# AI - POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

A PROJECT REPORT

Submitted by


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in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING
IN
ELECTRONICS AND COMMUNICATION ENGINEERING


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KOVILVENNI , THIRUVARUR -614403.
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**INTRODUCTION:**

**Abstract:**

A healthy diet has been a concern for many health conventions. Today, nutrition analysis tools make it easier to maintain a healthy eating pattern. Nutrition Analysis is the process of analysing foods to determine their nutritional content. The main objective of the project is to build a model used to classify fruit images based on different characteristics and image.A nutrition analyser is used to estimate and predict calories based on deep learning techniques. Its purpose is to maintain a healthy lifestyle by tracking diet and exercise habits.

**Project Overview:**

- To know the fundamental concepts and techniques of Convolutional Neural Network and Broad understanding of image data.
- To pre-process/clean the data using different data pre-processing techniques.
- Build a web application using the Flask framework. The user interacts with the UI (User Interface) and gives the image as input, then the input image is then passed to our flask application, and finally with the help of the model which we build we will classify the result and showcase it on the UI.

**Purpose:**

AI Algorithms may help better understand and predict the complex and non-linear interaction between nutrition - related data and health outcomes.

These nutrition analyser tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet.

## LITERATURE SURVEY:

**Existing Problem**:

People who don't aware about the nutrient content in they are consuming that lead to lack of appetite, or decrease hunger, is one of the most troublesome nutrition problems they are experiencing which leads to nutrition disease, nutrition related diseases and conditions that cause illness in humans. They include deficiencies or excesses in the diet, obesity and eating disorder, and chronic diseases such as diabetes mellitus.

# Artificial Intelligence in Nutrients Science Research: A Review

Author :Jarosław Sak and Magdalena Suchodolska

Artificial intelligence (AI) as a branch of computer science, the purpose of which is to imitate thought processes, learning abilities and knowledge management, finds more and more applications in experimental and clinical medicine. In recent decades, there has been an expansion of AI applications in biomedical sciences. The possibilities of artificial intelligence in medical diagnostics, risk prediction and support of therapeutic techniques are proliferating. The aim of the article is to analyse the current use of AI in nutrients science research. The literature review was conducted in PubMed. A total of 399 records published between 1987 and 2020 were obtained, of which, after analysing the titles and abstracts, 261 were rejected. In the next stages, the remaining records were analysed using the full-text versions and, finally, 55 papers were selected. These papers were divided into three areas: AI in biomedical nutrients research (20 studies), AI in clinical nutrients

research (22 studies) and AI in nutritional epidemiology (13 studies). It was found that the artificial neural network (ANN) methodology was dominant in the group of research on food composition study and production of nutrients. However, machine learning (ML) algorithms were widely used in studies on the influence of nutrients on the functioning of the human body in health and disease and in studies on the gut microbiota. Deep learning (DL) algorithms prevailed in a group of research works on clinical nutrients intake. The development of dietary systems using AI technology may lead to the creation of a global network that will be able to both actively support and monitor the personalized supply of nutrients.

## AI for Understanding Food and Nutrition

### Author: Barbara Korousic Seljak, Tome Eftimov, Fabio Mainardi

Topics of interest include algorithms, methods, and systems related to food and nutrition:

- Information retrieval and extraction in efforts to build food ingredient databases;

- Data normalization, ontologies, and ontology design in efforts to record individual eating patterns with great detail and link eating to important locational, temporal, and social factors, including unstructured (social media, text, images etc.) and structured data resources;

- Predict relationships between food and nutrition and health behaviours, linking this to health and environmental outcomes;

- Recommender systems in efforts to build personalized nutrition systems and drive food choices;

- NLP frameworks in efforts to inform community interventions and population

health and environment policies that affect access to and consumption of food;

- Digital tracking tools, wearable devices, and other sensors in efforts to record, represent, and analyse quantified-self data, and link food consumption to health and environmental sustainability.

# How Nutrition AI Determines People's Health Metrics?

## Author: ThinkMl team

Randomized trials in the nutrition field are complex because this technique demands sticking to a diet for years, resulting in higher human error chances. There are several factors of dietary recommendations that influence everyone differently; hence, the ideology of a universal diet plan for everyone fails here as it is impossible biologically. Artificial intelligence allows researchers to analyse big data and better understand how diet affects human health patterns, including factors influencing their nutritional needs.

AI Diet Planner: Use of AI to determine your diet plan

The food business uses AI in a variety of ways, such as anticipating the influence of a taste or utilizing robots in manufacturing. A diet plan driven by AI is rapidly gaining traction, with the ability to create tailored diet programs based on our physical characteristics and exact objectives.

Personalized Nutritional Guide by Artificial Intelligence

Micronutrients strives to integrate genomic science with nutrition to improve nutritional-based artificial intelligence. DNA tests recommend a personalized diet plan focusing on specific aspects of a person's microbiome, including lifestyle, genetics, and surroundings. These suggestions are based on data extracted from

billions of human dietary patterns. Such nutritional guides based on the micronutrient approach help scientists leverage AI for personalized recommendations and interventions.

Artificial intelligence made it possible to analyse personal health metrics and give birth to many ongoing projects in the same field. For instance, smartphone nutritional applications are developed that use deep learning to analyse photos of plates for streamlining food logging processing without human-based errors. However, a complete dataset must comprise major factors like sleep patterns, activity levels, microbiome functioning, and medication consumption. Advanced algorithms help achieve this goal by tracking important health metrics for personalized AI diet chart plan development. In the coming five to ten years, it is expected that AI and ML techniques will grow further in the nutrition and fitness department.

## A Survey on Automated Food Monitoring and Dietary Management Systems

### Author: Vieira Bruno, Silva Resende, Cui Juan

Healthy diet with balanced nutrition is key to the prevention of life-threatening diseases such as obesity, cardiovascular disease, and cancer. Recent advances in smartphone and wearable sensor technologies have led to a proliferation of food monitoring applications based on automated food image processing and eating episode detection, with the goal to conquer drawbacks of the traditional manual food journaling that is time-consuming, inaccurate, under-reporting, and low adherent. In order to provide users feedback with nutritional information accompanied by insightful dietary advice, various techniques in light of the key computational learning principles have been explored. This survey presents a variety of methodologies and resources on this topic, along with unsolved

problems, and closes with a perspective and border implications of this field.

## Mobile-Based Diet Monitoring System for Obesity Management.

Author: Bruno Vieira Resende E Silva, M. Rad, J. Cui, Megan McCabe, Kaiyue Pan

A new interactive mobile system that enables automated food recognition and assessment based on user food images and provides dietary intervention while tracking users' dietary and physical activities and the realization of real time energy balance monitoring through metabolic network simulation is presented.

Personal diet management is key to fighting the obesity epidemic. Recent advances in smartphones and wearable sensor technologies have empowered automated food monitoring through food image processing and eating episode detection, with the goal to conquer drawbacks of traditional food journaling that is labour-intensive, inaccurate, and low adherent. In this paper, we present a new interactive mobile system that enables automated food recognition and assessment based on user food images and provides dietary intervention while tracking users' dietary and physical activities. Also using techniques in computer vision and machine learning, one unique feature of this system is the realization of real time energy balance monitoring through metabolic network simulation. As a proof of concept, we have demonstrated the use of this system through an Android application.

# Integrating Concepts about Food, Nutrition and Physical Activity

Authors: Jennifer Adkins Ernst , MS Anastasia Snelling, PhD, RD Devin Ellsworth

The Community Voices for Health curriculum “Integrating Concepts about Food, Nutrition and Physical Activity into Middle School” is intended to help you increase the amount of nutrition education and physical activity you are providing for your students. Educators agree that healthier students are better learners (Basch, C.), so empowering students to make healthy food choices and be physically active is very important to academic achievement. Healthy environments, good role-models, and learning opportunities all contribute to improving the health behaviours and academic outcomes of your students. The following conceptual model will stimulate teachers’ interest in topics about food, food production, gardening and nutrition, and help them seamlessly include them in their regular lesson plans. The curriculum is organised into six nutrient content areas - carbohydrates, protein, fat, vitamins, minerals and water. Each content area contains fundamental food, growing, nutrient and food labelling information, common core standards for maths, language arts, science and history, provocative facts and questions, and lesson suggestions. The intent of the design is that teachers can easily coordinate with their colleagues across their grade, and the school, to focus the delivery to suit your school schedule and priorities

## Problem Statement Definition:

A Problem Statement is a description of an issue to be addressed or condition to be improved upon. Statement of a Current issue or problem of the users based on the nutritional Problem or deficiency and individual experience about the shortage of essential nutrients or some specific Nutrient.


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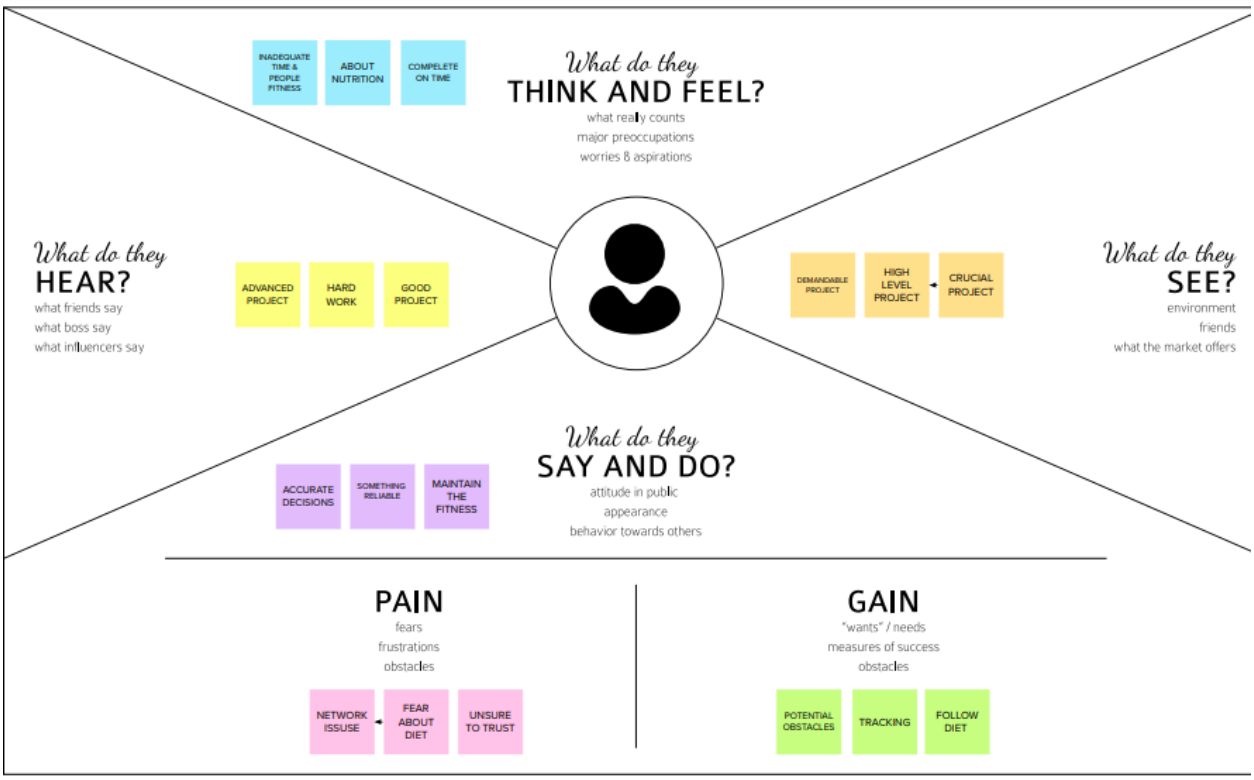
## IDEATION AND PROPOSED SOLUTION:

### Empathy map canvas:

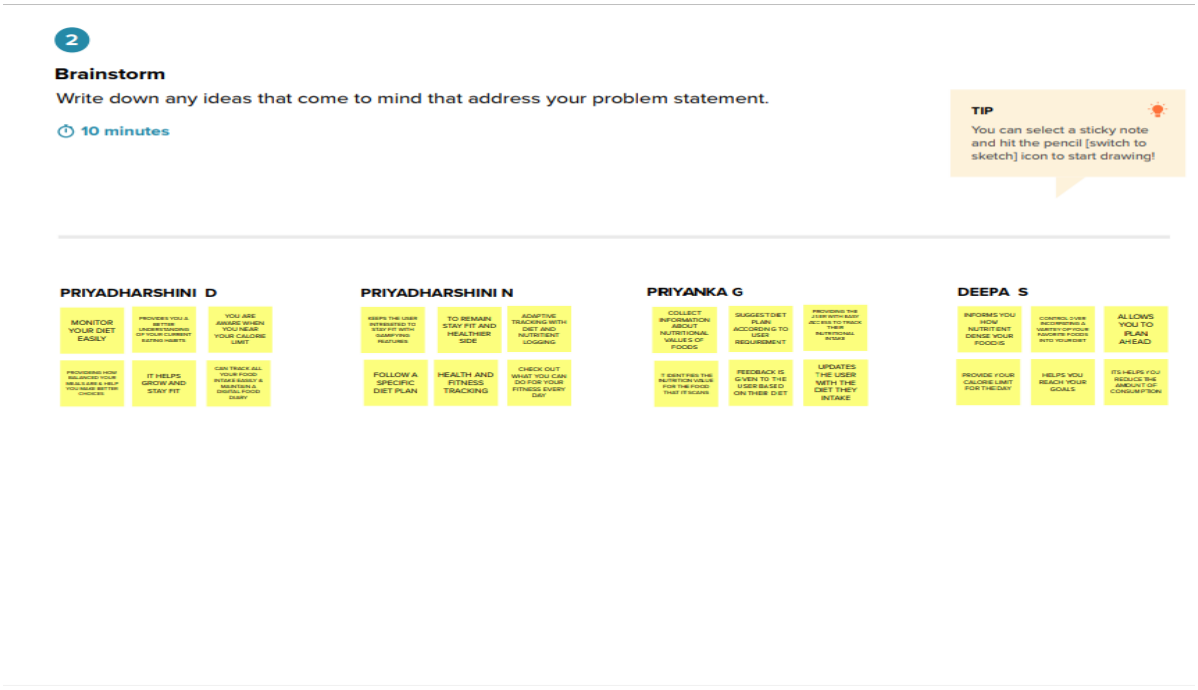
An Empathy map which helps identify and describe the users needs pain points and it gives valuable information for improving the user experience. It helps to understand the various reasons for experience.

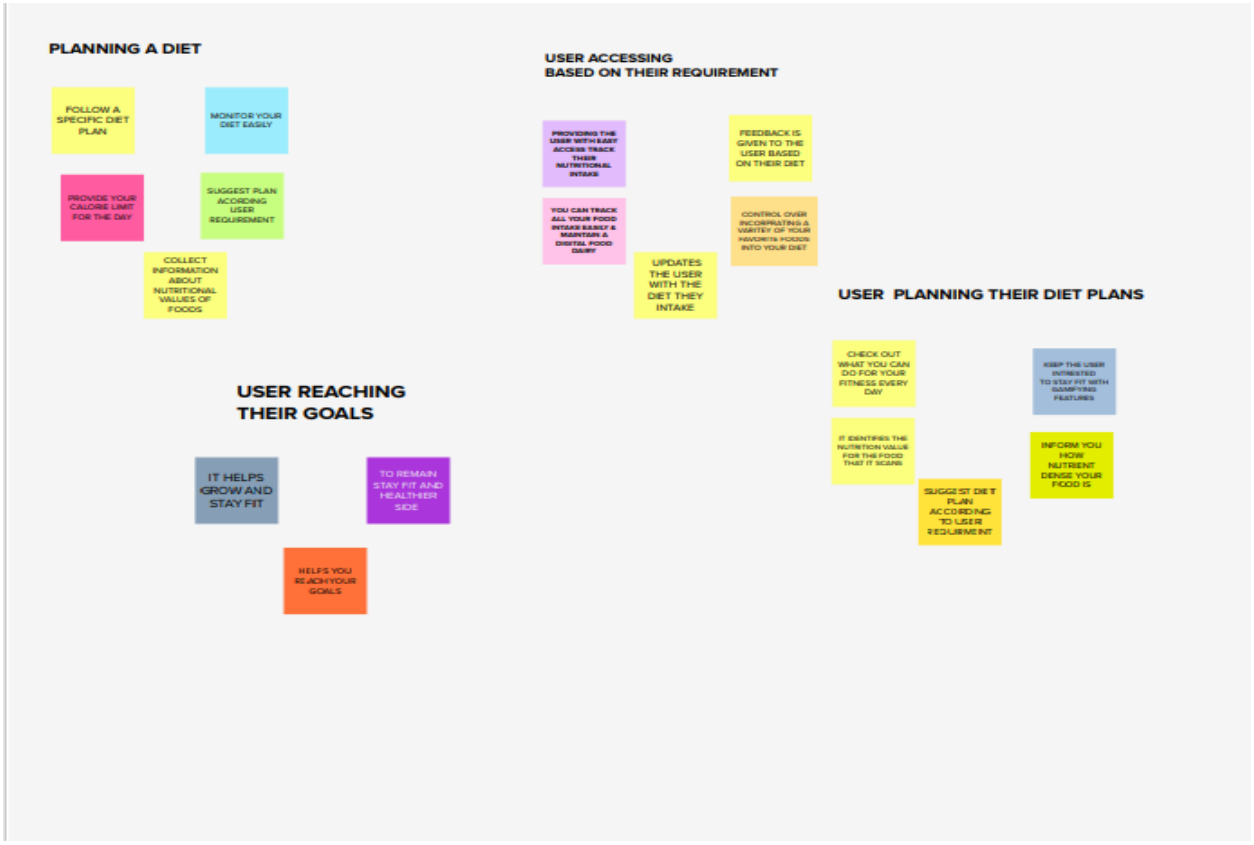
- What do users say and do?
- What do users think and do?
- What do users see and hear?


INADEQUATE TIME & PEOPLE FITNESS
ABOUT NUTRITION
COMPELETE ON TIME
What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
What do they
HEAR?
what friends say
what boss say
what influencers say
ADVANCED PROJECT
HARD WORK
GOOD PROJECT
DEMANDABLE PROJECT
HIGH LEVEL PROJECT
CRUCIAL PROJECT
What do they
SEE?
environment
friends
what the market offers
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
ACCURATE DECISIONS
SOMETHING RELIABLE
MAINTAIN THE FITNESS
PAIN
fears
frustrations
obstacles
NETWORK ISSUSE
FEAR ABOUT DIET
UNSURE TO TRUST
GAIN
"wants" / needs
measures of success
obstacles
POTENTIAL OBSTACLES
TRACKING
FOLLOW DIET

**IDEATION AND BRAIN STORMING:**

Ideation describe the  entire process of developing the formalizing ideas.Brainstorming is primary role in the process. Ideation and the Brainstorming as the formative stage of the group discussion where everyone expose their ideas regarding the issues. One or more people directing their thoughts towards the particular that problem and issue. Typical brainstorming tools take the form of the graph that helps the prioritize and specific ideas into the scope of the project




PLANNING A DIET
FOLLOW A SPECIFIC DIET PLAN
MONITOR YOUR DIET EASILY
PROVIDE YOUR CALORIE LIMIT FOR THE DAY
SUGGEST PLAN ACCORDING USER REQUIREMENT
COLLECT INFORMATION ABOUT NUTRITIONAL VALUES OF FOODS
USER ACCESSING BASED ON THEIR REQUIREMENT
PROVIDING THE USER WITH EASY ACCESS TRACK THEIR NUTRITIONAL INTAKE
FEEDBACK IS GIVEN TO THE USER BASED ON THEIR DIET
YOU CAN TRACK ALL YOUR FOOD INTAKE EASILY & MAINTAIN A DIGITAL FOOD DIARY
CONTROL OVER INCORPORATING A VARITEY OF YOUR FAVORITE FOODS INTO YOUR DIET
UPDATES THE USER WITH THE DIET THEY INTAKE
USER REACHING THEIR GOALS
IT HELPS GROW AND STAY FIT
TO REMAIN STAY FIT AND HEALTHIER SIDE
HELPS YOU REACH YOUR GOALS
USER PLANNING THEIR DIET PLANS
CHECK OUT WHAT YOU CAN DO FOR YOUR FITNESS EVERY DAY
KEEP THE USER INTRESTED TO STAY FIT WITH GAMIFYING FEATURES
IT IDENTIFIES THE NUTRITION VALUE FOR THE FOOD THAT IT SCANS
INFORM YOU HOW NUTRIENT DENSE YOUR FOOD IS
SUGGEST DIET PLAN ACCORDING TO USER REQUIREMENT


PROVIDING HOW BALANCED YOUR MEALS ARE & HELP YOU MAKE BETTER CHOICES
COLLECT INFORMATION ABOUT NUTRITIONAL VALUES OF FOODS
HEALTH AND FITNESS TRACKING
MONITOR YOUR DIET EASILY
UPDATES THE USER WITH THE DIET THEY INTAKE
IT IDENTIFIES THE NUTRITION VALUE FOR THE FOOD THAT IT SCANS
YOU CAN TRACK ALL YOUR FOOD INTAKE EASILY & MAINTAIN A DIGITAL FOOD DIARY
INFORMS YOU HOW NUTRITIENT DENSE YOUR FOOD IS
ADAPTIVE TRACKING WITH DIET AND NUTRITIENT LOGGING
PROVIDING THE USER WITH EASY ACCESS TRACK THEIR NUTRITIONAL INTAKE
INFORM YOU HOW NUTRIENT DENSE YOUR FOOD IS
SUGGEST DIET PLAN ACCORDING TO USER REQUIRMENT
PROVIDES YOU A BETTER UNDERSTANDING OF YOUR CURRENT EATING HABITS

**Proposed Solution :**

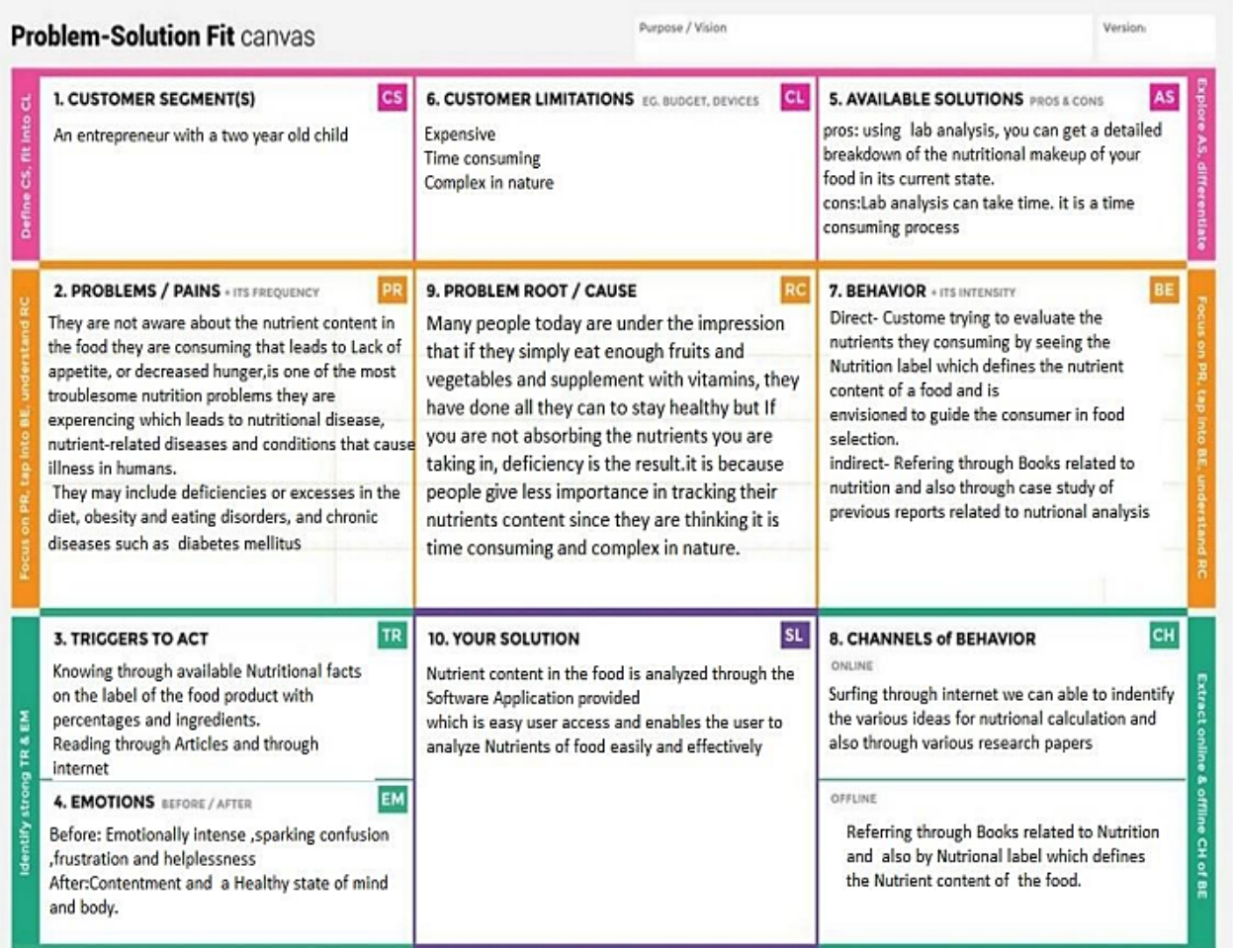
Main goal of presenting a proposed solution to provide solution for given problem which faced by a potential buyer .It should be as comprehensive and address all the needs that pointed.

| S. No | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | Sita is a business woman who needs a way to intake Nutritional food because of her busy scheduled need to track her Nutritional intake so that she can maintain her health. |
| 2. | Idea / Solution description | AI Nutrition Analyser can automatically recognize food items and compute the recommended volume and nutritional information of that food items. |
| 3. | Novelty / Uniqueness | Customization,<br>User friendly nutritional calculator,<br>Intuitive |
| 4. | Social Impact / Customer Satisfaction | Easy and quick handy nutrition calculators for all food items,<br>Cost effective,<br>To better understand their expectations & Perspectives. |

| | | |
|---|---|---|
| 5. | Business Model (Revenue Model) | AI is one of today's most hyped technologies with widespread advances in data capturing & manipulation, Machine learning becoming low cost & main stream .AI technologies to market still need to select the right revenue models to drive profits.<br>Term of Recurring revenue prospects using this guidelines subscription, service, usage based. |
| 6. | Scalability of the Solution | AI algorithms may help better understand and predict complex & non-linear interaction between nutrition -related data & health outcomes. It performs nutrient analysis of dietary intakes. |

**Problem Solution fit:**

Problem solution fit which found a problem with customer and that the solution we have realized for it actually solves the customer's problem.This stages proved the existence of a problem and have designed a value proposition that addresses customer's pains and gains.



## REQUIREMENT ANALYSIS

### Functional Requirement:

Functional Requirements are product features or functions that developers must implement to enable users to accomplish their tasks.

It explains how the system must work and its performance. They define the basic system behaviour under the specific condition.

Following are the functional requirements of the proposed solution.

| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form<br>Registration through Gmail<br>Registration through LinkedIn |
| FR-2 | User Confirmation | Confirmation via Email Confirmation<br>via OTP |
| FR-3 | User Access | Should be able to Access the current as well as the previous data. |
| FR-4 | User Security | Application should be secured and also it should have two step verification. |
| FR-5 | Performance | Application should be able to access huge amount of data and provide information in a span of time |
| FR-6 | Display | The Application should display the information in same page and their should be a download option |

**Non -Functional Requirement:**

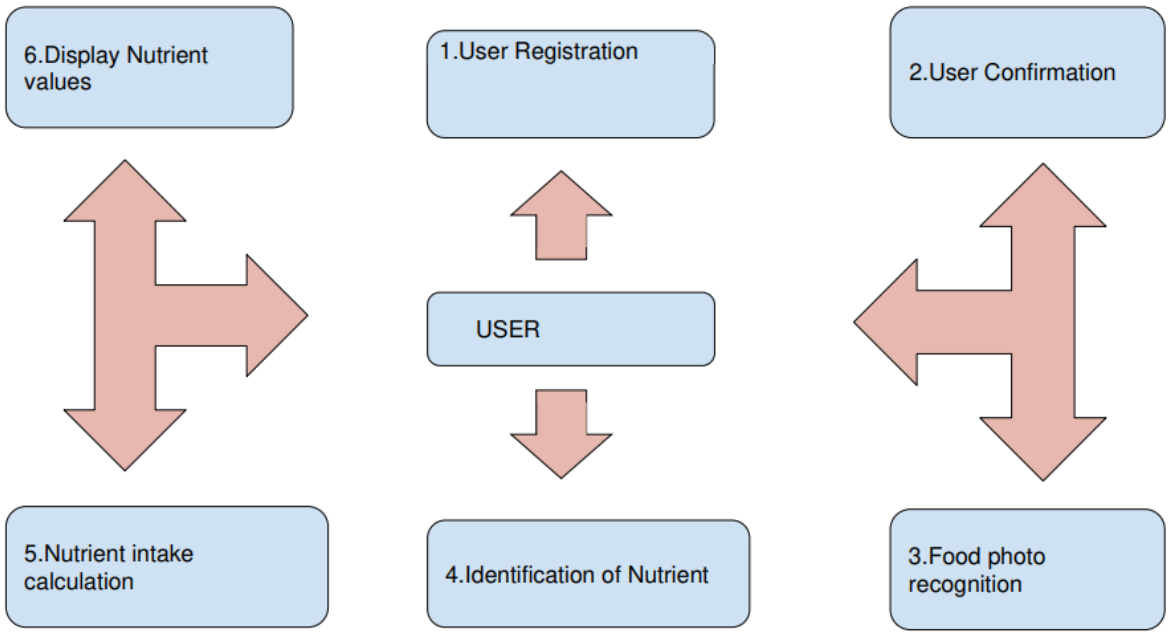
It defines the System Attributes such as Security, Reliability, performance, Maintainable, Scalability, Usability.

Following are the non-functional requirements of the proposed solution.

| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | A user can access the information through the application without consuming time . |
| NFR-2 | **Security** | confidentiality and authentication of user information is maintained. |
| NFR-3 | **Reliability** | A user can access the information that is previously stored at any time. |
| NFR-4 | **Performance** | Web application loading time is not more than few seconds. |
| NFR-5 | **Availability** | A user can access the resources at free of cost they can collect the information which they required. |
| NFR-6 | **Scalability** | It can be accessed easily with an increased number of users. |

## PROJECT DESIGN

**Data flow Diagram:** Data flow diagram is a way of representing a flow of data through the process or a system. It also provides information about the output and input of each entity and the process itself. It has no control flow and No decision rules and no loops.

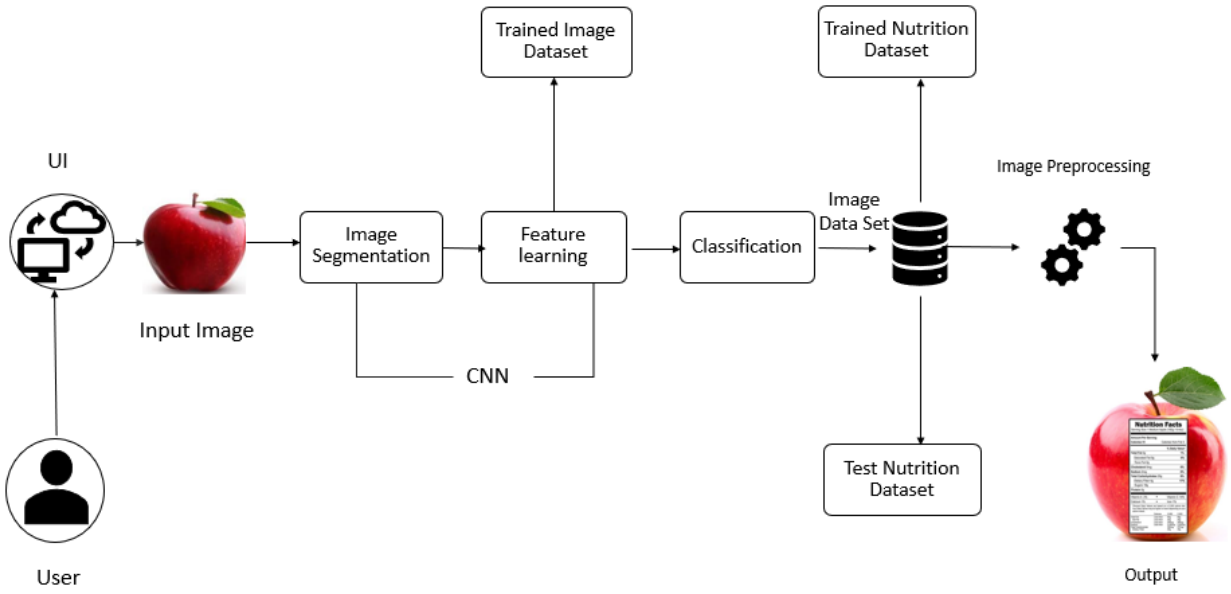



**Solution And Technical Architecture:**

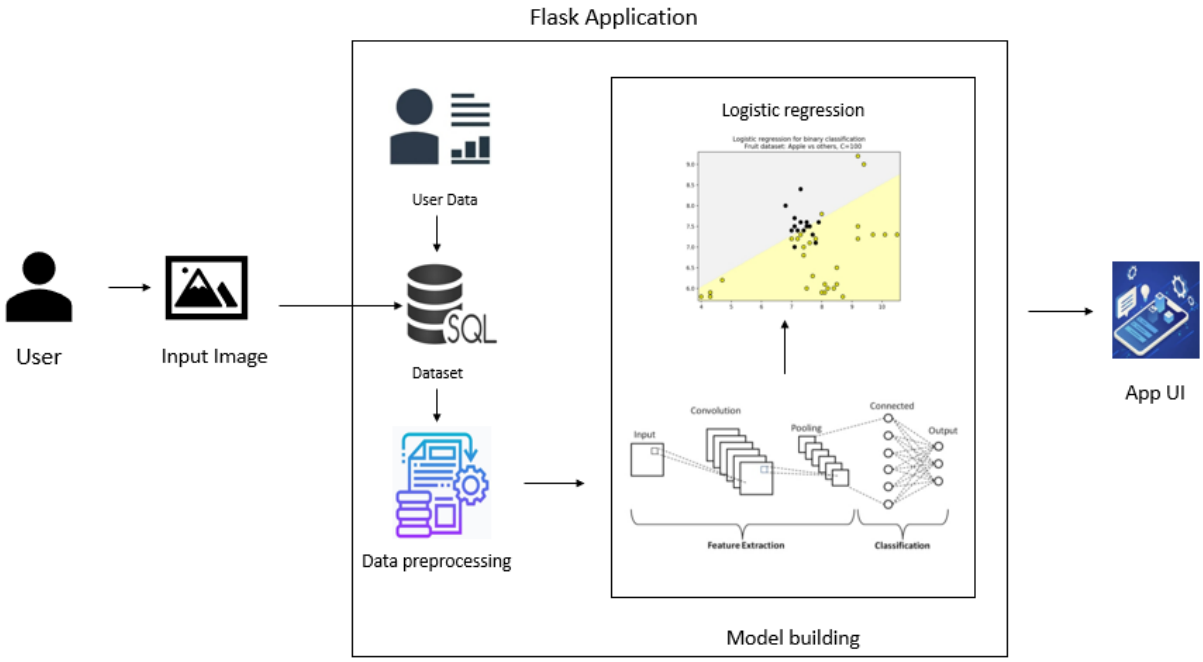
Technical architecture usually goes a lot deeper into the architecture of the solution and understands the implementation from the technical level.

Solution Architecture description of a specific solution. We can understand how all the parts of the model work together,  including processes and application.

## Solution Architecture:



## Technical Architecture:



**User Stories:**

A user story is an informal, general explanation of a software feature written from the perspective of the end user or customer. Its purpose how a piece of work will deliver a particular value back to the customer.

Jse the below template to list all the user stories for the product.

| 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 register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
| Customer (Mobile user) | Registration | USN-2 | 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 |
| Customer (Mobile user) | Registration | USN-3 | As a user, I can register for the application through Facebook | I can register & access the dashboard with Facebook Login | Low | Sprint-2 |
| Customer (Mobile user) | Registration | USN-4 | As a user, I can register for the application through Gmail | I can register through mail | Medium | Sprint-1 |
| Customer (Web user) | Login | USN-5 | As a user, I can log into the application by entering email & password | I can login through mail by some security purpose | High | Sprint-1 |
| Customer (Web user) | Dashboard | USN-6 | As a user,I can access all the options through Mobile Applications | I can access through mobile applications | High | Sprint-1 |
| Customer (Web user) | Queries | USN-7 | As a user,Is there any queries part in web page | I can clear my queries | Medium | Sprint-1 |
| Customer Care Executive | Rechecking | USN-8 | As a user,I can recheck the previous report,which was submitted before 1 month | I can recheck my previous report | Low | Sprint-2 |
| Administrator | Registration | USN-9 | As a user,I can access the web page for free or premium | I can access the web page as free | Medium | Sprint-1 |
| Administrator | Registration | USN-10 | As a user,If it is premium,How much I want to pay to visit the web page | I can access the web page as free | High | Sprint-1 |
| Administrator | Network speed | USN-11 | As a user, Is there is any speed limitation for access/visit the web page | I can also use speed of network below 1mbps | Medium | Sprint-1 |
| Administrator | Application | USN-12 | As a user,I can download these app in play store or Google | I can download applications through playstore | Low | Sprint-2 |

## PROJECT PLANNING & SCHEDULING

### Sprint Planning & Estimation:

Sprint Planning is a time boxed working session that lasts roughly one hour for every week of a sprint. The entire team agrees to complete a set of product backlog items.

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | User story | USN-1 | A working Professional Mother is unable to evaluate the calorie value in food that they are Consuming. | 4 | High | S. Deepa |
| Sprint-1 | Data sets | USN-2 | Collect the image of different food Items and create the dataset | 3 | Medium | N.Priyadharshini |
| Sprint-1 | Data Preprocessing | USN-3 | Process the Image from the dataset | 4 | High | D.Priyadharshini |
| Sprint-2 | Imageprocessing | USN-4 | Once images are processed can be constructed for train and test | 3 | Medium | G. Priyanka |
| Sprint-2 | Train and Test | USN-5 | Apply Image data generator functionality to trainset and test set | 2 | Medium | N.Priyadharshini |
| Sprint-2 | Import Model | USN-6 | Import the model building libraries with CNN algorithm | 5 | High | S. Deepa |
| Sprint-3 | Configure Model | USN-7 | Adding dense layer to configure the learning process to train and test the model | 3 | High | D.Priyadharshini |
| Sprint-3 | Webpage Creation | USN-8 | Create the HTML web page with python code | 4 | Medium | G. Priyanka |
| Sprint-3 | Dashboard Creation | USN-9 | It contains the details of predicting criteria and user information. | 3 | High | S. Deepa |

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-4 | Application Creation | USN-10 | Create the flask application and loading our model by using load model method | 3 | Medium | N.Priyadharshini |
| Sprint-4 | Application Building | USN-11 | Routing the HTML Page and Run the Application | 4 | High | G.Priyanka |
| Sprint-4 | Train the Model | USN-12 | Train the Model on IBM Cloud | 5 | High | D.Priyadharshini |

**Sprint Delivery Schedule:**

A sprint Delivery is a Document that outlines the sprint planning from end to end based on the Duration of the sprint planning [Sprint start Date to end date], Average velocity or capacity & length of the sprint.

| 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 | 11 | 6 Days | 24 Oct 2022 | 29 Oct 2022 | | 30 Oct 2022 |
| Sprint-2 | 10 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | | 06 Nov 2022 |
| Sprint-3 | 10 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | | 13 Nov 2022 |
| Sprint-4 | 12 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | | 19 Nov 2022 |

**Velocity:**

Sprint 1 Average Velocity = 11/6 = 1.833

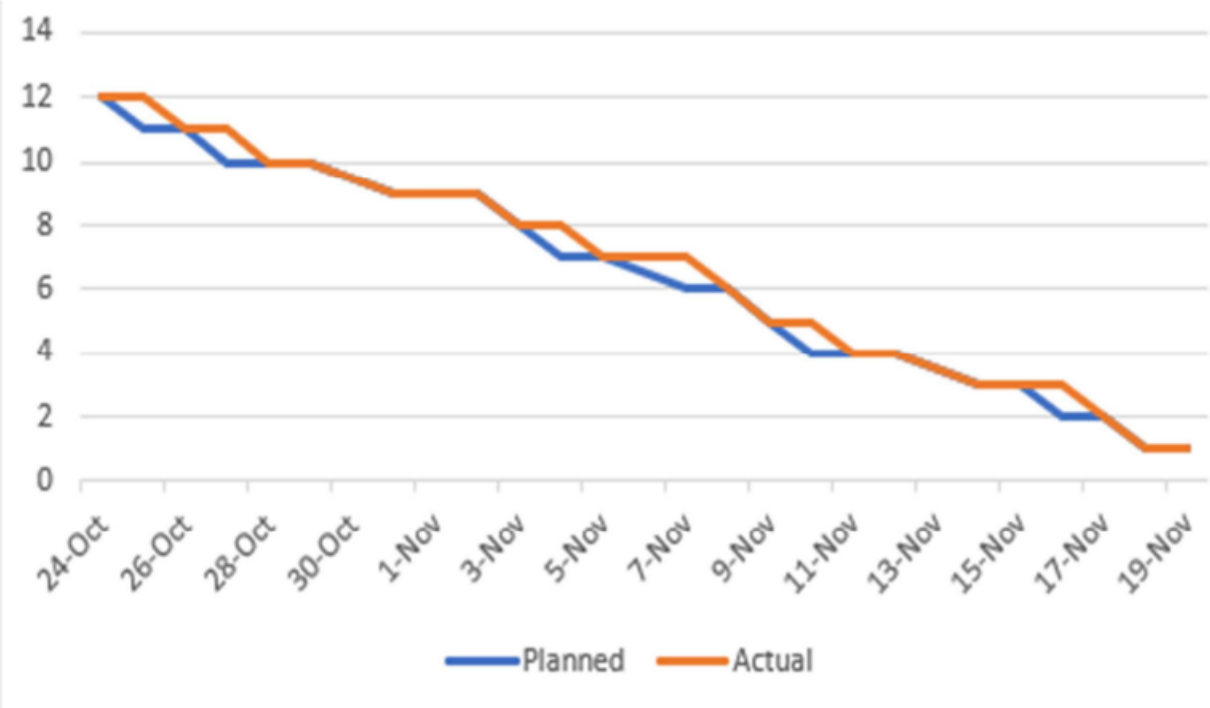
Sprint 2 Average Velocity = 10/6 = 1.66

Sprint 3 Average Velocity= 10/6 = 1.66

Sprint 4 Average Velocity= 12/6 = 2

**Report from JIRA:**

Reporting helps you track and analyse team works through the project. JIRA software has ranged the report that can use of the show information about Planned and actual.



## CODING AND SOLUTIONING

### Feature 1:

Coding is the process of transforming ideas, solutions and instruction into the language that the computer can understand.

Using different languages ,framework ,libraries . Everything seems to be interconnected and intertwined.

We are using Deep learning neural networks library, python, flask,CNN,IBM cloud.

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

**Image Data Agumentation**

```
#setting parameter for Image Data agumentation to the training data
train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
#Image Data agumentation to the testing data
test_datagen=ImageDataGenerator(rescale=1./255)
```

### Loading our data and performing data agumentation

```
#performing data agumentation to train data
x_train = train_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Dataset/TRAIN_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
#performing data agumentation to test data
x_test = test_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Dataset/TEST_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

```
Found 4118 images belonging to 5 classes.
Found 929 images belonging to 5 classes.
```

```
print(x_train.class_indices)#checking the number of classes
```

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

```
print(x_test.class_indices)#checking the number of classes
```

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

```
from collections import Counter as c
c(x_train .labels)
```

```
Counter({0: 995, 1: 1354, 2: 1019, 3: 275, 4: 475})
```

### Importing Neccessary Libraries

```
import numpy as np#used for numerical analysis
import tensorflow #open source used for both ML and DL for computation
from tensorflow.keras.models import Sequential #it is a plain stack of layers
from tensorflow.keras import layers #A layer consists of a tensor-in tensor-out computation function
#Dense layer is the regular deeply connected neural network layer
from tensorflow.keras.layers import Dense,Flatten
#Faltten-used fot flattening the input or change the dimension
from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout #Convolutional layer
#MaxPooling2D-for downsampling the image
from keras.preprocessing.image import ImageDataGenerator
```

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

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

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

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

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

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

 max_pooling2d (MaxPooling2D  (None, 31, 31, 32)       0
 )

 conv2d_1 (Conv2D)           (None, 29, 29, 32)        9248

 max_pooling2d_1 (MaxPooling  (None, 14, 14, 32)       0
 2D)

 flatten (Flatten)           (None, 6272)              0

 dense (Dense)               (None, 128)               802944

 dense_1 (Dense)             (None, 5)                 645

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

**Compiling the model**

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

## Fitting the model

```
classifier.fit_generator(
        generator=x_train,steps_per_epoch = len(x_train),
        epochs=10, validation_data=x_test,validation_steps = len(x_test))# No of images in test set
```

## Saving our model

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

### Predicting our results

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

```
img = image.load_img("/content/drive/MyDrive/Dataset/TRAIN_SET/PINEAPPLE/120_100.jpg",target_size= (64,64))#loading of the image
img
```

```
x=image.img_to_array(img)#conversion image into array
```

```
x
```

```
x=np.expand_dims(x,axis=0) #expand the dimension
```

```
x.ndim
```

```
pred = model.predict(x)
```

```
pred
```

```
labels=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
labels[np.argmax(pred)]
```

```
'PINEAPPLE'
```

**Feature 2:**

**http://localhost:8888/notebooks/Downloads/Image%20Preprocessing.ipynb**

**http://localhost:8888/notebooks/Downloads/CNN_Image_Preprocessing.ipynb**

**http://localhost:8888/notebooks/Downloads/nutrition%20cloud(image_preprocessing).ipynb**

**http://localhost:8888/edit/Downloads/nutrition-classification.tar.gz**

**http://localhost:8888/edit/Downloads/nutrition%20(1).h5**

**TESTING**

**Test cases:**

A test case is a set of actions performed on a system to determine if it satisfies software requirements and functions correctly.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Date | 18-Nov-22 | | | | | | | | |
| | | | | Team ID | PNT2022TMID33008 | | | | | | | | |
| | | | | Project Name | AI-powered Nutrition Analyzer | | | | | | | | |
| | | | | Maximum Marks | 4 marks | | | | | | | | |
| **Test case ID** | **Feature Type** | **Component** | **Test Scenario** | **Pre-Requisite** | **Steps To Execute** | **Test Data** | **Expected Result** | **Actual Result** | **Status** | **Commnets** | **TC for Automation(Y/N)** | **BUG ID** | **Executed B** |
| LOGIN_PAGE_1 | Functional | 0 page | successfully verify | HTML,CSS,JS,PYTHON, FLASK | 1.Enter URL and click go | http://127.0.0.1:5000/ | opened | Working as | Pass | Steps are clearly follow | yes | no bugs | All the Team members |
| LOGIN_PAGE_2 | Functional | Home Page | successfully verify | HTML,CSS,JS,PYTHON, FLASK | 1.Enter URL and click go<br>2.click classify | http://127.0.0.1:5000/ | opened | Working as | Pass | Steps are clearly follow | yes | no bugs | All the Team members |
| LOGIN_PAGE_3 | Functional | image uploading page | successfully verify | HTML,CSS,JS,PYTHON, FLASK | 1.After click classify<br>2.click the choose button | http://127.0.0.1:5000/ | opened | Working as expected | Pass | Steps are clearly follow | yes | no bugs | All the Team members |
| LOGIN_PAGE_4 | Functional | Image prediction page | successfully verify | HTML,CSS,JS,PYTHON, FLASK | 1.upload the image for data set 2.and click classify<br>3.Nutrition path is display | http://127.0.0.1:5000/ | loaded | Working as expected | Pass | Steps are clearly follow | yes | no bugs | All the Team members |

**User Acceptance Testing:**

## 1. Purpose of Document

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

## 2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|---|---|---|---|---|---|
| By Design | 7 | 8 | 8 | 7 | 30 |
| Duplicate | 1 | 0 | 1 | 0 | 2 |
| External | 0 | 1 | 0 | 1 | 2 |
| Fixed | 9 | 7 | 8 | 6 | 30 |
| Not Reproduced | 0 | 0 | 1 | 0 | 1 |
| Skipped | 0 | 2 | 1 | 1 | 4 |
| Won't Fix | 0 | 0 | 0 | 1 | 1 |
| Totals | 17 | 18 | 19 | 15 | 69 |

## 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 | 10 | 0 | 0 | 7 |
| Client Application | 9 | 0 | 0 | 9 |
| Security | 10 | 0 | 0 | 8 |
| Outsource Shipping | 2 | 0 | 0 | 1 |
| Exception Reporting | 6 | 0 | 0 | 5 |
| Final Report Output | 9 | 0 | 0 | 8 |
| Version Control | 3 | 0 | 0 | 2 |

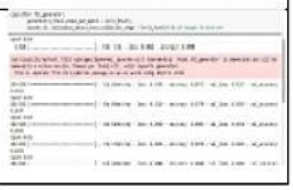
## RESULT

### Performance Metrics:

Performance metrics is a process of collecting, analysing or reporting the performance.Its data is used to track processes using parameters such as model summary, Accuracy and their values.

**Model Performance Testing:**

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

| S.No. | Parameter | Values | Screenshot |
|---|---|---|---|
| 1. | Model Summary | **Total params-813,733**<br>**Trainable params-813,733**<br>**Non-trainable params-0** |  |
| 2. | Accuracy | Training Accuracy – 0.89714<br><br>Validation Accuracy -0.85124 |  |

**ADVANTAGES:**

- AI Nutrition Analyser used to guide the users towards a healthy diet and assist them to achieve their health goals.
- Good to estimate calorie intake.
- It ensures that the food has optimal requirement of vitamins and minerals.
- Give more accurate values.
- Cost efficiency.

**DISADVANTAGES:**

- Applicability to other nutrients like proteins, vitamins is limited.
- Inaccurate information.
- Time consuming.

## CONCLUSION

For fitness enthusiasts, we create a practical deep learning algorithm based on the AI-powered Nutrition Analyser. In this technique, a deep learning algorithm–based food image recognition system employs the services. We are improving the performance of the algorithm (in terms of detection accuracy). In the future, we will integrate our system into a real-world mobile device to enhance the cloud computing system. This system takes the image of the food from the user and classifies the image to measure the attributes of the food using the estimation model. The results are enhanced via image preprocessing, model building, and flask application in the IBM cloud. This classification method extracts accurate values. In the future, we will improve the usability and accuracy of the system.

## FUTURE SCOPE

The future scope of an AI-powered nutrition analyser for fitness enthusiasts' goals is to handle health problems and issues and to help everyday people achieve their goals easily. To get more data, add more layers and increase the epochs. It can provide us with advanced abilities such as custom searches, improved visualization, etc.

**APPENDIX**

**http://localhost:8888/notebooks/Downloads/Image%20Preprocessing.ipynb**

**http://localhost:8888/notebooks/Downloads/CNN_Image_Preprocessing.ipynb**

**http://localhost:8888/notebooks/Downloads/nutrition%20cloud(image_preprocessing).ipynb**

**http://localhost:8888/edit/Downloads/nutrition-classification.tar.gz**

**http://localhost:8888/edit/Downloads/nutrition%20(1).h5**

**https://github.com/IBM-EPBL/IBM-Project-40962-1660637833.git**