AI - Powered Nutrition Analzer For Fitness and Enthusiasts

IBM – DOCUMENTATION

UNDER THE GUIDANCE OF

Industry Mentor(s) Name : SRI TULASI
Faculty Mentor(s) Name : Dr. S. RAMESH

TEAM ID : PNT2022TMID38905

SUBMITTED BY:

Kiruthika S	421319104014
Eashwar M	421319104004
Girija S	421319104006
Jayasri K	421319104010

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

KRISHNASAMY COLLEGE OF ENGINEERING AND TECHNOLOGY 2019-2023

ANNA UNIVERSITY : 2019-2023

AI-powered Nutrition Analyzer for Fitness Enthusiasts

1. INTRODUCTION

Endurance athletes rarely compete in the fasted state, as this may compromise fuel stores. Thus, the timing and composition of the pre-exercise meal is a significant consideration for optimizing metabolism and subsequent endurance performance. Carbohydrate feedings prior to endurance exercise are common and have generally been shown to enhance performance, despite increasing insulin levels and reducing fat oxidation. These metabolic effects may be attenuated by consuming low glycemic index carbohydrates and/or modified starches before exercise. High fat meals seem to have beneficial metabolic effects(e.g., increasing fat oxidation and possibly sparing muscle glycogen). However, these effects do not necessarily translate into enhanced performance. Relatively little research has examined the effects of a pre-exercise high protein meal on subsequent performance, but there is some evidence to suggest enhanced pre-exercise glycogen synthesis and benefits to metabolism during exercise. Finally, various supplements (i.e., caffeine and beetroot juice) also warrant possible inclusion into pre-race nutrition for endurance athletes. Ultimately, further research is needed to optimize pre-exercise nutritional strategies for endurance performance.

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

As the world grows more fitness-conscious with passing time, the demand for technological solutions to cater to this burgeoning demand is diversifying. In India, this global trend has had a positive impact on scores of startups and websites catering to this segment. AI and its various subsets have been leveraged by these platforms to identify the calorie intake and also to make food recommendations for a healthy diet. In most cases, what we see is that these platforms act as a data repository where while providing real-time information to its users, it also makes available to numerous clients who work in this field for a determined rate. In this article, we take a look at the top AI-based online platforms which make use of AI and other deep learning technologies to provide a real-time updates about nutrition intake. 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.

1.2 Purpose

The nt 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, main aim of the project is to building a model which is used for classifying the fruit depends on the differeCalories, etc.).

2.LITERATURE SURVEY

2.1 Existing problem

In the short term, poor nutrition can contribute to stress, tiredness and our capacity to work, and over time, it can contribute to the risk of developing some illnesses and other health problems such as: being overweight or obese. Tooth decay ,high blood pressure. There are now strong links between low intakes of particular nutrients and the risk of developing chronic disease including some cancers, heart disease, diabetes, osteoporosis and depression. During pregnancy, insufficient nutrient intake can have long-term health implications for the health of the child.

2.2 References

- Published on April 8, 2019 From Gynaecology to Data Science : The journey of Dr Nitin Paranjape. Analyticsindiamag.com, Akshaya Asokan.

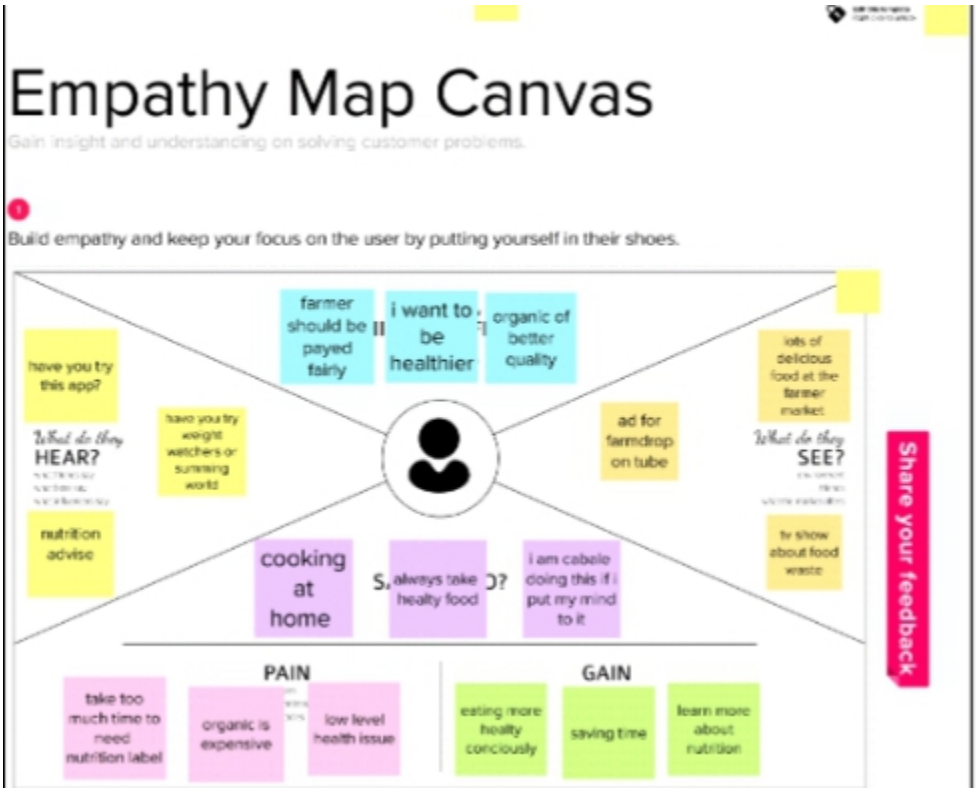
- Melina cote and Benoit Lamarche , Applied Physiology , Nutrition and Metabolism 15
- Johnson K.W., Torres Soto J., Glicksberg B.S.,. LITE Shameer K., Miotto R., Ali M., Ashley E., Dudley J.T. Artificial intelligence in cardiology. J. Am. Coll. Cardiol. 2018;71:2668–2679. doi: 10.1016/j.jacc.2018.03.521. [PubMed] [CrossRef] [Google Scholar]
- Hessler G., Baringhaus K.-H. Artificial intelligence in drug design. Molecules. 2018;23:2520. doi: 10.3390/molecules23102520. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- Heydarian H., Adam M.T.P., Burrows T., Collins C.E., Rollo M.E. Assessing eating behaviour using upper limb mounted motion sensors: A systematic review. Nutrients. 2019;11:1168. doi: 10.3390/nu11051168. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- Demirci F., Akan P., Kume T., Sisman A.R., Erbayraktar Z., Sevinc S. Artificial neural network approach in laboratory test reporting: Learning algorithms. Am. J. Clin. Pathol. 2016;146:227–237. doi: 10.1093/ajcp/aqw104. [PubMed] [CrossRef] [Google Scholar]

2.3Problem Statement Definition

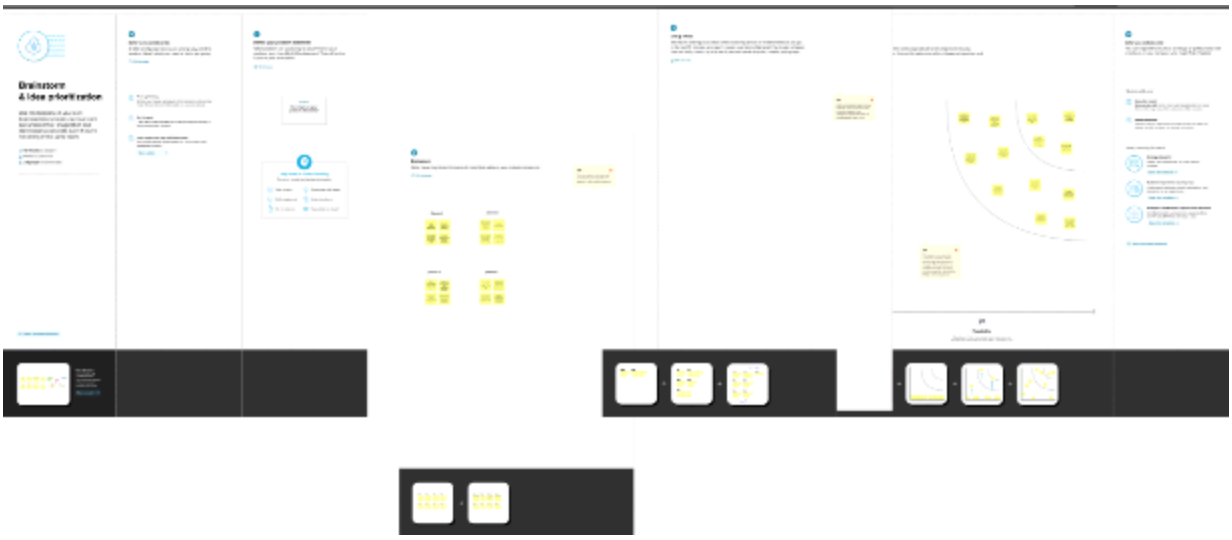
The amount of physical activity you need depends on your individual fitness goals and your current fitness level. It's important to start within your abilities and listen to your body's cues in terms of pain and injury. Obesity is a common health issue that is defined by having a high percentage of body fat. Being overweight or obese increases your chances of dying from hypertension, coronary heart disease, sleep apnea, and endometrial, breast, prostate, and colon cancers. Junk foods are high in calorie but low in nutrition value and lead to an excess metabolic weight leading to obesity. An obese individual is prone to life-threatening diseases which are not only limited to cholesterol or diabetes but also can cause stoke and NCDs. Overtraining may wear down the immune system. It Increases cardiovascular stress. Incorrect workouts may cause sprains, strains, fracture and other painful injury.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



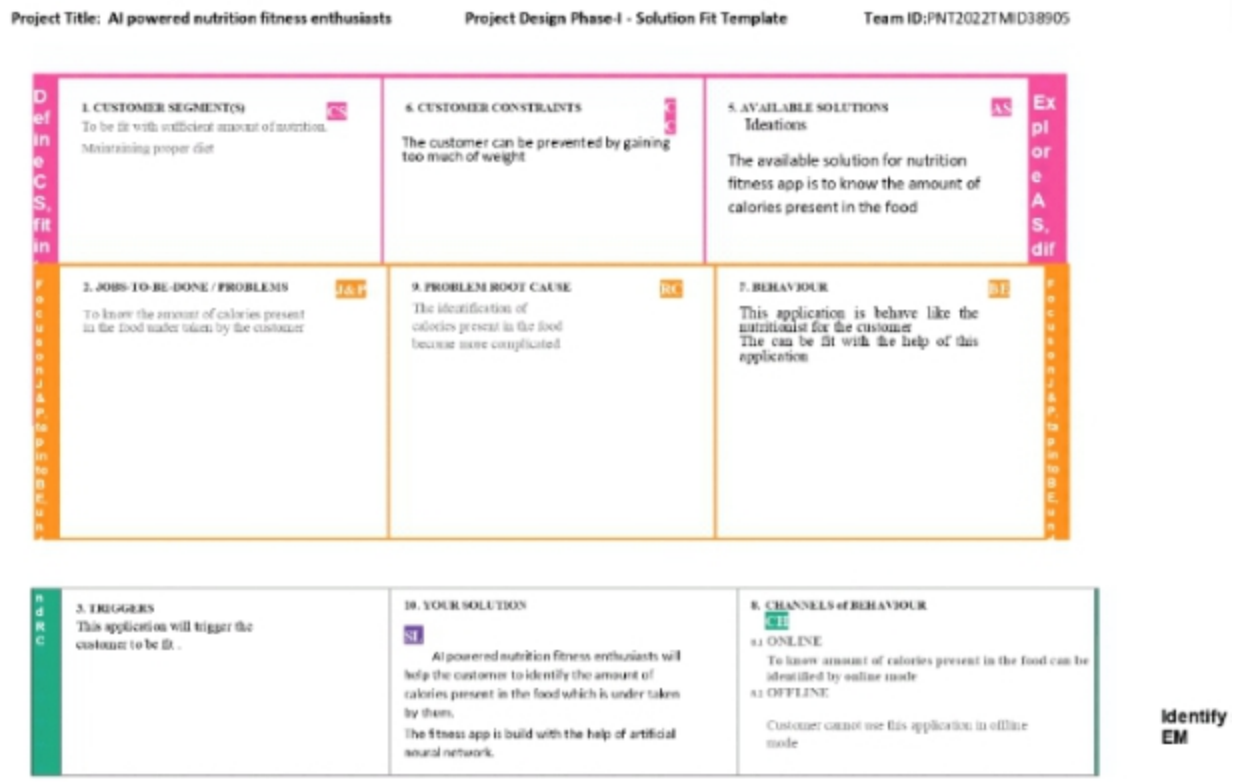
3.2 Ideation & Brainstorming



3.3 Proposed Solution

	PARAMETER DESCRIPTION
1	Problem Statement (Problem to be solved) To identify the amount of nutrition present in the food and to help for their nutrient fitness.
2	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.
3	Novelty/UniquenessThis applicaion is a unique app which is helpful for their fitness enthusiast.
4	Social impact/Customer Satisfaction using this application customer can satisy their requirement and they cannot worry about their fitness.
5	Business model (Revenue Model) Business model for this application is to reduce the people weight with healthy nutrition.
6	Scalability of the solution Scalability of this application will be high because it is based on artificial intelligence.

3.4Problem Solution fit



4.REQUIREMENT ANALYSIS

4.1Functional requirement

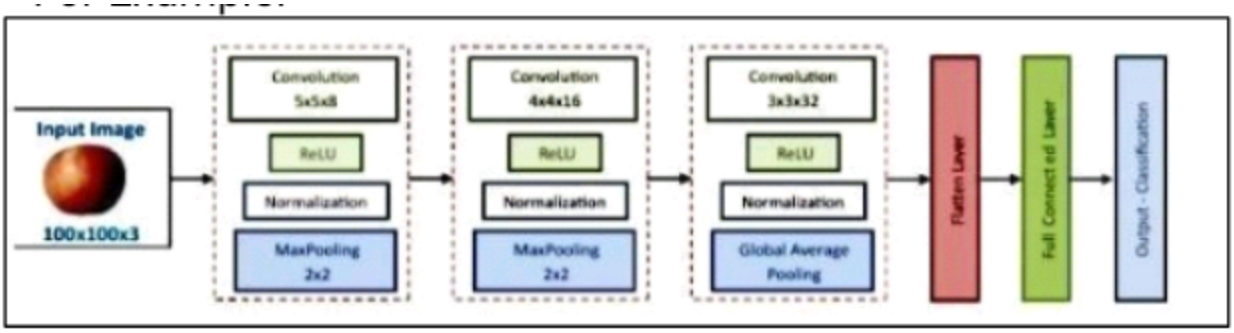
It will generate the diet plan as well as monitor the user's health to classify the category of the disease and to create the diet plan. It will also reduce the cost of consulting the person nutritionist.

The task of food detection/classification is not easy as it seems. All possible options related to the given Image.

Image classification, object detection, segmentation, face recognition.
Classification of crystal structure using a convolutional neural network.
Computer-Assisted Nutritional Recognize Food Images – In order to solve this issue, a brand-new Convolutional Neural Network (CNN)- based food picture identification system was created, as described in this study. We utilized our suggested strategy on two sets of actual food picture data.

Here the user can capture the images of different fruits and then the image will be sent to the trained model. The model analyzes the image and detects the nutrition based on the fruits like (Sugar, Fiber, Protein, Calories, etc.)
The Ultimate Workout at Home Solution This fitness AI software is designed with personalized training regimens for each individual. It began as “gym only software,” but has now improved its system to satisfy “at home fitness” expectations.
You take a picture, dial in data such as whether you are eating breakfast or lunch and add a quick text label, and the app estimates the calorie content.
This software collaborated with IBM’s natural language capability to provide 24-hour assistance and dietary recommendations.

For Example:

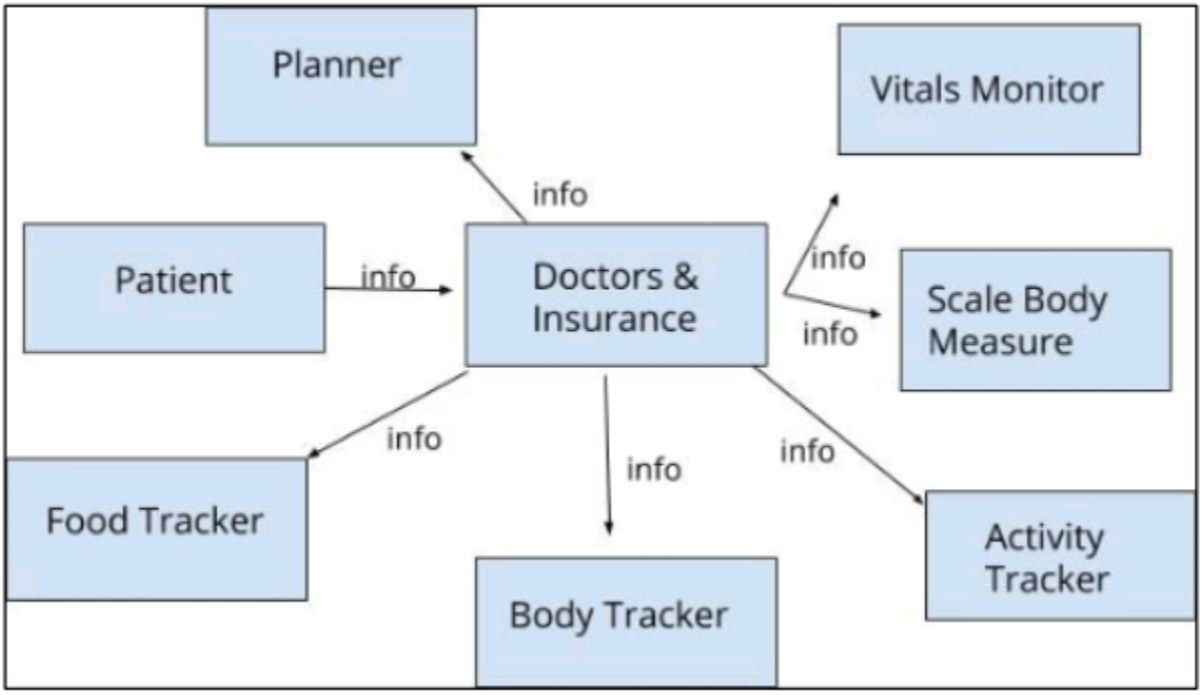


The comparison of the proposed model with the conventional models shows that the results of this model are exceptionally good and promising to use in real-world applications. This sort of higher accuracy and precision will work to boost the machine’s general efficiency in fruit recognition more appropriately.
A generic model for the dietary protein requirement (as with any nutrient) defines the requirement in terms of the needs of the organism,

i.e. metabolic demands, and the dietary amount which will satisfy those needs, i.e. efficiency of utilization, thus: dietary requirement = metabolic demand/efficiency of utilization.

5.PROJECT DESIGN

5.1 Data Flow Diagram



5.2Solution & Technical Architecture

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

It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

6. PROJECT PLANNING & SCHEDULING

6.1Sprint Planning & Estimation

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	17 Nov2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	17 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	17 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	17 Nov 2022

6.2Sprint Delivery Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	Download Food Nutrition Dataset	2	Medium	kiruthika
Sprint-1	Data Preprocessing	USN-2	Importing The Dataset into Workspace	1	Low	girija
Sprint-1		USN-3	Handling Missing Data	3	Medium	jayasri
Sprint-1		USN-4	Feature Scaling	3	Low	eashwar
Sprint-1		USN-5	Data Visualization	3	Medium	kiruthika
Sprint-1		USN-6	Splitting Data into Train and Test	4	High	girija
Sprint-1		USN-7	Creating A Dataset with Sliding Windows	4	High	jayasri
Sprint-2	Model Building	USN-8	Importing The Model Building Libraries	1	Medium	eashwar
Sprint-2		USN-9	Initializing The Model	1	Medium	kiruthika

Sprint-2	USN-10	Adding LSTM Layers	2	High	girija	
Sprint-2	USN-11	Adding Output Layers	3	Medium	jayasri	
Sprint-2	USN-12	Configure The Learning Process	4	High	eashwar	
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	USN-13	Train The Model	2	Medium	jayasri	
Sprint-2	USN-14	Model Evaluation	1	Medium	girija	
Sprint-2	USN-15	Save The Model	2	Medium	eashwar	
Sprint-2	USN-16	Test The Model	3	High	kiruthika	
Sprint-3	Application Building	USN-17	Create An HTML File	4	Medium	jayasri
Sprint-3	USN-18	Build Python Code	4	High	girija	
Sprint-3	USN-19	Run The App in Local Browser	4	Medium	kiruthika	
Sprint-3	USN-20	Showcasing Prediction On UI	4	High	girija	
Sprint-4	Train The Model On IBM	USN-21	Register For IBM Cloud	4	Medium	girija
Sprint-4	USN-22	Train The ML Model On IBM	8	High	jayasri	
Sprint-4	USN-23	Integrate Flask with Scoring End Point	8	High	eashwar	

7.CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 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')
```

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:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Pl
  """Entry point for launching an IPython kernel.
Epoch 1/20
494/494 [==============================] - ETA: 6:53 - loss: 0.7194 - accuracy: 0.7174
```

7. Saving The Model

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

8. Testing The Model

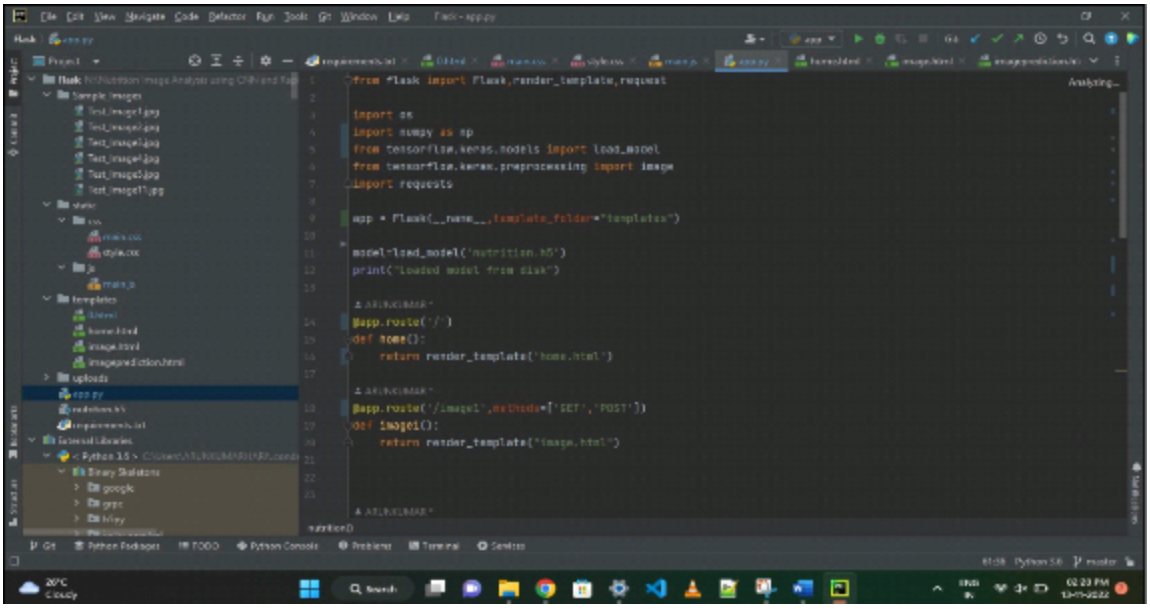
```
from tensorflow.keras.models import load_model
from keras.preprocessing import image
model = load_model("nutrition.h5")
```

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model("nutrition.h5")
img = image.load_img('/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 63ms/step
array([0])
```

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

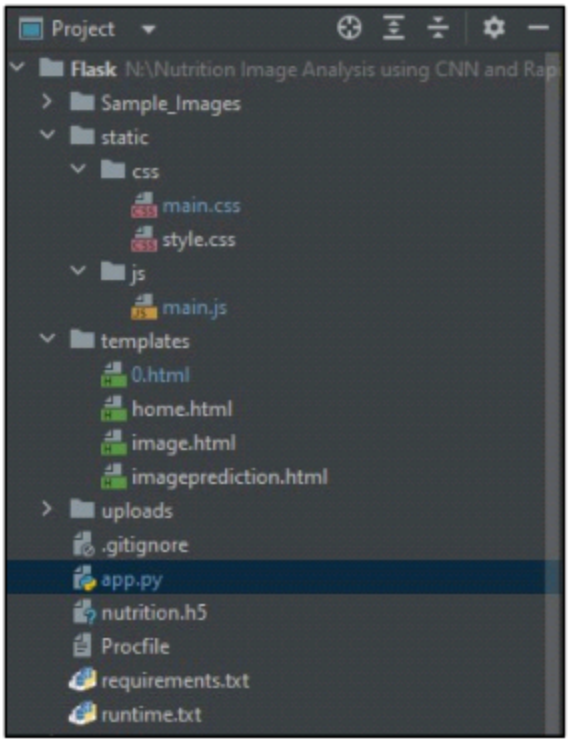
7.2Feature 2

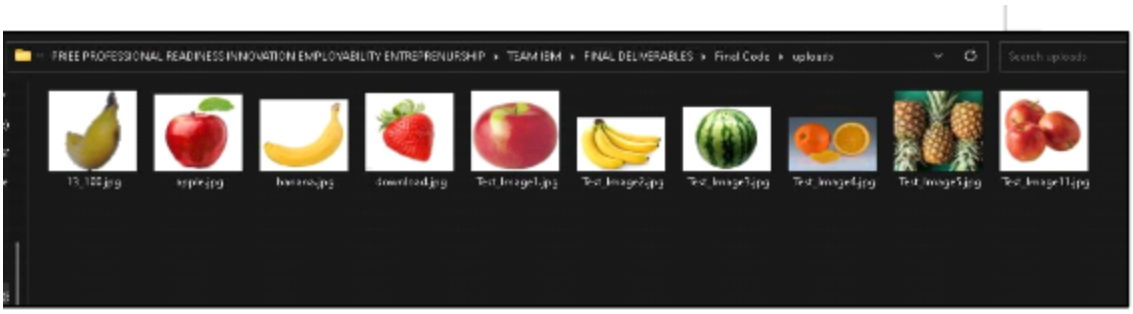


Database Schema (if Applicable)

8.TESTING

8.1Test Cases

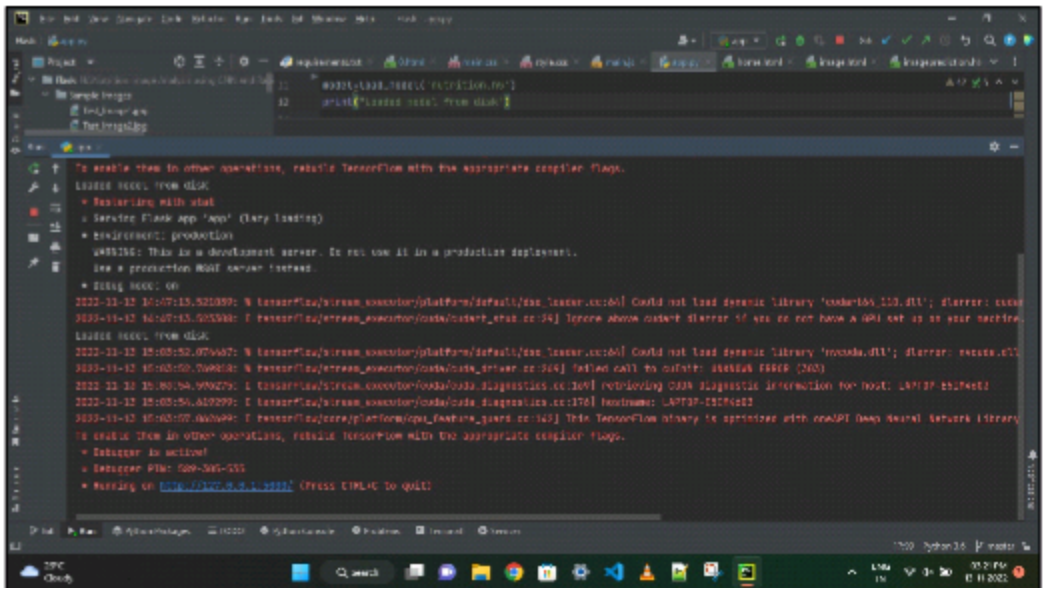




8.2User Acceptance Testing

9.RESULTS

9.1Performance Metrics



10.ADVANTAGES

Advantages-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.

11.CONCLUSION

Thus powered nutrition analyzer for fitness enthusiasts good nutrition promotes not only better physical healthy and reduced susceptibility to disease, but has also been demonstrated to contribute to cognitive development and academic success. Left to their own devices, children will not automatically select healthy food. A balance diet and appropriate meal timings are important for healthy body and mind. Most countries nowadays implement health seducation program in schools which include feeding to students, vitamin and mineral supplementation.

12.FUTURE SCOPE

AI is revolutionizing the health industry. It is majorly used in improving marketing and sales decisions, AI is now also being used to reshape individual habits. In future we don't want to go to gym and do any diets. By using this nutrition fitness analyzer we can maintain our diet plans without any help from others and we can lead a happy and healthy life with good wealth.AI can easily track health behaviors and repetitive exercise patterns and use the data to guide you towards your fitness journey and diet plans.

13.APPENDIX

GitHub & project Demo Link

https://github.com/IBM-EPBL/IBM-Project-43394-1660716564/tree/main/Project%20Design%20%26%20Planning/project%20design%20phase%201