
Eat Matters: An Android Food Journal for Diet Monitoring

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Abstract:

Food journal is a detailed record of the food and drink you consume over a given period of time. It is commonly used to identify eating patterns, track calories, and to identify changes that can be made. Most food journals are usually manually inputted and computed. To lessen the burden and hassle of computing it manually, an automated food journal is introduced in this study. This aims to provide a tool to help people in tracking their daily calorie intake as well as its macronutrients, calorie, protein and fats. This will operate in android operating system based smart phones and tablets. The application is developed using PhoneGap framework that enables developers to use HTML 5, CSS, and Javascript in developing hybrid mobile application. The application was tested and evaluated by Registered Nutritionist-Dietitian. The results showed that the application was rated as very good according to functionality, efficacy, usability and user interface.

Key words: automated food journal, eating patterns, daily calorie intake, android operating system

1. Introduction

In planning a diet a person must consider his total energy requirement. As defined by Food and Nutrition Research Institute in the Philippines; Calories are the units of measurements for the energy our body gets from food. Energy is supplied by all foods in varying amounts according to their content of fat, carbohydrates and protein. According to the National Center for Chronic Disease Prevention and Health Promotion, a person must sustain a careful balance between calories consumed and energy used in order to maintain his recommended body weight and must consume fewer calories than used in order to lose weight. In computing the person's total energy requirement the FNRI provided a formula given the height and weight of the individual.

One of the practices that contribute to monitoring the right amount of calories eaten is through food journaling. Food journal is a detailed record of the food and drink you consume over a given period of time. It is commonly used to identify eating patterns, track calories, and to identify changes that can be made.

Before those people who wants to track their calorie intakes manually computes the calorie of every food and beverages they had eaten and drunk. Now, for a hassle free computation of amount of calories being eaten per day, there is a new trend that is provided by technology nowadays. Few of those are the calorie counter, food diary or journal and BMI calculators. However, only few of these applications provide Filipino foods and mostly focus on either gaining or losing weight. Also these applications lack information in providing the user's desirable body weight, body mass index and total energy requirement. It only allows the user to choose their desired weight. The problem is the user may input a weight wherein he may be categorized as being underweight or overweight which can lead him to be unhealthy.

In line with this, the researchers aim to provide an Android Food Journal Application whose respondents are Filipino adults from 20 years old and above. The user is prompted for his basic information such as height and weight. From this information, the system will calculate the user's ideal body weight, body mass index and total energy requirement or daily calorie intake. Hence, this Android Food Journal application will serve as a tool which guides the respondents' diet monitoring each day.

2. Methodology

Data Gathering

➤ Identifying the needed inputs

Mrs. Remedios N. Montaña, RND stated that the factors to consider in creating a diet are the height, weight and the level of activity of the person. The height is used in computing the desirable body weight, while the weight is used to calculate the Body Mass Index. The BMI indicates whether the person's weight is normal for his height, it determines whether the person is underweight, overweight, obese or normal. A person's level of activity must be identified in order to know his daily energy requirement. The level of activity is classified into four (4) categories: Sedentary, Light, Active and Very Active. The Desirable Body Weight (in kilograms) of a person is multiplied to the number of calories depending upon his level of activity in order to identify his total energy requirement per day. Every food item is equated with an amount of calorie content as well as carbohydrates, protein, and fats. These will determine the limit on the amount of food one must eat.

➤ Identifying the Process

In order to start a food journal, the person must undergo assessment wherein the Body Mass Index and Total Energy

Requirement are calculated. Then he must list down the food he eats on a daily basis and identify its nutritional facts (Carbohydrates, Protein and Fats). These nutritional facts are considered in order to know the right amount of food to eat. After identifying and calculating such data he may start his diet journal. On a diet journal he must write all the food he has eaten for one day and total the calories consumed for a day and compare whether he has gone beyond the total energy requirement.

System Design

The proponent identified four (4) major processes: Assessment Activity, Journaling Activity, Food Entry Activity, and Progress Activity.

➤ Assessment Activity

Assessment Activity is where the user input his height, weight and the level of his activity. In this activity, the user provides information that the application needs. After acquiring the needed data from the user, the application then computes the users DBW, BMI and TER.

- DBW is the appropriate weight for the user's height. The DBW has an allowance of plus or minus 10kg that will still categorize the user as normal. The formula used to calculate the DBW:

$$DBW(kg) = [Height(cm) - 100] - [Height(cm) \times 0.1]$$

- The BMI is then determined through the formula:

$$\frac{w}{h^2} (703) = BMI$$

- TER per day is then calculated. TER is used to know the required amount of calorie the user must consume per day. The formula used to calculate the TER:

$$TER = DBW \times Level\ of\ activities$$

Table 1 shows the amount of calorie according to the activity level of a person. These values are multiplied to the DBW of a person in order to know his total energy requirement per day. Sedentary having 30kcal, light having 35kcal, moderate having 40kcal and very active having 45kcal.

Table 1: Calorie multiplier by level of Activity rigorousness

Level of Activities	Calorie/kilo
1. Sedentary (e.g. office worker, call center agent)	30.0
2. Light (nurse, teachers)	35.0
3. Moderate (House keeper, gym instructor, athlete)	40.0
4. Very Active (police, soldier, sea man)	45.0

- The Macronutrients is calculated through these formulae:

Carbohydrates: $TER (0.65) / 4 = CHO$

Protein: $TER (0.15) / 4 = PRO$

Fat: $TER (0.20) / 9 = FAT$

➤ **Profiling Activity**

Profiling Activity is where entered information as well as the subsequently changed information, such as weight and TER, are displayed.

➤ **Diet Journal Activity**

Diet Journal Activity is designed to record the user's daily food intake. At the same time organize his meal for the following day and so on.

➤ **The Food Registration Activity**

Food Registration Activity is designed for users to add, edit and delete food in the food list. The food activity will specify the serving and the nutritional content of a particular food.

➤ **Progress Activity**

Progress Activity is where the user may check his progress in graphical representations. These graphs show the percent of his daily calorie intake comparing to his TER and macronutrients.

➤ **System Diagram**

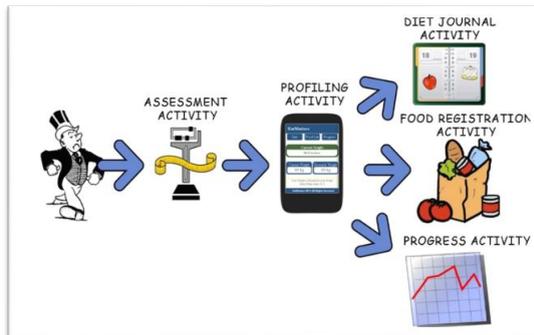


Figure 1. Activity Flow Diagram

Figure 1 illustrates the flow of activities that the user will encounter during operation of the application. During boot up for the first time, it will ask the user to input his current height, current weight, and the type of physical activity. This is the Assessment Activity. This activity is only encountered once during the lifetime of the application. During subsequent operation, this will boot into the home screen where the statistics are shown such as the computed DBW, TER, Carbohydrates, Protein and Fats. This is the Profiling Activity. In the home screen, the user can then choose between three activities depending on the circumstances. These are the Diet Journal Activity, Food Registration Activity, and Progress Activity. The Diet Journal Activity includes daily logged foods of the user, breakfast, lunch, dinner and snacks. Food Registration Activity shows the food list, here the proponent provided basic foods that is available for the user. The user may add, update and delete foods and beverages given that he

knows the basic inputs namely: no. of calories, carbohydrates, protein and fats. Progress Activity allows the user to check and monitor his calorie, CHO, PRO and Fat intake per day.

System Development

➤ Hardware

The application is tested on a Polaroid PRO G590 with a 5.9-inch show (480 x 800 resolution), the device is referred as a Phablet, combination of phone and tablet because of its size. It may be run on a Jelly Bean (Android version). This device was chosen because it was readily available during the development of the application.

➤ Software

The Application is designed using HTML, CSS3, and JS using PhoneGap 2.9.0 as platform because these are the languages that are most familiar to the proponent. Eclipse Indigo is used to build the .apk file as was specified by the PhoneGap documentation. During the development process, Ripple Emulator Chrome extension is used to emulate screen size of mobile devices as it provides an adequate range of emulated screen sizes available.

Evaluation

The testing and evaluation phase of the development is divided into two phases. The Alpha Testing Phase and the Evaluation and Verification of Field Experts. The first part comprises a series of tests made by the proponent to test the capabilities of the application as well as the robustness of the product. The test comprised of input testing where forms were fed different types of input aside from the accepted inputs to test error handling. Screen tests were also made to see the integrity of the

GUI on different platforms and screen sizes. Algorithm test were made to verify correctness of operations within the application.

The Evaluation and Verification of Field Experts is an evaluation tool used by the proponent to test the app's correctness and relevance in accordance with latest advances in the field namely Nutrition and Dietetics. The proponent designed a questionnaire that specifically address the main concerns of the app namely the correctness of formulae and computations used. Experts were given a copy of the application together with the questionnaire and were asked to evaluate the application by filling out the questionnaire. The results are then collated and interpreted by the proponent.

3. Results and Discussions

1. Application Screenshots

The following are screenshots of the application during actual operation. These images are captured using Asus MemoPad android version 4.1.1, single core processor and 1 GB ram. These images were taken during alpha test and were made to simulate real world operation of the application.

Figure 2 shows the screen when the app is opened for the first time, it boots the assessment screen. This is where it asks the user for his current weight, height and the level of his daily activity.



Figure 2. Assessment Screen

Figure 3 shows the Four (4) Activity Level of a person when you press the Activity Level combo box.



Figure 3. Activity Level

Figure 4 shows the screen after the user entered information as well as the computed information such as the Desirable Body Weight, Total Energy Allowance, Carbohydrates, Protein and Fats. This screen serves as the base screen for navigation.



Figure 4. Home Screen

Figure 5 shows the Navigation Pane, it is activated when the Menu Button is pressed (upper left corner) or by using the “swipe right” gesture. It is dismissed by the “swipe left” gesture or by pressing the Home Screen



Figure 5. Navigation Pane

Figure 6 shows the page where the user enters the food for journaling. Food can be entered on any day of the week and can be labeled according to the type of meal it is.

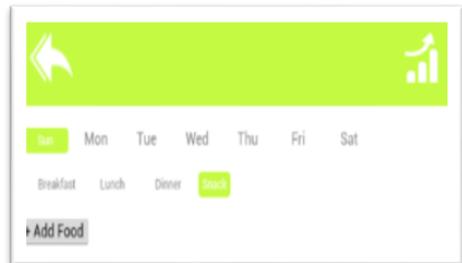


Figure 6. Diet Screen

Figure 7 shows the Diet Screen when food is entered.



Figure 7. Diet Screen Sample

Figure 8 shows the pane of total Calorie, Fat, Protein, and Carbohydrates of the entered food by the user. This pane also displays whether the user has reached the limit of these levels for the day. This pane is activated by pressing the Monitor Button on the upper right corner of the screen as well as using the "swipe left" gesture.



Figure 8. Macronutrients Monitor Pane

Figure 9 displays the food within the database available for searching. This is activated by pressing the Add Food Button.



Figure 9. Add Food Screen

Figure 10 shows all the foods listed in the database, pre-entered foods and user-entered food. The pre-entered foods are based on the given food list of FNRI and nutritional facts of commercial foods.

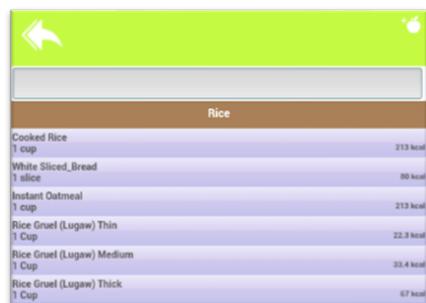


Figure 10. Food List Screen

Figure 11 shows the progress of the calorie intake of the user within a week, it is displayed in a daily basis.



Figure 11. Calorie Progress Screen

Figure 12 shows the distribution of carbohydrates, protein, and fats of the user depending on the updated input of the user in his daily diet.

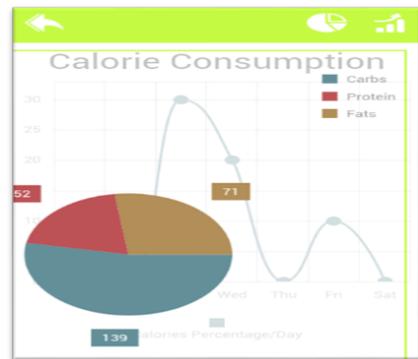


Figure 12. Macronutrients Distribution

2. Alpha Testing Phase

The proponent tested the application on different devices with different screen sizes. This is to test the application's GUI integrity across various screen real estate. GUI related functions and events are also tested namely: Navigation, Scrolls, Buttons, and Swipe among others as these components are crucial to the overall interaction of the application. The devices used for testing are: Cherry Blaze S180, Asus MemoPad, and Polaroid G590 with screen sizes: 4.7 in, 7 in, 5.9 in respectively.

Table 3 shows the scoring system of one (1) to three (3) where three is the highest. Three or Always means that the feature tested is useable and working all of the time on the tested devices. Two or Often means that the feature tested is useable most of the time though there are slight changes in performance or responsiveness. One or Seldom means that the feature tested is seldom working or not at all on the device tested.

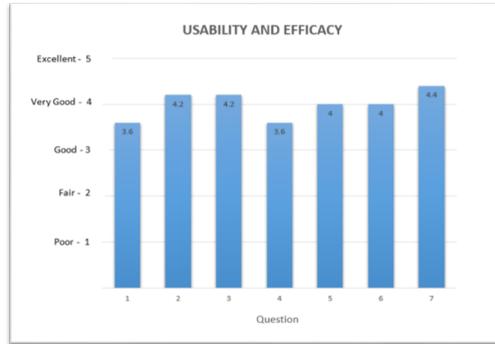
Table 3. Screen Test Results

Mobile Device	Navigation	Scrolls	Buttons	Swipe	Loading Time
Cherry Blaze S180	3	3	3	3	2
Asus MemoPad	3	3	3	3	2
Polaroid Pro G590	3	3	3	3	3

3. Evaluation and Verification of Field Experts Phase

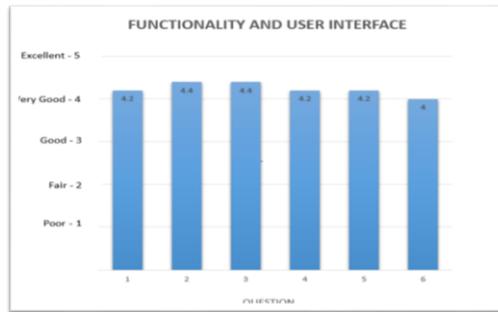
The second phase of testing was achieved by subjecting the application to evaluation by experts of the fields namely registered duly licensed Nutritionist Dieticians. The evaluators were furnished copies of the application and a questionnaire designed to rate it on specific aspects related to the functionality, efficacy, usability and user interface. Areas such as formulas, computations, information asked from the user, and information displayed to the users are the fields evaluated by said evaluators. The application was tested for the duration of one (1) week. This is to ensure that all functions and features of the application are experienced by the evaluators since some of these features are time based. The questionnaires rate each

field using a five (5) point system where five (5) being the highest. Additional inputs and comments are also asked from the evaluators to justify and or clarify the ratings given to each field.



Graph 1. Average rating according to usability and efficacy

Graph 1 shows the average results of each question according to usability and efficacy. The items that received the least rate are complete identification of needed inputs and organization of food list. It received an average rating of 3.6 pertaining as good. It was pointed out by the evaluators that the food list should be updated to include more food items in order to be more organized and up to date. For the assessment of comprehensive food information and convenience of in tracking daily diet, it received an average rating of 4.0, Accuracy of results (DBW, TER, CHO, PRO and Fats) it received an average of 4.2 and Understandable assessment of progress activity it received an average rating of 4.4, all of this results is assessed as Very Good. Overall, the usability and efficacy aspect of the application was generally evaluated as very good.



Graph 2. Average rating according to functionality and user interface (UI)

Graph 2 shows the average results of each question according to functionality and user interface (UI). The application stability received an average rating of 4.0 as very good, Application's color combination, Ease of use and Responsiveness of the application was generally assessed and received a rating of 4.2 as very good and Eligibility of the text and overall design received the highest rating of 4.4 as very good. Overall, All questions in accordance to functionality and user interface generally received an average rating of 4.2 as very good.

4. Conclusion and Recommendations

Conclusion

During the Alpha Test, the application performed well on the Polariod PRO G590 as it meets the minimum required specifications. On the other devices, these features are usable though users might experience decreased responsiveness.

During the evaluation and verification of field experts, the application scored as very good according to usability and efficacy as well as functionality and user interface (UI). All requirement set by the evaluators have been met satisfactorily. In general, the application sufficiently supplied the needed information.

Overall the results of the testing had been rated as very good. The application performed well on all the tests and evaluations conducted.

Recommendations

In keeping with the scope and limitations, the proponent recommended the following:

The application was developed for individual's personal food journaling order for him to monitor his daily diet. For further enhancement, the proponent recommend that the future developers may include bed rest in activity level for the computation of daily calorie intake. For dietitian's use, it is recommended that the application may include dynamic computation of carbohydrates, protein and fats in order to assess their patients for a specific therapeutic diet. Also for comprehensive food list, it may include specifications of micronutrients in every food. For more effective ways for the user to optimize the application, it is recommended that physical activities may be included for the user to monitor and assess every calorie he has burnt in any physical activities he may have. To be able to monitor his daily diet the developers may include a push notification that will remind the user to enter his meal any time of the day.

The application may be optimized for best usage if it can be used by different platforms. Due to the fast access to the internet nowadays the application is recommended that it may be synchronized through the internet and may be shared and accessed through social networking sites.

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