ul style="list-style-type: none">• A regular person must use cutting-edge AI- based analyzing software to identify fruits and vegetables based on colour, texture, form, and other characteristics.• At the time of identification, the user must also be aware of the nutritional content of that specific edible.
2.	Idea / Solution description	<p>Main Solution:</p> <ul style="list-style-type: none">• Clear and proper identification of the given input data.• Provide nutritional facts based on the obtained data.• Fitness analysis and maintenance as per the user's body conditions. <p>Additional benefits:</p> <ul style="list-style-type: none">• Analysis of daily dietary requirements.• Daily tracking of dietary consumption thoroughly.
3.	Novelty / Uniqueness	<ul style="list-style-type: none">• The availability of fitness plans with add on bonuses.• Suggestion of home remedies and simple solutions for basic problems.• An individualized food plan based on health condition and deficiency.• Allowing for diet flexibility helps promote a healthy and effective eating pattern.

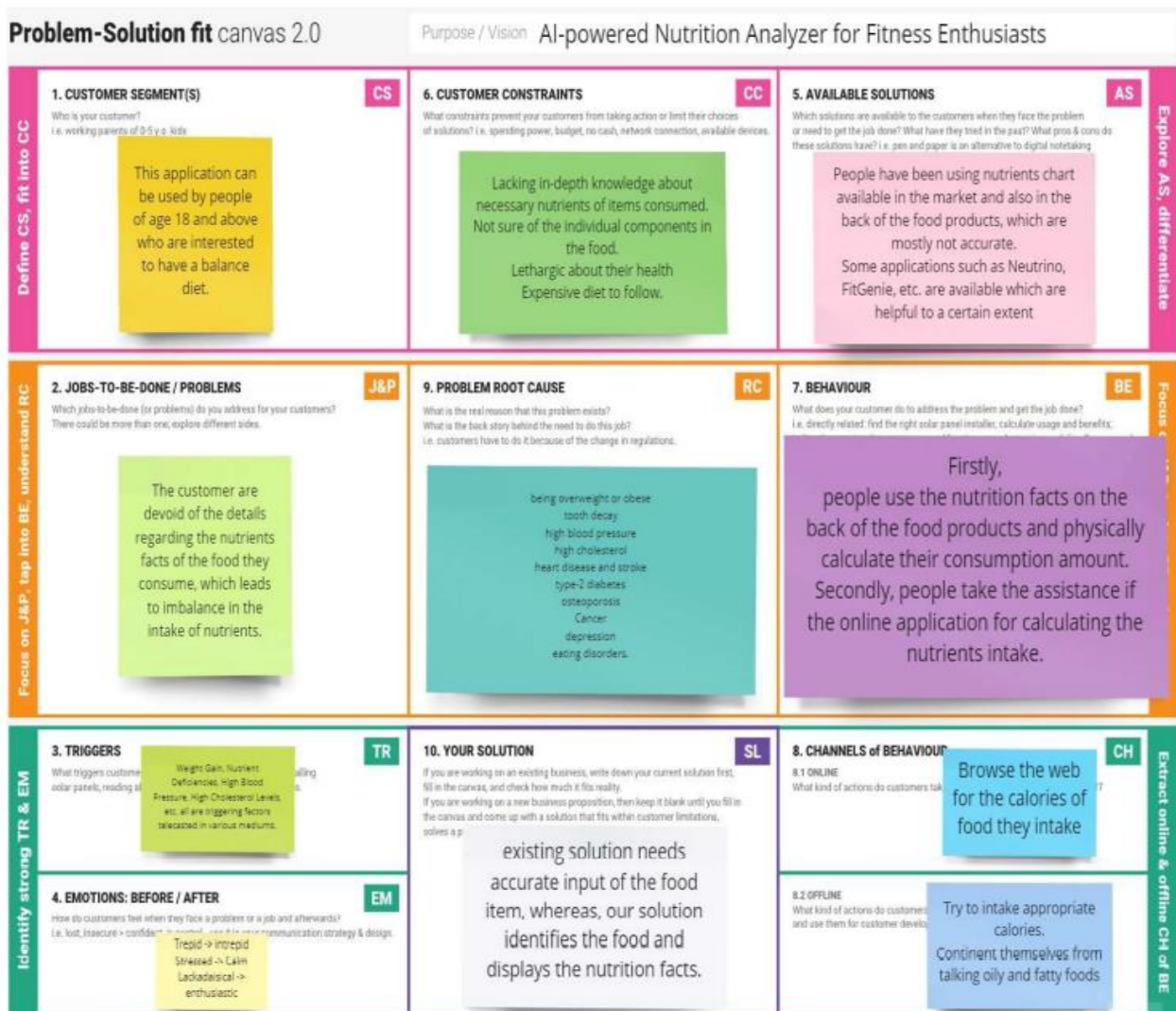
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"> • Healthy lifestyle development. • Constant calorie management monitoring results in a fitness mind set.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"> • Consultation with nearest trainers and nutritionist for personalized plans. • Adopt a specialized diet plan under the direction of an expert. • Advertise and offer nutritional supplements and fitness gear. • Promotion for fitness centers and hospitals.
6.	Scalability of the Solution	<ul style="list-style-type: none"> • Improving accuracy by expanding the data collection using user input data. • Storage requirements of a specific food. • User friendly UI for everyone to use and get benefit from it.

3.2 Proposed Solution Fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioural patterns

Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behaviour.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touch-points with your company by finding the right problem-behaviour fit and building trust by solving frequent annoyances, or urgent or costly problems.



4. REQUIREMENT ANALYSIS

4.1. Functional requirement

- It will generate a diet plan and also track the user's health to classify the disease category and create a diet plan. It will also reduce the cost of consulting a nutritionist.
- The task of food detection/classification is not as easy as it seems. All possible options related to a given image.
- Image classification, object detection, segmentation, face recognition.
- Crystal structure classification using a convolutional neural network
- Nutrition is vital for the growth of the human body. Nutritional analysis ensures that the food meets the appropriate vitamin and mineral requirements, and the nutrition examination of the food helps to understand the proportion of fat, dilution of carbohydrates, protein, fibre, sugar, etc. Another thing to keep in mind is not to exceed our daily requirements for calorie
- Computer Aided Nutrition for Food Image Recognition – To solve this problem, a completely new Convolutional Neural Network (CNN) based food identification system was created. Created as described in this study. We applied our proposed strategy on two real food datasets.
- Here the user can capture images of different fruits and then the image will be sent to the trained model. The model analyses the image and detects nutrition based on the fruit as (sugar, fiber, protein, calories, etc.)
- The best solution for working out at home This AI fitness software is designed with
- individual training regimens for each individual. It started out as "gym-only software" but has now refined its system to meet "home fitness" expectations.
- You take a picture, dial in information such as whether you're having breakfast or lunch, add a quick text label, and the app estimates the calorie content.
- This software worked with IBM's natural language capability to provide 24-hour assistance and dietary recommendations.

For Example:

FUNCTIONAL REQUIREMENTS:

Following are the functional requirements for the proposed solution

FR NO.	FUNCTIONAL REQUIREMENTS(EPIC)	SUB REQUIREMENT(STORY/SUBTASK)
FR-1	USER REGISTRATION	<p>Interacting the user through web interface and automated voice to answer the user queries and to guide them in a proper way to maintain their fitness.</p> <p>In the web interface,</p> <ul style="list-style-type: none">• There will be separate and special features for the registered user to get personalized and well defined advice and good practice lectures to maintain their fitness.• All the registered users will be verified with either email or mobile number based on their interest in giving their information, but the verification is a must one.• For non-registered users, the user can visit the website free of cost and can check the nutrient value in the fruits and vegetables, and also can view the common practices for fitness.
FR-2	USER MANAGEMENT	<p>Creating a group of people, who are willing to be fit in their health and making them organized in a same place, through which they can collaborate and also can achieve their goals with others, by encouraging each other.</p> <p>The application gives the ability to ask questions about a problem in the fitness groups, through which they can work effectively.</p>
FR-3	USER SATISFYING	<p>The satisfaction of each user is a must, so UI/UX should be more than enough to engage the user in the platform and the performance of the application should be optimized in order to keep every user for a long time.</p> <p>On an periodic interval (like once in month), we need to interact one to one with each and every user to solve the queries</p>
FR-4	USER ENGAGEMENT	<p>The user should be engaged in the application at least Once a day to get notified about the latest and good practice on fitness which is recommended by the backend model.</p>

NON-FUNCTIONAL REQUIREMENTS:

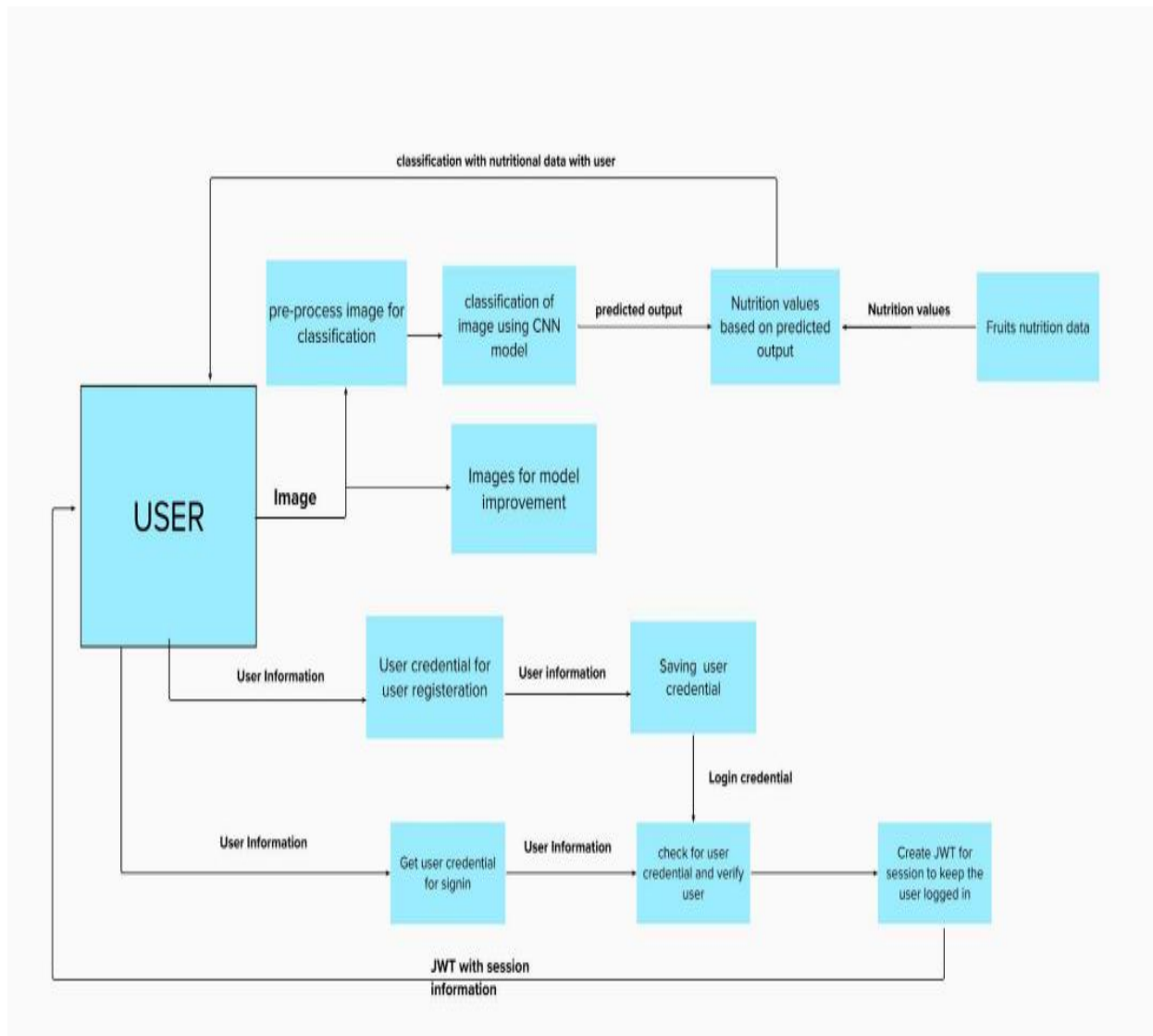
Following are the functional requirements for the proposed solution.

FR.NO	NON-FUNCTIONAL REQUIREMENTS	DESCRIPTION
NFR-1	USABILITY	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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 touse.• It is Important that the AI powered nutrition analyzer for fitness provides should Must reliable.

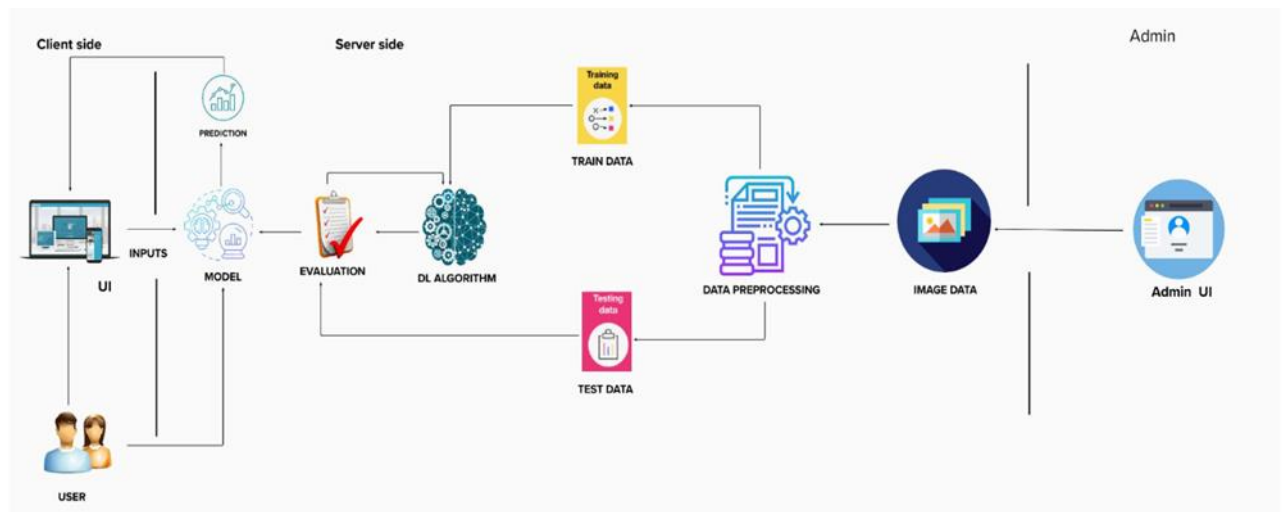
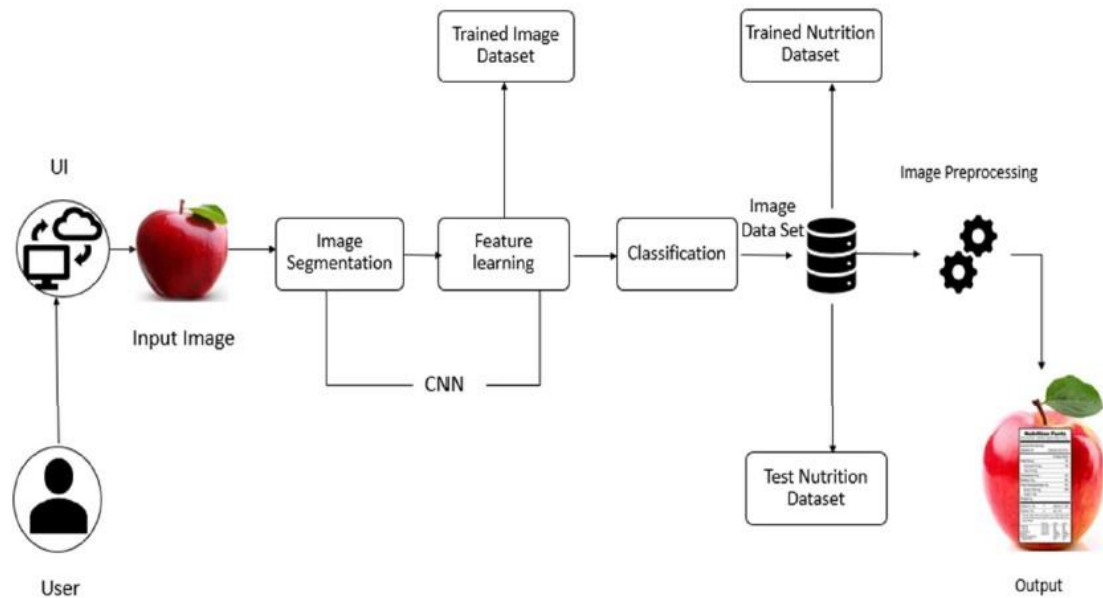
NFR-3	RELIABILITY	<ul style="list-style-type: none"> • How a person can find it is reliable? It is easy to find that is he/she can compare the nutrition based food with other nutrition related application so, it can easily rectify whether it is reliable or not. • But it takes too much time, to avoid this a reliable application should be 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 guide and proper information in which we can get a nutrition properly and we can have get a proper fitness plan. • It should also provide the information on nutrition and health which it should prevent from health information on diseases, health risks and prevention guidelines. It should also provide 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 contain the calorie information, balanced diet plans, what type food can be consumed at what time etc..... So, by this way it can be reliable.
NFR-4	PERFORMANCE	<ul style="list-style-type: none"> • 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

5. PROJECT DESIGN

5.1. DATA FLOW DIAGRAM



5.2. SOLUTION AND TECHNICAL ARCHITECTURE



5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can do registration by my mobile and get confirmation email	I can access my account / dashboard	High	Sprint-1
Customer (Webuser)	Registration	USN-2	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-3	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-4	As a user, I can register for the application through other social media	I can register & access the dashboard with Login	Low	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email & password	I can successfully logged into the home page	High	Sprint-1
	Dashboard	USN-6	As a user, I can select the list of options provided in the dashboard	I can access the options according to my need	Medium	Sprint-1
	Search	USN-7	As a user, I can search for different variety of fruits	I can get the nutrition content of different fruits	High	Sprint-2
	View	USN-8	As a user, I can view the list of fruits	I will get the information such as calories, vitamins, etc...	High	Sprint-2
	Notifications	USN-9	As a user, I will receive notification about variety and textures of different fruits	I will get the frequent updates of different fruits	Low	Sprint-2

Customer Care Executive	Mediator	USN-10	As a customer care executive ,they could take care of customer feedbacks and solve user requirements	Users can get help and support from customer care executives	Medium	Sprint-2
Administrator	Database	USN-11	As a admin, I will store the user database confidentially	I can store and access data if it is needed in future	High	Sprint-1
	Data Information	USN-12	As a admin, I will include the dataset for performing various processes	I can store dataset and analyze it	High	Sprint-2
	Processing	USN-13	As a admin, I will use various convolution layers for image analysis	I can process using various convolution layers	High	Sprint-2
	Nutrition Analyzer	USN-14	As a admin, I will predict the fruit that has send as input	I can get the nutrition content of particular food after processing and display it	High	Sprint-2

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	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	Ugendhar U Pavan kumar N Jeeva S Thiru Mugil T
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	2	High	Ugendhar U Pavan kumar N Jeeva S Thiru Mugil T
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password	2	High	Ugendhar U Pavan kumar N Jeeva S Thiru Mugil T
Sprint-2	User Dashboard	USN-4	As a user, I can view the page of the application where I can upload my images which predicts the fruits and provides the nutrition.	5	High	Ugendhar U Pavan kumar N Jeeva S Thiru Mugil T

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Creating Web application	USN-5	A base Flask will be created as which is the Interface for our application	3	High	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-3	Improve efficiency of AI model	-	As a developer I have to give a better model that will analyse fruits precisely and provide accurate results	3	Medium	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-2	User Analysis record	USN-6	As a user, I can check the previous records and I can analyse my food habits	4	Medium	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-3	Model creation	USN-7	Creating a model which classifies the fruits from the input image	8	High	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-3	Framework Integration	USN-8	Integrate Flask, CNN model and Cloudant DB	6	High	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-4	Login	USN-9	As a admin, I can login to the website using the login credentials of the administrator	2	High	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-4	Optimize the user experience with the app	-	As a developer I have to provide clean and smooth interface to my user	5	High	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T
Sprint-4	Dashboard	USN-10	As a admin, I can add new fruit varieties, advanced information, weather updates and so on.	3	High	Ugendhar U Pavan Kumar N Jeeva S Thiru Mugil T

6.2 SPRINT DELIVERY SCHEDULE

Milestone	Activity
Data Collection	Collecting images of food items apples,bananas, oranges, pineapples, watermelons for analysis.
Image Preprocessing	Increasing the amount of data by generating new data points from existing data. Applying image data generator functionality to train and test dataset.
Modeling Phase	Building the model using a deep learning approach and adding CNN layers. Training,saving,testing and predicting the model. Database creation for the input classes.
Development phase	Dashboard creation. Analysis and prediction page creation. Creating feedback and rating page.
Application Phase	Building the python code and importing the flask module into the project. Create the Flask application and load the model. Connecting front end and back end and performing routing and running the application.
Testing Phase	Checking usability and accessibility. Checking scalability and performance of the application.

6.3 REPORTS FROM JIRA

Jira Software is part of a family of products designed to help teams of all types manage work. Originally, Jira was designed as a bug and issue tracker. But today, Jira has evolved into a powerful work management tool for all kinds of use cases, from requirements and test case management to agile software development. Jira is one of the best open-source tools for planning and tracking in Agile methodology. Development teams use Jira for tracking bugs and projects, managing Scrums, and visualizing workflows with Kanban boards. Workflows in Jira make it easy to plan, track, release, and report on software.



7. CODING & SOLUTIONING

7.1 FEATURE 1[MODELBUILDING]: Import the Libraries

Import the libraries that are required to initialize the neural network layer, and create and add different layers to the neural network model

```
In [8]: import tensorflow as tf
        from tensorflow.keras import models, layers
        import matplotlib.pyplot as plt
```

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.

Now, will initialize our model.

Initialize the neural network layer by creating a reference/object to the Sequential class.

```
model = models.Sequential([
    resize_and_rescale,
    layers.Conv2D(32, kernel_size = (3,3), activation='relu', input_shape=input_shape),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, kernel_size = (3,3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, kernel_size = (3,3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(n_classes, activation='softmax'),
])

model.build(input_shape=input_shape)
```

Data augmentation

```
])

In [23]: data_augmentation = tf.keras.Sequential([
        layers.experimental.preprocessing.RandomFlip("horizontal_and_vertical"),
        layers.experimental.preprocessing.RandomRotation(0.2),
    ])
```

Data preprocessing

```
In [12]: dataset = tf.keras.preprocessing.image_dataset_from_directory(
    "train",
    seed=123,
    shuffle=True,
    image_size=(IMAGE_SIZE, IMAGE_SIZE),
    batch_size=BATCH_SIZE
)
```

Found 2626 files belonging to 5 classes.

```
In [13]: class_names = dataset.class_names
class_names
```

```
Out[13]: ['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE', 'WATERMELON']
```

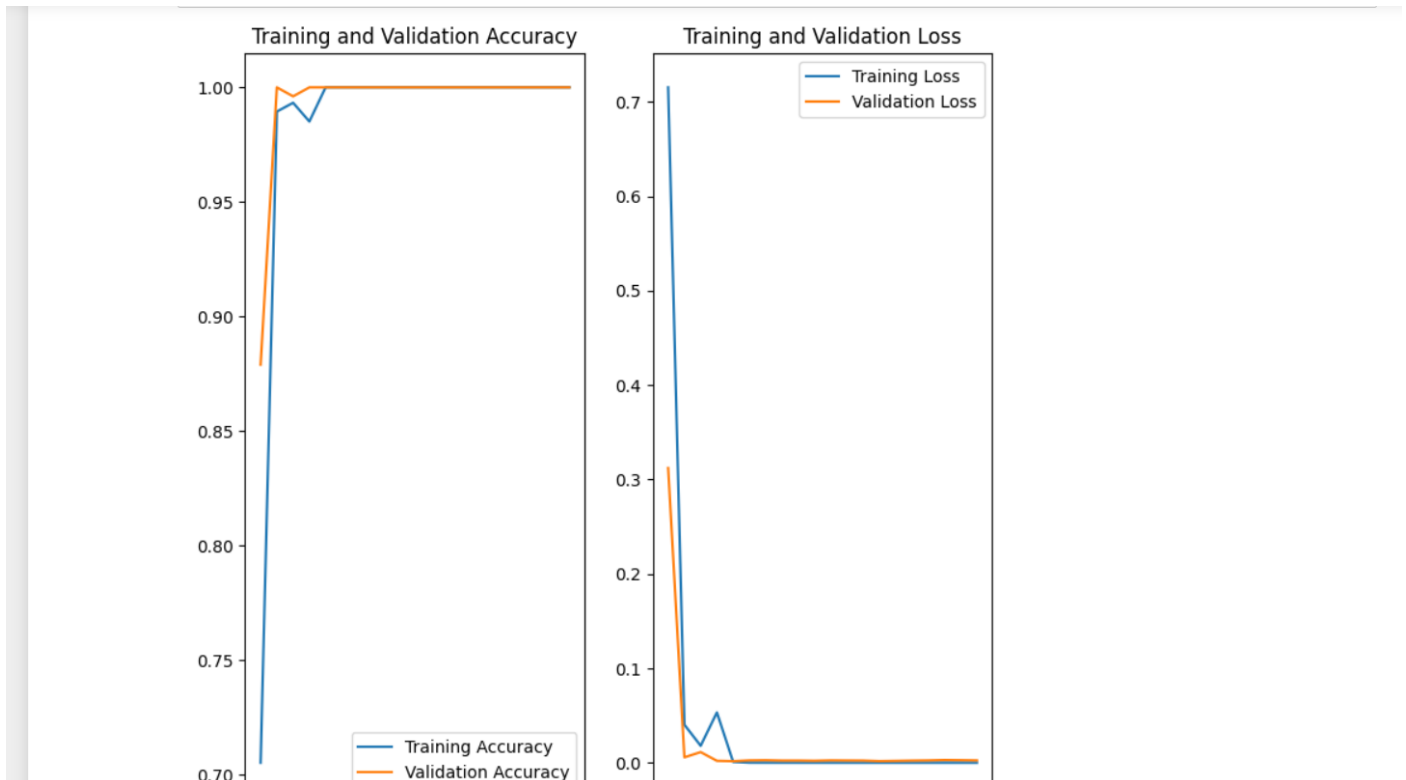
Model compiling and Modelfit

```
In [28]: model.compile(
    optimizer='adam',
    loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
    metrics=['accuracy']
)
```

```
In [30]: history = model.fit(
    train_ds,
    batch_size=BATCH_SIZE,
    validation_data=val_ds,
    verbose=1,
    epochs=20,
)
```

```
Epoch 1/20
66/66 [=====] - 132s 2s/step - loss: 0.7154 - accuracy: 0.7051 - val_loss: 0.3122 - val_accuracy: 0.8789
Epoch 2/20
66/66 [=====] - 111s 2s/step - loss: 0.0403 - accuracy: 0.9894 - val_loss: 0.0058 - val_accuracy: 1.0000
Epoch 3/20
66/66 [=====] - 115s 2s/step - loss: 0.0180 - accuracy: 0.9933 - val_loss: 0.0113 - val_accuracy: 0.9961
Epoch 4/20
66/66 [=====] - 120s 2s/step - loss: 0.0533 - accuracy: 0.9851 - val_loss: 0.0020 - val_accuracy: 1.0000
Epoch 5/20
66/66 [=====] - 115s 2s/step - loss: 9.0093e-04 - accuracy: 1.0000 - val_loss: 0.0017 - val_accuracy: 1.0000
Epoch 6/20
66/66 [=====] - 115s 2s/step - loss: 9.0444e-05 - accuracy: 1.0000 - val_loss: 0.0025 - val_accuracy: 1.0000
Epoch 7/20
66/66 [=====] - 116s 2s/step - loss: 5.3588e-05 - accuracy: 1.0000 - val_loss: 0.0026 - val_accuracy: 1.0000
Epoch 8/20
66/66 [=====] - 120s 2s/step - loss: 3.5351e-05 - accuracy: 1.0000 - val_loss: 0.0023 - val_accuracy: 1.0000
```


Training validation Accuracy and Training and validation loss



Sample prediction

```
In [41]: import numpy as np
for images_batch, labels_batch in test_ds.take(1):
    first_image = images_batch[0].numpy().astype('uint8')
    first_label = labels_batch[0].numpy()

    print("first image to predict")
    plt.imshow(first_image)
    print("actual label:", class_names[first_label])

    batch_prediction = model.predict(images_batch)
    print("predicted label:", class_names[np.argmax(batch_prediction[0])])
```

```
first image to predict
actual label: APPLES
1/1 [=====] - 1s 729ms/step
predicted label: APPLES
```



Saving the model

```
In [45]: import os
model_version=max([int(i) for i in os.listdir("models") + [0]])+1
model.save(f"models/{model_version}")

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op, _jit_compiled_convolution_op, _jit_compiled_convolution_op, _jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing 5 of 6). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: models/1/assets

INFO:tensorflow:Assets written to: models/1/assets

In [46]: model.save("models/fruits.h5")
```

8. TESTING

8.1. Testing case:

- Verify user is able to see the home page or not
- Verify the UI elements in Home page
- Verify user is able to select the dropdown value or not
- Verify user is able to upload the image or not
- Verify user is able to preview the image or not
- Verify whether the image is predicted correctly or not

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 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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	1	0	0	1
Security	1	0	0	1
Outsource Shipping	1	0	0	1
Exception Reporting	1	0	0	1
Final Report Output	1	0	0	1
Version Control	1	0	0	1

9. RESULTS

9.1 Performance Metrics

Model Summary:

In [27]:

model.summary()

Model: "sequential_3"

Layer (type)	Output Shape	Param #
sequential (Sequential)	(32, 300, 300, 3)	0
conv2d_6 (Conv2D)	(32, 298, 298, 32)	896
max_pooling2d_6 (MaxPooling2D)	(32, 149, 149, 32)	0
conv2d_7 (Conv2D)	(32, 147, 147, 64)	18496
max_pooling2d_7 (MaxPooling2D)	(32, 73, 73, 64)	0
conv2d_8 (Conv2D)	(32, 71, 71, 64)	36928
max_pooling2d_8 (MaxPooling2D)	(32, 35, 35, 64)	0
conv2d_9 (Conv2D)	(32, 33, 33, 64)	36928
max_pooling2d_9 (MaxPooling2D)	(32, 16, 16, 64)	0
conv2d_10 (Conv2D)	(32, 14, 14, 64)	36928
max_pooling2d_10 (MaxPooling2D)	(32, 7, 7, 64)	0
conv2d_11 (Conv2D)	(32, 5, 5, 64)	36928
max_pooling2d_11 (MaxPooling2D)	(32, 2, 2, 64)	0
max_pooling2d_10 (MaxPooling2D)	(32, 7, 7, 64)	0
conv2d_11 (Conv2D)	(32, 5, 5, 64)	36928
max_pooling2d_11 (MaxPooling2D)	(32, 2, 2, 64)	0
flatten_1 (Flatten)	(32, 256)	0
dense_2 (Dense)	(32, 64)	16448
dense_3 (Dense)	(32, 6)	390

=====

Total params: 183,942

Trainable params: 183,942

Non-trainable params: 0

Accuracy:

Epoch 10/20

66/66 [=====] - 126s 2s/step - loss: 2.6776e-05 - accuracy: 1.0000 - val_loss: 0.0021 - val_accuracy: 1.0000

Epoch 11/20

66/66 [=====] - 119s 2s/step - loss: 2.0710e-05 - accuracy: 1.0000 - val_loss: 0.0025 - val_accuracy: 1.0000

Epoch 12/20

66/66 [=====] - 122s 2s/step - loss: 1.7586e-05 - accuracy: 1.0000 - val_loss: 0.0024 - val_accuracy: 1.0000

Epoch 13/20

66/66 [=====] - 116s 2s/step - loss: 1.5951e-05 - accuracy: 1.0000 - val_loss: 0.0023 - val_accuracy: 1.0000

Epoch 14/20

66/66 [=====] - 112s 2s/step - loss: 1.6429e-05 - accuracy: 1.0000 - val_loss: 0.0017 - val_accuracy: 1.0000

Epoch 15/20

66/66 [=====] - 121s 2s/step - loss: 1.0409e-05 - accuracy: 1.0000 - val_loss: 0.0020 - val_accuracy: 1.0000

Epoch 16/20

66/66 [=====] - 118s 2s/step - loss: 7.8128e-06 - accuracy: 1.0000 - val_loss: 0.0023 - val_accuracy: 1.0000

Epoch 17/20

66/66 [=====] - 116s 2s/step - loss: 7.5343e-06 - accuracy: 1.0000 - val_loss: 0.0024 - val_accuracy: 1.0000

Epoch 18/20

66/66 [=====] - 114s 2s/step - loss: 6.5557e-06 - accuracy: 1.0000 - val_loss: 0.0029 - val_accuracy: 1.0000

Epoch 19/20

66/66 [=====] - 112s 2s/step - loss: 5.5629e-06 - accuracy: 1.0000 - val_loss: 0.0027 - val_accuracy: 1.0000

Epoch 20/20

66/66 [=====] - 110s 2s/step - loss: 5.3098e-06 - accuracy: 1.0000 - val_loss: 0.0025 - val_accuracy: 1.0000

In [31]:

scores = model.evaluate(test_ds)

9/9 [=====] - 12s 363ms/step - loss: 0.0016 - accuracy: 1.0000

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

- New dietary assessment and nutrition analysis tools provide more opportunities to help people understand their daily eating habits
- It helps in exploring nutritional patterns in their daily routines and this is very helpful for people to maintain a balanced healthy diet.
- Nutritional analysis is used to determine the nutritional content of foods.
- This app eliminates travel costs when visiting a nutritionist.

DISADVANTAGES

- Android mobile user will not be able to insert or view details if the server is down.
- So, the disadvantage is single point failure.

11. CONCLUSION

By the end of this project, we will be knowing the basic concepts and techniques of convolutional neural network. There will be a broad understanding of image data know how to create a web application using the Flask framework. We will also know how to pre-process data and know how to clean data using various data pre-processing techniques.

12. FUTURE SCOPE

- Artificial intelligence is revolutionizing healthcare.
- Mainly used to improve marketing and sales decisions, AI is now also being used to reshape individual habits.
- We don't want to go to the gym and follow any diets in the future. With this nutrition analyser we can maintain our diet plans without the help of others and can lead a happy and healthy life with good wealth.
- AI can easily track health behaviours and repetitive exercise patterns and use the data to guide you on your fitness journey and diet plans.

13. APPENDIX

APPENDIX A

CODING SNIPPETS

```
from flask import Flask, escape, request, render_template
import os
import numpy as np
import tensorflow as tf
from keras.models import load_model
from keras.preprocessing import image
```

```
APP_ROOT = os.path.dirname(os.path.abspath(_file_))
```

```
# model = load_model("models/fruits.h5")
model = load_model("models/1")
```

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

```
app = Flask(_name_)
```

```
@app.route('/')
def home():
```

```
    return render_template("index.html")
```

```
@app.route('/about')
```



```
def about():
    return render_template("about.html")

@app.route('/prediction', methods=['GET', 'POST'])
def prediction():
    if request.method == 'POST':
        f = request.files['fruit']
        filename= f.filename
        target = os.path.join(APP_ROOT, 'images/')
        # print(target)
        des = "/".join([target, filename])
        f.save(des)

        test_image = image.load_img('images\\'+filename,target_size=(300,300))
        test_image = image.img_to_array(test_image)
        test_image = np.expand_dims(test_image, axis=0)
        prediction = model.predict(test_image)
        # print(prediction)

        predicted_class = class_name[np.argmax(prediction[0])]
        # print(predicted_class)
        confidence = round(np.max(prediction[0])*100)

        # print(confidence)

        return render_template('prediction.html', confidence= "chances -> "+str(confidence)+ "%",
        prediction = "prediction -> "+str(predicted_class))

    else:
        return render_template('prediction.html')
```

```
if _name_ == '_main_':
```

```
    app.debug = True
```

```
    app.run()
```

Index.html

```
<!doctype html>
```

```
    <html lang="en">
```

```
    <head>
```

```
        <!-- Required meta tags -->
```

```
        <meta charset="utf-8">
```

```
        <meta name="viewport" content="width=device-width, initial-scale=1">
```

```
        <!-- Bootstrap CSS -->
```

```
        <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/css/bootstrap.min.css"
rel="stylesheet" integrity="sha384-
KyZXEAg3QhqLMpG8r+8fhAXLRk2vvoC2f3B09zVXn8CA5QIVfZOJ3BCsw2P0p/We"
crossorigin="anonymous">
```

```
        <link href="https://unpkg.com/tailwindcss@^2/dist/tailwind.min.css" rel="stylesheet">
```

```
    <title>Fruit Recognition</title>
```

```
</head>
```

```
<body class="bg-gray-200">
```

```
    <header class="text-gray-600 body-font -my-8">
```

```
        <div class="container mx-auto flex flex-wrap p-5 flex-col md:flex-row items-center">
```

```
            <a class="flex title-font font-medium items-center text-gray-900 mb-4 md:mb-0">
```

```
                <span class="ml-3 text-xl"> AI-NUTRITION ANALYZER</span>
```

```
            </a>
```

```
            <nav class="md:ml-auto flex flex-wrap items-center text-base justify-center">
```

```
<a href="/" class="mr-5 hover:text-gray-900">Home</a>
```

```
<a href="/about" class="mr-5 hover:text-gray-900">About us</a>
```

```
<a href="/prediction" class="mr-5 hover:text-gray-900">prediction</a>
```

```
</nav>
```

```
</div>
```

```
</header><hr>
```

```
<section class="text-gray-600 body-font -my-8">
```

```
<div class="container mx-auto flex px-5 py-24 md:flex-row flex-col items-center">
```

```
<div class="lg:flex-grow md:w-1/2 lg:pr-24 md:pr-16 flex flex-col md:items-start
md:text-left mb-16 md:mb-0 items-center text-center">
```

```
<h1 class="title-font sm:text-4xl text-3xl mb-4 font-medium text-gray-900">Fruit
Recognition
```

```
</h1>
```

```
<p class="mb-8 leading-relaxed"><strong>Adopting a new healthier lifestyle can
involve changing diet to include more fresh fruit and vegetables as well as increasing levels of
exercise.</strong> </p>
```

```
<div class="flex justify-center">
```

```
<a href="/prediction"><button class="inline-flex text-white bg-green-500 border-0
py-2 px-6 focus:outline-none hover:bg-green-600 rounded text-lg">prediction</button></a>
```

```
</div>
```

```
</div>
```

```
<!-- Optional JavaScript; choose one of the two! -->
```

```
<!-- Option 1: Bootstrap Bundle with Popper -->
```

```
<script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/js/bootstrap.bundle.min.js"
integrity="sha384-U1DAWAznBHeqElIVScgzq+c9gqGAJn5c/t99JyeKa9xxaYpSvHU5awsuZVVFIhvj"
crossorigin="anonymous"></script>
```

```

        <!-- Option 2: Separate Popper and Bootstrap JS -->

        <!--

        <script
src="https://cdn.jsdelivr.net/npm/@popperjs/core@2.9.3/dist/umd/popper.min.js"
integrity="sha384-
eMNC0e7tC1doHpGoWe/6oMVemdAVTMs2xqW4mwXrXsW0L84lytr2wi5v2QjrP/xp"
crossorigin="anonymous"></script>

        <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/js/bootstrap.min.js"
integrity="sha384-cn7l7gDp0eyniUwwAZgrzD06kc/tftFf19TOAs2zVinnD/C7E91j9yyk5//jjpt/"
crossorigin="anonymous"></script>

        -->

    </body>

</html>

```

Prediction.html

```

<!DOCTYPE html>

<html lang="en">

  <head>

    <!-- Required meta tags -->

    <meta charset="utf-8">

    <meta name="viewport" content="width=device-width, initial-scale=1">


    <!-- Bootstrap CSS -->

    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/css/bootstrap.min.css"
rel="stylesheet" integrity="sha384-
KyZXEAg3QhqLMpG8r+8fhAXLRk2vvoC2f3B09zVXn8CA5QIVfZ0J3BCsw2P0p/We"
crossorigin="anonymous">

    <link href="https://unpkg.com/tailwindcss@^2/dist/tailwind.min.css" rel="stylesheet">


    <title>Fruit Recognition</title>

  </head>

  <body class="bg-gray-200">

    <header class="text-gray-600 body-font -my-8">

      <div class="container mx-auto flex flex-wrap p-5 flex-col md:flex-row items-center">

```

```
<a class="flex title-font font-medium items-center text-gray-900 mb-4 md:mb-0">
```

```
<span class="ml-3 text-xl">AI-NUTRITION ANALYZER</span>
```

```
</a>
```

```
<nav class="md:ml-auto flex flex-wrap items-center text-base justify-center">
```

```
<a href="/" class="mr-5 hover:text-gray-900">Home</a>
```

```
<a href="/about" class="mr-5 hover:text-gray-900">About us</a>
```

```
<a href="/prediction" class="mr-5 hover:text-gray-900">prediction</a>
```

```
</nav>
```

```
</div>
```

```
</header><hr>
```

```
<section class="text-gray-600 body-font -my-8">
```

```
<div class="container px-5 py-24 mx-auto">
```

```
<div class="flex flex-col text-center w-full mb-20">
```

```
<h1 class="sm:text-3xl text-2xl font-medium title-font mb-4 text-gray-900">Fruit  
Recognition</h1>
```

```
<p class="lg:w-2/3 mx-auto leading-relaxed text-base">Adopting a new healthier lifestyle can  
involve changing diet to include more fresh fruit and vegetables as well as increasing levels of  
exercise.</p>
```

```
<br><p class="text-primary"><b>{{prediction}}</b></p><br>
```

```
<p class="text-primary"><b>{{confidence}}</b></p>
```

```
</div>
```

```
<div class="center">
```

```
<form action="/prediction" method="POST" enctype="multipart/form-data">
```

```
<div class="mb-3">
```

```
<label for="exampleInputEmail1" class="form-label">Select fruit image</label>
```

```
<input type="file" class="form-control" id="fruit" name="fruit" aria-  
describedby="emailHelp">
```

```
</div>
```

```
<button type="submit" class="btn btn-success">Submit</button>
```

```
</form>
```

</div>

</div>

</section>

<!-- Optional JavaScript; choose one of the two! -->

<!-- Option 1: Bootstrap Bundle with Popper -->

```
<script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/js/bootstrap.bundle.min.js"
integrity="sha384-U1DAWAznBHeqElIVScgzq+c9gqGAJn5c/t99JyeKa9xxaYpSvHU5awsuZVVFIhvj"
crossorigin="anonymous"></script>
```

<!-- Option 2: Separate Popper and Bootstrap JS -->

<!--

```
<script src="https://cdn.jsdelivr.net/npm/@popperjs/core@2.9.3/dist/umd/popper.min.js"
integrity="sha384-
eMNC0e7tC1doHpGoWe/6oMVemdAVTMs2xqW4mwXrXsW0L84lytr2wi5v2QjrP/xp"
crossorigin="anonymous"></script>
```

```
<script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/js/bootstrap.min.js"
integrity="sha384-cn7l7gDp0eyniUwwAZgrzD06kc/tftFf19TOAs2zVinnD/C7E91j9yyk5//jjpt/"
crossorigin="anonymous"></script>
```

-->

</body>

</html>

</body>

</html>

About.html

<!doctype html>

<html lang="en">

<head>

<!-- Required meta tags -->

<meta charset="utf-8">

```
<meta name="viewport" content="width=device-width, initial-scale=1">
```

```
<!-- Bootstrap CSS -->
```

```
<link href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/css/bootstrap.min.css"
rel="stylesheet" integrity="sha384-
KyZXEAg3QhqLMpG8r+8fhAXLRk2vvoC2f3B09zVXn8CA5QIVfZOJ3BCsw2P0p/We"
crossorigin="anonymous">
```

```
<link href="https://unpkg.com/tailwindcss@^2/dist/tailwind.min.css" rel="stylesheet">
```

```
<title>Fruit Recognition</title>
```

```
</head>
```

```
<body class="bg-gray-200">
```

```
<header class="text-gray-600 body-font -my-8">
```

```
<div class="container mx-auto flex flex-wrap p-5 flex-col md:flex-row items-center">
```

```
<a class="flex title-font font-medium items-center text-gray-900 mb-4 md:mb-0">
```

```
<span class="ml-3 text-xl">AI-NUTRITION ANALYZER</span>
```

```
</a>
```

```
<nav class="md:ml-auto flex flex-wrap items-center text-base justify-center">
```

```
<a href="/" class="mr-5 hover:text-gray-900">Home</a>
```

```
<a href="/about" class="mr-5 hover:text-gray-900">About us</a>
```

```
<a href="/prediction" class="mr-5 hover:text-gray-900">prediction</a>
```

```
</nav>
```

```
</div>
```

```
<!-- Optional JavaScript; choose one of the two! -->
```

```
<!-- Option 1: Bootstrap Bundle with Popper -->
```

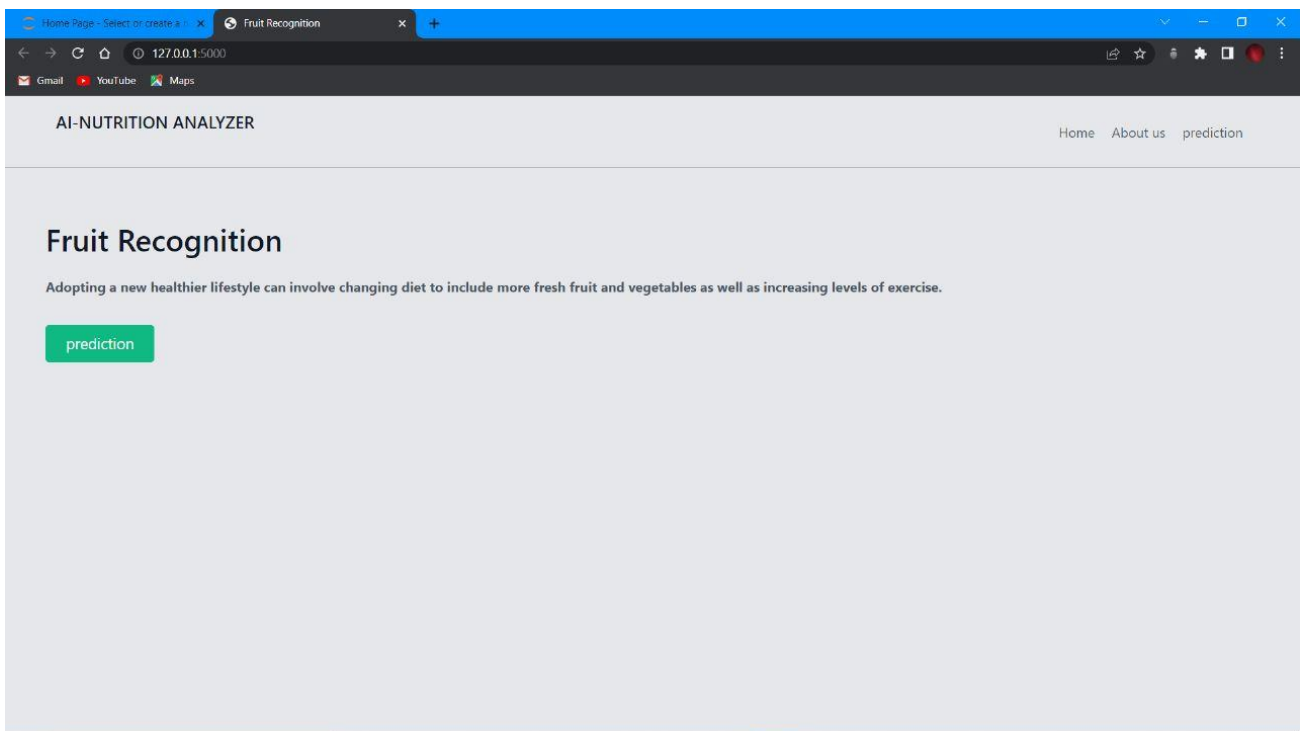
```
<script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/js/bootstrap.bundle.min.js"
integrity="sha384-U1DAWAznBHeqElIVScgzq+c9gqGAJn5c/t99JyeKa9xxaYpSvHU5awsuZVVFIhvj"
crossorigin="anonymous"></script>
```

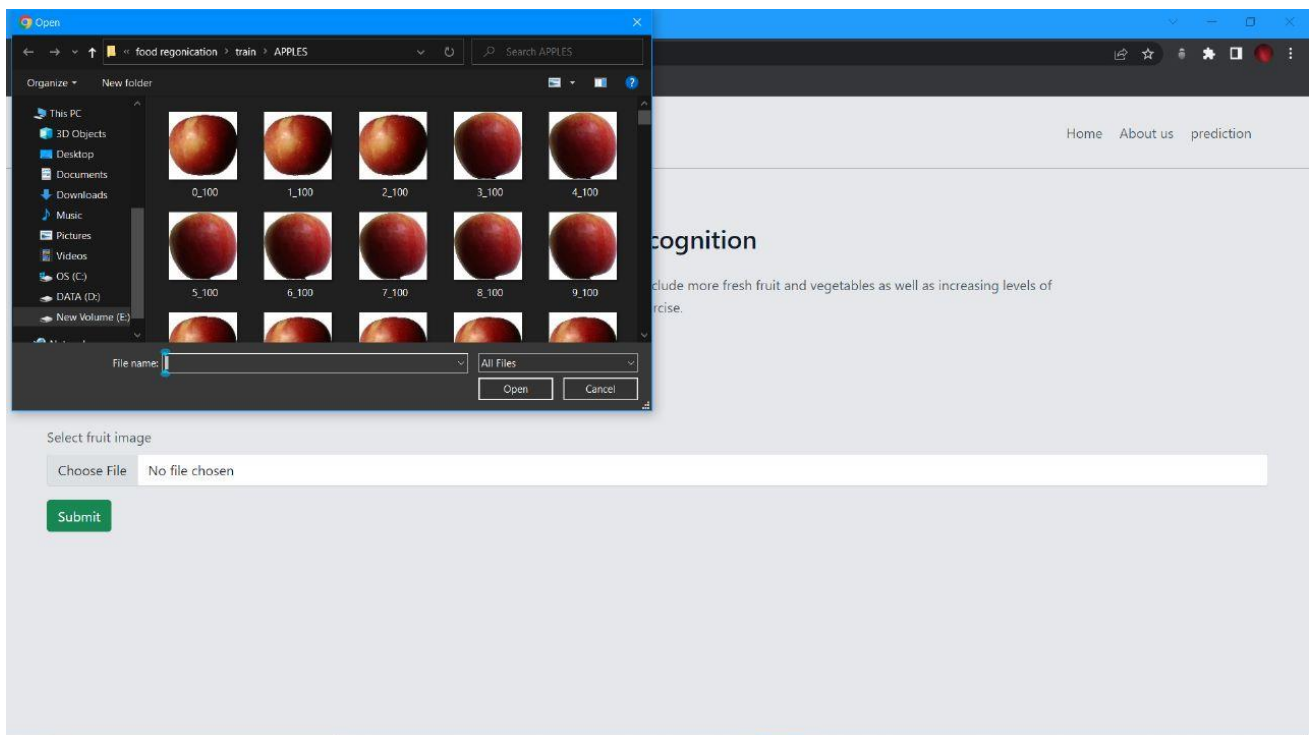
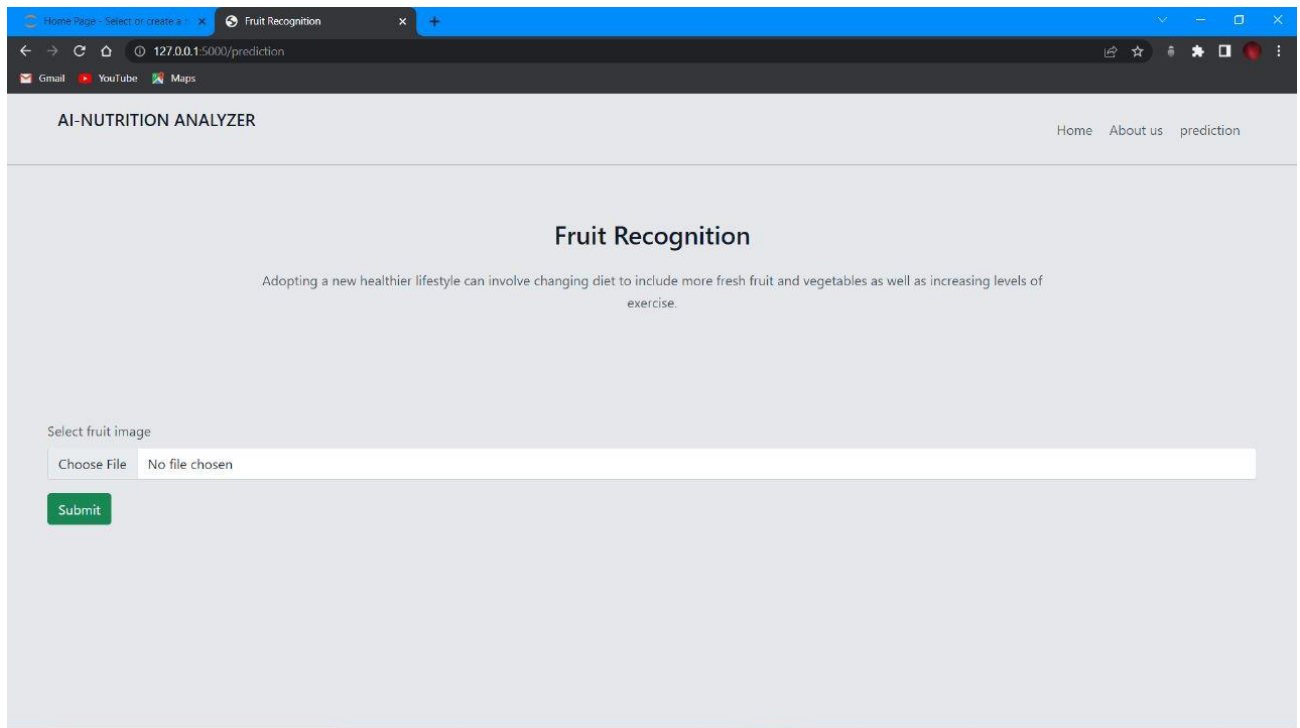
```
<!-- Option 2: Separate Popper and Bootstrap JS -->
```

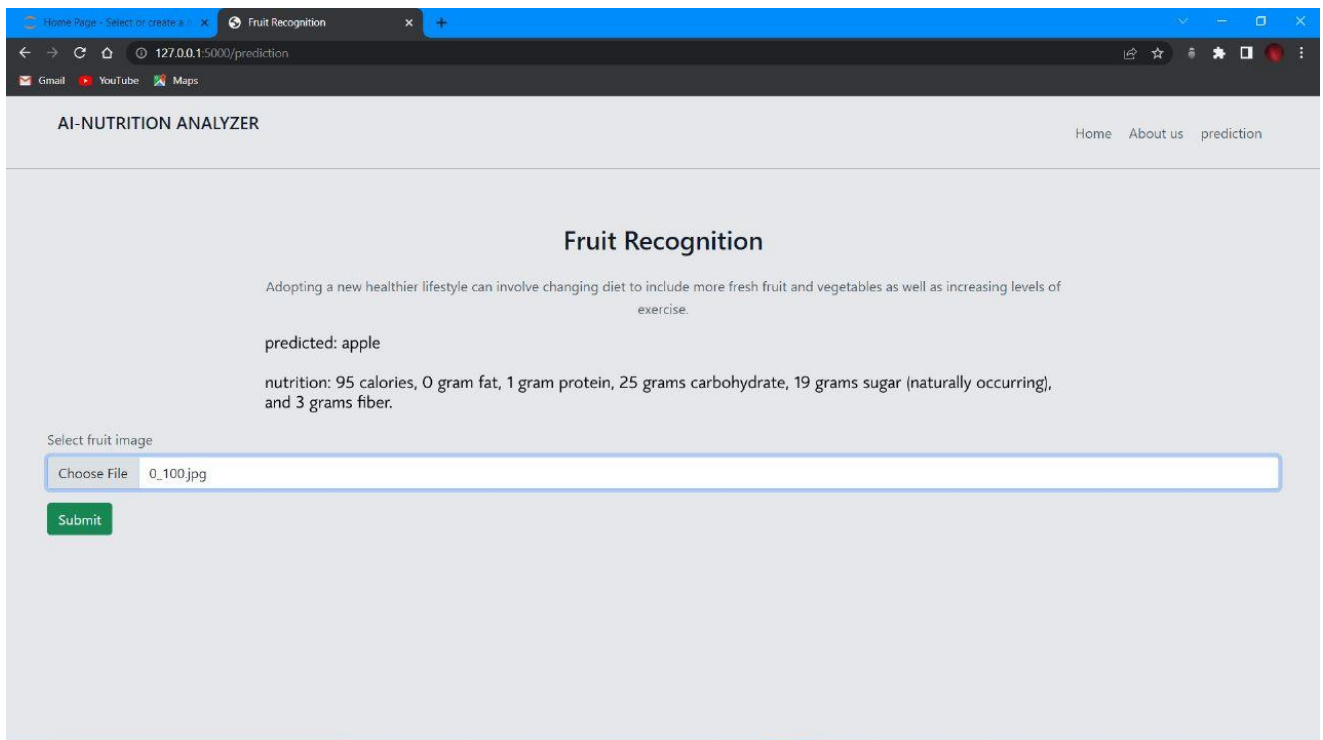
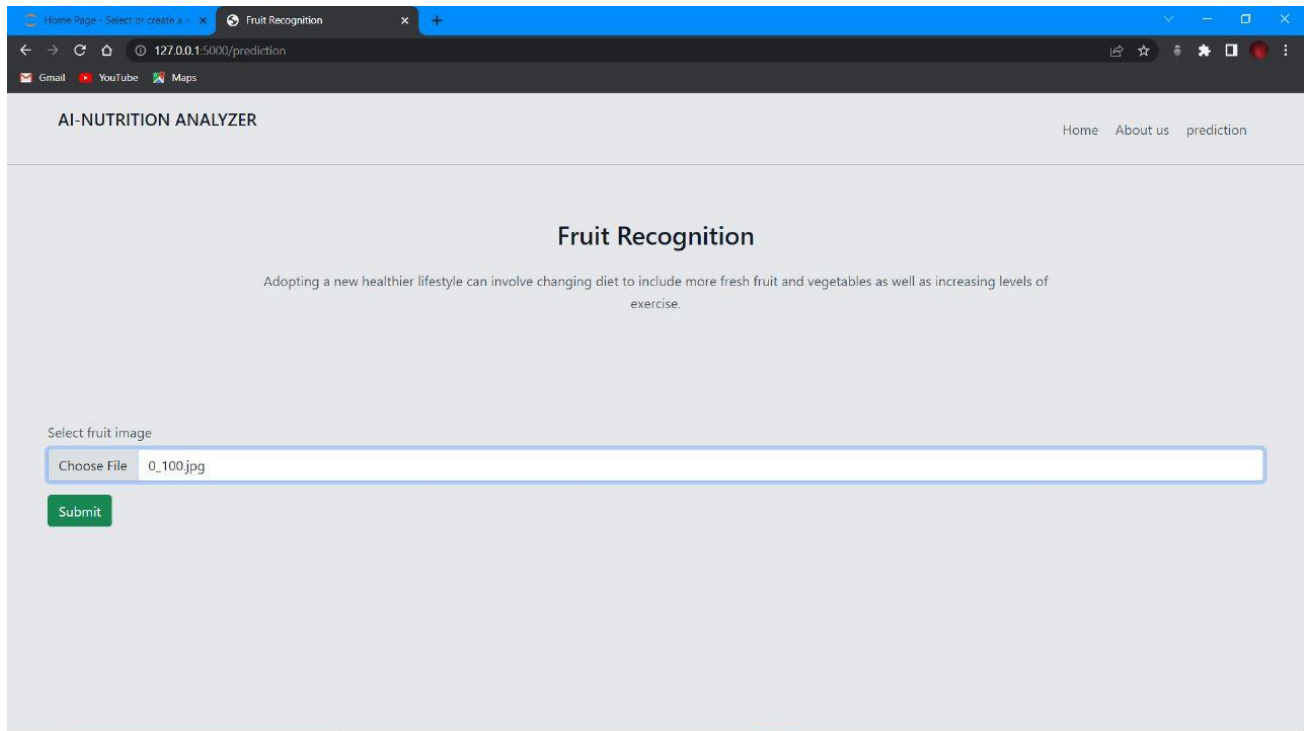
```
<!--  
  
<script src="https://cdn.jsdelivr.net/npm/@popperjs/core@2.9.3/dist/umd/popper.min.js"  
integrity="sha384-  
eMNCOe7tC1doHpGoWe/6oMVemdAVTMs2xqW4mwXrXsW0L84lytr2wi5v2QjrP/xp"  
crossorigin="anonymous"></script>  
  
<script src="https://cdn.jsdelivr.net/npm/bootstrap@5.1.0/dist/js/bootstrap.min.js"  
integrity="sha384-cn7l7gDp0eyniUwwAZgrzD06kc/tftFf19TOAs2zVinnD/C7E91j9yyk5//jjpt/"  
crossorigin="anonymous"></script>  
  
-->  
  
</body>  
  
</html>
```

APPENDIX B

RESULT PAGE SCREENSHOTS:







APPENDIX C

GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-10034-1659089012>