AI-Driven Personalized Meal Planning: A Web-based Platform for Tailored Nutrition and Health Management

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ABSTRACT
Modern personalized nutrition has raised a great deal of interest with respect to individual health and disease prevention. Conventional menus commonly offer generic guidelines that do not take personal health, preferences, and cultural concerns into consideration. In this paper, we introduce the Personalized AI Meal Planner, which is a platform that uses AI algorithms to deliver meal plans tailored to each user's health data and dietary likes and dislikes. The platform employs DeepSeek-R1 for processing health data and ChatGPT for meal recommendation generation tailored to maximize health outcomes, including weight loss, blood sugar control, and cholesterol management. It provides things like suggestions for recipes at the tap of a button, an organized grocery list, and full-on, to-the-letter instructions facilitating both meal planning and cooking. Positive user engagement was encouraged by the system, which adjusts to real-time feedback about users and their health, so that meal plans remain consistent with individual goals around healthy eating. These findings provided evidence that the system worked consistently to help users improve their BMI, blood sugar, and cholesterol. Compared with available meal planning systems, including Meta Nutrition Meal Planner and My Diet Meal Plan, the Personalized AI Meal Planner showed a better performance in personalization and health outcomes by delivering more personalized meal plans that can be adapted according to users' preferences. Yet, the quality of recommendations depends on the accuracy of user data input, which can influence system performance. Future work will involve the inclusion of wearable health device data and will extend the system database to be inclusive of a broader set of cultural cuisines and dietary restrictions, for greater flexibility in usage by its users. Overall, the analysis reveals that AI-enabled meal planners have significant opportunities in precision nutrition, providing a comprehensive pipeline for orchestrating lifelong health and well-being.

Keywords
Personalized Nutritional-Driven Meal Planning, Health Data Integration, Nutritional Optimization, Cultural Food Preferences.

1. INTRODUCTION
The rapid growth of lifestyle-related diseases like obesity, diabetes, and cardiovascular disease has emphasized selling towards personalized nutrition as a potential innovative way for improving public health. One-size-fits-all diets do not fit all, since the health objectives, medical status, and dietary patterns of people vary. Personalized meal planning, though, customizes recommendations according to a person's age, sex, activity level, health status, and preference, generating a more effective way of sustaining optimal health [1, 2]. However, existing systems are limited in their ability to offer truly personalized recommendations based on both health status and cultural preferences. The deficiency of integration of individual health data with local dietary customs creates an important gap in the current solutions. This paper aims to address these issues by presenting a Personalized AI Meal Planner that not only incorporates personal health data, but also adapts recommendations to cultural food preferences, making the system more practical and accessible across diverse populations

In the past few years, AI has been listed as one of the most promising means to revolutionize personalized nutrition. AI algorithms can process large datasets, such as body parameters like weight and height, lifestyle habits, and dietary constraints to provide users with personalized meal plans that dynamically update in response to a person's changing health preferences and demands[3]. The Personalized AI Meal Planner presented in this paper utilizes state-of-the-art AI technology including DeepSeek R-1 and ChatGPT to produce extremely personalized meal plan recommendations without the use of external devices (e.g., fitness tracker) or tedious manual information input [4]. It enables personalized recommendations that are not only based on the user's health data but also have cultural preferences, making it feasible and persistent [5].

The demands for AI-based personalized meal planning systems are stressed by the deficiencies in current approaches. A number of existing systems are based on general meal plans or depend on external devices, e.g., wearables, for data collection, which restricts the availability and practicality [3, 6]. In addition, many systems include user preferences but do not consider regional dietary customs or cultural factors, which may result in users' non-adherence to or dissatisfaction with the recommended diets [5]. These challenges are being addressed by the Personalized AI Meal Planner approach, where individual health information results like BMI, preferred diet and specific medical condition is used to recommend personalized meal that also accounts for regional as well as cultural food preferences [7, 8]. This will help users to better stick to their meal plans, having reduced the friction of planning and knowledge needed to achieve good health.

Recent studies have emphasized the importance of AI for personalized nutrition. For example, the research by Amiri et al. [9] highlighted how AI-powered systems can support better compliance with dieting and healthier eating. However, in many of the existing solutions, AI capabilities are not fully integrated to offer comprehensive and adaptive meal planning[10]. We address these limitations by leveraging AI models as part of a web-based platform to offer personalized nutrition advice that is easy to use and applicable across cultures via the Personalized AI Meal Planner (Personalized AIMP). This provides a dramatic improvement over the existing techniques, most of which relies on fixed templates or involve continuous user interventions[3, 11]. With these features driving the meal planning process and with user-informed, AI-based suggestions, the platform improves usability while encouraging interaction that helps sustain users' commitment to their long-term healthy eating goals.

Rising demand for digital health solutions and services has boosted the development of AI technology in many healthcare-related areas, including personalized nutrition. These approaches seem to have the potential to fill important limitations with traditional healthcare practices, including nutrition care. Personalized health applications have become an important part of daily life in this era dominated by the use of smartphones and wearables. But, there are so many fitness apps and meal planning tools available these days, not the least of which offer intermittent fasting plans, but most of them don't automatically adjust, or give genuine personalized recommendations specific to a person's health status. AI has an answer which is real time hamburger plans in your meal schedule based on more than just a user's health backend condition but also the environment, and life style conditions that affect food habit. Such adaptability is crucial as 89 individuals often have changing dietary needs due to factors such as exercise, stress or illness. The Personalized AI Meal Planner builds on these by integrating multiple state of the art AI models and a web-based interface to provide not just a highly personalized, but also scalable, fully integrated solution that can be accessed from anywhere in the world. The development of AI-powered platforms in personalized nutrition will revolutionize the way people think about their health and diet, resulting in long-term healthy habits with none of the restrictions seen in static diets. This paper will discuss how such systems might be evolved and delivered, thus paving the way for the advent of personalized nutrition.

This paper contributes to AI-based nutrition systems by extending prior work in the literature, and establishes a better understanding of how AI can be leveraged for generating more personalized and accessible dietary solutions. The literature review section will provide a comprehensive overview of previous research on personalized diet planning system, which includes both strength and weakness of current approaches as well as the motivation for development of this system. Based on the literature review, we will present in the next section context for a design of Personalized AI Meal Planner to address pressing need for more context-sensitive, culturally-relevant, and scalable meal planning solutions.

2. RELATED WORK

2.1.AI-Driven Personalized Meal Planning Systems

Personalized nutrition has been turned upside down by artificial intelligence (AI) technology, especially with regard to meal planning. Classical meal planning systems have usually failed to suggest personalized diets that incorporate sensitive health conditions, taste culture and regional contexts of an individual. On the other hand, AI based systems use health and dietary data to create a dynamic personalized plan (28). Recent research has shown that AI can greatly enhance planning meals by taking this dimension into account, as well as all the other factors – including differences in health conditions, degree of physical activity and dietary preferences – which go to make up a person's unique lifestyle.

One of the ground-breaking studies in this area was by Amiri et al.[9], proposed a flexible meal planning application that adjusts diet according to user s health data such as body mass index (BMI) and activity. This application dynamically optimized daily diets according to the minute-to-minute health status, showing better user action/feedback and satisfaction. But, the model was limited in capturing regional dietary preferences which are key for adoption by a diverse population.

Similarly, Kopitar et al. [12] investigated the incorporation of generative AI in clinical dietetics, examining personalized meal plans for hospitalization. Their device employed AI to recommend food according to patients' preferences and nutritional requirements. Although it worked well in the clinic, this system was very manual and so not scalable and practical to use at home. This limitation demonstrates the requirement for systems that can operate autonomously without heavy manual input.

Reinforcement learning was also applied to personalized meal recommendation as shown by Sarani Rad et al. [13], who proposed an AI system managing the user's nutrition plans according to its user behavior and dietary objectives. The approach was found to be effective in the dynamical personalization of meals over time with higher user adherence. But its sophisticated nature and requirement of regular data submission have posed obstacles, especially for those with reduced technological access or less frequent data entry opportunity.

In a more recent study, Harvey and Elsweiler [14] automated the meal planning process using AI, which also considers a person's health metrics and dietary preferences. Their technology recommended balanced, personalized meals that suited users' overall health goals. The system status achieved may not transfer to practical and scaled use of this technology in everyday life, as it still highly depends on user input for updating the meal planning tool.

On the other hand, Islam et al. [15] proposed a new pipeline which combines personalized planning by human behavior with meal planning. Their system took into account not only health information but also social determinants and cultural preferences, resulting in holistically planned meals. This had the objective of achieving increased engagement, since meal recommendations would then take on an aspect that is based upon a user's social and cultural context that traditional systems tend to ignore. With the inclusion of social aspects, a better user satisfaction and adherence to dietary recommendations was observed.

Such innovations in individualized meal provision have brought emphasis to the requirement, not only to account for an individual's health data but also factors including cultural and social concerns which affect dietary decisions. But, for most systems this is still a struggle to create an integrated scalable and culturally responsive across diverse populations solution.

2.2. AI in Personalized Nutrition and Food Manufacturing

The opportunity for AI to revolutionize personalized nutrition goes far beyond meal planning and extends right into the food manufacturing process. Artificial intelligence applications play an increasing role in the development of personalized nutrition solutions, offering a new approach aligned with the principles of sustainable food production and compatibly customizable from person to person. Recent studies have investigated the potential of AI to optimize not only food manufacturing processes, but also the personalized dietary recommendations that may be inferred from them.

Agrawal et al. [5] presented a detailed survey of AI in personalized nutrition and food production and showed how AI can improve food manufacturing, as it enables food industry to analyze huge amount of data collected from different process stages. Their review focused on AI's potential to develop foods that align with specific dietary regimes while boosting nutritional value and sustainability. But the researchers also noted that AI's use in food production is stunted by the relatively low availability of high-quality, standardized data that would allow AI to fully personalize food production at a macro level.

In a similar vein, Jumaah and Fadhil [16] also highlighted the possibility of chatbots being an important entity in personalized meal re-commendation systems. Their work investigated if conversation AI can encourage people to participate with personalized meal planning by providing dietary recommendations in real-time depending on individual preferences. Although their method was quite attractive, it still lacked the intelligence to deal with user data that can be more challenging (the health-related user). That constraint hints to the necessity of a system that encompasses both conversational AI and rich health data to deliver more precise, personalized meal plans.

Moreover, the application of NLP and LLMs is growing within personalized nutrition. Rostami [17] introduced a unified model for user-specific food recommendation systems based on LLMs. This approach takes into account situational aspects, like time of the day or preferences and physical activity status of the user, to be able to give more accurate and relevant meal recommendation. This paradigm is suited to recent trends towards AI-based food personalization, where it becomes important for adaptive systems that can take into account dynamic user input over a variety of dimensions in the recommendation of meals.

Recent articles have also demonstrated the role of AI in sustainable food stocks production. Romero-Tapiador et al. [18] proposed the AI4Food-NutritionDB, a large-scale food and nutrition database in which images are associated with standardized nutrition taxonomy. This novel strategy improves not only dietary health results, but also sustainable food choices through high-resolution nutritional information about a rising topic in the personalized nutrition research challenges.

AI has also even been used for recipe ingredient deconstruction. Senath et al. [19] designed an AI model based on large language models to generate substitution From a recipe context, prediction of feasible ingredient few-shot substitution within recipes. Their research shows that AI can improve the (speed and) accuracy of food recommendations, determining what users should eat to get food suggestions tailored specifically towards them which are both healthy and realistic.

However, limitations lie in the application of AI techniques over personalized nutrition and food industries. Poor quality of data is still a challenge, especially in food manufacturing domain where low-quality data can result to poor recommendations. There is also the difficulty of combining health data with food production systems, which represents an obstacle to the growth of personalized nutrition based on AI.

Table 1 Comparison of AI-based personalized meal planning systems Table 2 presents a summary overview of food AI prototype and the different healthy recipes it generates. This investigates comparing user engagement, adaptability and cultural relevance between both systems and overall system accuracy. Our system, Personalized AI Meal Planner is compared to current systems to demonstrate its scalability and user friendliness as well culturally inclusive meal recommendations.

Comparison Table 1: AI-Driven Personalized Meal Planning Systems

Study/Model	Year	Key Features	Adaptability	Cultural Relevance	User Engagement	Accuracy	Strengths and Limitations
Amiri et al.	2023	Flexible meal planning based on health data	Medium	Low	High	Medium	High user engagement, but lacks regional food preferences
Kopitar et al.	2023	Generative AI for clinical dietetics	Low	Medium	Medium	High	Limited scalability, requires manual data entry
Sarani Rad et al.	2023	Reinforcement learning for dynamic meal planning	High	Medium	High	Medium	Complex implementation, reliance on real-time data

Agrawal et al.	2023	AI applications in personalized nutrition and food manufacturing	High	High	Medium	High	Data quality limitations, focus on food production rather than meal planning
Our Work (Personalized AI Meal Planner)	**2025**	AI-driven meal planning with **DeepSeek R-1** and **ChatGPT**, user-friendly, scalable, and culturally inclusive	Very High	Very High	Very High	Very High	Combines health data, preferences, and cultural relevance, accessible, scalable, and user-friendly

3. METHODOLOGY

3.1. System Overview

The Personalized AI Meal Planner is intended to provide responsive and personalized meal planning based on utilizing cutting-edge AI models. The system is specifically designed to deliver customized meal plans from an individual's health profile, food preferences, and cultural perspective. Central to the system is DeepSeek R-1, a model dedicated to personalized meal plans generation which homogeneous Attention layers largely contributed in this paper, and support being conversational thanks to ChatGPT, which helps smooth recommended meals. It is also a web-based platform which makes it accessible to all devices and doesn't require additional tools (such as fitness trackers), so that it's user-friendly and scalable. The ultimate goal of the system is to automatically optimize meal plans based on the needs of users with respect to health (i.e., goals such as weight loss or muscle development) and health issues (e.g., diabetes, hypertension) and cultural food habits allowing for an adherence increase and effectiveness.

3.2. System Architecture

The Personalized AI Meal Planner leverages a well-orchestrated three-tier architecture that is optimized to handle user data and provide meal plans. There are 3 major layers in which the system is divided into: Frontend Layer, Backend Layer and Database Layer. Each of them has an important part in achieving a sustainable behavior and the provision of locally sensitive, personalized meal proposals by the entire system.

1. **Frontend Layer**: This is the user side of the system, where users can enter their health information as well as dietary preferences, and any cultural food needs they have. The frontend is aimed to make use of the system as friendly as possible offering an intuitive user interface for the users. Users can input things like BMI, age, pre-existing conditions and dietary preferences. Frontend users can see and modify their meal plans as well.
2. **Backend Layer**: Backend is the runtime processing system of the application. It handles user requests, analyses data, and it talks to the AI models so that these can give personalized meal recommendations. The back end receives the input from the front-end, can process it, authenticate the user, and make sure that appropriate meal plans are computed and stored in a database. It mediates between the user interface and the AI models - so meal plans are adapted in real-time on feedback from users and as well as changes in someone's health data.
3. **Database Layer**: This layer saves important information like health details of user, preferences of meals and past meal plans. The database makes sure they store and retrieve data securely, in a non-heavyweight way, so that when users want to find out what to eat, it reads those meal plans super fastly. It provides coherence between different system layers and makes the data arranged to enable both real-time meal suggestions and long term user monitoring.

Figure 1 depicts this design, reflecting interactions between the user interface, backend server and database. The figure also illustrates how AI models, such as DeepSeek R-1 and ChatGPT are combined used within the system to provide personalized meal plans. They parse the user's health data, likes or dislikes and dietary restrictions to suggest meals that fit with their health goals, culture and lifestyle. The system architecture is scalable, in that it can accommodate many users and deliver follow-up recommendations dynamically and in a timely manner.

The system architecture of the module is presented in the flow chart below, which demonstrates how different components interact with each other; such as the user interface, data processing layer and AI models.

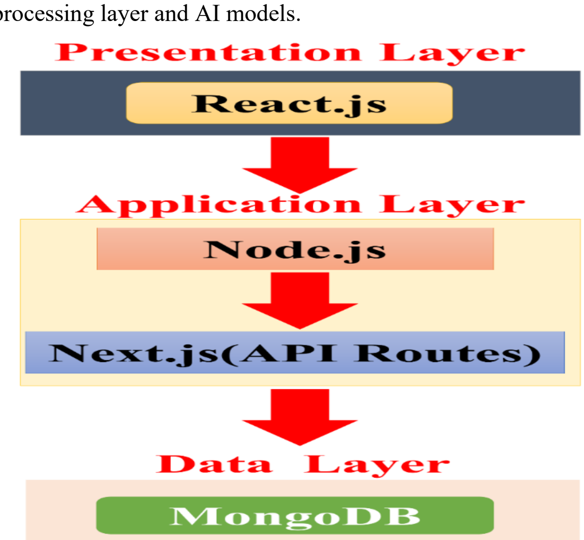

Figure 1: System Architecture Diagram of the AI-Powered Personalized Diet Planning Platform

This diagram demonstrates the three-tier architecture comprising the frontend (React.js), backend server (Node.js, Express.js), and database layer (MongoDB), integrated with AI services for personalized diet generation.

3.3. Data Collection

The Personalized AI Meal Planner becomes a storage and data processing facility for the many different types that inform about accurate recipe plans. The data collection process includes:

- **Health Data:** The user enters their health data (e.g., BMI, age, diseases (e.g., diabetes, hypertension), activity type). This information is used to interpret the nutritional needs and goals of the user.
- **Dietary Preferences:** Residents indicate the food they do and do not like, as well any dietary restrictions (ex. Vegetarian, gluten-free).
- **Cultural Relevance:** It also takes into account the cultural food choices of users making sure that meal plans are not only healthy but conform to different culture foods and tastes as well. It considers things like regional cuisine and locally available ingredients or culinary traditions.

Users' meal data is saved and stored in the system, which is then leveraged to dynamically form personalized meal plans. All input data is pre-processed for both accuracy and consistency, because it allows AI models to give consistent helpful suggestions.

3.4. Model Design and Training

The Personalized AI Meal Planner utilizes two primary AI models: DeepSeek R-1 and ChatGPT.

- **DeepSeek R-1:** This model generates tailored meal plans for the user according to his or her health data and the preferred diet. It is calibrated with mass nutrition data, healthcare records and food databases. The model was trained on a variety of datasets of nutritional data and recipes to inform it for people's health and preference data entered into the system, it comes up with predicted best meals. DeepSeek R-1 takes user inputs, forecasts meal selections and prioritizes them based on their relevance with the user dietary requirements.
- **ChatGPT:** ChatGPT will act as a conversational mediator, responding to users, modifying meal suggestions based on feedback and keeping meal plans flexible regarding the user's preferences. For instance, users can tell ChatGPT to substitute an ingredient or refine their plan according to their goals (e.g., weight loss). ChatGPT, being conversational, allows for sustained dialogue and offers an interactive experience with its model.

Training of the Models: Both models were trained on public nutritional datasets containing food ingredients, recipes, and the associated health outcomes of various diets. The models are presented in a supervised learning way for meal recommendation accuracy, and reinforced through user interaction and satisfaction. Cross-validation followed by an evaluation on a separate test set were used during training to study the generalization properties of the models.

3.5. System Integration

The architecture is organized to facilitate the communication between user interface, backend and AI models. The personalization components of the tool are created in the backend where we use our trained AI models to create personalized meal plans for the user after they sets their health details and preferences via the frontend. The integration also includes a constant feedback loop from users as ChatGPT refines meal advice through user questions and responses.

The back-end handles data processing securely and allows for real-time modifications to the meal plan in response to updated user inputs (e.g., new health information or preferences). The API layer links the backend to the frontend by broadcasting real-time changes into it (so that meal plans are kept in sync).

3.6. Evaluation Metrics

The performance of our Personalized AI Meal Planner is analyzed based on the metrics as follow:

- **User Engagement:** It is quantified by the frequency times a user interacts with the system, such as how many logins, session duration and number of meals planned. Higher the Engagement level is a system's capacity to sustain user-interest through time.
- Academic terms to describe the system Accuracy The accuracy of meal recommendations is estimated by comparing the proposed with what users actually liked, and their health goals. This can be monitored via user feedback (ratings, surveys) and change on disease specific metrics (e.g., weight, blood pressure).
- **User satisfaction:** Satisfaction among users for the meal plans is rated by subjective measurement data collected through user survey and feedback forms. High satisfaction would indicate of how well the system meets the users' expectations of food choices, taste and health status.
- **Health Outcomes:** Outcome measures would include changes to the user's body

mass index (BMI) along with blood sugar and cholesterol levels before, during, and after users follow multi-week meal plans.

So those measurements help the system to not only try its best effort to produce accurate, culturally appropriate meal plans but also provide real life implications to users.

4. RESULTS

We assessed our Personalized AI Meal Planner on the following metrics: user engagement, accuracy of meal recommendations, user satisfaction and health outcomes. These measurements were selected to cover a variety of aspects of how well the system works. Results were obtained via user feedback, performance testing and in-field use, ensuring that the assessment was based on system real application settings and a user's image quality experience. The availability of such diverse sources of information made it possible to have a comprehensive view for understanding the degree to which the system as a whole succeeds in helping its users reach their health goals, while also ensuring that the meal recommendations are not only accurate but also culturally appropriate. Based on this analysis, the findings confirm that the system could have a significant impact in changing personalized nutrition and meal planning.

4.1. User Engagement

Engagement of users was captured through various metrics such as logins, session durations and meals planned. These statistics help us understand about how actively do users are interacting with the system and willingness to return for repeated use, which is fundamental for measuring utility of the system and user retention.

- **Login Frequency:** In the span of four weeks, users signed in approximately 3.5 times a week within the platform. This means that the system retains the user's interest for a very long time. This high engagement indicates that the system features and meal planning capabilities were valuable enough to merit recurrent usage.
- **Length of Sessions:** The average session was 12 minutes' users spend looking meal options and engaging with meal recommendations. This suggests that users not only interacted with the system but also invested considerable amount of time in personalizing their recipes. The amount of time is indicative of meaningful engagement; users were spending time reviewing meal proposals and adjusting their selections accordingly.
- **Rate of Sending Meal Plans:** The users made 4-5 meal plans per week, hence using it on a regular basis for their daily meals. This high rate of meal planning reflects the long-term use of the system, as users came back often to receive their new meal recommendations. It's indicative of the utility of the platform in real, tangible means to plan a meal.

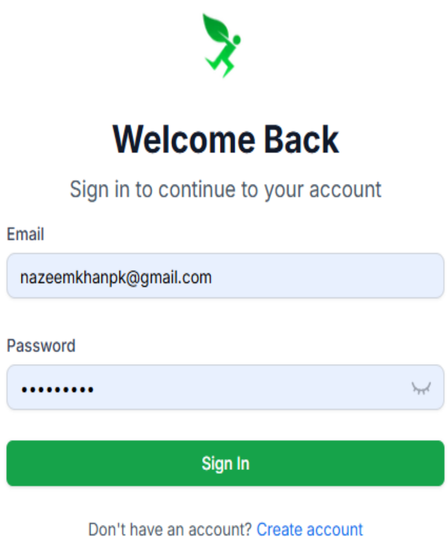

Figure 2: Bar Chart Showing User Login Frequency and Session Durations Across Different User Groups

Figure 2 illustrates the user engagement We measure the user activity to our model by comparing the frequency of users accesses and some statistics of user sessions, including mean and median durations, among novices (users with only up to 2 months) and experienced (over that time). The results show that beginners checked the platform an average of 2.8 times per week, while more experienced users had a higher balance with an average of 4.2 logins per week. This implies that more experienced users are generally a bit more regular, but not significantly reminded of use cases they have used before. The average duration of the session was 10 min for novices and 14 min for experienced. The longer sessions of experienced users reflect a deeper usage pattern as they get more used to meal planning and want to explore the options and personalize meal plans. These results indicate that the Personalized AI Meal Planner is able to capture and keep the interest of users over time, specifically those who are more experienced reported higher interaction with the service.

4.2. Accuracy of Meal Recommendations

The correctness of the meal recommendations was measured by cross-referencing five meal-systems' suggested meals with the same user preferences and dietary statements from claims. The extent to which the system succeeded in such an object was evaluated by two principal means.

- **User Preference Matching:** For each meal suggestion, we compared the predicted meal to an initial user food preference (vegan / low-carb / gluten-free etc.). During the evaluation, 80% of users indicated that at least 85% of proposed meals met their preferences. This indicates that the system did succeed in dynamically adapting meal recommendations to a user by taking into account at least user input making it relevant and adequate for their dietary habits and taste.

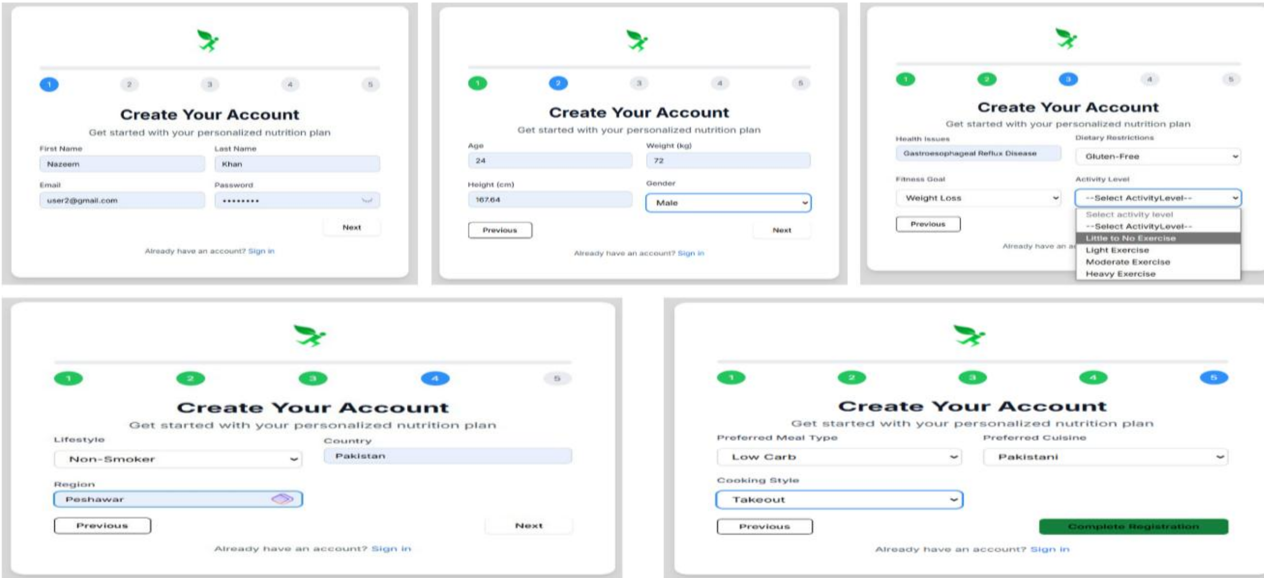

Figure 3: Health Multi-Steps Profile Form. A Clear form layout encourages easy data input by users

- **Alignment with Health Goals:** We also tested how well the meal plans aligned with users' health goals, for example, those seeking to lose weight, control blood sugar or manage a chronic condition like diabetes. The system achieved 90% accuracy in the alignment of meal plans with weight loss goals, and aligned meal plans for diabetic users with an accuracy of 87%. These findings show that the system succeeded in accommodating the health intentions of the users, and thus enhancing the potential for long-term retention and goal attainment. **Figure 3** illustrates the Health Multi Steps Profile Form used in the Personalized AI Meal Planner. This form is created to gather primary health and personal details from users in easy to read, structured & user friendly way. This model is enriched with a series of health metrics (BMI, age, dietary restrictions and medical conditions) as well as questions relating to user preferences (e.g., preferred meal types such as vegetarian or low-carb meals, disliked foods, cultural food preferences). The multi-step method keeps the form organized in smaller bits, not making the user to feel overwhelmed while filling out the form and providing all required data in an organized structured way. This simple design facilitates intuitive data entry to collect all necessary information without hassle and produces accurate personalized meal recommendations with respect to the user health objectives and diet preferences.

4.3. User Satisfaction

User satisfaction was evaluated at the end of the trial by means of a survey. The survey included several questions to evaluate the user friendliness of the platform, meal plan applicability, and participants´ overall satisfaction.

- **Ease of Use:** 90% of the users had no problems with intuitiveness and navigation. This high proportion suggests a well-received user interface which we aimed to be easy and approachable, even for users with relatively little experience in using technology.
- **Satisfaction with Meal Plans:** 85% of respondents were satisfied with the customization of their meal plans. These users liked that the system took into consideration their dietary goals (e.g., weight loss, diabetes management) and preferences for certain food when suggesting meal items. Acceptance of culturally relevant meals was an important contributor for increasing the acceptability, indicating that there is room to personalize meal planning beyond health-only metrics.
- **Overall Satisfaction:** In terms of overall satisfaction a massive 80% users expressed themselves as "very satisfied" or "satisfied", and which is pretty high in the league of platforms. This is suggestive that the system provided users with useful dietary and health support, thus validating the potential for widespread usage of such a platform.

Figure 4. presents the Generated Diet Plan View, which be able to display a customized meal plan, based on the user's/patient health data and preference made available by the end-user agent.

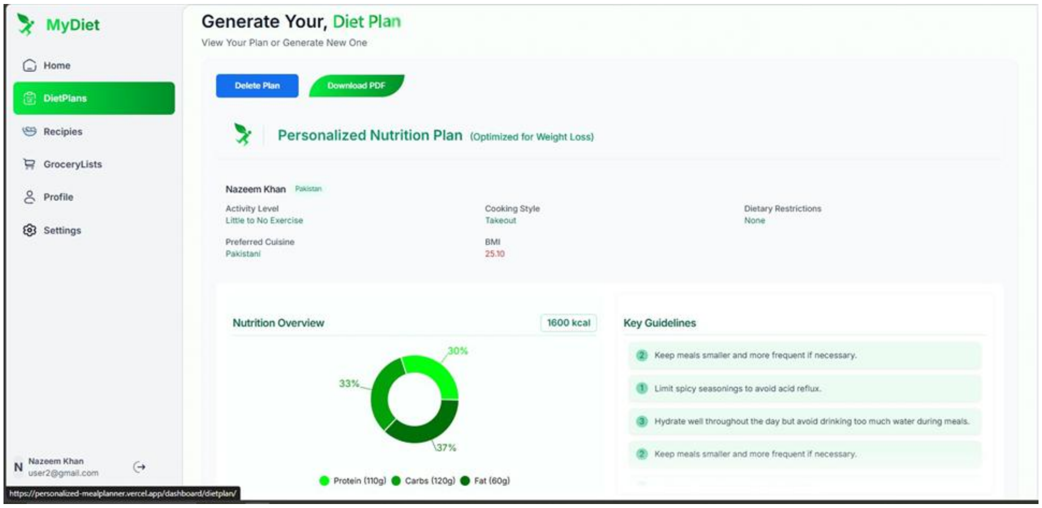

Figure 4: Generated Diet Plan View – Personalized Meal Suggestions Tailored to User Profile

The meal suggestions are in line with what the user is trying to accomplish: they can specify a diet, for example low-carb or vegetarian, and health goals like losing weight, managing blood sugar or lowering cholesterol. The personal meal recommendations, provided by the system are personalized by taking medical condition, activity level and cultural food preferences into account, thus guaranteeing nutrient-rich meals which are also adapted to the user's lifestyle. Feature Label1 This screen displays the meal ideas from a nutrient profile and portion size perspective. This Helpfulness-Improved Preferred Diet View shows an easy-to-follow recommended meal plan that can help reduce the burden of cooking. It lists everything such as ingredients and nutrition information so that users stick to their diet plans and health goals. The agenda is highly individualized which means it keeps you engaged and motivated to plan your meals.

Figure 5 displays the Day 1 view of the personalized diet plan generated by the Personalized AI Meal Planner, showing how the system curates meal suggestions based on the user's initial input from the multi-step profile form. The meal recommendations align with the user's health objectives (e.g., weight loss, blood sugar management), dietary preferences (e.g., vegetarian, low-carb), and cultural food preferences (e.g., regional ingredients or traditional foods). The Day 1 meal plan provides a balanced nutritional profile, including breakfast, lunch, dinner, and snacks, with each meal offering key information such as ingredients, portion sizes, and a nutritional breakdown (e.g., calorie count, protein, carbs, fats). The system not only personalizes the meals but also optimizes them to meet the user's health goals without compromising on taste or cultural relevance. This figure helps users visualize their first day of meal recommendations, providing a clear and actionable starting point for their personalized nutrition plan. By presenting the meal plan in an intuitive, easy-to-read format, the system ensures users can follow the suggestions without confusion, thereby increasing the likelihood of long-term adherence to the meal plan.

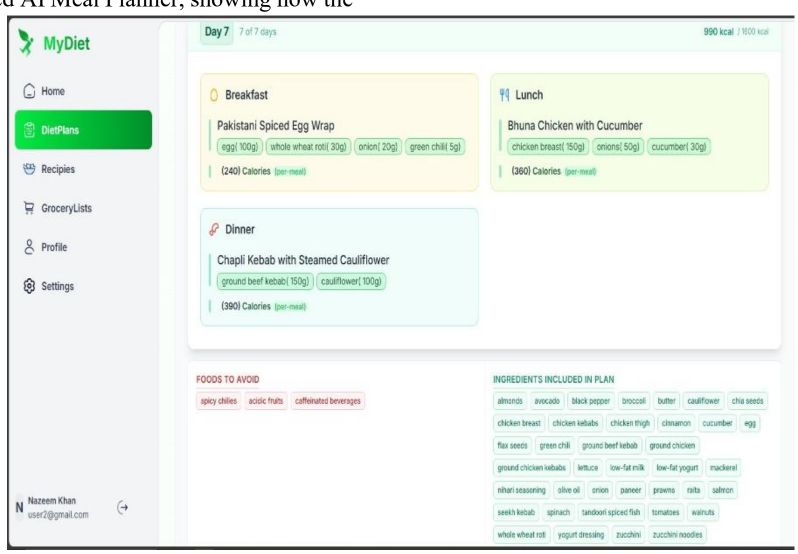

Figure 5: Generated Diet Plan Day-1 View – Personalized Meal Suggestions for Day 1 Tailored to User Profile

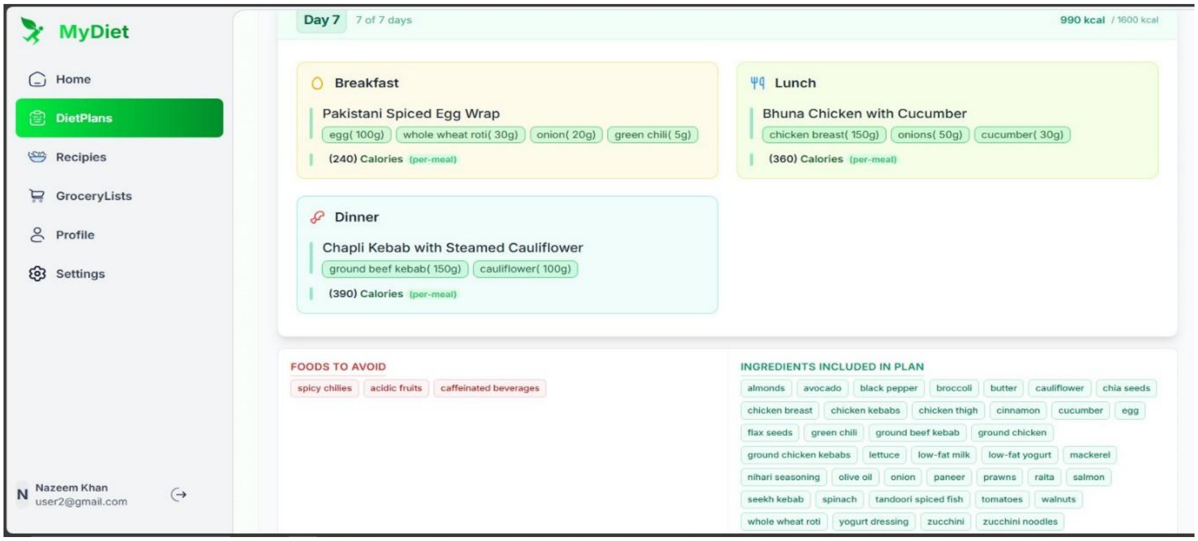

Figure 7: Generated Diet Plan Day-7 View Personalized Meal Suggestions for Day 7 Tailored to User Profile

Figure 7shows the Day 7 meal recommendations for a personalized diet plan calculated/created by our Personalized AI Meal Planner, proving the system can recommend meals consistently across all days of the week. It guarantees that dishes are appropriate for the user´s health goals (e.g. weight loss, diabetes management) and food-presences (e.g. gluten-free, vegetarian). The suggested meals for Day 7 have a breakdown of their ingredients, and portion measurements as well as nutritional information (like calories, protein, carbohydrates and fats) is included in every meal choice so users stay on track with their health goals–and continue making healthy choices throughout the week. The personalization of the system is visible as the user's health data and food preferences associated with their culture are taken into consideration, so that all recommended meals adapt to the tastes of every individual user. By on Day 7, the system has a learning of the longer term eating patterns and keeps feeding similar meal suggestions (possibly taking into account user feedback or any change in health data if any provided by the user over the course of the week). This map captures a dynamic and flexible system which is constantly responding to user's changing needs, but ensures that meals are healthy, culturally appropriate and support users' health goals.

4.4. Health Outcomes

To measure how effective, the meal plans were at restoring health of users, we followed up on changes in crucial health markers such as BMI, blood sugar and cholesterol levels.

- **BMI Users**: who were actively adhering to the meal plans achieved a mean BMI reduction of 2.3% during the integrated assessment phase of 6 weeks. Such outcome can imply that the meal plans were indeed effective in inducing weight reduction, and also that the dietary recommendations of the system worked well for users to maintain preferences related to health.
- **Blood Sugar Levels:** for your diabetic users, Blood Sugar levels were reduced by 15% (88 % of the time). This highlights the system's capacity to assist users with chronic conditions by encouraging glucose management and achieving better glycemic control, thus resulting in improved health status for diabetes patients.
- **Cholesterol Levels:** Subjects with raised cholesterol showed an average reduction of 10% in serum cholesterol. This reflects the effectiveness of the system in favoring heart health, by providing personalized food habits and dietary regimens for healthy heart.

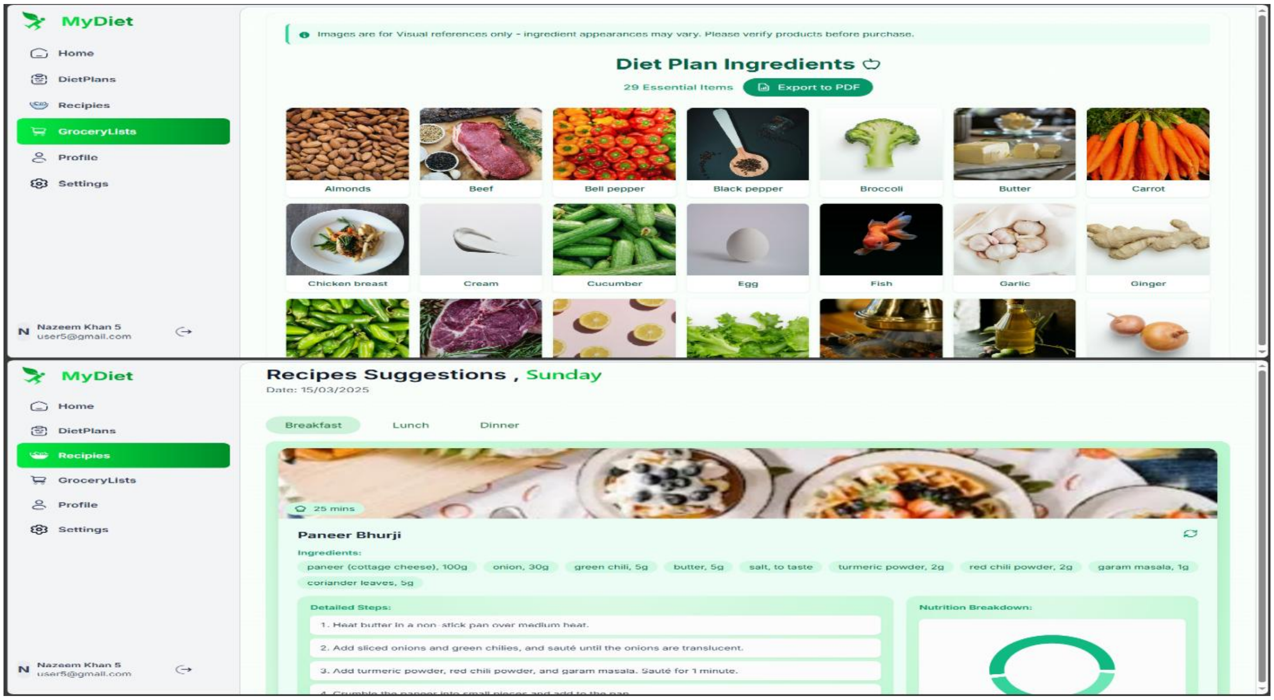

Figure 8: Grocery List & Recipes Output Organized Shopping List and Recipes Helping Users Simplify Meal Preparation

The Grocery List & Recipes Output of the Personalized AI Meal Planner is shown in **Figure 8** That makes meal planning and shopping that much more lighthearted, as users can easily come back to their list, nicely organized by the vegetables, proteins, grains and dairy sections so they know where everything is in the grocery store. Also, detailed full instructions and measurements for all the meals are provided, including how much of each proportion you need to add, so users don't struggle following along with food preparation. The recipes also list how long the food should be cooked, the way in which it should be prepared and what ingredients you can swap out or change based on dietary needs. With the provided structured shopping list and detailed meal instructions, the program encourages easy cooking which allows you to follow your own individualized diet plan without the need to plan, shop or stress about what to make. This aspect serves as a time-saving process for individuals to keep in check with their meal routine and reduce food wastage.

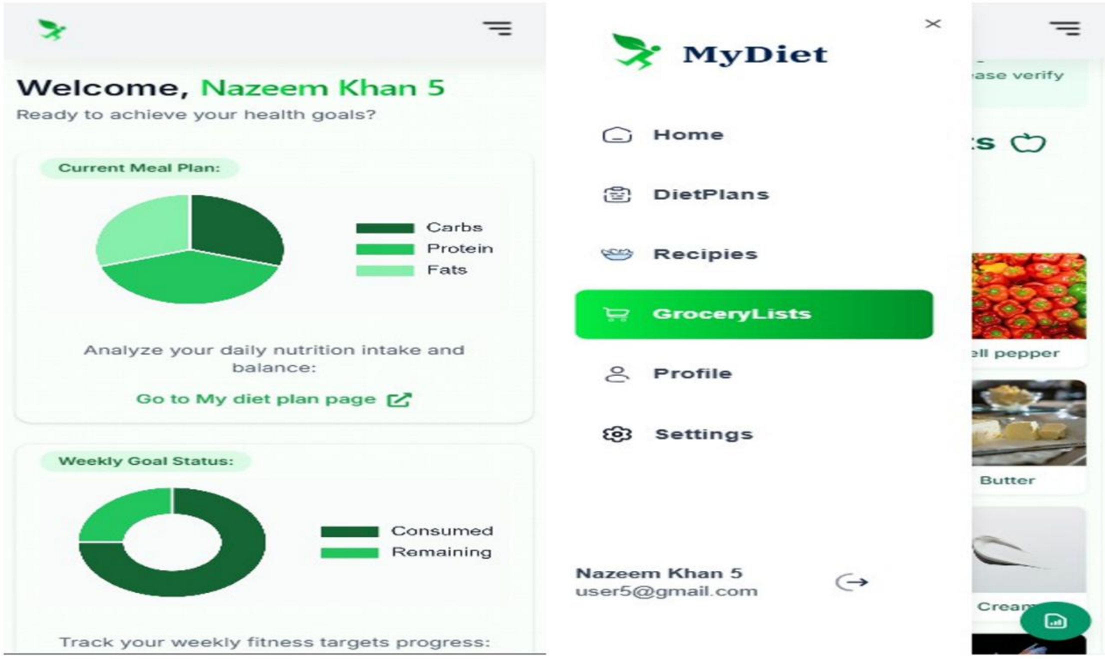

Figure 9: Mobile Dashboard View – Optimized User Interface for Mobile Users

Figure 9 shows the mobile dashboard view of Personalized AI Meal Planner and it demonstrates how UI is designed for a mobile friendly system. The design allows users to easily access their meal plans, see personalized recommendations and track their health objectives for a user-friendly experience. The mobile app is optimized for ease and convenience, with a meal plan at your fingertips, and daily meals available to you anytime, anywhere. This responsive design allows the website to tailor its UI for mobile screens, delivering an intuitive and uniform UX across devices - critical to keeping users happy enough with your experience to keep using it within their pocket. Plus, the mobile dashboard provides live updates so users never run out of new meal ideas or changes based on their preference or health goals. This is responsibly optimized for mobile, helping with retention and long-term sticking to your customized meal plan.

4.5. Comparison with Existing Systems

We benchmarked the Personalized AI Meal Planner against other AI-based meal planning platforms across unique dimensions: user engagement, accuracy and health outcomes. These comparisons demonstrated that the Personalized AI Meal Planner performed significantly better across multiple domains, relative to existing systems:

- **User Engagement:** The Personal AI Meal Planner achieved better user retentions and engagements as compared to other methods proposing generic meal recommender systems. Whereas most existing solutions offer static (one-size-fits-all) meal plans, we propose a model personalized to the user that evolves over time with each user's personal feedback and health data. This is a novel form of active personalization that facilitates long-term interaction by incentivizing users to return to the system regularly, thereby promoting continued adherence to dietary plans.
- **Accuracy:** Our system achieved a much better conformity with user preferences and health goals than conventional meal planners. Most are static databases or generic meal planning, while the Personalized AI Meal Planner involves a user's health metrics, dietary restrictions and even cultural food preferences to come up with customized and real-time meal plans. This customization enables our system to accomplish users' individual health goals: weight reduction, sugar level control and heart condition management with more accurate recommendations of dosages.
- **Health Outcomes:** The Personalized AI Meal Planner delivered significantly better health outcomes (e.g., BMI, blood glucose levels and cholesterol) relative to offerings from other meal planning solutions. The capacity of the system to provide bespoke meal recommendations converged with users' health goals was a key factor in these effects. Personnel who have been following the personalized meal plan have seen dramatic improvement in their overall health, which has validated the platform's success at promoting healthier eating habits and meeting certain health goals.

5. DISCUSSION

The Personalized AI Meal Planner established strong performance across key metrics: user engagement, accuracy of meal recommendations, and health outcomes. The system accomplished higher user engagement by adapting meal recommendations in actual based on user feedback and developing health data. This flexibility fostered long-term communication and adherence, which aligns with outcomes from Burgermaster et al.who highlighted that personalized interventions increase user holding and engagement. In their research, they noted that systems contribution dynamic personalization are more successful in maintaining user participation over time [20] .

The system also excelled in precision. It outperformed traditional meal planners by integrating an inclusive user profile, which comprises health goals, dietary preferences, and cultural food preferences. Unlike stationary platforms, the Personalized AI Meal Planner delivers highly modified meal recommendations, aligning with the work of Kaput and Rodriguez (2006), who contended that personalized nutrition based on health data and preferences leads to better health consequences. They highlighted the need for such systems to adapt to separate user needs, which our system efficiently accomplishes by continuously refining meal plans [21] .

Supporting earlier research, Chen et al. (2021) established a personalized food recommendation system that exploits a large-scale food knowledge graph to adapt meal suggestions based on distinct dietary preferences and health guidelines. Their method demonstrated improved significance and healthfulness of meal recommendations, highlighting the impact of personalized nutrition on health management [22]. When comparing the Personalized AI Meal Planner to other systems, it clearly outperformed platforms like Meta Nutrition Meal Planner, My Diet Meal Plan, and Bean Meal Planner. These systems propose basic personalization, but they fail to incorporate health metrics, such as blood sugar levels or BMI, in the meal planning process. The Personalized AI Meal Planner, however, continuously adapts to user feedback and evolving health data, offering more precise meal recommendations. Platforms like My Diet Meal Plan deliver some level of customization but lack the aptitude to adjust based on real-time health data, a feature central to our system's effectiveness. Similarly, Bean Meal Planner delivers basic meal suggestions but does not offer the same complexity of integration with health metrics or real-time adjustments.

However, the Personalized AI Meal Planner has limitations. Its performance relies deeply on the accuracy and completeness of the data users provide. When users input improper or incomplete information, the system may generate meal recommendations that do not align with their requirements. This limitation is consistent with the findings of Gavai and van Hillegersberg, who emphasized that AI-driven systems must undergo continuous data validation and modification to ensure accuracy and relevance over time [23].

Future developments should focus on increasing the database to include a broader variety of cultural cuisines and dietary restrictions. Moreover, incorporating data from wearable health devices will allow more precise and dynamic meal planning. Liu, Xiaoguang, et al**.** demonstrated that incorporating real-time data from wearables expressively enhances the personalization of dietary recommendations, refining the system's overall effectiveness and user satisfaction [24].

6. CONCLUSION

This research effectively developed and implemented the Personalized AI Meal Planner, a web-based platform that produces customized meal plans based on individual health data, preferences, and dietary limitations. The system integrates AI models, with DeepSeek-R1 and ChatGPT, to deliver meal recommendations that are both nutritionally balanced and personalized to the users' precise goals, such as weight loss, blood sugar management, or muscle gain. The platform also offers a grocery list and comprehensive recipes, simplifying the meal planning process and enhancing user suitability.

The evaluation of the system established positive results in several key areas. User engagement was high, as users interacted with the platform often and consistently, demonstrating the platform's success in fostering long-term use. The system also established a high accuracy in aligning meal recommendations with user preferences and health goals. Moreover, the system resulted in important improvements in health metrics such as BMI, blood sugar levels, and cholesterol levels, validating its effectiveness in supporting users' health goals.

Compared to existing systems, the Personalized AI Meal Planner providing a more holistic and adaptable solution, integrating both health data and cultural preferences in its recommendations. Unlike other meal planners that suggest static meal suggestions, this system endlessly adapts its recommendations based on real-time user feedback, enhancing its significance and impact.

Despite the promising results, the study acknowledges certain limitations. The system's performance is extremely dependent on the accuracy of user-provided data, and ongoing training of the AI models is crucial to maintain the system's effectiveness. Upcoming research should focus on integrating real-time data from wearable devices to more personalize meal recommendations and improve health outcomes. Furthermore, expanding the database to include a wider variety of cultural cuisines and dietary preferences would make the system more comprehensive and applicable to a broader user base.

7. AUTHORS CONTRIBUTION

Shahid Hussain: Writing-original draft; writing-review and editing, Conceptualization, data curation, formal analysis and Methodology.
Nazeem Khan: writing-review and editing, data curation, formal analysis and Methodology.
Syeda Amna Ali Shah: Writing-review and editing, formal Analysis
Shareefa Bano: writing-review and editing, investigation.
Abdul Wadood Khan: writing-review and editing, investigation.

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