

Pratibhojana: An alarm based personalized diet recommendation system

Amiya Kumar Tripathy¹, Ditty Varghese², A.J Sudhakaran³, Mohit Deorukhkar⁴, Stacy Bardeskar⁵

^{1,2,3,4,5}Department of Computer Engineering, Don Bosco Institute of Technology, Mumbai, India.

¹amiya@dbit.in, ²ditty@dbit.in, ³sudhakaran.cj@gmail.com, ⁴mohit.deorukhkar44@gmail.com,
⁵bardeskar_stacy@yahoo.com

Abstract— Good health is paramount especially when we have women suffering from diseases such as anemia, osteoporosis and heart disease in India. There is lack of awareness amongst older women about importance of good nutrition which is based on the appropriate, balanced intake and utilization of nutrients. Deficiencies in nutrition lead to long-term damage to both individuals and society. The proposed system aims to design a personalized diet recommendation system supported with an alarm reminder for women in the age group of 40-50. With the help of this system, women can gain access to diet recipes based on some standard inputs. The system thereby relieves women from the burden of having to identify the right diet for their condition and will thereby help improve the nutritional status of households. Investing in nutrition in women is vital because it reduces healthcare costs, improves productivity and economic growth, and promotes education, intellectual capacity, and social development for present and future generations.

Keywords—Diet Recommendation system, Diet history; Alarm reminder

I. INTRODUCTION

Nutrition focuses on how to protect the body from disease with a healthy diet. Human body receives nutrition from the food consumed. The major classes of nutrients are: carbohydrates, fats, minerals, protein, vitamins, fiber and water. All these nutrients are necessary for human body but in varying quantities. Poor health or nutritional deficiency occurs due to inadequate amount of a particular nutrient or group of nutrients.

For a woman, working at home, taking care of her children and the elderly as well as working outside the home can greatly affect her physical and mental well being. Nowadays, working women tend to neglect their health. Fast life and unhealthy eating habits are leading to various health problems. Due to these changing trends, illnesses that used to usually occur during later stages of life are now arriving at an early age. And as a result women are facing a constant pressure of being health conscious. Due to this they feel the urge to obtain a quick access to information with respect to their health and are therefore resorting to the internet for the same. Also there are many women who lack appropriate knowledge of the right nutrition needed for the body [6]

Anemia and osteoporosis are the health issues commonly prevalent amongst women. Cultural factors in India deprive the female child nutritious food and that is the reason why Indian women are mostly anemic and prone to osteoporosis in old age [7] It is a major concern of health problems related to ageing amongst women. Particularly at the onset of ageing which is probably at 40, women are easily prone to numerous ailments such as heart diseases, menopause and others. Indian middle class women often tend to ignore their health and visit a doctor only when certain disease symptoms occur, which later might turn out to be incurable. Doctors and nutritionists have thus mentioned lack of awareness amongst women as the major cause which leads them to greater disease states. Prevention is better than cure. Therefore, it is best if women adopt a healthy lifestyle which could help them keep such health issues at bay.

To promote a healthy lifestyle by correcting diet now-a-days we have a lot of information available on the internet. But this can also be confusing at times. Also mobile being a handy source of information the availability of nutrition apps these days has greatly increased.

But despite all this the information available is not crisp in various ways as they are not age specific, they do not cater to the Indian population, they do not take the diet history of a person into account and also the diet recommended does not consider the availability of ingredients.

Therefore a system was proposed that would enable women to gain access to diet recipes based on some standard inputs. The proposed system is designed to take in general inputs such as the height, age, weight, type of lifestyle and all the allergies and disease inputs specific to a person. Based on these inputs, the system recommends diet recipes for each meal to be eaten at the appropriate time selected. Amongst all the categories of individuals, the ones that require utmost attention are women particularly in the age group of 40 to 50 years as they are most likely prone to diseases. The proposed system aims at providing good nourishment to these individuals. An additional advantage of the proposed system is the alarm reminder for food. With the help of this system, women will be able to obtain proper diet recommendations at the right time, thus helping them eat proper food as per their body condition and nutritional needs.

II. RELATED WORK

Four systems that were related to the proposed system were reviewed. These are [4] SapoFitness: A Mobile Health Application for Dietary Evaluation, [4] Implementation of a Goal-Oriented Recipe Recommendation System Providing Nutrition Information, [1] SmartDiet: A Personal Diet Consultant for Healthy Meal Planning, [5] iCare: A Mobile Health Monitoring System for the Elderly.

A. SapoFitness: A Mobile Health Application for Dietary Evaluation

SapoFitness is a mobile health application for a dietary evaluation and the implementation of challenges, alerts, and constantly motivates the user to use the system and keep the diet plan. The main goal of this application is to offer a motivation tool for weight reduction and increase physical activity. The application offers a continuous alert system activity, sending alerts/messages concerning the user diet program taking into account also his/her physical activity. It is a challenged mobile application that delivers the action to the user, motivating for a healthier life style. SapoFitness is customized to its user keeping a daily record of his/her food intake and daily exercise. The user enters all the necessary information such as his/her height, weight, age, and sex, for determining the BMI (body mass index) and the maximum daily calories must consume. Thus, the system automatically sets a sort of user profile and the system basically tells the user if he/she is or not on overweight and some more information surrounding, such as weight target, date for the purpose, and calories to consume.

B. Implementation of a Goal-Oriented Recipe Recommendation System Providing Nutrition Information

This system proposes a goal-oriented recipe recommendation system that utilizes information about nutrition on the Internet. Their system enables users without knowledge about nutrition to search easily for recipes with natural language to improve specific health conditions. The natural language includes “I want to cure my acne” and “I want to recover from my fatigue”. The measure of the effectiveness of the system was done using F-Measure and the average F-measure was 0.64 respectively. Based on the input of a particular diseased condition, the system enables users without knowledge about nutrition to search easily for recipes. The most impressive field of this system was on the real time basis it gives recipes which cures everyday health problems through suggestion of food recommendation. The dishes in this system are only japan based and in their own national language as this system is just available for their own nation.

C. SmartDiet: A Personal Diet Consultant for Healthy Meal Planning

SmartDiet is a location-aware interactive diet consultant named SmartDiet based on the multi-objective optimization.

Jen-Hao Hsiao, the main author of this paper says that, the objective of their research was to achieve nutrient-balanced food recommendations for each individual, while considering individual's requirements at the same time. To reach this goal, they developed a location-aware interactive diet consultant named SmartDiet based on the multi-objective optimization. The proposed personalized diet planning approach not only translates nutrient recommendations into realistic dish choices, but also accepts feedbacks from users to fine-tune their meal plans. The results showed that daily nutrition needs can be fulfilled by the designated meals, and the interactive diet planning scheme helps a user adjust the plan in an easier way. The guidelines generated by SmartDiet are expected to potentially improve the overall health and reduce the risk of chronic diseases of individuals.

D. iCare: A Mobile Health Monitoring System for the Elderly.

Ziyu Lv, the main author of the system says, this paper describes a mobile health monitoring system called iCare for the elderly. Wireless body sensors and smart phones are used to monitor the wellbeing of the elderly. It can offer remote monitoring for the elderly anytime anywhere and provide tailored services for each person based on their personal health condition. When detecting an emergency, the smart phone will automatically alert preassigned people who could be the old people's family and friends, and call the ambulance of the emergency center. It also acts as the personal health information system and the medical guidance which offers one communication platform and the medical knowledge database so that the family and friends of the served people can cooperate with doctors to take care of him/her. The system also features some unique functions that cater to the living demands of the elderly, including regular reminder, quick alarm, medical guidance, etc. iCare is not only a real-time health monitoring system for the elderly, but also a living assistant which can make their lives more convenient and comfortable. Remotely it monitors the elderly person. Interesting innovation is that the new technology (wireless) sensors remotely monitor the BP and pulse rate and when it goes above the threshold value and when it goes above a particular level, an alarm and message is signaled by the application to the emergency contacts that is the family person, hospitals and or police as the concerned people are notified.

III. PROPOSED SYSTEM

A. System Configuration

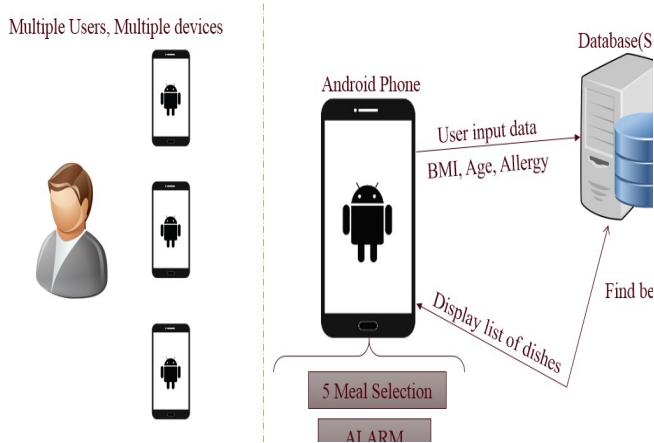


Figure 1. System Configuration.

The Android App supports multiple users and can be used simultaneously in multiple devices. As shown in Figure 1, the system asks for the required medical input from the user. Here, the user needs to input her name, age, height and weight for calculation of BMI, lifestyle followed and also the illness she is suffering from along with allergies if any. A recall/diet history is now taken to know the current daily diet routine of the user. Based on these inputs, the app provides a five meal selection for which the user needs recipes. The proposed system has 5 categories for meal selection, namely- Breakfast, Morning snacks, Lunch, Evening snacks and Dinner. Then, the system processes the input and applies data mining algorithm on the built-in SQLite database. The next stage is the output phase where the system displays a list of recommended dishes to the user. The user can choose any of these dishes and view their recipe. The final stage of the system is the alarm. Here, the user inputs a specific time along with any medicine name (optional) to set a reminder for the meal he/she has chosen.

B. DATA COLLECTION

Data collection first involved conducting a survey of general physicians and nutritionists to find out the most commonly existing diseases and allergies amongst women in the age group of 40-50 years. This gave the list of allergies and diseases which we included in the system. From the internet, the most common levels of the diseases was found out and considered. Also one factor that was highlighted was that BMI plays an important role when it comes to diet recommendation because it gives the amount of body fat. We thereby included it in the system thus providing users an insight of their BMI value and which category they belong to, namely; underweight, normal or overweight. Data related to the amount of nutrients contained in ever ingredient was obtained

from the book [2] which also gave the 9 categories of food to be considered.

C. FORMULAE AND ALGORITHM

Consultation with a nutritionist helped in the inclusion of diet history as part of the recommendation because that is how they begin their recommendation to patients visiting them.

1) BMI is calculated in the following way:

$$\text{BMI} = \text{Weight (kg)} / \text{Height (m}^2\text{)}$$

After calculation of BMI, the value falls into one of the three categories;

Underweight; Normal; Overweight

2) Calorie needs for the day is calculated in the following way:

$$\text{Calorie needs} = \text{BMR} * \text{Activity Factor}$$

$$\text{BMR} = (10 \times \text{weight (kgs)}) + (6.25 \times \text{height (cm)}) - (5 \times \text{age (years)}) - 161$$

Activity Factor:

- 1) Sedentary: 1.2
- 2) Moderately active: 1.55
- 3) Active: 1.725

3) Amount of nutrients consumed are calculated in the following way:

$$\text{Nutrient consumed} = \text{Multiplication factor} * \text{Nutrients contained in 100 grams/ 1tsp}$$

4) Recommendation of dishes:

According to the user's BMI category and diseases, the dishes for recommendation are identified.

In the database, each disease has a set of dishes for recommendation. If the user has more than one disease, the common dishes from each of these sets are selected.

These set of common dishes are compared with allergy provided by the user. The dishes which contain ingredients that the user is allergic to, are removed from the list, to get the final set of dishes for recommendation.

Algorithm

Step1: Initialize array 'list'. If there is more than one disease go to step 2, else go to Step4.

Step2: Find array list of dishes for a disease and compare with array 'list'. Store the common dishes from both these arrays in the 'list' itself. Go to Step3.

Step3: Repeat Step2 for all diseases. Then go to Step5.

Step4: Find set of dishes for the given single disease and store them in array 'list'. Then go to Step5.

Step5: Compare array 'list' with the allergies of the user. Remove those allergic dishes from 'list' and display the final set of dishes to the user as recommendation.

D. NUTRITIONAL INFORMATION DATABASE

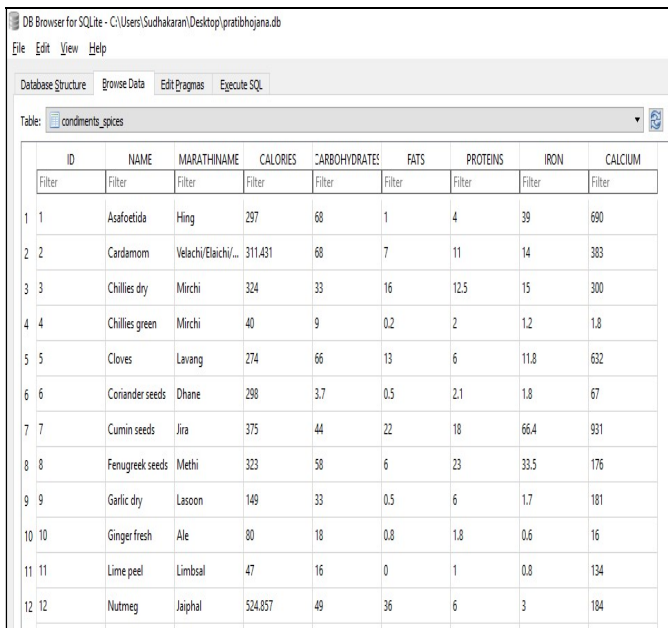
Any food item that we eat, consists of ingredients that fall under the nine categories of food; namely 1) Cereals and grains 2)Pulses and legumes 3)Vegetables 4)Fruits 5)Fats, sugars and edible oils 6)Condiments and spices 7)Nuts 8)Dairy products 9)Meat and seafood. The nutritional part of the database consists of these nine tables, one for each category of food.

Amongst all the ingredients available and used, the ones included in the ingredient tables were those that are commonly available in an Indian household.

Each table consists of ingredient names with the amount of nutrients (proteins, carbohydrates, fats, iron and calcium) contained in them in a given specific quantity. This information was collected from standard nutrition websites such as WHO and others.

Also the amount of calories obtained from every ingredient has an entry in the ingredient table.

This data was used to calculate the amount of calories consumed and nutrients contained in the diet of the user the previous day which helps in getting an idea of the diet lifestyle.



ID	NAME	MARATHI NAME	CALORIES	CARBOHYDRATES	FATS	PROTEINS	IRON	CALCIUM
1	Asafoetida	Hing	297	68	1	4	39	690
2	Cardamom	Velachi/Elaichi...	311.431	68	7	11	14	383
3	Chillies dry	Mirchi	324	33	16	12.5	15	300
4	Chillies green	Mirchi	40	9	0.2	2	1.2	1.8
5	Cloves	Lavang	274	66	13	6	11.8	632
6	Coriander seeds	Dhane	298	3.7	0.5	2.1	1.8	67
7	Cumin seeds	Jira	375	44	22	18	66.4	931
8	Fenugreek seeds	Methi	323	58	6	23	33.5	176
9	Garlic dry	Lasoon	149	33	0.5	6	1.7	181
10	Ginger fresh	Ale	80	18	0.8	1.8	0.6	16
11	Lime peel	Limboal	47	16	0	1	0.8	134
12	Nutmeg	Jaiphal	524.857	49	36	6	3	184

Figure 2. Ingredient Table.

IV. SYSTEM OVERVIEW

A. System Flow

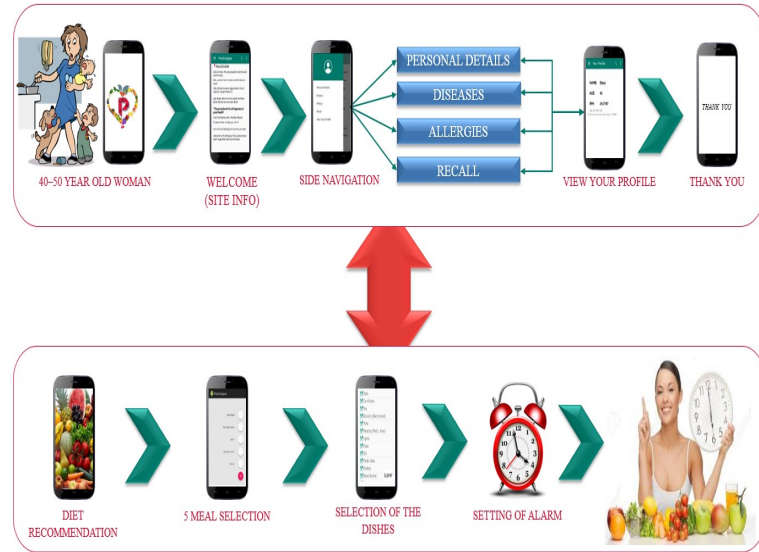


Figure 3. Flowchart of System.

As shown in Figure 3 the system starts by asking the users who are Indian Maharashtrian women in the age group of 40 to 50 years of age, to give inputs such as name, age, height, weight and their cuisine choice, which is vegetarian or non-vegetarian. In the next step, the app asks for the name and levels of the disease and allergies if any, which the woman is suffering from. Followed by basic inputs the user is now asked to give their diet history in recall activity in which they input what they have eaten the previous day, which helps us to know their regular diet routine. After completion of the input procedure, the system applies algorithm to the offline database to display the recommended list of dishes. The user has a free choice to choose any of the dishes that are recommended to her. After selecting the dish, the app shows an option for reminder for the intake of the dish.

V. DESIGN AND IMPLEMENTATION OF THE SYSTEM

A. Module-I Data collection and design of GUI

Data collection first involved conducting a survey of general physicians and nutritionists to find out the most commonly existing diseases and allergies amongst women in the age group of 40-50 years. This gave the list of allergies and diseases which we included in the system. From the internet, the most common levels of the diseases was found out and considered. Also one factor that was highlighted was that BMI plays an important role when it comes to diet recommendation because it gives the amount of body fat. We thereby included it in the system thus providing users an insight of their BMI value and which category they belong to, namely; underweight, normal or overweight.

GUI design included:

- The main GUI of the system was developed in the first module.
- The GUI of the system helps the user to provide input to the system, navigate to different activity and get diet recommendation from the system.
- The GUI was designed using XML coding with an option for drag/drop of GUI components present in Android Studio IDE.

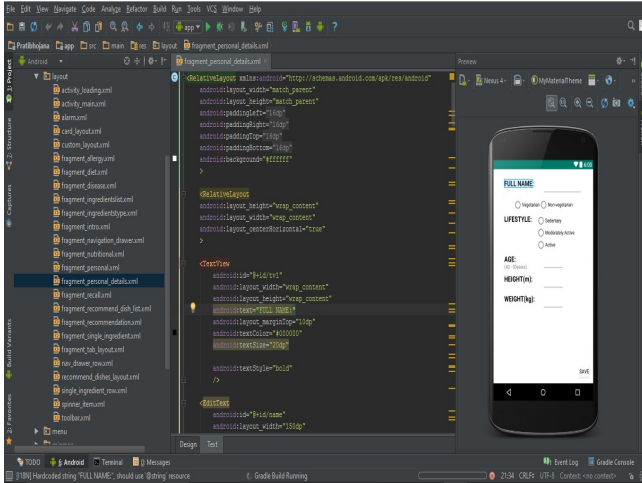


Figure 4. System GUI Design

B. Module-II Back-End Coding and Database Design

- The main objective of this module is to integrate the GUI of the app with the database present in the backend.
- This module is implemented using Java.
- Here the input taken from the user is saved in the database tables.
- Calculation of BMI value and its classification is done here.
- The constraint validation of the input also takes place here.
- With the help of this module, output of the system (Diet recommendation) is found based on the user input.

With respect to database design;

- The main objective of this module is to save the necessary data for the system along with user data.
- This module is implemented using GUI based software SQLite Browser.
- The database file also has a facility for auto-upgradation in case of app updating.

VI. RESULT AND DISCUSSION

Survey of doctors gave the list of the most common diseases and allergies in the age group of 40-50. Recommendations were the main results obtained. It was learnt that diet depends on a variety of factors such as BMI, BMR, disease and allergy and the diet history. Based on these factors, diet was recommended to the user giving the following output.

A. User Interface for the Nutrition recommendation system



Figure 5. First activity of android app Pratihbojana.

Figure 5 shows the first activity of the proposed app which consists of the official logo and title of the app. It displays the name of the proposed system which is Pratihbojana. The word Pratihbojana is derived from the Sanskrit word prescribed diet. Just as a doctor prescribes medicines to patients, in the same way, the proposed system aims at recommending healthy nutritious food to women based on some standard inputs. The proposed system enables women without knowledge about good nutrition to search for simple Indian recipes filtered on the basis of some standard input conditions taken by the system.

Figure 6. Personal Details activity of android app PratiBhojana.

Figure 6. Asks the user to input her name, cuisine preference, age, height and weight. The age of the user should be in the age group of 40-50 years as the app is intended for this age group only. The height and weight specified by the user must be in metres and kilograms respectively. Usually from the height and weight, the BMI is calculated which is then used for deriving certain health results. All the inputs must be properly filled. On clicking the SAVE button all the information given by the user are inserted into the database after the above constraints are satisfied successfully.

Figure 7. Allergies activity of android app PratiBhojana.

Figure 7 shows the allergies taken into account. This list is based on the survey of doctors conducted to find the most common allergies prevalent amongst women in the age group of 40-50 years. The user is expected to select the allergy names that she has, else 'none of these' option.

Figure 8. Diseases activity of android app PratiBhojana.

Figure 8 shows the second set of input categories which are illnesses. This list is based on the survey of doctors conducted to find the most common illnesses prevalent amongst women in the age group of 40-50 years. The user is expected to select the allergy names that she might be suffering from else 'none of these' option.

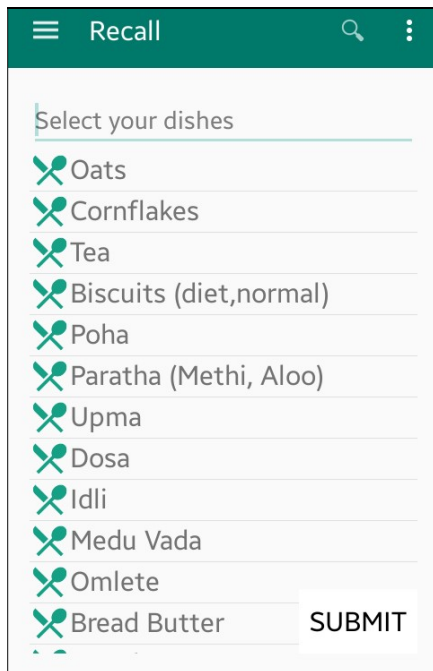


Figure 9. Recall/Diet history activity of android app Pratibhojana

Figure 9 displays the recall activity wherein the system asks the user what she has eaten the previous day. The search bar at the top of the page helps the user to search and select the dishes efficiently.

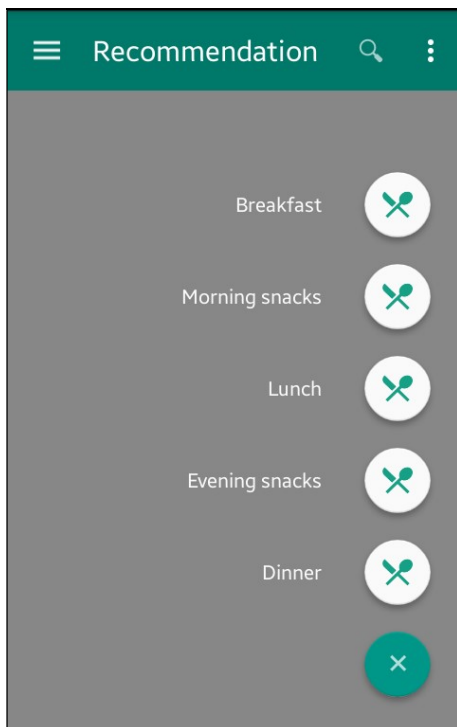


Figure 10. Five meal selection page of android app Pratibhojana.

Figure 10 shows the user interface for the 5-Meal Selection plan. For viewing the list of dishes the user has to select a meal and then based on the inputs provided by the user the system accesses database to retrieve the set of dishes to be recommended to the user who can now set an alarm reminder for the same.

B. User Interface for the Alarm system

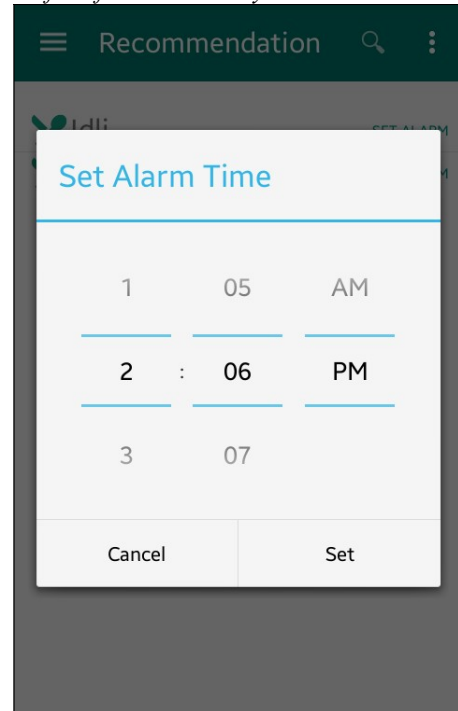


Figure 11. Alarm clock pop-up

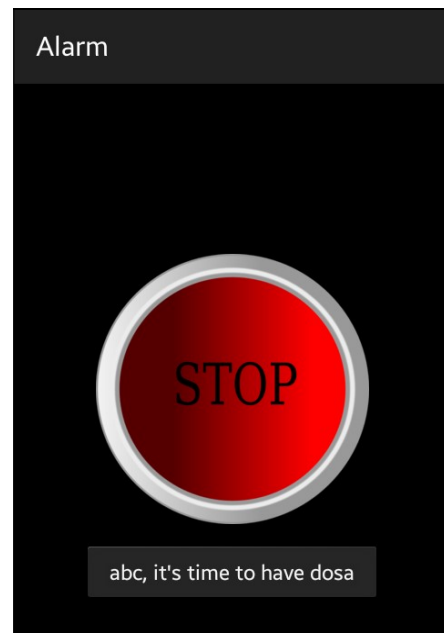


Figure 12. Basic implementation of Alarm System

The final stage of the system is the alarm reminder with voice output. The user can now select one dish for every meal from the 5-time meal plan suggested and set an alarm reminder for the same. The voice output specifying the dish to be eaten makes it easier for the user to identify the purpose of the alarm. Therefore, at the specified timing, the alarm will ring reminding the user to eat the selected dish.

VII. CONCLUSION AND FUTURE WORK

The survey of general physicians threw light that there is lack of awareness amongst women about the importance of nutrition particularly when they enter the age group of 40-50 where they are most likely to develop unhealthy conditions. The importance of nutrition needs to be realized by every woman. Necessary changes in the lifestyle of every woman has to be incorporated in order to ensure a healthy living. A healthy living comes from a healthy diet. For this reason, women need to get some sort of guidance for the right diet for their condition. And to support that, this project described an alarm based personalized nutrition recommendation system for women in the age group of 40-50 years.

Good nutrition starts with the basics: a well-rounded diet consisting of whole grains, fresh fruits and vegetables, healthy fats, and high quality sources of protein. These kinds of foods provide women with plenty of energy, the means for lifelong weight control, and the key ingredients for looking and feeling great at any age. Instead of obsessing over specific foods or nutrients, it's the overall eating pattern that's most important. Diet has a major effect on an individual's food cravings, stress levels, and energy throughout the day. By making smart food choices and developing healthy eating habits, it's much easier to stay slim, control cravings, and feel energetic all day long.

In this way Pratibhojana aims at playing a good nutritional role in the lives of women in the age group of 40-50 by improving their daily diet. The system relieves users the burden of having to identify the right diet as per their body conditions and nutritional needs and will save them the time of browsing the internet for appropriate diet recipes. An additional advantage of the proposed system is the alarm reminder for food. Therefore, this proposed system, is a fine attempt to build an efficient diet recommendation system that provides home made Indian recipes that will help improve the nutritional status of households. Future work may include the alarm reminder system being made multipurpose and with a

better voice output. Also the app can be made online in future to incorporate more amount of data. Another task of future research is to make the system for infants as well as the elderly.

Since, Life can be hectic, and sometimes it's hard to take the time to make healthy food choices. But making wise food choices—along with regular physical activity—can offer big benefits, now and in the future.

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