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Personalized AI Framework for Monitoring Pregnancy Nutrition and Diabetes-Friendly Diet with Real-Time Water Tracking

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***Abstract*— Significant developments in artificial intelligence (AI) in recent years have produced strong AI systems that can be applied to nutrition to improve individualised dietary recommendations and general health and wellbeing. Aim of this research is to develop personalize AI model for pregnancy nutrition monitoring and diabetes free diet plan with real time water tracking. The smart phone application module is used in pregnancy nutrition monitoring and recommendation based on the user inputs. Then the recommendation will be diabetes friendly diet based on the blood sugar level which is tested, the application will also track the water in real time. The quality of nutrition care will be enhanced and next-generation nutrition care practices will be navigated with the aid of AI-based dietary evaluation tools. To assess the accuracy and effectiveness of these instruments, more research is needed.**

***Keywords*— personalize AI model, pregnancy nutrition, diabetes free diet, real time water tracking, recommendation**

I. Introduction

Food is one of the most basic need for human survival. Human health and fitness depend on eating the right foods, which are often seen as much more than just a way to survive. Four types or quantity of food we eat have a direct impact on our health [1]. These days, there are a lot of fitness and health-related apps available in app stores. In 2017, there were 32,500 mobile health apps accessible in major app stores, number is still growing. Tracking health-related behaviours and managing weight can be made easier with the use of apps [2]. Additionally, new food identification systems for dietary assessment have been made possible by the widespread use of smartphones as well as quick development of artificial intelligence (AI) methods. These systems are important for preventing as well as treating chronic diseases like type 2 diabetes mellitus, cardiovascular disease, obesity, among other health problems. Additionally, if food items or categories are identified, food intake behaviour can be examined [3].

Despite the availability of numerous health apps, many lack the precision and intelligence needed for accurate food recognition and personalized dietary assessment. Manual logging of meals remains a significant challenge for users, often leading to incomplete or inaccurate data entries. To address this, modern research has turned toward image-based food recognition systems powered by machine learning and computer vision techniques. These systems allow users to simply capture an image of their meal, which is then analyzed to identify food items and estimate nutritional content. Such advancements not only reduce user burden but also increase compliance and accuracy in dietary monitoring. Moreover, integrating AI with health data enables personalized recommendations tailored to an individual's nutritional needs and health conditions. This approach supports a proactive model of health management, where users can receive real-time feedback and suggestions. As chronic diseases continue to rise globally, intelligent food recognition systems are becoming a vital component of preventive healthcare solutions [17-19].

II. Literature Survey

The creation of healthy eating recommendations has been the subject of numerous studies in recent years. A diet low in carbs may be beneficial for someone with type 2 diabetes [4], whereas a diet devoid of lactose-containing foods like milk, cheese, and other dairy products is necessary for someone with lactose intolerance. Additionally, it has been demonstrated that cancer patients' immune systems can be strengthened by personalised nutrition (PN) [5]. As a result, PN can assist people in both preventing and mitigating a number of chronic illnesses. [6] claims that the intersection of computer science (CS), AI, ML with food sector resulted in the creation of corresponding apps that made use of big data analysis [7]. The substantial effects of AI on the food sector, particularly its function in PN, were studied in work [8]. Lastly, the efficiency and difficulties of these systems in providing individualised nutritional and health advice were investigated by the author [9]. While [10] offer an online program that uses women's personal data, such as age and height, to prevent cardiovascular issues, it describes a hospital recommendation system that uses personal data from in-hospital sensors, such as insulin levels, to change patients' daily meals. The

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results of the aforementioned studies indicate that the field of study is rapidly growing.

Building on these advancements, recent studies have emphasized the importance of integrating real-time data from wearable devices and smartphone sensors to provide continuous monitoring of dietary and health behaviors. These technologies enable dynamic feedback systems that can adapt to a user's changing physiological status, activity levels, and nutritional needs. For example, some systems use continuous glucose monitoring (CGM) data to adjust dietary recommendations in real time for diabetic individuals. Others incorporate GPS data to suggest healthier food choices available nearby, enhancing both accessibility and adherence to diet plans. Additionally, advancements in natural language processing (NLP) have enabled conversational interfaces and chatbots that offer interactive dietary guidance, making these systems more engaging and user-friendly. Despite these developments, challenges such as food image recognition accuracy, cultural food diversity, and data privacy remain. However, the growing convergence of AI, nutrition science, and mobile technology shows great promise in transforming how personalized dietary advice is delivered and utilized in daily life.

The major objective of this initiative is to implement measures to reduce the incidence of chronic illnesses in patients. Age, sex, zodiac sign, daily cigarette use, and other medical information serve as inputs, which are then modeled for predictive analysis. Abstract A significant challenge in the medical business nowadays is the prognosis of cardiac conditions. Currently, one individual gets heart disease for every four individuals. A vast quantity of data is analyzed in the healthcare sector using machine learning [11, 12].

The suggested system primarily aims to provide diagnostic information to users by using autonomously generated ontology and semantic web-based personal health record services. The ontology for diagnosing diseases in individuals is developed automatically to provide graded results of prospective diagnoses to the patient, based on ranking criteria that identify the patient's symptoms, personal health traits, and multi-tiered diagnoses. This information is conveyed inside a comprehensive semantic web, used to assess an individual's health state based on the manifestation of similar symptoms. This research seeks to improve diagnostic precision and provide pertinent diagnostic information to users for action in healthcare [13, 14].

The patient may get the doctor's data and the hospital's address promptly by providing the illness and specific location required. He arranges appointments with several physicians for corresponding therapies. The user may ascertain information on the acceptance and rejection of their appointment. If the appointment is approved concurrently, the invoices may be sent to the corresponding user, who can remit the payment using this application [15]. A medical system is essential for analyzing vast amounts of medical data to get more insights and enhance prediction and diagnosis. This gadget need to possess the intelligence to assess a patient's health status by evaluating social activities, personal health data, and behavioral analysis. The Health Recommendation System (HRS) has emerged as a vital component of medical treatment [16].

III. Proposed Methodology

The general structure and key components of a standard diet and exercise advice system are depicted in Figure 1.

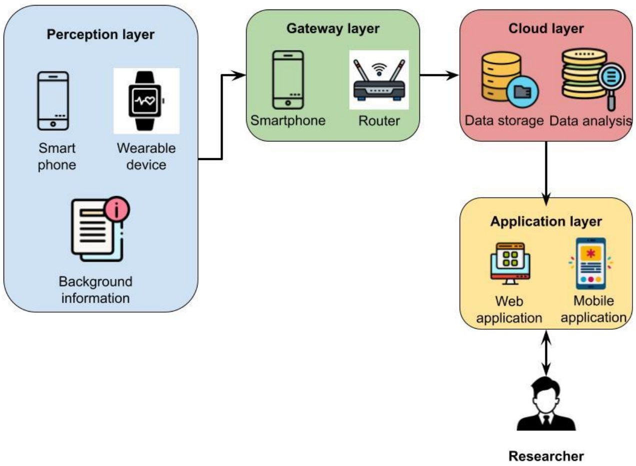


Figure 1. Pregnancy health monitoring system

The suggested AI-based diet advice system offers customers individualised meal recommendations according to their profile by utilising a revolutionary deep generative network architecture. Input is a vector containing personal data that is processed by a variational autoencoder network. Generated feature representation is located in a latent space where input data is optimally modelled to capture significant and instructive features on the user's dietary needs. Finally, a final weekly meal plan is created by feeding generated meal plans to an optimiser, which modifies meal amounts to make sure energy and nutrients meet user's needs. Additionally, original meal database is expanded and meal recommendations are improved with use of ChatGPT10, a potent language model created by OpenAI. Pregnant women who were at higher risk for GDM at the time of recruitment were sent for an OGTT based on their ethnicity, age, family history of diabetes, prepregnancy weight. According to Norwegian recommendations, a 2-hour OGTT blood glucose level of $\geqslant 9$ mmol/L was used to diagnose GDM in study's eligible women. The study excluded women with lactose intolerance, coeliac disease, twin pregnancies, or type 1 or type 2 diabetes (OGTT blood glucose levels$\geqslant 11$ mmol/L). 238 of the 774 women who had their eligibility evaluated took part.

Data analysis, data management, and user administration are all offered by our server. Creating new user accounts, editing existing users, giving users the appropriate access levels, and assigning them a set of questions are all handled by the user management module. An authorised user can set up a time for specific notifications and reminders as well as add, edit, and remove questions in this configuration. To protect user privacy, the data is kept on the server anonymously. Through the wristbands and mobile application, the mothers provide data to the data management module. The server has an authentication system in place. The received data's veracity is then examined. If there are any problems, the user is alerted to upload the data again. Regarding user privacy, no personal information is transmitted to the server. Additionally, users must be authorised and verified in order to access the data. This monitoring system's data analysis module is in charge of examining the gathered objective and subjective data. This module offers services for tracking sleep, physical activity, and stress.

To further enhance the adaptability and user-centric nature of the proposed AI-based diet advisory system, contextual learning is integrated to adjust meal recommendations based on environmental and temporal factors such as season, time of day, and physical activity levels. The system employs a feedback loop mechanism that allows users to rate meals, which in turn helps fine-tune future recommendations using reinforcement learning. Moreover, the system can dynamically adapt dietary plans based on changes in health parameters collected from wearable devices, such as fluctuations in blood glucose or heart rate. This makes the solution not only reactive but also predictive in nature. For high-risk groups, such as pregnant women prone to gestational diabetes mellitus

(GDM), the system can preemptively adjust carbohydrate intake and recommend specific micronutrient-rich foods. All data interactions are encrypted, ensuring robust privacy and data protection. This comprehensive integration of AI, user data, and medical context makes the model scalable, secure, and suitable for real-world deployment.

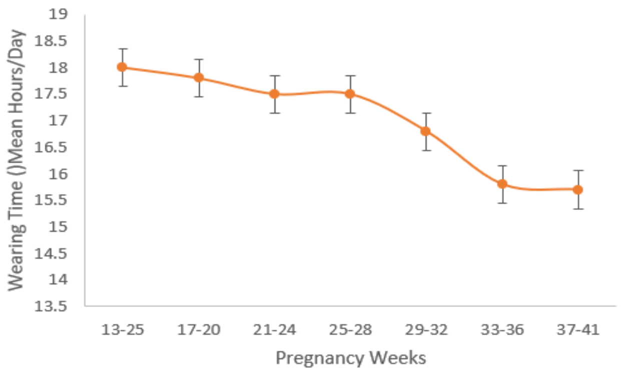
IV. Performance Evaluation

One of the most crucial features of applications that track and recommend food consumption is the ability to suggest foods based on the user's needs. Just 3.75% of the applications (3/80) suggest foods that are generally healthy, but they don't take into account the user's calorie or nutritional intake history. "Carb Manager: Keto Diet Tracker & Macros Counter," "AI Nutrition Tracker: Macro Diet & Calorie Counter," and "TrackEats" are the three apps.

Table 1. Assessment criteria for measurement functionality of apps in 3 different app platforms

Measurement criteria	Google play	Apple app	Microsoft	Total
Food recognition	66	4	5	73
Volume estimation	68	2	3	74
Nutrition estimation	65	2	4	72
History visualization	69	4	2	72
Food recommendation	3	1	0	4
Allow to add new food info	53	3	3	58

Percentage of functionality assessment criteria met by apps analysed from 3 app shops is shown in Table 1. It offers a general assessment of each app's quality across all platforms (app stores). According to Table 1's findings, there are more apps available on the Google Play store (also known as the Android platform) than on the Microsoft and Apple app stores. Additionally, only four of the 80 apps were able to suggest foods to users, demonstrating how infrequently the food suggestion criterion is used.



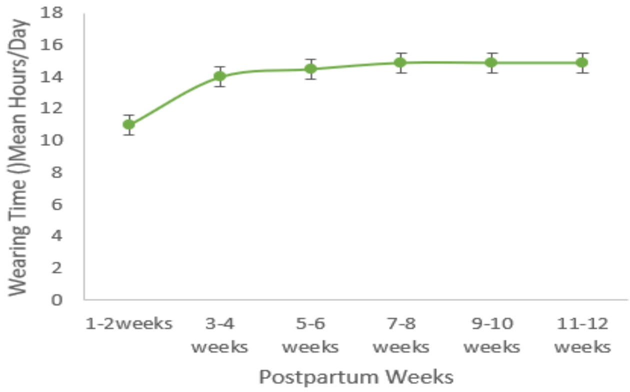


Figure 2. Smartwatch wearing time during pregnancy and postpartum of 28 high-risk pregnant women

In order to demonstrate the smartwatch's utility, we look at the average amount of time spent wearing it each day during pregnancy and after giving birth. Figure 2 displays average daily wearing time for each participant during pregnancy as well as after giving birth. Due to pregnancy difficulties, three individuals spent many days in hospital and were unable to use the smartwatch. After giving birth, average wearing time dropped to 13.72 ± 5.71 hours per day from 17.01 ± 4.20 hours per day throughout pregnancy. Average wear time throughout pregnancy was 17.3 hours per day, for one month following delivery, it was 14.4 hours per day, according to a feasibility study on smart wristband use during pregnancy. This study is consistent with our findings. Our study's wearing time, however, is marginally less than their results. This can be explained by the fact that the moms in our study who had high-risk pregnancies were admitted to hospitals. As a result, it is possible to collect data using the smartwatch both during and after pregnancy

V. Conclusion

Creating a personalised AI model for diabetes-free food plans and real-time water surveillance during pregnancy is the goal of this project. Using user input, the smartphone application module monitors and recommends nutrition during pregnancy. Based on the blood sugar level that is measured, a diabetes-friendly diet will then be suggested. The app will also track the water in real time. With more features and considerations added as future work as well as during application integration, suggested nutrition recommendation method is intended to serve as a proof of concept for creation of precise personalised meal plans. The success of suggested diet recommendation technique was shown by the performed trials, suggesting that it has the ability to solve the difficulties related to AI alignment in context of nutrition as well as diet planning.

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