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ANALYSIS AND DESIGN OF INFORMATION SYSTEM FOR JOURNAL SELF-DIETARY ASSESSMENT BASED ON FOOD RECORD FOR DIABETES PATIENTS

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Abstract— In this era of globalization, there are several diseases related to the pattern of human life and descent. One of these diseases is diabetes mellitus that none of the drugs are be able to cure it. One of the small but very essential forms of management is done by recording the foods eaten and recording what activities are performed according to the advice of experts in exercise for diabetic. But there are several problems in that related matter so we using a analysis and design of information system with based on self dietary assesment: food records to solve those problems. This study is written into five parts and the purpose of this study is for diabetics to perform self-control wherever they are.

Keywords— Self-dietary assesment; diabetics food record; food record; diabetics diet tools; information system analysis and design;

I. INTRODUCTION

In this era of globalization, there are several diseases related to the pattern of human life and descent. One of these diseases is diabetes mellitus that none of the drugs is being able to cure it. In the case of diabetes, the patient expected to be able to apply a healthy lifestyle, manage the daily food intake, and perform positive activities for exercise. One of the small but very essential forms of management is done by recording the foods eaten and recording what activities are performed according to the advice of experts in exercise for diabetics [1]

But the problem is **1. How ordinary diabetics that have no clue about nutrition will be able to control and understand the limits about something they ate can be at risk for their diabetes? Is it just enough to record food that they eat?** The answer is of course not. It takes control of a nutritionist to calculate the limitations he can eat in one day. However, **2. Does a diabetic have enough time, money or energy to visit a nutritionist?** Then the next question is **3. If an expert has calculated the limitations that something that they can eat in one day how does a diabetic calculate what he or she eats is appropriate, less or more than the expert advice?**

The answer is of course not sure. Because of course, diabetics do not know the exact dosage and caloric value contained in one food. We know that media such as the Internet has provided much information about food calories. Again, the information is not explicit for diabetics. Supported by the convenience of information technology, such as computers and smart handheld devices, enables them to carry the notes in the form of an application that will certainly help them select and record specific types of food intake before and after consumption. Departing from these needs, we are from study program of information system of Mercubuana University conducted a research about Analysis and Design of information system application with food records based method that can be accessed well through the internet network to help those who need access to information and recording it whenever and wherever located. Benefits of this research are authors perceived benefits include Provide experience in the field of science being pursued as well as providing additional insight beyond the field of science in the field of nutritional, especially dietary assessment based on food record. But the most important thing is to solved the problems above that we explained before so they can perform self-control wherever they are. In this writing, the author's presents in five parts, **I. Introduction**, in this section will be described about the formulation of the problem and the purpose of research benefits. **II. Platform Theory**, in this section will be described briefly the theory that supports the preparation and writing of this journal. **III. Methods**, in this section will be discussed about the exposure method used by the authors. **IV. Result and Discussion**, in this section will be described about analysis and design of the information systems. **V. Conclusion**. In this section, the author gives the conclusion of what has been discussed in previous chapters.

II. PLATFORM THEORY

A. System Information

An information system can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision-making and control in an organization. In addition to supporting decision-making, coordination, and control, information systems may also help managers and workers analyse problems, visualize complex subjects, and create new products. [2]

B. Unified Modelling Language

According to Dennis, Unified Modelling Language (UML) is the standard language for visualization, specification, construction and documentation of the artefacts of software, and can be used for all stages in the system development process from analysis, design to implementation, according to Denn [3]. UML provides some standard notation and diagrams that can be used as a communication tool for system developers in the process of system analysis and design. Diagrams in UML are defined as information in various forms that are used or produced in the software development process. Based on the perspective in object-oriented analysis and design process with UML, there are several main diagrams in UML that can be used, namely: **1. Use Case Diagram**. Describe the expected functionality of a system. **2. Activity Diagram. A**n analysis model used or describes an activity process **3. Sequence Diagram**. ilustrates the objects in use cases and messages that run in a use case and **4. Class Diagram** Describes the number of classes and relationships between classes in the system.

C. Dietary Assesment

Dietary Assessment Method is a method used to assess the early signs of nutritional deficiency, including inadequate intake. For this reason, information from the dietary assessment can also predict the likelihood of nutritional deficiencies that can later be confirmed further by using other methods such as biochemical, anthropometric and clinical assessments. [4] In Siagian, 2010 there are six methods commonly used to assess individual food consumption: 1. 24-hour recall method, 2. repeated 24-hours recall method, 3. food record method, 4. weighed food method, 5. dietary history method, and 6. food frequency method (VASQ)

D. Food Records

According to Fahmida and Dillon, 2007 [5] the principle and use of food record methods are as follows:

1. The basis for recording the size of the food portion of food consumed by the individual is estimated using the household size (URT) or weighing using food scales. The weighing method is an ideal method for research and control research studies especially during dietary counseling activities or for knowing the correlation between intakes and biological parameters.
2. Useful for activities in research, particularly in epidemiological studies of nutrition. Data intake of nutrients can then be used as the basis of nutrition education program.
3. If we use the weighing method, respondents need to be motivated, should be able to count and not illiterate, or alternatively use an enumerator to collect data and record the respondent's food intake.
4. If it takes a 24-h recall (24-h recall) memory to estimate individual food intake habits, then it depends on the variation in daily consumption in food intake on an individual. If you need a recall more than one day, then you should choose a non-consecutive (non-consecutive) day.
5. 24-h recall (24-h recall) can be repeated during different seasons of the year to estimate the average individual intake over a longer period of time (for the intake of food intake).

In Fahmida & Dillon, 2007 it is also mentioned that procedures on food estimation methods and food weighing are as follows:

1. Respondents were asked to record, consumption at the same time, all food and beverages (including snacks) eaten in the household size (URT) for a predetermined time period.
2. Details of the description of the food include a. Name (local / local and general if known), b. cooking method, c. Food conditions (raw, cooked, peeled or processed), d. Brand name if possible, e. All herbs, herbs and spices, f. Complete description of each food, g. Considering the amount consumed or estimated using the size of the household (URT) and using the calibrated household appliances. If the respondent eats outside the home, then the respondent is usually asked to record the description and the amount of food eaten. The nutritionist may then purchase and weigh the duplicate portion of each recorded item of food, this is done where possible, to assess the likely amount of food consumed.

E. Related or Previous Research

In system information major, we found two kinds of journal that related to our current works. We can see it briefly in this following sentences:

1. The research that conducted by Rifky Indra Perwira, proposed System for consulting diet menu for diabetes patients with rule based approaching method[6]. He did some research that related to body mass index until they found the best menu composition for diabetics. But the scope is not to manage diabetes on diabetics own.
2. The research that conducted by Galih yuda pramana and Amak yunus was about an expert system for diabetics type 2 with forward chainng and constraint satisfaction problems[7]. They did some research that related to body mass index until they found a best composition of diet for diabetics type 2. But still the scope is not to manage diabetes on diabetics own too.
3. The research that conducted by Jehan Luchi Agusty, Nanang Sulistyanto, Ir. M.Eng and Mochammad about application for BMI calculating as a fundamental for diabetes diet application.[8]

III. METHOD

A. Research Method

This research is a combination of the type of applied research and qualitative research. The results can be directly applied to solve the problems encountered.

B. Sample Selection Method

The sample selection using Purposive Sampling technique, which is one of the sampling technique that is often used in research. Selection of samples based on informants such as patients and descendants of patients with diabetes[9]

C. Method of collecting data

1. Interview, we've done question and answer section with nutritionists from the faculty of public health from the university of Indonesia
2. The literature study method, which is collecting data obtained by studying references suggested by nutritionists, related scientific studies and literature reviews
3. Questionnaire method is by making a list of written questions that have been prepared previously, then distributed to the respondent with the aim of identifying the needs of the system.

D. Analysis Method

Analytical techniques used in this study is by using object oriented analysis (OOA) with UML. In the analytical process, the analysis techniques performed are 1. data and information analysis that obtained from interviews, library studies, and documentation, 2. Analysis of functional, non-functional, and user needs. Modeling with use case diagram[10]

E. Design Method

The design technique used in this research is using object-oriented design (OOD) approach. In the design process, the designing techniques are: 1. Database design. Modeled with an entity relationship diagram, 2. Design of static structure of information system specification. Modeled with a class diagram, 3. Designing user interface. Includes the design of navigation, input form, and output form. Modeled using wireframing

F. Implementation Method

We are using PHP and MySQL from SQLYog for Prototyping. In the section of implementation, we give some example how the design turn into a real page by screenshooting the result of implementation.[11]

IV. RESULT AND DISCUSSION

A. Functional Analysis

1. Interview Based Result

TABLE I - INTERVIEW AND ANALYSIS RESULT

No.	Interview Result	Analysis Result
1	a. Expertise straightens the term treatment into a Diet b. There is no specific diet classification for diabetic patients unless accompanied by complications. c. Complications are exemplified: gangrene, hypoglycemia, DMG, Kidney Complications	No classification Diet for diabetics unless there's complication.
2	Classification of diets depending on the daily caloric needs of a person that assessed from the formula body weight and height (Body Mass Index - BMI) Exemplified: 1300 Calories Diet, 1500 Calories, 1900 Calories	The formula needed for BMI: **BMI = Body Weight / (Body Height x Body Height)** Body Weight Unit : Kg Body Height Unit : m
3	Highlights for DM diet are: Type, Amount and Time Type is Type of food that is allowed and not to be eaten Amount is the amount of food that has been calculated and can be consumed Hours are giving time, consisting of 3 big meals and 3 light meals example: 07:00 pm Large Eating Category (Breakfast) 10:00 WIB Light Eating Category (Morning Selection) 12:00 WIB Large Eating Category (Lunch) 16:00 WIB Light Eating Category (Daylight) 19:00 WIB Large Eating Category (Dinner) 20:00 WIB Light Eating Category (Interlude)	a. In the system we categorized time as Breakfast, lunch and dinner. Breakfast included morning selection, lunch included daylight and Dinner included interlude b. For guiding diabetics to eat properly as diet calories that sugested for them, we shall add the information on board info page about amount and type of the food that they can consume. This way they will had a free will to eat what they want as long as they take the proper calories sugested.
4	Physical activity gives effect to health and calculation of daily caloric sufficiency for diabetics	availability of information on types of physical activity, daily needs related calculations
5	Self dietary assessment is highly recommended for self-control, but not many diabetics doReasons Exemplified: Do not understand its usefulness, Difficult to find and calculate the daily calories and other related things	a. Easiness to entry and manage the journal b. Easiness to find some information about food and calorie
6	Health analysis obtained from self-dietary assesment: 1. Controlling how many calories you get 2. Determine what type of DM diet to do	a. status view to see how many calories that have been consumed in 24 hour b. determining type of DM diet to do (this function will be assigned into the registration page)

2. Reference Result

As for reference result, we took some information as knowledge in this system. In this following table, we give some example of knowledge based we took [12] and its modified as per consumption for diabetics purpose[13]

TABLE II- KNOWLEDGE BASED I: FOOD AND CALORIE INFORMATION IN A TABLE

id	Food Name	Portion in Grams	Calorie	Unit
1	Steamed Corn	250	90,2	Pcs
2	Steamed Potato	200	166	Pcs
3	White Sticky Rice	120	217	Portion
4	Ketupat	160	32	Pcs
5	Lontong	200	38	Pcs
6	Steamed Rice	100	175	Portion
7	KFC Steamed Rice	225	349	Portion
8	High Fiber Bread	60	149	Portion
9	Steamed Cassava	100	146	Pcs
10	Steamed Talas	100	98	Pcs

Beside the knowledge based for food and calorie information, there's also activity and calorie information in table. Next, prospective user will be displayed body category information based on BMI as shown in following table

TABLE II - KNOWLEDGE BASED II: BMI CATEGORY INFORMATION

WOMAN	MAN
<17 -> Skinny 17-22 -> Nomal 23-27 -> Overweight > 27 -> Obesity	<18 -> Skinny 18-24 -> Nomal 25-27 -> Overweight > 27 -> Obesity

Also, ideal weight will take some effects for diabetics, so we calculate it for them so they know how much weight they should be. In this following statement is the formula that we used for the application:

Ideal Weight = 0.9x(Body Height – 100)
***Body height unit is in cm**

Then in this following statement is the formula that we used for calculating daily calories needed by diabetics

Daily Calorie Needs : 0,9xBody Weight x 24xVA
***Body weight unit is in kg**

VA (Variable of Activities) that used in formula above is:

TABLE IV - KNOWLEDGE BASED III: VARIABLE OF ACTIVITIES

Daily Activities	Value
Light	1.55
Average	1.70
Heavy	2.00
Extreme	2.25

B. Use Case

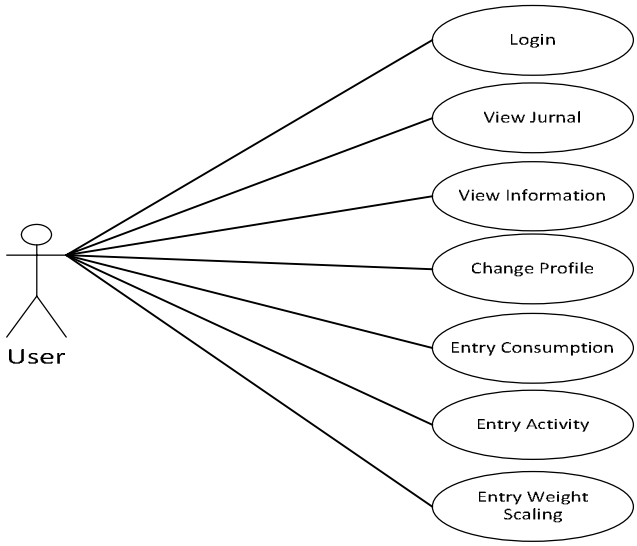

Fig. 1. Use Case Diagram

C. Database Design

1. Entity Relational Diagram

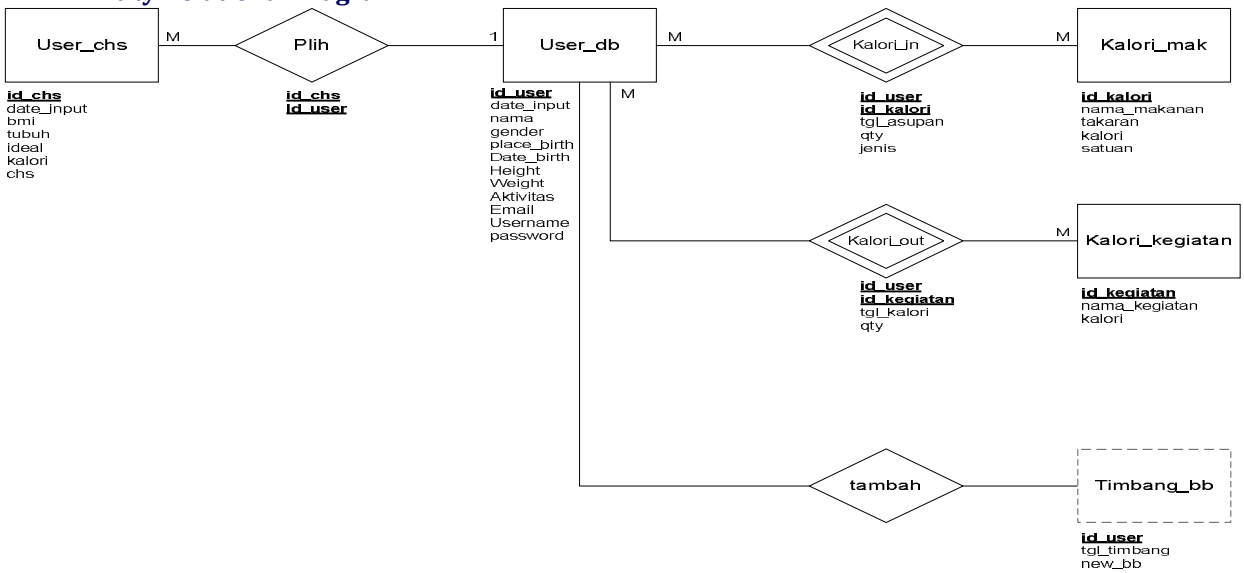

Fig 2. Entity Relational Diagram

2. Database Spesification

1. User_chs Table

TABLE V- USER_CHS TABLE SPESIFICATION

No	Field Name	Type	Size	Description
1	id_chs	int	11	Choice ID
2	date_input	int	11	Input Date
3	bmi	date	3	Body Mass Index
4	tubuh	double	99,9	Body Category
5	ideal	int	1	1:skinny, 2:Normal, 3:Overweight, 4: Obesity
6	kalori	Double	4	Daily calorie needed
7	chs	int	1	Program Choice (1:1300, 2:1500, 3:1900, 4:2200)
8	id_user	Int	11	User ID

2. User_db Table

TABLE VI - USER_DB TABLE SPESIFICATION

No	Field Name	Type	Size	Description
1	id_user	int	11	Choice Id
2	date_input	int	11	Input Date
3	nama	varchar	50	User Name
4	gender	int	1	1:Male, 2: Female
5	place_birth	varchar	50	User Place Birth
6	date_birth	date	8	User birth date (format:yyyy-mm-dd)
7	height	double	3	User height
8	weight	double	3	User Weight
9	aktivitas	int	1	1:light,2:average,3:heavy,4:extreeme
10	email	varchar	100	User email
11	username	varchar	20	User system username
12	Password	varchar	10	User system password

3. Kalori_in Table

TABLE VII - KALORI_IN TABLE SPESIFICATION

No	Field Name	Type	Size	Description
1	id_user	int	11	User Id
2	id_kalori	int	11	Calorie Id
3	tgl_asupan	date	3	Consumption Date {format: yyyy-mm-dd}
4	qty	double	99,9	quantity of portion consumed
5	jenis	int	1	Type of Consumption {1 : Breakfast, 2 : Lunch, 3:Dinner}

4. Kalori_db Table

TABLE VIII - KALORI_DB TABLE SPESIFICATION

No	Field Name	Type	Size	Description
1	id_kalori	int	11	Food ID
2	nama_makanan	varchar	50	Food Name
3	takaran	decimal	3	Serving size
4	kalori	double	999,9	Food Calorie
5	Satuan	Varchar	10	Unit

5. Kalori_Out Table

TABLE IX - KALORI_OUT TABLE SPESIFICATION

No	Field Name	Type	Size	Description
1	id_user	int	11	User Id
2	id_kegiatan	int	11	Activity ID
3	tgl_kalori	date	3	Activity Date {format: yyyy-mm-dd}
4	qty	double	999,9	Duration of Activity In Minutes

6. Kalori_Kegiatan Table

TABLE X - KALORI_KEGIATAN TABLE SPESIFICATION

No	Field Name	Type	Size	Description
1	id_kegiatan	int	11	Activity ID
2	nama_kegiatan	varchar	30	Activity Name
3	kalori	Double	99,9	Kalorie Out of Activity

7. Timbang_bb Table

TABLE XI - KALORI_KEGIATAN TABLE SPESIFICATION

No	Field Name	Type	Size	Deskripsi
1	id_user	int	11	id user
2	tgl_timbang	date	3	Newest weighing scale result date (format: yyyy-mm-dd)
3	new_bb	double	999,9	Newest weighing scale result

D. Design Menu Structure

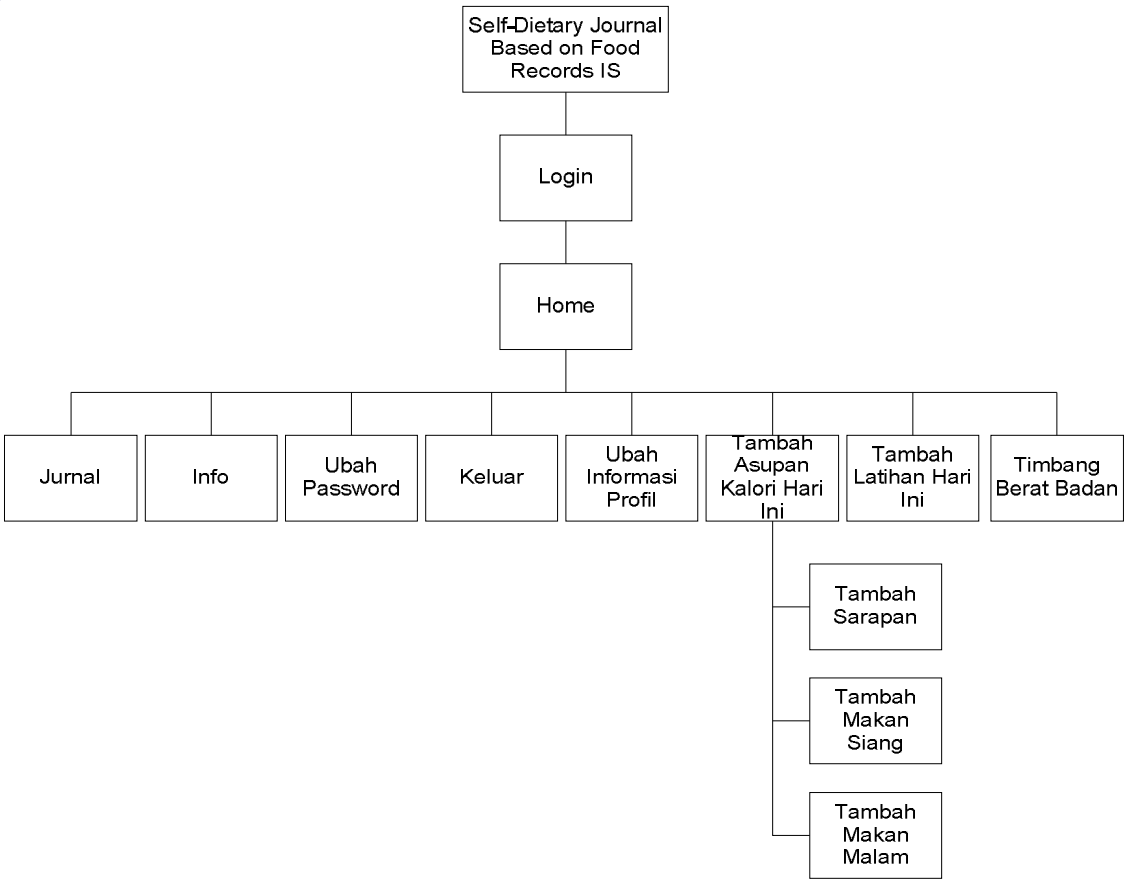

Fig 3. Design Menu Structure

E. User Interface Design

1. Registration Page Design

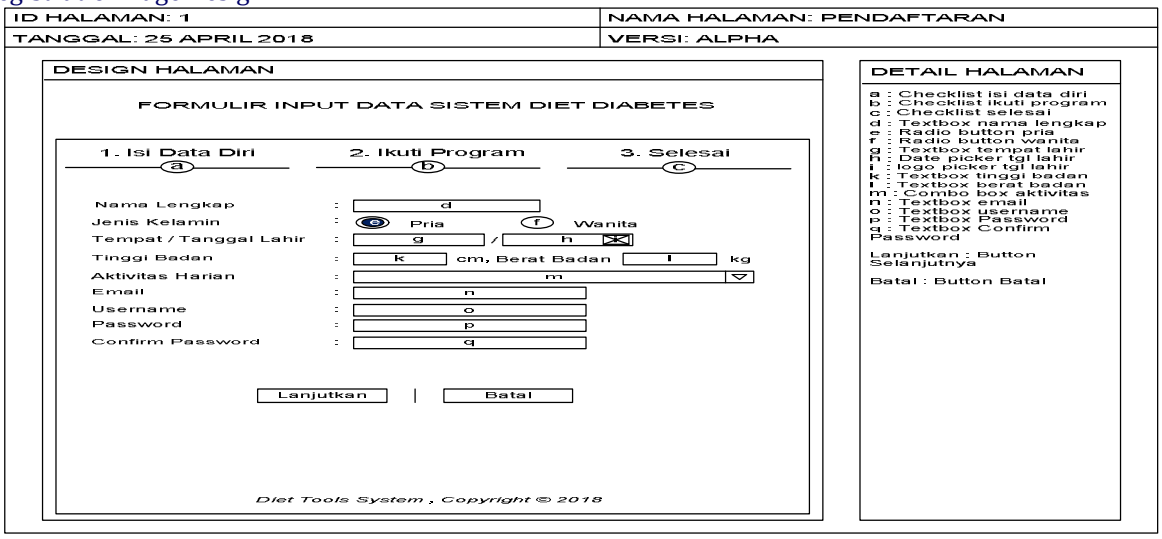

Fig 4. Registration Page Design

2. Program Page Design

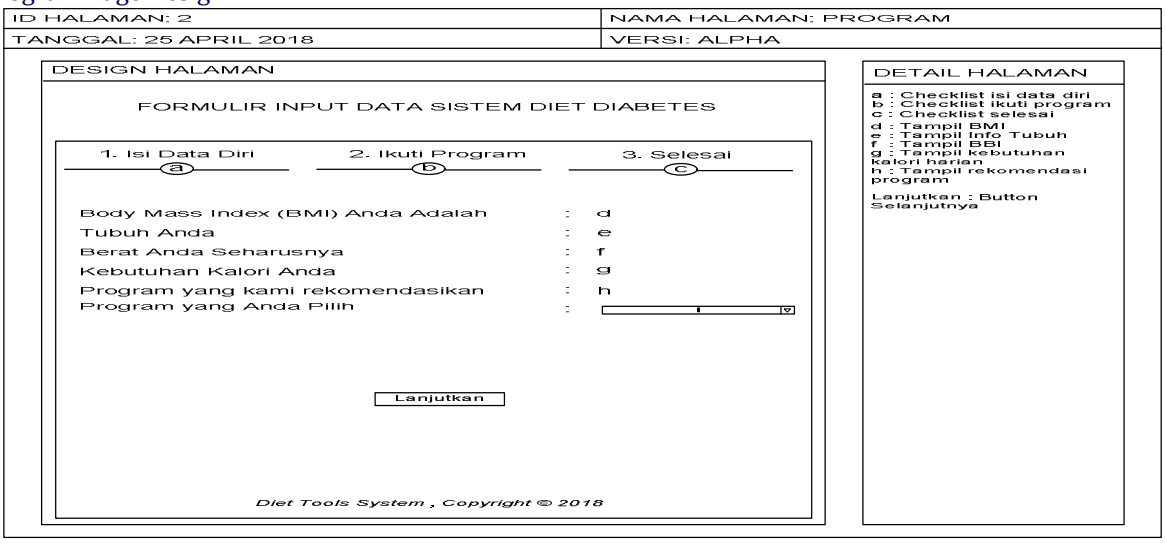

Fig 5. Program Page Design

3. Home Page Design

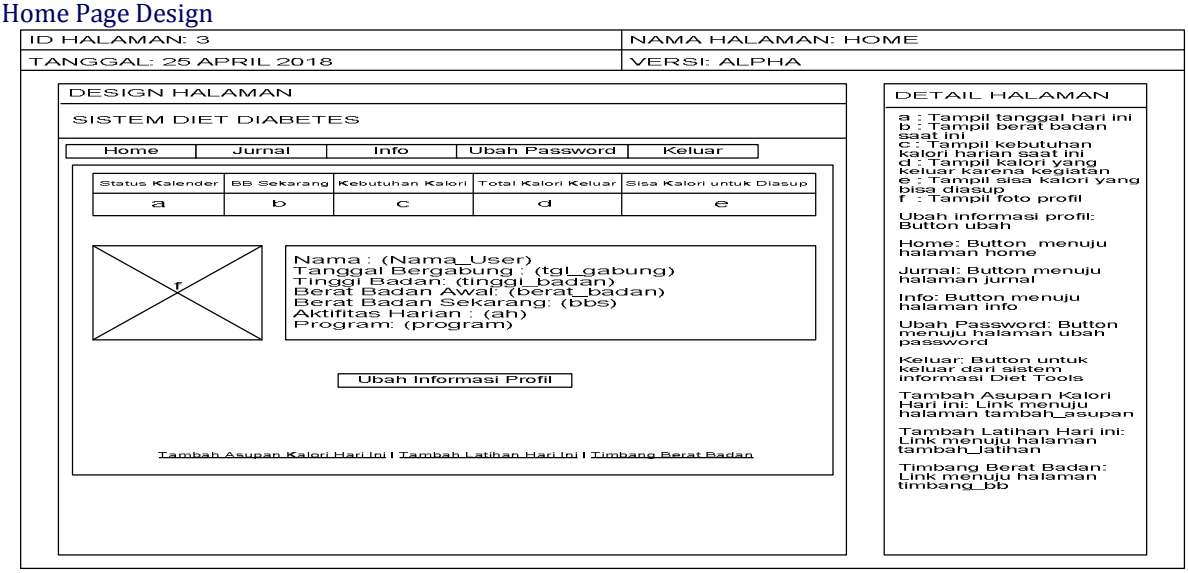

Fig 6. Home Page Design

4. Entry Consumption In Page

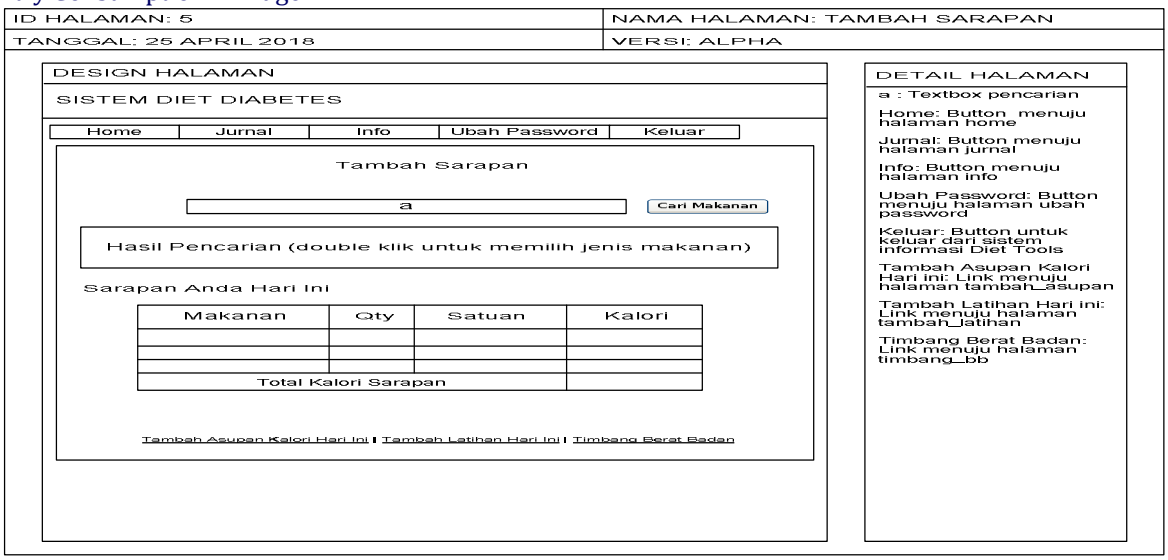

Fig 7. Entry Consumption Page Design

5. Entry Activity Page

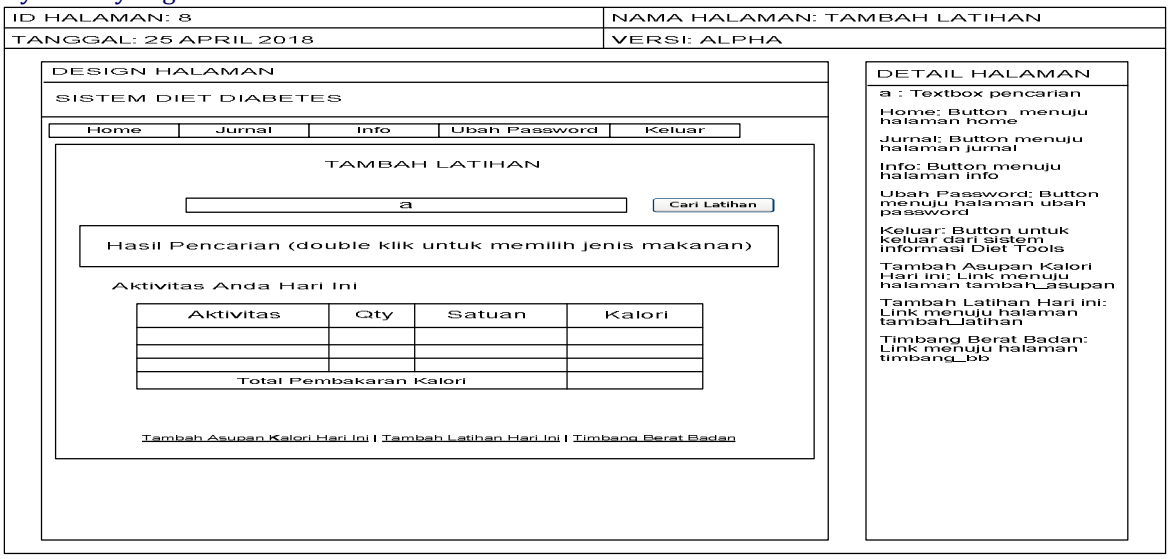

Fig 8. Entry Activity Page Design

6. Entry Weight Scaling Page

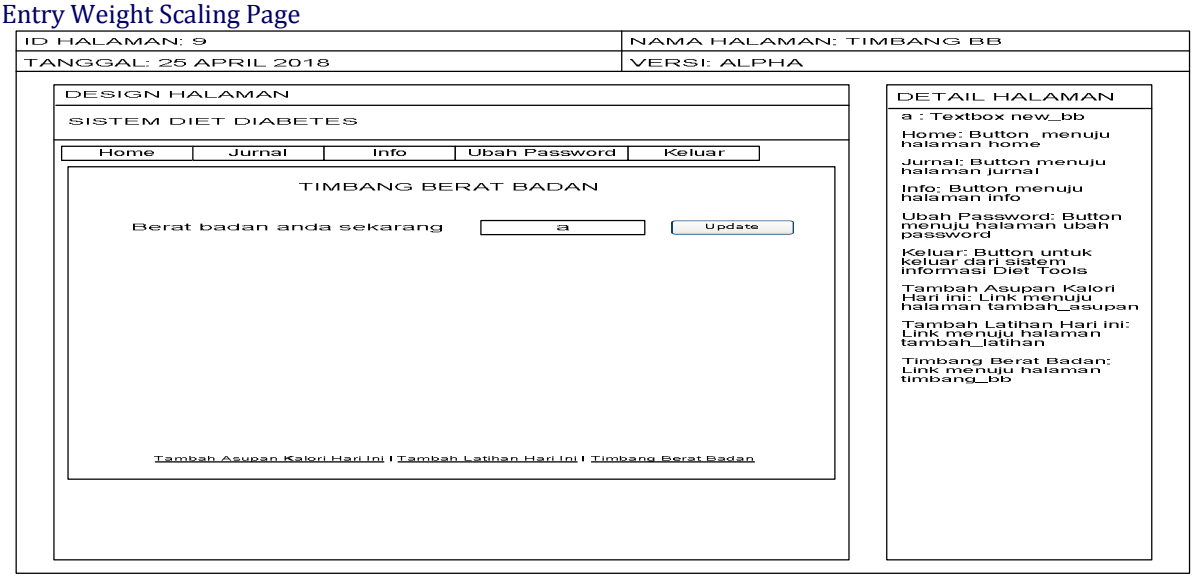

Fig 9. Entry Weight Scaling Page Design

7. View Journal Detail Page

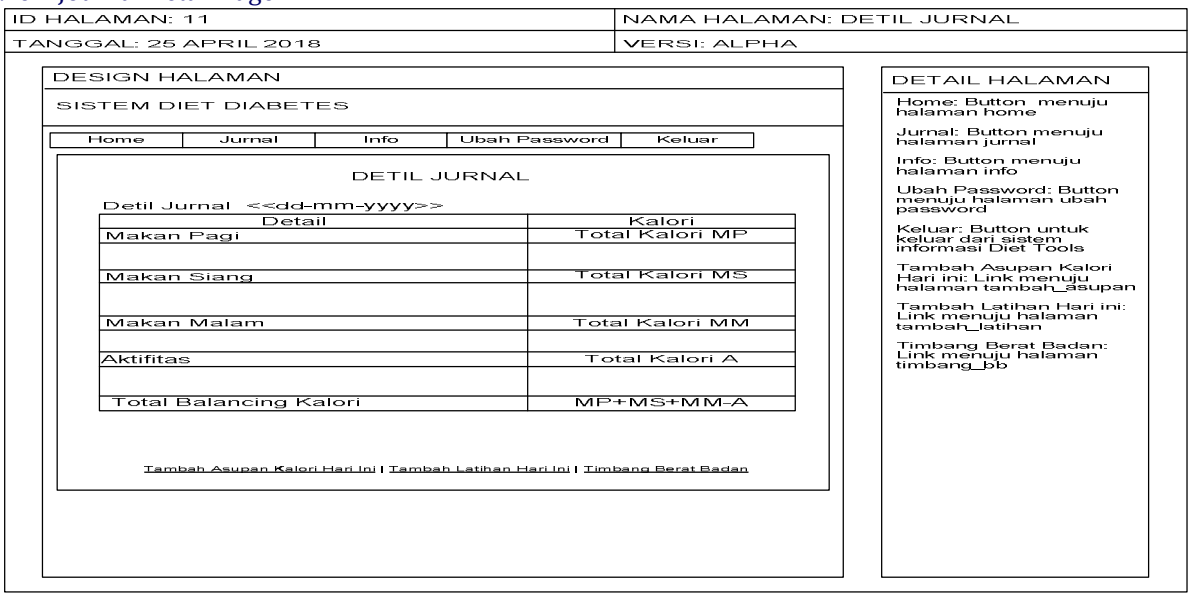

Fig 10. View Journal Detail Page Design

F. Class Diagram Design

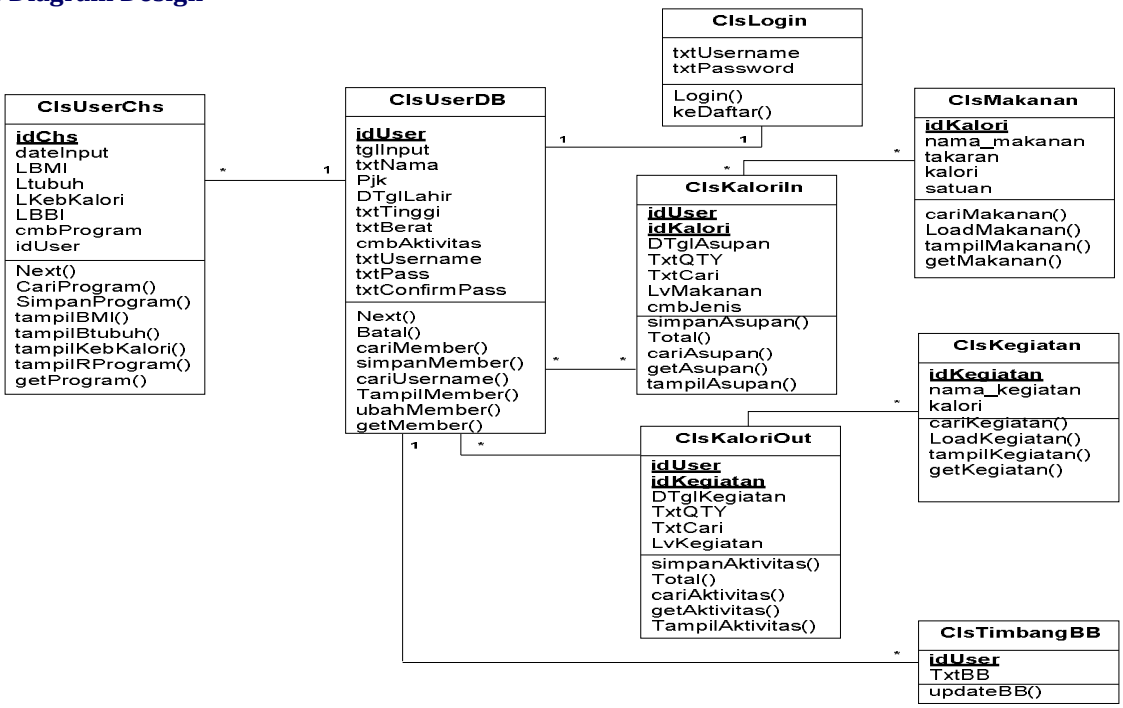

Fig 11. Class Diagram Design

V. CONCLUSIONS

A. Ordinary diabetics that have no clue about nutrition will be able to control and understand the limits about something they ate can be at risk for their diabetes with this system as a supporting tool. It is enough to just record food that they eat and add little more parameter like body weight regulary, body height, and what activities that they do into the system. Then system will calculate and help maintaining status for the rest

B. The diabetics will have enough time, no need for extra money or wasting much energy to use this system. Because this system has an analysis for nutrition like a nutritionist do, like calculating daily calorie need, BMI or choosing program. But this system is only for daily self control. For more health complication, real expert will help diabetics more. And the advantages of this system is the data that recording into the system can give more valid information to the real expert to make decisions for diabetics problem.

C. The diabetics can do calculate what he or she eats is appropriate, less or more than the expert advice, theres a status in Home Page that view daily calories they need and the rest calories of the day that can be consumed .

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