IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

SmartBite – An Intelligent Web-Based Platform for Food Waste Reduction and Personalized Meal Planning

[1]Nithya B, [2]Nikhitha S A, [3]Malaiarasan S
[1]Student, [2]Student, [3]Assistant Professor,
[1]Department of Computer Science and Engineering,
[1]Francis Xavier Engineering College, Tirunelveli, TamilNadu, India

Abstract : Food loss and dietary planning remain critical global issues affecting both sustainability and public health. This article introduces SmartBite, an online meal planning tool that intelligently suggests recipes based on the ingredients users already have at home. Developed with a frontend using HTML, CSS, and JavaScript and a backend powered by Python Flask, the app ensures a seamless and responsive experience. Users can enter available or leftover items, and SmartBite generates personalized, nutritious meal recommendations. It also offers filtering options by dietary preferences, such as low-carb or vegan choices. The platform aims to encourage healthier eating habits and reduce food waste, showcasing how technology can support sustainable food management at the individual level.

KEYWORDS
SmartBite, Food Waste Reduction, Meal Planning, Python Flask, Web Application, Personalized Diet, HTML, CSS, JavaScript

INTRODUCTION

Millions of tons of safe-to-eat food are wasted every year as a result of overspending, poor planning, or ignorance, making food waste a growing global concern. At the same time, many people struggle to eat a healthy, balanced diet, especially when they are pressed for time, money, or nutrition expertise. By establishing a link between these two elements, technology can encourage more sensible intake and promote wholesome eating practices.

A web-based program called SmartBite aims to address these issues by letting users make meal plans using items they currently have on hand. SmartBite encourages the preparation of home-cooked, well-balanced meals and the prevention of food waste by avoiding an excessive reliance on prepared or prompt food options. In addition to offering the option to select results based on dietary preferences like vegetarian, low-calorie, or high-protein diets, users may input a list of ingredients, and SmartBite will automatically match them with suitable recipes. SmartBite is an interactive and user-friendly interface that is appropriate for both individuals and families. It was developed using HTML, CSS, and JavaScript as the frontend and Python Flask as the backend. A structured database guarantees accurate and timely recipe information retrieval, increasing the platform's scalability and efficiency. All things considered, SmartBite simplifies daily meal selections while promoting sustainable living by improving nutrition and conserving food.

THE STUDY'S NEED

Food loss and a diet deficient in nutrients continue to pose serious threats to public health and global sustainability. In most households, poor meal planning and inefficient use of available ingredients result in needless waste, and consuming diets low in nutrients hastens the emergence of lifestyle diseases. Intelligent solutions that can bridge this gap by offering more intelligent ways to manage food supplies and promote healthier living are becoming more and more necessary. The importance of optimizing food consumption in the home, encouraging individualized and balanced meals, and encouraging conscious consumption makes a platform like SmartBite essential. SmartBite satisfies the urgent need for a workable, user-friendly solution by leveraging technologies like HTML, CSS, and JavaScript for a flexible frontend interface and Python Flask for safe backend processing. Furthermore, adding features like mood-based meal ideas, BMI-based diet advice, and zero-waste recipe preparation highlights the crucial shift to technology-enabled sustainable living and health management.

ALGORITHMS

1. Mood Detection Algorithm Based on Sentiment Analysis

To improve user experience and foster emotional well-being, SmartBite includes a mood-based meal recommendation function. Sentiment analysis technology analyzes users' input—either descriptive text or chosen emotion markers—and categorizes them into such emotions as happy, sad, stressed, or neutral. This categorization is done with simple Natural Language Processing (NLP) techniques. Based on the identified mood, SmartBite recommends meals proven to aid in that specific emotional state, e.g., comfort foods during stress or energizing meals when one is happy.

2. Ingredient-Based Recipe Matching Algorithm

This algorithm aligns user-inputted ingredients with saved recipes in the database. It works by reading through available ingredient input from the user and matching it with the recipe database through pattern-matching and keyword filtering. Recipes that can be prepared entirely or partially using available items are shown as suggestions to avoid wastage of food. This aspect is core to SmartBite's zero-waste mission to ensure that users maximize what they have.

3. K-Means Clustering of User Preferences

The website can employ clustering to divide users into groups based on their interests, lifestyle, and health metrics in order to better customize the user experience. K-Means can categorize users into groups such as "weight-loss monitors," "fitness enthusiasts," or "balanced-diet enthusiasts" and then offer pertinent recommendations based on those groups. The algorithm establishes the foundation for a flexible and intelligent user experience in later SmartBite versions, even if it is not essential to the initial release.

4. Filtering Recipe Suggestions Based on Content

In addition to collaborative filtering, content-based filtering specifically targets user-specific data, such as favorite foods, food allergies, and dietary preferences. SmartBite suggests meals that closely resemble the user's past choices based on these unique features. Without utilizing other people's data, our method ensures that even new users receive highly tailored recommendations.

5. Apriori Algorithm for Association of Ingredients

Foods that are frequently used together can be correlated using the Apriori approach. Recipe collections are analyzed to identify common item sets, such as "tomatoes and basil" or "oats and honey." When users supply easily accessible food items, SmartBite can use this data to recommend complimentary foods, enabling them to prepare satisfying and delectable meals.

6. Rule-Based Approach to Food Safety and Allergy Identification

SmartBite has a rule-based logic system in place to ensure food safety. A preset set of guidelines is used to weed out hazardous recipes as users add allergies or intolerances (such gluten or peanuts). There is a backup system in place to guarantee that the suggested foods are secure, wholesome, and suitable for individual circumstances.

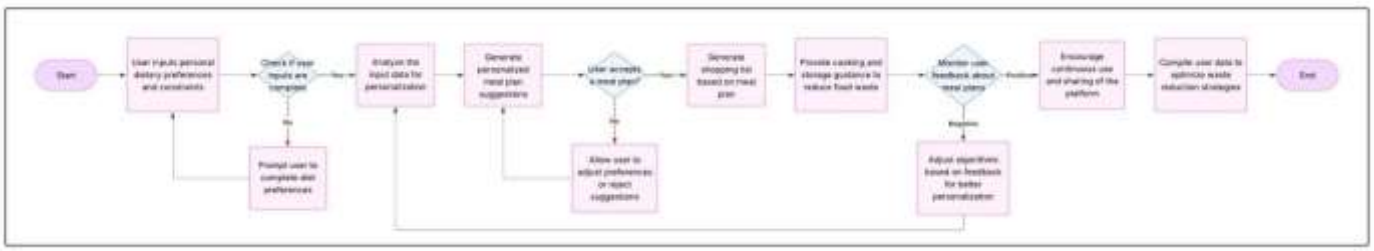

Figure 1: The SmartBite System's Flow Diagram

Figure 1 shows how the SmartBite system is designed, starting with the user entering their health details, mood, or available ingredients to receive personalized meal suggestions and zero-waste recipe ideas.

PROPOSEDSYSTEM

1. Personalized Health Evaluation and BMI Calculation

Using an intuitive and straightforward interface, SmartBite begins by collecting essential user information including height, weight, age, and gender. The user's Body Mass Index (BMI), a crucial health metric that classifies people as underweight, normal, overweight, or obese, is then calculated by the system. Based on the user's health goals, such as weight loss, maintenance, or healthy weight growth, SmartBite suggests appropriate eating habits based on the computed BMI. The tailored recommendations force individuals to follow a nutrition plan that meets their physical needs and, over time, promotes a balanced, healthful lifestyle.

2. Intelligent Interface for Meal Planning

The website offers an interactive meal planning area designed to make eating healthily simple and convenient. The system, which has a Python Flask backend and a front-end built with HTML, CSS, and JavaScript, provides users with dynamic meal suggestions depending on their BMI category and food choices (e.g., vegetarian, gluten-free, keto). Users can enter daily caloric goals, change portion sizes, and select their favorite cuisines. Any user can easily modify the weekly or daily food intake thanks to the meal planner's flexibility, which encourages better adherence to dietary goals and improved nutritional balance.

3. Food Suggestion System Based on Mood

SmartBite has a mood-based food recommendation tool in recognition of the significant correlation between eating habits and emotional well-being. Using a straightforward input mechanism, people can indicate whether they are stressed, tired, anxious, or happy at the moment. SmartBite makes recommendations for scientifically supported foods that have been shown to improve mental health based on the selected emotional state. For example, omega-3 meals to improve mood stability or foods high in magnesium to relieve tension. In addition to personalizing the eating experience, this feature helps consumers maintain their mental health by promoting mindful eating.

4.Zero-Waste Ingredient Manager

One of SmartBite's highlighting features is its sustainability emphasis on its Zero-Waste Food Manager. The users can enter what ingredients they already have on hand at home into the system. SmartBite cleverly searches its embedded recipe bank and recommends meals made with those ingredients on hand. This helps users minimize food waste by making the most of what they have, saving on consumption. Through the encouragement of sustainable cooking practices, the system enables the user to save money, reduce domestic waste, and positively contribute to environmental protection.

5. Integrated Recipe Database and Search Engine

SmartBite links consumers to a rich and varied recipe database, updated regularly to contain a broad selection of meal choices from numerous cuisines. Recipes are accompanied by step-by-step instructions, nutritional analysis, and recommended portion sizes. The integrated search function enables consumers to locate recipes by typing in ingredient names, diet requirements, or meal category (e.g., breakfast, snacks, or dinner). This functionality allows users to never run out of inspiration when preparing healthy and tasty meals specific to their individual requirements and available ingredients.

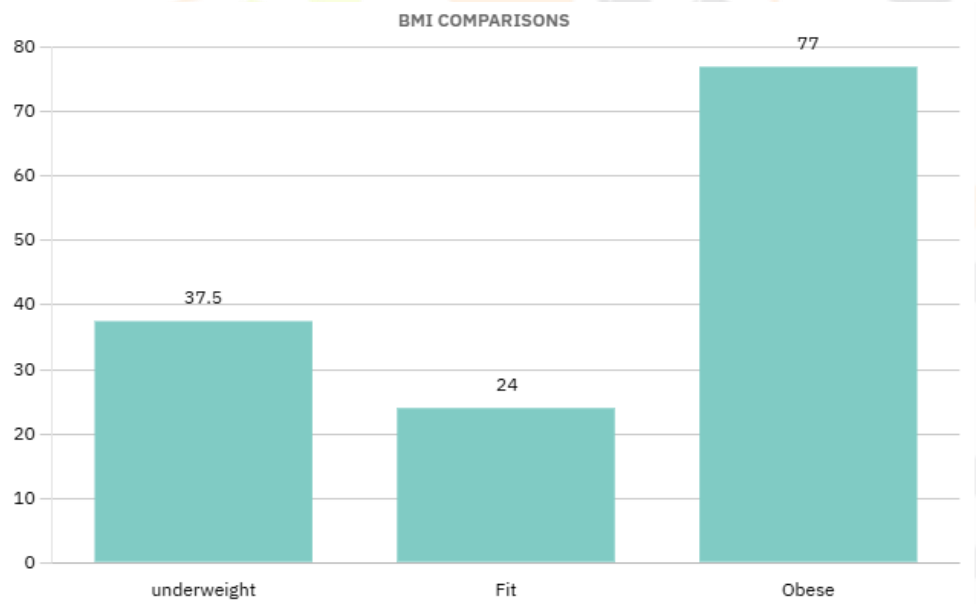

Figure 2: Bar Chart of underweight vs fit vs obese

Figure 2 The bar graph compares BMI categories (underweight, fit, and obese) based on key dietary factors. It highlights the varying nutritional needs and caloric intake for each body type.

6. An easy-to-use analytics dashboard

SmartBite features an analytics dashboard that lets customers track their health gains in order to keep consumers interested and inspired. Important parameters, such as weekly mood-food patterns, calorie trends, and long-term BMI changes, are visually displayed on the dashboard. Users can identify emotional eating tendencies, track adherence to diet plans, and make educated lifestyle adjustments based on graphs and summaries. The dashboard serves as a personal health assistant, offering a comprehensive view of the user's journey towards better health and a sustainable way of living.

7. System Architecture that is Secure and Responsive

With its robust Python Flask backend, SmartBite ensures that all user data is handled in the most secure way possible. The frontend, which was created using HTML, CSS, and JavaScript, offers a smooth and responsive user interface across PCs, tablets, and

smartphones. This enables food management and meal preparation at any time and from any location. Because the system is lightweight, it loads quickly and responds to user input, which improves usability and user satisfaction.

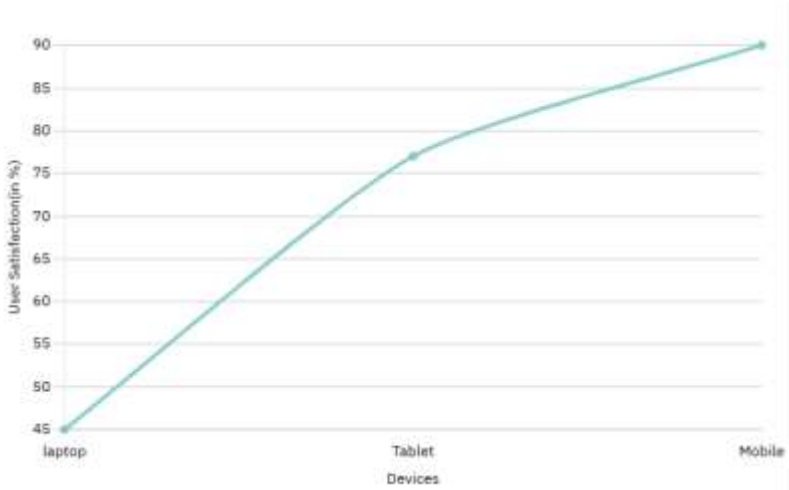

Figure 3: Analytics Dashboard for the User Satisfaction

Figure The line graph displays user satisfaction levels across different devices while using the SmartBite app. It highlights how consistently the app delivers a smooth and responsive experience on PCs, tablets, and smartphones.

RESULTS AND DISCUSSION:

1. Interface of the User Dashboard

The main command center for using the SmartBite platform is the User Dashboard. Users may easily navigate through health data, meal planning, mood-based recommendations, and stored recipes on its straightforward, uncluttered design. Important user information is shown for quick reading, including recent meals viewed, nutritional recommendations, and BMI values. Additionally, users receive personalized alerts about new mental wellness advice, meal updates, and reminders to record their ingredient levels or mood. Users can update their health goals and preferences, as well as track their progress on a daily or weekly basis, thanks to the dashboard's personalization possibilities. Users may interact with the platform, diet management, and food sustainability with ease because to its real-time and interactive design.

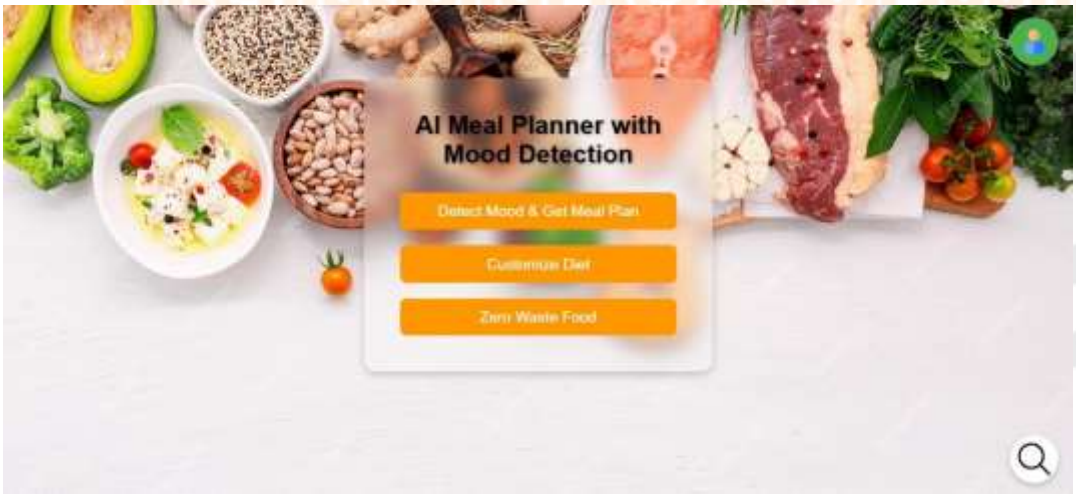

Figure 4:**Get Started Page of SmartBite**

Figure 4 displays the entry screen where users can register or log in to SmartBite, initiating their interaction with the personalized diet and meal planning system.

2 Fill the Smart Pantry with Ingredients

The most crucial element for helping consumers appropriately arrange the ingredients they have on hand is the Smart Pantry. With the help of this feature, consumers can maintain an electronic inventory of the foods they now own. A minimal form can be used to enter data such as ingredient name, category, quantity, and expiration date. Users of all backgrounds can enter data with ease thanks to the "Add Ingredient" feature's user-friendly design. The pantry list is immediately updated when the items are submitted. By ensuring that the available components are used first in meal recommendations, this feature greatly reduces food waste. SmartBite encourages customers to make better use of their resources by simplifying pantry management, guaranteeing sustainable and ethical food usage.

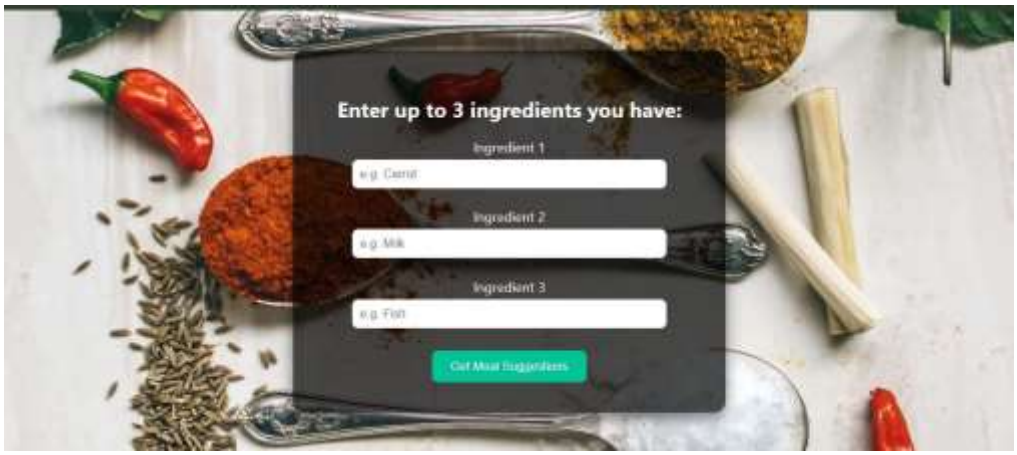

Figure 5:Fill the Smart Pantry with Ingredients Page of SmartBite

Figure 5 The system assists users in discovering recipes that match the ingredients they already have, helping to minimize food waste.

.

3. A Summary of Mood-Based Advice

Additionally, it has a unique feature that allows users to receive meal and food recommendations based on their mood or feelings. It connects them to scientific research that have shown emotional correlations and suggests foods based on those food kinds by recording their feelings, such as anxiety, tension, low energy, happiness, and so on. From there, recommendations for foods or entire meals that promote mental health and wellbeing arise. The dashboard educates the user about eating habits and emotional trends by providing a streamlined history of previous mood logs and associated meal recommendations. Through mindful eating, the user experience is optimized and mental wellness is promoted through the individualized integration of mood and nutrition.

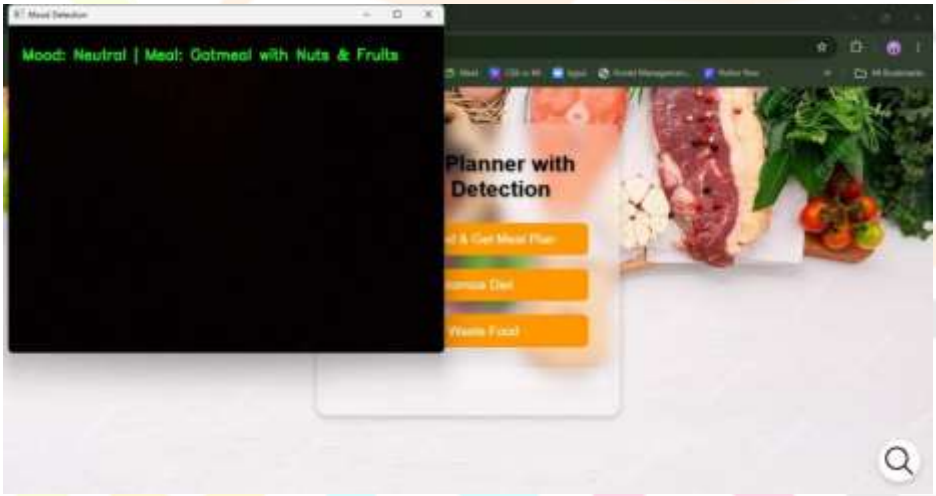

Figure 6: **Summary of Mood-Based Advice in SmartBite**

Figure 6 displays the mood-based recommendation summary, where users can view food suggestions tailored to their current emotions, helping promote better mental well-being through personalized meal choices.

4.Customized Meal Planning

The meal planning area offers a flexible and customized method for creating weekly or daily meal plans. Meals are suggested to users according to their BMI category, food choices (such as vegan, low-carb, or gluten-free), and the items in their pantry. Recipe directions, nutritional components (calories, proteins, lipids, and carbohydrates), and portion sizes are all included in meal suggestions. Users can refine their options based on available ingredients, cooking time, or meal type using a filter and search feature. SmartBite also offers "most popular among users" and "recommended meals" based on aggregate data patterns. Users may quickly locate suitable, healthful, and appealing meals thanks to the comprehensive and user-friendly meal database, which increases their commitment to following a balanced diet.

Figure 7: Customized Meal Planning Page of SmartBite

Figure 7 illustrates the Customized Meal Planning interface, where users can input their health details and dietary goals. The system then generates personalized meal plans, helping users maintain a balanced and healthy lifestyle.

5. Zero-Waste Recipe Finder for Sustainable Dining

SmartBite's Zero-Waste Recipe Finder highlights its strong focus on sustainability. By syncing their Smart Pantry with the app, users allow the system to scan its recipe database and suggest meals that closely match the ingredients they have. Recipes are prioritized based on how many available ingredients they use and the time left before those items expire, helping to minimize food waste. This feature not only promotes sustainable food practices but also inspires users to get creative with their cooking, encouraging exploration of new dishes while reducing their environmental footprint.

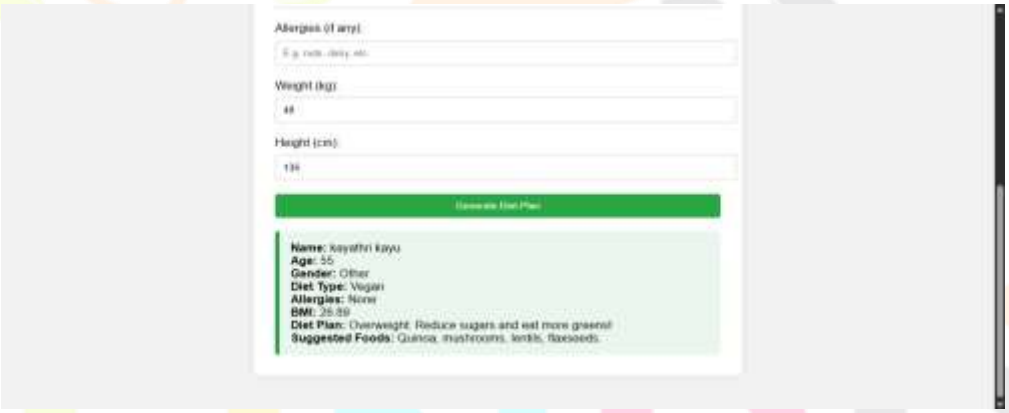

Figure 8: Zero-Waste Recipe Finder for Sustainable Dining

Figure 8 Figure 8 illustrates the Zero-Waste Recipe Finder feature, allowing users to input the ingredients they have on hand. Based on these inputs, the system recommends recipes that prioritize reducing food waste, supporting users in preparing ecofriendly meals with what is already available.

REFERENCE:

[1] Bahirat, Adish Devidas, Bharati Dixit, and Asheesh Dixit. "Diet Consultation Using Artificial Intelligence." Food Sci. Technol 12 (2024): 24-47.

[2] Z. Lei et al., "Mining of Nutritional Ingredients in Food for Disease Analysis," in IEEE Access, vol. 6, pp. 52766-52778, 2018, doi: 10.1109/ACCESS.2018.2866389.

[3] L. Jiang, B. Qiu, X. Liu, C. Huang and K. Lin, "DeepFood: Food Image Analysis and Dietary Assessment via Deep Model," in IEEE Access, vol. 8, pp. 47477-47489, 2020, doi: 10.1109/ACCESS.2020.2973625

[4] J. Sultana, B. M. Ahmed, M. M. Masud, A. K. O. Huq, M. E. Ali and M. Naznin, "A Study on Food Value Estimation From Images: Taxonomies, Datasets, and Techniques," in IEEE Access, vol. 11, pp. 45910-45935, 2023, doi: 10.1109/ACCESS.2023.3274475.

[5] S. Turmchokkasam and K. Chamnongthai, "The Design and Implementation of an Ingredient-Based Food Calorie Estimation System Using Nutrition Knowledge and Fusion of Brightness and Heat Information," in IEEE Access, vol. 6, pp. 46863-46876, 2018, doi: 10.1109/ACCESS.2018.2837046.

[6] S. J. Kim, V. A. Swanson, G. H. Collier, A. R. Rabinowitz, D. K. Zondervan and D. J. Reinkensmeyer, "Using Large-Scale Sensor Data to Test Factors Predictive of Perseverance in Home Movement Rehabilitation: Early Exercise Frequency and Schedule Consistency," in IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 32, pp. 3251-3260, 2024, doi: .1109/TNSRE.2024.3428915.

[7] M. Günder, N. Piatkowski, L. Von Rueden, R. Sifa and C. Bauckhage, "Towards Intelligent Food Waste Prevention: An Approach Using Scalable and Flexible Harvest Schedule Optimization With Evolutionary Algorithms," in IEEE Access, vol. 9, pp. 169044-169055, 2021, doi: 11.1109/ACCESS.2021.3137709

[8] A. Morales-Garzón, J. Gómez-Romero and M. J. Martin-Bautista, "A Word Embedding-Based Method for Unsupervised Adaptation of Cooking Recipes," in IEEE Access, vol. 9, pp. 27389-27404, 2021, doi: 10.1109/ACCESS.2021.3058559. [9] M. Gim, D. Park, M. Spranger, K. Maruyama and J. Kang, "RecipeBowl: A Cooking Recommender for Ingredients and Recipes Using Set Transformer," in IEEE Access, vol. 9, pp. 143623-143633, 2021, doi: 10.1109/ACCESS.2021.3120265. [10] Y. A. Alshehhi, M. Abdelrazek, B. J. Philip and A. Bonti, "Understanding User Perspectives on Data Visualization in mHealth Apps: A Survey Study," in IEEE Access, vol. 11, pp. 84200-84213, 2023, doi: 10.1109/ACCESS.2023.3302325. [11] L. Bastida et al., "Promoting Obesity Prevention and Healthy Habits in Childhood: The OCARIoT Experience," in IEEE Journal of Translational Engineering in Health and Medicine, vol. 11, pp. 261-270, 2023, doi: 10.1109/JTEHM.2023.3261899. [12] H. Shi, W. Gao, Y. Liu, B. Wang and H. Zhao, "An Adaptive Multi-Homogeneous Sensor Weight Calculation Method for Body Sensor Networks," in IEEE Access, vol. 7, pp. 121629-121644, 2019, doi: 10.1109/ACCESS.2019.2936831.

[13] F. S. Konstantakopoulos, E. I. Georga and D. I. Fotiadis, "A Review of Image-Based Food Recognition and Volume Estimation Artificial Intelligence Systems," in IEEE Reviews in Biomedical Engineering, vol. 17, pp. 136-152, 2024, doi: 10.1109/RBME.2023.3283149.

[14] G. A. Santos, G. G. de Andrade, G. R. S. Silva, F. C. M. Duarte, J. P. J. D. Costa and R. T. de Sousa, "A Conversation-Driven Approach for Chatbot Management," in IEEE Access, vol. 10, pp. 8474-8486, 2022, doi: 10.1109/ACCESS.2022.3143323.

.