

PROJECT REPORT

AI-powered Nutrition Analyzer for Fitness Enthusiasts

Team ID:

PNT2022TMID27210

Done By:

Vasudha. S – Team Leader

Thiththiksha. S – Team member 1

Sailaja. K. B – Team member 2

Rosar Mary Agaraphin. J – Team member 3

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Chapter 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.

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.).

1.2 Purpose

This is useful for fitness enthusiasts for having a balanced diet, to check nutrients in the food that they are consuming.

The purpose is to have healthy life style by consuming healthy foods in balanced diet.

This is also used to monitor body condition by calculating the BMI value. On the whole this helps us to lead a healthy life.

Chapter 2

LITERATURE SURVEY

2.1 Existing problem

The fundamental problem with nutrition analyzer is that it cannot analyze the calories at once for all the food images given in a single picture. The prediction model might go wrong well model is not tuned properly. Additionally, there will be issues of wrong prediction of food. Setting clear goals and objectives is a hectic task. Limited coverage of food items, variability in the composition of the foods and inappropriate food composition values are few more problems. Errors occurs in the database usage. As a final touch, prediction may go wrong for cooking foods.

2.2 References

AUTHORS: By Stuart Russell & Peter Norvig.

This book on artificial intelligence has been considered by many as one of the best AI books for beginners. It is less technical and gives an overview of the various topics revolving around AI. The writing is simple, and the reader can easily understand all concepts and explanations.

The concepts covered include subjects such as search algorithms, game theory, multi-agent systems, statistical Natural Language Processing, local search planning methods, etc. The book also touches upon advanced AI topics without going in-depth. Overall, it's a must-have book for anyone who wants to learn about AI.

AUTHORS: John Paul Mueller and Luca Massaron.

Machine Learning for Dummies provides an entry point for anyone looking to get a foothold on Machine Learning. It covers all the basic concepts and theories of machine learning and how they apply to the real world. It introduces a little coding in Python and R to teach machines to perform data analysis and pattern-oriented tasks.

From small tasks and patterns, the readers can extrapolate the usefulness of machine learning through internet ads, web searches, fraud detection, and so on. Authored by two data science experts, this Artificial Intelligence book

makes it easy for any layman to understand and implement machine learning seamlessly.

AUTHOR: Vinod Chandra S. S.

The primary audience for this book is computer science and engineering undergraduate and graduate students. The book uncovers the gap between the challenging environments of artificial intelligence and machine learning. All the concepts are explained with the help of case studies and worked-out examples.

It also encompasses other forms of learning like reinforcement, supervised, unsupervised, statistical learning, artificial intelligence, and machine learning.

AUTHOR: EthemAlpaydin.

The new AI gives a concise overview of machine learning. It describes its evolution, explains machine learning algorithms, and presents example applications. It explains how digital technology has advanced from numbercrushing machines to mobile devices, putting today's machine learning boom in context.

The book on artificial intelligence gives examples of how machine learning is being used in our day-to-day lives and how it has infiltrated our daily existence. It also discusses the future of machine learning and the ethical and legal implementation of data privacy and security.

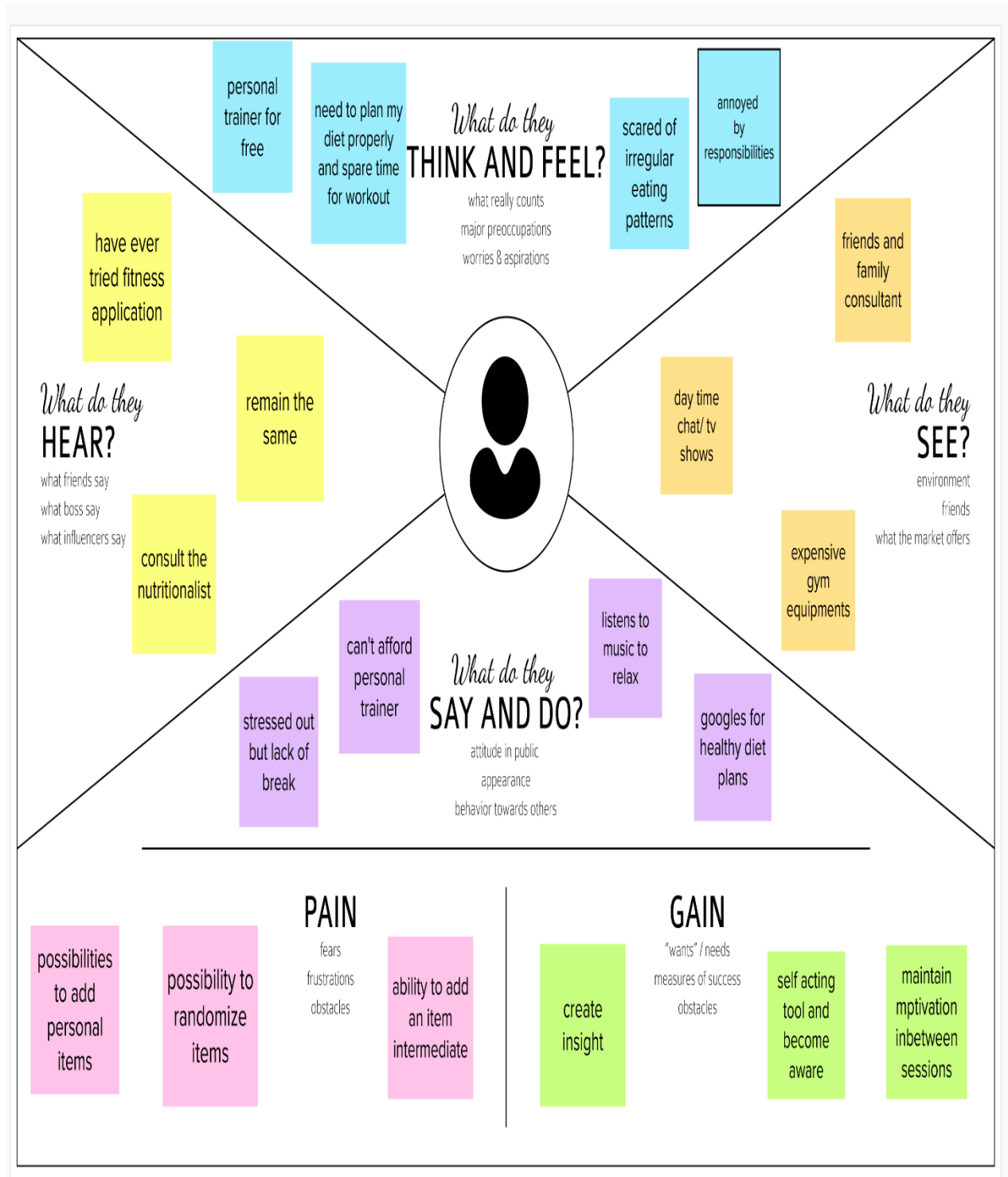
2.3 Problem Statement Definition

A problem statement is an evaluation of an issue expected to be addressed or a specific condition that can be improved upon in a timely manner. The problem statement briefly explains the issue at hand. It should address the current state, the desired future state of the problem, and any gaps identified between the two. Problem statements often have three elements: the problem itself, stated clearly and with enough contextual detail to establish why it is important; the method of solving the problem, often stated as a claim or a working thesis; the purpose, statement of objective and scope of the document the writer is preparing. In general it contains the problem, issues occurred due to it, reason and the solution.

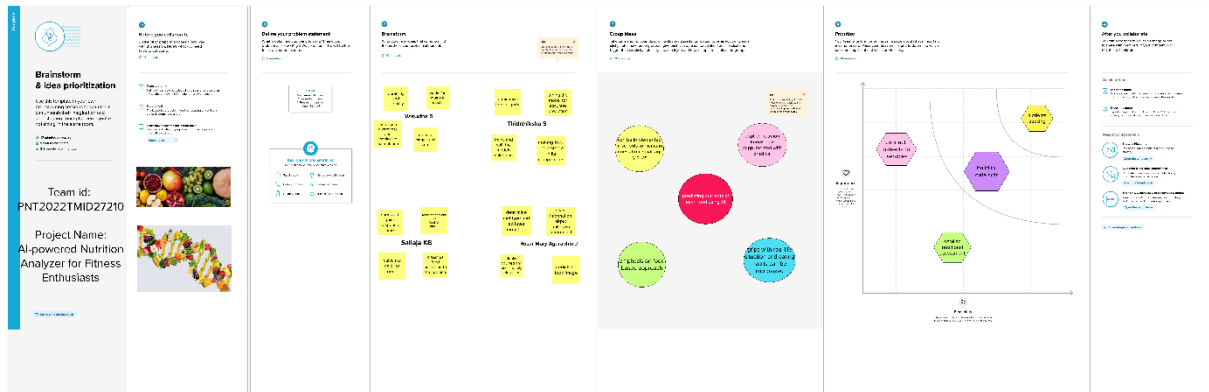
Chapter 3

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



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

Team id:
 PNT2022TMID27210

Project Name:
 AI-powered Nutrition Analyzer for Fitness Enthusiasts

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](#)

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

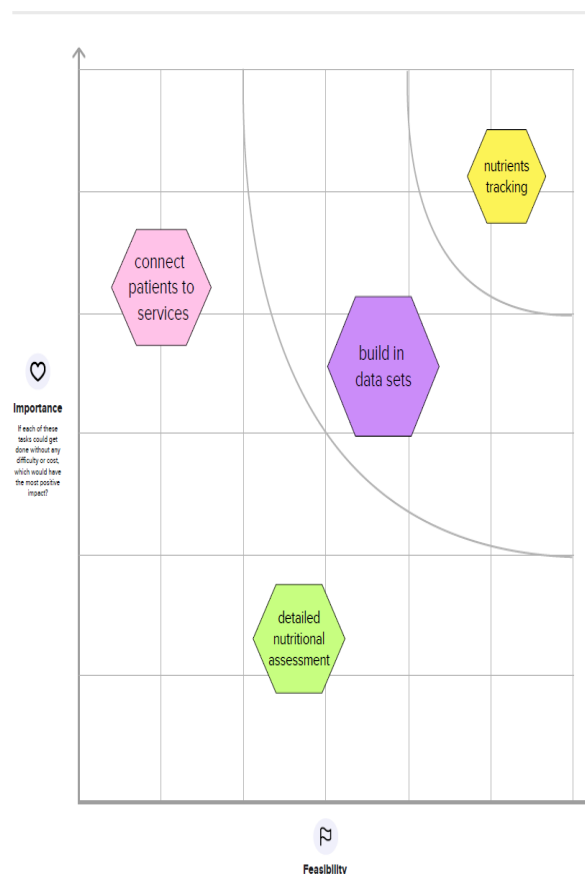
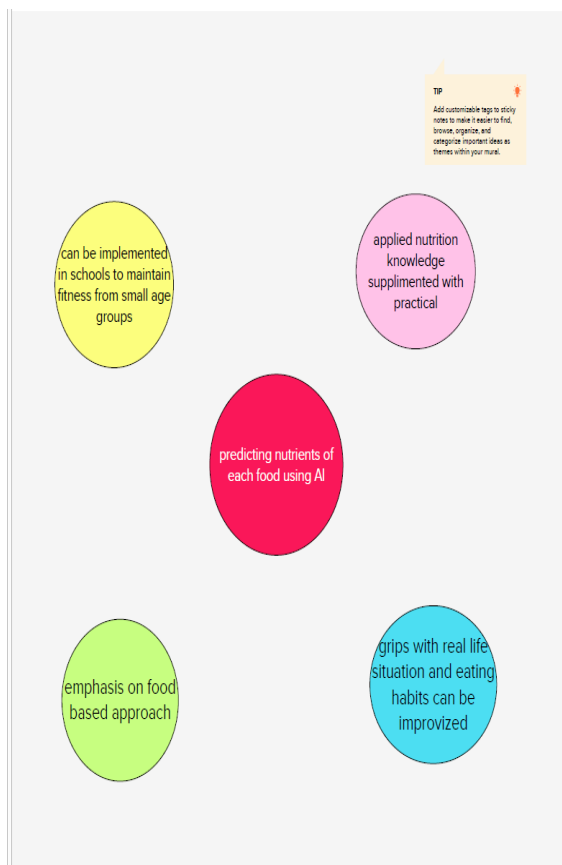
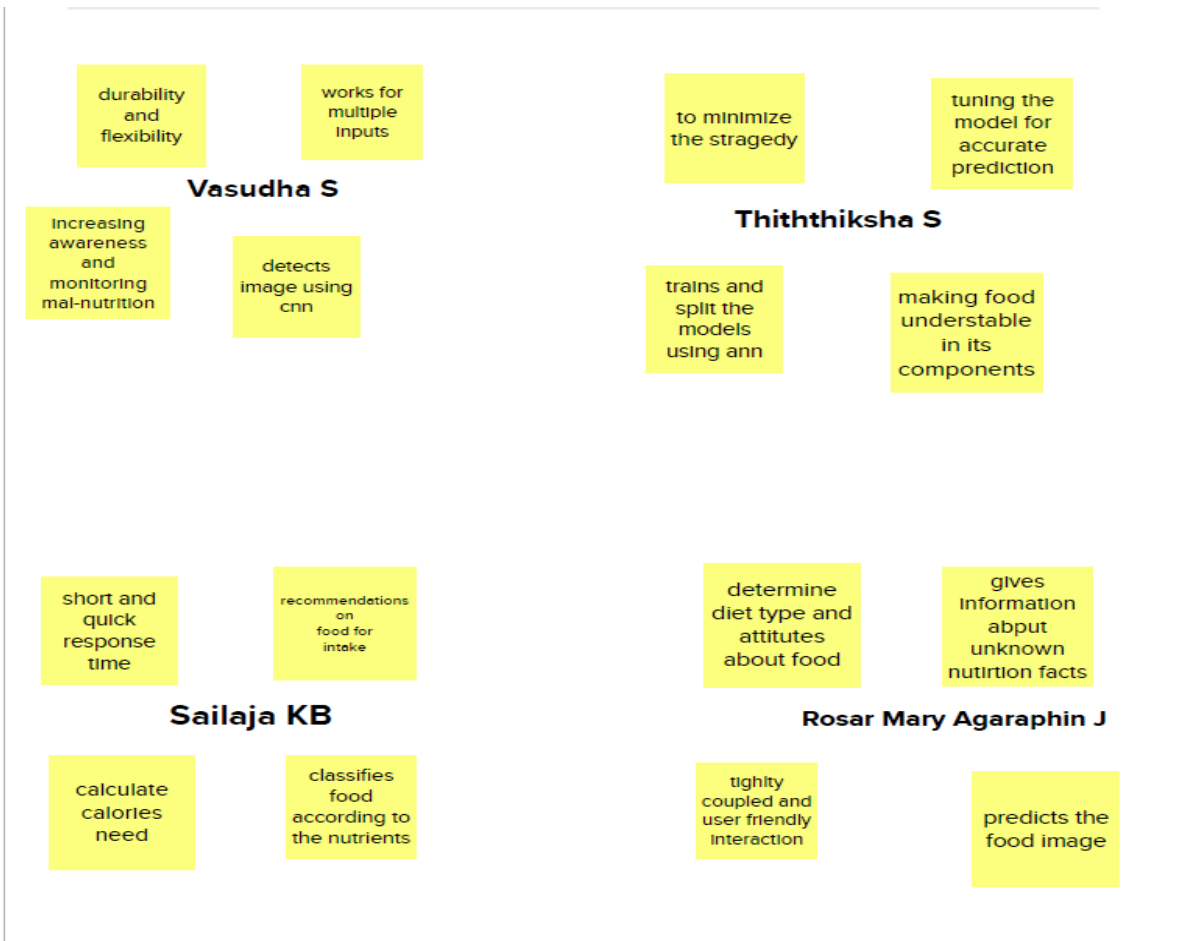
PROBLEM

AI-powered Nutrition Analyzer for Fitness Enthusiasts (helps for maintaining diet)

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Defer judgment.
- Go for volume.
- Encourage wild ideas.
- Listen to others.
- If possible, be visual.



3.3 Proposed Solution

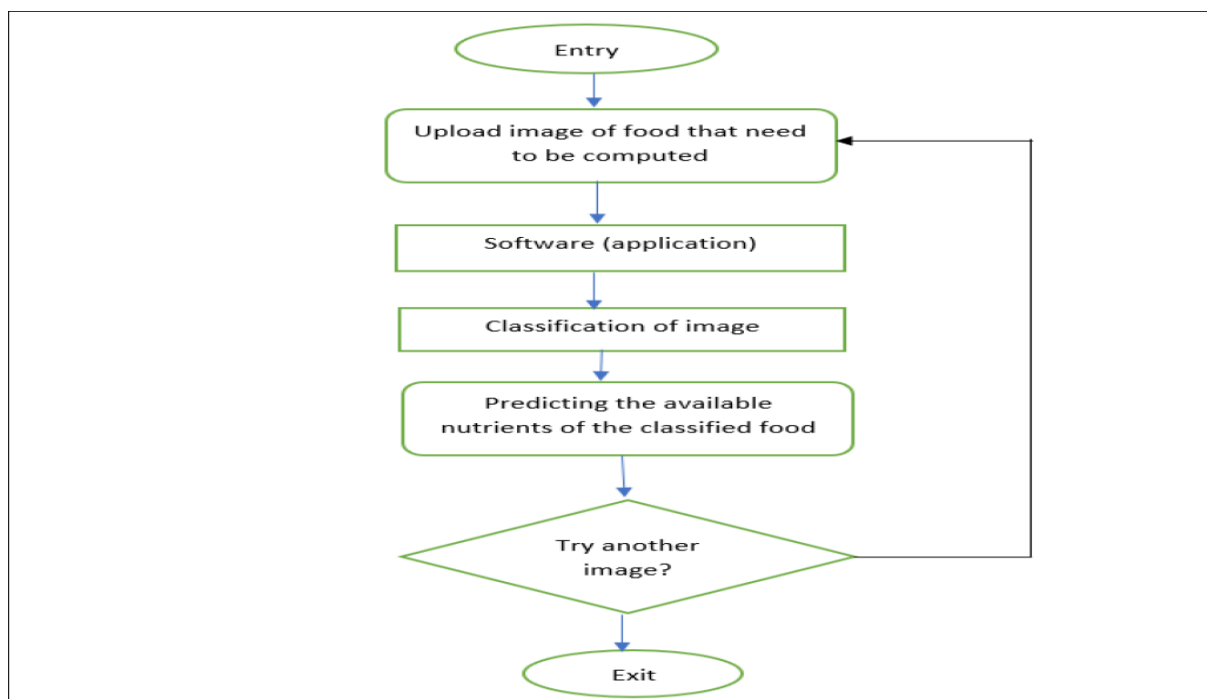
Novelty:

- Artificial intelligence offers unparalleled opportunities of progress and applications in nutrition. There remain gaps to address to potentialize this emerging field.
- Recently, there has been an increase in demand from common people for fresh, nutritious foods.
- This new trend shifting towards safe and nutritious foods has resulted in the development of analysing nutrition and consuming food that helps to maintain fitness with the help of fitness analyser.
- In this project, the image of food is processed using AI to find its corresponding nutrients (eg; carbohydrate, sugar, fat content etc.,).

Feasibility of idea:

- This idea can be achieved through AI with the help of ANN, CNN models to process the image and classify them. This classification gives the output and its corresponding nutrients are computed.
- This can be made convenient by creating the software which gives the expected result.
- Market survey to collect availability of foods, household food habits survey and identification of inexpensive and nutrient-rich local foods.

Business model:



Social impact:

- The relationship between an individual's social, psychological, and cultural environment and his or her nutritional status is one of both cause and effect. Cultural patterns, economic stability, and attitudes toward health and disease all affect an individual's eating behaviour.
- With the use of this software one can keep track of how much nutrients he/she intake and also can balance their diet.

Scalability of solution:

- Scalability refers to the ability of this software project to perform well under an increased or expanding workload. By scalability software maintains or increase its level of performance. Server virtualization reduces physical server sprawl.
- Virtualization enables to create and abstract multiple virtual instances on a single server. And can isolate these virtual environments, which means you can run several independent OSES with different configurations on the same server.
-

3.4 Problem Solution fit

<div>Define CS, fit into CC</div> <div>1. CUSTOMER SEGMENT(S) Consumers of nutrition content fit into three main categories: Experts, such as professional athletes, semi-pros, and instructors. The “average” health-conscious enthusiast. Beginners, or people who want to live healthier but need encouragement.</div> <div>CS</div>	<div>6.CUSTOMER CONSTRAINTS</div> <div>1. Biological determinants such as hunger, appetite, and taste 2. Economic determinants such as cost and income 3. Physical determinants such as access, education, skills and time</div> <div>CC</div>	<div>5. AVAILABLE SOLUTION</div> <div>1. Eat smaller meals and snacks more frequently. ... 2. Use of AI apps 3. Avoid non-nutritious beverages such as black coffee and tea; instead choose milk and juices.</div> <div>AS</div>	<div>Explore AS, differentiate</div>
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Focus on J&P, tap into BE, understand RC	<p>2. JOBS-TO-BE-DONE / PROBLEM</p> <p>Successful innovations help consumers to solve problems—to make the progress they need to, while addressing any anxieties or inertia that might be holding them.</p> <p>J & P</p>	<p>9. PROBLEM ROOT CAUSE</p> <p>The main problem root cause is the wide variety of different characteristics of foods, including their composition, structure, physicochemical properties and sensory attribute.</p> <p>RC</p>	<p>6. BEHAVIOUR</p> <p>There is increasing interest in consumer behavior and nutrition. However, the present attempts are inadequate inasmuch as they follow the "curative" approach. What is needed is a "preventive health approach."</p> <p>BE</p>	Focus on J&P, tap into BE, understand RC
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<p>3. TRIGGERS TM&EM</p> <p>Customers get triggered by seeing their neighbour installing gym equipments in home and by reading more efficient solution in social media.</p> <p>4. EMOTIONS: BEFORE / AFTER</p> <p>Customers may feel stressed and get into depression before and after that they may feel happy and relaxed</p>	<p>10. YOUR SOLUTION SL</p> <p>Nutrition software that makes coaching easy. Create meal plans, evaluate food diaries, perform nutritional analyses, track progress etc.</p>	<p>8. CHANNELS of BEHAVIOUR CH</p> <p>8.1 ONLINE People use social media in maintaining healthy diets and learning about nutrition.</p> <p>8.2 OFFLINE People try to control their food habits and change their diet plan.</p>
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Chapter 4

REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Login	User can login using their personal details and get the home screen of the application.
FR-4	Choose Package	The user can select the package by looking into the offers, features, duration of the package., etc
FR-5	Generate The Daily Plan	Suitable diet and exercise plans will be generated to the user.
FR-6	Manage Progress Report	Gathering report from database and generating report.
FR-7	Query	The user can ask for changes in their plans.
FR-8	Payment	The payment is made for the selected package.
FR-9	Update the details	The details like height, weight, working hours, eating habits, medical history., etc is updated in the database.

4.2 Non-Functional requirements

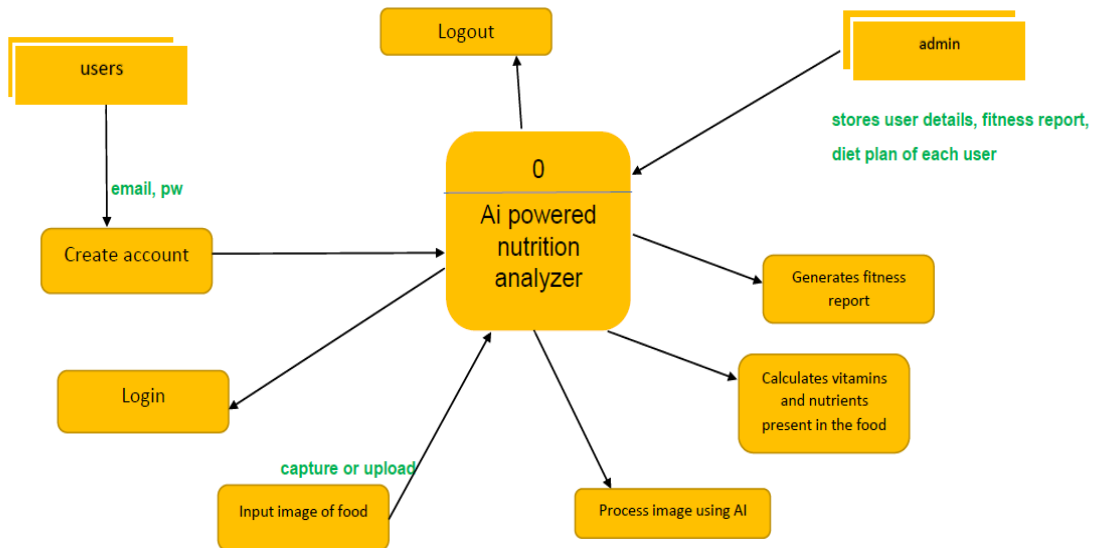
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The system interface will be easy to use with quality attributes.
NFR-2	Security	The user will be able to access only their personal information and not that of others. Medical condition and payment methods will be handled through a secured server to ensure protection of users credit card and personal information.
NFR-3	Reliability	The average time of failure shall be 7 days. If the app crashes then the backup will be given in 7 days.
NFR-4	Performance	The app will be properly programmed. The device, server, and network will be proper. The app will be in the way that the user themselves can perceive the performance of the app.
NFR-5	Availability	The AI-Powered Nutrition analyser app will be available to the users 24/7. If any bug appears then it will be handled within 12 hours.
NFR-6	Portability	User must have smartphones that supports later version.
NFR-7	Maintainability	Any update or detect fix shall be made on server-side computers only without any patches required by the user.

Chapter 5

PROJECT DESIGN

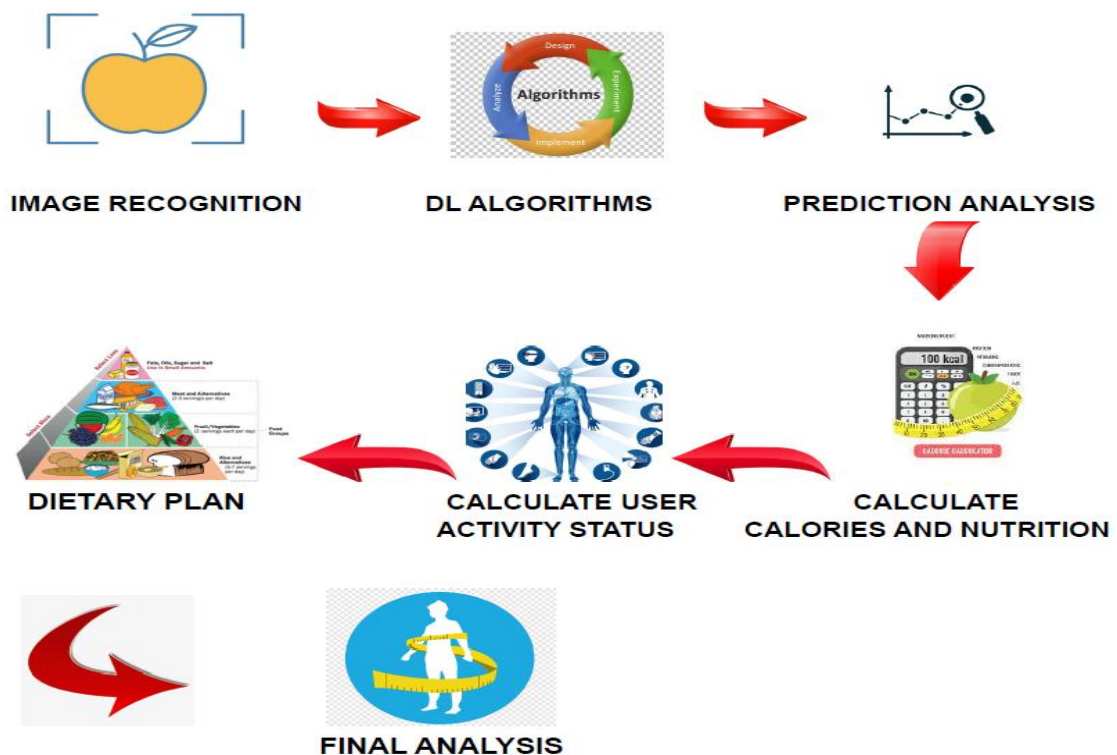
5.1 Data Flow Diagrams

Data flow diagram – level 0



5.2 Solution & Technical Architecture

Technology Stack (Architecture & Stack)



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user and Web 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
		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	Sprint1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint1
	Dashboard	USN-6	As a user, I can edit my profile details		Medium	Sprint2
Customer Care Executive	Queries	USN-13	As a user, I can raise and submit their queries in the Q&A section	can raise the queries how to use the application in Q&A.	Medium	Sprint1
	Diet plans	USN-14	As an executive, I must give the right nutrition with proper diet plans	A complete guide for nutrition provided to user	High	Sprint1
Administrator	Community Chart	USN-15	User can create a community and chat with them accordingly	Users can interact with other users.	Medium	Sprint 2
	Stores user data	USN-16	As an admin, I must store records of users	Users can get proper diet plans	High	Sprint1

Chapter 6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint 1

Data selection and Image Preprocessing:

In this milestone, we will be improving the image data that suppresses unwilling distortions or enhances some image features important for further processing, although performing some geometric transformations of images like rotation, scaling, translation, etc. The ImageDataGenerator accepts the original data, randomly transforms it, and returns only the new, transformed data.

Timeline: 24 - 29 Oct 2022

Sprint 2

Model Building

Steps to Build a Deep Learning Model

1. Defining the model architecture
2. Configure the learning process
3. Train The Model
4. Save the Model
5. Predictions

Timeline: 31 Oct - 5 Nov 2022

Sprint 3

Application Building

Now that we have trained our model, let us build our flask application which will be running in our local browser with a user interface. In the flask application, the input parameters are taken from the HTML page. These factors are then given to the model to predict the type of food and to know the nutrition content in it. In order to know the nutrition content we will be using an API in this project.

Timeline: 7 - 12 Nov 2022

Sprint 4:

Train The Model On IBM

In this milestone, we will register in the IBM cloud and Train the Model in the cloud. Finally we will build a deep learning model.

Timeline: 14 - 19 Nov 2022

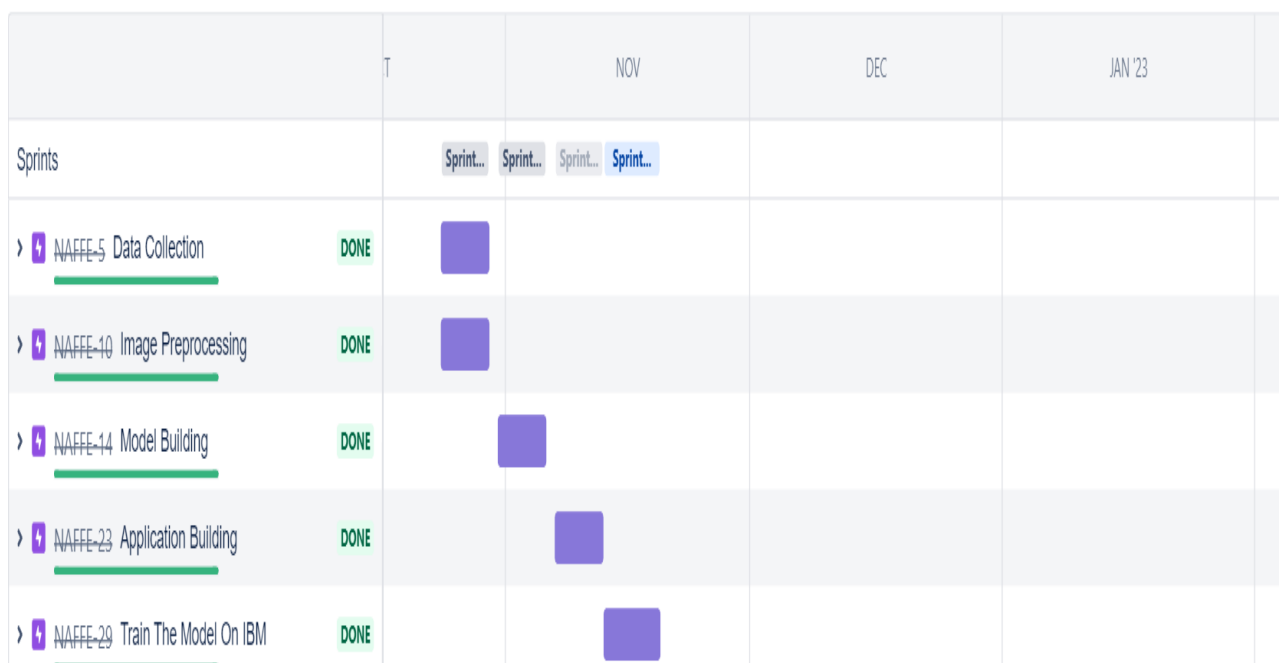
6.2 Sprint Delivery Schedule

Sprint	Duration	Sprint Start Date	Sprint End Date (Planned)
Sprint-1	6 Days	24 Oct 2022	29 Oct 2022
Sprint-2	6 Days	31 Oct 2022	05 Nov 2022
Sprint-3	6 Days	07 Nov 2022	15 Nov 2022
Sprint-4	6 Days	13 Nov 2022	19 Nov 2022

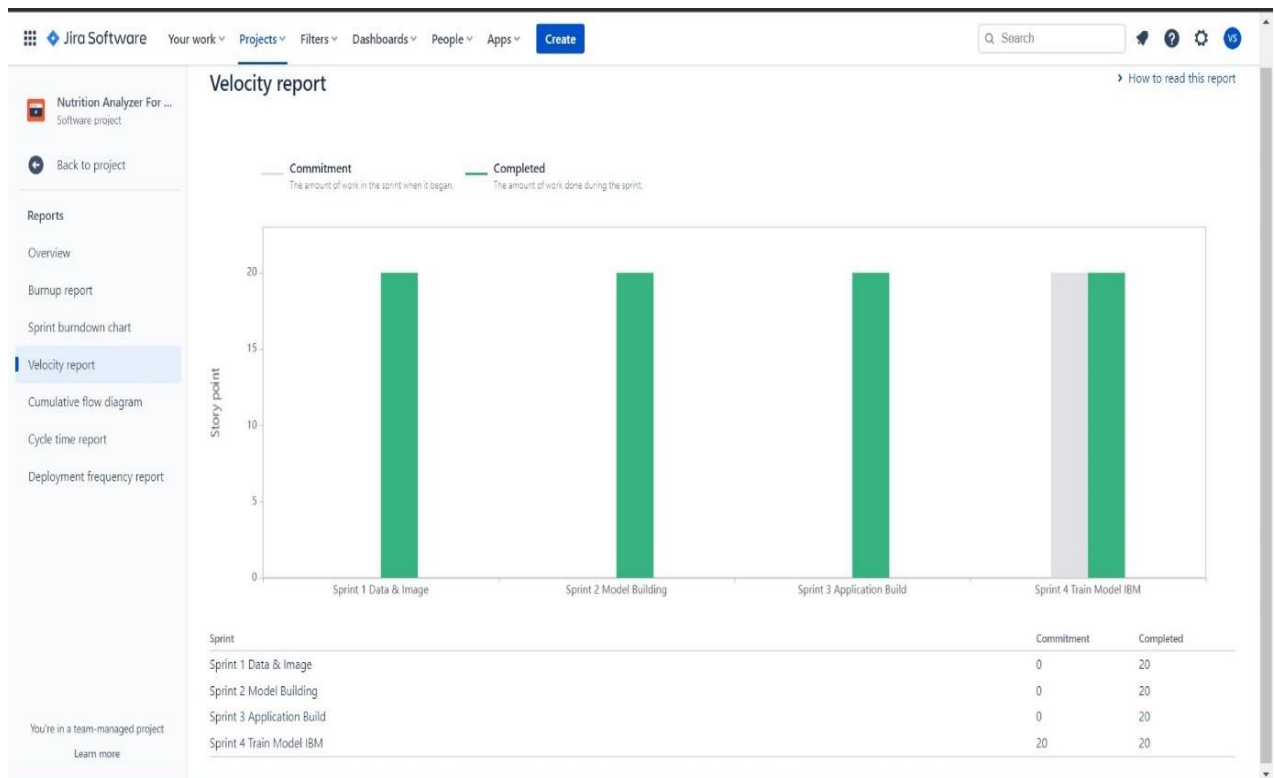
6.3 Reports from JIRA

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)	AV= sprint duration /velocity
Sprint1	20	6 Days	24/10/22	29/10/22	20	29/10/22	3.33
Sprint2	20	6 Days	31/10/22	05/11/22	20	2/11/22	6.66
Sprint3	20	6 Days	07/11/22	15/11/22	20	14/11/22	2.5
Sprint4	20	6 Days	13/11/22	19 /11/22	20	15/11/22	6.66

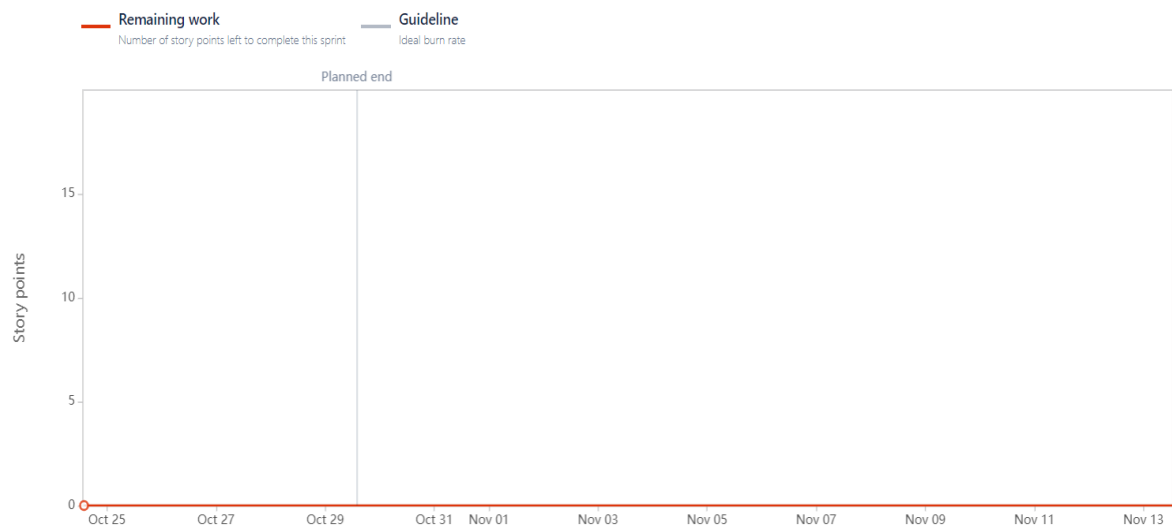
Roadmap report



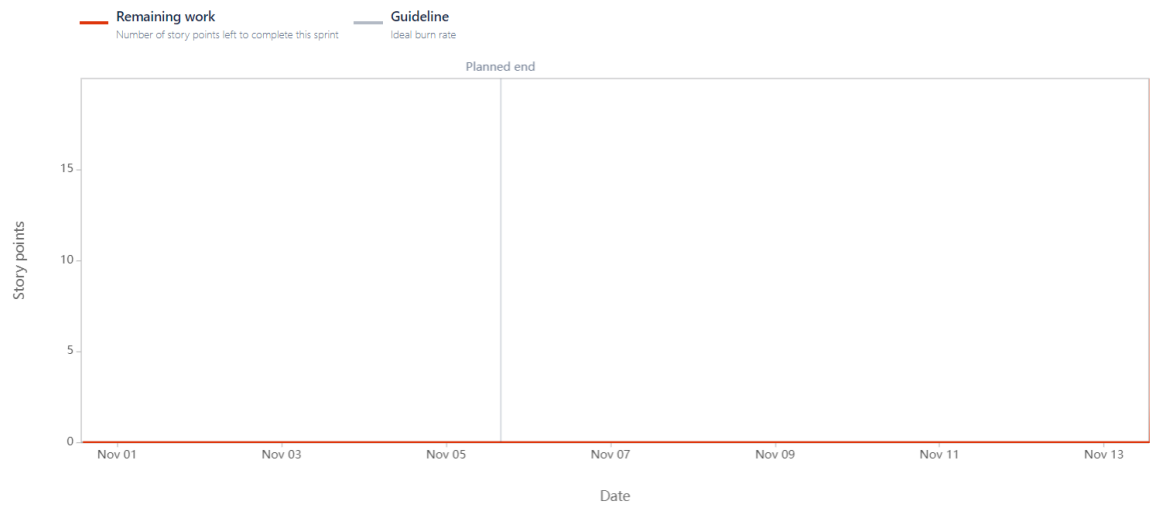
Velocity report



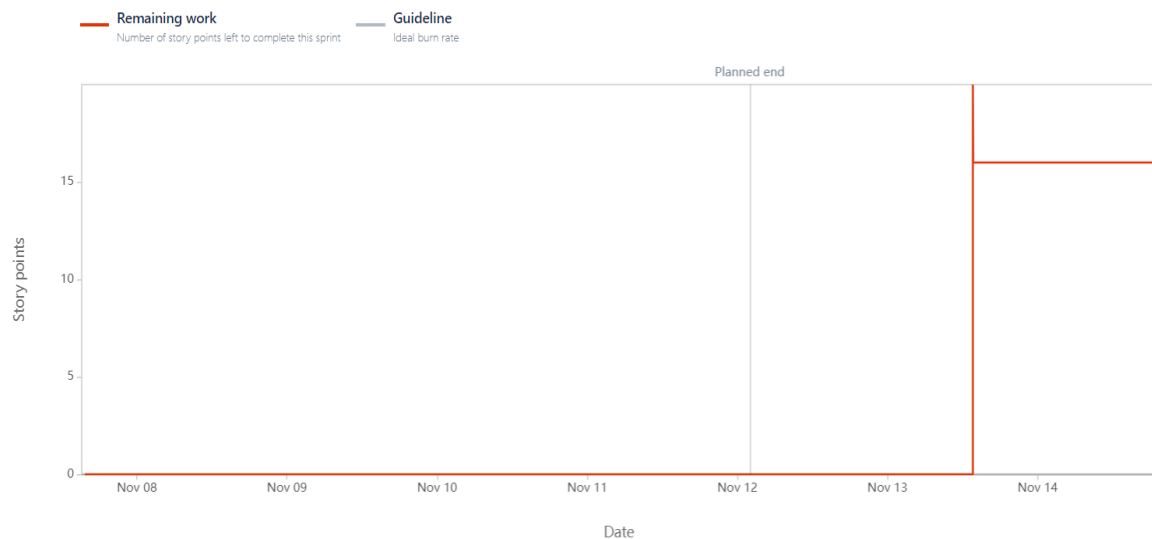
Burndown chart report for sprint 1



Burndown chart report for sprint 2



Burndown chart report for sprint 3



Burndown chart report for sprint 4



Chapter 7

CODING & SOLUTIONING

7.1 Feature 1

```
@app.route('/classify', methods=['POST'])
def upload_image():
    if 'file' not in request.files:
        flash('No file part')
        return redirect(request.url)
    file = request.files['file']
    if file.filename == '':
        flash('No image selected for uploading')
        return redirect(request.url)
    if file and allowed_file(file.filename):
        filename = secure_filename(file.filename)
        filepath = os.path.join(app.config['UPLOAD_FOLDER'], filename)
        file.save(filepath)
        flash('Image successfully uploaded and displayed below')

        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)
        foods = ['Apple', 'Banana', 'Bhel puri', 'Burger', 'Egg', 'Mango', 'Onion', 'Pizza']
        text = str(foods[pred[0]])
        print(text)

    def apple_nut():
        name = "The Food displayed here is Apple"
        info = '''Apples are considered nutrient-dense fruits, meaning they provide a lot of nutrients per serving.
                One medium 7-ounce (200-grams) apple offers the following nutrients '''
        a = "Calories: 104"
        b = "Carbs: 28 grams"
        c = "Fiber: 5 grams"
        d = "Vitamin C: 10% of the Daily Value (DV)"
        e = "Copper: 6% of the DV"
        f = "Potassium: 5% of the DV"
        g = "Vitamin K: 4% of the DV"
        return [name, info, a, b, c, d, e, f, g]
```

7.2 Feature 2

```
if text == 'Apple':
    nutrient = apple_nut()
elif text == 'Banana':
    nutrient = banana_nut()
elif text == 'Bhel puri':
    nutrient = bhel_puri_nut()
elif text == 'Burger':
    nutrient = burger_nut()
elif text == 'Egg':
    nutrient = egg_nut()
elif text == 'Mango':
    nutrient = mango_nut()
elif text == 'Onion':
    nutrient = onion_nut()
elif text == 'Pizza':
    nutrient = pizza_nut()
return render_template('index.html', filename='uploads_images/' + filename, name=nutrient[0], info=nutrient[1], a=nutrient[2],
                      b=nutrient[3], c=nutrient[4], d=nutrient[5], e=nutrient[6], f=nutrient[7], g=nutrient[8])
else:
    flash('Allowed image types are - png, jpg, jpeg, gif')
    return redirect(request.url)

@app.route('/display/<filename>')
def display_image(filename):
    return redirect(url_for('static', filename='uploads_images/' + filename), code=301)

if __name__ == "__main__":
    app.run()
```

Chapter 8

TESTING

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Expected Result	Actual Result	Status
HP_TC_001	UI	Home Page	Verify UI elements in Home Page	Home Page must be displayed	Working as Expected	Pass
HP_TC_006	Functional	Login page	Check if user cannot upload unsupported files	The application should allow only supported files	Working as Expected	Pass
HP_TC_002	Functional	Home Page	Check if the UI elements are displayed properly in different screen sizes	The Home Page must be displayed properly in all sizes	Not working as expected if given different screen sizes	Fail
HP_TC_005	Functional	Home Page	Check if the classify button is working properly after choosing files	The input image must be uploaded successfully	Working as expected	Pass
HP_TC_004	Functional	Home Page	Check if the Prediction button is working properly	User should be able to view gallery	Working as Expected	Pass
HP_TC_003	Functional	Home page	Check if the BMI button is working properly	User should navigate to BMI page	Working as Expected	Pass
HP_TC_007	Functional	Login page	Check if any food can be correctly predicted	User can be able to predict all types of images	Not working as Expected	Fail
BE_TC_001	Functional	Back End	Check if all the routes are working properly	All routes must work properly	Working as Expected	Pass
M_TC_001	Functional	Model	Check if model can handle different sizes	The model should rescale the image and predict	Working as Expected	Pass
M_TC_002	Functional	Model	Check if the model displays all nutrients	The model should display all the nutrients in predicted food	Working as Expected	Pass
M_TC_003	Functional	Model	Check if the model can handle multiple inputs	The model should predict multiple food images	Not working as Expected	Fails
BMI_TC_001	UI	BMI Page	Verify UI elements in BMI page	The page must be displayed properly	Working as Expected	Pass
BMI_TC_002	Functional	BMI Page	Check if the BMI calculator works	The calculator should display BMI along with the current state such as normal, obesity etc	Working as Expected	Pass
BMI_TC_003	Functional	BMI Page	Check if BMI calculator works for any Units	The calculator should allow user to enter different	Not working as expected. It only allows cm and kg units	Fail
BMI_TC_004	Functional	BMI Page	Check if warning is displayed if empty fields are present	The warning should be displayed in red colour	Working as Expected	Pass

8.2 User Acceptance Testing

8.2.1 DEFECT ANALYSIS:

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	15	0	2	0	17
Duplicate	0	0	0	0	0
External	0	3	0	1	4
Fixed	10	0	1	0	11
Not Reproduced	0	0	1	0	1
Skipped	0	0	0	1	1
Won't Fix	0	1	0	1	2
Totals	25	4	4	3	36

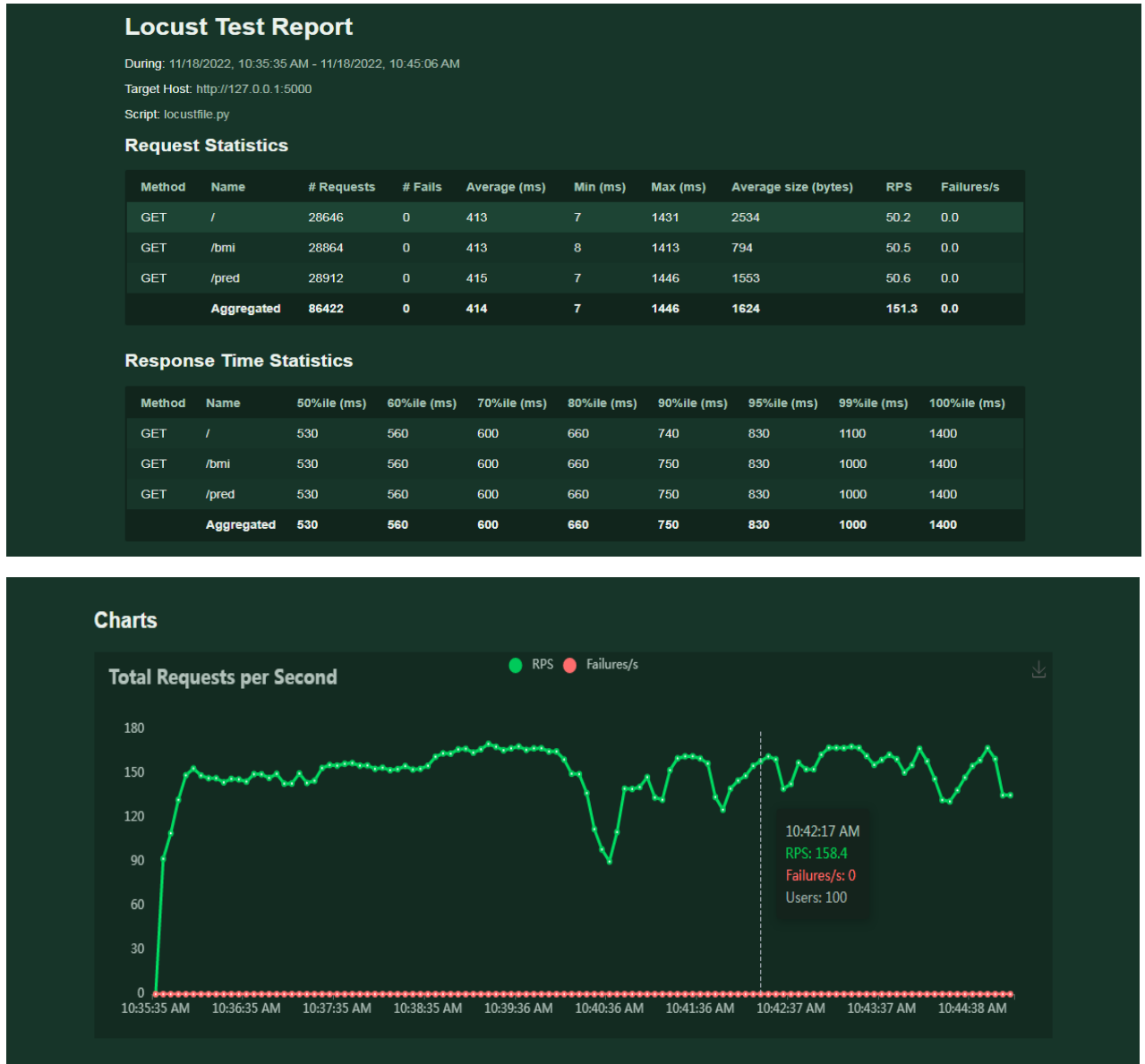
8.2.2 TEST CASE ANALYSIS:

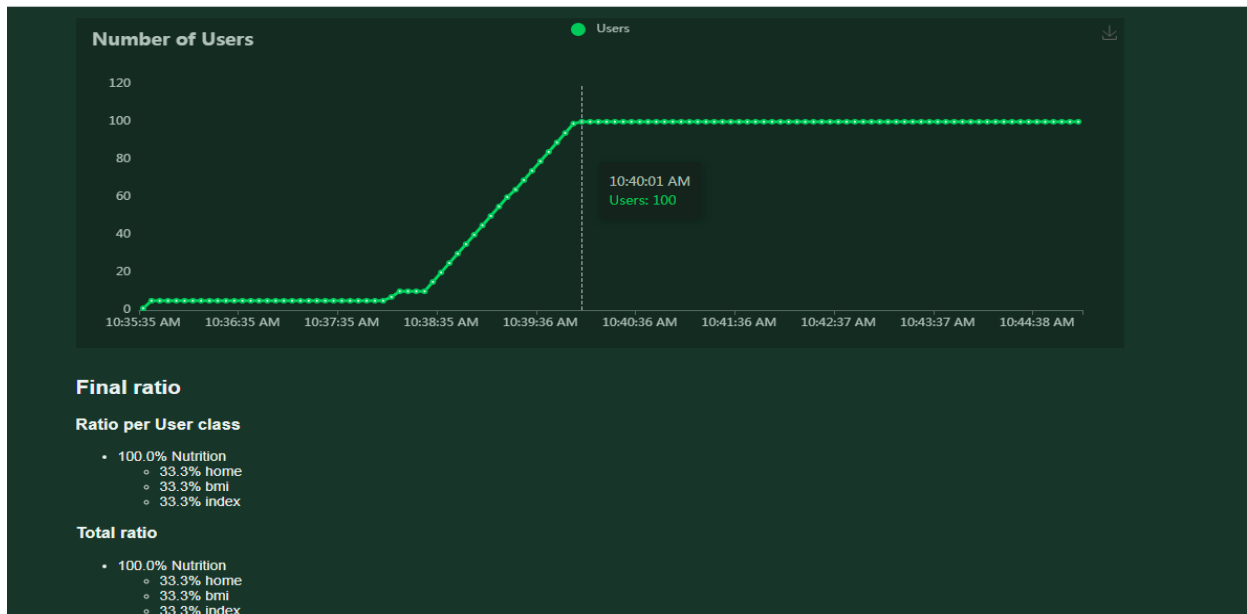
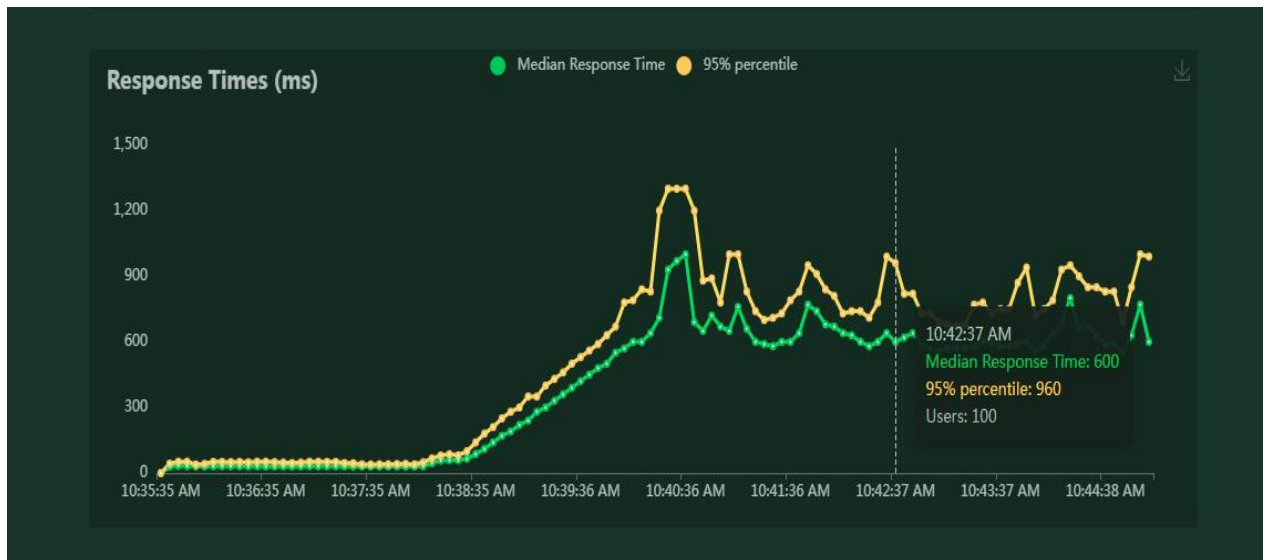
Section	Total Cases	Not Tested	Fail	Pass
Client Application	10	0	2	8
Security	2	0	0	2
Exception Reporting	8	0	2	6
Final Report Output	4	0	1	3
Version Control	1	0	0	1

Chapter 9

RESULTS

9.1 Performance Metrics





Chapter 10

ADVANTAGES & DISADVANTAGES

Advantage:

- The main advantage is increased accuracy in food and nutrients intake.
- It helps to maintain better eating habits and aid in attaining a balanced energy level.
- It shows some key nutrients to impact your health.
- By constantly monitoring the food we consume, it helps us to lead a healthy lifestyle.

Disadvantages:

- Inaccurate information.
- It causes changes to the patient's condition.
- Not advisable in using when hospitalized.
- Sometimes can give invalid laboratory values in case of any malfunctioning or network issues.

Chapter 11

CONCLUSION

On the whole this project is very useful in monitoring the goodness that we take and as a contrary the unwanted foods we are consuming, it helps us to track current state of our body. This is useful for having a sound physical and mental health.

Chapter 12

FUTURE SCOPE

- In future we can further enhance this project by adding some extra features like giving diet plans to an individual by collecting their personal information and health conditions.
- We can make prediction of different foods at a time and detecting the overall calorie.
- Android application can be developed.
- Then we can frame customised workout plan based on their BMI value.
- Monitoring them on daily basis, calories count that is been burnt.
- Water intake can be monitored.
- Overall screening their health condition towards a healthy life style.

Chapter 13

APPENDIX

13.1 Source Code

- <https://www.youtube.com/watch?v=tXpFERibRaU>
- <https://youtu.be/CGftYT6KcrM>
- <https://youtu.be/IwEqvjsDVU0>
- <https://tutorial101.blogspot.com/2021/04/python-flask-upload-and-display-image.html>
- <https://www.promptworks.com/blog/load-testing-with-locust>
- <https://getcssscan.com/css-buttons-examples>

13.2 GitHub & Project Demo Link

- GitHub link: <https://github.com/IBM-EPBL/IBM-Project-778-1658322231>
- Project Demo Link:
<https://www.youtube.com/watch?v=VGzcnulewac&t=289s>