Android-Based Nutrition Education Application

Endah Sudarmilah\textsuperscript{1,2}, Dony Randy Alvian\textsuperscript{1,3}

\textsuperscript{1} Informatics Department, Faculty of Communication and Informatics, Universitas Muhammadiyah Surakarta, Indonesia

\textsuperscript{2} Endah.Sudarmilah@ums.ac.id
\textsuperscript{3} donyrandyalvian@gmail.com

Abstract. Nutrition is a constituent of foodstuff having an important function to body health. Many people ignore as to how the food can influence the body. Due to their negligence, it is often that the calorie or energy entering the body is excessive resulting in a negative impact on the body health. The lack of nutrition knowledge along with the negligence of food intake arrangement entering the body can have a negative impact on the body. Therefore, the needs to find out the number of nutritional need required by the body can be manually calculated; however, it is a little bit complex. This study aimed to design application to provide nutrition education easiness in finding out the nutrition needs and arranging the proper food pattern. The application was made by using studio android with database firebase and operated by using Android Smartphone, Harris Benedict method in calculating energy, System Development Life Cycle (SDLC) method approach with the Waterfall model. This study result was Android-based nutrition education application. In this application, there is a user menu to find out the nutrition needs and administrator in managing data. System testing was performed by Black box, expert validation test, and System Usability Scale (SUS) method, with 30 respondents resulting in a very good SUS score of 84.5 and thus the application can be accepted.

1. Introduction

Nutrition is a basic component of foodstuffs having function as energy source, supporting body growth, arranging metabolism, and playing role in the body health. The lack of nutrition needs knowledge for the body can result in the growth process inhibition \cite{1}. Many people do not pay attention as how the food can influence the body. Due to their negligence, it is often that the calorie or energy entering the body is excessive resulting in negative impact to the body health \cite{2}. Therefore, the needs to find out the number of nutritional need required by the body can be manually calculated; however, it is not simple. Hence, the objective of this study is to design nutrition education application that can calculate the nutritional need such as, calorie, carbohydrate, protein and fat; find out body weight condition; food choice; and nutritional information by applying android smart phone technology.

Android smart phone technology has been experiencing rapidly growth on the side of both hardware and software, including application features development in which it has many purposes.
inside it; one of them is as the nutritional information facility for society [3]. Android based smart phone has also been widely used in public and thus it can be more affordable and easier to use [4]. Smartphone capability utilization for the necessity in various fields have been also developed with applications that are able to support its operation, including android-based Smartphone application as a learning media [5]. As explored in this study, it is an android-based nutrition education application.

Nutritional needs application of adolescents with the web-based Harris Benedict method, can assist teens in conducting nutritional consultations and arranging healthy food menus according to the calories needed [1]. This researcher created a website-based system with the PHP programming language and MySQL database aimed at teenage students in this system to provide nutritional information, be able to calculate calorie requirements and understand weight problems. Then the system of calculating nutritional needs and applying food advice, which is aimed at diabetic patients in this system uses forward chaining to determine the decision of food groups according to energy needs [6]. Weaknesses of the system of implementing food suggestions compilation of users bored or related to approved foods, are not able to supplement the nutritional needs of food that have not been met.

Based on the problems of previous studies conducted on research on food systems that can calculate nutritional needs, in addition to information about food, in this application system regarding food selection that can regulate the number of servings and can calculate the amount of food available with the help of existing food quantities So users can choose foods according to nutritional needs. Android-based application development with the Java programming language and Firebase Realtime Database data storage. Firebase Realtime Database supports data retrieval in real time and does not need to do programming from the server side so it requires easier and faster [7].

This application is expected to provide some benefit to the society to have a better life through nutritional education by applying Harris Benedict method to calculate either energy or calorie needs and calculate body weight using BMI (Body Mass Index) formula. Decision making Forward chaining method is employed to find out body weight condition and the food chosen in order to know whether it’s already fulfilled or not.

2. Application Description
This application aimed to general society particularly adult >18 years old. While operating this application, user must login first. In this login menu, it can be used to admin and user login. If previously the user has not registered as the new one, and thus the user must register first. Menu admin is a special menu of data processing. Admin can edit another admin, add new admin, manage user data, manage food data, and nutritional information. Menu user is the one to see nutritional need profile, calculate the choice food from the food data. Interestingly, in the additional menu of the choice food, the user can arrange his/her food portion as needed. It can be more clearly seen in Figure 1 (a), (b), and (c).

2.1.1. Application Operational Principle
This application warrants expert system. It is the programs automatically providing suggestion in which it tries to imitate experts’ thinking processes and knowledge to achieve the goal of certain problem [8]. In operating the process, expert system needs inference machine to achieve solution or conclusion [6]. One of them is using forward chaining inference machine. Forward chaining is started or controlled by data (data-driven). Looking for the rules of the right inference (decision) when they are found and thus it will make the decision making machine to be able to conclude [8].

This application needs a decision to find out the user’s body weight condition and the calculation result decision of the choice food, whether it is already fulfilled or not. In order to get the right decision, the application should calculate the energy need. The calculation of the energy amount needed by a body requires two factors. First is the value of Basal Metabolic Number from Harris Benedict method. And the second is someone’s physical activity [9]. In the carbohydrate, protein, and fat need, Balance Nutritional Guidelines suggests to fulfill 60-75% of carbohydrate need, 10-15% of
protein need, and 10-25% of fat need [2]. In order to come to the decision of body weight condition by applying IMT formula, then the IMT value is compared to the IMT threshold category [9].

![Figure 1](image1.png)

**Figure 1.** The display of Android-Based Nutrition Education Application

2.1.2. Metode

The approach method used to develop the software system in this study is the SDLC Waterfall model. The waterfall model provides a sequential approach from analysis, design, coding, and testing. This stage of the model is illustrated as shown in Figure 2 [10].

![Figure 2](image2.png)

**Figure 2.** Waterfall Model
2.1.3. Analysis
The intensive requirements collection phase specifies what software requirements are needed by the user. In this research data collection is done by means of literature study and nutrition specialist interviews. The need for tools and materials can be seen in Table 1.

Table 1. Tools and materials

| No | Hardware                                      | Software            |
|----|-----------------------------------------------|---------------------|
| 1  | Laptop Acer Swift SF314-56G Intel® Core™ i5-8265U CPU 1.60GHz, RAM 4GB, Hardisk 1TB | Android Studio 3.2.1 |
| 2  | Smartphone OS Android                         | Adobe XD CC 13.0.12.14 |
| 3  | Kabel Micro USB                               |                     |

2.1.4. Design
The software requirements step from the requirements analysis stage are represented into a design so that it can be implemented into a program at a next step. At this step the researcher designed a use case diagram and activity diagram. Use case diagrams are used to get the functional requirements of a system, containing what is done by the system [1]. Activity Diagrams are diagrams that are drawn from the page or application program to completion, explaining the procedural logic and workflow of the application program created from the user side as well as from the system side [5]. The use case diagram design can be seen in Figure 3 usecase user (a), usecase admin (b) and activity diagram design can be seen in Figure 4 user activity diagram (a), admin activity diagram (b).

Figure 3. Usecase Diagram
2.1.5. **Code**

The stage where the design is converted into program code, produces a program that matches the design stage that has been made before.

2.1.6. **Test**

Testing is conducted to minimize the mistake and ensure the system output in accordance to the objective.

3. **Application Testing**

System testing step in this study utilized Black box, expert validation test and Usability.

3.1. **Black box Test**

Black box test aimed to find out whether the functions of software’s *input* and *output* are compatible with the specifications needed [10]. Of the part or menu tested by researcher, it was suggested that the accepted result or function in this application operates well and compatible with the specifications needed. The researcher has conducted the manual and application outcome comparison test by randomly trying over 10 data and only resulting in small error, between 1% and 2%.
3.2. Expert Validation Test

The next step in testing this nutrition education application is system validation test involving expert in performing the assessment or often called as expert review. This assessment is conducted by collecting data that will be reviewed by expert to validate the already designed application [11]. The expert validation test of this application was reviewed by the persons who have competence in nutrition science.

This nutritional education application system is performed by asking important questions related to nutrition implemented in application to be validated by expert. The results of this application study have been validated by expert and stated that it is excellent and innovative; however, there is different reference in the energy calculation employed.

3.3. Usability Test

Usability test in this study using the SUS method tested the system with 30 respondents in the adult category. SUS is a valid and reliable measurement tool, by making a comparison of the scores achieved on the system [12]. In getting scores from respondents by asking 10 questions in the form of score scales (1), (2), (3), (4), (5) [13]. SUS questions can be seen in Table 2.

3.3.1 Usability Test Result

Question numbers (1), (3), (5), (7), and (9) calculate the score scale minus 1 and question numbers (2), (4), (6), (8) and (10) 5 calculated minus the score scale. The results of the calculation of the question score will range from 0 to 4, then do a multiplication of the total score with 2.5 to get the sus score [13]. Sus score of 30 respondents was added to get the number of SUS scores and look for the average value of the number of sus scores that can be seen in equation 1. Then the results are seen how well the application system with the SUS score rank benchmark can be seen in Figure 5 [12]. The results of the SUS usability test calculation of nutrition education applications get the total SUS score of 2535 which can be seen in Table 3, then the average value of the total SUS score gets 84.5 which can be seen in Equation 2. The nutritional education application system shows very good results (excellent) and acceptable.

\[
\text{Average SUS Score} = \sum_{i=1}^{n} \frac{x_i}{N}
\]

\(x_i = \text{Total SUS Score}\)

\(N = \text{Numbers of respondent}\)

So, \(\text{Average SUS Score} = \frac{2535}{30} = 84.5\) (2)

![Figure 5. SUS Score Rank](image-url)
Table 2. SUS Test Question of Nutrition Education Application

| No | Question (p)                                                                 | Score 1        | Score 2       | Score 3       | Score 4       | Score 5 |
|----|------------------------------------------------------------------------------|----------------|---------------|---------------|---------------|---------|
| 1  | The application is really liked and will play it many times                   | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 2  | The application is too complicated to play                                   | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 3  | The application is easy to operate                                           | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 4  | Need other people assistance to operate the application                       | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 5  | The application parts can be well operated                                    | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 6  | The application is confusing                                                  | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 7  | Other people will learn to operate this application either very quickly or easily | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 8  | This application is not practical and difficult to operate                    | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 9  | Feeling bias to operate this application                                      | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |
| 10 | Need to learn just to operate this application                                | Totally disagree | Disagree     | Doubtful     | Agree         | Totally agree |

Table 3. SUS Test Result of Nutrition Education Application

| Respondent | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | Amount | SUS score (amount x 2.5) |
|------------|----|----|----|----|----|----|----|----|----|-----|--------|--------------------------|
| 1          | 3  | 4  | 3  | 4  | 3  | 3  | 4  | 4  | 4  | 4   | 36     | 90                        |
| 2          | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4   | 40     | 100                       |
| 3          | 4  | 4  | 4  | 4  | 3  | 4  | 3  | 4  | 4  | 4   | 37     | 92.5                      |
| 4          | 4  | 3  | 4  | 3  | 4  | 3  | 4  | 4  | 4  | 4   | 36     | 90                        |
| 5          | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4   | 36     | 90                        |
| 6          | 4  | 3  | 4  | 4  | 3  | 4  | 3  | 4  | 4  | 4   | 37     | 92.5                      |
| 7          | 3  | 3  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4   | 37     | 92.5                      |
| 8          | 3  | 3  | 4  | 3  | 4  | 2  | 3  | 3  | 4  | 2   | 30     | 75                        |
| 9          | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 4  | 3  | 3   | 32     | 80                        |
| 10         | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4   | 40     | 100                       |
| 11         | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4   | 39     | 97.5                      |
| 12         | 3  | 3  | 3  | 2  | 3  | 2  | 3  | 2  | 3  | 2   | 26     | 65                        |
| 13         | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 4  | 3  | 3   | 33     | 82.5                      |
| 14         | 3  | 3  | 4  | 3  | 4  | 3  | 3  | 4  | 3  | 4   | 34     | 85                        |
| 15         | 3  | 3  | 4  | 3  | 3  | 3  | 3  | 4  | 4  | 3   | 32     | 80                        |
| 16         | 2  | 3  | 3  | 3  | 3  | 3  | 3  | 4  | 4  | 4   | 32     | 80                        |
| 17         | 2  | 3  | 3  | 3  | 3  | 3  | 3  | 4  | 3  | 4   | 30     | 75                        |
| 18         | 3  | 4  | 3  | 4  | 3  | 4  | 4  | 4  | 4  | 4   | 37     | 92.5                      |
| 19         | 4  | 3  | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 3   | 36     | 90                        |
| 20         | 3  | 2  | 2  | 2  | 3  | 3  | 3  | 4  | 3  | 3   | 28     | 70                        |
| 21         | 3  | 4  | 4  | 4  | 3  | 4  | 4  | 4  | 4  | 4   | 38     | 95                        |
| 22         | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4   | 39     | 97.5                      |
| 23         | 3  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4   | 38     | 95                        |
| 24         | 3  | 4  | 3  | 4  | 4  | 2  | 4  | 0  | 3  | 4   | 31     | 77.5                      |
| 25         | 2  | 4  | 3  | 4  | 3  | 3  | 4  | 4  | 2  | 4   | 32     | 80                        |
| 26         | 4  | 1  | 4  | 2  | 4  | 2  | 4  | 3  | 3  | 2   | 29     | 72.5                      |
| 27         | 1  | 3  | 3  | 4  | 4  | 2  | 3  | 4  | 3  | 4   | 31     | 77.5                      |
| 28         | 4  | 2  | 3  | 4  | 4  | 2  | 4  | 2  | 4  | 2   | 29     | 72.5                      |
| 29         | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3   | 28     | 70                        |
| 30         | 4  | 4  | 4  | 4  | 1  | 4  | 3  | 3  | 3  | 3   | 31     | 77.5                      |

Total SUS score: 2535
4. Conclusion

Nutrition education application system is constructed for user to be more understood of the importance in finding out the nutritional need and paying attention to the eating pattern resulting in the body health, particularly among adults who are often neglectful as a result of their activity or work density. In this application, user can choose the food and find out the number of food nutrition content that can be arranged its portion as well as calculate the number of food chosen and take the right decision whether the nutritional need has been fulfilled or not.

Nutritional need calculation, food portion calculation, food calculation result as well as the decision of nutritional education application were excellent in which the researchers performed manual result comparison test. The application outcome obtained by trying to randomly input 10 data only resulted in a small error, between 1% and 2%

Nutritional education application testing also obtained a good result. In black box test, application functions were operated as needed. In expert validation test, they were also validated and stated that the application is excellent and innovative; however, there is different reference in using the energy calculation. Usability test also suggested that the application obtained a very good average SUS score, 84.5 and thus this application can be accepted.

References

[1] R. D. Sari, “Sistem Informasi Penghitungan Gizi Remaja Dengan Metode Harris Benedict Berbasis Website,” J. Tek. Dan Inform., vol. 5, no. 2, pp. 56–59, 2018.
[2] G. A. Pamungkas, R. R. Isnanto, and K. T. Martono, “Pembuatan Aplikasi Panduan Gizi Seimbang Berbasis Android Dengan Menggunakan Metode Backward Chaining,” J. Teknol. dan Sist. Komput., vol. 4, no. 2, p. 369, 2016.
[3] R. A. Supono, Karmilasari, and Y. D. Wulandari, “Aplikasi Penghitungan Kebutuhan Gizi Lansia Berbasis Smartphone Android,” J. Fak. Huk. UII, no. 13, pp. 11–17, 2015.
[4] U. M. Afif, H. Millah, and S. Purnama, “Calculations of Energy Athlete Based on Android Application,” J. Phys. Educ. Sport., vol. 7, no. 2, pp. 134–140, 2018.
[5] E. Sudarmilah and R. M. P. Siregar, “The Usability of ‘Keepin’ Collect the Trash: Virtual Reality Educational Game in Android Smartphone for Children,” Int. J. Eng. Adv. Technol., vol. 8, no. 4, pp. 944–947, 2019.
[6] R. I. Perwira, “Purwarupa Sistem Pakar untuk Menentukan Jumlah Kalori Diet bagi Penderita Diabetes Mellitus,” Telematika, vol. 10, no. 2, pp. 79–90, 2014.
[7] K. N. M. Kumur, K. Akhi, S. K. Gunti, and M. S. P. Reddy, “Implementing Smart Home Using Firebase,” Int. J. Res. Eng. Appl. Sci., vol. 6, no. 10, pp. 193–199, 2016.
[8] I. Akil, “Analisa Efektifitas Metode Forward Chaining dan Backward Chaining Pada Sistem Pakar,” J. Pilar Nusa Mandiri, vol. 13, no. 1, pp. 35–42, 2017.
[9] D. Hermawan, F. Faturahmah, and W. Dharmawan, “Pengembangan Aplikasi Pedometer Berbasis Android dengan Menggunakan Sensor Motion Untuk Saran,” Pros. SENIATI, vol. 3, no. 1, pp. 9–10, 2017.
[10] R. S. Pressman, Software Engineering: A Practitioner’s Approach. McGraw-Hill, 2001.
[11] E. Sudarmilah, U. Fadillah, R. Ferdiana, and N. Ramdhani, “Expert Judgment on Preschoolers ’Cognitive Game Prototype,” Int. J. Pure Appl. Math., vol. 118, no. 20, pp. 539–544, 2018.
[12] J. Brooke, “SUS : A Retrospective,” J. Usability Stud., vol. 8, no. 2, pp. 29–40, 2013.
[13] J. Brooke, “SUS - A Quick and Dirty Usability Scale,” Usability Eval. Ind., pp. 4–7, 1996.