

Project Report

AI-Powered Nutrition Analyzer for Fitness Enthusiasts

INTRODUCTION

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, contamination of food.

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.).

LITERATURE SURVEY:

EXISTING PROBLEM

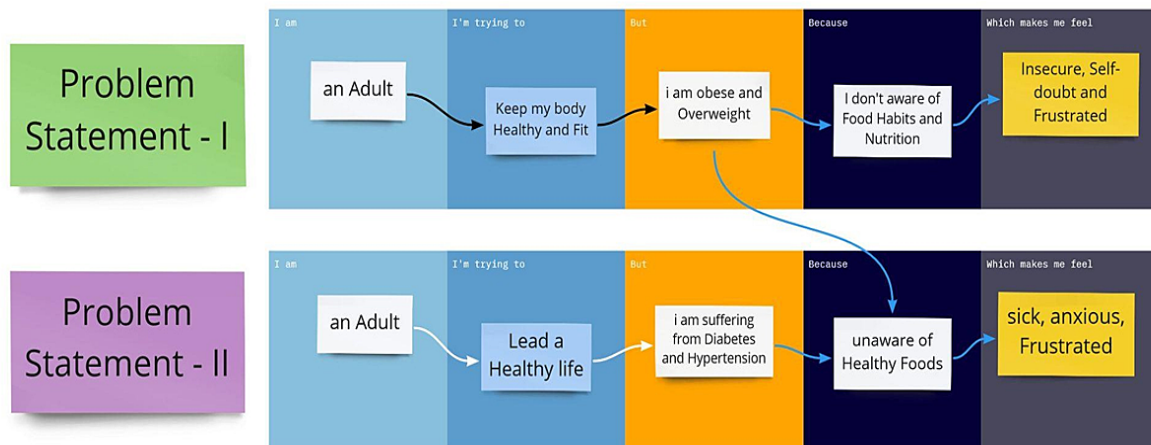
The biometric health devices can record the various data like metabolism rate, sleep hour, sedentary activity while being in contact with the user and this data from user can be used by physicians to recommend any changes to user's routine. Our project attempts to use the information obtained using such devices to give the detailed analysis of health of a patient/individual that can help in getting a prompt and timely advice from a doctor. Currently healthcare monitoring is extensively doctor depending. Our System is basically designed for those customers who can self-monitor their health indicators to check the progress that they are making through a diet plan change or exercise routine modification. An option will also be provided to customer to send the report to the doctor for expert advice in case the customer feels he/she is not completely satisfied by the diet routine, sleep hours or any other general habit he is acquiring

REFERENCE

Strickland, E. (2019). IBM Watson, heal thyself: How IBM overpromised and underdelivered on AI health care. *IEEE*

Paesar, A. (2019). *Machine learning and AI for healthcare* (pp. 1-73). Coventry, UK: Apress.

PROBLEM STATEMENT



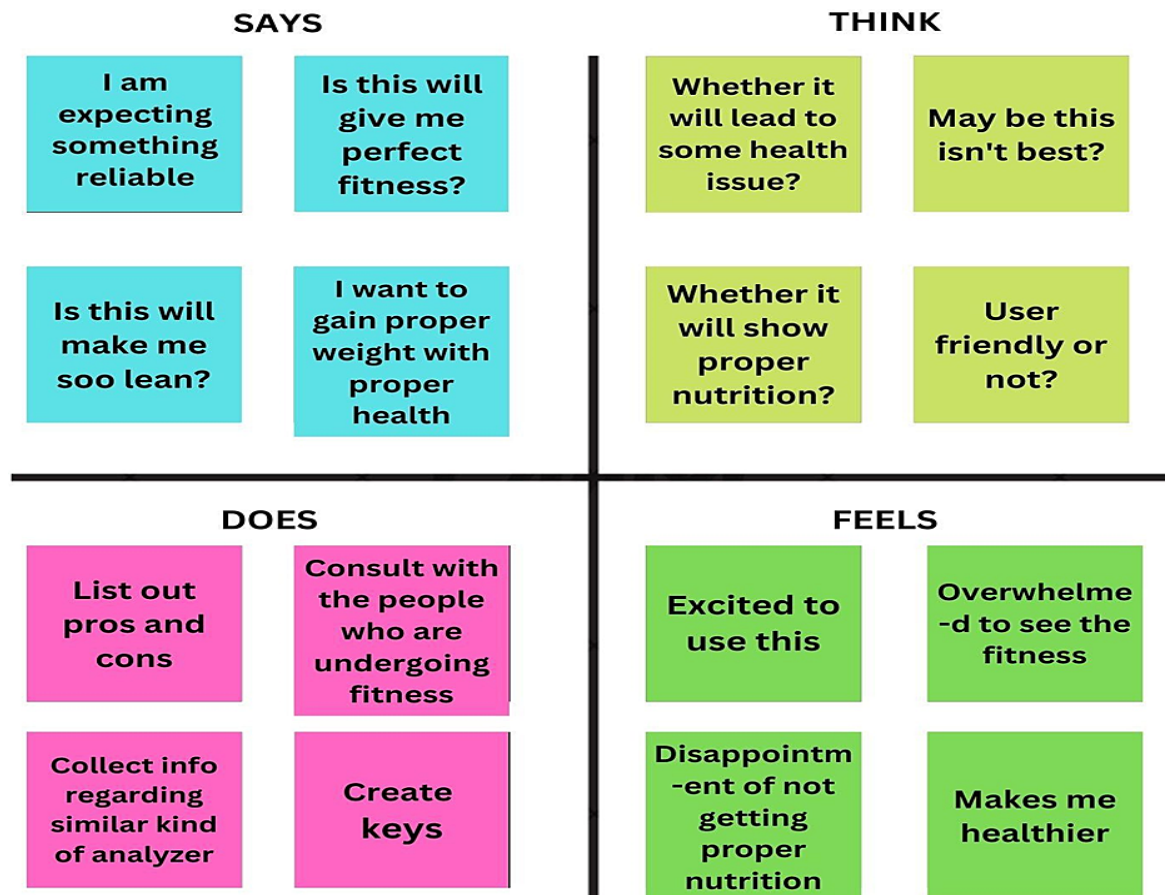
miro

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	An Adult	Keep my Body Healthy and Fit	I am Obese and Overweight	I don't aware of Food Habits and Nutrition	Insecure, Self-Doubt and Frustrated
PS-2	An Adult	Lead a Healthy Life	I am suffering from Diabetes, Hypertension	Unaware of Healthy Foods	Sick, anxious and Frustrated

IDEATION AND PROPOSED SOLUTION

EMPATHY MAP

AI-Powered Nutrition Analyzer For Fitness Enthusiasts



IDEATION AND BRAINSTORMING


Brainstorm & Idea Prioritization:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creativethinking 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 many creative solutions.

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

Share template feedback

➔

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

A

Team gathering

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

B

Set the goal

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

C

Learn how to use the facilitation tools

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

[Open article](#) ➔

1

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

How might we create AI-powered Nutrition Analyzer for Fitness Enthusiasts?

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

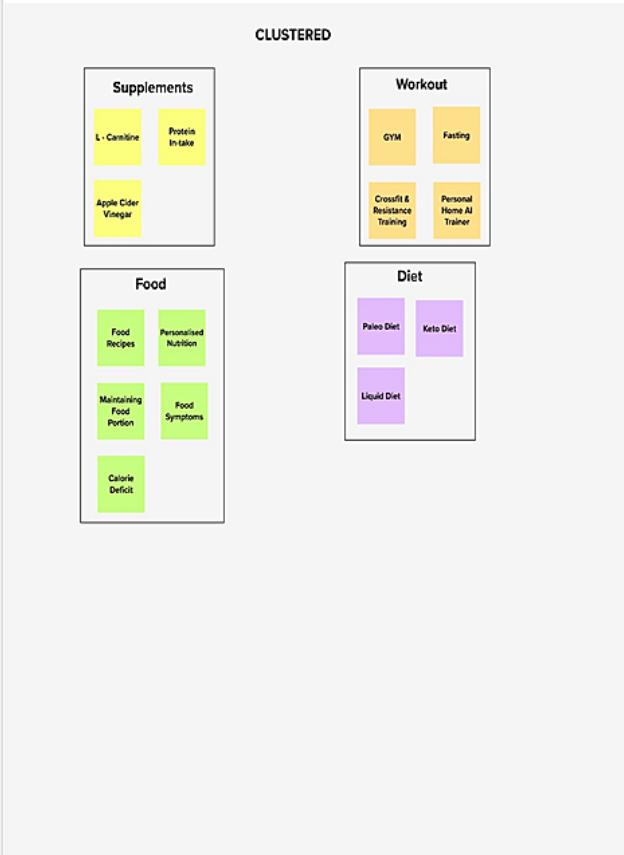


3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes



Step-3: Idea Prioritization

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



PROPOSED SOLUTION

S.NO	PARAMETER	DESCRIPTION
1.	Problem Statement (Problem to be solved)	A regular person must use cutting-edge AI-based analyzing software to identify fruits and vegetables based on colour, texture 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"> • Fitness analysis and maintenance as per the user body conditions • Provide nutritional facts based on the obtained data • Clear and proper identification of the given input data <p>Additional benefits:</p> <ul style="list-style-type: none"> . Analysis of daily dietary requirements . Daily tracking of dietary consumption thoroughly
3.	Novelty / Uniqueness	<p>The availability of fitness plans with add-on bonuses</p> <p>Suggestion of home remedies and simple solutions for basic problems.</p> <p>Allowing for diet flexibility helps promote a healthy and effective eating pattern</p>
4.	Social Impact / Customer Satisfaction	<p>Healthy lifestyle development</p> <p>Constant calorie management monitoring results in a fitness mindset..</p>

5.	Business Model (Revenue Model)	Consultation with nearest trainers and nutritionist for personalized plans.
6.	Scalability of the Solution	<p>Improving accuracy by expanding the data collection using user input data</p> <p>Storage requirements of a specific food.</p> <p>User friendly UI for everyone to use and get benefit from it</p>

PROBLEM SOLUTION FIT

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. Kids <ul style="list-style-type: none">Everyone needs to exercise regularly in order to preserve good health, including kids and the elderly.Fitness enthusiasts who are deeply committed to their health and who regard nutrition as a crucial component of that health.people with chronic and infectious diseases	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. <ul style="list-style-type: none">lacking in a number of ways.The nutritional facts and availability data for the food are insufficient.lacking a reliable tool for routinely monitoring their dietYou must spend extra money in order to receive a customized health advice.	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem? if need to get the job done? What have they tried in the past? What possibilities do these solutions have? i.e. pen and paper is an alternative to digital scheduling <ul style="list-style-type: none">with artificial intelligence's assistance Customers may get personalized fitness advice for a lot less money than they did previously.For decades, developers have been the fitness industry's critic book.Customers can always get nutritious advice on food, in contrast to designs that are flimsy and always stable.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customer? There could be more than one, explore different sides. <ul style="list-style-type: none">People must actively work on sustaining themselves.They must inspect the components and keep an eye out for anything to avoidallow people to make a healthy meal to achieve perfection.	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need or job to do this job? i.e. customers have to do this because of the change in regulations. <ul style="list-style-type: none">Consumers actively seek out self-education. They must inspect the parts and keep an eye out for things to avoid.receiving neither nutritional guidance nor boosters.Most people are unaware of the ingredients of the meals they consume.	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? Directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time volunteering work (i.e. housework) <ul style="list-style-type: none">Customers must take a picture of the meal using their smartphones, draw a frame around it, and then place the food image inside of it.Creators must adhere to the advice given in order to develop positive habits.	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	3. TRIGGERS TR Examining the potential impacts of our blog articles from the web and on social media, subsequent areas of our while living in a crowded physical and mental health.	10. YOUR SOLUTION SL If you are working in an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and compare with a solution that fits within customer limitations, solves a problem, and matches customer behaviour. Users of this software have access to real-time data about their calorie and nutrient intake. To accurately identify the meal and determine the number of calories depending on the meal, the software uses artificial intelligence (AI) and picture categorization technology. Before taking a picture and turning on food imaging for nutrition with a smartphone camera, the user must first permit the device to find the food. The fooding containers like the frame are shown on the screen. The name of the food group and re-entered into the daily meal log when the user taps one of the potential items. Based on factors like color, shape, and other characteristics, the computer identifies items and then displays their nutritional information to the user. Artificial intelligence offers smartest opportunities for development and utilization.	8. CHANNELS of BEHAVIOUR CH 1.1. ONLINE What kind of actions do customers take online? Extract online channels from it? A person's "MIND" - The nutritional data comes from the sensors. Additionally, you can educate yourself about the benefits of a healthy diet through platforms like social media. 1.2. OFFLINE What kind of actions do customers take offline? Extract offline channels from it and use them for customer development. Customers should familiarize themselves with the tips and recommendations before making a purchase and try to heed them.	Identify strong TR & EM

REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/ Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Details	Registering Through a Google Form
FR-4	Server Calculation	Computing Information Eg : - Age , Height, Weight
FR-5	Notification	The server will provide notifications based on your intake of food and water.

NON- FUNCTIONAL REQUIREMENTS

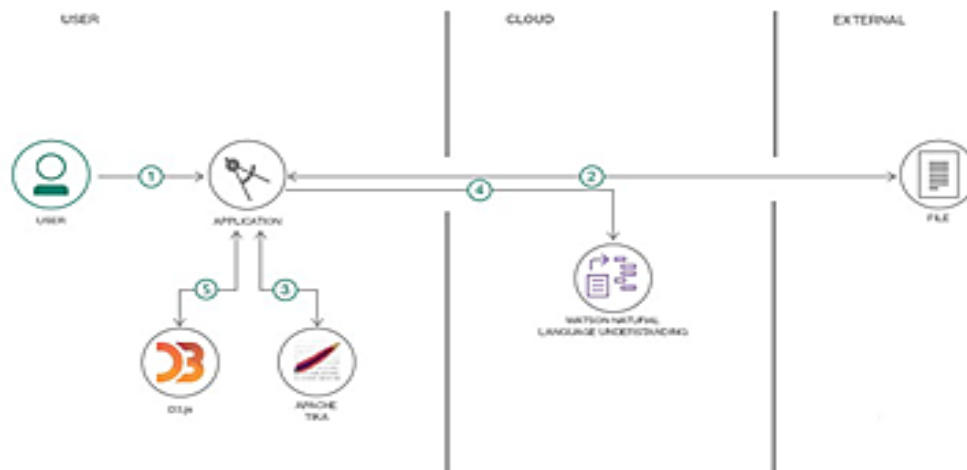
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To Evaluate all the Food dataset for nutritional Content of the item
NFR-2	Security	Information , User Health status and Nutritional Information about food are highly Secured.
NFR-3	Reliability	To provide nutritive information about food, image quality is crucial.
NFR-4	Performance	It will be based on the End product Development Phase
NFR-5	Availability	It is Available for all the People who think and worried about their health and wants to maintain a fit and healthy body
NFR-6	Scalability	The product can be increase its efficiency by based on the user experience and Feedback of the Customers

PROJECT DESIGN

DATAFLOW DIAGRAMS

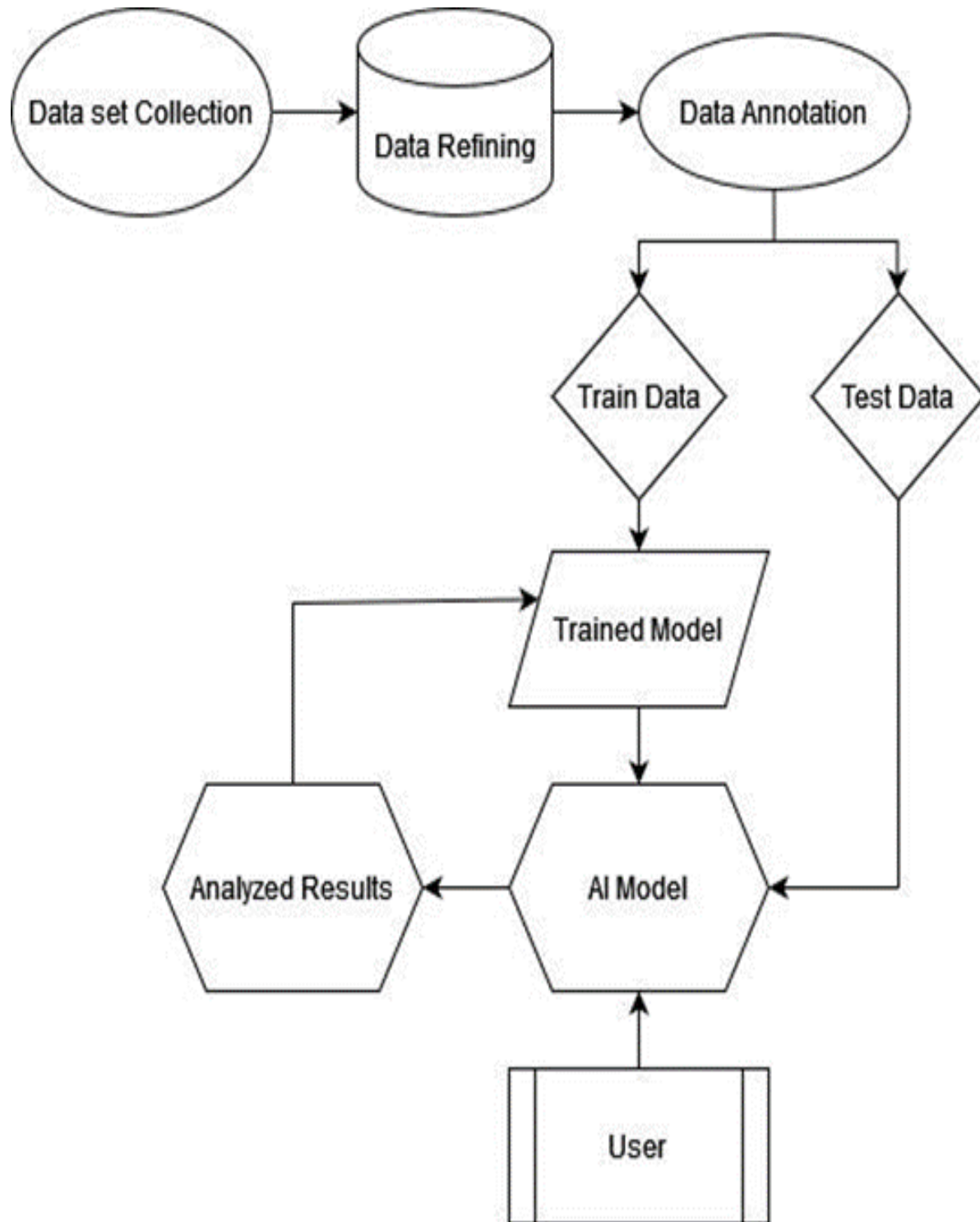
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

Flow



1. User configures credentials for the Watson Natural Language Understanding service and starts the app.
2. User selects data file to process and load.
3. Apache Tika extracts text from the data file.
4. Extracted text is passed to Watson NLU for enrichment.
5. Enriched data is visualized in the UI using the D3.js library.

Work Flow



Technical Architecture

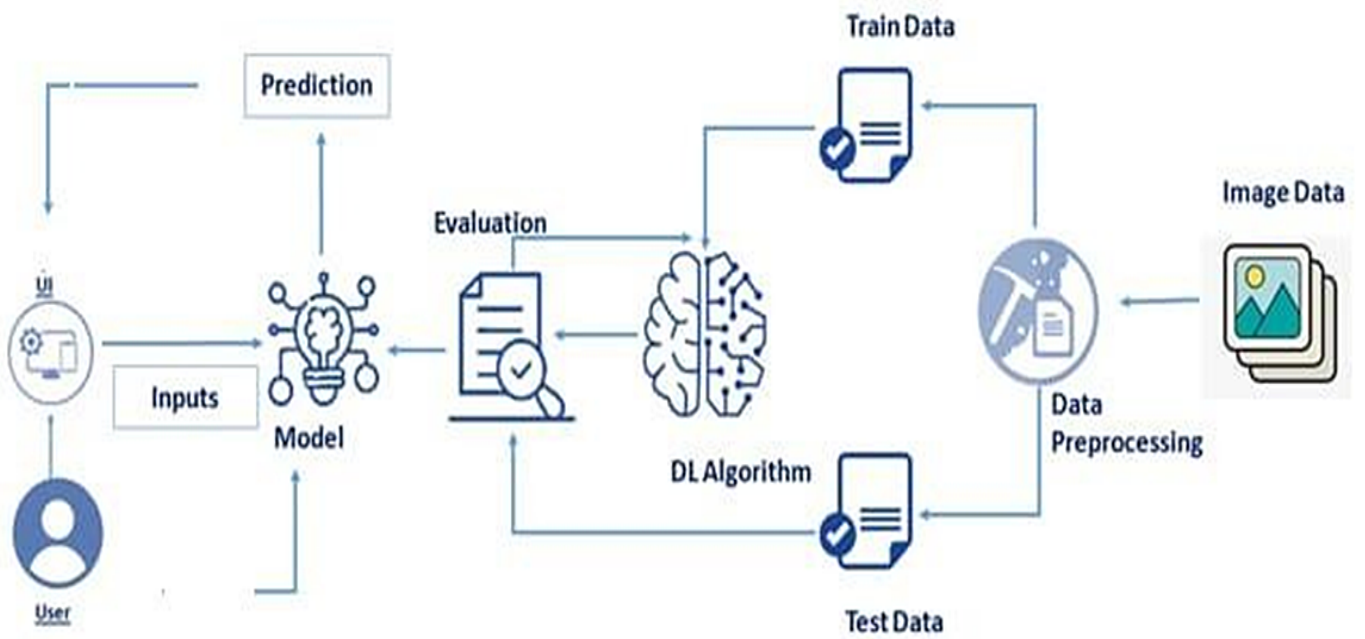


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Through a web UI, the user can engage with the application.	HTML, CSS, JavaScript / Angular Js / ReactJs etc.
2.	Application Logic-1	It has many in built libraries which helps in machine learning	Python
3.	Application Logic-2	It helps to build machinelearning model	IBM watson jupyternotebook service
4.	Application Logic-3	It is fastand accurate	IBM Watson Assistant
5.	Database	MySQL is used to storethe user information and warehouse the food items	MySQL
6.	Cloud Database	IBM Db2 is reliable and scalable	IBM DB2
7.	File Storage	Maintain files easily	Local Filesystem
8.	External API-1	Aadhar and customer KYC verification takes a little amount of time	Aadhar API, etc.
9.	External API-2	To recognise the patterns and trend	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Sequential, Dense& LSTM Model
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local system and IBM watson

Table-2:Application Characteristics

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Tensor flow-Implements model building and training. Flask- Can handle multiple user requests simultaneously. Scikit learn-Contains model for classification, regression, clustering	Tensor flow, flask, Scikit learn.
2.	Security Implementations	SHA-256 doesn't have any known vulnerabilities	SHA-256
3.	Scalable Architecture	MySQL can store huge amount of data and it is easily scalable	MySQL
4.	Availability	This application can be accessed from anywhere easily and it is easily scalable.	IBM Watson cloud
5.	Performance	Flask can handle multiple user request simultaneously.	Flask

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 register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	Confirmation	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
	Social Platforms	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
		USN-4	As a user, I can register for the application through Gmail	I can register & login to the Dashboard through Gmail	Medium	Sprint-1

	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login using Credentials along with image Captcha	High	Sprint-1
	Dashboard	USN-6	Once i Log on , I can see the Food Charts and plans to be follow according to my Body Condition	Each and Every Tasks are Enabled only after Followed the Previous Tasks	High	Sprint-1
Customer (Web user)	Membership Plan	USN-7	Free Trial Sessions are available for first 45 Days for a visible changes ,then asking for membership	Free Trial is disabled after the stipulated period of 45 days and enabled for pay	Medium	Sprint-2
Customer Care Executive	Complaints and Feedback	USN-8	Feedback and Complaints has been Taken out from the customers are been processed	Only valid Complaints are Accepted	Medium	Sprint-2
Administrator	Organizer	USN-9	Administrator records and maintains all the data stored from the user	Can Contact any time by appointment	High	Sprint-1

Project Planning and Scheduling

Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data collection	Task-1	To build a Deep learning Model which begins with the process of splitting data into training and testing set.	4	Medium	Azhagan, Karthick
Sprint-1	Data preprocessing	Task-2	We import the required libraries for preprocessing. We instantiate the ImageDataGenerator class to configure and augment different types of image data.	5	Low	Varsha Yamuna Mary
Sprint-1	Data Preprocessing	Task-3	Application of the ImageDataGenerator to the Train and Test Set.	7	Medium	Azhagan Karthick
Sprint-2	Feature Extraction	Task-4	Build a CNN Model and only use it as a feature extraction by freezing the convolution blocks.	8	High	Azhagan, Karthick, Varsha, yamuna mary
Sprint-2	Building the layers	Task-5	Adding of dense layers with the aid of Keras. Addition of Optimizer, choosing loss function and the Metrics.	7	High	Azhagan, Karthick
Sprint-2	Train, Save, Test	Task-6	To train the model with the configured neural network and save the model. Test the built model against the testing dataset.	3	High	Varsha Yamuna Mary

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Building HTML Pages	Task 7	Building the Home page, Classify Page and storing necessary images in a folder	9	High	Azhagan, Karthick
Sprint-3	Building prediction page	Task 8	Building Result Pages and working with API's	8	High	Karthick, Azhagan
Sprint-3	Build python code	Task-9	Import the libraries and Initialise the necessary modules	10	High	Azhagan, Karthick
Sprint-4		Task-12	Showcasing the model's prediction on UI.	1	High	Karthick, Varsha
Sprint-4	Run the application.	Task-13	Run the application in the anaconda prompt to check the application.	2	High	Varsha, Yamuna Mary
Sprint-4	Train Model On IBM	Task-15	train the model on IBM and integrate it with the flask Application.	3	High	Karthick, Azhagan, Varsha

Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint StartDate	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	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	5 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

Imagine we have a 10-day sprintduration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's averagevelocity (AV) per iteration unit (story pointsper day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

CODING & SOLUTIONING

Feature 1 (Model used and added Dense Layers)

```
model=Sequential()

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())

classifier.add(Dense(units=128, activation='relu'))

classifier.add(Dense(units=5, activation='softmax'))

classifier.summary()

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

Feature 2 (WebPage Application)

```
from flask import Flask, render_template, request
import os
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import session
from flask import Flask, redirect, url_for
import requests
import json
import ibm_db

app = Flask(__name__, template_folder="templates")
app.secret_key = 'NutritionAnalyzer'
model = load_model('NutritionAnalyser.h5')

def connectToDB():
    try:
        connection = ibm_db.connect("DATABASE=bludb;\
HOSTNAME=125f9f61-9715-46f9-9399-
c8177b21803b.clogj3sd0tgtu0lqde00.databases.appdomain.cloud;\
PORT=30426;\
Security=SSL;\
SSLServerCertificate=DigiCertGlobalRootCA.crt;\
UID=qlj81410;\
PWD=phBPVWNuoifGiYIC;", "", "")
```

```
        print("Connected to DB!")
        return connection
except:
    print("error while connecting ", ibm_db.conn_errormsg())
    return 0

connection = connectToDB()

@app.route('/Classify')
def index():
    return render_template('classify.html')

@app.route("/")
@app.route('/home')
def home():
    return render_template('home.html')

@app.route('/predict', methods=['GET', 'POST'])
def predict():
    if request.method == 'POST':
        f = request.files['file']
        basepath = os.path.dirname('__file__')
        filepath = os.path.join(basepath, "test", f.filename)
        f.save(filepath)

        img = image.load_img(filepath, target_size=(64, 64))
        x = image.img_to_array(img)
```



```
x = np.expand_dims(x, axis=0)

pred = np.argmax(model.predict(x), axis=1)
index = ['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE',
'WATERMELON']

predictedValue = str(index[pred[0]])

result = nutrition(predictedValue)

temp = result.json()["items"]
items = temp[0]
print(items)
sugar = items["sugar_g"]
fiber = items["fiber_g"]
sodium = items["sodium_mg"]
potassium = items["potassium_mg"]
fat_saturated = items["fat_saturated_g"]
fat_total = items["fat_total_g"]
calories = items["calories"]
cholesterol = items["cholesterol_mg"]
protein = items["protein_g"]
carbohydrates = items["carbohydrates_total_g"]
return render_template("result.html", name=(predictedValue),
sugar=(sugar), fiber=(fiber), sodium=(sodium), potassium=(potassium),
fat_saturated=(fat_saturated), fat_total=(fat_total),
calories=(calories), cholesterol=(cholesterol), protein=(protein),
carbohydrates=(carbohydrates))
```

```
def nutrition(index):  
  
    url = "https://calorieninjas.p.rapidapi.com/v1/nutrition"  
  
    querystring = {"query": index}  
  
    headers = {  
        'x-rapidapi-key':  
"5d797ab107mshe668f26bd044e64plffd34jsnf47bfa9a8ee4",  
        'x-rapidapi-host': "calorieninjas.p.rapidapi.com"  
    }  
  
    response = requests.request(  
        "GET", url, headers=headers, params=querystring)  
  
    print("from api "+response.text)  
    return response  
  
if __name__ == "__main__":  
    app.run(debug=False)
```

TESTING

Model Prediction

```
[ ] pred=np.argmax(model.predict(x),axis=1)
    print("predition",pred)

1/1 [=====] - 0s 24ms/step
predition [4]
```

We tested with a Watermelon image , after mentioning the fruit names with index values , it will shows the name of predicted image

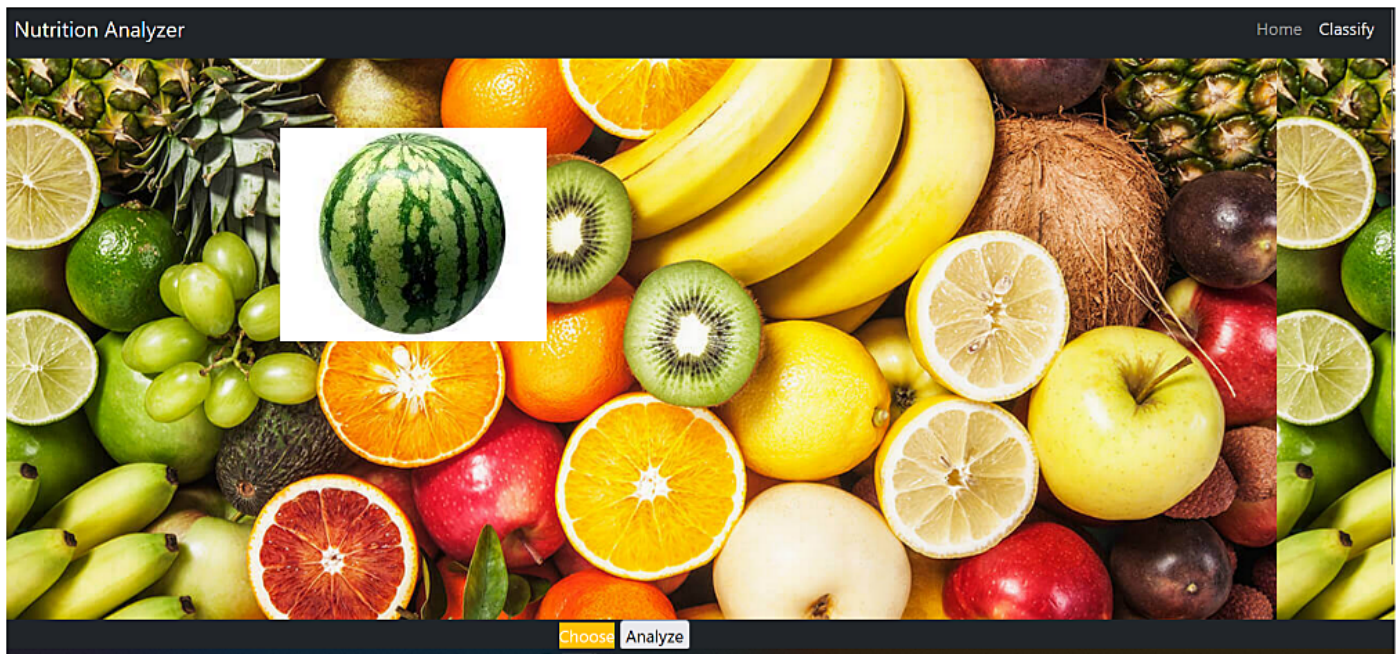
```
[ ] index=['APPLES','BANANA','ORANGE','PINEAPPLE','WATERMELON']

    result=str(index[pred[0]])

    print(result)

WATERMELON
```

RESULTS



Chosen the Test Image

A screenshot of a web browser displaying the prediction result for the selected watermelon image. The browser's address bar shows the URL "127.0.0.1:5000/predict". The page title is "WATERMELON". Below the title, a list of nutrients and their predicted values is shown in a two-column format.

Calories	30.3 grams
Protein	0.6 grams
Carbohydrates	7.4 grams
Sugar	6.2 grams
Fat Saturated	0.0 grams
Fat Total	0.1 grams
Cholesterol	0 milligram
Fiber	0.4 grams
Sodium	0 milligram
Potassium	10 milligram

Result Page Containing the Name and Nutrient Content of the Predicted Image

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.

DISADVANTAGES

1. Time-Consuming Food Entry Systems
2. Inaccurate Information
3. Obsessive Behavior
4. Unrealistic Weight Loss Goals

Counting Calories Can Change Habits

CONCLUSION

The services-based solutions evolve from careful study of customer needs and return superior results. Looking forward we will continue the process of working to increase the Efficiency of Prediction. We will transform data into actionable information to improve quality and efficiency. Finally, it will improve the Product to more User Friendly

FUTURE SCOPE

In future research, the real-time analyzing system will be available in the market. In this way, the monitoring the Food Nutrient for a Fitness Enthusiasts without a Nutrionist will be quite easy. Also, the health monitoring data of the whole remote areas population will be interlinked to the server cloud, and it can be observed by using the mobile application of this system.

APPENDIX

GitHub Link

<https://github.com/IBM-EPBL/IBM-Project-33204-1660215949/tree/main>