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MOBILE FOOD CONSUMPTION MONITORING APPLICATION

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ABSTRACT

Obesity is becoming a serious health issue due to the growing number of obese people in many countries. iFood, a mobile application to help individuals manage daily calorie consumption is presented and ways of optimizing the daily calorie needed is achieved by offering information of each food and suggestions on food and physical activities that can be carried out to balance the amount of calorie intake. The application is developed based on the Rational Unified Process Model (RUP) system development methodology which comprises of four stages including inception, elaboration, construction and transition. We present the design, implementation and evaluation of iFood for Android smartphones and demonstrate its feasibility in monitoring daily calorie intake. The application analyzes emphasizing on its accessibility and acceptance test. The results show that participants are satisfied with the features provided by the application. They agreed that the application helps them to monitor their food intakes and hence to lose weight.

Keywords: Obesity, Calorie, Mobile application, Health monitoring, Android.

Contribution/ Originality

This study investigates on obesity in Malaysia and it proposes mobile food application which is useful for people to monitor their food intakes. Furthermore, features of this application will be explained in the paper.

1. INTRODUCTION

Overweight or obesity is the result of an imbalance between the calories consumed and those burnt by a given person. Malaysia ranks sixth in terms of obesity in the Asia-Pacific region and first for obesity and diabetes in South-East Asia (Geok *et al.*, 2015). Statistics released by the National Health and Morbidity Surveys confirm that 17.7% of Malaysians 18 years old and above struggle with obesity and about 1 out of 3 Malaysia are overweight (Ministry of Health Malaysia, 2016).

Obesity is a major contributor to global diseases like hypertension, heart disease, type 2 diabetes, particular types of cancer and other health problems that can considerably reduce the quality of life in industrialized societies such as Malaysia (World Health Organization, 2010).

Urbanization and industrialization in developing and developed countries in recent decades have been the main determining factors inevitably leading to considerable modifications in the lifestyle of Malaysians. A hasty tendency toward unhealthy dietary habits and a lifestyle that obliges people into a sedentary state at home and work are believed to have obvious associations with the increasing health issues and chronic diseases among adults.

People require calories for daily use, and foods must be eaten to intake the required calories. The majorities of people do not know how many calories their body requires and have no information regarding the amounts of calories in different foods. In addition, most do not understand which activities are suitable to burn extra calories.

Not all obese individuals who live in rural areas are able to frequently meet dieticians due to the unavailability of transport. Thus, they lack correct guidelines on how to manage their diet intake and physical activities applicable to weight loss management (Yusof and Iahad, 2012).

Technology and the advent of more sophisticated and capable mobile applications have changed the basic ways of monitoring food consumption. This study sets out to establish a mobile application that can play an integral role in reducing weight and monitoring food consumption. The iFood is a mobile application that able to assists people to manage their daily calorie intake. It determines the amount of BMI and daily calories requirement for the users. The iFood helps the users to control their weight by suggesting foods and exercises. In addition to these features, iFood provides a list of Malaysian foods, exercises, weekly graph, meal remainder and Malay language.

The rest of the paper is structured as follows. Section II demonstrates related work focusing on features of three mobile applications and comparison to the iFood application. Methodology, system requirements and technology which were used to develop the iFood application are explained in section III. The application presentation and experimental evaluation are addressed on section IV. The last section concludes the paper and mentions future works.

2. RELATED WORK

This section explains the review carried out on three applications which are similar to the iFood, namely the Daily Calorie Manager, MyFitnessPal and My Diet Diary. The review were done on the functions provided by all three applications and to identify weaknesses or limitations on them. The knowledge gained is used to develop the iFood which will contains all similar functions as well as those that can overcome the shortcomings found in the similar applications.

A. **Daily Calorie Manager**

Daily Calorie Manager is an application that is built especially for Malaysian Android users in order to manage their daily calorie intake towards a healthier lifestyle.

Users can view the total amount of calories they require every day, the amount of consumed calories and the sum of burn calories in the main page. The proposed application provides list of Malay foods in it database and users are able to add consumed foods and activities that they had done into the application (Kasim and Zakaria, 2013).

B. **MyFitnessPal**

MyFitnessPal is a free mobile application with large food database and it helps users to count calorie and track food. The application suggests required calorie to user as goal and the user needs to eat daily foods based on suggested calories. User can add foods into Diary section for each meal and the total amount of consumed calorie will be deducted from calorie goal. User is able to choose exercise from the list and add it into Diary part. The burnt calorie will be reduced. The application provides reminder of each meal. User can add new food into database and he/ she is able to share his/her achievement with his/her friends. Some articles are provided for user and user can see the progress of his/her work.

C. **My Diet Diary**

My Diet Diary is a mobile application for counting calorie and it provides more than 150,000 foods in its database. My Diet Diary shows amount of calorie remaining, calorie consumed, calorie burned and

duration of doing exercise. Users are able to view the amount of consumed calories with details, determine activity level, goals, desired weight and target date. They can add what they eat for each meal into the application. This application offers features such as search box to selecting foods and exercises, weight charts, diet summary, MedHelp's community for asking questions and reports tracking use's weight loss.

D. **System Comparison**

Functions of these applications are compared based on several aspects and results are shown in the following Table 1. Its shows that the iFood application offers more functionalities to users including food suggestion, exercise suggestion, exercise video and time to next meal, which could further assist the users to control their food intake and to burn excess calorie.

Table-1. Comparison of iFood with similar applications

	Daily Calorie Manager	MyFitnessPal	My Diet Diary	iFood
Registration	✓	✓	✓	✓
Login	✓	✓	✓	✓
Malaysian Foods	✓	✓	✓	✓
Food Information		✓	✓	✓
Meal Reminder		✓	✓	✓
List of Exercises	✓	✓	✓	✓
Exercise Videos				✓
Time to Next Meal				✓
Suggested Foods				✓
Warning System	✓	✓	✓	✓
Suggested Exercises				✓
Progress		✓	✓	✓
Malay Language				✓

3. IMPLEMENTATION

A. Methodology

Selecting a suitable research method is important to achieving the research objectives. The work carried out is based on qualitative approach. Survey and interviews are used as research instruments. The survey aimed at determining the significant factors that should be considered in developing the iFood application. Interview sessions with a consultant and a dietitian were held to comprehend the reasons for the increasing numbers of obese Malaysians and thus to find better ways to manage this problem.

Rational Unified Process (RUP) served as the system development methodology. RUP is an iterative software development process structure. RUP is not only concrete prescriptive procedure but is a rather flexible process structure, planned to be tailored by developer groups and software project teams who will select the process elements suitable for their requirements. The RUP project contains four phases: Inception, Elaboration, Construction and Transition. The use case diagram for iFood mobile application is depicted in Figure 1. This diagram represents an overview of the functions performed by the user and admin.

B. System Requirements

In order to have a good user experience, mobile application requires providing specific requirements. The application should be user friendly. It should provide a screen with great design, minimal data input from the users and suitable font size. Additionally, there are some functional requirements which should provide by the iFood application. The proposed application requires registration module to collect information of users and it should show the amount of BMI and daily calorie requirements to the users. The users should be able to view list of foods, list of exercises, weekly graph of consumed calorie and total amount of calorie consumptions. The application requires the modules to add or delete the foods by the users, update the user's profile and change the language.

C. Used Technologies

The iFood application runs on mobile devices with Android platform. The programming language for the application development was Java, using the Android SDK (Software Development Kit). Eclipse IDE (Integrated Development Environment) with ADT (Android Development Tools) plugin used to create the mobile application. SQLite database utilized for structured data storage. The iFood application database involves user's personal information, list of Malaysian foods, list of exercises and the entire user consumed foods.

Figure-1. Use Case Diagram for iFood Application

4. DEMONSTRATION AND EVALUATION

The following section presents an overview of the iFood application from the user perspective. Additionally, the evaluation in user experience using the application is also discussed.

A. Demonstration

First time user is required to complete the registration process. The user can choose either the male or female icon or he/she can take a photo of himself/herself by clicking on "From Camera". The user is then required to key in information such as username, password, name, age, gender, height, weight and activity level for his/her profile. This information is crucial for calculating the BMI and Daily Calorie Requirement. Once done, the user can start

using the iFood application by login in using the username and password previously set. Figure 2 displays "Registration" section.
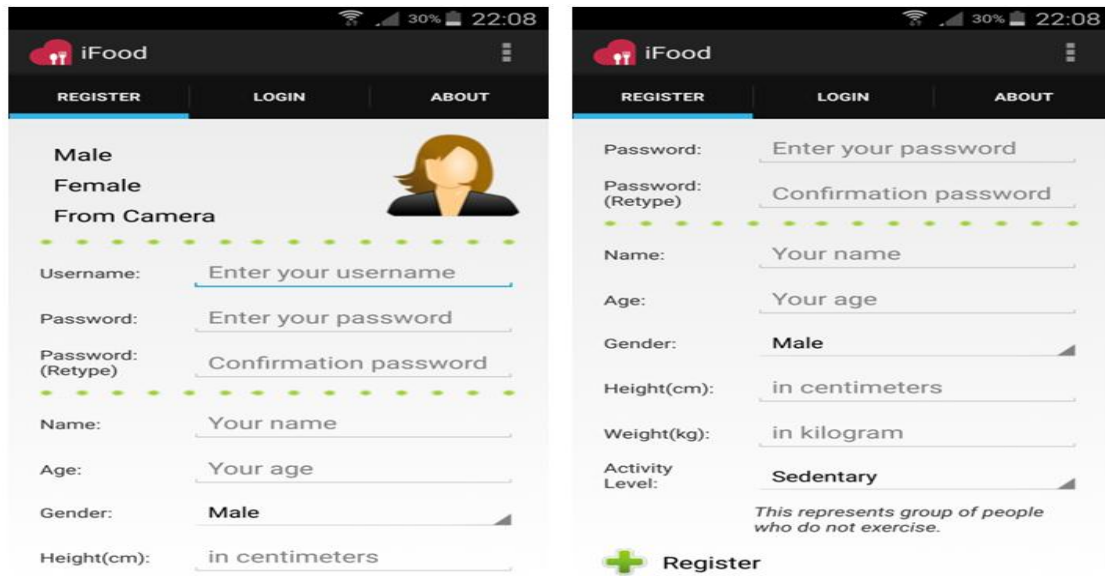

Figure-2. Registration

As shown in Figure 3, the iFood application automatically calculates and displays the user's BMI and required daily calorie amount based on the height, weight, age and activity level provided. The "Main Menu" consists of 8 modules as shown in the figure.
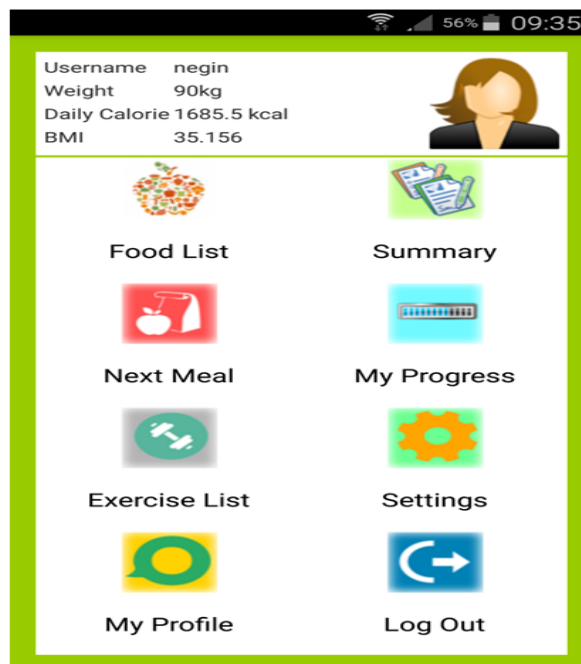

Figure-3. Main Menu

Figure 4 presents "Food List" of the iFood application which consists of Malaysian foods in its database. The foods are categorized into 4 sections, namely; "Rice-Based Foods", "Desserts", "Vegeterian Foods" and "Drinks" for easier viewing. Users are able to view image of the food, name, calorie and information of particular food.

Figure-4. Food List

The iFood application set the time for breakfast, lunch and dinner. The suitable time for breakfast, lunch and dinner is at 8am, 1pm and 7pm respectively. As shown in Figure 5, the "Summary" module displays the remaining time to next meal. The "Summary" module presents consumed calorie of each meal and total amount of daily consumed calories to the users. Users are notified about their calorie intake with images and messages.
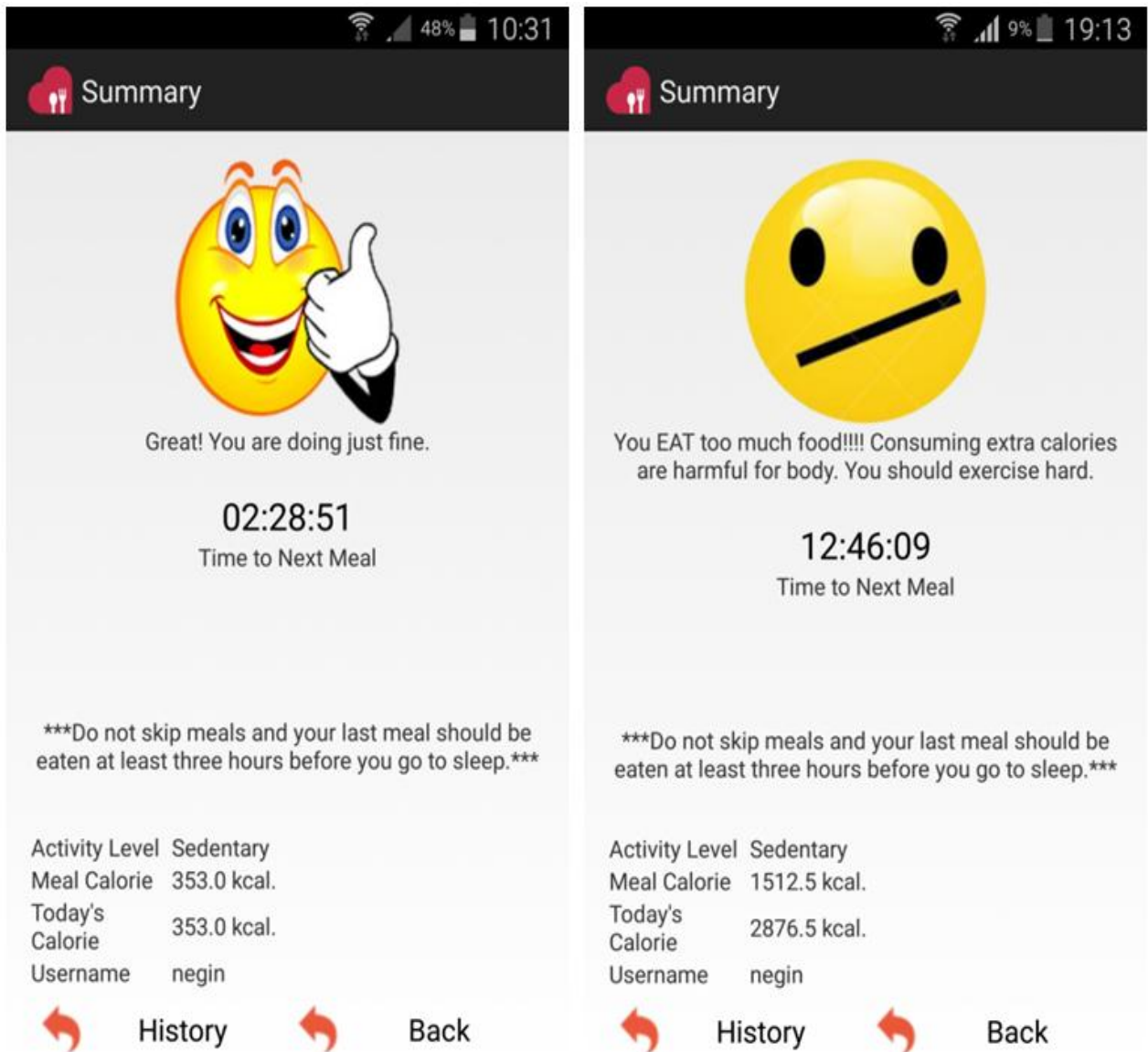
Figure-5. Summary

Figure 6 shows "Next Meal" section. User can add his/her food intakes using the "Add Foods" or "Suggested Foods by iFood" button. Based on an interview with a dietitian, obese people who want to lose weight require only 350 to 400 kilocalories for each meal and 150 to 200 kilocalories per day for snack. The "Suggested Foods by iFood" will show a list of foods with calori less than 450 kilocalories. Therefore, the users can simply select any foods from the suggested list.

The users can use the "Add Food" button to select the consumed foods from the menu. By clicking the button, 130 different type of foods with different amount of kilocalories are displayed to the users.

The iFood application will warn users abour their consumed calories. If the calorie consumption for each meal are between 800 to 1000 kilocalories, the application will show the amount of calorie with yellow color and play "Be careful" sound. If the amount of calorie consumption are 1000 or above, the iFood application will display the calorie's amount with red color and play a warning sound. And if this amount are less than 800 kilocalories, the application will show calorie consumption with green color.
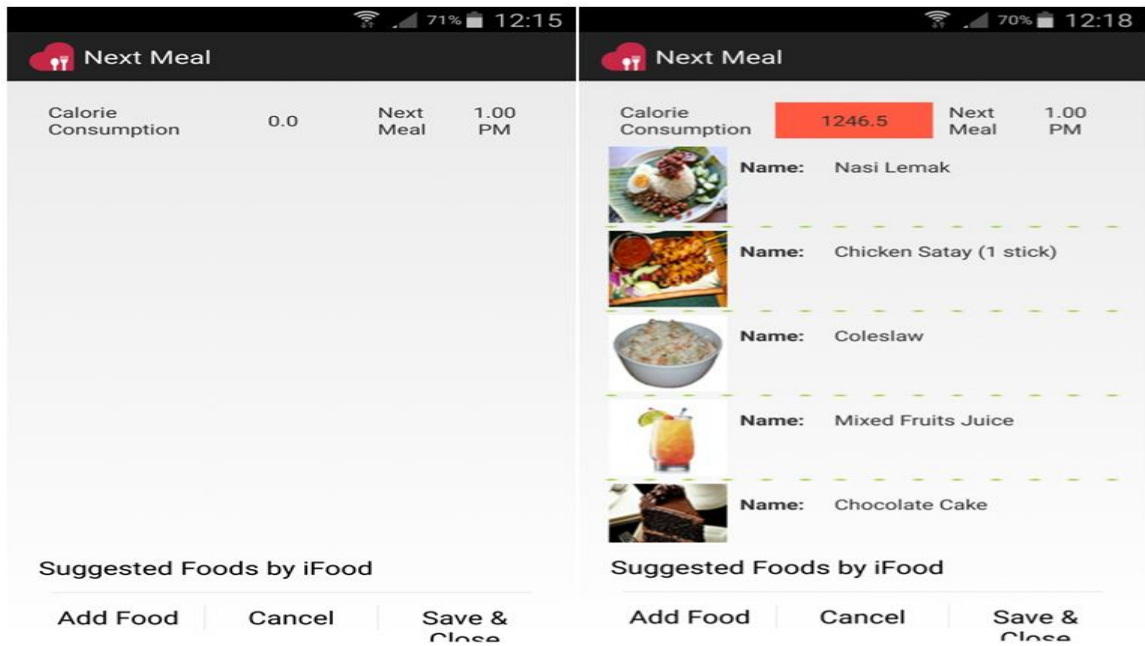
Figure-6. Next Meal

Figure 7 illustrates the screenshot of "Suggested Exercises". As it mentioned in previous part, the users can consume 450 kilocalories for each meal and if they eat foods more than 450 kilocalories, the application will suggest some exercises to help users to burn extra amount of calories.
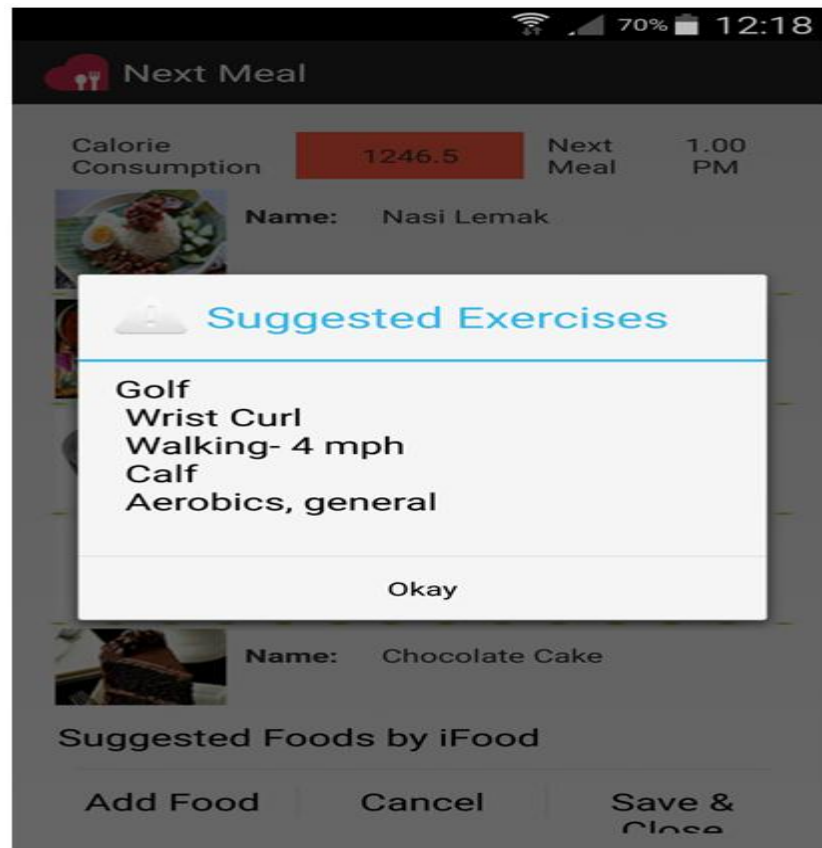

Figure-7. Suggested Exercises

Exercises are grouped into 4 sections which are "Endurance", "Strength", "Balance" and "Flexibility". Endurance activities rise heart rate and breathing compare to strength exercises which make the muscles stronger.

Balance activities assist to prevent falls and flexibility exercises help the body stay limber. For every exercise, the iFood application provides amount of burn calories, duration, type, description of that exercise and video. If the users have access to internet, they can watch the video exercise online. Figure 8 demonstrates "Exercise List" module.
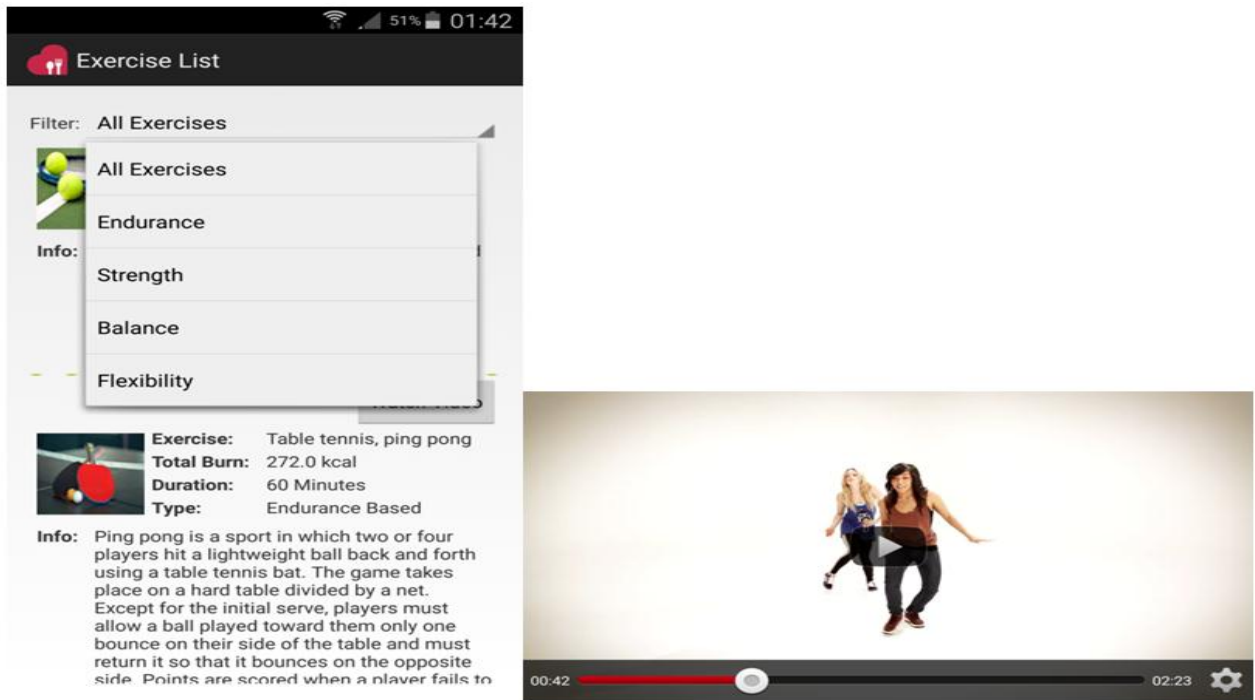

Figure-8. Exercise List

The users are able to view weekly graph of calorie consumption in "My Progress" module. Figure 9 displays screenshot of "My progress".
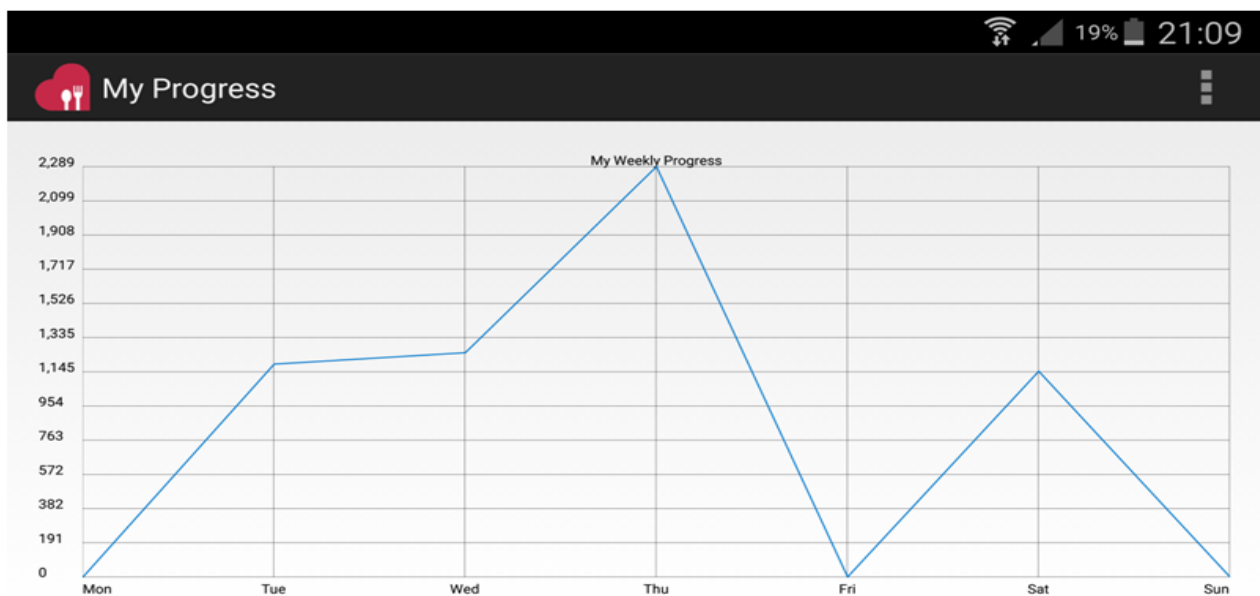

Figure-9. My progress

Reminder is an additional attribute that the iFood application provided. This application will remind users to eat foods 15 minutes before each meal. Figure 10 presents the screenshots of "Reminder" for breakfast, lunch and dinner.
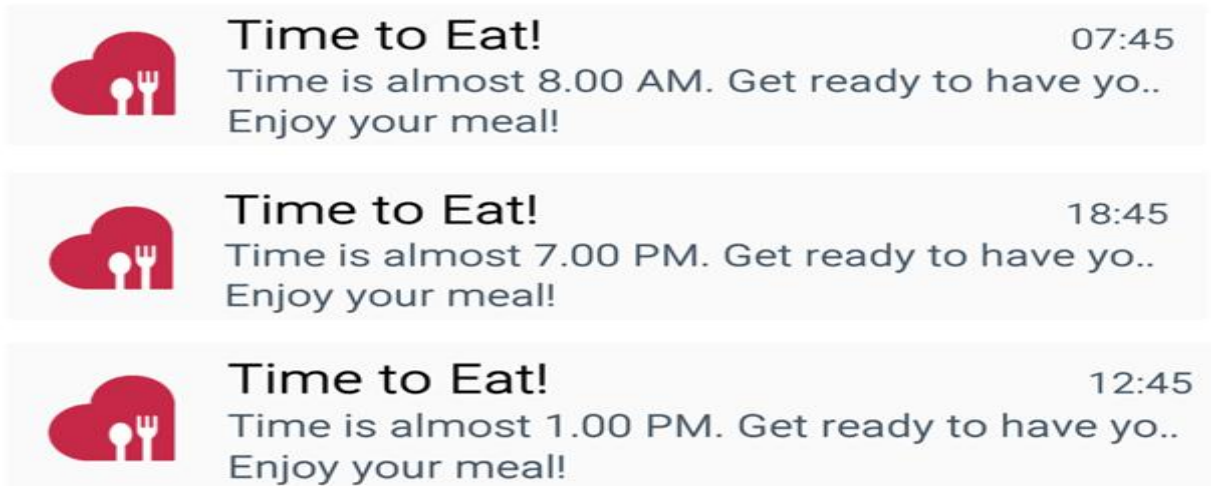
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Figure-10. Reminder

A very helpful feature provided by the iFood is that is was developed with two different languages; English and Malay. As Malay is the first language of Malaysia, many users will be much benefitted with the Malay version of iFood. Those whose are not good with English will be more comfortable and confident to use the application. Figure 11 presents the iFood application in Malay language.

Figure-11. Malay version

Users are able to update and change their information in "My Profile" section.

B. Evaluation

The iFood application was evaluated by a dietitian and 4 obese participants. The dietitian worked with the application and evaluated it during interview session. 4 obese people, 2 men and 2 women, participated in evaluating

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the application. They used this application for 2 months and after that they filled up the evaluation questions. The iFood application was assessed under two main aspects, namely; acceptance test and accessibility.

The results of the evaluation conducted showed that the participants are satisfied with features provided by the application. They believed that the list of Malaysian foods with details information; can help them to choose proper foods for each meal. They agreed food suggestions and exercise suggestions are helpful for them to consume fewer calories and know which exercise can burn extra amount of calories. Furthermore, the participants approved that the iFood application can support them to lose weight and monitor their food intakes. They mentioned that they could lose weight up to 4 kilograms during the 2 months while using the iFood . Therefore, the iFood application can be useful for overweight or obese people to manage their food intake and lose weight.

5. CONCLUSION AND FUTURE WORKS

The reasons behind the increasing numbers of obese individuals in Malaysia were investigated together with the development of a mobile application that can help Malaysians with weight control. A design for the iFood application was proposed and the application was developed based on the findings obtained throughout the study duration. The iFood application was assessed by a group of obese people and the results of this evaluation indicated that this application may benefit obese people.

This research outlined various features of the implementation of a mobile food consumption application. For future undertakings, it would be interesting to develop a mobile application that can take a photo of food or scan it, after which the application automatically calculates the amount of calories, instead of choosing food from a list. The application could have additional foods and exercises in its database. Furthermore, other features like serving size, nutritional facts and monthly graphs can be added to the application.

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