PROJECT REPORT

Team id	PNT2022TMID14614
Team leader	Jemima Sharon E
Team members	Mahalakshmi R, Preethi R, Preethi S
Department	Electronics and Communication Engineering
College Name	RMK college of Engineering and Technology
Project title	AI-powered Nutrition Analyzer for Fitness Enthusiasts
Date	24/11/2022

1 INTRODUCTION:

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.

1.1 Project overview:

The main aim of the project is to building a model which is used for classifying the food which depends on the different characteristics like color, shape, texture etc. Here the user can capture the images of different foods and then the image will be sent to the trained model. The model analyses the image and detect the nutrition content based on the food like (Fruits ,Vegetables ,Rice ,Wheat, etc.).

1.2 Purpose:

Application of AI-based methods may contribute to improving predictive models of diet and disease outcomes, to better collecting, processing and understanding complex nutrition-related data, and to better monitoring of a population's nutritional status.

2.LITERATURE SURVEY:

2.1 Existing Problem:

The work done by Martin CK, Kaya S, Gunturk BK. Quantification of food intake using food image analysis produced Reliable and accurate food and nutrient intake data are essential to plan and assess the effect of therapeutic menus for a patient under medical care. Earlier studies reported that the reliability of the data obtained through traditional methods might be biased due to incorrect estimation of the food intake data.

2.2 References:

1. IBM. Artificial Intelligence.2021.Available from https://www.ibm.com/cloud/learn/what-is-artificialintelligence .Viewed on, 2021.

2. Corinne L. Bush, Jeffrey B. Blumberg, Ahmed ElSohemy, Deanna M. Minich, Jóse M. Ordovás, Dana G. Reed & Victoria A. Yunez Behm . Toward the Definition of Personalized Nutrition: A Proposal by The American Nutrition Association, Journal of the American College of Nutrition, 2020; 39(1): 5-15. doi : 10.1080/07315724.2019.1685332

3. Bauer J, Capra S, Ferguson M. Use of the scored patientgenerated subjective global assessment (PGSGA) as a nutrition assessment tool in patients with cancer. Eur J Clin Nutr, 2002; 56: 779–85. doi: 10.1038/sj.ejcn.1601412

2.3 Problem Statement Definition:

A nutritional problem or deficiency refers to a condition when an individual's body experiences a shortage of essential nutrients or some specific nutrient. Such problems can give rise to several health issues such as anemia. This can resolved by AI based nutrition analyzer application.
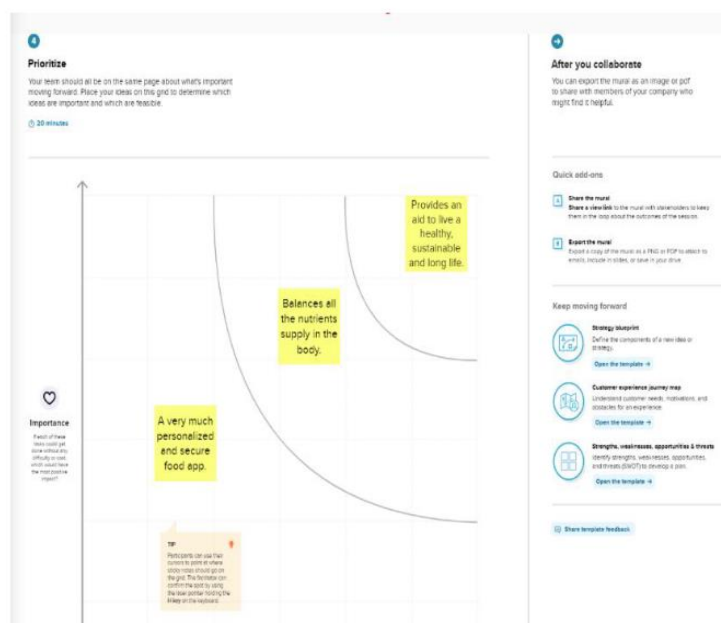
3.IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:
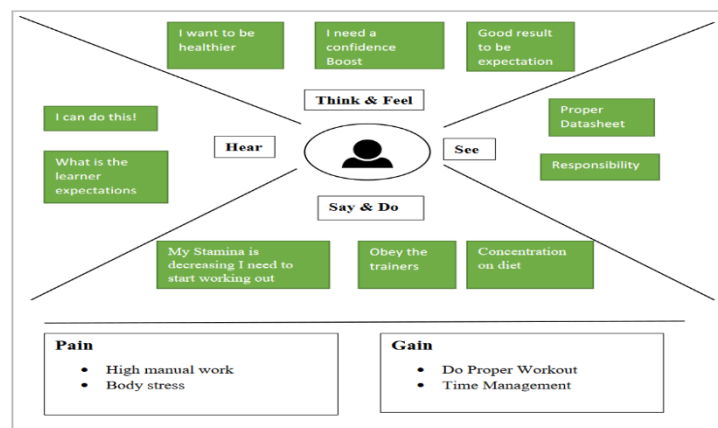
3.2 Ideation & Brainstorming:

Step 2: Brainstorm, Idea Listing and Grouping

3.3 Proposed solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	AI-powered Nutrition Analyzer for Fitness Enthusiasts
2.	Idea / Solution description	The main aim of the project is to build a model which is used for classifying the food which depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different foods and then the image will be sent to the trained model. The model analyses the image and detects the nutrition content based on the food like (minerals,vitamins,iron,fibre, e.t.c..).
3.	Novelty / Uniqueness	Building the model,using the special algorithm: **Mask Region based-Convolutional Neural Network(Mask R-CNN)** ✓ This variant of a Deep Neural Network detects objects in an image and generates a high-quality segmentation mask for each instance.Also is a very quick process.
4.	Social Impact / Customer Satisfaction	➢ Helps to better understand and predict the complex and non-linear interactions between nutrition-related data and health outcomes, particularly when large amounts of data need to be structured and integrated, such as in metabolics. ➢ Diet, Fitness and profitability are carried out.
5.	Business Model (Revenue Model)	Yes,it is definitely a revenue model.
6.	Scalability of the Solution	▢ Overall, nutrition and physical activity-related app show promise as tools to successfully facilitate positive health behavior change. ▢ Moreover, meal planning can be viewed as one technique to deliver nutrition knowledge in a more practical way. ▢ Personalization could be enabled in

		providing personalized feedback about healthy lifestyle, complying, at the same time, with established and ethical guidelines of different fields of nutrition research.

3.4:Proposed solution fit :

Project Title: AI Based Nutrition Analyzer for Fitness Enthusiasts
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Project Design Phase-I – Solution Fit Template

Define CS, fit into CC

1. CUSTOMERS SEGMENTS `CS`

Nutrition analyzer applications are used mainly by fitness enthusiastic and people with some health constraints focusing to eat certain vitamins and nutrition.

6. CUSTOMER CONSTRAINTS `CC`

What constrains prevent your customers from taking action or limit their choices of solution ?
1.e spending power,budget,no cash,network connection,available devices.

5. AVAILABLE SOLUTIONS `AS`

which solutions are available to the customers when they face the problem
or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

Explore AS, differentiate

Focus on J&P, tap into BE, understand

2. JOBS-TO-BE-DONE / PROBLEMS `J&P`

To building a model which is used for classifying the food which depends on the different characteristics like color, shape, texture etc. Here the user can capture the images of different foods and then the image will be sent to the trained model. The model analyses the image and detect the nutrition content based on the food like (Fruits ,Vegetables ,Rice ,Wheat, e.t.c..).

9. PROBLEM ROOT CAUSE `RC`

People in current era are facing many health complications at their young ages

7. BEHAVIOUR `BE`

What does your customer do to address the problem and get the job done?
i.e. directly related: find the right solar panel installer, calculate usage and benefits;
indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

Focus on J&P, tap into BE,

Identify strong TR & EM

3. TRIGGERS `TR`

Seeing neighbours following certain diet plans by downloading applications .

4. EMOTIONS: BEFORE / AFTER `EM`

Unhealthy, unaware of nutrition intake > correct compositions of nutrition and vitamins intake, proper diet plan, suggestions for consumption of food.

10. YOUR SOLUTION `SL`

1.Create custom dataset(Pre-trained COCO model)
2.Image annotation(ImgBox)
3.Building the model:
    (i)Mask Region based-Convolutional Neural Network(Mask R-CNN)
    (ii)Instance segmentation

8. CHANNELS of BEHAVIOUR `CH`

8.1 **ONLINE**
What kind of actions do customers take online? Extract online channels from #7
8.2 **OFFLINE**
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development

Focus on J&P, tap into BE, understand RC

4.Requirement Analysis:

4.1 Functional requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Create custom dataset	Pre-trained COCO model
FR-2	Image annotation	ImgBox
FR-3	Building the model	1. Mask Region based-Convolutional Neural Network(Mask R-CNN) 2. Instance segmentation 3. Weight of food= volume*density
FR-4	API analysis	Edamam's proprietary NLP
FR-5	Designing Application	Android studio, Jupyter notebook, Collab

4.2 Non Functional requirement:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	It is handy and easily accessible.
NFR-2	**Security**	The application is very secure because it can be opened only by its login credentials.
NFR-3	**Reliability**	It is convenient and can be changed as per user requirement.
NFR-4	**Performance**	Time taken to analyse the food by its texture and weight.
NFR-5	**Availability**	It is available all time.
NFR-6	**Scalability**	It can handle a large increase in users, workload or transactions without undue strain.

5.PROJECT DESIGN:

5.1 Data Flow Diagrams:
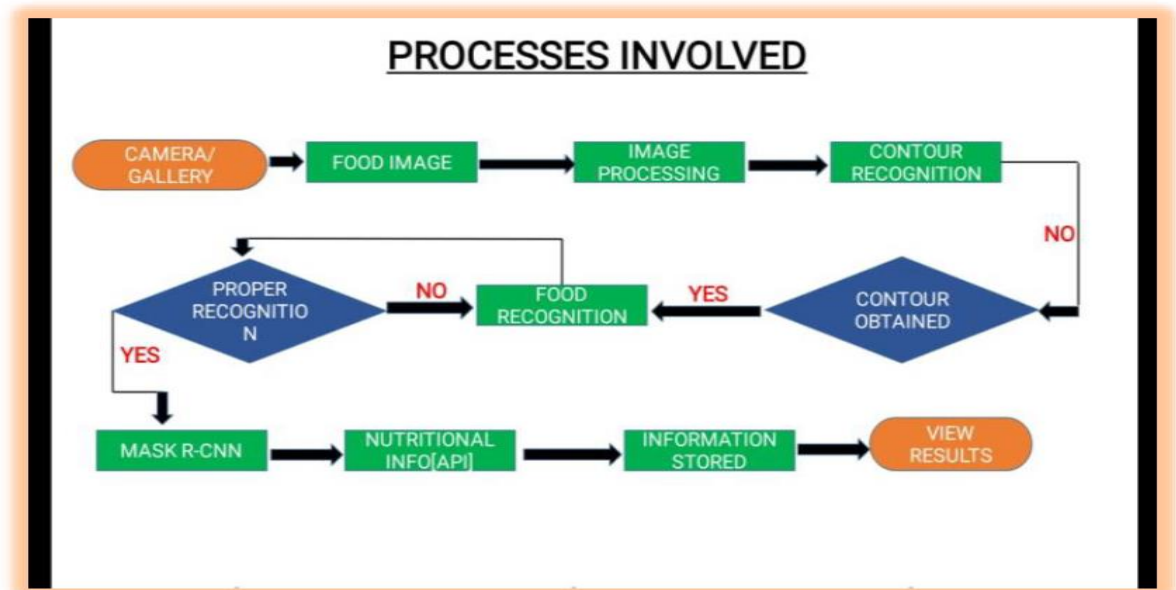
5.2 Solution & Technical Architecture:
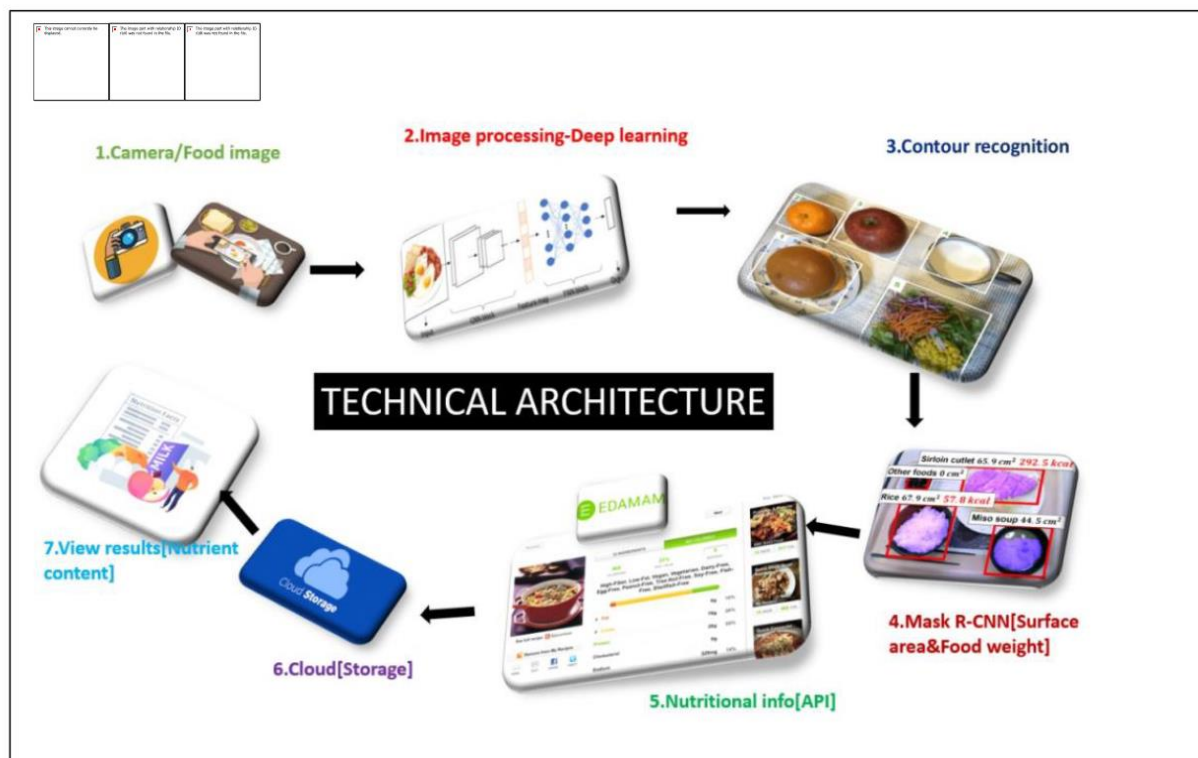
5.3 User Stories:

User Stories

Use 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
		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
		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 & access the dashboard with Gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login to my account by entering email & password	High	Sprint-1
	Dashboard	USN-6	Related to profile	Information regarding diet plan	High	Sprint-2
Customer(Web user)	Register	USN-7	By giving the user's height weight age and some body's physical condition.	Provides the BMI of user	High	Sprint-1
Customer Care Executive	Toll free number	USN-8	Provided in website	For queries	Low	Sprint-4
Administrator	Via email	USN-9	Confirmation through email	Conforming	High	Sprint-2

6 PROJECT PLANNING &ESTIMATION:

6.1 Sprint planning &Estimation:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data collection (Dataset)	USN-1	As a user, I will download dataset of gestures for this project.	2	High	Jemima Sharon.E
Sprint-1	Image Preprocessing	USN-2	As a user, I will import necessary libraries for configuration of image datagenerator and applying them to test and train dataset.	2	High	Jemima Sharon.E
Sprint-2	Model Building	USN-3	As a user, I can import necessary libraries and models of CNN and adding Dense layers.	2	Low	Preethi.S
Sprint-2	Model Building	USN-4	As a user, I will train, save and test the model.	2	Medium	Preethi.S

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	Application Building	USN-5	As a user, I create html front page (CSS for styling webpage and JS to connect back end).	1	High	Preethi.R
Sprint-3	Application Building	USN-6	As a user, I use python flask for building back end(for server side scripting).	2	High	Preethi.R
Sprint-3	Application Building	USN-7	As a user, going to run the application by combining both front end and back end.	2	High	Preethi.R
Sprint-4	Train the model on IBM	USN-8	As a user, register for IBM cloud.	1	Medium	Mahalakshmi.R
Sprint-4	Train the model on IBM	USN-9	As a user, train the model on IBM and integrate it with the flask application.	2	High	Mahalakshmi.R

6.2 Sprint delivery schedule:

Sprint	Total StoryPoints	Duration	Sprint StartDate	SprintEndDate (Planned)	Story Points Completed (as on Planned EndDate)	Sprint Release Date(Actual)
Sprint-1	20	6Days	24Oct2022	29Oct2022	20	29Oct2022
Sprint-2	20	6Days	31Oct2022	05Nov2022	20	03Nov2022
Sprint-3	20	6Days	07Nov2022	12Nov2022	20	10Nov2022
Sprint-4	20	6Days	14Nov2022	19Nov2022	20	17Nov2022

7 Coding and solutioning:

7.1 Feature 1:

IBM Watson Platform

Visual studio

Python Code

HTML

CSS

JS

7.2 Feature 2:

Neural Network

Artificial Intelligence

8.Testing and Results:

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 contaminationÂ ofÂ food.

Predict Fruits and its Nutrition

Upload

Predict Fruits and its Nutrition

The given fruit is APPLES Calories-96, Protein - 0.59g,Carbohydrate 25g,Fats -0.39g,Dietary Fiber 4.4g,Sugar 14 g,Sodium 18mg,Potassium 194.7mg

Upload

9.Advantages:

    A smart system that can accurately estimate the calories and nutrition in any quantity of food can be very helpful for health and fitness.

    It is an application that provides assistance to the users on the maintenance of their dietary intake on an hourly, daily, or monthly basis. Like smartwatches counting your steps and physical activities, these apps count the nutrition that one consumes in each meal.

10.Disadvantages:

    Variability in the composition of foods.
    Limited coverage of food items.
    Coverage of nutrients.
    Inappropriate database or food composition values.

11.Conclusion:

    All in all, it is an app that can save your entire data regarding your diet and offer you assistance in consuming healthy food timely.

12.Future scope:

    Personalized nutrition intake schedule based on the kind of foods they consume in a day.

    Can create a daily calorie goal and consume food only according to it.

    To scan the barcode on an edible product to get a count on the number of calories it contains.

13. Appendix
13.1 Source Code

```
<!DOCTYPE html>
<html>
<head>
<title>Nutrition Analyser</title>
<link rel="stylesheet" href="C:\Users\admin\Desktop\Site\css\bootstrap.css">
<link rel="stylesheet" href="C:\Users\admin\Desktop\Site\style.css">
<link
href="https://fonts.googleapis.com/css2?family=Akaya+Telivigala&display=sw
ap" rel="stylesheet">
```

```html
<link
href="https://fonts.googleapis.com/css2?family=Righteous&display=swap"
rel="stylesheet">
<script src="C:\Users\admin\Desktop\Site\js\bootstrap.js"></script>
</head>
<style>
body,html{
        height:100%;
        background-image:linear-
gradient(rgba(0,0,0,0.5),rgba(0,0,0,0.5)),url("fruit6.jpg");
        background-repeat:no-repeat;
        background-position: center;
        background-size: cover;
}
.logo{
        float:left;
        height: 65px;
        margin-top:30px;
        margin-left:20px;
}
.menu{
        list-style-type: none;
        float:right;
        margin-top: 40px;
        margin-right: 50px;
}
ul li{
        display:inline-block;
}
ul li a{
  border-radius: 20px;
  display: block;
  text-align: center;
  padding: 6px 30px;
  font-family: "Space Grotesk",-apple-system,system-ui,"Segoe
UI",Roboto,Helvetica,Arial,sans-serif,"Apple Color Emoji","Segoe UI
Emoji","Segoe UI Symbol";
```

```css
    font-style: bold;
    font-size: 20px;
    text-decoration: none;
    color: #6FEDD6;
    border: 1px solid transparent;
    transition: 0.6s ease;
}
.fixed{
        background:#FDFF00;
        color: #000 ;
}
ul li a:hover{
        text-decoration: none;
        background-color: #ffff;
        color: #000;
}
.midword{
        position:absolute;
    padding-left: 30px;
        top: 38%;
        margin-left: 48vh;
        /*font-family: 'Akaya Telivigala', cursive;*/
        background-color:#ffff;
    width: 500px;
    opacity:0.6;
    color:#000000;
    font-family:'Roboto',sans-serif;
    font-style: italic;
    border-radius:20px;
    font-size:25px;
}
.midpic{
        position:absolute;
        top: 16%;
        margin-left: 60vh;
}
.logo{
```

```
color: #FF8787;
font-size: 30px;
font-family: 'Akaya Telivigala', cursive;
margin-bottom: 30px;
}
</style>
<body>
<div class="logo">
<img src="fruit52.jpg" height="60px" width="60px">
  <b>Healthy and Fitness</b></div>
<ul class="menu">
<li><a href="index">Home</a></li>
<li><a href="home">Predict</a></li>
</ul>
<h3 class="midword">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.</h3>
<img src="nut2.png" class="midpic">
</body>
</html>
```

13.2 GitHub

https://github.com/IBM-EPBL/IBM-Project-31100-1660196130