SMART NUTRITIONAL PLANNER:

Revolutionizing dietary management with AI

Business Model by: -

Vedant R. Naik

Ojasri Konda

Market Segmentation & Analysis by: -

Gopika R. Nambiar

Biplab Bijoy Mahato

Prabhas Baddula

Abstract

The Smart Nutritional Planner is an AI-driven platform designed to provide personalized meal plans, dynamic nutritional advice, and real-time tracking. Leveraging machine learning, it adapts to individual health goals, dietary preferences, and lifestyle constraints. The platform simplifies meal planning, offers real-time feedback, and integrates with fitness trackers for comprehensive monitoring. With features like automated shopping lists, extensive recipe databases, and progress analytics, it empowers users to maintain a balanced diet and achieve long-term wellness. Personal interaction with fitness experts is also offered in our Smart Nutritional Planner. By addressing diverse dietary needs, it aims to enhance overall health and well-being.

Problem Statement

Today, the significance of health has been increased drastically which ultimately resulted in maintaining a good and healthy diet. The lack of personalized, easily accessible, and adaptable nutritional planning tools prevents individuals from achieving and maintaining their health and fitness goals. There is a need for a comprehensive Smart Nutritional Planner that leverages machine learning to provide tailored meal plans, dynamic nutritional advice, and real-time tracking to support diverse dietary requirements and lifestyle constraints. This solution should simplify meal planning, enhance adherence to healthy eating habits, and ultimately improve overall well-being.

1.0 Market/Customer/Business Need Assessment

1.1 Market Need
Increasing awareness of health and nutrition, a growing market for personalized health solutions, and the rise of lifestyle diseases necessitate effective dietary management tools. Significance of diet in day-to-day life has impacted a lot on the life of people.

1.2 Customer Need
Individuals seeking personalized nutrition plans that fits to their unique health goals, preferences, and dietary restrictions.

1.3 Business Need
Health and wellness industries, fitness centers, and dietitians require advanced tools to provide personalized nutritional guidance to their clients.

2.0 Target Specifications and Characterization

Health-conscious people who give importance to their health based on diet. Also, people who have specific diet needs which have allergies and diabetes. Fitness enthusiast or influencers who take all time care of their diet with nutritional goals. Aged persons who have health issues and need to maintain proper diet for well-being of health. Busy professionals seeking convenient meal planning solutions during their work time. Nutritionally weak young individuals who want to improve health.

3.0   External Search

4.1 Nutritional Information and Databases:

- [USDA Food Data Central](#)
- [Nutritional Information from NIH](#)
- [MyFitnessPal API](#)

4.2 Market Analysis and Industry Reports:

- [Statista: Digital Health Market](#)

4.3 Machine Learning and Personalization:

- [Towards Data Science on Personalized Recommendations](#)
- [Kaggle: Nutrition and Health Datasets](#)

4.0   Bench marking alternate products

- **MyFitnessPal** : Popular for calorie tracking but lacks deep personalization and adaptive meal planning.
- **Noom** : Focuses on behavioural coaching but can be expensive and time-consuming.
- **Lose It!** : Offers tracking features but lacks comprehensive dietary management and customization.
- **PlateJoy** : Provides personalized meal plans but with limited AI integration for real-time adjustments.

5.0   Applicable Patents

- **US Patent No. US6346284B1:** System and method for nutritional guidance and meal planning.
- **US Patent No. US11321631B1:** Machine learning for personalized diet recommendations.

6.0   Applicable Regulations

- **FDA** (Food and Drug Administration) Regulations: Compliance with dietary and health claims.
- **GDPR** (General Data Protection Regulation): Ensuring data privacy for users.
- **HIPAA** (Health Insurance Portability and Accountability Act): If handling sensitive health data.

7.0   Applicable Constraints

- **Budget:** There will be a initial development cost to implement the product, through collaborating with nutritionists and purchasing the required licences.
- **Expertise:** Need of expert in nutrition, fitness and personalisation.
- **Data privacy:** Ensuring the secure handling of personal health data of every individual.

8.0   Business Model

The monetization can be generated through providing different models in the smart nutrition app itself. The models are:

- **Freemium Model (Basic):** This model will only give basic information at a certain limit for free with displaying of ads in between the process. For more detailed information and ads free experience user or client needs to buy premium.
- **In-App Purchases:** Basically, this will provide some of the additional services like nutrition plan or recipes that can be purchased by paying some amount.
- **Subscription Model (Premium):** This model will offer all the features with personalised nutrition plan and recommendations given by fitness experts and nutritionist. The subscription can be monthly or yearly based on customer's preference.
- **Partnerships:** Collaboration with fitness centers, coaches and expert nutritionists to give them a platform to interact with customers.

9.0   Concept Generation

Identifying the need of nutritional tool that helps in day-to-day life of people to keep up with their health in a busy schedule through providing them an easy to main healthy diet which can be followed on regular basis. Conducting surveys and gathering data about health of people affecting due to junk food and non-healthy food products present in market. Prioritizing features and motivating the client to stay healthy by exercising and maintaining a healthy diet.
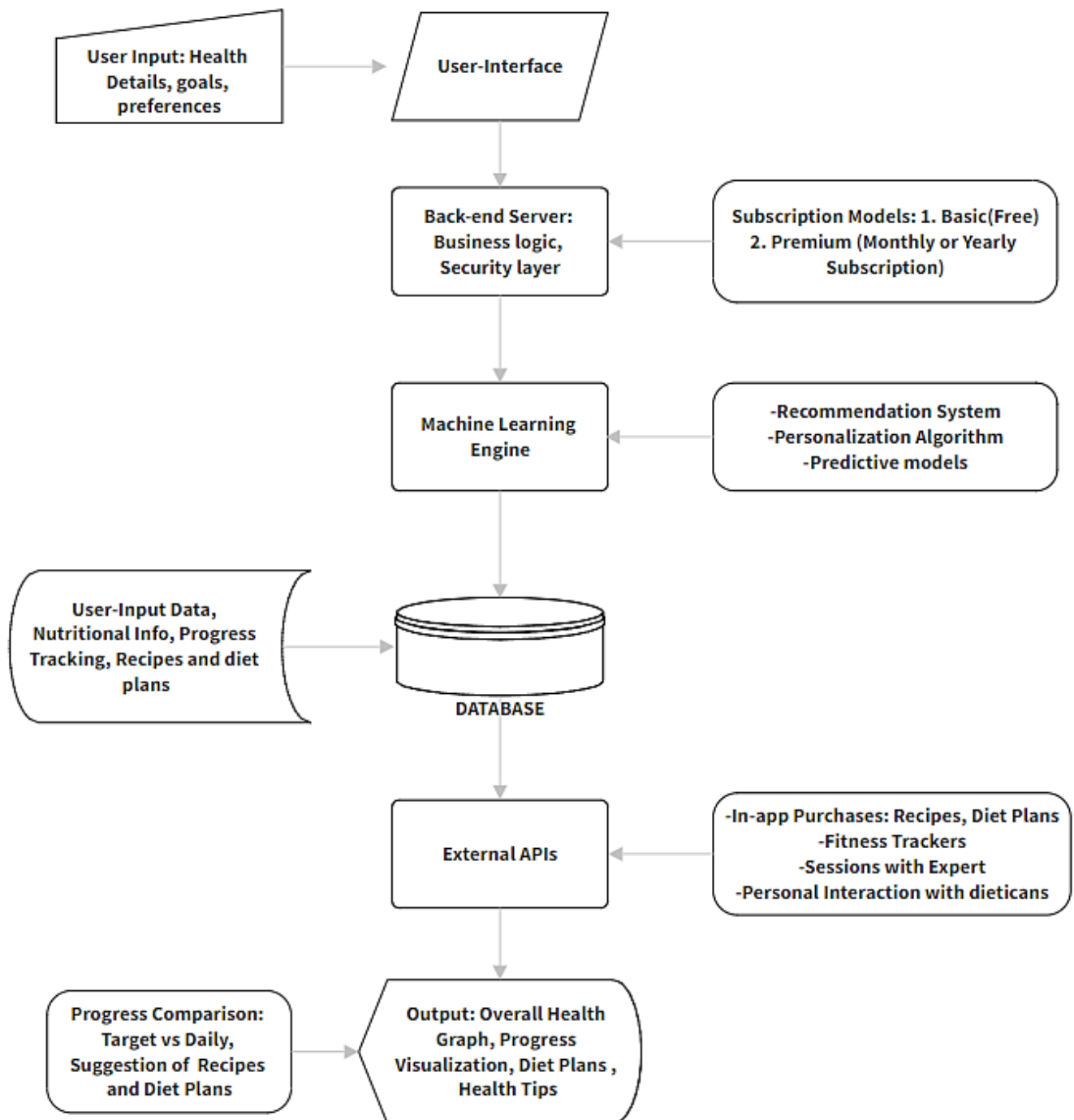
10.0 Concept Development

The Smart Nutrition Planner will be a mobile and web application providing personalized meal plans, real-time nutritional advice, and tracking features. By leveraging advanced machine learning algorithms and integrating with external data sources, the platform offers a holistic approach to nutrition management tailored to individual needs. Interaction with the fitness experts and diet plans provided by authorized dieticians. The Smart Nutritional Planner aims to revolutionize the way individuals manage their nutrition by providing a comprehensive, personalized, and data-driven approach to dietary planning and health improvement.

11.0 Final Product Prototype(abstract) with schematic diagram

The Major components:

- User-Interface (UI): This will showcase the interface to the client to interact and take the required input from the user.
- Machine-Learning Engine: It will consist the main algorithms which will be capable to learn from user's input and health data to and show them personalised nutrition and diet plans based on their health data.
- Database: This will store the user's data, nutritional data and progress tracking.
- External APIs: Various External APIs will be used to gather the nutritional data which is accurate inspected and approved by health experts.

Product Design

Flowchart:

- **User Input: Health Details, goals, preferences** → **User-Interface**
- **User-Interface** → **Back-end Server: Business logic, Security layer**
- **Subscription Models: 1. Basic(Free) 2. Premium (Monthly or Yearly Subscription)** → **Back-end Server: Business logic, Security layer**
- **Back-end Server** → **Machine Learning Engine**
- **-Recommendation System -Personalization Algorithm -Predictive models** → **Machine Learning Engine**
- **Machine Learning Engine** → **DATABASE**
- **User-Input Data, Nutritional Info, Progress Tracking, Recipes and diet plans** → **DATABASE**
- **DATABASE** → **External APIs**
- **-In-app Purchases: Recipes, Diet Plans -Fitness Trackers -Sessions with Expert -Personal Interaction with dieticans** → **External APIs**
- **External APIs** → **Output: Overall Health Graph, Progress Visualization, Diet Plans, Health Tips**
- **Progress Comparison: Target vs Daily, Suggestion of Recipes and Diet Plans** → **Output: Overall Health Graph, Progress Visualization, Diet Plans, Health Tips**

12.0 Product Details

How does it work?

At the first, user inputs their dietary preferences, health information, and target health goals. This collected input data stores in the database and machine learning algorithm analyses the data to create a personalized diet, nutrition and health plan. The user can track progress of their journey and also can make some purchases of exclusive healthy diet recipes approved by experts. User receives real-time feedback and can track their nutritional intake and progress.

Data Sources

- User-Input data
- Nutritional Information
- Health and fitness data tracking from wearables

Algorithms, Frameworks, Software

- **Algorithms:** Collaborative filtering, supervised learning models.
- **Frameworks:** Tensorflow, Pytorch for ML, React-native for app development.
- **Software:** Database management systems like PostgreSQL, cloud services like AWS.

Team Required

- Nutrition/Fitness Experts
- Data Scientists
- Software Developers
- UX/UI Designers

13.0 Code Implementation

Following is the github link to the small code implementation in python of Smart Nutritional Planner:

https://github.com/vedant2319/Smart-Nutritional-Planner/blob/master/snp.py

BUSINESS MODEL

By OJASRI KONDA & VEDANT NAIK

The Smart Nutritional Planner's business model is structured around two main revenue streams: the Freemium Model and In-App Purchases. These models are designed to provide value to users while also creating a sustainable and scalable business. Below, we delve into the intricacies of each model, its features, strategies for user engagement, and potential revenue generation.

Freemium Model (Basic)

Overview: The Freemium model offers a basic version of the app for free, providing essential features that attract a wide user base. This model serves as an introduction to the platform, showcasing its value and encouraging users to explore its functionalities and consider upgrading to the premium version for enhanced features.
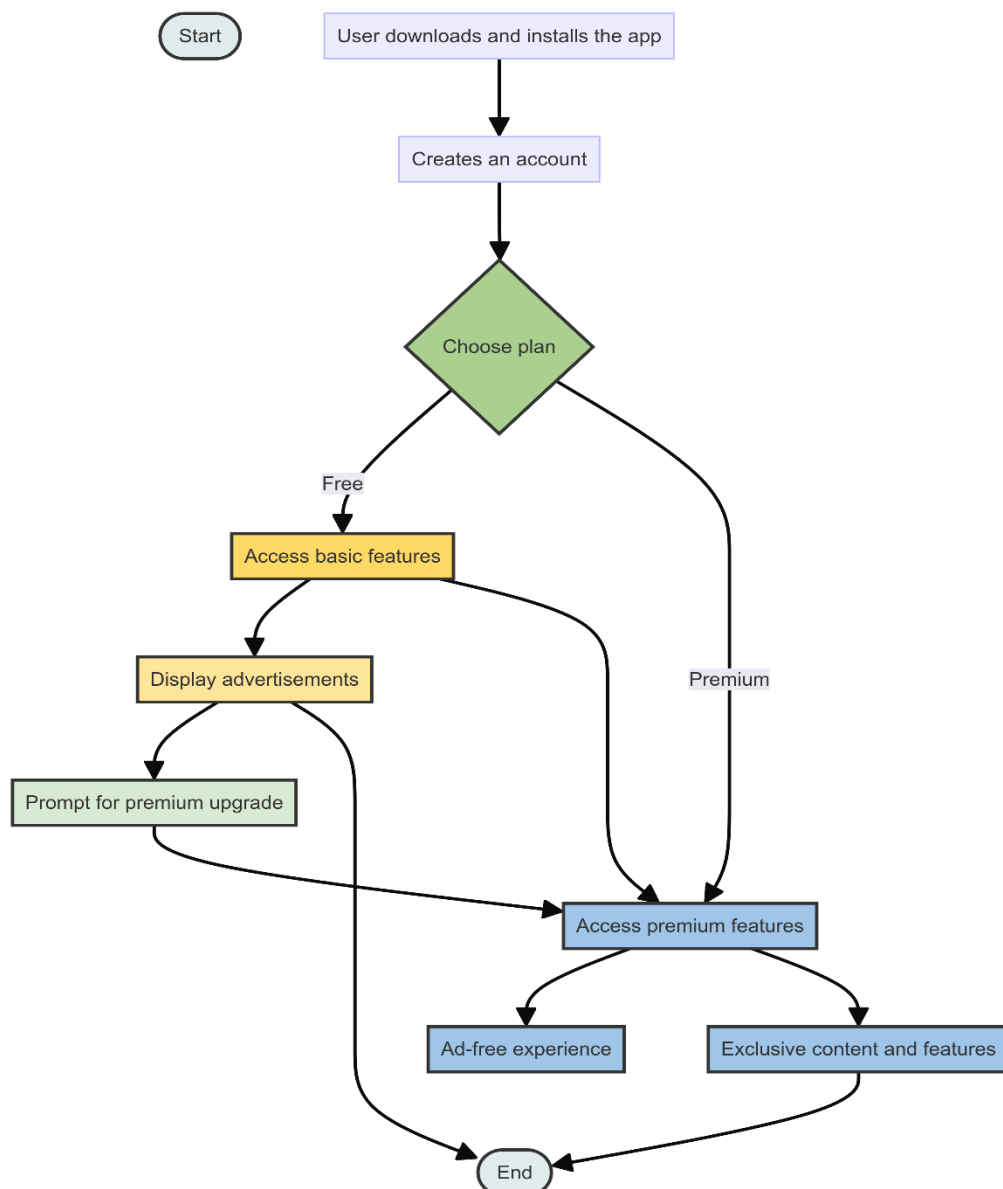
Key Features of the Free Tier:

1. **Basic Meal Planning:**

   - Users can access a simple meal planning tool that suggests meals based on general dietary preferences (e.g., vegetarian, low-carb).

   - The tool includes a basic database of common foods with nutritional information.

2. **Calorie and Macronutrient Tracking:**

   - Users can track their daily intake of calories, proteins, fats, and carbohydrates.

   - A simple dashboard displays progress toward daily goals, providing visual feedback.

3. **Nutritional Information:**

   - The app provides nutritional information for a wide range of foods, helping users make informed choices.

   - Basic tips and guidelines for healthy eating are available, tailored to general dietary needs.

4. **Advertisements:**

   - The free version includes ads, which are non-intrusive and strategically placed within the app to ensure they do not disrupt the user experience. These ads generate revenue and help support the free services.

Premium Subscription Features:

1. **Advanced Meal Planning and Customization:**

   - Users can access personalized meal plans tailored to their specific dietary goals, such as weight loss, muscle gain, or managing a medical condition.

   - The app can accommodate complex dietary restrictions (e.g., gluten-free, vegan, diabetic-friendly) and preferences.

2. **Enhanced Nutritional Analysis:**

   - Detailed breakdowns of micronutrients (vitamins, minerals) and other dietary components (fiber, sugar, etc.).

   - Recommendations for optimizing nutrient intake based on individual health profiles and goals.

3. **Ad-Free Experience:**

↓ Premium users enjoy an ad-free experience, providing a more streamlined and immersive user interface.

4. **Exclusive Content and Resources:**

    ↓ Access to a wider range of recipes, including those curated by nutritionists and chefs.

    ↓ Educational articles, videos, and webinars on topics such as nutrition, wellness, and fitness.

5. **Progress Tracking and Analytics:**

    ↓ Advanced tools for tracking progress over time, including weight changes, body measurements, and fitness levels.

    ↓ Insights and analytics to help users understand trends and make adjustments to their plans.

User Engagement and Conversion Strategies:

1. **Free Trials:**

    ↓ Offering a free trial period for premium features to let users experience the full range of capabilities.

    ↓ Trials can be time-limited or offer access to specific premium features.

2. **Personalized Recommendations:**

    ↓ Using machine learning algorithms, the app can suggest personalized content and features that align with users' interests and goals, encouraging them to upgrade.

3. **Limited-Time Offers and Discounts:**

    ↓ Offering promotions and discounts for premium subscriptions, especially during sign-up or seasonal campaigns.

4. **Gamification:**

    ↓ Introducing gamification elements, such as challenges, badges, and rewards, to engage users and motivate them to explore premium features.

In-App Purchases

Overview: In-app purchases (IAP) provide users with the option to buy additional services, features, and content directly within the app. This model allows for a highly customizable wexperience, where users can pay for exactly what they need.
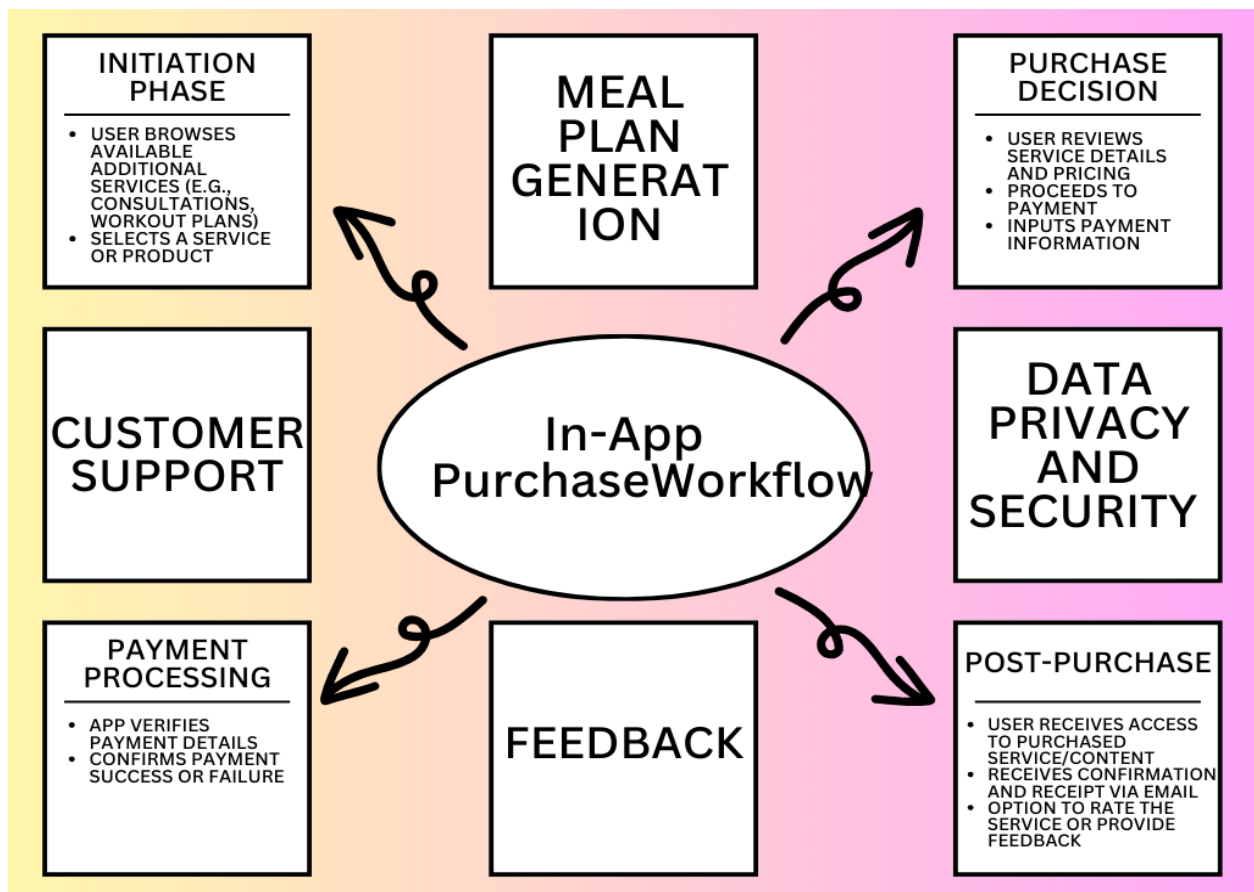
Types of In-App Purchases:

1. **Personalized Nutrition Consultations:**

   - Users can book one-on-one sessions with certified nutritionists for personalized advice and guidance.

   - These consultations can be conducted via video call or chat, offering convenience and flexibility.

2. **Customized Workout Plans:**

   - Tailored workout plans designed to complement users' dietary plans and fitness goals.

   - Plans may vary in intensity and focus, catering to different fitness levels and preferences.

3. **Specialized Diet Plans:**

   - Access to specific diet plans, such as ketogenic, intermittent fasting, or plant-based diets.

   - These plans include detailed meal suggestions, shopping lists, and preparation tips.

4. **Access to Exclusive Content:**

- Purchase access to exclusive recipes, cooking tutorials, and health tips.
- Premium video content, such as cooking classes or fitness tutorials, led by experts.

5. **Seasonal and Thematic Offerings:**

- Special packages or features released during specific times, such as holiday meal plans or summer fitness challenges.
- Limited-time offers to encourage spontaneous purchases and engagement.
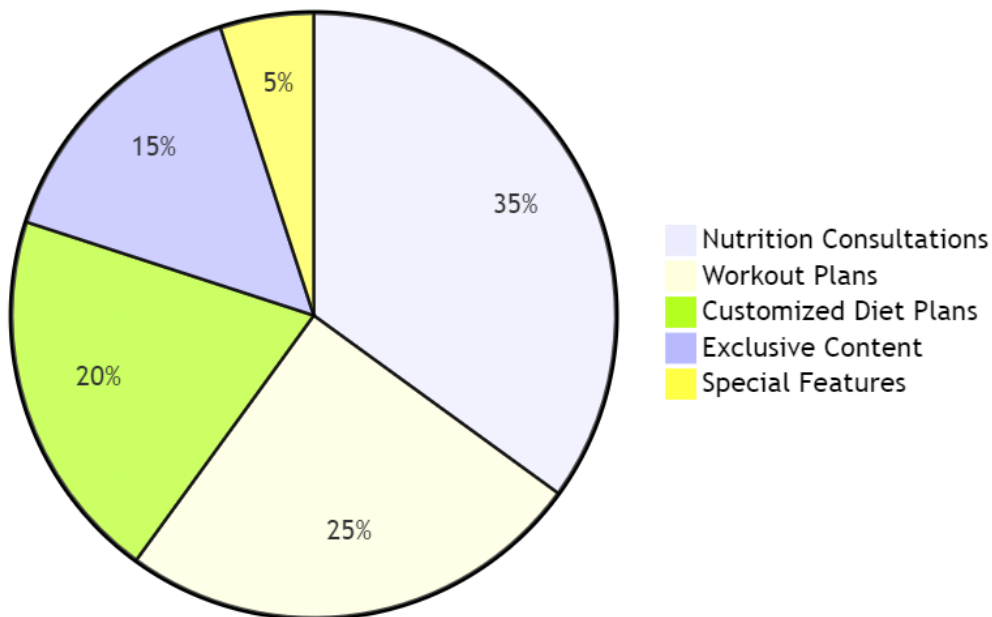
Revenue Maximization Strategies:

1. **Bundling and Package Deals:**

- Offering bundled packages that combine multiple services at a discounted rate (e.g., a package that includes a meal plan, workout plan, and consultation).

2. **Subscription-Based In-App Purchases:**

- Some in-app purchases, such as specialized diet plans, can be offered as subscription services, providing continuous updates and new content.

In-App Purchases Distribution

Legend:
- Nutrition Consultations — 35%
- Workout Plans — 25%
- Customized Diet Plans — 20%
- Exclusive Content — 15%
- Special Features — 5%

Subscription Model

The Subscription Model in the Smart Nutritional Planner app provides a comprehensive suite of features designed to offer personalized and enhanced user experiences. The model is structured to cater to a diverse range of user needs and preferences, ensuring value at different price points.

Key Components:

1. **Personalized Nutrition Plan:**

   - **Customized Diet Plans:** Tailored meal plans based on individual dietary preferences, health goals, and restrictions (e.g., vegan, keto, gluten-free).

   - **Nutritional Goals Tracking:** Tools to set and monitor goals, such as weight loss, muscle gain, or maintenance.

   - **Progress Reports:** Detailed reports on dietary intake, nutritional balance, and goal progress.

2. **Fitness Recommendations:**

   - **Personalized Workout Plans:** Exercise routines designed according to fitness levels, goals, and available equipment.

   - **Integration with Fitness Devices:** Syncing with wearables and fitness apps for real-time activity tracking.

   - **Performance Analytics:** Insights into workout efficiency, calorie expenditure, and progress tracking.

3. **Exclusive Access:**

   - **Premium Content:** Access to a vast library of advanced recipes, cooking tips, and wellness articles.

   - **Workshops and Webinars:** Participation in live sessions with experts on topics like nutrition, fitness, and mental wellness.

   - **Special Features:** Early access to new app features and beta releases.

4. **Direct Consultation:**

   - **One-on-One Sessions:** Personalized consultations with certified nutritionists and fitness experts.

   - **Customized Recommendations:** Expert advice on diet modifications, supplementation, and lifestyle changes.

   - **Follow-Up and Support:** Continuous support and follow-ups to adjust plans and provide motivation.
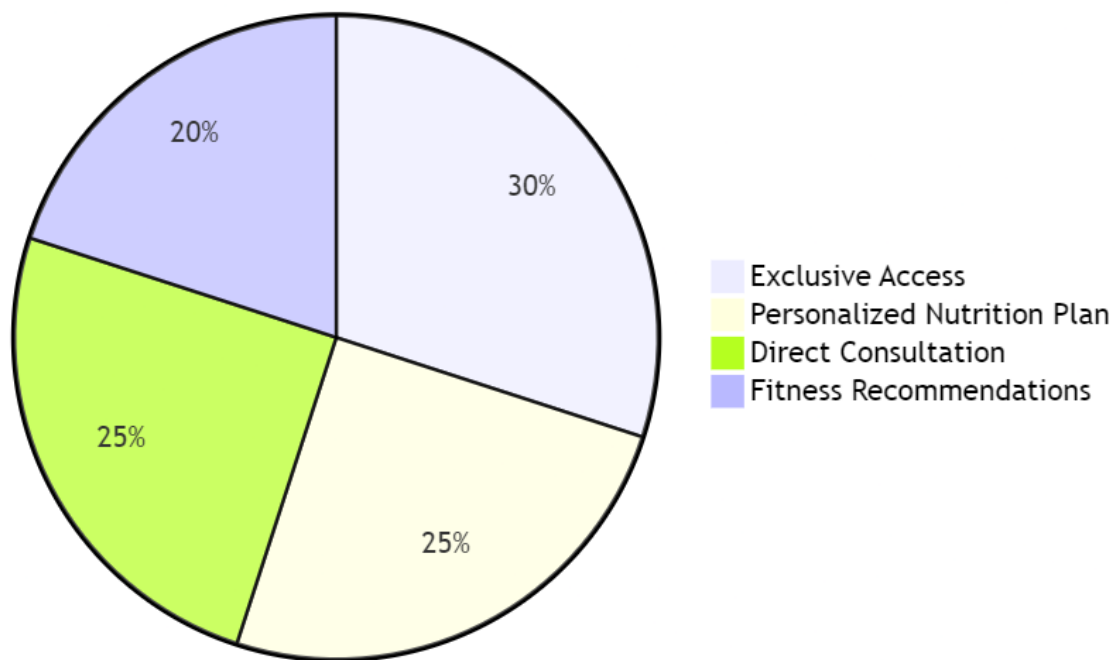
5. **Subscription Tiers:**

   - **Monthly Subscription:** Flexible option for users who prefer a shorter commitment. Offers the same features as the yearly plan but at a slightly higher cost per month.

   - **Yearly Subscription:** Offers a cost-effective solution for long-term users, with a discount compared to the monthly rate.

User Benefits:

- **Comprehensive Support:** From diet planning to fitness tracking, users receive holistic guidance.

- **Motivation and Accountability:** Regular updates and consultations keep users motivated.

- **Convenience:** Access to all features and expert advice in one platform.

Subscription Model Features

- Exclusive Access — 30%
- Personalized Nutrition Plan — 25%
- Direct Consultation — 25%
- Fitness Recommendations — 20%

Partnerships

The Partnerships component of the Smart Nutritional Planner app aims to create a holistic wellness ecosystem by collaborating with various external entities. These partnerships enhance the value proposition of the app by providing users with additional resources and benefits.

Key Partnerships:

1. **Fitness Centers:**

   - **Discounted Memberships:** App users can avail discounts or exclusive offers at partnered fitness centers.

   - **Exclusive Classes:** Access to specialized classes (e.g., yoga, pilates, strength training) curated for app users.

   - **Fitness Events:** Invitations to fitness events, challenges, and competitions.

2. **Coaches and Trainers:**

   - **Personal Training Sessions:** Booking sessions with certified trainers through the app, either online or in-person.

   - **Customized Training Programs:** Tailored exercise plans provided by professional coaches.

   - **Fitness Challenges:** Participation in app-based challenges designed by expert trainers, fostering community engagement and motivation.

3. **Expert Nutritionists:**

   - **Diet Consultations:** Personalized dietary advice and meal planning services.

   - **Nutritional Webinars:** Educational sessions on various nutrition-related topics, open exclusively to app users.

   - **Special Diet Programs:** Access to specialized diet programs (e.g., detox, weight loss, muscle gain) created by renowned nutritionists.

4. **Wellness Brands and Products:**

   - **Product Discounts:** Special offers on health supplements, fitness equipment, and wellness products.

   - **Product Recommendations:** Expert-curated product recommendations integrated into the app, enhancing the user experience.

   - **Collaborative Content:** Co-branded content, such as health articles, videos, and recipes, promoting holistic wellness.

Benefits for Users:

- **Diverse Resources:** Access to a wide range of wellness services and products.

- **Exclusive Offers:** Cost savings through discounts and special deals.

- **Enhanced Experience:** Comprehensive support from fitness to nutrition, all in one app.

Benefits for Partners:

- **Increased Visibility:** Exposure to a targeted audience of health-conscious users.

- **Customer Engagement:** Direct interaction with potential customers through the app platform.

- **Revenue Opportunities:** Opportunities for cross-promotion and upselling of services and products.

Partnerships Contribution

Fitness Centers — 40%
Coaches and Trainers — 35%
Nutritionists — 25%
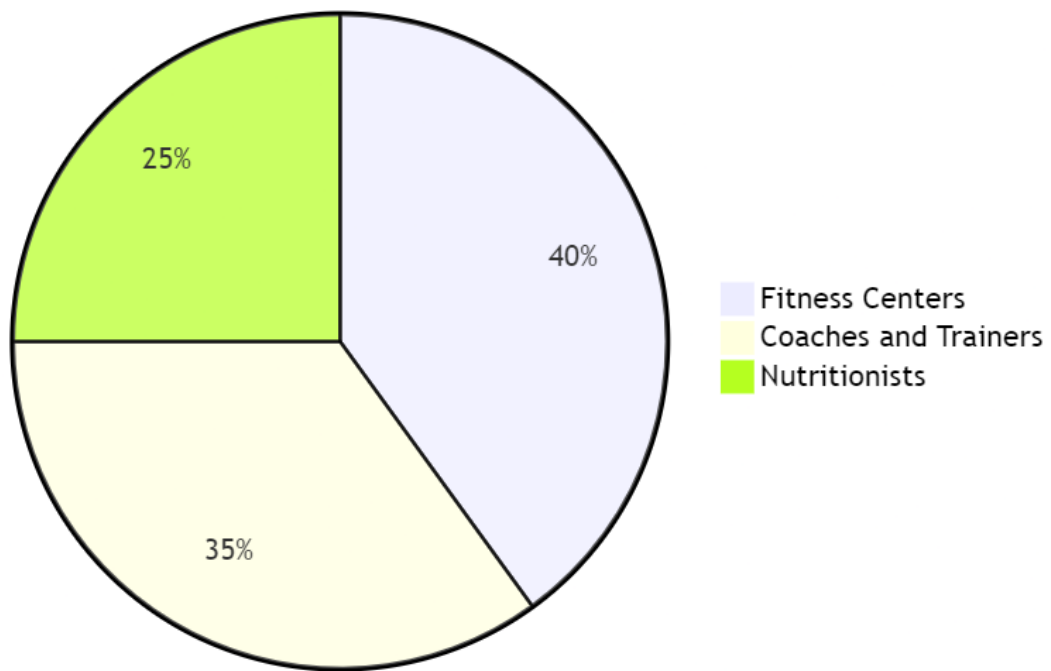
Data Analysis For the Smart Nutritional Planner

Biplab Bijoy Mahato

Data Information:

Collected from https://www.kaggle.com/datasets/thedevastator/healthy-diet-recipes-a-comprehensive-dataset

	Diet_type	Recipe_name	Cuisine_type	Protein(g)	Carbs(g)	Fat(g)
0	paleo	Bone Broth From 'Nom Nom Paleo'	american	5.22	1.29	3.20
1	paleo	Paleo Effect Asian-Glazed Pork Sides, A Sweet ...	south east asian	181.55	28.62	146.14
2	paleo	Paleo Pumpkin Pie	american	30.91	302.59	96.76
3	paleo	Strawberry Guacamole recipes	mexican	9.62	75.78	59.89
4	paleo	Asian Cauliflower Fried "Rice" From 'Nom Nom P...	chinese	39.84	54.08	71.55

```
Diet_type
dash              1726
mediterranean     1705
vegan             1508
keto              1496
paleo             1258
Name: count, dtype: int64
```

```
Cuisine_type
american          2870
mediterranean     1700
italian            791
french             593
world              254
british            238
mexican            223
nordic             149
south east asian   147
south american     136
asian              125
chinese            120
indian              92
middle eastern      91
eastern europe      55
japanese            50
central europe      34
caribbean           18
kosher               7
Name: count, dtype: int64
```

Visualization for flowcharts for methodology

Market/Customer/Business Need Assessment:

1.Growing Health Consciousness:

- The increasing awareness of health and wellness has led to a rise in demand for specialized diets such as Paleo, Keto, Vegan, Mediterranean, and Dash.

2.**Nutritional Information Transparency**:

- Customers want clear and detailed nutritional information to make informed choices about their diet. The dataset provides macronutrient details (protein, carbs, fats), which can help customers select recipes that align with their dietary needs and goals.

3.**Variety and Taste**:

- Consumers do not want to sacrifice taste for health. There is a need for diverse and flavourful recipes that cater to different dietary preferences while ensuring nutritional benefits. The data highlights a wide range of cuisines (American, South East Asian, Mexican, Chinese), offering plenty of options to satisfy varied taste preferences.

4.**Targeted Marketing**:

- Understanding the dietary preferences and nutritional needs of different customer segments allows businesses to create targeted marketing campaigns. Highlighting specific benefits, such as high-protein recipes for muscle gain or low-carb options for weight management, can attract and retain customers.

5.**Partnership and Collaboration**:

- Businesses can collaborate with nutritionists, dietitians, and fitness experts to create and promote diet-specific meal plans and products. This can enhance credibility and trust among health-conscious consumers.

Target Specifications and Characterization:

High-Protein Recipes

- **Characterization**: Recipes with a focus on muscle gain and satiety, such as "Turkey Soup" and "Homemade Turkey Alphabet Soup," characterized by high protein content (30-50g per serving), moderate to low carbs, and varying fat levels based on diet type.
- **Target Audience**: Athletes, bodybuilders, and individuals looking to increase muscle mass or maintain a high-protein diet for satiety and weight management.

High-Carbohydrate Recipes

- **Characterization**: Energy-boosting recipes like "Strawberry Kiwi Daiquiri Cupcakes" and "Baked Banana Chip Encrusted French Toast," with high carbohydrate content (100-200g per serving), moderate protein, and varying fat levels.
- **Target Audience**: Individuals needing quick energy boosts, such as athletes, active professionals, and those with high-energy demands.

Low-Carb Recipes

- **Characterization**: Recipes designed for weight loss and blood sugar management, such as "Low Carb Beef and Cheddar Cauliflower Bake," characterized by low carbohydrate content (under 20g per serving), high protein, and high fat content.
- **Target Audience**: People following Keto or low-carb diets for weight loss, diabetes management, or overall health improvement.

Balanced Nutrient Recipes

- **Characterization**: Well-rounded recipes like "Orange and Five-Spice Roasted Chicken Legs" that offer a balance of macronutrients (protein, carbs, fats) and are rich in micronutrients.
- **Target Audience**: General population seeking a balanced diet for overall health and wellness, including families and individuals without specific dietary restrictions.

Word Cloud Analysis:

The word cloud provides a visual representation of the most frequently mentioned words in the dataset related to recipes, diet types, and cuisine types. Here are some conclusions we can draw:

1. **Popular Diet Types**:
   o **Keto** and **Paleo** diets are prominently featured, indicating a significant number of recipes categorized under these diet types.
   o **Vegan** and **Mediterranean** diets are also frequently mentioned, suggesting they are popular among the recipe data.
2. **Common Ingredients and Food Terms**:
   o **Soup**, **oil**, **stuff**, and **preserve** are some of the most frequently mentioned terms, indicating common ingredients or preparation methods.
   o Other frequently mentioned ingredients include **grape**, **herb**, **eggplant**, **zucchini**, and **salmon**. These ingredients might be commonly used across various recipes.

Top 3 Highest Fat Recipe:

Conclusions:

- **Paleo and Keto Diets**: Feature prominently in high-fat recipes, aligning with their dietary principles of higher fat intake.
- **Vegan Diet**: Can also include high-fat recipes, mainly from plant-based sources like seeds and legumes.
- **Mediterranean Diet**: Incorporates healthy fats from sources like olive oil and fish, maintaining a balanced approach.
- **DASH Diet**: Even though it's focused on low-fat, heart-healthy recipes, there are still options with higher fat content, usually from healthy fats.

Top 3 Highest Protein Recipe:

Top 3 highest Protein Recipe Name
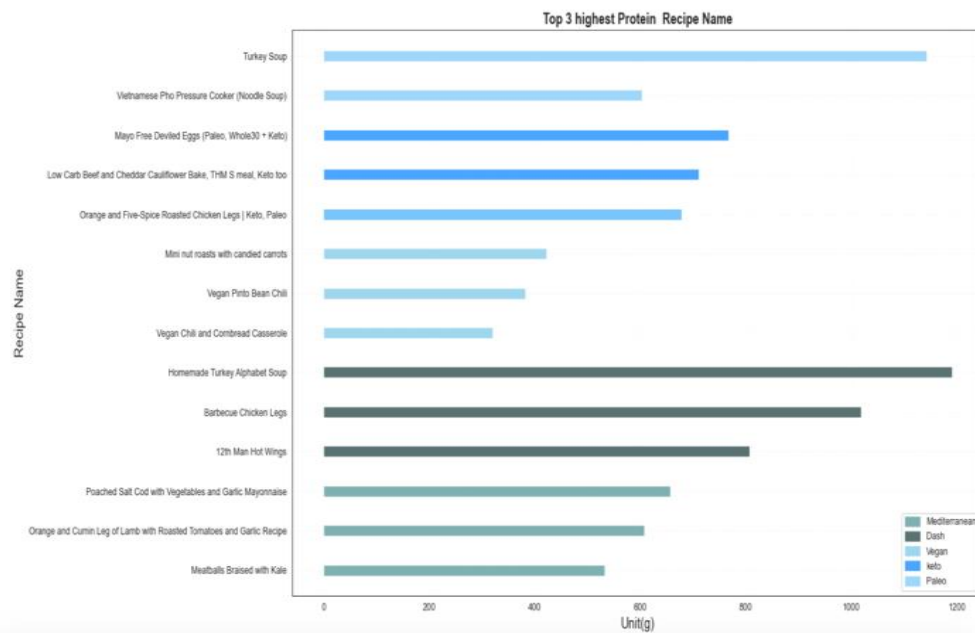
Conclusion:

The highest protein recipe is "Turkey Soup" under the Mediterranean diet. Recipes such as "Vietnamese Pho Pressure Cooker (Noodle Soup)" and "Mayo Free Devilled Eggs (Paleo, Whole30 + Keto)" are also high in protein but fall under the Keto and Paleo diets respectively.

Recommendations:

1. **For High-Protein Diet Seekers**:
   - Consider recipes such as "Vietnamese Pho Pressure Cooker (Noodle Soup)" and "Mayo Free Devilled Eggs." These diets often prioritize low-carb and high-protein meals, making them suitable for those looking to build muscle or lose weight.
2. **Balanced Diet Enthusiasts**:
   - While vegan options like "Vegan Pinto Bean Chili" and "Vegan Chili and Cornbread Casserole" have moderate protein levels.
3. **Health and Wellness**:
   - Mediterranean diet recipes are renowned for their heart-healthy benefits, thanks to the inclusion of healthy fats, lean proteins, and abundant vegetables. Recipes like "Turkey Soup" are beneficial for maintaining cardiovascular health.

Low-carb recipes from the Keto diet, such as "Orange and Five-Spice Roasted Chicken Legs," can help in managing blood sugar levels effectively

Top 3 Highest carbohydrate Recipe:

Top 3 highest carbohydrates Recipe Name
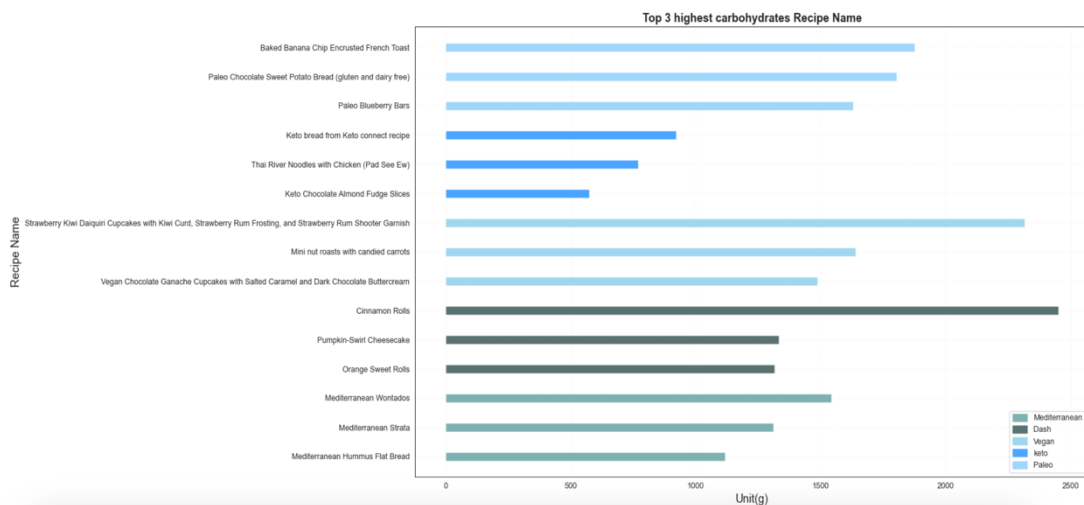
Observation:

The highest carbohydrate content is in "Strawberry Kiwi Daiquiri Cupcakes with Kiwi Curd, Strawberry Rum Frosting, and Strawberry Rum Shooter Garnish" and "Baked Banana Chip Encrusted French Toast," both of which are under the Paleo and Keto diets respectively.

Vegan and Mediterranean diets also feature recipes with substantial carbohydrate content, such as "Vegan Chocolate Ganache Cupcakes with Salted Caramel and Dark Chocolate Buttercream" and "Cinnamon Rolls."

Conclusion from Data Analysis and Market Segmentation:

A balanced diet that aligns with individual health goals should focus on moderation, variety, and the right mix of macronutrients:

1. **Macronutrient Balance**:
   - **Protein**: Aim for 20-30% of daily calories, focusing on lean sources like poultry, fish, beans, and legumes.
   - **Carbohydrates**: Comprise 45-65% of daily intake, prioritizing complex carbs from whole grains, vegetables, and fruits.
   - **Fats**: Keep fats at 20-35% of daily calories, with an emphasis on healthy unsaturated fats from sources like olive oil, nuts, and avocados.
2. **Diet Type Considerations**:
   - **Dash and Mediterranean diets** are well-rounded and support heart health, making them excellent choices for overall well-being.
   - **Vegan diets** can be healthy but require careful planning to ensure adequate protein, Vitamin B12, iron, and omega-3 intake.
3. **Moderation and Variety**:
   - Avoid extreme diets that overly restrict or emphasize one nutrient, as this can lead to imbalances. A diverse diet incorporating foods from all groups supports long-term health.

SMART NUTRITIONAL PLANNER
MARKET SEGMENTATION

Gopika R. Nambiar

Data set:


```
In [2]: data=pd.read_csv(r"C:\Users\gopik\Downloads\nutrition_dataset.csv")
        data
```

	Age	Gender	Height	Weight	Activity Level	Fitness Goal	Dietary Preference	Daily Calorie Target	Protein	Carbohydrates	Fat	Breakfast Suggestion	Lunch Suggestion	Dinner Suggestion	Snack Suggestion
0	25	Male	180	80	Moderately Active	Weight Loss	Omnivore	2000	120	250	60	Oatmeal with berries and nuts	Grilled chicken salad with mixed greens	Salmon with roasted vegetables	Greek yogurt with fruit
1	32	Female	165	65	Lightly Active	Weight Loss	Vegetarian	1600	80	200	40	Tofu scramble with veggies	Lentil soup with whole wheat bread	Vegetable stir-fry with brown rice	Apple with almond butter
2	48	Male	175	95	Sedentary	Maintenance	Vegan	2200	100	300	65	Tofu and veggie breakfast burrito	Black bean burger on a whole wheat bun	Lentil and vegetable curry	Trail mix
3	55	Female	160	70	Very Active	Weight Loss	Omnivore	2500	140	350	80	Greek yogurt with granola and fruit	Chicken and vegetable stir-fry	Turkey chili with brown rice	Banana with peanut butter
4	62	Male	170	85	Sedentary	Maintenance	Vegetarian	2000	80	250	55	Scrambled eggs with whole wheat toast and avocado	Quinoa salad with chickpeas and vegetables	Vegetarian chili with cornbread	Fruit and nut mix

Changing the data type:


```
In [8]: data['Age'] = pd.to_numeric(data['Age'], errors='coerce')
        data['Height'] = pd.to_numeric(data['Height'], errors='coerce')
        data['Weight'] = pd.to_numeric(data['Weight'], errors='coerce')
        data['Daily Calorie Target'] = pd.to_numeric(data['Daily Calorie Target'], errors='coerce')
        data['Protein'] = pd.to_numeric(data['Protein'], errors='coerce')
        data['Carbohydrates'] = pd.to_numeric(data['Carbohydrates'], errors='coerce')
        data['Fat'] = pd.to_numeric(data['Fat'], errors='coerce')

In [9]: data.dtypes
```

```
Out[9]: Age                     float64
        Gender                   object
        Height                  float64
        Weight                  float64
        Activity Level           object
        Fitness Goal             object
        Dietary Preference       object
        Daily Calorie Target    float64
        Protein                 float64
        Carbohydrates           float64
        Fat                     float64
        Breakfast Suggestion     object
        Lunch Suggestion         object
        Dinner Suggestion        object
        Snack Suggestion         object
        dtype: object
```

Scaling numeric features:


```
# Scaling the numeric features
scaler = StandardScaler()
numeric_columns = ['Age', 'Height', 'Weight', 'Daily Calorie Target', 'Protein', 'Carbohydrates', 'Fat']
data_encoded[numeric_columns] = scaler.fit_transform(data_encoded[numeric_columns])

In [14]: data_encoded
```

	Age	Height	Weight	Daily Calorie Target	Protein	Carbohydrates	Fat	Gender_Gender	Gender_Male	Activity Level_Lightly Active	...	Snack Suggestion_Trail mix with nuts and dried fruit	Suggesti mix w and dri
0	-1.071013	0.760904	0.252959	-0.258514	0.270068	0.072219	-0.083238	False	True	False	...	False	
1	-0.608539	-0.789124	-0.769002	-1.089094	-0.813469	-0.691373	-1.320833	False	False	True	...	False	
2	0.448544	0.244228	1.274921	0.156776	-0.271700	0.835811	0.226110	False	True	False	...	False	
3	0.911018	-1.305800	-0.428348	0.779711	0.811837	1.599404	1.154157	False	False	False	...	False	
4	1.373492	-0.272448	0.593613	-0.258514	-0.813469	0.072219	-0.392587	False	True	False	...	False	
...	...	...	...	...	...	...	...	...	...	...	...	...	
495	-1.467420	1.070910	0.116698	-0.258514	0.270068	-0.691373	-0.701936	False	True	True	...	False	
496	-1.071013	0.760904	0.593613	0.156776	1.082721	0.072219	-0.083238	False	True	False	...	False	
497	-0.608539	-0.789124	-1.109656	-0.258514	0.270068	-0.691373	-0.701936	False	False	True	...	False	
498	0.911018	0.244228	0.934267	-0.673804	0.270068	-0.691373	-0.701936	False	True	False	...	False	
499	1.769898	-1.305800	-0.428348	-1.089094	-0.813469	-0.996810	-1.320833	False	False	False	...	False	

500 rows × 603 columns

Checking null values and removing them:

```
In [17]: data_encoded.isnull().sum()
Out[17]: Age                                                  2
         Height                                               2
         Weight                                               2
         Daily Calorie Target                                 2
         Protein                                              2
                                                             ..
         Snack Suggestion_Yogurt Parfait with Granola         0
         Snack Suggestion_Yogurt parfait with granola         0
         Snack Suggestion_Yogurt with fruit                   0
         Snack Suggestion_Yogurt with fruit and granola       0
         Snack Suggestion_Yogurt with granola                 0
         Length: 603, dtype: int64

In [21]: data_encoded.dropna(inplace=True)

In [22]: data_encoded.isnull().sum()
Out[22]: Age                                                  0
         Height                                               0
         Weight                                               0
         Daily Calorie Target                                 0
         Protein                                              0
                                                             ..
         Snack Suggestion_Yogurt Parfait with Granola         0
         Snack Suggestion_Yogurt parfait with granola         0
         Snack Suggestion_Yogurt with fruit                   0
         Snack Suggestion_Yogurt with fruit and granola       0
         Snack Suggestion_Yogurt with granola                 0
         Length: 603, dtype: int64
```
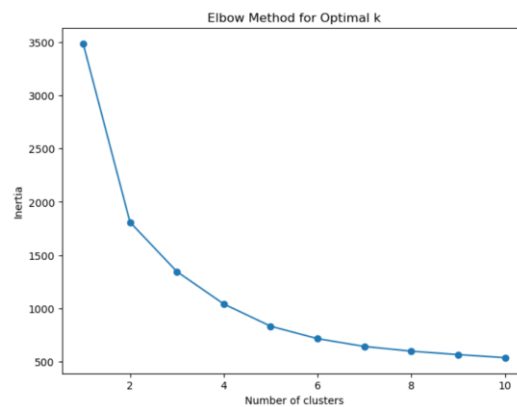
Finding number of clusters using elbow method:

We get number of cluster as 3 by using this method.

Data set used for kmeans clustering:

```
In [31]: features_for_clustering
Out[31]:
```

	Age	Height	Weight	Daily Calorie Target	Protein	Carbohydrates	Fat	Cluster
0	-1.071013	0.760904	0.252959	-0.258514	0.270068	0.072219	-0.083238	2
1	-0.608539	-0.789124	-0.769002	-1.089094	-0.813469	-0.691373	-1.320633	1
2	0.448544	0.244228	1.274921	0.156776	-0.271700	0.835811	0.226110	2
3	0.911018	-1.305800	-0.428348	0.779711	0.811837	1.599404	1.154157	2
4	1.373492	-0.272448	0.593613	-0.258514	-0.813469	0.072219	-0.392587	2
...	...	...	...	...	...	...	...	...
495	-1.467420	1.070910	0.116698	-0.258514	0.270068	-0.691373	-0.701936	2
496	-1.071013	0.760904	0.593613	0.156776	1.082721	0.072219	-0.083238	2
497	-0.608539	-0.789124	-1.109656	-0.258514	0.270068	-0.691373	-0.701936	1
498	0.911018	0.244228	0.934267	-0.673804	0.270068	-0.691373	-0.701936	2
499	1.769898	-1.305800	-0.428348	-1.089094	-0.813469	-0.996810	-1.320633	1

498 rows × 8 columns

Getting the cluster summary:

```
In [41]: cluster_summary
```
Out[41]:

Cluster	Age	Height	Weight	Daily Calorie Target	Protein	Carbohydrates	Fat
0	-0.463449	1.246174	1.113277	1.541076	1.515605	1.484116	1.451374
1	0.250973	-0.876638	-0.782041	-0.862572	-0.817357	-0.825824	-0.814426
2	-0.027709	0.300040	0.266804	0.123464	0.086823	0.113461	0.118583

Principal component analysis:

	PCA1	PCA2	Cluster
0	0.455147	0.492090	2.0
1	-2.061883	0.817467	1.0
2	0.711841	-1.119460	2.0
3	0.915326	0.057101	2.0
4	-0.846540	-1.501733	2.0
...	...	...	...
493	0.026887	0.710478	0.0
494	1.080066	0.369538	1.0
495	-1.104460	1.180521	2.0
496	-0.633798	-1.466878	2.0
497	-2.702632	-1.145004	1.0

498 rows × 3 columns

## Visualizing cluster:

3D t-SNE with KMeans Clustering
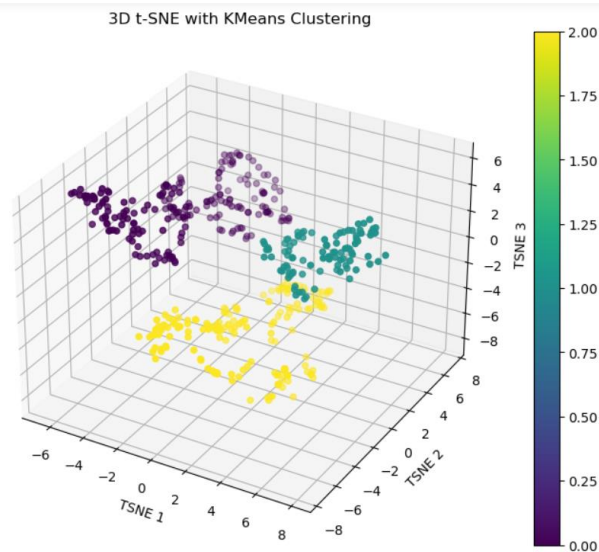
The plot has three axes labelled "t-SNE 1," "t-SNE 2," and "t-SNE 3," indicating that t-Distributed Stochastic Neighbour Embedding (t-SNE) is used for dimensionality reduction. This visualization helps in understanding high-dimensional data by reducing it to three dimensions, making it easier to interpret and analyse clusters.

```
In [67]: explained_variance_ratio
Out[67]: array([0.66204968, 0.15188174, 0.08224247, 0.05524928, 0.02164346])
```

- **PC1:** 66.20% of the variance
- **PC2:** 15.19% of the variance
- **PC3:** 8.22% of the variance
- **PC4:** 5.52% of the variance
- **PC5:** 2.16% of the variance

Interpretation: PC1 captures the majority of the variance in the data, highlighting it as the most significant component. The subsequent components capture less variance but still contribute to the overall data structure.
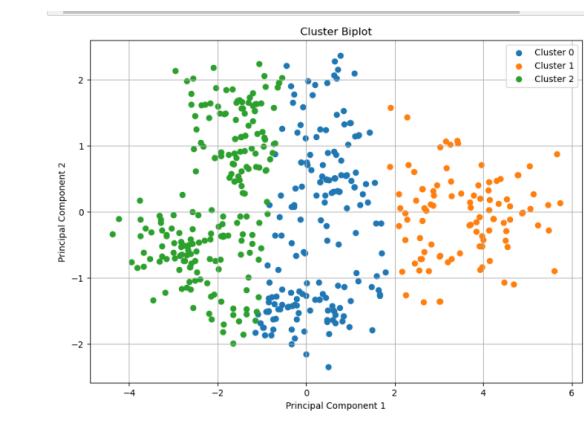
The different colours (green, blue, and orange) represent different clusters identified in the data. Each cluster groups data points that are similar to each other based on the features used in the analysis. Also the overlapping is also lesser indicating that the clusters are correctly separated.

Cluster analysis:

Cluster 0 (High Needs): Users with high values in all features. This cluster likely includes users who require higher caloric intake, protein, carbohydrates, and fat, possibly due to higher activity levels or specific dietary needs. Users with higher nutritional needs. Consider offering high-protein, high-calorie, and nutrient-dense meal plans and recipes. They might be more active or have higher metabolic rates.

Cluster 1 (Low Needs): Users with lower values across most features. This group might have more controlled dietary requirements or lower activity levels, leading to a need for more moderate caloric and nutritional intake. Users with

lower nutritional needs. Focus on balanced, moderate-calorie meal plans with a focus on maintaining a healthy lifestyle without excess intake.

Cluster 2 (Moderate Needs): Users with intermediate values. This cluster represents users who require balanced dietary options with moderate caloric and nutritional needs. Users with balanced needs. Provide well-rounded meal suggestions that cater to moderate nutritional requirements.

Strategic Recommendations

- **Personalized Nutrition Plans:** Tailor meal plans and dietary recommendations based on cluster characteristics to address specific nutritional needs. Develop tailored meal plans based on cluster characteristics. For instance, Cluster 0 might benefit from meal plans focusing on high-protein and calorie-rich options, while Cluster 1 might need calorie-conscious options.

- **Feature Customization:** Adjust app features such as daily calorie targets, meal suggestions, and nutritional tracking based on cluster profiles. Customize app features like daily calorie goals, meal suggestions, and nutritional tracking to match the needs of each cluster.

- **User Engagement:** Enhance user engagement by providing personalized tips and recommendations based on the cluster they belong to, improving the overall user experience and satisfaction.

- **Marketing and Communication:** Target marketing efforts and in-app promotions to address the specific needs of each cluster, improving user satisfaction and app utilization.

Conclusion

The cluster analysis identified three user groups with different nutritional needs: High Needs, Low Needs, and Moderate Needs. By tailoring meal plans and app features to these clusters, we can provide personalized nutrition, enhance user engagement, and improve overall satisfaction.

Data Analysis and Market Segmentation for The Smart Nutritional Planner

Baddula Prabhas

Dataset Name: Food Nutrition Dataset

Overview:

The Comprehensive Nutritional Food Database provides detailed nutritional information for a wide range of food items commonly consumed around the world. This dataset aims to support dietary planning, nutritional analysis, and educational purposes by providing extensive data on the macro and micronutrient content of foods.

Problem Statement

Today, the significance of health has been increased drastically which ultimately resulted in maintaining a good and healthy diet. The lack of personalized, easily accessible, and adaptable nutritional planning tools prevents individuals from achieving and maintaining their health and fitness goals. There is a need for a comprehensive Smart Nutritional Planner that leverages machine learning to provide tailored meal plans, dynamic nutritional advice, and real-time tracking to support diverse dietary requirements and lifestyle constraints. This solution should simplify meal planning, enhance adherence to healthy eating habits, and ultimately improve overall well-being.

```python
import pandas as pd
from sklearn.preprocessing import StandardScaler
# Load your datasets
files = [
'FOOD-DATA-GROUP1.csv'
,
'FOOD-DATA-GROUP2.csv'
,
'FOOD-DATA-GROUP3.csv'
,
'FOOD-DATA-GROUP4.csv'
,
'FOOD-DATA-GROUP5.csv'
]

# Combining datasets
dfs = [pd.read_csv(file) for file in files] combined_df = pd.concat(dfs, ignore_index=True)

# Select relevant columns for clustering (e.g., nutritional data) nutritional_columns =
combined_df.columns[3:-1] nutritional_data = combined_df[nutritional_columns].fillna(0)

# Standardizing the data
scaler = StandardScaler()
scaled_data = scaler.fit_transform(nutritional_data)
from sklearn.cluster import KMeans import matplotlib.pyplot as plt

inertia = []
for n in range(1, 11):
kmeans    =    KMeans(n_clusters=n,    random_state=42)    kmeans.fit(scaled_data)
inertia.append(kmeans.inertia_)

# Ploting the elbow curve
plt.figure(figsize=(8, 6))
```

```
plt.plot(range(1, 11), inertia, marker='o') plt.xlabel('Number of Clusters') plt.ylabel('Inertia')
plt.title('Elbow Method for Optimal Clusters') plt.grid(True)
plt.show()
```

/usr/local/lib/python3.10/dist-packages/sklearn/cluster/

_kmeans.py:1416: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning

```
    super()._check_params_vs_input(X, default_n_init=10)
```

/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:1

41 6: FutureWarning: The default value of `n_init` will change from 10 t

```
# Calculate mean values of each cluster for key nutritional features # Select only numerical columns for mean calculation numerical_columns = combined_df.select_dtypes(include=['number']).columns cluster_means = combined_df[numerical_columns].groupby('Cluster').mean()
```

```
# Display the cluster means for interpretation
print(cluster_means)
```

Saturated Fats \ Cluster

0	310.632143 310.632143	733.989286	41.262500	
	17.959643			
1	522.750000 522.750000	3698.333333	253.525000	
	80.008333			
2	36.000000 36.000000	110.000000	3.500000	
	0.500000			
3	265.828735 265.828735	136.023311	4.649324	
	1.622681			

Monounsaturated Fats Polyunsaturated Fats Carbohydrates Sugars \

Cluster

0	15.690364	8.578571	37.177604
	5.525357		
1	108.483333	39.875000	0.000000
	0.000000		
2	0.000000	0.000000	2.100000
	1.000000		
3	2.000439	1.082569	16.226868
	4.342300		

\

Cluster ...

0	49.883214 ...	178.787821	2.015479	7.627850	144.910000
1	331.825000 ...	196.941667	52.466667	16.075000	284.266667
2	12.000000 ...	0.000000	0.000000	0.000000	0.000000
3	6.723912 ...	34.362711	10.349291	1.003752	18.303212

	Manganese	Phosphorus	Potassium	Selenium	Zinc \ Cluster
0	2.774343	634.920811	1081.800714	20.124764	7.185079
1	44.007083	2712.456667	4754.750000	600.033333	28.608333
2	0.000000	0.000000	0.000000	0.000000	0.000000
3	5.474911	77.953395	174.938669	53.436057	0.678898

	Density	Nutrition Cluster
0		331.556818
1		808.538667
2		62.600000
3		73.022834

[4 rows x 36 columns]

```python
# Assume subscription revenue based on cluster engagement

# Hypothetical: Cluster 0 - Basic Plan, Cluster 1 - Premium Plan, etc. revenue_per_user = [5,
10, 15, 20] # Revenue in dollars per user per month


# Estimate number of users in each cluster (using a sample user base)

user_counts = combined_df['Cluster'].value_counts()

estimated_revenue    =    sum(user_counts[i]    *    revenue_per_user[i]    for    i    in
range(optimal_clusters))


# Print the estimated monthly revenue

print(f"Estimated Monthly Revenue: ${estimated_revenue}")
```

Insights from Data Analysis

The following insights have been derived from the data analysis and market segmentation, directly supporting the goals of The Smart Nutritional Planner:

1.   Market Segmentation and Targeting

●   Insight: Through clustering, we identified distinct groups of food items based on their nutritional content, such as low-calorie, high-nutrient foods or high-protein options.

●   Relevance: These segments allow the platform to customize meal plans and nutritional advice for different user groups, such as those focusing on weight loss, muscle gain, or specific dietary preferences.

2.   Personalized Meal Planning

●   Insight: By categorizing foods into clusters, the platform can recommend foods that align with specific meal plans. For instance, foods from a cluster low in sugar and high in fiber might be recommended for users aiming to manage blood sugar levels.

●   Relevance: This ensures that meal planning is tailored to individual health goals, making the platform more effective in helping users achieve their dietary objectives.

3.   Nutritional Advice and Real-Time Feedback

●   Insight: The analysis enables the platform to offer real-time feedback based on the nutritional clusters a user's current diet falls into. If a user's diet is consistently drawing from a cluster low in essential nutrients, the platform can suggest alternatives.

●   Relevance: Providing dynamic advice helps users make informed decisions about their diet, supporting the platform's goal of enhancing overall health and well-being.

4.   Progress Analytics

●   Insight: By tracking which clusters of foods users consume over time, the platform can offer detailed analytics on their progress toward health goals.

●   Relevance: Progress analytics empower users to understand how their dietary choices are influencing their health, thereby motivating continued engagement with the platform.

5.   Financial Modeling

●   Insight: The clustering analysis informs the financial model by estimating revenue from different user segments. For example, users who opt for highly personalized plans (linked to specific clusters) may be more inclined to subscribe to premium services.

●   Relevance: Understanding the financial potential of different user segments helps in designing a sustainable business model, ensuring the platform's profitability while providing value to users.

6.   Health and Wellness Impact

●   Insight: Clusters reveal which foods are most beneficial for different health goals, enabling the platform to recommend foods that contribute significantly to long-term wellness.

●   Relevance: By promoting the consumption of foods from these beneficial clusters, the platform aligns with its mission to enhance overall health and well-being.

7.   Visualization for User Engagement

●   Insight: Visualizing the relationships between different nutrients in the clusters helps users understand the impact of their dietary choices.

●   Relevance: Engaging visualizations increase user satisfaction and retention by making the platform's recommendations more accessible and understandable.

Estimated Monthly Revenue: $43575

Conclusion from Data Analysis and Market Segmentation :

The data analysis and market segmentation for The Smart Nutritional Planner reveal several key insights that are crucial for the platform's success:

1.   Market Segmentation and Targeting: The identification of distinct food clusters based on nutritional content allows for precise customization of meal plans. This segmentation ensures that users receive tailored recommendations aligned with their health goals, such as weight loss or muscle gain.

2.   Personalized Meal Planning: By aligning food recommendations with specific nutritional clusters, the platform enhances its ability to support diverse dietary preferences and health objectives. This personalization increases the effectiveness of meal planning and user

satisfaction.

3.   Nutritional Advice and Real-Time Feedback: The ability to provide real-time feedback based on nutritional clusters enables dynamic advice that helps users optimize their diet. This feature supports informed decision-making and promotes better dietary habits.

4.   Progress Analytics: Tracking food consumption and progress through different clusters allows users to monitor their journey toward health goals. Detailed analytics motivate

continued engagement and help users understand the impact of their dietary choices.

5.   Financial Modeling: The insights from clustering inform the financial model by estimating potential revenue from various user segments. The premium services linked to highly personalized plans offer significant revenue potential, contributing to the platform's financial sustainability.

6.   Health and Wellness Impact: Recommending foods from beneficial clusters aligns with the platform's mission to enhance long-term wellness. This focus on healthful foods supports users in achieving their wellness goals effectively.

7.   Visualization for User Engagement: Effective visualizations of nutrient relationships within clusters enhance user understanding and engagement. Accessible and understandable recommendations improve user satisfaction and retention.

Financial Outlook

The estimated monthly revenue for The Smart Nutritional Planner is projected to be $43,575. This forecast reflects the potential profitability driven by targeted user segments and premium service offerings, validating the platform's business model and its capacity to provide value to users while ensuring financial viability.

Financial Models for Smart Nutritional Planner

This document outlines financial models for the 'Smart Nutritional Planner' project, considering both linear and exponential market growth scenarios.

1. Linear Market Growth Model

In a linear market growth scenario, the total profit y can be modeled as:

$$y = m \times x(t) + c$$

Where:
- y is the total profit.
- m is the price of the subscription or product offering.
- x(t) represents the total number of users or sales as a function of time (growing linearly over time).
- c represents the fixed costs (production, maintenance, server costs, etc.).

Assuming $x(t) = at + b$, the equation becomes:

$$y = (m \times a)t + (m \times b + c)$$

This equation suggests that the profit increases linearly over time as the user base grows steadily.

2. Exponential Market Growth Model

In an exponentially growing market, the total profit y can be modeled as:

$$y = m \times x_0 \times e^{kt} + c$$

Where:
- y is the total profit.
- m is the price of the product or subscription.
- x_0 is the initial number of users or sales.
- k is the market growth rate.
- t is time.
- c represents fixed costs.

This model indicates that as the market grows exponentially (e.g., through viral adoption), the total profit also grows exponentially.

Example with Hypothetical Values

For a Smart Nutritional Planner:
- Assume the subscription price m = $10 per month.
- Initial user base x_0 = 1000 users.

- Growth rate k = 0.05 (5% per month).
- Fixed costs c = $2000 per month.

Exponential Model:

$$y = 10 \times 1000 \times e^{0.05t} + 2000$$

This equation represents how the profit evolves over time with exponential market growth.

Linear Model:

Assume a = 200 new users per month and b = 1000 initial users.

$$y = (10 \times 200)t + (10 \times 1000 + 2000) = 2000t + 12000$$

This equation represents a steady increase in profit over time with linear market growth.