

Prediction Status Nutrition using by Body Mass Index on Mobile Device

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ABSTRACT

This paper is aim to predict nutrition status using by the Body Mass Index (BMI). BMI for men and women are obtained from the calorie needs. Calorie requirement is used to determine energy needs. The energy needs are determined by the needs of Protein, Carbohydrate, Fat, Vitamin and Mineral. The paper is made in the form of an application program using Mobile Programming. Mobile Programming by implementing Reverse Engineering. The tool used is a J2ME application on cell phone emulator having minimal CLDC, CDC 1.1, MIDP 2.0 and MIDlet. Main contribution, BMI as the simple, fast and easy to used method. BMI can be used to determine the nutrition status of individual. The benefit for individual reduce the cost of healthcare. The new result is the prediction of the nutrition status of individual using by BMI can be applied with new ways through the Mobile Application on Mobile Device, that is implemented to the cell phone. Mobile Application is a medium for the user can be accessed anytime and anywhere. It is known an application that can yield the rational decision in predicting the nutritious needs of families.

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1. INTRODUCTION

One of the important things in health information is nutrition [1]. The adequate nutrition of each people should be counted properly. If is known by the people, they will prepare the daily food [2] that are suitable with the needs of the entire family members, easily. A well chosen daily food will provide all essentials nutrients for normal function of the body. Conversely, if the foods are not selected properly, the body will lack of certain essentials nutrients [3]. In addition, all foods have essential nutrients which are differ among them. Based on paper toward the comprise nutrients in different types of food, food pyramid was formed which provide a visual aid to choose a nutritious and healthy food [4]. On the other hand, nowadays the use of cell phone as one of media for communication and information becoming very important. It is portable so it is easy to carry everywhere.

Based on a reported data that was taken on June 2011, the users of cell phone in Indonesia have been increased to 180 million users or 80% of the Indonesia population. This number is the highest amount of developed application and the use of mobile devices. Meanwhile one of the applications that can be developed is the use of mobile devices as an aid to predict the nutritious needs of families. This paper aimed at designing a mobile application to predict the nutritional status using by Body Mass Index (BMI) and nutritious needs of families on Mobile Application. Mobile Application tool is Java 2 Micro Edition (J2ME).

It can give some possibilities for developers to create multiplatform applications that can be implemented to any mobile phone brands supported by Java applications.

2. RESEARCH METHOD

In this paper used methods of field research, library research and laboratory research with the framework research. To achieve the aim, this research is conducted in several steps depicted in Figure 1.

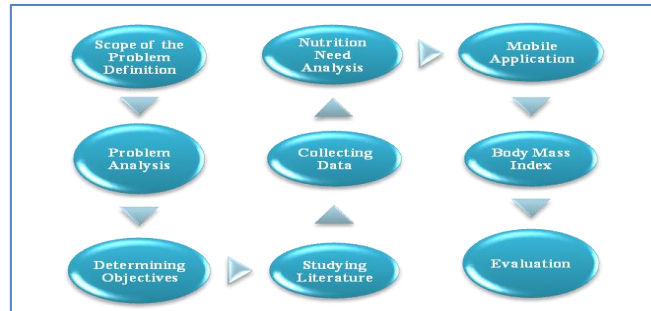


Figure 1. Framework

3. FUNDAMENTAL THEORY

3.1. Nutrition

The term of nutrition has many meanings. In general nutrition is the relationship of food and the welfare of human body. It is based on the principle that food intake and nutritional status [5] affect health significantly [6]. Beside, every food is not only has one type of nutrients. For example, rice contains carbohydrates, protein and energy. In 100 grams of rice, there are 175 kilo calories energy, 4 gram protein, and 40 gram carbohydrates. It is clearly stated there that rice is the main content of rice. Hence, rice is the source of carbohydrates along with other basic food nutrition. Another source of energy is fat. If the burning of 1 gram carbohydrates can produce 4 kilo calories energy, 1 gram fat will produce 9 kilo calories energy where the fat consumption is limited into $\frac{1}{4}$ energy needs. Moreover protein is also a source of energy. It is because in 1 gram protein has 4 kilo calories energy. However, protein is used as a building substance (for the growth of cell, recovery, enzymes, etc). The previous example – rice – also has protein and mineral which function as a regulator substance. According List of Food Composition, in 100 gram rice contains some vitamins, especially B1, B6, and E and several minerals. Furthermore, since in one food has different nutrients, it is advisable to consume various food in one meal. Therefore, people should eat various foods that have the source of energy substance (carbohydrates), builder substance (protein) and regulator substance (vitamin and mineral).

3.2. Nutrition Need

The calculation formulas of nutritional needs in a day [7].

1. Calories

$$C = 66 + (13.7 * W) + 5 (H) - (6.8 * A) \quad (1)$$

where C is calories, W is weight, H is height and A is age. This formulas for male.

$$C = 655 + (9.6 * W) + (1.7 * H) - (4.7 * A) \quad (2)$$

where C is calories, W is weight, H is height and A is age. This formulas for female.

2. Protein

$$C = (NC / 150) * 6.25 \quad (3)$$

where C is calories and NC is the need of calories.

3. Fat

$$C = 0.25 * NC \quad (4)$$

where C is calories and NC is the need of calories.

4. Carbohydrates

$$C = 0.70 * NC \quad (5)$$

where C is calories and NC is the need of calories.

Based on age group (year), weight (kilogram=kg), height (centimeter=cm), energy (kilocalories=kcal), protein (gram=gr), and activity, the calories needs for male, female and daily menu for household dose and nutritional needs of families in a day can be seen in Table 1, Table 2 and Table 3 [8].

Table 1. The Calorie Need for Male

Age group (year)	Weight (kg)	Height (cm)	Energy (kcal)	Protein (gr)	Activity
3 – 9	12	90	1500	35	Normal
10 – 12	30	135	2000	45	Normal
13 – 15	45	150	2400	69	Normal
16 – 19	56	160	2500	66	Normal
20 – 59	62	165	2800	55	Light
20 – 59	62	165	3600	55	Medium
20 – 59	62	165	3600	55	Heavy
60+	62	165	2200	55	Normal

Table 2. The Calorie Need for Female

Age group (year)	Weight (kg)	Height (cm)	Energy(kcal)	Protein (gr)	Activity
3 – 9	12	90	1500	35	Normal
10 – 12	35	149	1900	54	Normal
13 – 15	46	153	2100	62	Normal
16 – 19	50	156	2000	51	Normal
20 – 59	54	156	2050	48	Light
20 – 59	54	156	2250	48	Medium
20 – 59	54	156	2600	48	Heavy
60+	54	54	1850	48	Normal
-	-	-	+285	+12	Pregnant
0 – 6 month	-	-	+70	+16	Lactating
7 – 12 month	-	-	+500	+12	Lactating
13 – 24 month	-	-	+400	+11	Lactating

Table 3. Daily Menu for Household Dose and Nutritious Needs of Families in a Day

Time	Type of dish	Dose (2500 kcal)	Dose (2500 kcal)	Dose (1700 kcal)
Morning	Nasi	2 tablespoon rice	2 tablespoon rice	1 tablespoon rice
	Daging bumbu semur	1 slice	1 slice	½ slice
	Tumis kacang panjang + taugé	½ cup	½ cup	½ cup
	Teh manis	1 cup	1 cup	1 cup
10.00 - daylight	Bubur kacang hijau	1 cup	1 cup	1 cup
	Nasi	3 tablespoon rice	2 tablespoon rice	½ tablespoon rice
	Ikan goreng	1 slice	1 slice	1 slice
	Tempe bacem	2 slice	1 slice	1 slice
	Lalap	½ cup	½ cup	½ cup
	Sayur asem	1 cup	1 cup	1 cup
	Sambal tomat	1 tablespoon	1 tablespoon	1 tablespoon
	Nenas	1 slice	1 slice	1 slice
	Buah	-	-	1 slice
	Nasi	3 tablespoon rice	2 tablespoon rice	1½ tablespoon rice
16.00 - night	Pepes ayam	1 slice	1 slice	1 slice
	Tahu balado	1 slice	1 slice	1 slice
	Sayur bayam + jagung muda	1 cup	1 cup	1 cup
	Pepaya	1 slice	1 slice	1 slice

In Indonesia, the national adequate energy in average consumption level is 2150 kilo calories per person in a day. The national adequate energy in average supply level is 2500 kilo calories per person in a day. The national adequate protein in average consumption level is 46.2 gram per person in a day. The national adequate protein in average supply level is 55 gram per person in a day. Vitamin is mostly found in vegetables and fruits [9]. A healthy food that needs to be consumed in a day should consist of carbohydrate, protein, vitamin, mineral and fresh milk. In Indonesia, the national adequate energy in average consumption level is 2150 kilo calories per person in a day. The national adequate energy in average supply level is 2500 kilo calories per person in a day. The national adequate protein in average consumption level is 46.2 gram per person in a day. The national adequate protein in average supply level is 55 gram per person in a day. Vitamin is mostly found in vegetables and fruits [9]. A healthy food that needs to be consumed in a day should consist of carbohydrate, protein, vitamin, mineral and fresh milk.

3.3. Body Mass Index

Body Mass Index (BMI) is used to find out if a person is underweight, normal weight, overweight, or obese [10]. Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems. BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems. However, BMI is not a diagnostic tool [11]. Although the BMI number is calculated the same way for children and adults, the criteria used to interpret the meaning of the BMI number for children and teens are different from those used for adults. For children and teens, BMI is age and sex-specific and is often referred to as BMI-for-age. For adults, on the other hand, BMI is interpreted through categories that do not take into account sex or age. The formulas of Body Mass Index (BMI) is:

$$BMI = W / H^2 \quad (6)$$

Where BMI is body mass index, W is weight and H is height. BMI, classification and nutritional status can be seen in Table 4.

Table 3. Body Mass Index (BMI)

BMI	Classification	Nutritional Status
<18.5	Under weight	Malnutrition
18.5 - 24.9	Healthy weight	Normal
25.0 – 34.9	Over weight	Over Nutrition
>35.0	Obese	Very Excess Nutrition

3.4. Mobile Application

Mobile Application development is the process by which application software is developed for low-power handled devices, such as personal digital assistants, enterprise digital assistants or cell phones and the others [12]. Mobile Application for mobile devices using by emulator J2ME (Java 2 Micro Edition) with Java-based phones [13]. Mobile Application tool is Java 2 Micro Edition (J2ME) [14]. J2ME is a development environment designed to put Java software [15] on electronics good and other upholders. It is also known as Java ME that is one of three Java programming language used in developing application on mobile devices like mobile phone and personal digital assistance. The components to be used are:

1. Connected Limited Device Connection (CLDC). CLDC is used to implement Java programs on hardware devices with a very limited memory about 160-512 kilobytes. As a result the unimportant features that are implemented in handled devices of J2ME should be discarded. It handles only for three class of error (exception) such as class `Java.lang.Error`, class `Java.lang.OutOfMemory` and class `Java.lang.MachineError`.
2. Connected Device Configuration (CDC). CDC is super set of CLDC that provides broader Java runtime environment than CLDC and closer to J2SE environment.
3. Mobile Information Device Profile (MIDP). MIDP is higher than CLDC. It is because the users cannot write mobile applications only using by CLDC. The users still use MIDP that defines User Interface (UI). MIDP specification device has certain characteristics for instance the minimum screen size 96*54, the bit depth and the sharpness of the display in pixel are about 1:1. MIDP describes application model, UI, a powerful network storage, deployment and provisioning applications over the air.
4. MIDlet. The running application on a device that supports MIDP is known as MIDlet. MIDlet is an application created by using J2ME with MIDP. MIDP is devoted to handset with CPU ability, Memory,

keyboard, and limited screen like deployment of mobile phone, PDA and so forth. The MIDlet life cycle is shown at Figure 2.

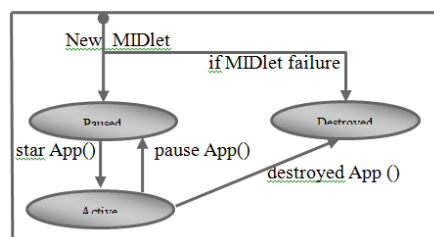


Figure 2. Midlet lifecycle

4. RESULTS AND ANALYSIS

4.1. Structure of Program

Based on gender, the nutritious needs for male and female can be determine such as calorie, carbohydrate, protein, and fat. The daily nutritious needs are determined by some factors such as the person's age, weight, height, and daily activities. The needs for daily energy and nutrients for male and female are different depends on their age, weight, height, and individual activities. The nutritional status covers under nutrition, normal, over, and very excess nutrition. The first kind is age group that is used to see the daily nutritious needs and nutritional status. Moreover every family member is given the natural healthy information menu at the family level from sources like carbohydrate, protein, fat, vitamin, and mineral. The information about adequate nutrition and energy are given that covers the Guidance of Nutrients Balance (General Guidelines for Balanced Nutrition) where the right amount of nutritious menu and complete information can be taken from the competence nutritionist.

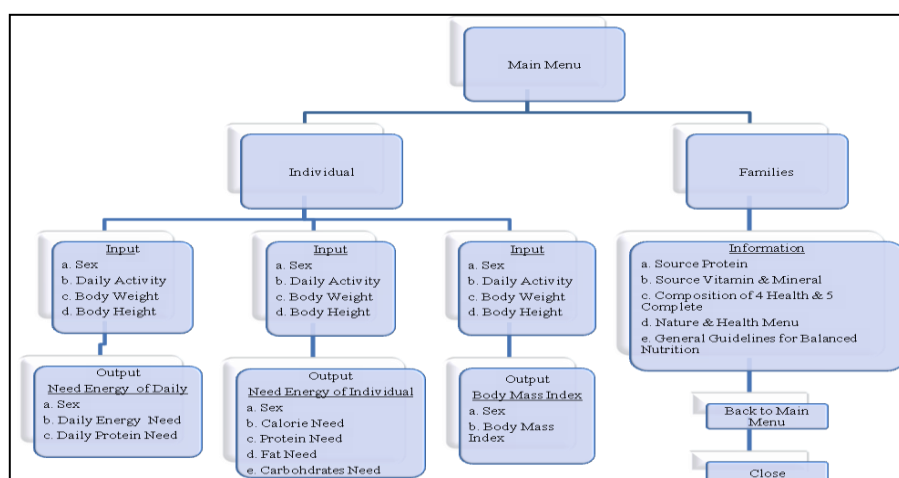


Figure 3. Structure of program

4.2. Reverse Engineering

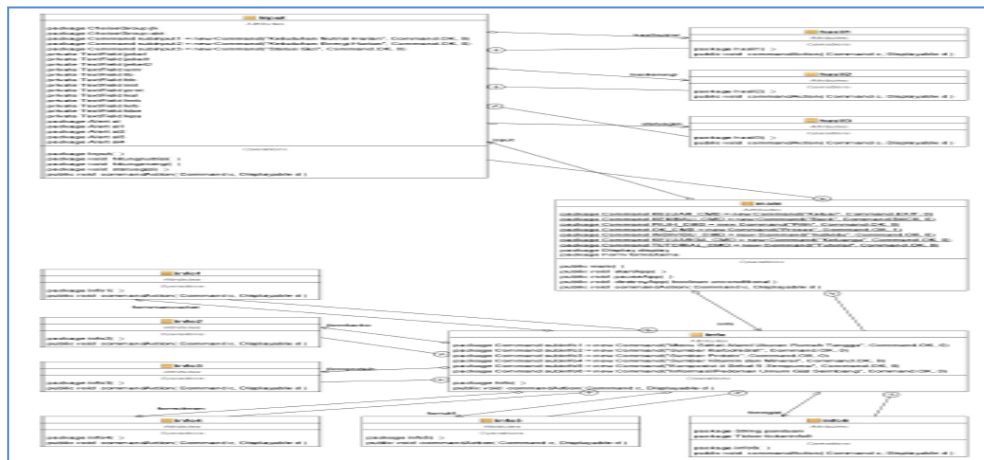


Figure 4. Class case diagram generated using by uml with reverse engineering

4.3. Mobile application

When the application runs, window's dialog and then the users can see the tutorial by choosing the tutorial menu as seen in Figure 5.



Figure 5a. Main Menu



Figure 5b. Tutorial Menu

Next, the user can use this application by selecting the menu of group and there will be a form that has to be filled by the users as seen Figure 6.



Figure 6a. Individual Menu

Figure 6b. Form Menu

Figure 7a. Nutrition Need Daily Menu

Figure 7b. Information Nutrition Menu

After that the users select the menu that is wanted to be used. There are nutrition need daily menu, energy needs and nutritional status as seen Figure 7. After that, the users select the menu that is wanted to be used, energy and protein needs as seen Figure 8.

Figure 8a. Energy Need Daily Menu

Figure 8b. Energy And Protein Need

Nutritional status menu and to appear BMI (Body Mass Index), it can be seen in Figure 9.

Figure 9a. Nutrition Status Menu

Figure 9b. BMI Menu

Based on BMI, the users know their nutritional needs and the other menu can be seen in Figure 10.

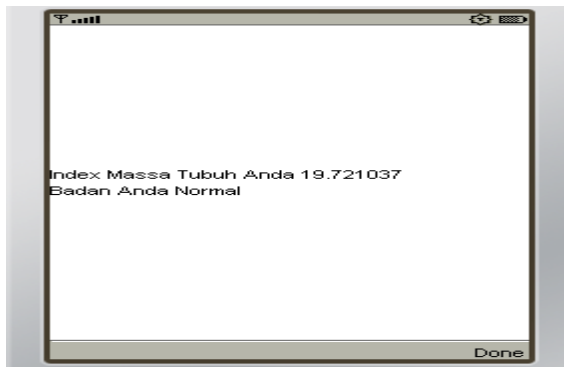


Figure 10a. Nutritional Status Menu

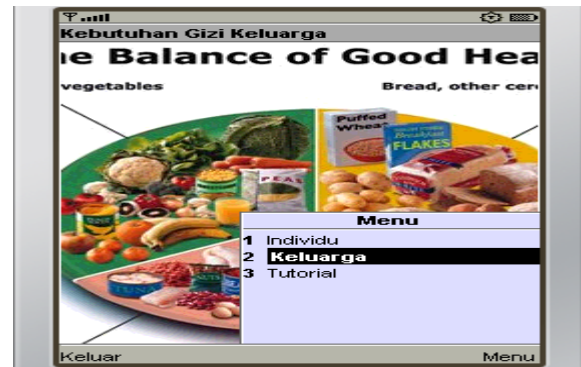


Figure 10b. Families Menu

The users can see source carbohydrate of needs as seen in Figure 11.



Figure 11a. Carbohydrate Menu

No	Nama Bahan Makanan	Energi	Karbohidrat
1	Beras Giling	360 kal	78.9 gr
2	Beras ½ Giling	363 kal	78.3 gr
3	Beras Tumbuk	359 kal	77.6 gr
4	Jagung Giling Kuning	361 kal	72.4 gr
5	Jagung Giling Putih	361 kal	72.4 gr
6	Singkong	146 kal	34.7 gr
7	Caplek	338 kal	81.3 gr
8	Ubi Merah	323 kal	27.9 gr
9	Ubi Putih	123 kal	27.9 gr
10	Kentang	83 kal	19.1 gr
11	Talas	98 kal	23.7 gr
12	Tepung Beras	364 kal	80 gr

Figure 11b. Source Carbohydrate Menu

To find out the source protein needs and vitamin, can be seen in Figure 12.

No	Bahan Makanan	Energi	Protein
1	Daging Kambing	154 kal	16.6 gr
2	Daging Kerbau	84 kal	18.7 gr
3	Daging Sapi	207 kal	18.8 gr
4	Ginjal Sapi	141 kal	15 gr
5	Hati Sapi	136 kal	19.7 gr
6	Usus Sapi	130 kal	14 gr
7	Dendeng Sapi	433 kal	55 gr
8	Daging Ayam	302 kal	18.2 gr
9	Daging Itik	326 kal	16 gr
10	Telur Ayam	162 kal	12.8 gr
11	Telur Ayam(kuning)	361 kal	16.3 gr
12	Telur Ayam(putih)	50 kal	10.8 gr

Figure 12a. Source Protein Menu

Sumber Vitamin dan Mineral

Vitamin memiliki fungsi vital dalam metabolisme setiap organisme. Vitamin tidak dapat dihasilkan oleh tubuh. Terdapat 13 jenis vitamin yang dibutuhkan oleh tubuh untuk dapat bertumbuh dan berkembang dengan baik. Vitamin tersebut antara lain vitamin A, C, D, E, K, dan B (tiamin, riboflavin, niasin, asam pantotenat, biotin, vitamin B6, vitamin B12, dan folat). Walau memiliki peranan yang sangat penting, tubuh hanya dapat memproduksi vitamin D dan vitamin K dalam bentuk provitamin yang tidak aktif. Oleh karena itu, tubuh memerlukan asupan vitamin yang berasal dari makanan yang kita konsumsi. Buah-buahan dan sayuran terkenal memiliki kandungan vitamin yang tinggi dan hal tersebut sangatlah baik untuk tubuh. Asupan vitamin lain dapat diperoleh melalui suplemen makanan.

Tabel Vitamin

Figure 12b. Vitamin And Mineral Menu

Composition 4 health and 5 complete, guidance of nutrients balance, nature and health menu, can be seen in Figure 13.

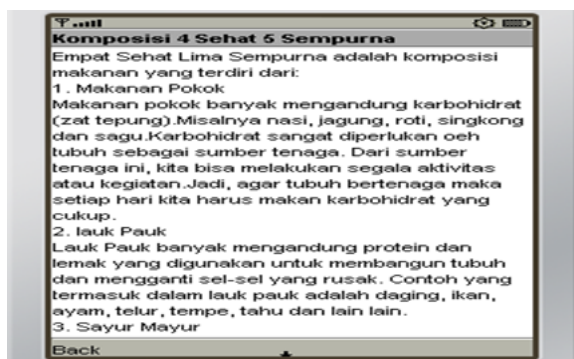


Figure 13a. Composition

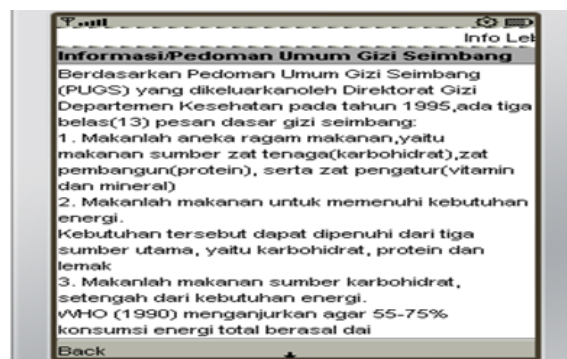


Figure 13b. Guidelines



Figure 13c. Household Dose

5. FUTURE WORK

Reverse Engineering becomes a separate subject for further survey. This application are useful for Healthcare Informatics. The use of application, the input data are determined by the individual. These are the subjects of study for research in the future. Mobile Application is given to individual user in general and natural condition. Next future work is food image, food composition, and food nutrition e-survey.

6. CONCLUSION

The result of BMI shows that nutritional status can be categorized into four groups: malnutrition, normal, over nutrition and very excess nutrition. The needs for nutrition are determined by some factors such as the adequate calories, carbohydrate, protein, and fat that will produce adequate energy. This research is also shown the example of the nutritious menu – contains sources of carbohydrate, protein, fat, vitamin, mineral and other information about the guidance of a balanced nutrients, for a family in a day in order to overcome their lack in nutrition. Body Mass Index used to determine nutritional needs. Implementation of Mobile Application to cell phone more easily, more quickly, anytime and anywhere. If compared by accessing Body Mass Index Calculator on the web, which requires a connection to the internet. If compared by nutritional counseling and nutrition needs with a doctor needs time, cost and place.

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