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IMPLEMENTASI KANSEI ENGINEERING PADA *APLIKASI* KONTROL GULA DARAH MANDIRI UNTUK MEMBANTU PASIEN DIABETES TIPE 2 NON-INSULIN

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IMPLEMENTATION OF KANSEI ENGINEERING IN SELF-MONITORING BLOOD GLUCOSE *APPLICATION* TO HELP PATIENTS OF NON-INSULIN TREATED TYPE 2 DIABETES

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TO HELP PATIENTS OF NON-INSULIN TREATED TYPE 2 DIABETES

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ABSTRACT

The proportion of people having diabetic in Indonesia is 6.9% of Indonesia population, and 90% of the diabetic population is including in Type 2 Diabetes. To control diabetes, International Diabetes Foundation (IDF) has a program named Self-Monitoring of Blood Glucose (SMBG). It is designed to gather detail information about the blood glucose on the certain time that will be used to adjust dietary habit and physical activity. In Indonesia, self-monitoring have not been done widely, because there are many obstacles in its application. One of them is patient's ability to read blood glucose level they have recorded, and use it to determine their food consumption. Seeing the rapid development of smartphone and internet in recent years, information and technology can become a solution for the success of SMBG in Indonesia. To solve this problem, Kansei Engineering method is used to translate the customer / patient's perception of the application into design elements. Kansei Engineering usage in this research is based on the ability of this method to catch the impression of the product that usually hidden. Statistical analysis which are Factors Analysis and Partial Least Squares (PLS) Analysis are used to support Kansei Engineering. From the statistical analysis, there are four selected Kansei components which are data record persistence', 'ease of use', 'data presentation', and 'visual attractiveness'. From Partial Least Analysis, these new concepts were transferred to new design specifications that became the basic design concepts.

Keywords: Type 2 Diabetes, Android Application, Product design, Kansei Engineering, Statistical Kansei Analysis

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IMPLEMENTASI KANSEI ENGINEERING
PADA *APLIKASI* KONTROL GULA DARAH MANDIRI
UNTUK MEMBANTU PASIEN DIABETES TIPE 2 NON-INSULIN

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ABSTRAK

Prosentase penderita penyakit diabetes di Indonesia adalah sebesar 6.9 % dari keseluruhan populasi. 90 % diantaranya termasuk ke dalam diabetes tipe 2. Dalam usahanya untuk membantu penanganan diabetes, *International Diabetes Foundation* (IDF) memiliki suatu program yang disebut dengan *Self-Monitoring of Blood Glucose* (SMBG). Program tersebut dirancang untuk mengetahui informasi terkait dengan level gula darah pada waktu tertentu, dimana hasil informasi akan digunakan sebagai acuan dalam penentuan diet makanan serta aktivitas fisik yang harus dilakukan penderita dalam usahanya menurunkan level gula darah mereka. Di Indonesia, sistem *self-monitoring* belum diimplementasikan secara merata dikarenakan banyaknya hambatan dalam penggunaan aplikasi. Salah satunya adalah kemampuan penderita untuk menginterpretasikan level gula darah yang dicek dan penggunaannya dalam menentukan diet makanan yang harus dilakukan. Melihat perkembangan penggunaan *smartphone* dan internet pada beberapa tahun terakhir, media informasi dan teknologi dapat dijadikan salah satu solusi kesuksesan implementasi SMBG di Indonesia. Untuk penyelesaian permasalahan yang ada, digunakan metode *Kansei Engineering* sebagai upaya dalam menangkap suara *customer* terkait aplikasi tersebut untuk kemudian ditranslasikan ke komponen-komponen rancangan baru pada aplikasi. Penggunaan *Kansei Engineering* pada penelitian diakibatkan oleh kemampuannya dalam menangkap atribut tersembunyi dalam produk. Analisa statistik yang digunakan untuk mendukung penggunaan *Kansei Engineering* merupakan *Factor Analysis* dan *Partial Least Squares* (PLS). Hasil dari analisa statistik menunjukkan terdapat empat (4) komponen *kansei* terpilih, diantaranya konsistensi pencatatan data (*data record persistence*), kemudahan penggunaan (*ease of use*), tampilan data (*data presentation*), dan tampilan visual (*visual attractiveness*). Dari *Partial Least Analysis*, empat komponen ini kemudian dijadikan konsep rancangan dasar dalam pembuatan rancangan baru aplikasi.

Kata Kunci – Aplikasi Android, Diabetes Tipe 2, *Kansei Engineering*, Perancangan Produk, *Statistical Kansei Analysis.*

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Aufaria Rosa Irfoni

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CHAPTER I
INTRODUCTION

This chapter consists of background, problem identification, research objectives, research benefits, research scope, and research outline.

1.1 Background

According to WHO (2016), diabetes is a chronic disease in which the pancreas cannot produce enough insulin or cannot use insulin. Insulin is a hormone that is required to digest the carbohydrate, turn it into glucose, and then transport the glucose from the bloodstream into the body's cell where it is used as energy. Insulin also works to keep the blood glucose in right amount (Hess-Fischl, 2016). The lack of insulin in diabetic person usually leads to high blood glucose, called hyperglycemia. Hyperglycemia may cause serious complication such as nerve damage, vision problems, kidney damage, heart problems, gangrene (localized death and decomposition of body tissue), and etc (Robertson, 2010). Those are the most avoided problem of hyperglycemia effects.

According to International Diabetes Federation on Diabetes Atlas (2015), as stated on Figure 1.1, Indonesia was ranked as the seventh highest diabetic population country, with total of 8,5 million patient, after China, India, United States of America, Brazil, Russian Federation, Mexico, and Bangladesh. Meanwhile in Sout East Asia, Indonesia considered as the highest diabetic population country.

The proportion diabetic patients in Indonesia is 6.9% of Indonesia population. High prevalence number (total number of occurrence in the specific time) of a diabetic person caused by several factors. Based on *Riset Kesehatan Dasar* done by *Kementerian Kesehatan* (2013), shown in Table 1.1, can be seen that the main cause of diabetes is high consumption of sweet food and beverages. It makes 53.1% of Indonesian population have a risk of having diabetes. For other factors, 40.7% of diabetes caused by eating excessive fatty food, 35.9% because of the high level of cholesterol, and 26.1% as the result of less physical activity.

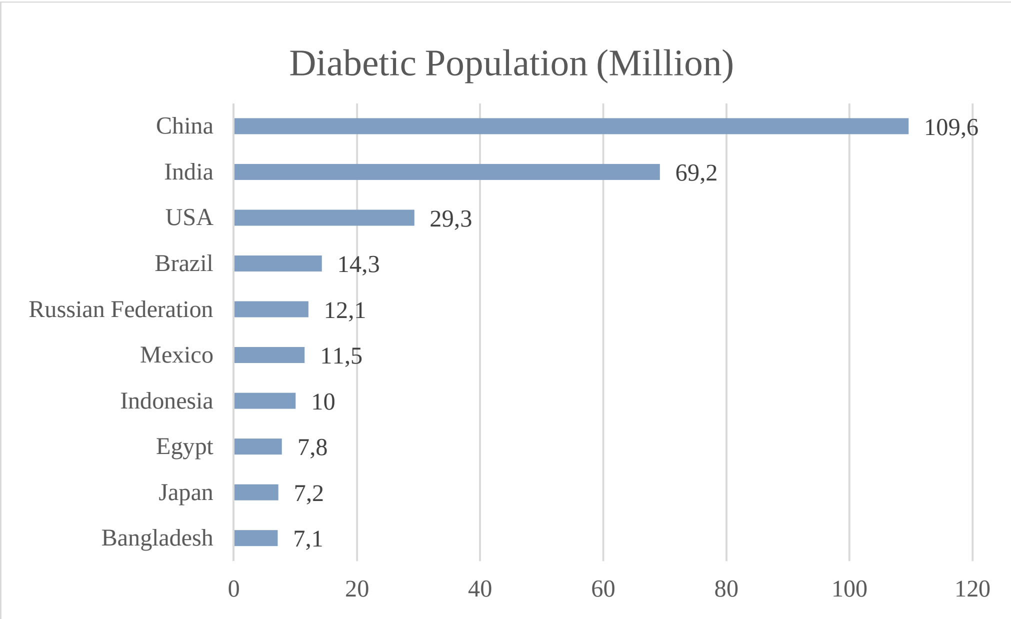

Figure 1.1 World Rank of Highest Diabetic Population (IDF, 2015)

Moreover, in term of demography as many as 54.69% of diabetic person are female with age between 45 until 64 years old. In terms of economy and lifestyle, there are 63.40% of diabetes patient came from middle and upper economic class. Most of them work as employee or entrepreneur (Riskesdas, 2013). From four diabetes cause factors mentioned before, can be concluded that the whole factors are related to food consumption and lifestyle.

Table 1.1 Indonesian Diabetes Risk Factor Proportion

RISK FACTOR	%	EXPLANATION
Overweight		24.9 < BMI*<30
< 5 y.o	11.8	
5-12 y.o	10.8	
13-15 y.o	8.3	
16-18 y.o	5.7	
>18 y.o	11.5	
Male	10.0	
Female	12.9	
Obesity		29.9 < BMI* < 40
< 5 y.o	NA	
5-12 y.o	8.0	
13-15 y.o	2.5	
16-18 y.o	16	

Table 1.1 Indonesian Diabetes Risk Factor Proportion (con't)

RISK FACTOR	%	EXPLANATION
>18 y.o	14.8	
Male	9.6	
Female	20.0	
Central Obesity	26.6	Abdominal circumference:
Male	11.3	Male : > 90 cm
Female	42.1	Female : > 80 cm
Less physical activity	26.1	on > 15 y.o* population
Hypertension	25.8	on > 18 y.o* population
Dyslipidemia		on > 15 y.o* population
High cholesterol	35.9	
Low HDL	22.9	
High HDL	15.9	
High Triglycerides	11.9	
Imbalance Diet		on > 10 y.o* population
Consuming sweet food / beverages > 1x a day	53.1	
Consuming salty food / beverages > 1x a day	26.2	
Consuming fatty food / beverages > 1x a day	40.7	
Smoking	24.3	on > 10 y.o* population

*BMI (Body Mass Index) = kg/m^2

*y.o = years old

Source: Situasi dan Analisis Diabetes, 2014

Basically, there are two types of diabetes, which are type 1 and type 2 diabetes. Type I diabetes caused by the inability of the body to produce insulin from early birth. In patient type 2, at the beginning, the body can produce insulin normally, but due to several factors such as unhealthy eating habits and lack of physical activities, the patient's body become insulin resistant. It makes the insulin can no longer transport the glucose on the bloodstream into body cells which should be turned into energy (IDF, 2015). Type 2 is the most common diabetes type with the highest population. As many as 9 from 10 diabetic population are included in this type (Diabetes.co.uk, 2016).

In order to control diabetes, Ministry of Health has three ways of controlling the non-communicable disease. The first way is done through non-communicable disease risk factor that is integrated into primary service facilities such as counseling and risk prediction. The second way is through *Posbindu PTM (Pos Pembinaan Terpadu Penyakit Tidak Menular).* This program aimed to increase the community's diabetes awareness. Thus, the community can predict and monitor the condition of themselves and their surrounding. The last is to socialize *PATUH* and *CERDIK* programs. *PATUH* stand for ***P****eriksa kesehatan secara rutin dan ikuti anjuran dokter,* ***A****tasi penyakit dan pengobatan yang tepat dan teratur,* ***T****etap diet sehat dengan gizi seimbang,* ***U****payakan beraktivitas fisik dan aman, dan* ***H****indari rokok, alkohol dan zat karsinogenik lainnya* (**R**egular health check up and follow the doctor's advice, **O**vercome disease with proper and regular medication, **S**tay healthy diet with balance nutrition, **E**xercise safely and regularly, and Avoid smoking, alcohol, and other carcinogenic substance). *CERDIK* program aimed to be socialized in the school. This program including ***C****ek kondisi kesehatan secara berkala,* ***E****nyahkan asap rokok,* ***R****ajin aktifitas fisik,* ***D****iet sehat dengan kalori seimbang,* ***I****stirahat yang cukup, dan* ***K****endalikan stress* (**C**heck the health condition regularly, **A**void smoking, **E**xercise regularly, **H**ealthy diet with proper calorie amount, **R**est enough, and **C**ontrol Stress) (Situasi dan Analisis Diabetes, 2014). From those programs mentioned before, can be concluded that the key to diabetes control is self-management. In international scale, International Diabetes Foundation (IDF) has a program named Self-Monitoring of Blood Glucose (SMBG). It is designed to gather detail information about the blood glucose on the certain time that will be used to adjust dietary habit and physical activity for a better day by day blood glucose level control (Benjamin, 2002).

On type 2 diabetic person, blood glucose control is focused on the food arrangement and the duration of physical activities. After dietary habit and exercise are considered impossible to reduce the blood glucose, medicine will be the last choice. This reason makes Self-Monitoring of Blood Glucose (SMBG) should be implemented on the type 2 diabetes patient. The research was done by Bosi et al (2013) on 1024 type 2 diabetes patient in 12 months able to prove that structured and controlled SMBG usage may increase the control of blood glucose level and can be used as a proper guide to prescribing the medicine and diet improvement. There are several SMBG parameters which are data retrieval frequency, patient's knowledge and ability, ease of the doctor to access the data, and ease of data interpretation (Polonsky and Fisher, 2012). On Self-Monitoring of Blood Glucose, patients are required to perform several glucose tests by using a lancet (prick device) to draw the blood sample then insert it to the glucometer to read the blood glucose level. Next, the number is recorded in the logbook. Then, those number can be used as a guidance to determine the diet and physical activity (Benjamin, 2002).

In Indonesia, self-monitoring have not been done widely, because there are many obstacles in its application. One of them is patient's ability to read blood glucose level they have recorded, and use it to determine their food consumption. The diabetic person in Indonesia tends to neglect their dietary habit. In fact, it has a strong relationship with up and down of blood glucose level. For the example, rice as the staple food of Indonesia has a quite high glycemic index (GI), which is around 88. The higher the GI number, the higher blood glucose rise will be (Disehat.com, 2016). In this case, SMBG will be very useful to know patient's blood sugar levels. Thus, the diet and medicine arrangement can be done with more accuracy.

Based on Liu (2015), smartphone users growth in Indonesia from 2014 to 2019 predicted to have high positive growth. From Table 1.3, it can be seen that Indonesia ranked number 3 for the highest smartphone user. From the operation system (OS) that is used, Indonesian people prefer using Android rather than iOS. With total 41 million people compared to 2.8 million people, android platform is more popular (Liu, 2015). Seeing the rapid development of smartphone and internet in recent years, information and technology can become a solution for the success of SMBG in Indonesia.

Table 1.2 Smartphone Users in Asia-Pasific by Country 2014-2019 (millions)

Country	2014	2015	2016	2017	2018	2019
China	482.7	525.8	563.3	599.3	640.5	687.7
India	123.3	167.9	204.1	243.8	279.2	317.1
Japan	46.2	51.8	55.8	58.9	60.9	62.6
Indonesia	44.7	55.4	65.2	74.9	83.5	92
South Korea	32.2	33.6	34.6	35.6	36.5	37
Philippines	21.8	26.2	29.9	33.3	36.5	39.2
Vietnam	16.6	20.7	24.6	28.6	32	35.2
Thailand	15.4	17.9	20	21.9	23.4	24.8

Table 1.2 Smartphone Users in Asia-Pasific by Country 2014-2019 (millions) (con't)

Country	2014	2015	2016	2017	2018	2019
Taiwan	15.2	16.4	17.2	17.8	18.3	18.6
Australia	13.5	14.6	15.4	16	16.5	16.8
Malaysia	8.9	10.1	11	11.8	12.7	13.7
Hong Kong	4.4	4.8	5	5.2	5.3	5.4
Singapore	38	4	4.2	4.3	4.4	4.6
New Zealand	2.3	2.7	2.9	3.1	3.2	3.3

Source: Liu, 2015

Ghoyal, Morita, and Lewis (2015) explain that effective self-management for type 2 diabetes patient needs a mobile application that can train the patient's habit and makes the SMBG activities easier. These type of application has been existing, BantII is one of them. This application use target as a trigger for the patient to record their blood glucose. The plus point of this apps is BantII already linked with a wireless glucometer. Thus, when the patient measures their blood glucose, the number will be directly recorded in this application. From BantII application, can be seen that almost all of the SMBG parameter already fulfilled, except the ease of the doctor to access and interpret the data.

In Indonesia, wireless glucometer is not available yet. In addition, to anticipate incorrect data interpretation, it is necessary to make an application that will warn the patient to track their blood glucose, giving the right type of food, warning the patient, and sending the report to the private physician who will provide recommendation and diagnosis of the patient's condition. Therefore, this study aims to create applications that can help people with type 2 diabetes non-insulin in running Self-Monitoring Blood Glucose effectively, and in accordance with the patient's conditions in Indonesia.

To solve this problem, Kansei Engineering method is used to translate the customer / patient's perception of the application into design elements. Kansei Engineering is a product development methodology, which translates impressions, feelings, and demands of the customers on the product (Nagamachi, 1995). Kansei Engineering usage in this research is based on the ability of this method to catch the impression of the product that usually hidden. Statistical method which are Factors Analysis and Partial Least Squares (PLS) Analysis also used to support Kansei

Engineering considering its ability to identify hidden dimensions or constructs which may not be apparent from the direct analysis.

1.2 Problem Formulation

Based on the research background, the main focus of this research is to design a Self-Monitoring Blood Glucose Program Android based application to help non-insulin treated type 2 diabetes by capturing the customer's perspective and develop the design elements through Kansei Engineering concept.

1.3 Research Objectives

The objectives of this research are listed below:

1. Identify the Indonesian user’s preferences on Self-Monitoring Blood Glucose mobile application.
2. Identify the application elements based on the Kansei Engineering concept.
3. Design the Self-Monitoring Blood Glucose (SMBG) Android based application in accordance with the condition of type 2 diabetes patient in Indonesia.

1.4 Research Benefits

The benefits of this research are listed below:

1. Makes the Self-Monitoring Blood Glucose (SMBG) activity of type 2 non-insulin diabetes patient process easier.
2. Providing proper data through historical blood glucose for a better and more accurate medicine, food, and exercise prescription.
3. Providing proper type of food based on the current blood glucose level.

1.5 Research Scope

This subchapter will shows the boundaries and assumptions that are used in this research. The boundaries are listed below:

1.5.1 The Boundaries

The boundary of this research are listed below:

1. The research only focused on type 2 diabetes non-insulin patient with stable regiments and controllable blood glucose.
2. The application did not consider complication caused by another disease such as cardiac, kidney failure, etc.

1.5.2 The Assumptions

The assumption of this research is type 2 diabetic person is familiar and able to use blood glucose meter device (glucometer). This is due to the application will use blood glucose level from glucometer as the input.

1.6 Research Outline

The outline that is used in this research classified into several chapters which shown as below:

CHAPTER I BACKGROUND

This chapter will describe the reason of the conducted research, including the identification of the problem. The components that included in this chapter are background, problem identification, research objectives, research benefits, research scope, and research outline.

CHAPTER II LITERATURE REVIEW

Literature review chapter describes the theory or existing research that used as references to conduct the research. Topics that are included in this chapter are Kansei Engineering, Factor Analysis, Partial Least Squares (PLS) Analysis, diabetes, blood glucose, Self-Monitoring Blood Glucose (SMBG), Glycemic Index (GI), and blood glucose meter

CHAPTER III RESEARCH METHODOLOGY

This chapter describes the sequences and how methods are used in the research. Research methodology will make the research more systematic and structured. In this chapter, there will be a flowchart and explanation regarding the steps to complete this research.

CHAPTER IV DATA COLLECTION AND PROCESSING

This chapter consists of data collection that will become the input of the system and calculation based on the methodology that already explained in the previous chapter. It also consists of the design phase of the application based on the data processing that already done before. In addition, the software will be tested and evaluated through several steps.

CHAPTER V ANALYSIS AND EVALUATION

In this chapter, there will be explanation and analysis about the result of the application design. The analysis are including the user requirement gathering, statistical analysis result, and also the analysis of Self-Monitoing of Blood Glucose application

CHAPTER VI CONCLUSION AND SUGGESTION

This chapter consists of the conclusion of the research regarding the research objectives. At last, several recommendations are given for further research on the related topic.

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CHAPTER II
LITERATURE REVIEW

This chapter consists of definition and theories used in the research that is used as basic understanding about the context of the research.

2.1 Kansei Engineering

In this research , the product development tool that is used is Kansei Engineering. Further explanation regarding Kansei Engineering shown as follows:

2.1.1 Definition of Kansei Engineering

Kansei engineering was developed as a consumer-oriented technology for new product development. It is defined as "translating technology of a consumer's feeling and image for a product into design elements". Kansei Engineering aims to produce a new product based on the customer's feeling and demand. It is used psychological feeling that being processed through Kansei Engineering System (KES) to find the product design elements, as shown in Figure 2.1 below (Nagamachi, 1995):

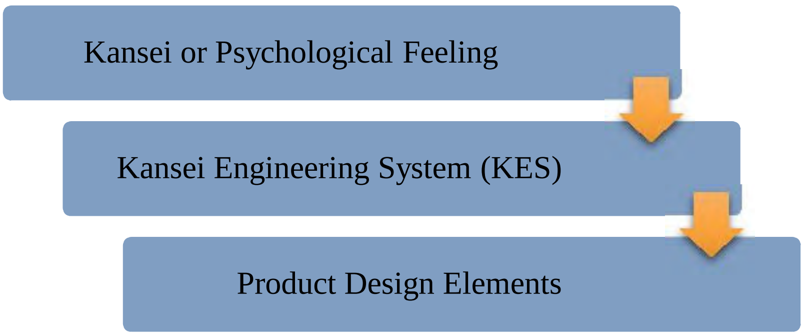

Figure 2.1 A Diagram of a Process of Kansei Engineering System (KES) (Nagamachi, 1995)

Human Kansei can be seen from behavior, action, verbal, facial expression, and body language of the customers. Kansei engineering concern about four points, which are:

1. How to grasp the customer's feeling about the product in terms of ergonomic and psychological estimation.
2. How to identify the design characteristic based on the customer's feeling.
3. How to build Kansei Engineering as an ergonomic technology.
4. How to adjust product design to the current societal change or people's preference trend.

Regarding the first point, the Semantic Differentials (SD) is used as the main technique to grasp the consumer's Kansei. The Kansei words are collected from the books, journals, magazines, and other media. Kansei words are gathered and then selected of the most relevant words. On the second point, survey and experiments are done to find the relations between the Kansei words and the design elements. In regard to the third point, the statistical or mathematical model is used to build a systematic framework on Kansei Engineering. At last, the new Kansei trend inputted to the databases of Kansei Engineering every three or four years.

2.1.2 Advantages and Disadvantages of Kansei Engineering

As a development tool, Kansei Engineering has several advantages and disadvantages. The advantages of using Kansei Engineering based on Stanton (2005) mention as follows:

1. Considering the costumer's Kansei value based on the product that will be developed.
2. Aiming for the customer's satisfaction.
3. May give a dominant trend of new product for further development.
4. Increase the design quality.

Beside its advantages, the disadvantages of Kansei Engineering based on Stanton (2005) mention as follows:

1. The customer's Kansei is quite hard to get regarding various behavior and psychophysiological of the customer.
2. Kansei engineer is needed to know and use the statistical method.
3. Kansei engineering is needed to translate the number from the statistical analysis results to the developed product design.

4. There is no fixed method to measure the deterministic statistics to calculate nonlinear feature from the existing kansei.

2.1.3 Types of Kansei Engineering

Kansei Engineering divided into three types of the category, which are Type I, II, and III. Each type explains as follows:

1. Type I: A Category Classification

   The category classification is a method in which a Kansei category of a product is broken down in the tree structure to get the design details. As presented in Figure 2.2 below, the procedure of Type I Kansei Engineering begin with decision strategy, determining Kansei words, setting of Semantic Differential (SD) scale, evaluation experiment, data interpretation, data explanation, and collaboration between designer and Kansei engineer.

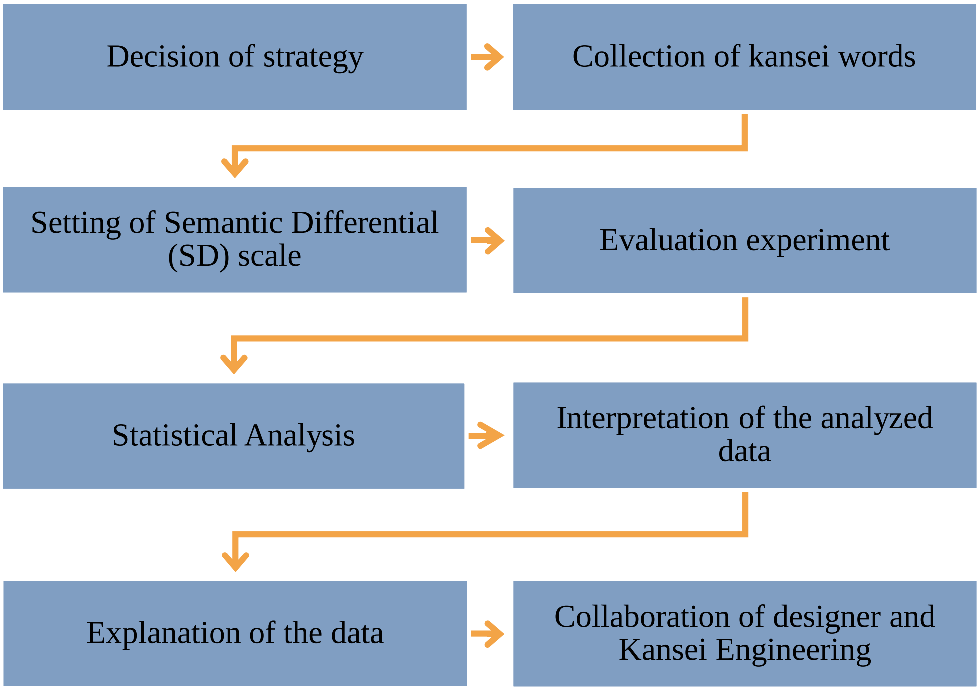

Figure 2.2 Flow of the Kansei Engineering Type I (Nagamichi and Tachikawa, 2015)

The first step of Kansei Engineering is defining the strategy of the product. It is including the specified concept for the new product that will be developed. Even though the detail will be gathered from the customer, the company should have a basic product concept, related with what kind of product that will be produced, market target and segment, etc.

Next, is to collect the Kansei words related to the product concept (about 20-30 Kansei words). At first, the Kansei words are collected as many as possible. Then, those words are sort into the most relevant words. The collected Kansei words are arranged on a 5-point or 7-point Semantic Differential (SD) scale, as shown in Table 2.1. The 5-point scale is better for panel's work on easy evaluation.

Table 2.1 Example of Kansei SD Scale of Bath Salt Product

1	**Feeling watching at the packaging design**	**1**	**2**	**3**	**4**	**5**
	1. Easy to hold up					
	2. Easy to open the cover					
	3. Premium					
	4. Highly qualified					
	5. Gorgeous					
	....					
2	Feeling after opening the cover					
	1. Easy to open the cover					
	2. Easy to open middle cover					
	3. Easy to measure the material					
3	Feeling after putting into bathtub					
	1. Clear					
	2. Like southern country sea					

Source: (Nagamichi and Tachikawa, 2015)

Fourth, the customer's Kansei are gathered in the evaluation experiment through interview using Feedback Capture after Task (FCAT)

Method and questionnaire. Their feelings are recorded with Kansei words to each sample on the SD scale.

At the fifth step, the evaluation result will be processed by using Factor Analysis to reduce the number of variables. This method groups variable with similar characteristic together. Following explanation regarding factor analysis is provided in Subchapter 2.2.

Sixth, as can be seen in Figure 2.3 all analyzed data interpreted from the viewpoint of Kansei Engineering to find the relationship between human Kansei and product property through Partial Least Squares (PLS) Analysis. From here, the relations of each Kansei with design specification fill be found.

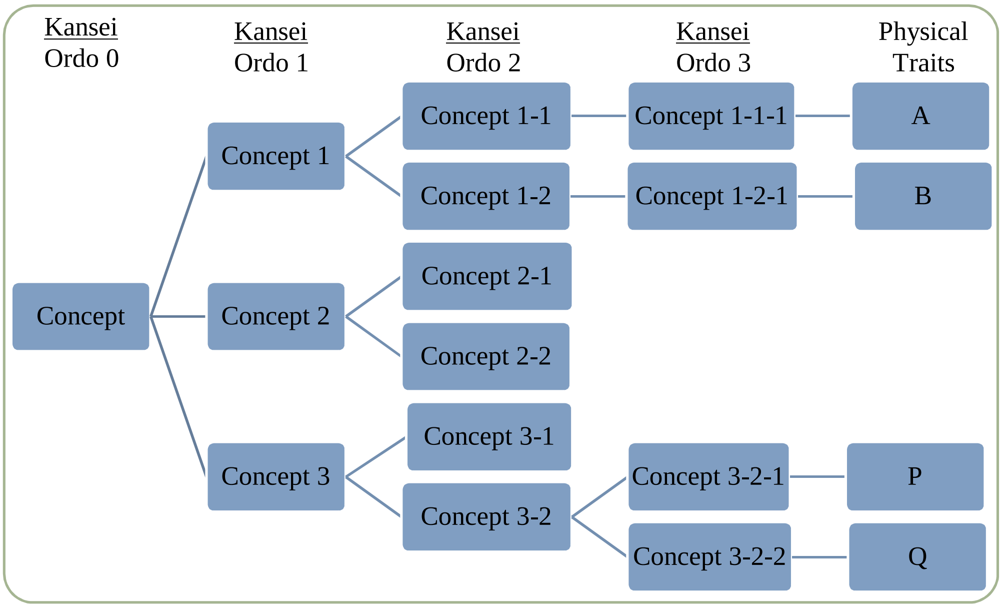

Figure 2.3 The Translation of Kansei into Physical Traits (Nagamichi and Tachikawa, 1995)

Seventh, the design specifications are explained to the designer in order to make the new design. The last, the Kansei engineer motivates the company designer to create the new emotional product design stepped over the analyzed data. In this process, the Kansei engineer should support the designer's creation based on the Kansei engineering data. This is a kind of collaboration between Kansei engineer and the designer (Nagamichi and Tachikawa, 2015).

2. Type II: Kansei Engineering Computer system

    Kansei Engineering Type II is a computer-assisted Kansei Engineering System (KES). KES is a computerized system with the Expert System to transfer the consumer's feeling and image to the design details. The computerized Kansei Engineering System architecture basically has four databases, which are (Nagamachi, 1995):

    1. Kansei Word Database
    2. Image Database
    3. Knowledge
    4. Design and Color Database

3. Type III: Kansei Engineering Modeling

    In Kansei Engineering Type III, the ergonomic outcome from Kansei words found by constructing a mathematical model. The mathematical model implies a kind of logic which plays a similar role to the rule-base.

2.2 Factor Analysis

Factor analysis is used to reduce a mass of data to a smaller data set that is easier to be managed and understood (Darlington, 2016). It is a way to find hidden patterns, show how those patterns overlap and seen what characteristic are seen in multiple patterns. With factor analysis, there is no distinction between dependent and independent variables. Rather, all variables are analyzed together to identify underlying factors.

Factor analysis is a complex mathematical procedure, but there are several software that will make it easier. Software that can be used to perform factor analysis are including Stata, Minitab, or SPSS.

In the factor analysis, here are several assumptions that are used. The assumptions are listed as follow:

1. Models are usually based on linear relationship
2. Models assume that the data collected are interval scaled
3. Multicollinearity in the data is desirable because the objective is to identify an interrelated set of variables.

Factor analysis is a very useful tool for complex sets of data involving psychological studies, socioeconomics status, and other similar concepts. The factor analysis application can be used in advertising to better understand media habits of various customers. In pricing, it may help to identify the characteristic of price-sensitive and prestige-sensitive customers. On the field like product development, factor analysis will help to identify brand attributes that influence consumer choice. While In distribution, factor analysis can be employed to better understand channel selection criteria among distribution channel members.

Same with other method, factor analysis has several advantages and disadvantages. Compared to similar techniques such as cluster analysis and multidimensional scaling, factor analysis has several advantages which are:

1. Can be used to identify hidden dimensions or constructs which may not be apparent from the direct analysis.
2. Able to cope with certain unique properties of correlation matrices.
3. Recognize certain properties of correlation.
4. A more concise representation of the market situation.

Despite the advantages mentioned before, factor analysis has several drawbacks, that are listed below:

1. Subjective interpretation of the factors meaning.
2. Factor analysis will find apparent structure in the data, even though there are a lot of random numbers generated. It is difficult to tell whether those factors reflect the data or the factor analysis power to find patterns.

2.3 Partial Least Squares (PLS)

Partial Least Squares was developed by Swedish econometrician Herman Wold and co-workers from middle of 1970a. PLS was developed by Swedish econometrician Herman Wold and co-workers from middle of 1970s. Chemometrics is the PLS's most applied field from middle of 1990s. A typical example takes spectrum distribution on huge number of *x*. In these applications, number of *x* ups to several hundreds and correlations between *x* variables are very high because of spectrum. On the other hand, *y* takes measured value such as temperature or PH, and sample number is tens at the most. Brereton (2003) shows such smaller sample size cases in Chemometrics. Common multiple regression can not deal with such data.

PLS uses several latent variables. There are s (number of samples) observations of objective (dependent) variable. These become vector y. There are p dimensional explanatory (independent) variables. These become vector x. There are number s of x, then become matrix X (Matsubara et al, 2009)

In Kansei Engineering, Partial Least Square (PLS) Analysis is used to identify the influential design elements. PLS is done using the data from Kansei words survey and the influential of design elements. It is a list of the physical trait alternatives that can be generated from the design elemnts. Relationship between the Kansei words and the design element describe in the item/category is obtained (Chuan et al., 2013).

According to Garson (2016) Partial Least Squares has several advantages and disadvantages. The advantages of PLS include:

1. Ability to model multiple dependents as well as multiple independents
2. Ability to handle multicollinearity among the independents
3. Robustness in the face of data noise and missing data
4. Creating independent latent variables directly on the basis of cross-products involving the response variable(s)

The disadvantages of Partial Least Squares (PLS) are including as follows:

1. Greater difficulty of interpreting the loadings of the independent latent variables (which are based on cross-product relations with the response variales)
2. Distributional properties of estimates are not known

Partial Least Squares can be perform using several statistical tools such as Excel XLSTAT, SPSS, Minitab etc.

2.4 Diabetes

Diabetes is a chronic condition that occurs when the body cannot produce enough insulin or cannot use insulin, and is diagnosed by observing raised levels of glucose in the blood. Insulin is a hormone produced in the pancreas; it is required to transport glucose from the bloodstream into bod’s cells where it is used as energy. The lack, or ineffectiveness, of insulin in a person with diabetes means that glucose remains calculating in the blood (known as hyperglycemia) causes damage to many tissues in the body, leading to the development of disabling and life-threatening health complications (IDF, 2015).

Diagnose a person has diabetes or not is done based on the several symptoms, which some of them mentioned as follows (American Diabetes Association, 2016):

1. Urinating often
2. Feeling very thirsty
3. Feeling very hungry – even though while eating
4. Extreme fatigue
5. Blurry vision
6. Cuts/bruises that are slow to heal
7. Weight loss – even though with higher meal portion (type 1)
8. Tingling, pain, or numbness in the hands/feet (type 2)

2.4.1 Type 1 Diabetes

Type 1 diabetes is an auto-immune condition in which the immune system is activated to destroy the beta cells in the pancreas that produce insulin. As the result, the body can no longer produce the insulin it needs. This type of diabetes usually happens in children and young adult. People with this form of diabetes need insulin injection every day to control their blood glucose (Diabetesaustralia.com.au, 2016). Because the body cannot produce insulin, people with type 1 diabetes needs to do things mentioned below:

1. Insulin replacement through lifelong insulin injection (up to 6 every day) or use of an insulin pump.
2. Monitoring of blood glucose levels regularly.
3. Following healthy diet and eating plan.
4. Taking regular exercise.

2.4.2 Type 2 Diabetes

In type 2 diabetes, the body does not use insulin properly, which is called as insulin resistance. At first, the pancreas makes extra insulin make up for it. Over time, the pancreas is not longer able to keep up and cannot make enough insulin keep the blood glucose levels normal. Type 2 is treated with lifestyle changes, oral medication (pills) and insulin (American Diabetes Association, 2015).

The development of type 2 diabetes has been associated with several risk factors. These risk factors include (American Diabetes Association, 2015).

1. History of hyperglycemia, prediabetes, and/or gestational diabetes
2. Overweight and obesity
3. Unhealthy diet
4. Physical inactivity
5. Genetics
6. Family history
7. Race and ethnicity
8. Age
9. High blood pressure
10. Abnormal cholesterol
11. Poor nutrition during pregnancy

American Diabetes Association (2015) stated that there are two goals of diabetes treatmens, which are to make sure the patient well day-to-day and to prevent or delay long-term health problems. The best way to reach those goals is by (American Diabetes Association, 2015):

1. Medication (only if the doctor prescribes them).
2. Planning the meals (what, how much, and when to eat).
3. Being active physically.

2.5 Blood Glucose

Blood glucose is the main sugar that the body makes from the food in the food. Glucose is carried through the bloodstream to provide energy to all cells in the body. In order to use glucose and change it into energy, cells need insulin (MedicineNet, 2016).

Blood glucose level is the amount of glucose in the blood. For a diabetic person, it is important to control the blood glucose level to prevent it becomes too low or too high. High levels of blood glucose over a sustained period of time may lead to damage blood vessels. When the blood glucose is too low, cells cannot get the element to produce energy. Poorly controlled blood glucose levels can increase the chances of developing diabetes complication.

Table 2.2 shows the comparison between blood glucose target between people without diabetes and people with diabetes. Blood glucose will be up and down in a day. The lowest will be on the time after waking up. It is called fasting blood glucose. Then, there will be differences between before and after a meal. Before meal blood glucose called preprandial, and should be between 70mg/dl until 30mg/dl. Blood glucose after a meal usually tested 2 hours after meal time, and called postprandial blood glucose, and should be less than 180 mg/dl. HbA1c or glycol hemoglobin A1c is a type of blood glucose check that should be done once in three months in the laboratory.

Table 2.2 Blood Glucose Ranges Target

Type of Blood Glucose	Goal Plasma Blood Ranges for People Without Diabetes	Goal Plasma Blood Glucose Ranges for People With Diabetes
Fasting (mg/dl)	< 100	70 - 130
Preprandial (mg/dl)	< 110	70 – 130
Postprandial (mg/dl)	< 140	< 180
Bedtime (mg/dl)	< 120	90 - 150
HbA1c or glycohemoglobin (A1c) (%)	< 6%	< 7%

Source: diabetes.co.uk, 2016

2.6 Self Monitoring Blood Glucose

Self Monitoring Blood Glucose is a system designed by International Diabetes Federation (IDF) after studies in large, long-term, randomized controlled trial of both type 1 and type 2 diabetes. Based on the study, glucose control has not affected much by the Type 1 Diabetes. However, in Type 2 Diabetes tight glucose control have not shown a desired outcomes at the beginning. But after several years, it shows several benefits. This so-called ‘metabolic memory’ or ‘legal effect’ which suggest that while the short-term benefits of tight glycemic control for macrovascular disease have not been shown in samples object, the long-term benefits may be substantive particularly when good HbA1c (glycated haemoglobin), a haemoglobin that joins with glucose in the blood, levels are achieved and maintained early in the course of the disease.

2.6.1 Benefits of Self-Monitoring of Blood Glucose

Based on the IDF Guideline on Self-Monitoring of Blood Glucose for Non-Insulin Type 2 Diabetes, the effective use of SMBG has several benefits mentioned as follows:

1. Support to enhance a diabetes care program that aims to educate people about their condition.
2. Instruments for objective feedback on the impact of daily lifestyle habits, special situations (illness, stress) and medication on glucose levels, and thereby to foster self-management and empower the individual to make the necessary changes
3. Support to the healthcare team in providing individually tailored advance about lifestyle components and blood glucose-lowering medication.

Figure 2.4 shows that SMBG does not only need people with diabetes as the one who should be active at SMBG practice, but also healthcare team to make sure that SMBG and health treatment are done correctly. For people with diabetes, it is important to know their disease, everything they should do and not do, thus they can adjust their behavior, to control their disease. In healthcare team, glycaemic assessment and therapy optimization should be done based on the SMBG data from the patient. Thus, it will make the result is suitable for every individual.

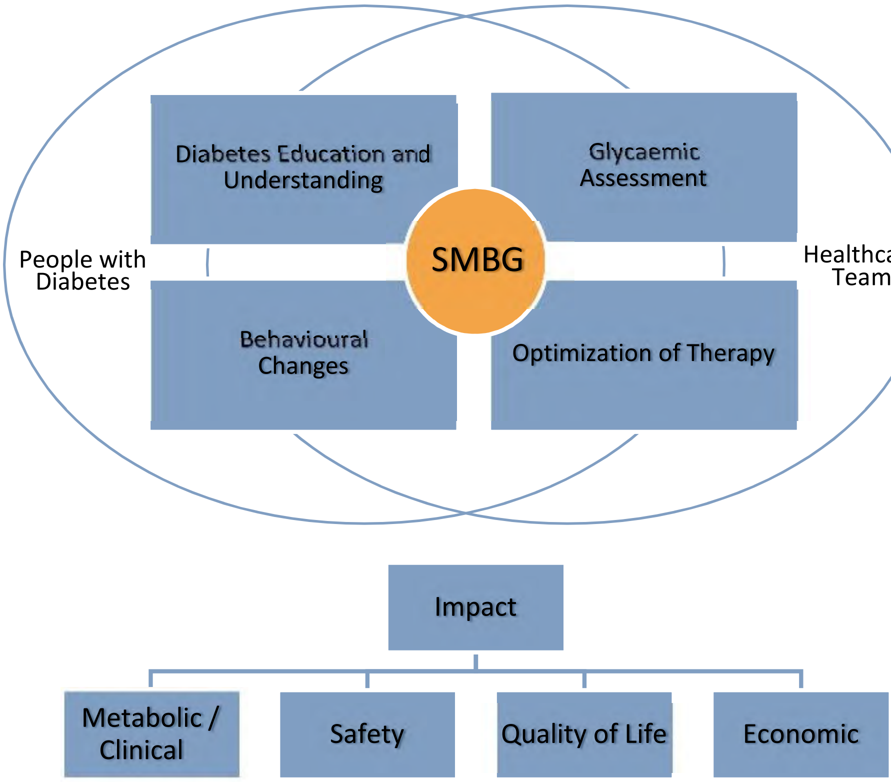

Figure 2.4 SMBG as a Component of the Education/Treatment Program (IDF, 2009)

2.6.2 Self-Monitoring of Blood Glucose Recommendation

IDF in on Self-Monitoring of Blood Glucose for Non-Insulin Type 2 Diabetes guideline suggest several recommendations for people in the use of SMBG, which mentioned as follows:

1. SMBG should be used only when individuals with diabetes (and/or their caregivers) and/or their healthcare providers have their knowledge, skills and willingness to incorporate SMBG monitoring and therapy adjustment into their diabetes care plan in order to attain agreed treatment goals. Considering that SMBG involves balancing between food intake, physical activity and drug therapy, the patient and healthcare in charge should be aware and active to perform proper SMBG.

2. SMBG should be considered at the time of diagnosis to enhance the understanding of diabetes as part of individuals' education and to facilitate timely treatment initiation and titration optimization.
3. SMBG should also be considered as part of ongoing diabetes self-management education to assist people with diabetes to better understand their disease and provide a means to actively and effectively participate in its control and treatment, modifying behavioral and pharmacological interventions as needed, in consultation with their healthcare provider.
4. SMBG protocols (intensity and frequency) should be individualized to address each individual's specific educational/behavioral/clinical requirements (to identify/prevent/manage acute hyper- and hypoglycemia) and provider requirements for data on glycemic patterns and to monitor the impact of therapeutic decision making.
5. The purpose(s) of performing SMBG and using SMBG data should be agreed between the person with diabetes and the healthcare provider, these agreed upon purposes/goals and actual review of SMBG data should be documented.
6. SMBG use required an easy procedure for patients to regularly monitor the performance and accuracy of their glucose meter.

2.6.3 Steps of Self-Monitoring of Blood Glucose

Self-Monitoring of Blood Glucose basically is the activity of checking and tracking the blood glucose in a certain time in order to manage diabetes in the best way possible and to prevent long-term complications (Tomsky, 2010). There ara several steps that should be taken to perform SMBG, which mentioned as follows:

1. Check the blood glucose on the following time:
   a) Before meals and before taking medication.
   b) Two hours after meals.
   c) Before bedtime.
2. Check the blood by using blood glucose meter.
   a) Wash the hands or clean the finger or another site with alcohol, and let it dry.
   b) Prick the site with a lancing device.

c) Put a little drop of blood on a test strip.

d) Insert the test strip on the blood glucose meter.

3. Record the blood glucose level.

   The blood glucose level should be recorded in the logbook or checksheet for further data interpretation.

2.6.4 Self Monitoring Blood Glucose Frequencies

Non-insulin-treated type 2 diabetes patient did not need to draw the blood glucose level every day, after wake up, also before and after taking meals regularly. International Diabetes Federation gave several recommendations of SMBG schedule or called SMBG regimens. The chosen of regimens profile should be done by a physician to determine the most suitable regimens based on the patient's condition. The IDF recommendation of SMBG regimens shown in the tables below:

Intensive or focused SMBG protocols as shown in Table 2.3 until Table 2.5 use pattern analysis, a systematic approach to creating glucose profiles that can identify daily glycemic patterns and then take appropriate action based upon those results. These profiles can be generated by performing 5 to 7 measurements per day over 1 to 3 days, or through staggered testing, in which the individual performs pre- and postprandial testing for alternating meals over the course of a week.

Table 2.3 5 Point Profile of focused SMBG Regimens

	Pre-Breakfast	Post-Breakfast	Pre-Lunch	Post-Lunch	Pre-Supper	Post-Supper	Bedtime
Monday							
Tuesday							
Wednesday	x	x		x	x	x	
Thursday	x	x		x	x	x	
Friday	x	x		x	x	x	
Saturday							
Sunday							

Source: IDF, 2009

Table 2.4 7 Point Profile of focused SMBG Regimens

	Pre-Breakfast	Post-Breakfast	Pre-Lunch	Post-Lunch	Pre-Supper	Post-Supper	Bedtime
Monday							
Tuesday	x	x	x	x	x	x	x
Wednesday	x	x	x	x	x	x	x
Thursday	x	x	x	x	x	x	x
Friday							
Saturday							
Sunday							

Source: IDF, 2009

Table 2.5 Staggered Profile of focused SMBG Regimens

	Pre-Breakfast	Post-Breakfast	Pre-Lunch	Post-Lunch	Pre-Supper	Post-Supper	Bedtime
Monday	x	x					
Tuesday			x	x			
Wednesday					x	x	
Thursday	x	x					
Friday			x	x			
Saturday					x	x	
Sunday	x	x					

Source: IDF, 2009

Meal-Based SMBG (before and after selected meals) as shown in Table 2.6 that helps individuals with diabetes understand the effects of their treatment on blood glucose concentration and assists clinicians in identifying postprandial hyperglycemia, guides therapeutic adjustment and provides more timely feedback regarding medication changes.

Table 2.6 Meal-Based Testing of Low-Intensity SMBG Regimens

	Pre-Breakfast	Post-Breakfast	Pre-Lunch	Post-Lunch	Pre-Supper	Post-Supper	Bedtime
Monday	x	x					
Tuesday							
Wednesday			x	x			
Thursday							
Friday							
Saturday					x	x	
Sunday							

Source: IDF, 2009

Bedtime and morning fasting SMBG regimen shown in Table 2.7 can be used to identify fasting and assess fasting hyperglycemia. Fasting hyperglycemia is a condition when the body did not receive any food for at least eight hours

Table 2.7 Detection / Assessment of Fasting Hyperglycemia SMBG Regimens

	Pre-Breakfast	Post-Breakfast	Pre-Lunch	Post-Lunch	Pre-Supper	Post-Supper	Bedtime
Monday							x
Tuesday	x						
Wednesday							x
Thursday	x						
Friday							x
Saturday	x						
Sunday							

Source: IDF, 2009

. Table 2.8 shows detection of asymptomatic hyperglycemia SMBG regimen. asymptomatic hyperglycemia is patient's possibility to have hyperglycemia. The blood glucose test is done on pre-lunch and pre-supper.

Table 2.8 Detection of Asymptomatic Hyperglycemia SMBG Regimens

	Pre-Breakfast	Post-Breakfast	Pre-Lunch	Post-Lunch	Pre-Supper	Post-Supper	Bedtime
Monday			x		x		
Tuesday							
Wednesday			x		x		
Thursday							
Friday			x		x		
Saturday							
Sunday							

Source: IDF, 2009

2.7 Glycemic Index (GI)

The glycemic index (GI) is a ranking of carbohydrates on a scale from 0 to 100 according to the extent to which they raise blood sugar levels after eating. Foods with high GI are those which are rapidly digested and absorbed and result in marked fluctuations in blood sugar levels. Low-GI foods, by virtue of their slow digestion and absorption, produce gradual rises in blood sugar and insulin levels and have proven benefits for health. Low GI diets have been shown to improve both glucose and lipid levels in people with diabetes (type 1 and type 2). They have benefits for weight control because they help control appetite and delay hunger. Low GI diets also reduce insulin levels and insulin resistance (Brand-Miller, 2006). The range of Glycemic Index (GI) shown in Table 2.9 below:

Table 2.9 Ranking of Glycemic Index (GI)

Ranking	GI Range
Low	0-55
Moderate	56-69
High	70 or more

Source: Brand-Miller, 2006

2.8 Blood Glucose Meter

Blood glucose meter (glucose meter) is a device that is used to check the glucose level in the bloodstream. Food is not the only factor that affects the glucose level, but other factors such as exercise, food, medication, stress and others also have an effect. By using a glucose meter, tracking the sugar level fluctuations can be done easily (Mayoclinic.org, 2016). Common glucose meter that is used in Indonesia is blood glucose testing with meter using test strips.

The procedures of using blood glucose meter according to WikiHow (2016) shown on Figure 2.5. The first thing that should be done is to test the glucometer before using it to make sure the device are reading correctly. The factory usually already including a test strip or a liquid. The second step is to wash the hands thoroughly, including the area where the blood will be drawn. Then, place alcohol on a cotton ball Third, place a test strip into the slot provided on the glucometer. The next is swab the area to draw the sample with the cotton ball. Use the lancet provided with the diabetic glucose meter and prick the area for the sample. The last is place a drop of blood on the test strip, then wait for the result. Every model has a different time to show the result. Newer glucometer will show the result faster.

Figure 2.5 Glucometer Usage Procedure (WikiHow, 2016)

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CHAPTER III
RESEARCH METHODOLOGY

This chapter describes the sequence that will be done to achieve the desired goal. The sequence described in a research framework, shown in Figure 3.1 below:

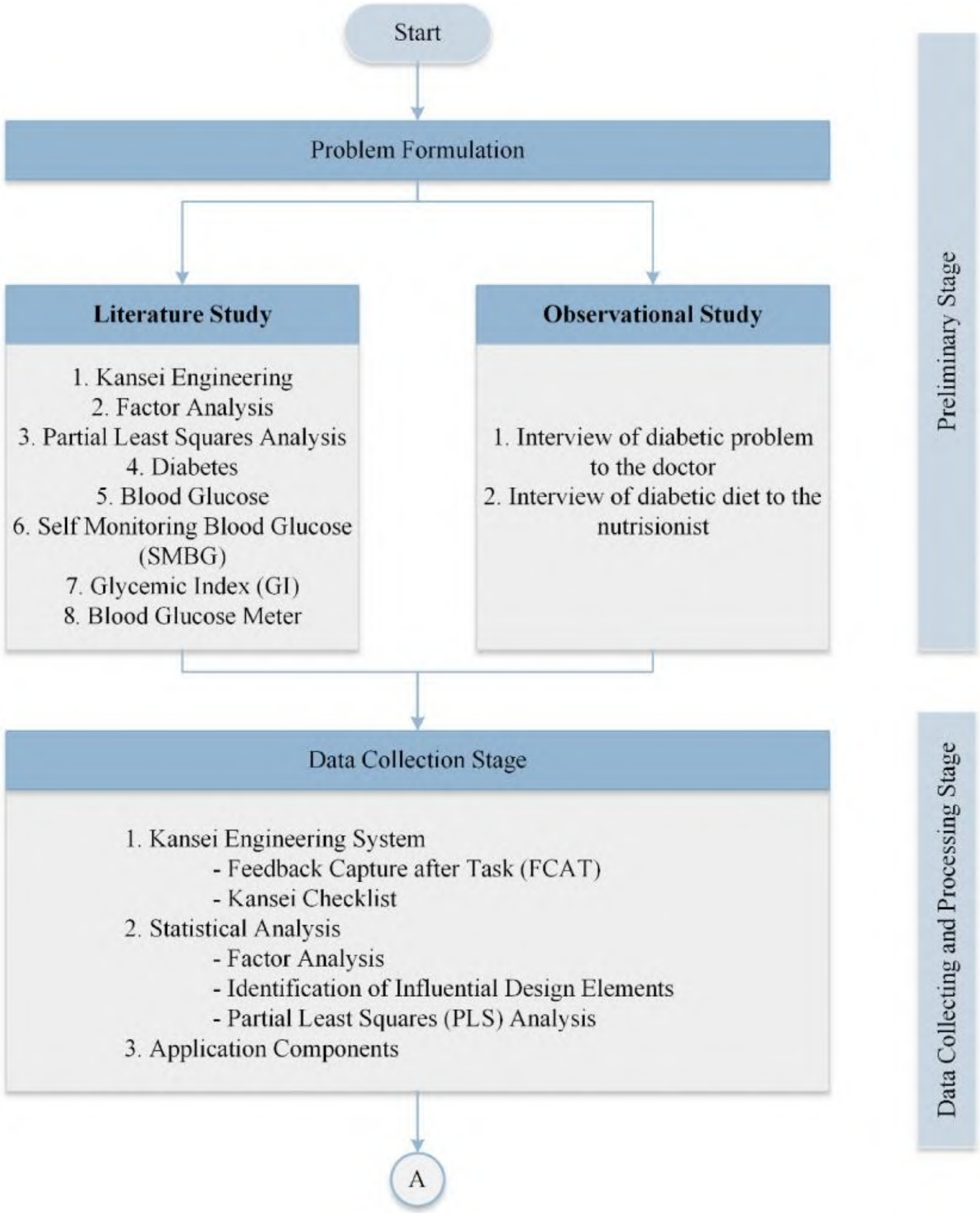


Figure 3.1 Research Methodology

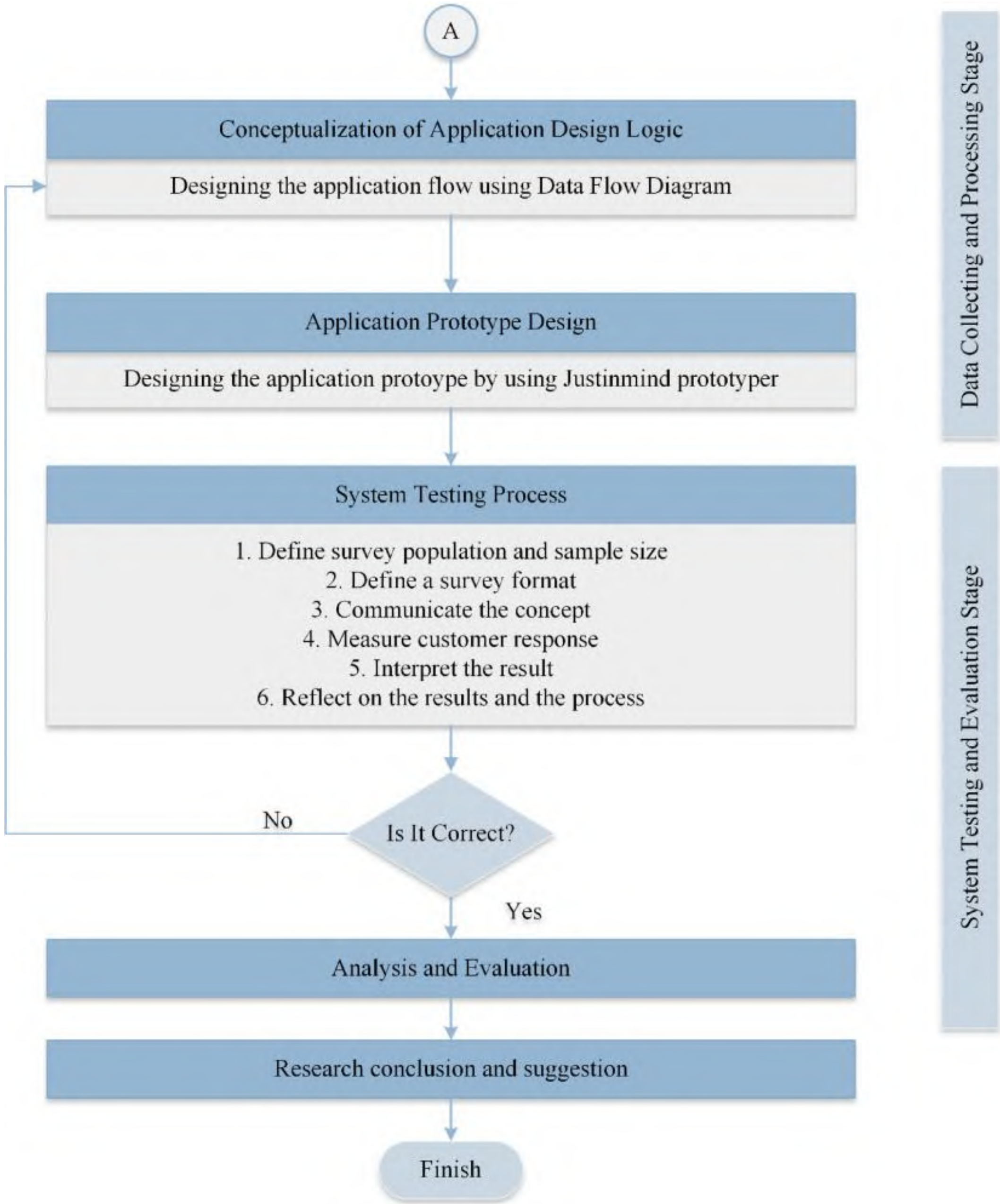


Figure 3.1 Research Methodology (cont')

Based on figure 3.1 that shows the research methodology, there are three main stages to complete this research. Those stages are (1) preliminary stage (2) data collecting and data processing stage (3) system testing and evaluation stage. Description of each stage will be shown on the sub chapter below.

3.1 Preliminary Stage

The preliminary stage begins with Identifying the problem that is found from a direct and indirect observation about type 2 diabetes condition in Indonesia, about lifestyle and blood glucose control. Then, the problem is formulated and followed by determining the research objectives and research scope that consists assumption and boundaries.

3.2 Data Collecting and Processing Stage

Data collecting and processing stage consists of data gathering and calculation process, including food recommendation, Kansei Engineering System, design logic, and application prototype design.

3.2.1 Kansei Engineering System

Besides Kansei Engineering, there are several methods that has been developed to support the product development. The other methods are Quality Funtion Deployment (QFD), Conjoint Analysis, and Voice of Customer (VOC). Although all of the methods described before are having the same goal, that is to develop product that satisfy consumer‟s needs and desire, KE has one significant difference. VoC, QFD and Conjoint Analysis focus on the explicit consumer's needs and develop design requirements that match these needs. On the other hand, KE is a method specifically used to analyze consumer's implicit needs and associate them with product design characteristic, so that a guide to design a new concept of product could be established.

There are 6 steps to do Kansei Engineering, collect the Kansei words using Feedback Capture after Task (FCAT) method, setting the 5 point Semantic Differential (SD) scale, gathering customer's kansei in the evaluation experiment process the data using Factor Analysis, determining the item / category of design alternative, interpreting the result from the viewpoint of Kansei Engineering to find the relationship between human Kansei and product property using Partial Least Squares (PLS) Analysis, and the last is gather the application components (Nagamichi and Tachikawa, 2015).

At the first step, in order to gather the kansei words and Kansei checklist arrangement, Feedback Capture After Task (FCAT) were done. The Feedback Capture after Task process shown on the following Figure 3.2

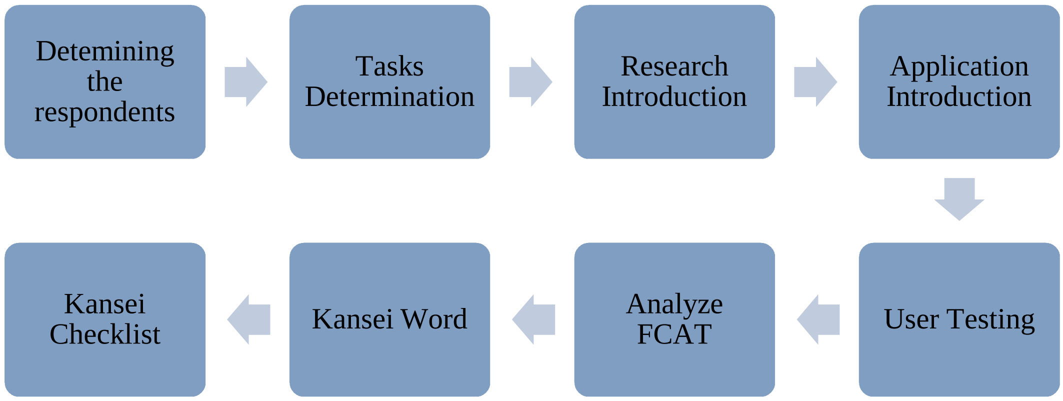


Figure 3.2 Kansei Words and Checklist Development

The first step is determining the respondent. In the FCAT, five users were chosen from among the targetted type 2 diabetes patient in RSU Haji Surabaya. According to Sauro (2010) performing a usability testing five users are enough to discover between 85% - 90% of the usability problems. After that, several tasks that may reflects on the application function were formulated. Then, the research aims and what should be done by the users are explained. The next step is explaining about the sample application. The explanation is covering several aspects, such as the apps functions and features that can be accessed from the home screen. During the FCAT, the difficulties to perform the given task were asked. It can be the input for the result. After performing the test, Feedback Capture After Task (FCAT) results are compiled and summarized. Words that may reflects the user's requirements were selected. These word called as kansei words. Then, kansei checklist which consists semantic differential (SD) will be formulated.

3.2.2 Statistical Analysis

Following points will describe each statistical analysis that is done in this research, that are including Factor Analysis and Partial Least Squares (PLS) Analysis.

1. Factor Analysis

After the Kansei Checklist already recaped, the next step is analyzing the data using Factor Analysis. Compared to the other techniques such as variance analysis or multiple regression, factor analysis has the advantage that all the involved variables play the same role. This analysis method is a statistical data reduction technique employed to explain variability among observed random variables, in terms of fewer unobserved random variables named factors. This reduction is possible because the attributes are related. Applying a factor analysis to the collected responses on a given questionnaire, it is possible to group responses with common meaning, reducing the number of required indicators to explain all the responses. The rating given to any one attribute is partially the result of the influence of other attributes. The observed variables are modeled as linear combinations of the factors. Its proper application implies the interrelation analysis between variables (using statistical covariance and correlations) to determine a new smaller set of variables than the original set (Mamaghani et al, 2014).

FA assumes that all the rating data on different attributes can be reduced down to a few important dimensions. This reduction is possible because the rating given to any one attribute is partially the result of the influence of other attributes. FA is commonly used to find psychological structure of Kansei that constitute the essential concept of Kansei of the domain under investigation. The result could be used to strategize new concept of Kansei product that represent consumer‟s Kansei determinants in a domain. The tool that is used to perform Factor Analysis is SPSS 22. The sequence of Factor Analysis process stated as follow:

1. Input the data → select “Analyze” on the menu bar → choose “Data Reduction” → click on “Factor

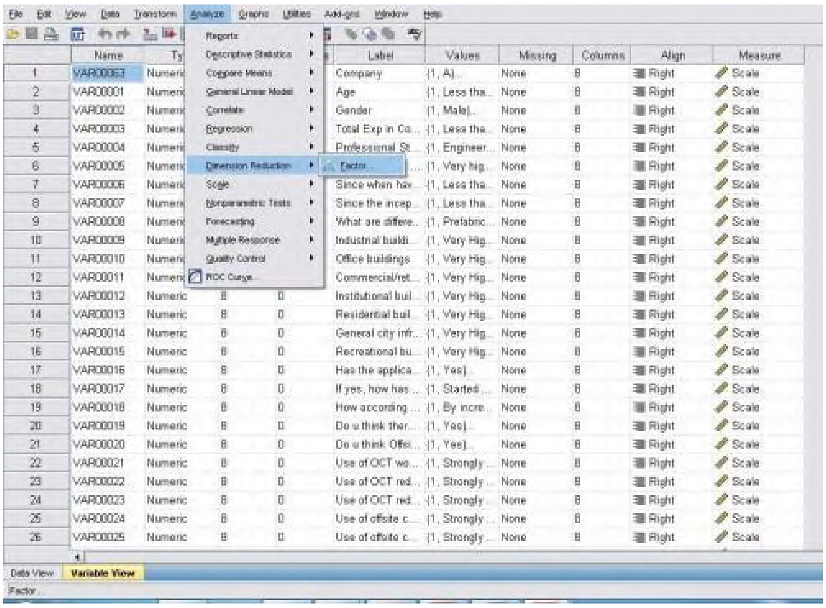


Figure 3.3 Factor Analysis in SPSS, Step 1 (Chetty and Datt, 2015)

2. Click on the “Descriptives” button → Check on the “Univariate descriptives”, “Coefficients”, “Determinant”, “KMO and Barlett’s test of sphericity”, and “Reproduced” → Click on “Continue”

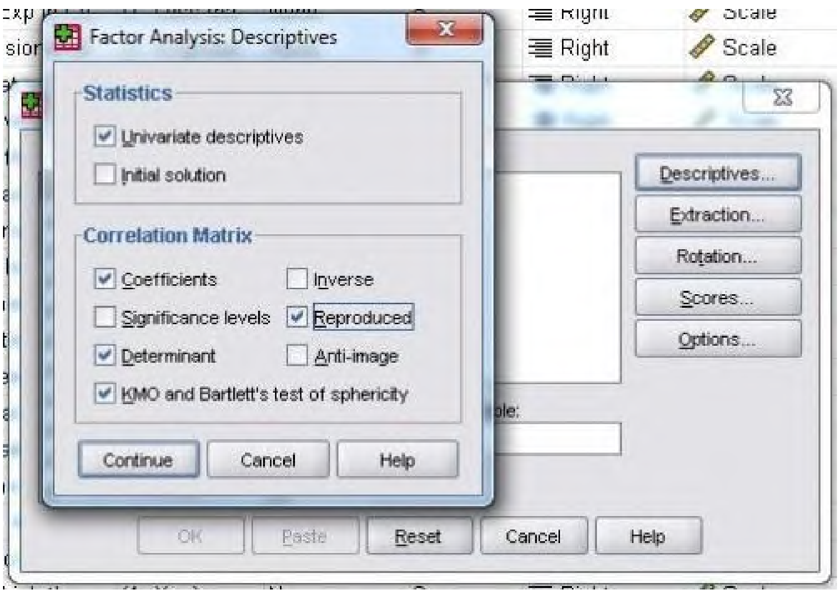


Figure 3.4 Factor Analysis in SPSS, Step 2 (Chetty and Datt, 2015)

3. From the Factor Analysis dialogue box, click on the "Extraction" button → on the dialogue box, check "Scree Plot" and untick the "Unrotated Factor Solution" option → Click on "Continue".

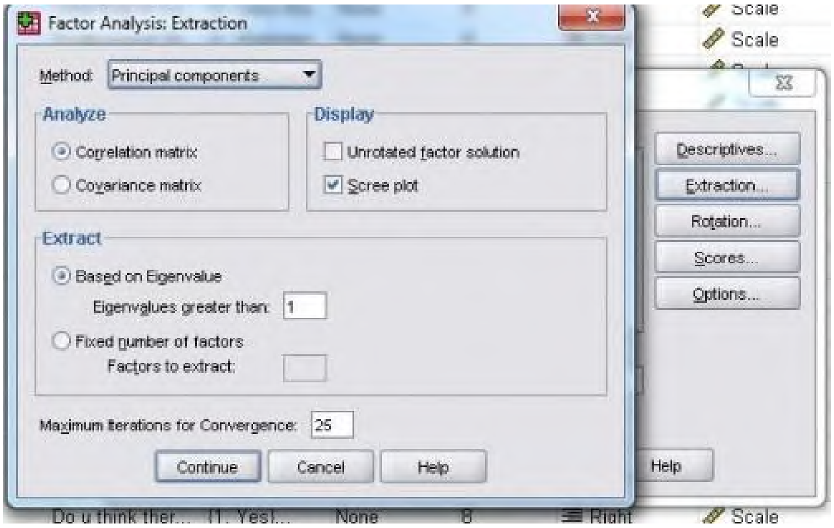


Figure 3.5 Factor Analysis in SPSS, Step 3 (Chetty and Datt, 2015)

4. From the Factor Analysis dialogue box, click "Rotation" → Click on the "Varimax" button → Click on "Continue"

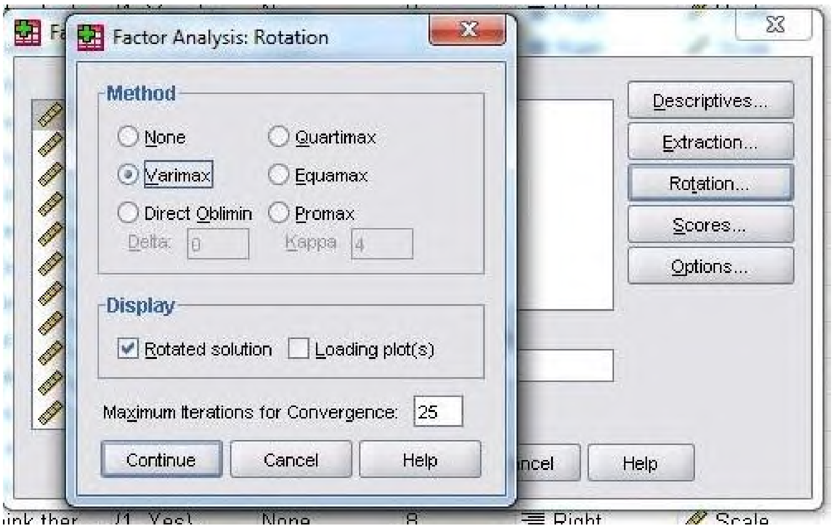


Figure 3.6 Factor Analysis in SPSS, Step 4 (Chetty and Datt, 2015)

5. From the Factor Analysis dialogue box click “options” → click on the check box “Suppress absolute values less than” → type 0.50 in the textbox → click “continue” → Click on “OK” to run the procedure.

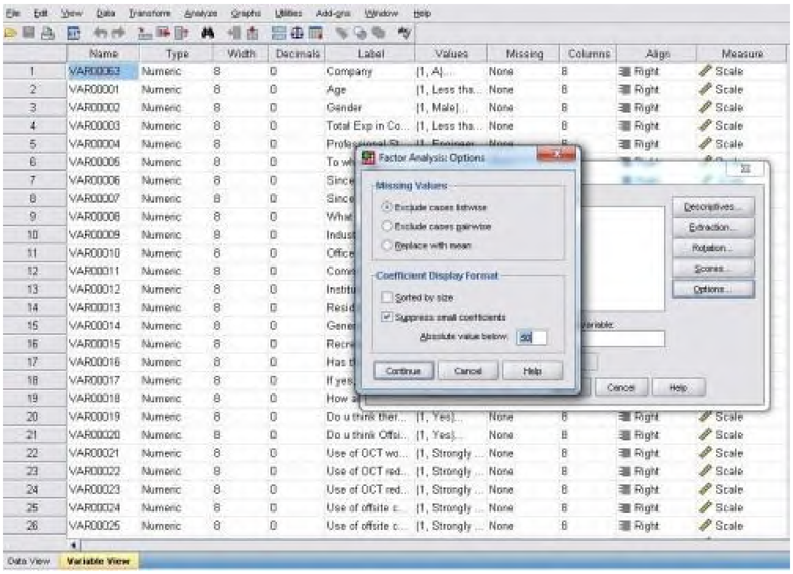


Figure 3.7 Factor Analysis in SPSS, Step 5 (Chetty and Datt, 2015)

2. Identification of Influential of Design Elementse

In This phase is the process of determining important design elements such as feature, color, and interface of the application. The process performed by using qualitative method. The procedure begins with collection of specimens of several diabetes management applications that are having visible differences in design. Observation is performed to investigate design elements in all specimens from the designer’s viewpoint.

3. Partial Least Squares Analysis

In Kansei Engineering, Partial Least Square (PLS) Analysis is used to identify the influential design elements. PLS is done using the data from kansei words checklist and the influential of design elements (Chuan et al., 2013). In Kansei Engineering, there are two methods to find the relation between kansei checklist with influential design elements which are Quantification Theory Type I and Partial Least Squares (PLS) Analysis. Regarding the research done by Tatsuro and Yukihiro (2009), analyzed result with PLS reflects smaller deviations (noise) by sample because of near perfect fit. Thus, in this research, PLS is selected to find the relations between Kansei word evaluation and design elements. Software that is used to perform PLS is Excel XLSTAT 2016

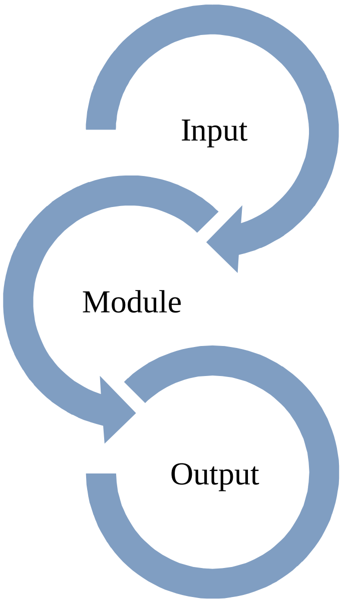
3.2.3 Application Components

After application design specifications was obtained, then, application components are gathered. The application components are including the data that will be used as the database. In this research, database needed are the regimens and Glycemic Index (GI)

3.2.4 Data Flow Diagram (DFD)

The flow of application logic needs to be arranged to develop a good application usability. Designing the application logic can be done using Data Flow Diagram (DFD). DFD show the flow of data from external entities into the system, showed how the data moved from one process to another, as well as its logical storage. It is a tool used by the engineers to transfer the flow of a software before handed it to the designer.

In general, as the initial design, there need to be determined the design architecture of the system. It consists of the basic concept of the proposed application. The design architecture of the system can be seen in following Figure 3.8:



- User's profile
- Type of SMBG regimen
- Blood Glucose Level
- Indonesian Food Glycemic IndexDoctor's contact

- Determination of SMBG regimen
- Determinaton of blood glucose severity level
- Dietary menu module

- Blood glucose testing warning
- Display of daily blood glucose level
- Critical Blood glucose warning
- Display of menu suggestion
- Display of monthly blood glucose level graph

Figure 3.8 Design Architecture

Figure 3.8 shows the software design architecture for the application. The required input consists of a type of recommended SMBG regimen, blood glucose level performed based on SMBG regimen, Indonesian food Glycemic Index (GI) for food recommendation and the last is doctor’s contact to send the monthly blood glucose report.

In the application, there is three basic modules. The first is SMBG regimen determination. At the first usage, the patient required to choose the type of SMBG regimen based on the doctor’s recommendation. Then, the system will remind the patient to perform self-monitoring based on the SMBG regimen’s schedule. After the patient input the blood glucose level, the system will generate the blood glucose range, and give food recommendation.

Patient able to see their daily blood glucose level and monthly blood glucose level. For the monthly report, both of patient, doctor, and nutritionist able to see the report that will be used as the base of the following treatment.

3.2.5 Application Prototype Design Stage

After needed database are already gathered and Data Flow Diagram are built, the next step is to build application prototype Application prototype design consists of application flow development and user interface. In this research, prototype is designed by using Justinmind prototyper. This software able to be used to design the interface of mobile and web software, along with several simple equations that will makes the prototype reflects the desired application. To design using this prototyper, the designer should make an account in www.justinmind.com, and downloading PC software. After designing the interface, simulation can be perform to see how the application will interact. To see the application in the smartphone, the designer should downloading Justinmind viewer apps in Google Play. Once the design in PC is saved, the prototype will be uploaded automatically and can be seen from the mobile device. The interface of Justinmind Prototyper can be seen on the Figure 3.9

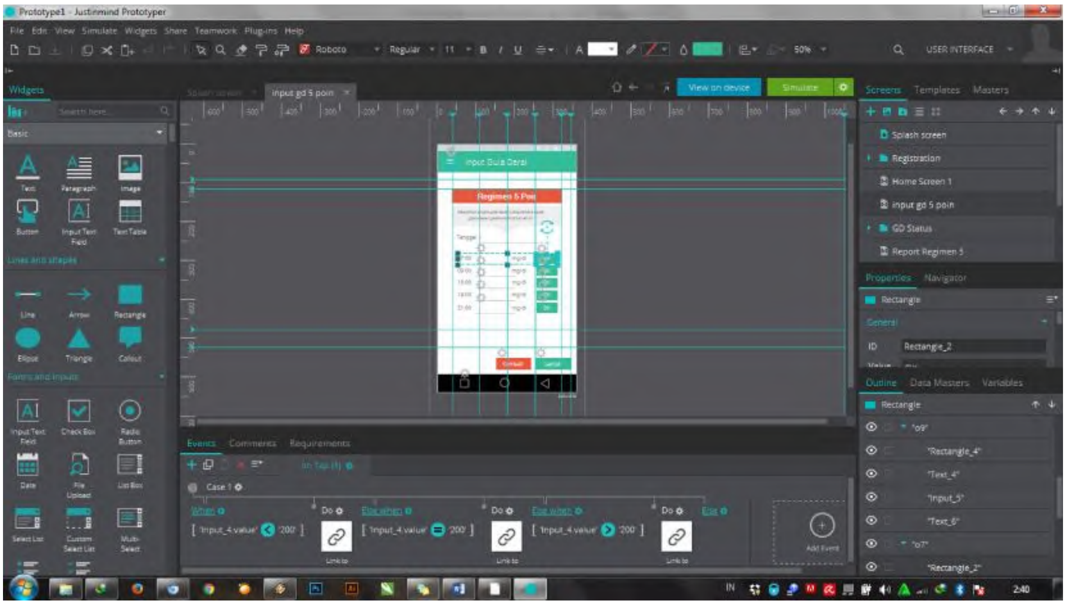


Figure 3.9 Justinmind Prototyper Interface

3.3 System Testing

In this stage, the application is analyzed to identified whether the application is able to run well, through product testing. There are six steps of product testing, which are:

1. Choose a survey population and sample size
2. Choose a survey format
3. Communicate the concept
4. Measure customer response

5. Interpret the result
6. Reflect on the results and the process

The testing process is done by using Nielsen’s Ten Heuristic method by giving the user questionnaire that consists of four strategic kansei words along with semantic differential scale. After the user given the explanation regarding the application, they try to use the application and fill the questionnaire.

The evaluation also will show the advantages and disadvantages of the application, including the blood glucose record accuracy, and the food amount suggestion accuracy.

An application that already analyzed and evaluated will give a conclusion regarding interoperability, before and after application usage. At last, recommendation for further research will be given.

CHAPTER IV
DATA COLLECTION AND PROCESSING

This chapter contains about data collection of the data that will be used in this final project. It also shows the calculation based on the data collected.

4.1 Kansei Engineering System

In this stage, the user requirements are gathered to capture the needs of the customers to design the application. In Kansei Engineering, kansei words become the basis of the customer requirement. Later, the kansei words will be used to determine the product attributes of the product designed.

4.1.1 Feedback Capture After Task (FCAT)

In a software design, the usability of a software is critical. Usability testing is important to know how people interact with the application and the perception towards the application. Nowadays, there are a lot of software or applications that have a really good function, but it cannot cope the usability of the users. Therefore, the application needs to be designed based on the customer's behavior to know their response to the application. One of the methods is through Kansei words. Kansei words are words expressed by the user towards a design when their senses are triggered. In this situation, the psychological cognition that involves perception, judgment and memory will become apparent to a person. Thus, it is important to know how will Kansei effect people's perception of a mobile Self-Monitoring of Blood Glucose application.

Kansei words gathering begin by using Feedback Capture After Task (FCAT). It is a method to capture the user's thought and feeling after trying a similar product and performing given tasks (Goh et al., 2013). In this research, a similar diabetes application called BeatO proposed to the 5 prospected customers, which are type 2 diabetes patients that are less than 50 years old and more than 20 years old. Type 2 diabetes was choosen beside that the SMBG is intended for type 2 diabetes, it is also because of the high and rapid growth of type 2 diabetes population. The minimun 50 years old of age is determined because majorly, the smartphone users in Indonesia are below 50. The ability to operate the smartpone in this range of age is considered as still capable. The respondents of this research was taken in RSU Haji Surabaya.

BeatO application is chosen because Android users gave 4.5 of 5 rating on this apps. Besides, BeatO Diabetes Management has quite functions, such as food suggestion, blood glucose log, and etc.

Figure 4.1 BeatO Home Screen Interface (Beatoapp.com, 2016)

In the Feedback Capture After Task (FCAT) method, the prospected users should complete five tasks as shown in Table 4.1. The task required the users to do several activities using BeatO application. The five users are hoped to be able to express their Kansei in words for the future experience they would like to encounter from a diabetes application. The entire tests of all five users were observed and noted, both verbal and non-verbal expression. Task given to the users are consists of the basic functions of the application, which are as the blood glucose recorder, food proposer, critical blood glucose warning, and sending the report to the physician. Thus, the task arranged for FCAT are made based on those four functions. Task description of FCAT described in Table 4.1. Besides the four basic functions, the task should cover several operational procedures of the application, such as creating new account and edit the profile. This function represented on task 1 and task 4. For the other function which is blood glucose recorder, the related task is inputting the blood glucose level. It is stated on task 2. The second function which is food recommendation is represented in the third task that is checking the food status in BeatO application, whether it is permittable or not. Third function is critical blood glucose warning. Based on this function, the user should be able to check and read the graph shown in the application. Thus, it is used as the task 5. The last function which is reporting the blood glucose to the physician, it has no correlation with the user. If there, it will be related with the edit the physician's information in the profile, which is already covered in task 4.

Table 4.1 Task Description

Tasks	Description
1	You are a new user to this application. Create a new account on this application.
2	Input your current blood glucose.
3	You will eat fried egg this afternoon. Find the fried egg's indicator to know whether it is permittable or not.
4	You have gain weight recently. Edit your weight in your profile.
5	Read your blood glucose report.

After the aim of the research and what should be done by the users are explained, the next step is explaining about the BeatO application. The explanation is covering several aspects of BeatO application, such as the apps functions and features that can be accessed from the home screen. During the FCAT, the difficulties to perform the given task were asked. It can be the input for the result. After performing the test, Feedback Capture After Task (FCAT) results are compiled and summarized in Table 4.2 until Table 4.6.

Table 4.2 below consists of the response of task, "You are a new user to this application. Create a new account on this application".

Table 4.2 Users Response of Task 1

User	Task 1
1	Too many personal information required.
2	The design of the login form is good.
3	It is better if the application uses Bahasa
4	OK
5	Hard to follow the registration flow

Table 4.3 shown below describe the output of FCAT for the task, “Input your current blood glucose.”

Table 4.3 Users Response of Task 2

User	Task 2
1	Hard to find the icon to check the blood glucose.
2	Too many information in one page. It makes the interface look crowded.
3	Feature scrolling the blood glucose level is quite confusing. It is hard to input specified number by scrolling the number,
4	A reminder to check blood glucose may help.
5	It is better if the application provides a schedule to check.

Table 4.4 shown below describe the output of FCAT for the task, “You will eat fried egg this afternoon. Find the fried egg’s indicator to know whether it is permittable or not.”

Table 4.4 Users Response of Task 3

User	Task 3
1	Easy to find the button.
2	Hard to know the meal portion, because the measurement for each food is different.
3	Useful information.
4	OK
5	OK

Table 4.5 below consists of the response of FCAT for task number 4 which is “You have gain weight recently. Edit your weight in your profile.”

Table 4.5 Users Response of Task 4

User	Task 4
1	Profile button should be placed on the upper part of the page.
2	Hard to find the profile icon.
3	Consider to rearrange the icon placement.
4	OK
5	Editing procedure is not clear enough.

Table 4.6 below consists of the response of FCAT for task number 5 which is "Read your blood glucose report." The answer to six users shown as follows:

Table 4.6 Users Response of Task 5

User	Task 5
1	Useful information.
2	Bigger font.
3	OK
4	Differentiate between the report of each blood glucose testing type.
5	OK

4.1.2 Kansei Checklist

From the interview by using Feedback Capture after Task (FCAT) method, the user's feedbacks was gathered. In this subchapter, the user's response are used as the input for the Kansei Words and will be used to construct the application's attribute. The output of the FCAT were selected and found the related word. Each kansei word can represent more than one FCAT output, and vice versa. For the example from the task 1, user 1 answer that too many information required on the sign up process. While for the task 2, the response is too many information in one page. From this answer, can be inferred that the user want a simple process and screen interface. Then, word simple can be included into the Kansei list. This proces is repeated until considered that there is no word can be extracted. Table 4.7 below shows the kansei words extracted from the FCAT result.

Table 4.7 Kansei Words List

No	Kansei Words
1	Interesting
2	Simple
3	Easy
4	Clear
5	New
6	Unique
7	User Friendly
8	Trustworthy
9	Consistent
10	Accurate
11	Detail
12	Systematic
13	Cheap
14	Innovative
15	Flexible
16	Formal
17	Neat
18	Specific
19	Modern
20	Good design
21	Plain
22	Practical

During Feedback Capture after Task, the user feedbacks were obtained in order to know the user's perceptions and what are they really wanted and needed from the application. Then, this feedback will be used as the input for Kansei Words. Basically, Kansei Words are divided into four concept categories, which are aesthetic, physical, sensational and operational (Goh et al., 2013). According to Nagamichi and Tachikawa (2015), the number of kansei words related to the new product concept are 20-30 kansei words. Later, these Kansei Words will be combined with semantic differential (SD) scale. Kansei words on the SD scale consists of couple of two opposite words such as "good-bad". It is called as alternating. According to Sauro and Lewis (2011), the major reasons for alternating the kansei words are for reducing acquiescent bias when users generally go on agree to all statements accidently. In a 5-point scale these would be all 4's and 5's. Besides, it is also to reducing extreme response bias where the users basically pick it is a situation that could be especially problematic for remote usability testing. For example, when items alternate, responses of all 1's make no sense. When items do not alternate, responses of all 1's could represent a legitimate set of responses.

In Kansei Engineering, the antonym of the word usually stated as "good-not good" or "attractive-not attractive". Kansei words do not have to be adjectives. Phrases like "easy to open the cover" and "want to use daily" are permittable, but in most cases, consumers understand best if the words are expressed as adjectives (Nagamachi and Lokman, 2011). The researchers agreed that the level of SD that can be used are 5, 7, 9, or 11 points SD scale (Hadiana, 2015). But according to Nagamichi and Tachikawa (2015), basically, 5-point SD scale is better than 7-point SD scale or others because the more rating levels will increase subject confusion.

Regarding criteria explained before, the kansei checklist constructed as shown in Table 4.8:

Table 4.8 Kansei Checklist

No	Kansei Words	Semantic Differential (SD)					Kansei Words
		5	4	3	2	1	
1	Interesting						Uninteresting
2	Simple						Not Simple
3	Easy						Not Easy
4	Clear						Unclear
5	New						Not New
6	Unique						Not Unique
7	User Friendly						Not User-Friendly
8	Trustworthy						Not trustworthy
9	Consistent						Inconsistent
10	Accurate						Not Accurate
11	Detail						Not detail
12	Systematic						Not Systematic
13	Cheap						Not Cheap
14	Innovative						Not Innovative
15	Flexible						Inflexible
16	Formal						Informal
17	Neat						Not Neat
18	Specific						Unspecific
19	Modern						Not Modern
20	Good Design						Not Good Design
21	Plain						Not Plain
22	Practical						Impractical

After the kansei checklist has been made, the complete questionnaire will be arranged. The questionnaire is including the introduction, and the objective of the research. Kansei questionnaire can be seen at Appendix 1.

Data collection was done by distributing kansei checklist questionnaires to several numbers of prospected users. The number of respondents is calculated by using linear time function as follows:

$$n = \frac{T - t_0}{t_i} \tag{4.1}$$

With:

n = Number of respondents

T = Time available for research (survey time is 1 month, 4 effective days per week, 4 weeks x 3 days = 12 days)

= 5 hours / day x 12 days = 60 hours

t_0 = Sampling time = 3 hours/day x 12 days = 36 hours

t_i = The amount of time respondents to fill questionnaires = 24 minutes = 0.4 hours

$$n = \frac{T - t_0}{t_i} = \frac{60 - 36}{0.4} = \frac{24}{0.4} = 60\ samples$$

Based on the calculation above, the number of samples needed in this study are 60 respondents. Same as the Feedback Capture after Task (FCAT) respondent, this survey was conducted among diabetes type 2 population that are able to use smartphone, and less than 60 years old. The questionnaire distribution was carried out in Surabaya, focusing on the RSU Haji Surabaya. But, it does not rule out the possibility that the respondents are came out from the hospital.

4.1.3 Respondent Demography

Respondent demography on this research explains through gender and age. Table 4.9 below will give a description about the distribution of respondent demography of this research. The respondents are type 2 diabetes that live in Surabaya.

Table 4.9 Respondent Demography Description

Demography	Frequency	Percentage (%)
Gender		
Male	28	47,0
Female	32	53,0
Total	60	100,0
Age		
30 – 39	14	23,3
40 – 49	27	45,0
50 – 59	19	31,7
Total	60	100,0

Table 4.9 shows that the distribution of male:female respondents are balanced. Male respondents in this research are 28, while the female respondents are 32. It makes the comparisons between male and female respondent 7:8. Here can be concluded that the respondent on this research fulfill the response disparity control requirements which state that the number of the male and female respondent should be or close to balance.

Regarding the respondent's age, Table 4.9 stated that the respondent of this research majority came from 40 until 49 years old. Respondents with age between 30 and 39 and lower are few in number because this range of age usually got Type 1 Diabetes.

4.1.4 Kansei Checklist Questionnaire Recapitulation

The kansei checklist questionnaire was given to 60 respondents of type 2 diabetes people in Surabaya, with ages more than 60 years old. After the respondents filling the questionnaire by chosing one of 5 Semantic Differential (SD) scale, the result are being recapped. Later, it will be used as the input of the following process which is Factor Analysis. The recapitulation of the 60 kansei checklist questionnaires shown on Table 4.10:

Table 4.10 Kansei Checklist Questionnaire Recapitulation

Respondent	**Kansei**																					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
1	3	4	5	5	3	4	4	4	3	4	3	4	4	2	3	3	4	2	4	4	4	4
2	3	4	3	5	4	3	5	4	3	4	4	4	5	2	3	3	5	3	5	5	5	4
3	4	4	4	4	4	4	4	4	3	4	4	4	5	2	3	3	4	4	3	3	5	4
4	4	4	5	4	4	3	4	3	3	4	4	4	5	4	3	2	4	4	4	5	4	4
5	3	4	3	4	3	4	3	3	3	4	4	4	4	4	3	2	4	2	4	3	3	5
6	3	5	4	5	3	4	5	3	3	4	4	4	5	2	2	2	3	4	3	4	5	4
7	3	4	3	5	2	2	4	3	4	4	3	4	5	4	2	2	4	2	4	5	4	5
8	5	4	5	5	3	3	5	3	3	4	4	3	5	4	2	2	5	4	3	5	3	3
9	4	4	5	4	2	3	5	4	4	5	4	4	5	2	2	2	5	3	4	3	5	5
10	4	5	5	4	3	2	3	3	3	4	3	3	4	4	3	2	4	2	5	3	4	5
11	3	4	5	4	3	3	3	4	4	5	4	4	5	4	2	3	3	2	5	4	3	4
12	5	4	3	5	4	2	4	3	3	5	3	4	4	4	2	2	5	2	5	4	3	3
13	5	5	5	4	3	2	5	3	3	5	3	3	5	2	2	3	5	3	4	3	4	4
14	4	5	3	4	3	2	3	3	3	5	5	4	5	4	3	2	4	3	5	5	5	4
15	5	4	4	5	3	2	3	4	4	4	3	4	4	4	3	3	3	3	4	5	3	5
16	4	4	4	5	2	4	4	4	3	4	3	4	4	2	2	3	4	4	4	4	5	3
17	5	4	5	4	2	4	3	3	3	4	5	4	4	3	3	2	4	4	4	5	3	3
18	3	5	4	4	2	2	5	4	4	5	3	3	5	2	2	3	3	2	5	5	5	5
19	5	4	3	5	3	4	3	4	4	4	5	4	4	4	2	2	4	4	4	4	4	4
20	4	5	3	5	4	2	4	4	4	5	3	3	4	4	3	3	3	4	4	4	4	3
21	4	4	4	5	3	3	5	4	3	5	4	3	5	4	2	3	4	4	5	5	4	5
22	4	4	3	4	2	4	5	4	4	5	4	4	5	3	3	3	5	2	4	4	5	3

Table 4.10 Kansei Checklist Questionnaire Recapitulation (con't)

Respondents	Kansei																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	5	4	4	4	2	4	4	4	4	5	3	3	5	4	3	2	3	3	3	4	3	5
24	5	4	4	5	2	3	4	3	4	4	5	4	4	3	2	2	4	2	4	3	5	4
25	5	5	5	4	4	2	5	4	4	4	4	4	4	2	3	2	3	2	3	4	3	3
26	4	4	5	5	2	3	5	3	4	4	4	3	5	4	3	2	5	2	3	4	5	4
27	4	4	5	4	4	4	3	4	4	5	4	4	5	4	3	2	4	4	4	5	4	4
28	5	5	5	5	3	4	5	4	4	5	4	4	5	3	2	2	3	3	5	5	3	4
29	3	5	3	4	4	4	4	3	3	4	5	5	5	4	3	2	4	2	3	4	3	4
30	4	4	5	4	4	3	4	4	3	5	4	4	5	4	3	3	4	4	3	4	5	5
31	5	4	3	5	2	3	4	3	3	4	5	4	5	4	3	2	5	3	5	3	3	3
32	4	4	4	4	4	3	4	3	4	4	4	3	5	2	3	2	3	4	5	5	4	3
33	5	4	3	5	4	2	3	3	3	5	5	4	4	2	3	2	3	3	4	5	5	3
34	5	4	5	5	3	4	4	4	4	5	3	4	4	2	3	3	4	4	4	4	5	4
35	4	4	5	4	4	4	3	4	4	5	4	4	5	4	3	2	4	4	4	5	4	4
36	3	4	4	4	4	3	4	4	4	4	4	4	4	2	3	2	3	2	3	5	3	5
37	4	4	3	4	3	3	4	4	4	4	4	3	5	4	3	2	5	4	3	4	5	4
38	4	4	3	4	3	3	4	4	4	4	4	3	5	4	3	2	5	4	4	5	5	4
39	4	5	4	5	3	4	5	3	3	4	3	4	4	4	2	3	5	2	5	3	3	5
40	5	4	3	5	2	3	4	3	3	4	5	4	5	4	3	2	5	3	5	4	3	3
41	3	5	3	4	4	4	3	3	3	4	5	4	5	4	3	2	4	2	3	4	3	4
42	4	4	3	4	4	4	3	3	3	4	3	3	5	3	3	3	5	4	5	3	4	3
43	4	4	5	5	2	3	5	3	4	4	4	3	5	4	3	2	5	2	3	4	5	4
44	3	4	4	4	4	3	4	4	4	4	4	4	4	2	3	2	3	2	3	5	3	5

Table 4.10 Kansei Checklist Questionnaire Recapitulation (con't)

Respondents	Kansei																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
45	4	4	4	4	4	3	4	3	4	4	4	3	5	2	3	2	3	4	5	5	4	3
46	4	4	3	4	4	4	3	3	3	4	3	3	5	3	3	3	5	4	5	3	4	3
47	3	5	3	4	4	4	3	3	3	4	5	4	5	4	3	2	4	2	3	4	3	4
48	4	4	3	4	4	4	3	3	3	4	3	3	5	3	3	3	5	4	5	3	4	3
49	4	4	5	5	2	3	5	3	4	4	4	4	5	4	3	2	5	2	3	4	5	4
50	3	4	4	4	4	3	4	4	4	4	4	4	4	2	3	2	3	2	4	5	3	5
51	4	4	5	5	2	3	5	3	4	4	4	3	5	4	3	2	5	2	3	4	5	4
52	4	4	3	4	3	4	4	4	4	5	3	3	4	4	3	3	3	3	3	3	3	4
53	5	5	3	4	3	2	4	4	4	5	4	4	4	4	2	3	3	3	5	5	5	4
54	3	5	4	5	2	2	4	3	4	5	3	4	4	3	2	3	4	2	4	4	4	4
55	4	4	3	4	3	3	3	4	4	5	5	4	5	4	2	2	4	3	5	5	5	4
56	3	4	4	4	4	3	4	4	4	4	4	4	4	2	3	2	3	2	4	5	3	5
57	4	4	3	4	4	4	4	3	3	4	3	3	5	3	3	3	5	4	5	4	4	3
58	5	5	5	5	3	4	5	4	4	5	4	4	5	3	2	2	3	3	5	5	3	4
59	5	4	3	5	2	3	4	3	3	4	5	5	5	4	3	2	5	3	5	4	3	3
60	3	4	4	4	4	3	4	4	4	4	4	4	4	2	3	2	3	2	4	5	3	5

The result of the Kansei Checklist Questionnaire as shown in the Table 4.10 will be proceed further by using Factor Analysis in SPSS 17.0 to find a small number of factors which will constitute the 22 variables of Kansei Words. Later, the design attributes were made based on the Factor Analysis results.

4.2 Statistical Analysis

This chapter will discuss the statistical analysis that will be processed based on the Feedback Capture after Task (FCAT) and kansei questionnaire that already done on the previous chapter. The statistical analysis including in this chapter consists of Factor Analysis and Partial Least Squares (PLS). To support the PLS calculation, identification of influential design components will be performed.

4.2.1 Factor Analysis

In a product development, it is hard to fulfill all of the customer's requirements. It due to the project time limitation also considering that the customer's preferences on each product are different. It is not possible if an attribute is againts other attribute. For example, cheap and premium cannot be paired and realized in one product. Thus, there should be done several processes to find the most important attributes that will be realized.

Factor analysis was conducted to find the most important Kansei that will be used as design specifications in the final designing stage. Factor analysis was conducted using an extraction method based on the principle component analysis.

There are nine outputs that can be obtained from SPSS 17.0 calculation, that include Descriptive Statistics, Correlation Matrix, KMO and Bartlett's Test, Scree Plot, Component Matrix, Reproduced Correlations, Rotated Component Matrix, Total Variance Explained, and Component Transformation Matrix.

The first output of Factor Analysis is Descriptive Statistics. It is consist of mean, standard deviation, and a number of respondents (N) who participate in the survey. Descriptive Statistics table is shown in the Table 4.11:

Table 4.11 Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Cheap	4.63	0.486	60
Clear	4.42	0.497	60
Accurate	4.35	0.481	60
Simple	4.25	0.437	60
Good design	4.20	0.755	60
Modern	4.07	0.800	60
Interesting	4.02	0.748	60
Neat	4.02	0.813	60
Intuitive	4.00	0.736	60
Practical	3.97	0.736	60
Plain	3.95	0.852	60
Easy	3.92	0.850	60
Detail	3.90	0.706	60
Systematic	3.72	0.524	60
Consistent	3.55	0.502	60
Professional	3.50	0.504	60
Innovative	3.23	0.890	60
Unique	3.18	0.748	60
New	3.13	0.812	60
Specific	2.95	0.872	60
Flexible	2.70	0.462	60
Formal	2.35	0.481	60

The first output from the Factor Analysis is descriptive statistics shown on Table 4.11 of all the variables under investigation. Descriptive statistic table consists of mean, standard deviation, and number of sample. Mean is used to conclude a respectability of the most important variable that influences customers to buy the product. In this research, a variable that has the biggest influence is cheap and then followed by clear and accurate. Standard deviation is a measure that is used to quantify the amount of variation of dispersion of a set of data values.

The second output from the factor analysis is the correlation coefficient. A correlation matrix is a simple rectangular array of numbers which gives the correlation coefficients between a single variable and every other variable in the investigation. The correlation coefficient between a variable and itself is always 1.

Table 4.12 Correlation Matrix

		Interesting	Simple	Easy	Clear	New	Unique	Intuitive	Professional	Consistent	Accurate	Detail	Systematic	Cheap	Innovative	Flexible	Formal	Neat	Specific	Modern	Good	Plain	Practical
Correlation	Interesting	1.00	-0.06	0.11	0.30	-0.25	-0.10	0.06	-0.07	-0.02	0.22	0.10	-0.07	-0.03	0.20	-0.13	-0.06	0.17	0.37	0.20	-0.10	0.00	-0.43
	Simple	-0.06	1.00	0.01	-0.02	0.05	-0.19	0.16	-0.12	-0.10	0.22	-0.03	0.09	-0.04	0.02	-0.29	0.06	-0.25	-0.23	0.05	-0.05	-0.10	0.08
	Easy	0.11	0.01	1.00	0.08	-0.16	0.00	0.35	0.14	0.23	0.11	-0.16	-0.05	0.01	-0.18	-0.11	-0.09	-0.12	-0.05	-0.24	0.11	0.04	0.24
	Clear	0.30	-0.02	0.08	1.00	-0.43	-0.12	0.37	-0.17	-0.05	-0.05	-0.02	0.14	-0.13	0.12	-0.33	0.02	0.19	-0.07	0.06	0.00	0.09	-0.15
	New	-0.25	0.05	-0.16	-0.43	1.00	0.10	-0.34	0.12	-0.18	-0.08	-0.04	0.01	-0.09	-0.23	0.33	0.05	-0.29	0.22	0.01	0.18	-0.24	-0.05
	Unique	-0.10	-0.19	0.00	-0.12	0.10	1.00	-0.12	0.07	-0.18	-0.18	0.07	0.09	0.19	-0.01	0.16	0.05	0.13	0.27	-0.13	-0.25	-0.14	-0.11
	Intuitive	0.06	0.16	0.35	0.37	-0.34	-0.12	1.00	0.09	0.18	0.05	-0.16	-0.13	0.19	-0.23	-0.30	0.05	0.14	-0.18	-0.17	0.03	0.19	0.09
	Professional	-0.07	-0.12	0.14	-0.17	0.12	0.07	0.09	1.00	0.50	0.38	-0.14	0.10	-0.21	-0.23	-0.07	0.24	-0.43	0.10	-0.08	0.31	0.06	0.37
	Consistent	-0.02	-0.10	0.23	-0.05	-0.18	-0.18	0.18	0.50	1.00	0.24	-0.08	-0.11	-0.13	-0.06	-0.08	-0.18	-0.40	-0.21	-0.18	0.33	0.11	0.28
	Accurate	0.22	0.22	0.11	-0.05	-0.08	-0.18	0.05	0.38	0.24	1.00	-0.14	0.00	0.05	0.08	-0.36	0.27	-0.23	0.08	0.20	0.13	0.17	0.08
	Detail	0.10	-0.03	-0.16	-0.02	-0.04	0.07	-0.16	-0.14	-0.08	-0.14	1.00	0.47	0.19	0.17	0.11	-0.59	0.00	-0.06	-0.11	0.23	-0.04	-0.14
	Systematic	-0.07	0.09	-0.05	0.14	0.01	0.09	-0.13	0.10	-0.11	0.00	0.47	1.00	-0.22	-0.04	-0.08	-0.21	-0.15	-0.29	-0.04	0.15	-0.22	0.11
	Cheap	-0.03	-0.04	0.01	-0.13	-0.09	0.19	0.19	-0.21	-0.13	0.05	0.19	-0.22	1.00	0.24	0.03	-0.09	0.40	0.28	0.06	0.02	0.24	-0.18
	Innovative	0.20	0.02	-0.18	0.12	-0.23	-0.01	-0.23	-0.23	-0.06	0.08	0.17	-0.04	0.24	1.00	0.01	-0.15	0.32	-0.01	-0.02	-0.10	-0.12	0.01
	Flexible	-0.13	-0.29	-0.11	-0.33	0.33	0.16	-0.30	-0.07	-0.08	-0.36	0.11	-0.08	0.03	0.01	1.00	-0.13	0.06	0.05	-0.27	-0.02	-0.08	-0.13
	Formal	-0.06	0.06	-0.09	0.02	0.05	0.05	0.05	0.24	-0.18	0.27	-0.59	-0.21	-0.09	-0.15	-0.13	1.00	0.07	0.20	0.25	-0.29	0.21	-0.06
	Neat	0.17	-0.25	-0.12	0.19	-0.29	0.13	0.14	-0.43	-0.40	-0.23	0.00	-0.15	0.40	0.32	0.06	0.07	1.00	0.10	0.08	-0.45	0.27	-0.31
	Specific	0.37	-0.23	-0.05	-0.07	0.22	0.27	-0.18	0.10	-0.21	0.08	-0.06	-0.29	0.28	-0.01	0.05	0.20	0.10	1.00	0.18	0.07	0.25	-0.40
	Modern	0.20	0.05	-0.24	0.06	0.01	-0.13	-0.17	-0.08	-0.18	0.20	-0.11	-0.04	0.06	-0.02	-0.27	0.25	0.08	0.18	1.00	0.06	-0.04	-0.23
	Good	-0.10	-0.05	0.11	0.00	0.18	-0.25	0.03	0.31	0.33	0.13	0.23	0.15	0.02	-0.10	-0.02	-0.29	-0.45	0.07	0.06	1.00	-0.04	0.13
	Plain	0.00	-0.10	0.04	0.09	-0.24	-0.14	0.19	0.06	0.11	0.17	-0.04	-0.22	0.24	-0.12	-0.08	0.21	0.27	0.25	-0.04	-0.04	1.00	-0.06
	Practical	-0.43	0.08	0.24	-0.15	-0.05	-0.11	0.09	0.37	0.28	0.08	-0.14	0.11	-0.18	0.01	-0.13	-0.06	-0.31	-0.40	-0.23	0.13	-0.06	1.00

The next output is Kaiser Meyer Olkin (KMO) and Bartlett's Test. KMO measures the sampling adequacy which determines if the response given with the sample are adequate or not. Recommended value of KMO should be close than 0.5 for satisfactory. Minimum of 0.5 KMO value is recommended, values between 0.7 until 0.8 are acceptable, and values that are more than 0.9 are incredible (Kaiser, 1974). On Table 4.13, KMO value is 0.475, which is close to 0.5 and therefore can be barely accepted. Thus, it can be concluded that the samples are adequate.

Bartlett's test is the indication of the strength of the relationship among variables. In this test, the null hypothesis stated that the correlation matrix is an identity matrix. In this research, the null hypothesis should be rejected. Thus, the Bartlett's Test Of Sphericity should be or close to 0. On Table 4.13, the significance level is 0. It means that the null hypothesis is rejected. Thus, can be concluded that the correlation matrix is not an identity matrix.

Table 4.13 Kaiser Meyer Olkin (KMO) and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.475
Bartlett's Test of Sphericity	Approx. Chi-Square	469.402
	df	231
	Sig.	0.000

The next output of Factor Analysis is Scree Plot. It is a graph that used to determine how many components to retain. Components that have eigenvalue less than 1 are neglected.

Scree plot as shown in Figure 4.2 shows that there are 9 components that have eigenvalue more than 1. Thus, it can be concluded that there are 9 components that have been retained.

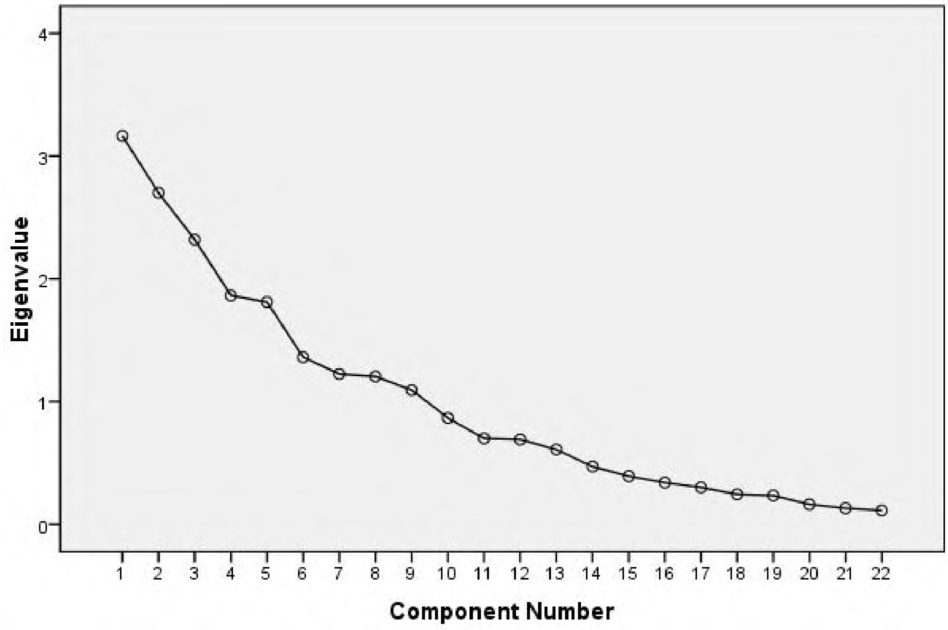


Figure 4.2 Scree Plot

Then, those 9 components are extracted out to explain the total variance. The resulting data was rotated using varimax rotation method. It is used to reduce the number of factors on which the variables under investigation have high loadings. This matrix will automatically discard the variable with small correlation value, which is smaller than 0.5 It will make the evaluation easier by knowing the most important variables for each component. From Table 4.14 below, 22 Kansei words were plot into 9 components.

Table 4.14 Rotated Component Matrix

	Component								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Interesting				0.779					
Simple							0.832		
Easy						0.772			
Clear		0.800							
New		-0.747							
Unique									0.858
Intuitive						0.543			
Professional	0.856								
Consistent	0.654								

Table 4.14 Rotated Component Matrix (con't)

	Component								
	1	2	3	4	5	6	7	8	9
Accurate	0.627								
Detail			0.879						
Systematic			0.579						
Cheap					0.792				
Innovative								0.880	
Flexible		-0.513					-0.577		
Formal			-0.772						
Neat	-0.538								
Specific				0.739					
Modern						-0.573			
Good			0.511						
Plain					0.718				
Practical				-0.698					
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.									
a. Rotation converged in 12 iterations.									

Table 4.14 consists of the correlation value of each factor in each component. The first component consists of 'professional', 'consistent', 'accurate', and 'neat' variables. The second component consists of 'clear', 'new', and 'flexible'. The third component including 'detail', 'systematic', 'formal', and good' and etc.

The contribution of the nine components to the whole dimension can be seen on the table variance explained as shown in Table 4.15 below. As the result, nine components can explain 76.108 % concerning the application kansei dimension.

Table 4.15 Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	2.447	11.122	11.122
2	2.199	9.994	21.116
3	2.155	9.797	30.913
4	2.008	9.126	40.038
5	1.767	8.030	48.068
6	1.652	7.507	55.576
7	1.632	7.417	62.993
8	1.468	6.671	69.664
9	1.418	6.444	76.108
Mean	1.860	8.456	
Extraction Method: Principal Component Analysis.			

After conducting factor analysis by using SPSS 17.0, the result that can be obtained is there are 9 components extracted from 22 kansei words. From table 4.15, components that have total sums of squared loadings that are less than the mean, which is 1.860 will neglected. It is because the correlation of those components to other components is low and if it still selected and go to the further process, it would not take a big impact on the customer's satisfaction. Thus,can be inferred that component 1, 2, 3, and 4 will be used for the further process. The summary of factor analysis result shown in the Table 4.16 as follows:

Table 4.16 Summary of Factor Analysis Result

Component	Total	% of Variance	Variable	Correlation
1	2.447	11.122	Professional	0.856
			Consistent	0.654
			Accurate	0.627
			Neat	-0.536
2	2.199	9.994	Clear	0.800
			Flexible	-0.513
			New	-0.747
3	2.155	9.797	Detail	0.879
			Systematic	0.579
			Formal	-0.772
			Good design	0.511
4	2.008	9.126	Interesting	0.779
			Specific	0.739
			Practical	0.718

Table 4.16 about the summary of factor analysis result consists of four components and its variables. Kansei words that are associated with component 1 such as 'professional', 'consistent', 'accurate', and 'neat' can be grouped together as **'Data Record Persistence'**. It is because that words consistent and accurate are really related with the data that are countable. For neat and professional, it is related with the data presentation that are well organized. Thus, the first component can be summarized as data record persistence. As for component 2, words 'clear' and 'flexible' are related to the application flow and application usage. Clear means that the application able to present it contains clearly. Thus, it will be easy to operate.

The, component 2 named as **'Ease of Use'.** For the word 'new' because it has no relation with application elements, it will be neglected. Words 'detail', 'systematic', 'formal', and 'good design' for component 3 are grouped together as **'Data Presentation'.** Detail means that the data are recorded in a certain regular frequencies. Systematic interpreted as the data are arranged in a systematic ways. Good design and formal refer to the viusal presentation. Thus, component 3 can be defined as data presentation. On the last component, 'interesting', 'specific', and 'practical' are associated with the display, and interface arrangement. Then, it is lead to name component 2 as '**Visual Attractiveness'.**

4.2.2 Identification of Influential Design Elements

Previously, Statistical Analysis using Factor Analysis is already done in SPSS 17.0. In this subchapter, the result from Factor Analysis will be interpreted from the viewpoint of Kansei Engineering to find the relationship between kansei and product properties.

The mobile application really relies on the visual emotional appeal, or usually called as user interface. Thus, the concept generation of this mobile application is limited to the physical trait. Table 4.17 shows the influentian design elements of the Self-Monitoring of Blood Glucose application. Later, the relationship between chosen Kansei words which are data record persistence, ease of use, data presentation, and visual attractiveness along with the design elements describes in the concept generation will be obtained.

First, items that are related to the selected kansei should be found. Attribute data record persistence is related to the blood glucose data input frequency. One of the way to keeping is persistence is by using reminder or notification. According to Pcsoft (2016), there are two main types of nofication. First is alarm type, and the second one is drop down notification which is shown in the smartphone's system bar.

Second attribute which is ease of use is related to home screen interface, blood glucose input, and language. According to Vogel (2006), home screen interface are divided into two types, which are list fragment and details fragment. List fragment shows the menu option in a list style, while details fragment highlight the most important menu with bigger size. Details fragment often to use graphic as the representation. For the blood glucose input dialog, there are also two options, which are by typing and scrolling. In scrolling, the user scroll the blood glucose level bar horizontally to select their blood glucose. The example of scroll bar is on the BeatO application that is used in the previous FCAT. For the blood glucose input, the user can fill it by directly press the specific time on the regimen table or by clicking the icon then there will appear a typing window. Then for language, Bahasa is considered as one of the choices because the application users are Indonesia. But, it does not rule out the possibility that the application is using English because it is a common language used in application.

Data presentation attribute is related to blood glucose report. It is related with how the blood glucose report will ber presented. According to Laurinavicius (2014), dynamic report on the application are best presented in whether bar chart or line chart.

For visual attractiveness attribute, it is related to all of the component that already mentioned before. It is because each of the components combination plays a role on how the user see the application in general. In addition, it is also related with the color scheme of the application. According to Li and Tran (2015), There are two basic application color sceme theme, which are light and dark. Light color scheme is good to be used in text and data based application. Dark color scheme is good for image based application and it is consume less energy. The design elements of the application shown on the Table 4.17:

Table 4.17 Influential Design Elements

<table>
<tr><th rowspan="2"></th><th colspan="3">PHYSICAL TRAIT</th></tr>
<tr><th>Item</th><th>Category</th><th>Image Representation</th></tr>
<tr><td rowspan="4">Overall</td><td rowspan="2">Color Scheme</td><td>Light color scheme</td><td>

Figure 4.3 Light Color Scheme
Source: www.appdesignvault.com</td></tr>
<tr><td>Dark color scheme</td><td>

Figure 4.4 Dark Color Scheme
Source: www.shuterstock.com</td></tr>
<tr><td rowspan="2">Language</td><td>English</td><td></td></tr>
<tr><td>Bahasa</td><td></td></tr>
<tr><td>Home screen</td><td>Home Screen interface</td><td>List Fragment</td><td>
Figure 4.5 List Fragment
Source: encrypted-tbn3.gstatic.com</td></tr>
</table>

Table 4.17 Item/Category Classification List (con’t)

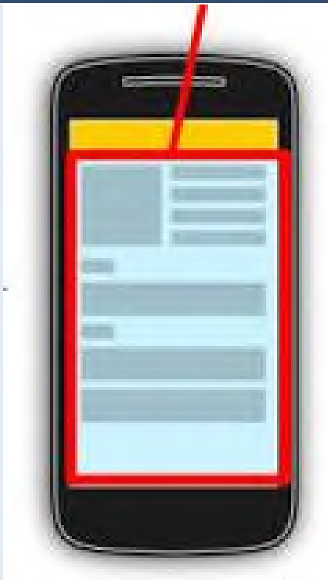
	PHYSICAL TRAIT		
	Item	Category	Image Representation
		Details Fragment	 Figure 4.6 Details Fragment Source: encrypted-tbn3.gstatic.com
Checking Reminder	Notification Types	Alarm	 Figure 4.7 Alarm Source: www.encrypted-tbn2.gstatic.com

Table 4.17 Item/Category Classification List (con't)

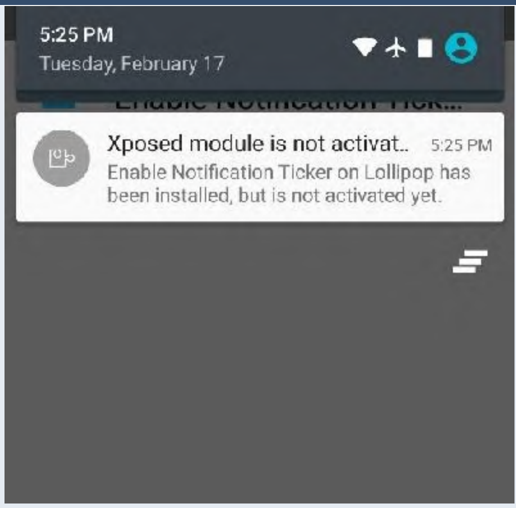
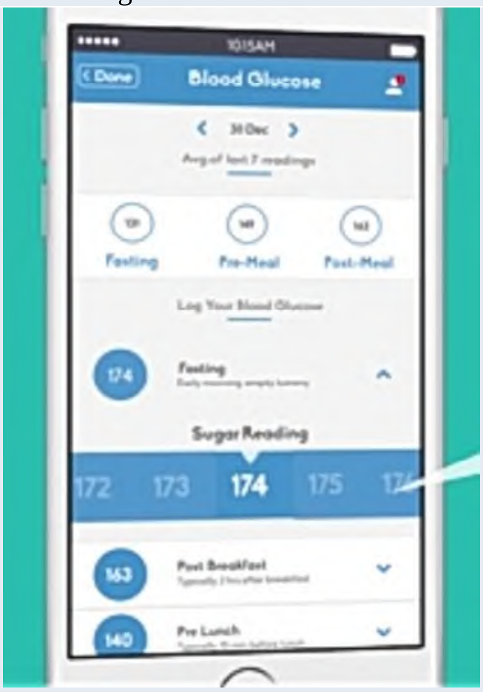
	PHYSICAL TRAIT		
	Item	Category	Image Representation
		Drop Down Notification	 Figure 4.8 Swipe Down Notification Source: img.wonderhowto.com
Blood Glucose Input	Input Dialog	Scrol Bar	 Figure 4.9 Scrol Bar Source: www.Beatoapp.com

Table 4.17 Item/Category Classification List (con’t)

<table>
<tr><th></th><th colspan="3">PHYSICAL TRAIT</th></tr>
<tr><th></th><th>Item</th><th>Category</th><th>Image Representation</th></tr>
<tr><td rowspan="3"></td><td rowspan="3">Input Method</td><td>Typing</td><td>

Figure 4.10 Typing Method
Source: encrypted-tbn1.gstatic.com</td></tr>
<tr><td>By clicking the icon</td><td>

Figure 4.11 Click the Icon
Source: www.iconfinder.com</td></tr>
<tr><td>By clicking the regimen / schedule</td><td>

	Sebelum sarapan	Sesudah sarapan	Sebelum makan siang	Setelah makan siang	Sebelum makan malam	Setelah makan malam	Sebelum Waktu tidur
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Senin							
Selasa							
Rabu	x	x		x	x	x	
Kamis	x	x		x	x	x	
Jumat	x	x		x	x	x	
Sabtu							
Minggu							

</td></tr>
</table>

Table 4.17 Item/Category Classification List (con’t)

	PHYSICAL TRAIT		
	Item	Category	Image Representation
Blood Glucose Report	Shape	Line chart	 Figure 4.12 Line Chart Source: encrypted-tbn1.gstatic.com
		Bar chart	 Figure 4.13 Bar Chart Source: www. Shutterstock.com

**

4.2.3 Partial Least Squares (PLS)

Partial Least Squares (PLS) Analysis is used to identify the influential design element (Nagamachi and Tachikawa, 2015). PLS is done using the data from selected Kansei words survey and the item/category list classification. Software used to perform Partial Least Square Analysis is Excel XLSTAT 2016.

Before processing the data on the XLSTAT, weighting of the selected kansei word with the item/category classification from the writer's point of view need to be done. Later, XLSTAT will use this weighting along with the kansei questionnaire result of four selected word as the input of the calculation. Then, the relationship between the four chosen Kansei words and the design element described in the item/category will be obtained.

Weighting the four selected Kansei words with the item/category classification were done by using Likert scale, from 5 to 1. 5 means Kansei and design element are highly related, 4 means related, 3 means not too related, 2 is not related, and 1 means highly unrelated. Weighting of selected kansei words with influential of design elements shown on the Table 4.18:

Table 4.18 Selected Kansei and Category Weighting

	Color Scheme - Light	Color Scheme - Dark	Language - English	Language - Bahasa	Main Activity - List Fragment	Main Activity - Details Fragment	Notification - Alarm	Notification - Drop Down	Input Dialog - Scroll Bar	Input Dialog - Typing	Input Method - Click the Icon	Input Method - Click the Regimen	Report Shape - Line Chart	Report Shape - Bar Chart
Data Record Presistence	4	2	2	4	2	4	4	2	1	5	4	2	4	2
Ease of Use	4	2	1	5	1	5	2	4	1	5	4	2	4	2
Data Presentation	4	2	3	3	2	4	4	2	2	4	2	4	5	1
Visual Attractiveness	2	4	4	2	1	5	2	4	5	1	4	2	4	2

Weighting process were done using likert scale. Because each item has two categories, if one category weighted more than the other, the weight of other category will be get contradicted. For the first component which is data record persistence, light color, Bahasa, details fragment, and line chart weighted as 4 because all of those aspects are related to the legibility. If the user feels hard to read or to use the application, they would not bother to use the application. Then, the data record would not be filled.

After weighting process already done, along with the selected kansei checklist questionnaire, the data are being processed by using Partial Least Square (PLS) Analysis in software Excel XLSTAT 2016.

Then, the relation list between the candidate kansei and each Item/Category concerning four selected Kansei word is obtained. Table 4.19 shows the Partial Least Square calculation results.

Table 4.19 PLS calculation result

	Data Record Persistence	Ease of Use	Data Presentation	Visual Attractiveness	Means
Color Scheme - Light	0.924	0.377	0.957	0.511	0.692
Color Scheme - Dark	-0.924	-0.377	-0.957	-0.511	-0.692
Language - English	-0.474	-0.875	-0.567	-0.933	-0.712
Language - Bahasa	0.474	0.875	0.567	0.933	0.712
Main Activity - List Fragment	0.818	-0.399	0.712	-0.360	0.193
Main Activity - Details Fragment	-0.818	0.399	-0.712	0.360	-0.193
Notification - Alarm	0.818	-0.399	0.712	-0.360	0.193
Notification - Drop Down	-0.818	0.399	-0.712	0.360	-0.193
Input Dialog - Scrol Bar	-0.817	-0.575	-0.857	-0.662	-0.728
Input Dialog - Typing	0.817	0.575	0.857	0.662	0.728
Input Method - Click the Icon	-0.602	0.668	-0.585	0.460	-0.015
Input Method - Click the Regimen	0.602	-0.668	0.585	-0.460	0.015
Report Shape - Line Chart	0.602	-0.668	0.585	-0.460	0.015
Report Shape - Bar Chart	-0.602	0.668	-0.585	0.460	-0.015

PLS table shows that the biggest positive value in each column means the design item which should be selected and the biggest negative value leads to the bad design. In Table 4.19, ‘color scheme – light’, ‘language – Bahasa’, and ‘input dialog – typing’, should be selected for premium kansei, because those three elements that have the highest influence to the Kansei words. In contrast, ‘color scheme dark’, ‘language – English’, and ‘input dialog – scroll bar’ should be avoided. Other design elements that have means less than 0.60 can be neglected since its influence to the Kansei words are insignificant. These results will be used in the knowledge base of the proposed system.

4.3 Application Components

The previous subchapter shows that the users prefer to use a concise application that is able to record, give recommendation what kind of food that they may and may not eat, to warn and send the report to their private doctor. Following ubchapter consists of data used in this application.

4.3.1 Regimens

Regimen is a term to call schedule of blood glucose checking. According to International Diabetes Federation (2015), there are six regimens that are commonly used. The user should consult the most suitable regimen with their doctor.

On the Chapter II, each regimen already explained its usefulness. Then, combined with recommended eating time for type 2 diabetes, the regimens that will be shown on the application shown in the Table 4.20 until Table 4.25:

Table 4.20 5-Point Profile of focused SMBG Regimens

	Before Breakfast	After Breakfast	Before Lunch	After Lunch	Before Dinner	After Dinner	Before Bedtime
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Monday							
Tuesday							
Wednesday	x	x		x	x	x	
Thursday	x	x		x	x	x	
Friday	x	x		x	x	x	
Saturday							
Sunday							

Table 4.21 7-Point Profile of focused SMBG Regimens

	Before Breakfast	After Breakfast	Before Lunch	After Lunch	Before Dinner	After Dinner	Before Bedtime
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Monday							
Tuesday	x	x	x	x	x	x	x
Wednesday	x	x	x	x	x	x	x
Thursday	x	x	x	x	x	x	x
Friday							
Saturday							
Sunday							

Table 4.22 Staggered Profile of focused SMBG Regimens

	Before Breakfast	After Breakfast	Before Lunch	After Lunch	Before Dinner	After Dinner	Before Bedtime
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Monday	x	x					
Tuesday			x	x			
Wednesday					x	x	
Thursday	x	x					
Friday			x	x			
Saturday					x	x	
Sunday	x	x					

Table 4.23 Meal-Based Testing of Low-Intensity SMBG Regimens

	Before Breakfast	After Breakfast	Before Lunch	After Lunch	Before Dinner	After Dinner	Before Bedtime
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Monday	x	x					
Tuesday							
Wednesday			x	x			
Thursday							
Friday							
Saturday					x	x	
Sunday							

Table 4.24 Detection / Assessment of Fasting Hyperglycemia SMBG Regimens

	Before Breakfast	After Breakfast	Before Lunch	After Lunch	Before Dinner	After Dinner	Before Bedtime
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Monday							x
Tuesday	x						
Wednesday							x
Thursday	x						
Friday							x
Saturday	x						
Sunday							

Table 4.25 Detection of Asymptomatic Hyperglycemia SMBG Regimens

	Before Breakfast	After Breakfast	Before Lunch	After Lunch	Before Dinner	After Dinner	Before Bedtime
	07.00	09.00	13.00	15.00	19.00	21.00	22.00
Monday			x		x		
Tuesday							
Wednesday			x		x		
Thursday							
Friday			x		x		
Saturday							
Sunday							

4.3.2 Glycemic Index

The glycemic index (GI) is a ranking of carbohydrates on a scale from 0 to 100 according to the extent to which they raise blood sugar levels after eating. Foods with high GI are those which are rapidly digested and absorbed and result in marked fluctuations in blood sugar levels. Low-GI foods, by virtue of their slow digestion and absorption, produce gradual rises in blood sugar and insulin levels and have proven benefits for health. Low GI diets have been shown to improve both glucose and lipid levels in people with diabetes (type 1 and type 2). They have benefits for weight control because they help control appetite and delay hunger. Low GI diets also reduce insulin levels and insulin resistance (Brand-Miller, 2006). The range of Glycemic Index (GI) shown in Table 4.26.

Table 4.26 Ranking of Glycemic Index (GI)

Ranking	GI Range
Low	0-55
Moderate	56-69
High	70 or more

Source: Brand-Miller, 2006

List of glycemic index of Indonesian food shown on the table 4.2. The table consists of beverages, fruits, carbohydrates, snacks, vegetables, and protein list including its GI level, in low, medium, and high level.

Table 4.27 Glycemic Index List

No	Food	Low GI	Med GI	High GI
Beverages				
	Apple juice, unsweetened	40		
	Grapefruit juice, unsweetened	48		
	Orange juice, unsweetened	50		
	Carrot Juice	43		
	Pineapple Juice	46		
	Tomato Juice, unsweetened	38		
	Yakult	46		
	Milo	36		
	Milk, Low-Fat	34		
	Low-fat Yoghurt	33		
	Ice Cream	62		
	Honey		58	
	Coca-Cola		63	
	Fanta		68	
	Milk Full Cream		61	
Fruits				
	Apple	28		
	Orange	42		
	Banana, Raw	52		
	Pears	38		
	Kiwi	53		
	Mango	51		
	Date Fruits	42		
	Grape		59	
	Pineapple		66	
	Papaya		60	

Table 4.27 Glycemic Index List (con't)

No	Food	Low GI	Med GI	High GI
	Banana, steamed 1 hr			70
	Watermelon			72
Carbohydrates				
	Red Rice, boiled	55		
	Pasta Fettucine	40		
	Instant Noodle	47		
	Spaghetti, boiled 5 min	38		
	Spaghetti, boiled 15	44		
	Sweet corn, boiled	48		
	Oatmeal		69	
	White Rice, boiled		64	
	White Bread		59	
	Spaghetti, boiled 20 min		61.3	
	Corn, Boiled		68	
	Kelloggs's Cornflakes			81
	Chicken Porridge			86
	Fried Rice with fried egg			79
	Nasi Kebuli			71
	Donut			76
	French Fries			75
Snacks				
	Potato chips	54		
	Snickers Bar	55		
	Chocolate bar, ex: Cadbury	49		
	Nutella	33		
	Popcorn, plain			72
	Nastar			70
Vegetables				
	Carrot, raw	16		
	Carrot, boiled	32		
	Cassava, Boiled	46		
	Potato, Boiled 30 min		56	
	Potato, Steamed 1 hr		65	
	Taro, Boiled		56	
	Potato, Baked			85
Protein				
	Soy Bean Cake, Fried	50		
	Soy Bean Cake, Boiled	30		
	Egg, Boiled	30		

4.4 Data Flow Diagram

Data Flow Diagram were introduced and popularized for structured analysis and design (Gane and Sarson, 1979). DFD show the flow of data from external entities into the system, showed how the data moved from one process to another, as well as its logical storage. It is a tool used by the engineers to transfer the flow of a software before handed it to the designer.

4.4.1 Data Flow Diagram Level 0 (Context Diagram)

Data Flow Diagram Level 0 or usually called as context diagram was made to show the general process going on the system. The context diagram of SMBG application shown in Figure 4.14 below:

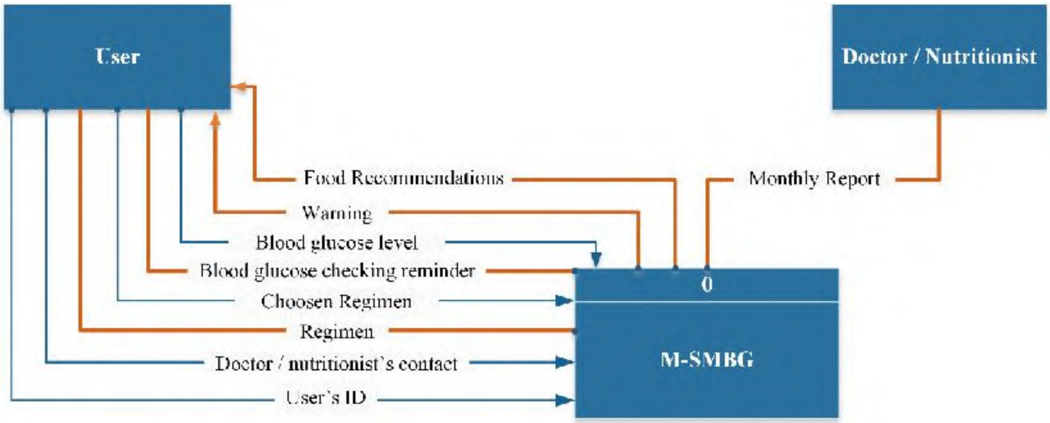


Figure 4.14 Data Flow Diagram Level 0

Context diagram of the application as drawn on Figure 4.14 above shows that there are two entities that become sources of the destination of data, which are user and doctor / nutritionist. Nine arrows representing the data flows, which can indicate the activities going on the system. The activities consist of login, doctor/ nutritionist contact, regimens, choose regimens, a reminder to check blood glucose, input the blood glucose, warning, food recommendation, and monthly report.

4.4.2 Data Flow Diagram Level 1

The context diagram will be broke down to make a higher level, which is level 1. In this diagram, the basic process of the application will be shown. Data Flow Diagram Level 1 shown on following Figure 4.15.

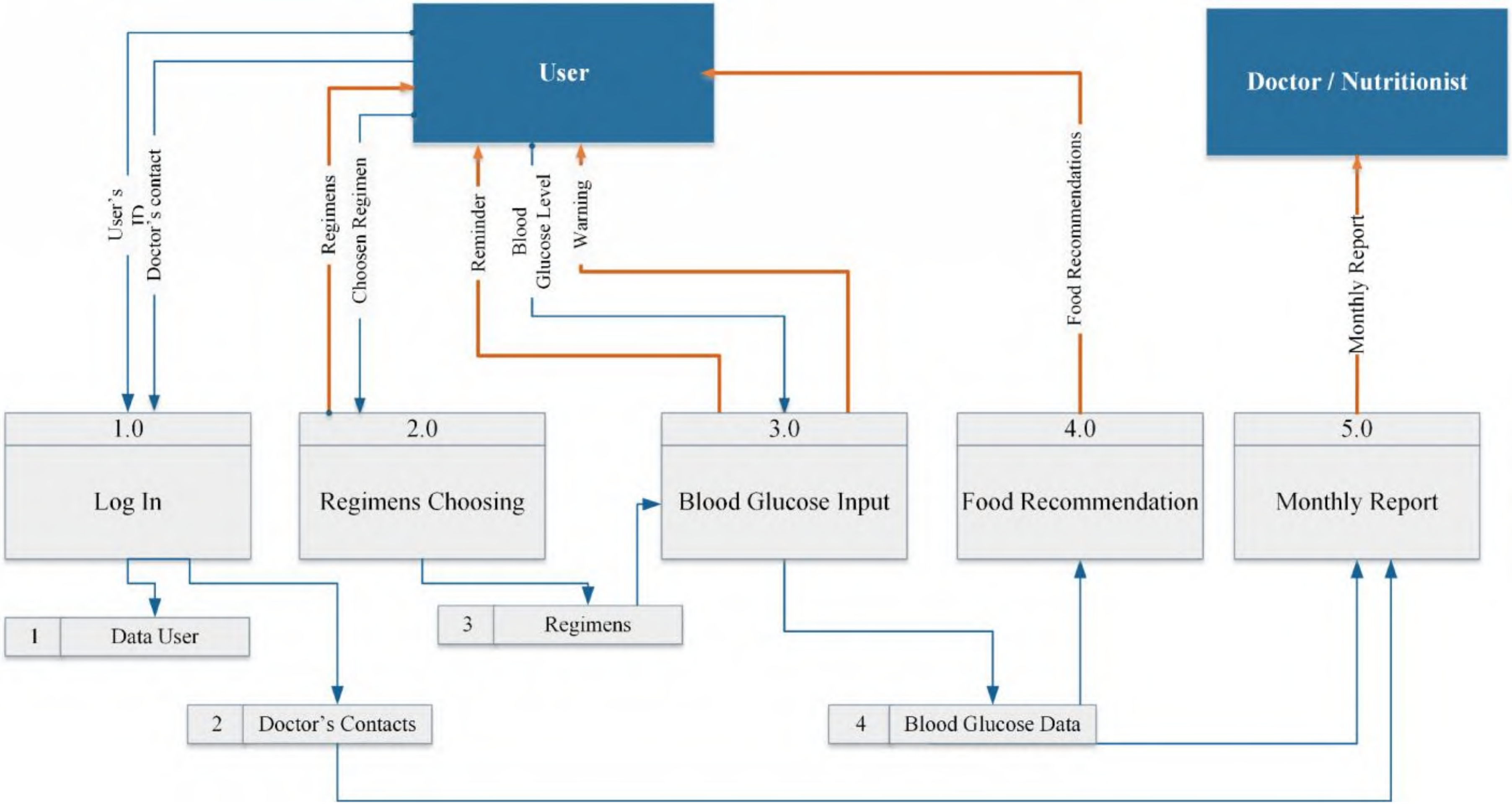


Figure 4.15 Data Flow Diagram Level 1

DFD Level 1 shows the process of the application, that consists of five main processes which are log in, regimen choosing, blood glucose input, food recommendation, and the last is blood glucose report. The boxes on the lower part show the data stores, a place to save the data both permanently or temporary. On the DFD as drawn in Figure 4.15, there are four data stores, which are data user, doctor's contact, regimens, and the last is blood glucose data.

4.4.3 Data Flow Diagram Level 2

DFD Level 2 consists of a further process that may go on the level 1. In this case, the process that being detailed is process number three, which is blood glucose input.

Data Flow Diagram Level 2 shows the further process of blood glucose input from DFD Level 1 before. Here, this process expanded into three processes which are a reminder, blood glucose input and the last is blood glucose warning. The Data Flow Diagram Level 2 of the application shown in Figure 4.16.

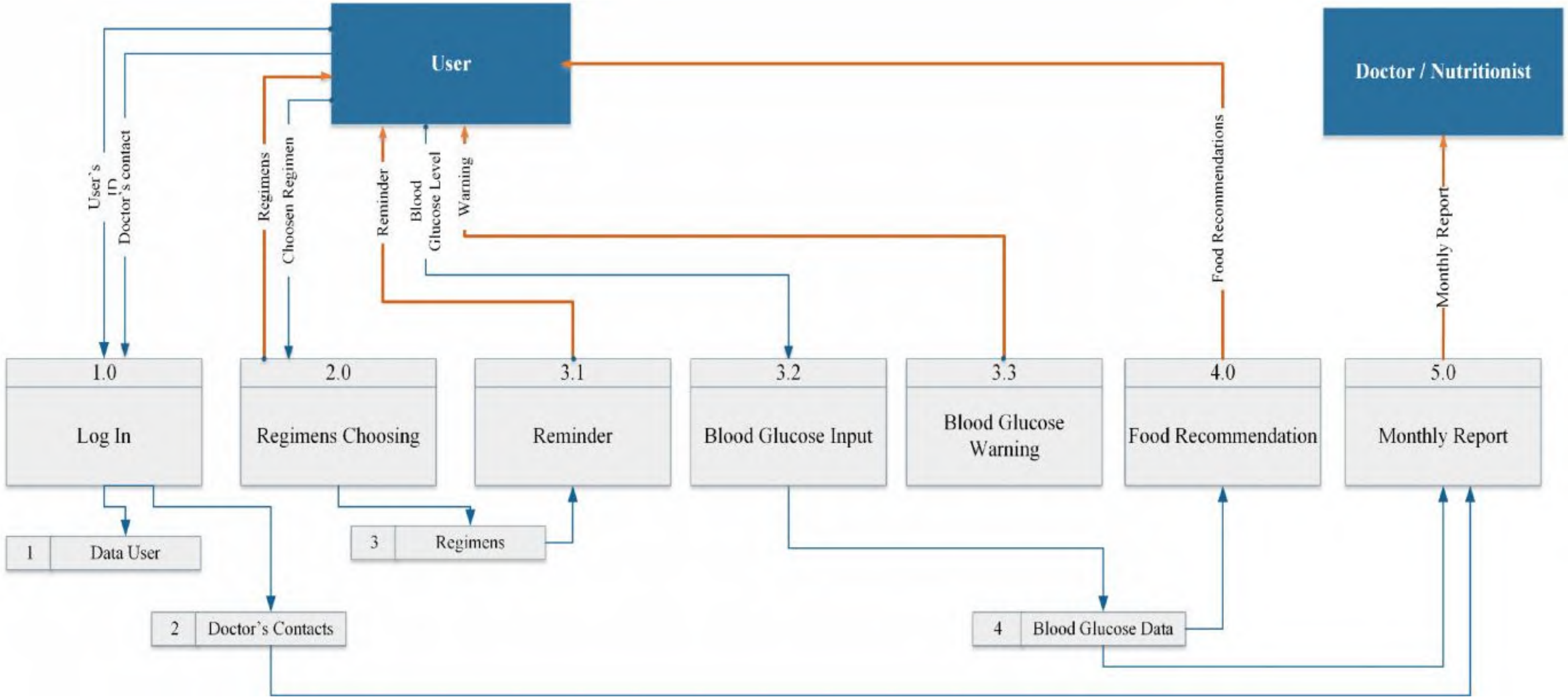


Figure 4.16 Data Flow Diagram Level 2

Thus, in general, the flow of this application will begin by the user inputting the personal information, and their doctor's contact. Then, the apps will give six regimens (blood glucose checking schedule) suggestion, that should be chosen by the user based on their doctor recommendation. After that, based on the regimen they already choose, the application will remind the user to check their blood glucose. After they input their blood glucose status, if it is higher than 300 mg/dl or lower than 40 mg/dl, there will be a warning that their blood glucose already exceeds the limit. Then, the system will give food recommendation. If their blood glucose below 70, it will show food list with high glycemic index, if it is normal the application will give a medium level glycemic index of food list, and if it is more than 200 mg/dl, it will show foods with low glycemic index. This time, the blood glucose status of the user are automatically recorded on the graph form. Later, once in a month, this report will be sent into their doctor / nutritionist by email to be used as the following examination.

4.5 Application Interface Design

The interface on an application act as an interaction medium between the systems with the user. After going through several statistical analysis processes, Android smartphone software was ready to be developed. A program that is used to build the application prototype is Justinmind prototyper.

4.5.1 Logo and Color Selection

At first, the application logo should be generated. Because this application is related to the blood glucose testing, then a glucometer is used as the main component on this logo. The application named as mControl with tag 'Control your blood glucose'. In user experience, color plays a crucial role because it transmits a psychological message to the users (usabilitygeek.com). Every color contains different emotion. In this application, turquoise (RGB: 55,188,155) choose as the main color because it is a combination of blue and green. Blue is often perceived as trustworthy, dependable, peace, and trust (usabilitygeek.com). One of the strategic kansei is data record persistent. Then, the use of blue shades hoped may reflect on the user's kansei. Greenish shade on the turquoise color linked into calming, safety, and peaceful, that was why this color is widely used in the health field. Besides, this color has good readability is combined with white color. Thus, the selection of turquoise color for this application aimed to apply the strategic kansei related to its legibility, color emotion, and visual attractiveness. The mControl logo visualized on following Figure 4.17

Figure 4.17 Application Logo

As mentioned in the previous paragraph, color plays a big role in the user experience. After determining the main color, the next step is to determine the color scheme that will be used as the basic to design the application. The tool that helps to determine the color scheme is a color wheel. It is an illustrative model of color hues around a circle that shows the relationships between colors and help demonstrate color temperature. Color wheel as can be seen in figure 4.18 below has three color schemes which are complementary, analogous, and triadic. Complementary consist of two colors with high contrast, analogous composed of colors that sit next each other, while triadic consists of colors that evenly spaced throughout the color wheel (usabilitygeek.com, 2013).

Figure 4.18 Color Wheel (source: www.pinterest.com)

From the several procedures of Kansei Engineering, one of the results is that the user tends to use a simple and concise application. In the color matter, the most suitable color scheme is a complementary color that has two colors with great contrast. In a mobile application, contrast effect on the legibility and visual hierarchy (the ability of the eye to capture the order of visual content). Seen from the color wheel on Figure 4.18, a color that complementary with turquoise is orange. Thus, combined with monochromatic color (black and white), the application color scheme is shown in Figure 4.19.

Figure 4.19 Selected Color Scheme

4.5.2 Application Screens

Mobile Self-Monitoring Blood Glucose (mSMBG) application consists of several screens. Screen is a term in the mobile application of pages that the users interact with. The main screens in mControl are blood glucose checking reminder, blood glucose input screen, food recommendation screen, warning screen and the last is report screen. Besides, those five screens, there are other additional screens such as splash screen, sign up the screen, and regimen choosing. Each screen will be explained as the following subchapters:

1. Splash and Registration Screen

A second after opening the application, the first interface is a splash screen. It is a welcome screen that consists of application logo and spinner. Spinner indicates the process of the application to load the data. After welcome screen, there will be a registration screen. Here, the user gave 2 option. If they already had an account, log in button should be pressed. If they are a new user of this application, then sign up button should be chosen. The splash screen and registration screen interface of m-SMBG shown in figure 4.20 below:

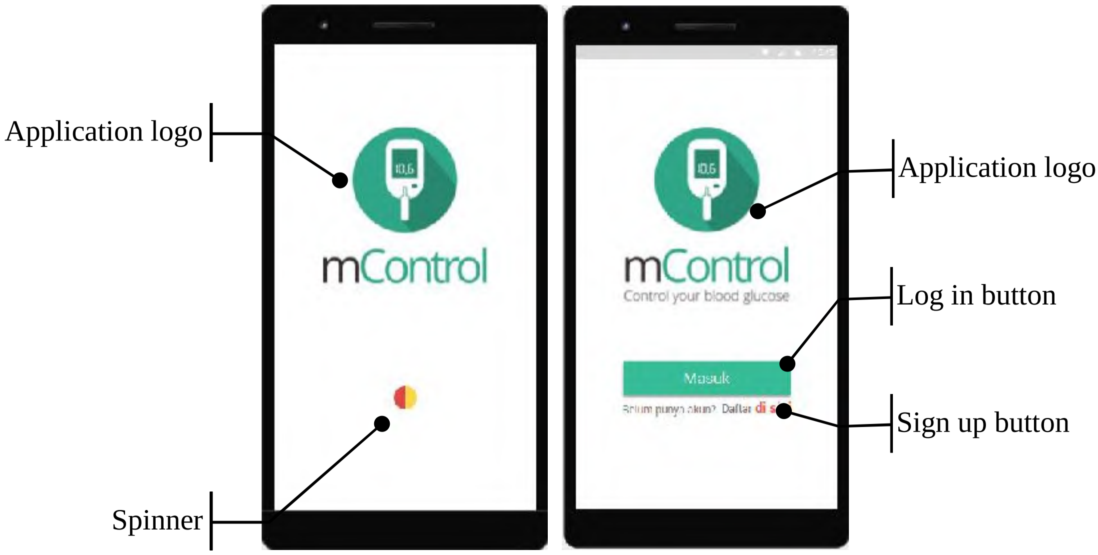


Figure 4.20 Splash Screen and Registration Screen Interface

2. Login and Sign Up Screen

After the two options which are to log in or to sign up was given to the user, they will be brought to their selected screen. Log in screen consists of profile picture, user's email and account password that should be filled, and also log in button. If the users input wrong email and password, there will be an error message appear. The back button will bring the user back to the log in screen to repeat input the email and password. The interface of the login screen and error screen is shown in the Figure 4.21.

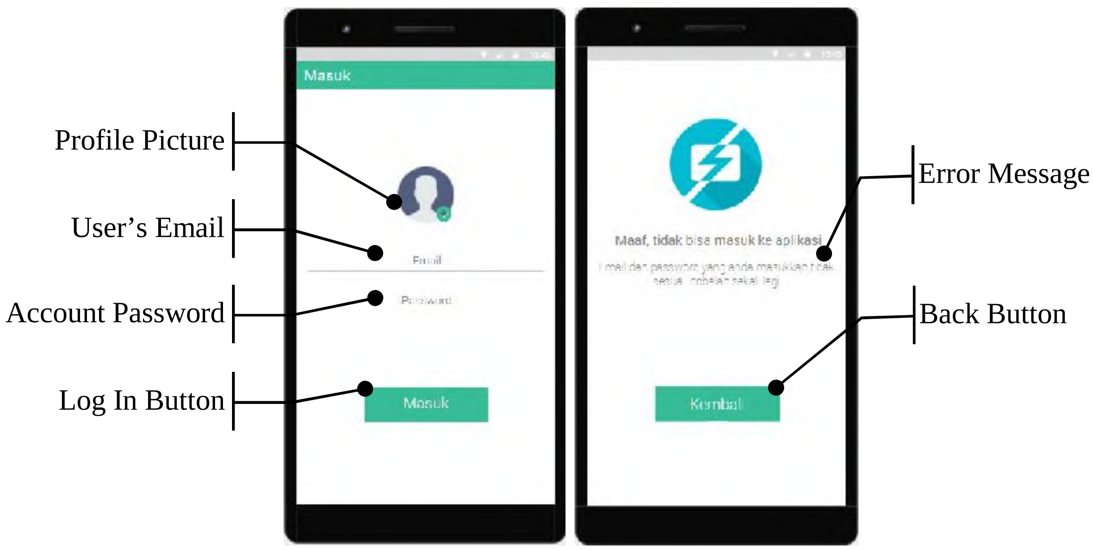


Figure 4.21 Log In and Error Screen

If the user has no mControl account yet, they can register by pressing the sign-up button. On the sign-up screen, there are two fields that should be filled. The first field is user's data. It is consists of email and password. The second field is doctor's information, composed by doctor's email. This email will be used to send the user's blood glucose report. The interface of sign up screen shows in Figure 4.22 as follows:

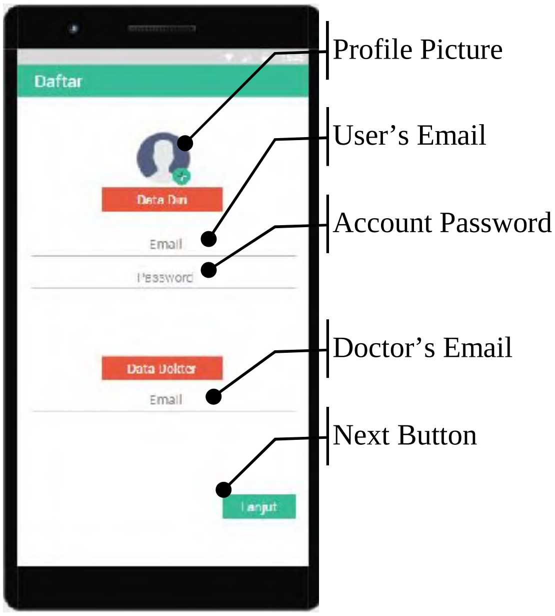


Figure 4.22 Sign Up Screen

3. Regimen Choosing Screen

After the sign-up process was done, the user is directed to the regimen choosing screen. Here, the user is required to select on a regimen based on their doctor recommendation. The regimen tables consist of days and time of the user to check their blood glucose. Later, this regimen will be used as the base to perform the blood glucose checking. The interface of regimen choosing shows on Figure 4.23 as follows:

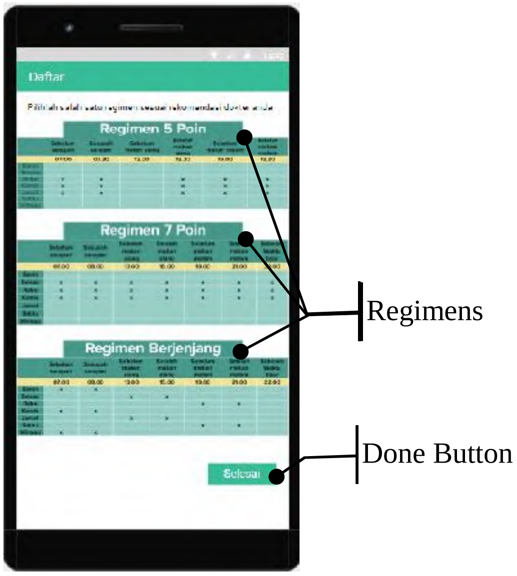


Figure 4.23 Regimen Choosing Screen

4. Reminder Screen

After the user select one of the regimen, then the application will generate a reminder that will appear every blood gluocose checking time. This reminder appear on the phone notification screen, both on the lock screen and drop down notification. Once the user touch the notification, the application will be opened the blood glucose input screen. The interface of reminder screen shown in Figure 4.24 as follows:

Figure 4.24 Reminder Screen

5. Home Screen

Home screen is the main screen in mControl application. The user will enter this page after they have complete the login or the registration processes. In this screen, there are two main menus, which are Blood Glucose Input and Report. This home screen is made as simple as possible to reduce the user confussion with full and crowded screen. The home screen interface shown on the Figure 4.25.

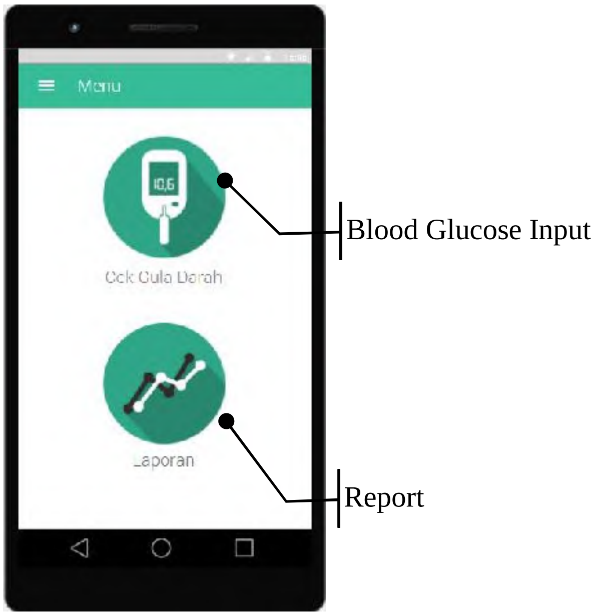


Figure 4.25 Home Screen

6. Blood Glucose Input Screen

At the home screen, the user is required to choose between blood glucose input or report. The interface of blood glucose input screen as in Figure 4.26 displays the blood glucose checking schedule on each day. Here, the user input their blood glucose level as stated on the glucometer to the input field. Then, after the OK button were clicked, the application will determine their blood glucose state and the food recommendation.

Figure 4.26 Blood Glucose Input Screen

7. Food Recommendation Screen

After the blood glucose level being inputted on the blood glucose input screen, the application will switch it into food recommendation screens. Blood glucose level called as low if it is below 70 mg/dl before meals, below 100 mg/dl after meals, and below 90 mg/dl before bedtime. It is called as normal if the blood glucose level ranges between 70 to 130 mg/dl before meals, below 180 mg/dl after meals, and between 90-150 mg/dl before bedtime. Then, it is called as high if the blood glucose is higher than 130 mg/dl before meals, more than 180 mg/dl after meals, and higher than 150 mg/dl before bedtime. The interface of food recommendation screens shown in Figure 4.27 as follows:

After several blood glucose checking in a day, just in case the user's blood glucose hit the upper limit that is set as 300 mg/dl more than 3 times, there will be a warning signs that will appears. The blood glucose warning screen interface shown on the Figure 4.28.

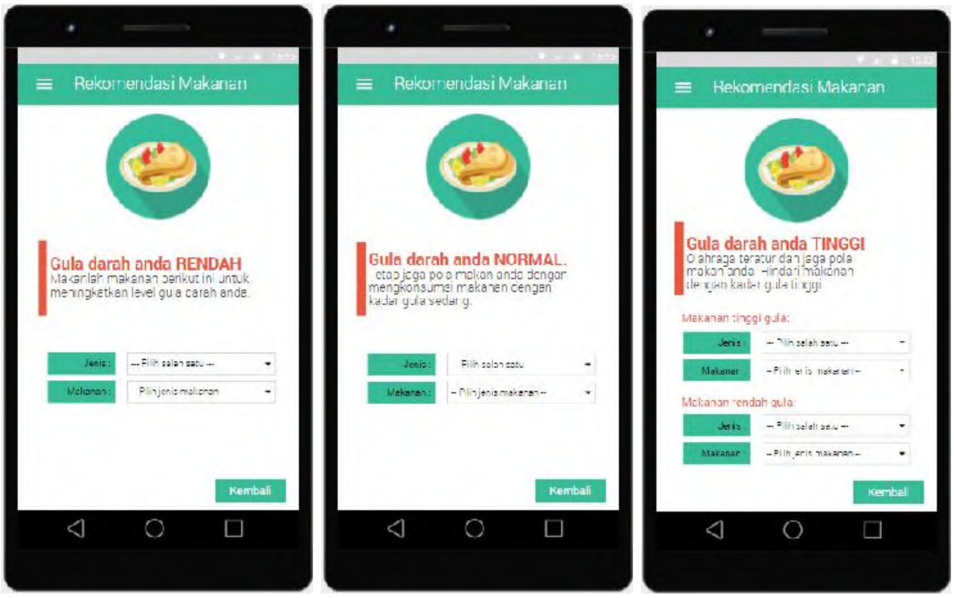


Figure 4.27 Food Recomendation Screens

Figure 4.28 Warning Screen

8. Report Screen

Previously, already mentioned that there are two main menus, which are blood glucose input and report menu. Report menu will displays the blood glucose level throughout the month. The interface of report screen shown in Figure 4.29.

Figure 4.29 Report Screen

4.6 System Testing

After the application prototype already developed, the next step is to test the prototype into the user. The testing process is done by using Nielsen's Ten Heuristic method by giving the user questionnaire that consists of four strategic kansei words along with semantic differential scale. After the user was given the explanation regarding the application, they try to use the application and fill the questionnaire. The questionnaire recapitulation shown on Table 4.28.

Table 4.28 Satisfaction Level Recapitulation

	Data Record Presistence	Ease of Use	Data Presentation	Visual Attractiveness
1	4	4	4	5
2	3	4	3	4
3	3	5	3	4
4	5	4	4	4
5	4	4	4	5
6	3	5	4	3
7	4	3	5	4
8	3	4	4	4
9	3	3	4	5
10	4	3	4	4

Table 4.28 Satisfaction Level Recapitulation (con't)

	Data Record Presistence	Ease of Use	Data Presentation	Visual Attractiveness
11	4	4	5	5
12	3	3	3	4
13	4	4	3	4
14	4	4	4	5
15	4	4	3	4
Median	4	4	4	4
Modus	4	4	4	4
Level	4	4	4	4

The next step is comparing the satisfaction level with initial questionnaire regarding the kansei words selection. Then, median and mode of the selected kansei words were calculated. The aim of this comparison is ti find thge GAP between those two. The initial selected kansei word recapitulation shown in Table 4.29

Table 4.29 Median and Mode of Initial Kansei Questionnaire

	Data Record Persistence	Ease of Use	Data Presentation	Visual Attractiveness
Median	4	3	3	4
Mode	4	3	3	4
Level	4	3	3	4

Here, both of the tables were combined to find the GAP if the satisfaction level below the kansei initial level, the design should be revised. If the satisfaction level above the initial level, it means that the prototype already fulfill the user's requirements. The comparison table shown in following Table 4.30

Table 4.30 Comparison of Kansei Initial Level and Satisfaction Level

	Kansei Initial Level	Satisfaction Level	GAP
Data Record Persistence	4	4	0
Ease of Use	3	4	+1
Data Presentation	3	4	+1
Visual Attractiveness	4	4	0

Based on the Table 4.30, can be inferred that most of all the satisfaction level are above the kansei initial level. Eventhough there are several functions of the planned application than cannot be performed by the prototype which are reminder and sending report, the prototype of mControl is already reflects the user requirements. Thus, in the final application development, the protoype is good to be used as the basis.

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CHAPTER V
DATA ANALYSIS AND EVALUATION

This chapter consists of analysis and discussion about the implementation of Kansei Engineering on the development of Self Monitoring Blood Glucose Android application.

5.1 User Requirement Gathering Analysis

This chapter will discuss the result of the user requirement gathering that already done in Chapter IV. In this section, there will be explained about the output of Feedback Capture after Task (FCAT).

5.1.1 Feedback Capture after Task (FCAT) Analysis

Feedback Capture after Task or FCAT is one of many approach to find the Kansei words from the customer after they performed a couple of task in a similar application. This method aimed to capture the spoken and unspoken language of the users while using the application. In this research, five prospected users that have diabetes type 2 was tested to do five tasks in BeatO application. The tasks starting from creating an account, inputing the blood glucose, knowing whether a food is good or bad for blood glucose, editing the profile, and the last is reading the blood glucose report. Here, the feedback was noted to be extracted later into kansei words.

The first impression of the users in performing the given tasks is a language problem. Eventually, there is no similar application provided in Bahasa. All of them are in English. Thus, the users are finding it hard to understand how to use the application without guidance. But, icons usage play a big role of the application to communicate with the user. The second result is Indonesian users tend to get confused with a lot of function provided by BeatO application, regarding the age restriction. Mobile health application is new to them. Majorly, the users only use their smartphone to communicate through messaging or chat application. They need a clear and concise application that meets their needs. A lot of information on one screen may confuse them. Thus, can be concluded, that the proposed Self-Monitoring application should be made simple and concise.

The output of Feedback Capture After Task (FCAT) that already done was extracted to be 22 kansei words and arranged into a 5-point semantic differential questionnaire that was spread into 60 type 2 diabetes respondents in Surabaya.

5.2 Analysis of Statistical Analysis Result

This subchapter will explain the result of the statistical analysis done in this research. The analysis consist of Factor Analysis done by SPSS Statistics 17 and Partial Least Squares (PLS) Analysis done by using Excel XLSTAT 2016.

5.2.1 Analysis of Factor Analysis Result

Factor Analysis was conducted to find a small number of factors which will constitute the application design elements. Factor Analysis in this research was done by using SPSS 17 with kansei checklist questionnaire recapitulation as the input. By using this software, there are nine outputs obtained which are Descriptive Statistics, Correlation Matrix, KMO and Bartlett's Test, Scree Plot, Component Matrix, Reproduced Correlations, Rotated Component Matrix, Total Variance Explained, and Component Transformation Matrix. But in Kansei Engineering, it is only focused on five output. The first is Descriptive Statistics which explain general information of the data, then KMO and Bartlett's Test to test the data adequacy, the third is Scree Plot to determine how many component obtained, then Rotated Component Matrix to know what variables that are including in a component, and the last is Total Variance Explained that shows the distribution of the contribution of each component.

The first output is descriptive statistics as shown in Table 4.11. From the mean column, can be seen that the respondents put cheap as their priority, followed by clear, accurate, simple, and good. These top five kansei represents the Feedback Capture after Task (FCAT) output that already done previously.

The second important output is Kaiser Meyer Olkin (KMO) and Bartlett's Test. KMO measures the sampling adequacy, while Bartlett's Test indicate the strength of the relationship among variables. From the Kaiser Meyer Olkin (KMO) and Bartlett's Test results as shown in Table 4.13, KMO value is 0.475 which is barely accepted. It means that the number of 60 samples are enough to represent the population. Recommended value of KMO should be close than 0.5 for satisfactory. Minimum of 0.5 KMO value is recommended, values between 0.7 until 0.8 are acceptable, and values that are more than 0.9 are incredible (Kaiser, 1974). On the Bartlett's Test, it works by rejecting or accepting the null hypothesis which states that the correlation matrix is an identity matrix. The closer the value to 0 means the stronger correlation matrix to reject the null hypothesis. On Table 4.13, significancy value of Bartlett's Test has 0.00 value. Thus, can be concluded that the correlation matrix is not an identity matrix.

22 variables were extracted into 9 components as shown on the scree plot on Figure 4.2. It is because that there are 9 variables with eigen value more than 1. Variables that are included on each component explained on the rotated component matrix as shown in Table 4.14. the correlation value was shown on the Total Variance Explained in Table 4.15. From this table, 9 component can represent 76,108% of the total variables. On the product development, it is hard to fulfill all of the customer requirements to the product. Thus, a trade-off should be done to choose several aspects to be focused on. Thus, in this case, components that have a value below the mean, which is 1.860 should be neglected. As the result, components 1, 2, 3, and 4 are chosen to be used to construct the design elements.

Table 4.16 list the top 14 Kansei words with the highest weight for components 1, 2, 3, and 4. Then, based on the variables that consist on each component, it is named as 'data record persistence', 'ease of use', 'data presentation', and the last is 'visual attractiveness'.

From four selected Kansei words, Item/Category Classification were done to find several alternative design elements that are related to the selected kansei. As the result, there are 7 items of application part and 14 categories related with the selected Kansei, 2 categories for each item.

5.2.2 Analysis of Partial Least Square (PLS) Result

Partial Least Square (PLS) is used to identify the influential design elements by finding the relationship between the item/category classification and the four chosen kansei words. Using Excel XLSTAT as the tool, there are three design elements that have significant influence to the Kansei words. Those design elements are ‘color scheme – light’, ‘language – Bahasa’, and ‘input dialog – typing’. These categories called as premium kansei. That premium kansei was selected because that three categories have the biggest positive values. In contrast, other options with biggest negative value should be avoided.

5.3 Analysis of Self-Monitoring of Blood Glucose Application

Subchapter follows will discuss about Self-Monitoring of Blood Glucose application which named as mControl. The material discuss will cope of application interface and application user testing.

5.3.1 Application Interface

In order to achieve good user experience, color scheme for the application was determined. At the end the application use turquoise color as the main color scheme, by considering that mControl is a health application. Partial Least Squares procedure that already done before got three premium kansei, which are ‘color scheme – light’, ‘language – Bahasa’, ‘input dialog – typing’. Considering that the first premium kansei is color scheme – light, turquoise and white was choosen because this color have a good contrast and has trustworthy, dependable, peace, trust, calming, safety, and peaceful emotion. As mentioned on the subchapter 4.2.1 as the factor analysis result, there are four selected kansei components which are data record persistence, ease of use, data presentation and visual attractiveness. Thus, the turquoise color choosing can cope on the selcted kansei and premium kansei both from its appearences and emotion gave to the user.

Self-Monitoring of Blood Glucose application or mControl was designed into several screens. The main mControl screens consists of Splash, registration, login, sign up, regimen choosing, reminder, home, blood glucode input, food recommendation, and the last is report screen. Each of the screen was designed as simple as possible with minimum contents on each screen to reduce the user’s confussion in interacting with the application.

5.3.2 Application User Testing

The application prototype testing is done by comparing the initial kansei level with user satisfaction level. The selected kansei components consists of data record persistence, ease of use, data presentation, and visual attractiveness were measured its suitability with the application prototype. At the development process, the final application is expected to have a reminder function. As this research is focusing on the design especially the Kansei Engineering process, there are several planned functions of the application that cannot be coped by the prototype. The first is reminder function that should be appeared on the swipe down menu. On the planned design, once the user click the notification bar, the application will automatically appear on to the the blood glucose input screen. But, in the prototype, such function cannot be simulated, but still can be designed its interface. On the user testing, this function is not really matter because eventhough the prototype can perform this function, it means that the application testing should be done at the specified time. Second function that cannot be performed by the application is sending the graph to the doctor. Basically, the application prototype facilitate the designer to design the application interface that can perform simple functions. After the interface and user experience already defined, the prototype will be used by the application developer to built the real one.

Based on the application testing result, the users are satisfied with the application, indicated by the satisfaction level that are equals and more than the initial kansei level. From the function matter, the mControl application helps the user by reminding them at the checking time, recording their blood glucose, and providing report.

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ATTACHMENT 1
KANSEI QUESTIONNAIRE

KUESIONER PENELITIAN

Kepada
Bapak/Ibu/Saudara/Saudari

Dengan hormat,

Saya Aufaria Rosa Irfoni, mahasiswi Jurusan Teknik Industri Institut Teknologi Sepuluh Nopember Surabaya dan saya saat ini sedang dalam proses penulisan skripsi. Sehubungan dengan penyelesaian skripsi yang berjudul ***"Implementasi Kansei Engineering dalam Aplikasi Monitoring Gula Darah Mandiri Berbasis Android untuk Membantu Penderita Diabetes Tipe 2 Non-Insulin"*** dilakukan penyebaran kuesioner untuk mengumpulkan data.

Saat ini, jumlah penderita diabetes terus mengalami peningkatan. Namun, kesadaran penderita diabetes untuk melakukan tes gula darah mandiri masih sangat rendah. Sebetulnya, di luar negeri sudah banyak aplikasi yang membantu program tes gula darah mandiri ini. Namun dikarenakan perbedaan demografi dan budaya, aplikasi tersebut tidak cocok intuk diaplikasikan di Indonesia. Oleh karena itu, penelitian ini dilakukan untuk mengetahui persepsi *user* di Indonesia mengenai aplikasi kontrol gula darah.

Saya mohon kesediaan Bapak/Ibu/Saudara/Saudari meluangkan waktu untuk mengisi kuesioner penelitian ini. Seluruh informasi pribadi yang diberikan akan dijaga kerahasiaannya.

Atas partisipasi Bapak/Ibu/Saudara/Saudari saya sampaikan terima kasih.

Hormat saya,
Aufaria Rosa Irfoni

Nomor Kuesioner : ____________________

Tanggal Pengisian : ___________Juni 2016

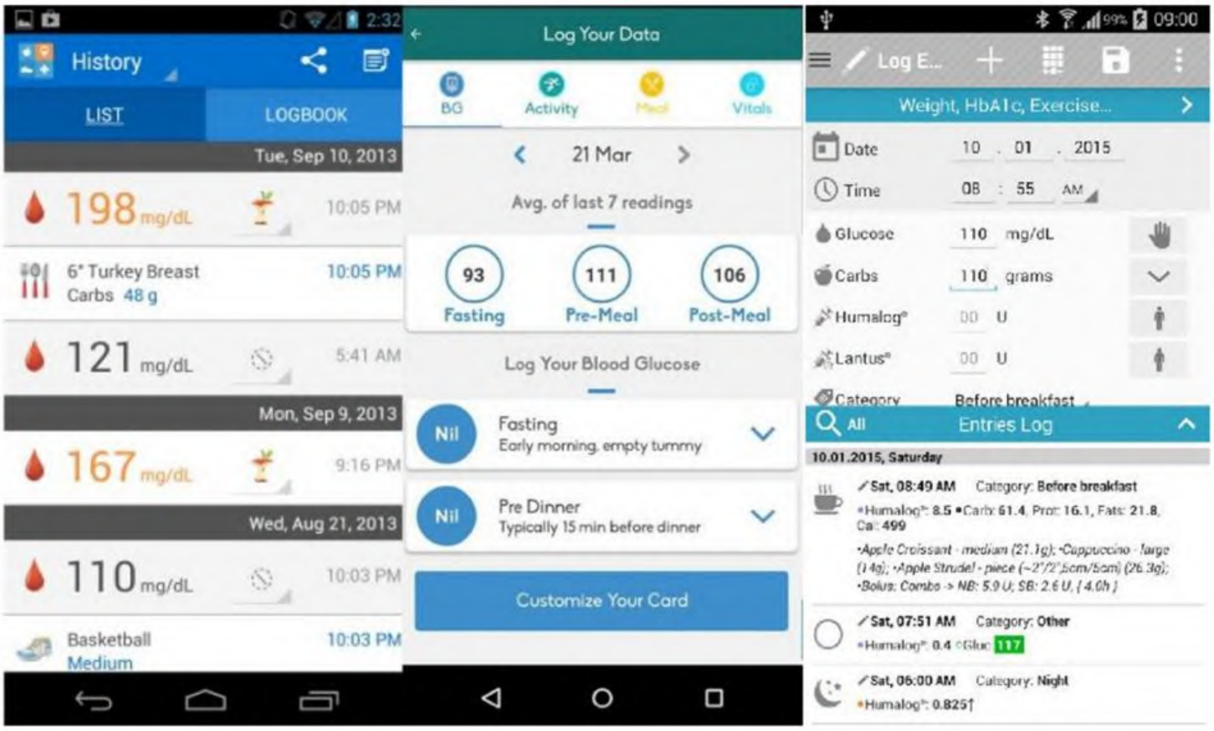
PROFIL RESPONDEN

Jenis Kelamin : ☐ Laki laki ☐ Perempuan

Umur : _____________ tahun

PENGAMATAN GAMBAR

Pada bagian ini anda akan mengamati tampilan muka dari beberapa aplikasi kontrol diabetes. Gambar gambar berikut akan menjadi acuan anda untuk menjawab pertanyaan pada bagian selanjutnya.



Diabetes Applications (play.google, 2016)

SEMANTIC DIFFERENTIAL

Pernyataan pada bagian ini mewakili beberapa **kata sifat** dari aplikasi diabetes yang ada di pasaran. Berdasarkan gambar yang anda lihat pada halaman sebelumnya, berikan pendapat seberapa pentingkah sifat sifat tersebut untuk diaplikasikan pada sebuah aplikasi diabetes dengan memberikan **tanda centang (√)** pada salah satu kolom yang tersedia.

Kolom di bawah ini akan mewakili 5 skala. Pilihlah nilai skala yang sesuai dengan pendapat anda. Berikut merupakan keterangan mengenai kelima skala tersebut.

1 : Sangat tidak setuju
2 : Tidak setuju
3 : Cukup setuju
4 : setuju
5 : Sangat setuju

Kansei Words		Semantic Differential (SD)					Kansei Words
		5	4	3	2	1	
1	Menarik						Tidak Menarik
2	Sederhana						Tidak Sederhana
3	Mudah						Sulit
4	Jelas						Tidak Jelas
5	Baru						Lama
6	Unik						Tidak unik
7	Intuitif						Tidak Intuitif
8	Profesional						Tidak Profesional
9	Konsisten						Tidak Konsisten
10	Akurat						Tidak Akurat
11	Detail						Tidak Detail
12	Sistematis						Tidak Sistematis
13	Murah						Tidak Murah
14	Inovatif						Tidak Inovatif
15	Fleksibel						Tidak Fleksibel
16	Formal						Formal
17	Rapi						Acak
18	Spesifik						Tidak spesifik
19	Modern						Kuno
20	Bagus						Jelek
21	Polos						Tidak polos
22	Praktis						Tidak praktis

"Terima kasih atas kesediaan Bapak/Ibu/Saudara/Saudari dalam mengisi kuesioner ini"

ATTACHMENT 2

FACTOR ANALYSIS RESULT

Reproduced Correlations

		Interesting	Simple	Easy	Clear	New	Unique	Intuitive	Professional	Consistent	Accurate	Detail	Systematic	Cheap	Innovative	Flexible	Formal	Neat	Specific	Modern	Good	Plain	Practical
Reproduced Correlation	Interesting	.840[a]	-.108	.152	.403	-.270	-.041	.025	-.109	-.003	.213	.046	-.117	-.010	.261	-.190	-.071	.137	.401	.234	-.014	-.070	-.481
	Simple	-.108	.770[a]	.096	-.050	.080	-.224	.177	-.174	-.167	.266	-.070	.087	.039	.000	-.398	.036	-.227	-.281	.162	-.013	-.246	.147
	Easy	.152	.096	.674[a]	.117	-.160	.075	.511	.206	.322	.094	-.155	-.142	.020	-.189	-.130	-.127	-.182	-.028	-.374	.079	-.029	.176
	Clear	.403	-.050	.117	.711[a]	-.543	-.163	.378	-.171	-.029	-.045	.039	.186	-.182	-.013	-.376	-.011	.249	-.129	.105	-.108	.114	-.190
	New	-.270	.080	-.160	-.543	.742[a]	.150	-.396	.092	-.178	-.109	-.021	-.024	-.080	-.331	.362	.055	-.379	.235	.072	.181	-.260	-.086
	Unique	-.041	-.224	.075	-.163	.150	.809[a]	-.128	.118	-.292	-.142	.104	.197	.190	-.009	.205	.108	.186	.308	-.235	-.307	-.118	-.080
	Intuitive	.025	.177	.511	.378	-.396	-.128	.770[a]	.001	.164	.046	-.166	-.120	.164	-.283	-.365	.023	.105	-.152	-.191	.008	.320	.112
	Professional	-.109	-.174	.206	-.171	.092	.118	.001	.828[a]	.524	.441	-.172	.113	-.223	-.258	-.121	.236	-.495	.115	-.077	.328	.110	.390
	Consistent	-.003	-.167	.322	-.029	-.178	-.292	.164	.524	.734[a]	.286	-.078	-.104	-.168	-.019	-.052	-.162	-.389	-.155	-.237	.413	.134	.426
	Accurate	.213	.266	.094	-.045	-.109	-.142	.046	.441	.286	.753[a]	-.166	-.052	.083	.154	-.474	.278	-.260	.173	.291	.185	.122	.159
	Detail	.046	-.070	-.155	.039	-.021	.104	-.166	-.172	-.078	-.166	.826[a]	.528	.254	.221	.095	-.642	.029	-.042	-.066	.346	-.104	-.121
	Systematic	-.117	.087	-.142	.186	-.024	.197	-.120	.113	-.104	-.052	.528	.828[a]	-.232	-.048	-.176	-.245	-.204	-.284	-.003	.169	-.273	.133
	Cheap	-.010	.039	.020	-.182	-.080	.190	.164	-.223	-.168	.083	.254	-.232	.843[a]	.249	.015	-.122	.428	.322	-.024	-.009	.388	-.179
	Innovative	.261	.000	-.189	-.013	-.331	-.009	-.283	-.258	-.019	.154	.221	-.048	.249	.818[a]	-.003	-.226	.325	-.066	.021	-.224	-.113	-.001
	Flexible	-.190	-.398	-.130	-.376	.362	.205	-.365	-.121	-.052	-.474	.095	-.176	.015	-.003	.664[a]	-.228	.050	.119	-.271	-.017	-.126	-.088
	Formal	-.071	.036	-.127	-.011	.055	.108	.023	.236	-.162	.278	-.642	-.245	-.122	-.226	-.228	.819[a]	.090	.228	.317	-.359	.229	-.015

Reproduced Correlations

		Interesting	Simple	Easy	Clear	New	Unique	Intuitive	Professional	Consistent	Accurate	Detail	Systematic	Cheap	Innovative	Flexible	Formal	Neat	Specific	Modern	Good	Plain	Practical
	Neat	.137	-.227	-.182	.249	-.379	.186	.105	-.495	-.389	-.260	.029	-.204	.428	.325	.050	.090	.792[a]	.139	.028	-.490	.322	-.329
	Specific	.401	-.281	-.028	-.129	.235	.308	-.152	.115	-.155	.173	-.042	-.284	.322	-.066	.119	.228	.139	.803[a]	.252	.044	.210	-.515
	Modern	.234	.162	-.374	.105	.072	-.235	-.191	-.077	-.237	.291	-.066	-.003	-.024	.021	-.271	.317	.028	.252	.599[a]	.034	.097	-.329
	Good	-.014	-.013	.079	-.108	.181	-.307	.008	.328	.413	.185	.346	.169	-.009	-.224	-.017	-.359	-.490	.044	.034	.727[a]	.078	.084
	Plain	-.070	-.246	-.029	.114	-.260	-.118	.320	.110	.134	.122	-.104	-.273	.388	-.113	-.126	.229	.322	.210	.097	.078	.693[a]	-.050
	Practical	-.481	.147	.176	-.190	-.086	-.080	.112	.390	.426	.159	-.121	.133	-.179	-.001	-.088	-.015	-.329	-.515	-.329	.084	-.050	.701[a]
Residual[b]	Interesting		.043	-.043	-.103	.016	-.056	.036	.042	-.022	.006	.054	.043	-.019	-.063	.057	.008	.030	-.036	-.037	-.082	.071	.051
	Simple	.043		-.085	.031	-.032	.029	-.019	.059	.070	-.044	.042	.005	-.079	.021	.104	.024	-.024	.047	-.113	-.039	.143	-.068
	Easy	-.043	-.085		-.033	.004	-.078	-.159	-.067	-.094	.020	-.001	.088	-.013	.013	.022	.034	.062	-.023	.133	.026	.070	.064
	Clear	-.103	.031	-.033		.110	.045	-.008	.002	-.022	-.008	-.063	-.050	.053	.134	.044	.029	-.056	.061	-.048	.108	-.024	.044
	New	.016	-.032	.004	.110		-.052	.056	.032	-.005	.031	-.015	.035	-.009	.099	-.028	-.003	.093	-.010	-.060	-.004	.025	.037
	Unique	-.056	.029	-.078	.045	-.052		.005	-.051	.109	-.040	-.036	-.105	-.002	-.005	-.043	-.054	-.052	-.034	.101	.060	-.027	-.031
	Intuitive	.036	-.019	-.159	-.008	.056	.005		.090	.020	.002	.003	-.012	.025	.051	.066	.025	.036	-.033	.018	.023	-.131	-.018
	Professional	.042	.059	-.067	.002	.032	-.051	.090		-.021	-.057	.029	-.016	.015	.031	.049	.008	.061	-.019	-.007	-.016	-.051	-.024
	Consistent	-.022	.070	-.094	-.022	-.005	.109	.020	-.021		-.043	-.003	-.002	.036	-.046	-.028	-.017	-.008	-.052	.059	-.082	-.029	-.145
	Accurate	.006	-.044	.020	-.008	.031	-.040	.002	-.057	-.043		.021	.048	-.033	-.070	.116	-.011	.028	-.090	-.088	-.054	.045	-.078
	Detail	.054	.042	-.001	-.063	-.015	-.036	.003	.029	-.003	.021		-.056	-.066	-.049	.020	.048	-.026	-.021	-.043	-.117	.067	-.016
	Systematic	.043	.005	.088	-.050	.035	-.105	-.012	-.016	-.002	.048	-.056		.016	.010	.099	.039	.056	-.007	-.032	-.024	.051	-.026
	Cheap	-.019	-.079	-.013	.053	-.009	-.002	.025	.015	.036	-.033	-.066	.016		-.009	.016	.028	-.026	-.046	.088	.028	-.147	.002
	Innovative	-.063	.021	.013	.134	.099	-.005	.051	.031	-.046	-.070	-.049	.010	-.009		.012	.071	-.002	.060	-.043	.129	-.006	.013
	Flexible	.057	.104	.022	.044	-.028	-.043	.066	.049	-.028	.116	.020	.099	.016	.012		.098	.008	-.073	.005	-.003	.044	-.042

Reproduced Correlations

	Interesting	Simple	Easy	Clear	New	Unique	Intuitive	Professional	Consistent	Accurate	Detail	Systematic	Cheap	Innovative	Flexible	Formal	Neat	Specific	Modern	Good	Plain	Practical
Formal	.008	.024	.034	.029	-.003	-.054	.025	.008	-.017	-.011	.048	.039	.028	.071	.098		-.019	-.024	-.070	.070	-.020	-.047
Neat	.030	-.024	.062	-.056	.093	-.052	.036	.061	-.008	.028	-.026	.056	-.026	-.002	.008	-.019		-.042	.048	.043	-.052	.019
Specific	-.036	.047	-.023	.061	-.010	-.034	-.033	-.019	-.052	-.090	-.021	-.007	-.046	.060	-.073	-.024	-.042		-.077	.023	.038	.116
Modern	-.037	-.113	.133	-.048	-.060	.101	.018	-.007	.059	-.088	-.043	-.032	.088	-.043	.005	-.070	.048	-.077		.028	-.142	.102
Good	-.082	-.039	.026	.108	-.004	.060	.023	-.016	-.082	-.054	-.117	-.024	.028	.129	-.003	.070	.043	.023	.028		-.115	.051
Plain	.071	.143	.070	-.024	.025	-.027	-.131	-.051	-.029	.045	.067	.051	-.147	-.006	.044	-.020	-.052	.038	-.142	-.115		-.007
Practical	.051	-.068	.064	.044	.037	-.031	-.018	-.024	-.145	-.078	-.016	-.026	.002	.013	-.042	-.047	.019	.116	.102	.051	-.007	

Extraction Method: Principal Component Analysis.

a. Reproduced communalities

b. Residuals are computed between observed and reproduced correlations. There are 84 (36,0%) nonredundant residuals with absolute values greater than 0.05.

Component Transformation Matrix

Component	1	2	3	4	5	6	7	8	9
1	.702	-.069	.048	-.435	-.292	.254	.177	-.271	-.235
2	.172	.679	-.435	.207	.334	.193	.292	.052	-.200
3	.273	-.497	-.662	.289	.128	-.233	-.049	-.255	.136
4	.189	.058	.268	.439	-.330	-.574	.477	.077	-.154
5	.452	-.102	.458	.478	.411	.217	-.348	.086	-.049
6	.030	-.367	.030	-.357	.536	-.151	.383	.477	-.227
7	-.293	-.131	.259	.086	.326	.158	.429	-.712	-.032
8	.246	.143	.112	-.126	.119	-.029	.265	.065	.895
9	-.124	-.317	-.094	.333	-.319	.646	.363	.328	.075

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

ATTACHMENT 3

PARTIAL LEAST SQUARES (PLS) RESULT

SUMMARY STATISTICS

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	sd
R1	4	0	4	3.000	3.750	3.479	0.336
R2	4	0	4	3.333	4.000	3.833	0.333
R3	4	0	4	3.500	4.000	3.729	0.208
R4	4	0	4	3.500	4.000	3.729	0.208
R5	4	0	4	3.250	3.500	3.354	0.105
R6	4	0	4	3.250	3.667	3.438	0.185
R7	4	0	4	3.000	3.750	3.396	0.315
R8	4	0	4	3.333	4.000	3.646	0.292
R9	4	0	4	2.667	4.500	3.604	0.809
R10	4	0	4	2.750	3.667	3.313	0.399
R11	4	0	4	3.000	4.000	3.438	0.515
R12	4	0	4	3.250	4.000	3.563	0.343
R13	4	0	4	3.000	4.000	3.500	0.577
R14	4	0	4	3.333	4.000	3.688	0.275
R15	4	0	4	3.667	4.333	3.875	0.308
R16	4	0	4	3.000	3.750	3.479	0.336
R17	4	0	4	3.000	4.000	3.625	0.479
R18	4	0	4	2.667	4.000	3.375	0.551
R19	4	0	4	3.333	4.333	3.854	0.421
R20	4	0	4	3.250	4.000	3.729	0.356
R21	4	0	4	3.333	4.333	3.854	0.421
R22	4	0	4	3.000	4.500	3.563	0.718
R23	4	0	4	3.000	4.333	3.583	0.687
R24	4	0	4	3.000	3.750	3.479	0.336
R25	4	0	4	3.333	3.750	3.563	0.185
R26	4	0	4	3.250	4.000	3.479	0.349
R27	4	0	4	3.667	4.250	3.917	0.264
R28	4	0	4	3.333	4.000	3.771	0.315
R29	4	0	4	3.000	4.000	3.542	0.417
R30	4	0	4	3.667	4.333	3.938	0.299
R31	4	0	4	3.333	3.750	3.563	0.185
R32	4	0	4	3.500	3.667	3.583	0.096
R33	4	0	4	3.500	4.000	3.792	0.250

SUMMARY STATISTICS

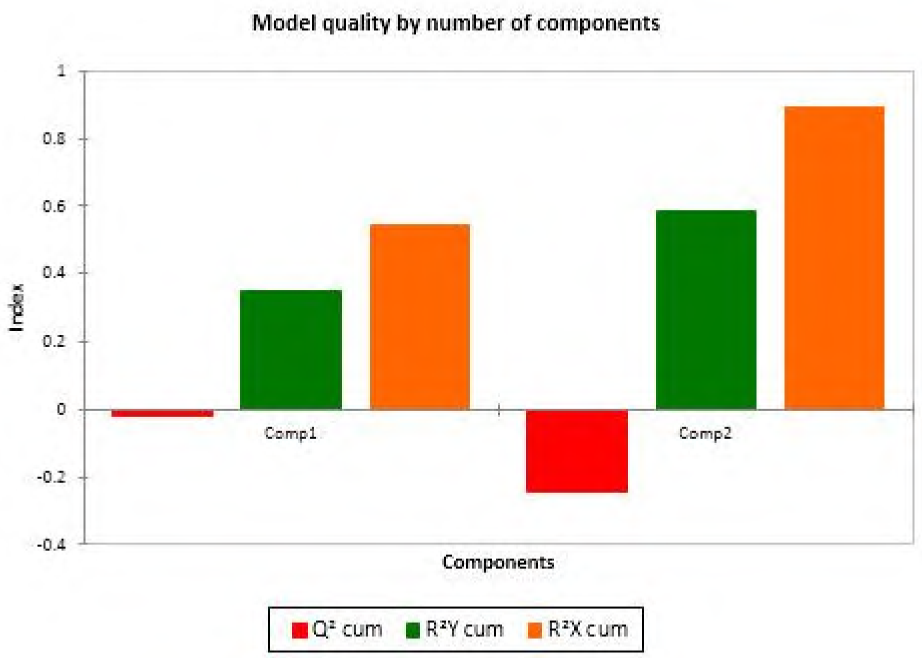
Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	sd
R34	4	0	4	3.500	4.333	3.938	0.416
R35	4	0	4	3.667	4.250	3.917	0.264
R36	4	0	4	3.333	3.750	3.625	0.198
R37	4	0	4	3.250	4.250	3.708	0.493
R38	4	0	4	3.333	4.250	3.771	0.427
R39	4	0	4	3.250	3.750	3.500	0.245
R40	4	0	4	3.333	3.750	3.625	0.198
R41	4	0	4	3.000	3.750	3.479	0.336
R42	4	0	4	3.000	3.750	3.521	0.349
R43	4	0	4	3.250	4.000	3.479	0.349
R44	4	0	4	3.333	3.750	3.625	0.198
R45	4	0	4	3.500	3.667	3.583	0.096
R46	4	0	4	3.000	3.750	3.521	0.349
R47	4	0	4	3.000	3.750	3.479	0.336
R48	4	0	4	3.000	3.750	3.521	0.349
R49	4	0	4	3.333	4.000	3.542	0.315
R50	4	0	4	3.333	3.750	3.625	0.198
R51	4	0	4	3.250	4.000	3.479	0.349
R52	4	0	4	3.000	4.000	3.500	0.430
R53	4	0	4	3.000	4.000	3.750	0.500
R54	4	0	4	3.000	4.000	3.375	0.479
R55	4	0	4	3.000	4.250	3.729	0.542
R56	4	0	4	3.333	3.750	3.625	0.198
R57	4	0	4	3.250	3.750	3.583	0.226
R58	4	0	4	3.333	4.000	3.771	0.315
R59	4	0	4	3.333	4.000	3.688	0.275
R60	4	0	4	3.333	3.750	3.625	0.198
Color Scheme - Light	4	0	4	2.000	4.000	3.500	1.000
Color Scheme - Dark	4	0	4	2.000	4.000	2.500	1.000
Language - English	4	0	4	1.000	4.000	2.500	1.291
Language - Bahasa	4	0	4	2.000	5.000	3.500	1.291
Main Activity - List Fragment	4	0	4	1.000	2.000	1.500	0.577
Main Activity - Details Fragment	4	0	4	4.000	5.000	4.500	0.577
Notification - Alarm	4	0	4	2.000	4.000	3.000	1.155
Notification - Drop Down	4	0	4	2.000	4.000	3.000	1.155

SUMMARY STATISTICS

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	sd
Input Dialog - Scrol Bar	4	0	4	1.000	5.000	2.250	1.893
Input Dialog - Typing	4	0	4	1.000	5.000	3.750	1.893
Input Method - Click the Icon	4	0	4	2.000	4.000	3.500	1.000
Input Method - Click the Regimen	4	0	4	2.000	4.000	2.500	1.000
Report Shape - Line Chart	4	0	4	4.000	5.000	4.250	0.500
Report Shape - Bar Chart	4	0	4	1.000	2.000	1.750	0.500

MODEL QUALITY

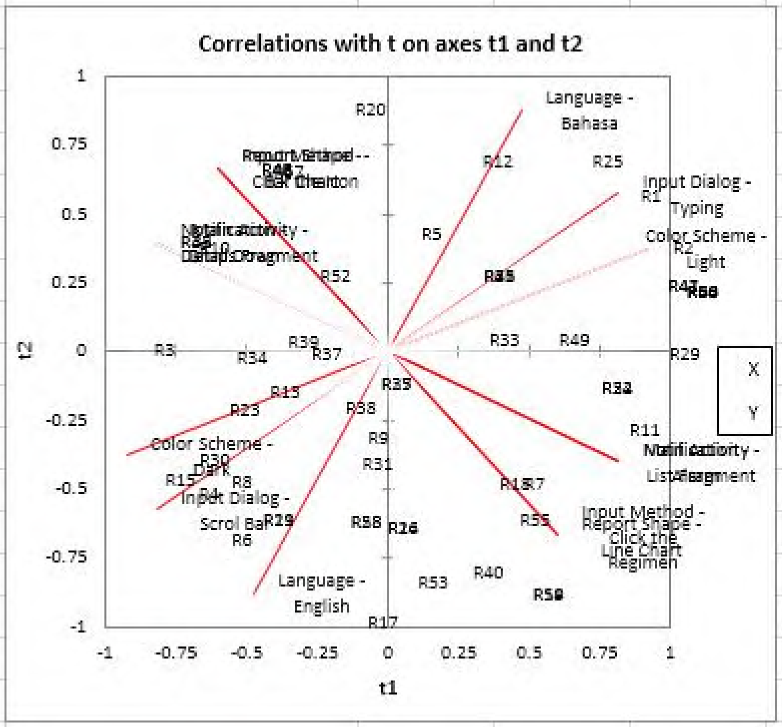
Index	Comp1	Comp2
Q^2 cum	-0.020	-0.246
R^2Y cum	0.349	0.585
R^2X cum	0.544	0.894



Correlation matrix of the variables with the t and u~ components:

Variable	t1	t2	u~1	u~2
Color Scheme - Light	0.924	0.377	0.957	0.511
Color Scheme - Dark	-0.924	-0.377	-0.957	-0.511
Language - English	-0.474	-0.875	-0.567	-0.933
Language - Bahasa	0.474	0.875	0.567	0.933
Main Activity - List Fragment	0.818	-0.399	0.712	-0.360
Main Activity - Details Fragment	-0.818	0.399	-0.712	0.360
Notification - Alarm	0.818	-0.399	0.712	-0.360
Notification - Drop Down	-0.818	0.399	-0.712	0.360
Input Dialog - Scrol Bar	-0.817	-0.575	-0.857	-0.662
Input Dialog - Typing	0.817	0.575	0.857	0.662
Input Method - Click the Icon	-0.602	0.668	-0.585	0.460
Input Method - Click the Regimen	0.602	-0.668	0.585	-0.460
Report Shape - Line Chart	0.602	-0.668	0.585	-0.460
Report Shape - Bar Chart	-0.602	0.668	-0.585	0.460
R1	0.810	0.566	0.834	0.627
R2	0.924	0.377	0.957	0.511
R3	-0.911	0.007	-0.952	-0.216
R4	-0.756	-0.518	-0.744	-0.519
R5	0.033	0.430	-0.044	0.218
R6	-0.639	-0.688	-0.653	-0.678
R7	0.397	-0.483	0.241	-0.583
R8	-0.639	-0.474	-0.757	-0.684
R9	-0.156	-0.316	-0.309	-0.537
R10	-0.754	0.374	-0.778	0.132
R11	0.770	-0.285	0.656	-0.291
R12	0.250	0.690	0.225	0.550
R13	-0.503	-0.147	-0.623	-0.404
R14	0.429	-0.880	0.308	-0.833
R15	-0.872	-0.470	-0.925	-0.609
R16	-0.086	-0.640	-0.249	-0.800
R17	-0.157	-0.983	-0.265	-0.991
R18	0.311	-0.482	0.151	-0.604
R19	-0.527	-0.613	-0.659	-0.798
R20	-0.201	0.880	-0.168	0.724
R21	-0.527	-0.613	-0.659	-0.798
R22	0.672	-0.132	0.554	-0.194
R23	-0.647	-0.215	-0.756	-0.464
R24	-0.086	-0.640	-0.249	-0.800
R25	0.639	0.688	0.653	0.678
R26	0.255	0.278	0.157	0.097

Variable	t1	t2	u~1	u~2
R27	-0.110	-0.114	-0.250	-0.347
R28	-0.217	-0.622	-0.375	-0.799
R29	0.911	-0.007	0.952	0.216
R30	-0.754	-0.397	-0.852	-0.608
R31	-0.176	-0.407	-0.332	-0.618
R32	-0.818	0.399	-0.712	0.360
R33	0.273	0.044	0.401	0.296
R34	-0.621	-0.023	-0.718	-0.286
R35	-0.110	-0.114	-0.250	-0.347
R36	0.974	0.220	0.977	0.342
R37	-0.357	-0.005	-0.476	-0.265
R38	-0.236	-0.202	-0.378	-0.441
R39	-0.439	0.034	-0.548	-0.231
R40	0.216	-0.800	0.060	-0.866
R41	0.906	0.240	0.964	0.439
R42	-0.533	0.662	-0.530	0.444
R43	0.255	0.278	0.157	0.097
R44	0.974	0.220	0.977	0.342
R45	-0.818	0.399	-0.712	0.360
R46	-0.533	0.662	-0.530	0.444
R47	0.906	0.240	0.964	0.439
R48	-0.533	0.662	-0.530	0.444
R49	0.521	0.043	0.405	-0.074
R50	0.974	0.220	0.977	0.342
R51	0.255	0.278	0.157	0.097
R52	-0.326	0.274	-0.413	0.015
R53	0.021	-0.838	-0.135	-0.927
R54	0.672	-0.132	0.554	-0.194
R55	0.382	-0.609	0.225	-0.688
R56	0.974	0.220	0.977	0.342
R57	-0.492	0.655	-0.496	0.433
R58	-0.217	-0.622	-0.375	-0.799
R59	0.429	-0.880	0.308	-0.833
R60	0.974	0.220	0.977	0.342



W VECTORS

Variable	w1	w2
Color Scheme - Light	0.353	0.179
Color Scheme - Dark	-0.353	-0.179
Language - English	-0.209	-0.409
Language - Bahasa	0.209	0.409
Main Activity - List Fragment	0.263	-0.225
Main Activity - Details Fragment	-0.263	0.225
Notification - Alarm	0.263	-0.225
Notification - Drop Down	-0.263	0.225
Input Dialog - Scrol Bar	-0.316	-0.257
Input Dialog - Typing	0.316	0.257
Input Method - Click the Icon	-0.216	0.258
Input Method - Click the Regimen	0.216	-0.258
Report Shape - Line Chart	0.216	-0.258
Report Shape - Bar Chart	-0.216	0.258

W* VECTORS:

Variable	w*1	w*2
Color Scheme - Light	0.353	0.207
Color Scheme - Dark	-0.353	-0.207
Language - English	-0.209	-0.425
Language - Bahasa	0.209	0.425
Main Activity - List Fragment	0.263	-0.204
Main Activity - Details Fragment	-0.263	0.204
Notification - Alarm	0.263	-0.204
Notification - Drop Down	-0.263	0.204
Input Dialog - Scrol Bar	-0.316	-0.283
Input Dialog - Typing	0.316	0.283
Input Method - Click the Icon	-0.216	0.241
Input Method - Click the Regimen	0.216	-0.241
Report Shape - Line Chart	0.216	-0.241
Report Shape - Bar Chart	-0.216	0.241

C VECTORS:

Variable	c1	c2
R1	0.295	0.258
R2	0.336	0.172
R3	-0.332	0.003
R4	-0.275	-0.236
R5	0.012	0.196
R6	-0.233	-0.313
R7	0.145	-0.220
R8	-0.233	-0.216
R9	-0.057	-0.144
R10	-0.275	0.171
R11	0.280	-0.130
R12	0.091	0.314
R13	-0.183	-0.067
R14	0.156	-0.401
R15	-0.317	-0.214
R16	-0.031	-0.291
R17	-0.057	-0.448
R18	0.113	-0.220
R19	-0.192	-0.279
R20	-0.073	0.401
R21	-0.192	-0.279

Variable	c1	c2
R22	0.245	-0.060
R23	-0.235	-0.098
R24	-0.031	-0.291
R25	0.233	0.313
R26	0.093	0.126
R27	-0.040	-0.052
R28	-0.079	-0.283
R29	0.332	-0.003
R30	-0.274	-0.181
R31	-0.064	-0.186
R32	-0.298	0.182
R33	0.099	0.020
R34	-0.226	-0.010
R35	-0.040	-0.052
R36	0.355	0.100
R37	-0.130	-0.002
R38	-0.086	-0.092
R39	-0.160	0.015
R40	0.079	-0.365
R41	0.330	0.109
R42	-0.194	0.302

Variable	c1	c2
R43	0.093	0.126
R44	0.355	0.100
R45	-0.298	0.182
R46	-0.194	0.302
R47	0.330	0.109
R48	-0.194	0.302
R49	0.190	0.020
R50	0.355	0.100
R51	0.093	0.126

Variable	c1	c2
R52	-0.118	0.125
R53	0.008	-0.382
R54	0.245	-0.060
R55	0.139	-0.278
R56	0.355	0.100
R57	-0.179	0.298
R58	-0.079	-0.283
R59	0.156	-0.401
R60	0.355	0.100

CHAPTER VI
CONCLUSION AND SUGGESTION

In this chapter, there will be several explanations about the conclusion of the research and also the suggestion that might be used for further research regarding this research field.

6.1 Conclusion

This chapter consists of the conclusion got from this reasearch. After several steps that has been done, there are three aspects that can be inferred, explain as follows:

1. Indonesian user's preferences on Self-Monitoring Blood Glucose mobile application were found by several steps of statistical analysis. Feedback Capture after Task (FCAT) was done to capture the user's thought and feeling after trying a similar product and performing given tasks. As the output, there are 22 kansei words that have been inferred from the interview and user's response. Then Factor Analysis was conducted to find the most important Kansei. As the result, 22 kansei words were extracted into 9 components that can represent 76,108% of the total variables. Seen from the Table 4.16, four out of nine components that has total squared loading which more than the mean of all components was selected. Then, those 4 were named as 'data record persistence', 'ease of use', 'data presentation', and 'visual attractiveness'. After that, the result from Factor Analysis will be interpreted to find the relationship between kansei and product properties by using Partial Least Squares (PLS) Analysis. To support the PLS calculation, identification of influential design components was performed. At last, the 'color scheme – light', 'language – Bahasa', and 'input dialog – typing' are selected as premium kansei that are used as the application design basis.
2. Second, the application elements was found with Partial Least Squares (PLS) Analysis. PLS is done using the data from selected Kansei words survey and the item/category list classification. From the PLS results 'color scheme –

light', 'language – Bahasa', 'input dialog – typing', are selected for premium kansei, because it have a big influence to the Kansei words. In contrast, 'color scheme dark', 'language – English', and 'input dialog – scroll bar' should be avoided.

3. Based on this research, the most suitable Self-Monitoring Blood Glucose (SMBG) application with the condition of type 2 diabetes patient in Indonesia should be made simple and concise to reduce the user's confussion in interacting with the application. From the statistical analysis, four main components which consisted of 'data record persistence', 'ease of use', 'data presentation', and 'visual attractiveness'was found. From Partial Least Squares (PLS) Analysis, these new concepts were transferred to new design specifications that became the basic design concepts. The selected design elements or premium kansei are 'color scheme – light', 'language – Bahasa', and 'input dialog – typing'.

6.2 Suggestion for Further Research

This subchapter discusses the suggestion of this research. The suggestions are made based on the mControl application that already developed.

1. The recommendation of food portion can be added into the application to give further information to the user.
2. The research regarding the Glycaemic Index (GI) of Indonesian food can be developed to add the database of what kind of food that are good or bad to be eaten by the diabetic patients.
3. Self-Moitoring of Blood Glucose program need to be socialized to inrease the diabetes patient awareness to monitor their blood glucose.

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