DEVELOPMENT OF SKIN MOISTURE SYSTEM

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2017

DECLARATION

I hereby declare that work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

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ABSTRACT

Every day the skin is bombarded with dust and particles. Our skin is cleverly designed to prevent evaporation of moisture from within its topmost layer. Yet when the skin dries out, this protective ability is lost and the integrity of our skin and our comfort suffer. Dryness can result from any number of things that remove water from the skin. Skin care products, weather, and bathing habits are the biggest offenders. Dry skin is the result of water loss in the stratum corneum - the surface layer of the epidermis. As the stratum corneum loses moisture, skin starts to become drier and drier, until it eventually begins to flake. Basically there is no specific range or reading to classify the skin type. Sometimes, a person might not even be aware that he or her skin is dry or that dry skin has its undesirable consequences. The dryness of a person's skin usually determined by an individual genetic, makeup and the environment or due to a person's profession. This make a lot of people hardly to know their skin type. They also hardly to know their skin requirement. The objective of this project is to measure the moist and dry skin, to analyze the type of moist and dry skin, to characterize the type of skin and lastly to design a software using MATLAB. By completing this project, two main work were carried out which are experiment towards subjects' skin moisture and design an automatic system to identify the skin moisture using MATLAB GUI.

ABSTRAK

Setiap hari kulit dihujani dengan debu dan zarah. Kulit kita bijak direka untuk menghalang penyejatan lembapan dari dalam lapisan yang paling atas. Namun apabila kulit kering, keupayaan perlindungan ini hilang, integriti kulit serta keselesaanya juga hilang. Kekeringan boleh disebabkan oleh pelbagai perkara yang membuang air daripada kulit. Produk penjagaan kulit, cuaca, dan tabiat mandi adalah penyumbang kekeringan kulit yang terbesar. Kulit kering adalah hasil daripada kehilangan air dalam corneum strata - berada pada lapisan permukaan epidermis. Apabila corneum strata kehilangan kelembapan, kulit mula menjadi lebih kering dan lebih kering, sehingga ia akhirnya mula mengelupas. Pada dasarnya tidak ada julat tertentu atau bacaan untuk mengklasifikasikan jenis kulit. Kadang kala, seseorang mungkin tidak sedar bahawa dia atau kulitnya kering atau kulit kering mempunyai kesan yang tidak diingini kepada individu tersebut. Kekeringan kulit seseorang biasanya ditentukan oleh individu genetik, alat solek dan alam sekitar atau kerana profesion seseorang. Ini membuat banyak orang tidak tahu jenis kulit mereka. Mereka juga tidak tahu keperluan kulit mereka. Objektif projek ini adalah untuk mengukur kulit lembap dan kering, untuk menganalisis jenis kulit lembap dan kering, untuk mencirikan jenis kulit dan akhir sekali untuk mereka bentuk perisian yang menggunakan MATLAB. Dengan melengkapkan projek ini, dua kerja utama telah dijalankan iaitu melakukan eksperimen terhadap kelembapan kulit subjek dan mereka bentuk sistem automatik untuk mengenalpasti kelembapan kulit dengan menggunakan MATLAB GUI.

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LIST OF ABBREVIATIONS

SC	Stratum Corneum
NMF	Natural Moisturizing Factor
TEWL	Transepidermal Water Loss
BIA	Bioelectric Impedance Analysis
TBW	Total Body Water
GUI	Graphical User Interface
PSA	Politeknik Shah Alam
JKE	Jabatan Kejuruteraan Elektrik

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Every day the skin is bombarded with dust and particles [1]. Our skin is cleverly designed to prevent evaporation of moisture from within its topmost layer. Yet when the skin dries out, this protective ability is lost and the integrity of our skin and our comfort suffer [1]. Dryness can result from any number of things that remove water from the skin. Skin care products, weather, and bathing habits are the biggest offenders [2]. Dry skin is the result of water loss in the stratum corneum - the surface layer of the epidermis. As the stratum corneum loses moisture, skin starts to become drier and drier, until it eventually begins to flake [3]. Cosmetic facial skin type has been used generally without any scientific explanation. He also stated that the skin type normally is classifies into four type. Which are oily, normal, dry and combination type. These skin types are causes by various factor [4]. Due to high temperature and high humidity in Malaysia the air trap dust mite, microorganism and etc, that clogging human face skin. Despite the high humidity, a person face still can be considered as dry or dehydrated. Most of Malaysian has oily skin type due to the weather. Nevertheless it does not mean a person skin is not dry. Because of the environment factor, the sun causes water to evaporate from skin, which is why a person still has a dehydrated condition despite they have an oily type of skin.

For the concept of this Development of Skin Moisture System, there is an additional on the software. The software will display a result of the categorization of human skin moisture. Either dry or moist. The result will be programmed using MATLAB software. The data of skin types will be collected randomly among 30 students of Jabatan Kejuruteraan Elektrik, Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam. The current technology of human skin device in the market only state the reading of the skin without displaying the classification of skin types.

1.2 Problem Statement

Facial skin type or cosmetic skin type is not a term that has been defined either scientifically or medically [5]. Basically there is no specific range or reading to classify the skin type. Sometimes, a person might not even be aware that he or her skin is dry or that dry skin has its undesirable consequences. The dryness of a person's skin usually determined by an individual genetic, makeup and the environment or due to a person's profession [6]. This make a lot of people hardly to know their skin type. They also hardly to know their skin requirement. So, with the Development of Skin Moisture System people can understand their skin types.

1.3 Objective

The main objective of this project is to develop skin moisture measuring system. To achieve that objective, there are four sub-objectives requirement:

1. To measure the moist and dry skin on subjects.
2. To analyze the type of moist and dry skin.
3. To characterize the type of skin.
4. To design a software using MATLAB.

1.4 Scope of Project

The purpose of this project is to develop skin moisture system. The algorithm were design by using MATLAB software while Digital Monitor Moisture Skincare is used to collect data by measuring respondent's type of skin. The experiment was held at ME007 Laboratory in JKE. This project focusing on two type of skin which are dry and moist then the system will be display the result of skin according to their categorization. According to the specification of Digital Moisture Monitor For Skin, the device can be operate in 5°C until 40°C and the device will display the result on LCD with percentages. The data is collected on 30 random student of JKE, PSA.

1.5 Significant of Project

The study proposes a system for skin moisture. The technique employs an algorithm MATLAB software to identify the type of human face skin. This method will automated display the type of skin either dry or moist. The system will assist a person to understand their skin condition in selecting a suitable treatment products for their own skin.

CHAPTER 2

LITERATURE REVIEW

2.1 Anatomy and Physiology of Skin

Skin is the largest organ of the body, it performs many vital functions, which is protection against external attack either in physical, chemical and biological form. Plus, it also prevent excess water loss from the body [7]. It has an area of approximately 16, 000 cm^2 for an adult and represents about 8% of the body weight [8]. The skin is composed of three primary layers which are epidermis, dermis and subcutaneous tissue. As shown in figure 2.1, each layer possess specific characteristics and functions. To understand a person skin types either dry or moist, the study will be more focus on the outermost layer of the skin which is epidermis layer.

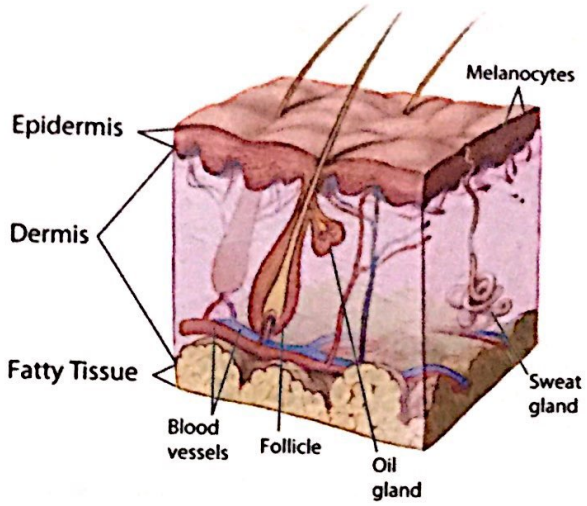


Figure 2.1: Skin Layers

2.1.1 Epidermis

The epidermis is the most outward layer of the skin. In cosmetic standpoint this layer is the most important. This is because, this layer gives the skin its texture and moisture, and contribute to skin colors. If the surface of the epidermis is dry and rough, the skin appears aged. An individual able to understand the basic knowledge of epidermis, a person able to improve the appearance of theirs' skin [9]. As shown in figure 2.2, epidermis also divided into five sub-layers. From the bottom which is the innermost stratum basale (basal cell layer), stratum spinosum (prickle cell layer), stratum granulosum (granular cell layer), stratum lucidum (clear layer) and the last one the outermost layer is stratum corneum (horny cell layer) [8].

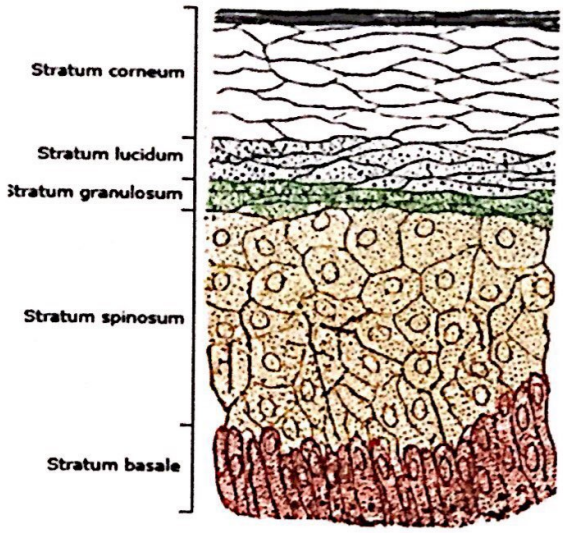


Figure 2.2: The Anatomy of Epidermis Layer

2.1.2 Stratum Corneum

Stratum Corneum (SC) is located at the outermost layer of epidermis. Under normal circumstances, the stratum corneum must be as impermeable or water - resistant as possible except for a small amount of water loss. The small amount of water loss is to hydrate the external layers of the stratum corneum to preserve its flexibility. It also to provide enough water to allow enzyme reactions that facilitate stratum corneum maturation events, together with corneodesmolysis and ultimately desquamation [10]. Stratum Corneum which is also known as horny cell layers provide mechanical protection to the underlying epidermis and a barrier to prevent water loss and invasion by foreign substances [7]. According to Warner et al in 'Correlation Of Water Content With Ulstrastructure In The Stratum Corneum', about one third of the outer layers of the stratum corneum are reported to contain less than 10% water content. The condition of the stratum corneum would be dysfunctional and brittle. This show how the condition of dry skin is or cosmetic xerosis. Other function of the SC is to prevent transepidermal water loss and regulate the water balance in the skin. The major components that allow the SC to

perform this role are lipids and the Natural Moisturizing Factor (NMF). NMF have the biggest contribution to the skin. It can be found in the cells of the stratum corneum. NMF also can absorb large amounts of water despite the humidity levels are low [9]. This make the NMF still can keep high water content even in dry environment.

In healthy skin the mature corneocytes contain high concentrations of the Natural Moisturizing Factor (NMF), low molecular weight, water-soluble compounds, which effectively bind water against the desiccating action of the environment [11].

2.1.3 Dry Skin

Dry skin has an opposition look with normal skin. It looks harsh and brittle scaly surface i.e, rough skin [12]. Dry skin also known as xerosis. Dry skin can be so mild that it hardly to be detect. This is the condition that always occur to some people where they complaints about the condition of their skin and spend a lot of cosmetic to overcome this condition. Dry skin is characterized by the deficit of moisture in the stratum corneum. Increase in transepidermal water loss (TEWL) is the cause to dry skin. TEWL is the results of defect in the permeability barrier which allows excessive water to be lost at the atmosphere [9]. Figure 2.3 shows the a condition of skin due to dry skin.

Figure 2.3: Dry Skin

The moisture volume in the stratum corneum is an important factor for the maintenance of skin shape and protection and is affected by surrounding environmental conditions such as temperature, humidity and air currents as well as internal factors such as sweat, moisture and protein in the keratin layer and body temperature. Age factors are not affecting skin hydration according to the previous study [13].

Eventually, dry skin is basically about barrier function of our skin. Some studies have reported a trend towards decreased TEWL (transepidermal water loss) with age. TEWL and skin hydration, when measured simultaneously, provide important information regarding skin function. One study show that the TEWL values of a very dry facial skin are higher than those of normal skin and the hydration of a very dry skin is lower than that of normal skin [13].

2.1.4 Oily Skin

Oily skin results from the overactivity of sebaceous glands and the overflow of excess sebum onto the skin. Although many patients classify

themselves as either dry or oily skinned, the two conditions are not mutually exclusive and most people have a combination of both skin types [14]. Sebum production plays an important role in skin hydration by producing glycerol, which is necessary for an intact skin barrier. In addition, sebum supplies lipids to the surface of the epidermis that may aid in preventing transepidermal water loss (TEWL). Excess sebum production produces oily skin, and in many cases, contribute to acne [15].

Human facial skin is covered with a lipid film derived from sebum and epidermal lipids. Sebum has various functions such as moisturizing, barrier protection and sterilization. Sebum secretions vary individually according to age, sex and body region [13]. Clinically, oily skin presents as lipid-laden secretions resulting in a shiny appearance mostly over the T-zone area (forehead, nose and chin).

2.1.5 Combination Skin

Combination skin is said to have dry skin on parts of the face and oily skin in the T-zone area. T-zone area is located at forehead and nose. This is commonly called combination. In addition, one may have oily skin on the face and dry skin on the body because of a lack of sebaceous glands on the arms and legs [15].

2.1.6 Sensitive Skin

Sensitive skin is a condition characterized by hyperactivity to environmental factors. Individuals experiencing this condition report exaggerated reactions to topical personal care products that may or may not be associated with visible symptoms. Those with frequent skin reactions learn to

limit their use of skin products to the few that do not cause irritation in order to avoid the annoyance of redness and itching that can interfere with everyday activities [15].

Baumann Sensitive Skin Classification as below:-

i. Type 1 Pimples and comedones.

ii. Type 2 Flushing.

iii. Type 3 Burning and stinging or itching.

iv. Type 4 Impaired barrier, contact and irritant dermatitis.

2.2 Skin Diagnosis

Skin diagnosis discussing about the medium that can be used to diagnose dry or moist skin. Its either using Bioelectric Impedance Analysis (BIA), capacitance or conductance principle and lastly system (MATLAB or Visual Basic).

2.2.1 Bioelectric Impedance Analysis (BIA)

The device that is used to collect water content(moisture) in the skin is Digital Monitor Moisture Skincare which can be obtain through ME007. This device is using Bioelectric Impedance Analysis (BIA) method. BIA is a method of estimating body composition [16]. It is noninvasive method. The technology is actually determines the electrical impedance of body tissues, which provides an estimate total body water (TBW). From the values of TBW, a person can then estimate fat - free mass and body fat or adiposity. The application for a commercialized BIA skin moisture sensor is towards cosmetics. The device is small in size. It is usually about the size of a small

stapler. At the tip of the device is the transducer. The transducer consists of two metal electrode rods. When the device is placed against the skin, the user can turn the device on. The current runs between the electrodes through the skin and the impedance is measured.

The advantage of BIA is it quick, easy, low - cost and noninvasive method that has been proposed as a alternative to laboratory-based techniques of measuring body composition [17]. The disadvantage of BIA method is that it is considered to be quite inaccurate in measuring body composition. BIA uses the conductivity of the human body exposed to a weak alternating current at 50kHz. Conductivity is correlated to body water pool and is expressed as the impedance or resistance. In this journal it state that the impedance is a function of resistance an reactance, where

$$Z = \sqrt{R^2 + X^2_c}.$$

Resistance (R) is a measure of pure opposition to current flow through the body; reactance (Xc) is the opposition to current flow caused by capacitance produced by the cell membrane [17].

2.2.2 Capacitance or Conductance Principle

The moisture level of the skin is typically measured using one of two principles: capacitance or conductance. These two application is said to be easy to understand if one considers a simple electrical model of the skin as a resistor in parallel with a capacitor. This is because the value of both components is influenced by the water content of the skin, either the resistive component or the capacitive component may be measured. The best example of commercialized device to represent these two principles are the Corneometer which using capacitance principle and Skicon - 200 which using conductance principle [10]. The measurement of conductance is based on a

resistor-capacitor circuit. The capacitance principle operates at a mean frequency of 1MHz which is between 1.15MHz - very dry; 0.9 MHz - very hydrated. There is a good correlation between these two methods. A lack of low levels of hydration for the conductance method and a lack of sensitivity of the capacitance method at very high levels of hydration [10].

2.2.3 System

The system that is going to use for this research is focusing on their interface function. The user interface that are commonly used in the institution are MATLAB GUI and Visual Basic. These two programming software containing a user interface setup where a programmer can build an automatic system interface for the users.

2.2.3.1 MATLAB

MATLAB is a high - performance language for technical computing. It integrates computation, visualization and programming in an easy - to -use environment where problems and solutions are expressed in familiar mathematical notation [15].

Typical uses include:

i. Math and computation

ii. Algorithm development

iii. Modeling, simulation and prototyping

iv. Data analysis, exploration, and visualization

v. Scientific and engineering graphics

vi. Application development, including graphical user interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows user to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non - interactive language such as C or Fortran. The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by LINPACK and EISPACK projects. Today, MATLAB uses software developed by the LAPACK and ARPACK projects, which together represent the state-of-the-art in software for matrix computation.

The Graphical User Interface (GUI) was developed using MATLAB Graphical User Interface Development Environment (GUIDE). The system that is going to be develop is an automatic system where a subjects' skin moisture reading will be display together with the recommendation which suitable for their skin type either dry or moist.

2.2.3.2 MATLAB GUI

A user interface (UI) is a graphical display in one or more windows containing controls, called components, that enable a user to perform interactive tasks. The user does not have to create a script or type commands at the command line to accomplish the tasks. Unlike coding programs to accomplish tasks, the user does not need to understand the details of how the tasks are performed [18].

UI components can include menus, toolbars, pushbuttons, radio buttons, list boxes, and sliders just to name few. UIs created using MATLAB tools can also perform any type of computation, read and write data files, communicate with other UIs, and display data as tables or as plots.

The UI contains these components:

i. An axes component.

ii. A pop-up menu listing three data sets that correspond to MATLAB function: peaks, membrane, and sinc.

iii. A static text component to label the pop-up menu

iv. Three buttons that provide different kinds of plots: surface, mesh and contour.

2.2.3.3 How MATLAB GUI Works

Typically, UIs wait for a user to manipulate a control, and then respond to each user action in turn. Each control, and the UI itself has one or more callbacks, named for the fact that they "callback" to MATLAB to ask it to do things. A particular user action, such as pressing a screen button, or passing the cursor over a component, triggers the execution of each callback. The UI then responds to these events. As a UI creator, write callbacks that define what the components do to handle events.

This kind of programming is often referred to as *event driven* programming. In event driven programming, callback execution is *asynchronous*, that is, events external to the software trigger callback execution. In the case of MATLAB UIs, most events are user

interactions with the UI, but the UI can respond to other kinds of events as well, for example, the creation of a file or connecting a device to the computer.

Code callbacks in two distinct ways:

i. As MATLAB language functions stored in files

ii. As strings containing MATLAB expressions or commands (such as 'c = sqrt {a*a + b*b); 'or 'print')

Using functions stored in code files as callbacks is preferable to using strings, because functions have access to arguments and are more powerful and flexible. MATLAB script (sequences of statements stored in code files that do not define functions) cannot be use as callbacks.

Although a user can provide a callback with certain data and make it do anything user want, a user cannot control when callbacks execute. That is, when the UI is being used, a user have no control over the sequence of events that trigger particular callbacks or what other callbacks might still be running at those times. This distinguishes event-driven programming from other types of control flow, for example processing sequential data files.

2.2.3.4 Visual Basic.

The Visual Basic is a tool that allows you to develop Windows (Graphic User Interface -GUI) applications. The applications have a familiar appearance to the user. As shown in figure 2.4, Visual Basic is event - driven, meaning code remains idle until called upon to respond to some event (button pressing, menu selection,....). Visual Basic is governed by an event processor. Nothing happens until an

event is detected. Once an event is detected, the code corresponding to that event (event procedure) is executed. Program control is then returned to the event processor [19].

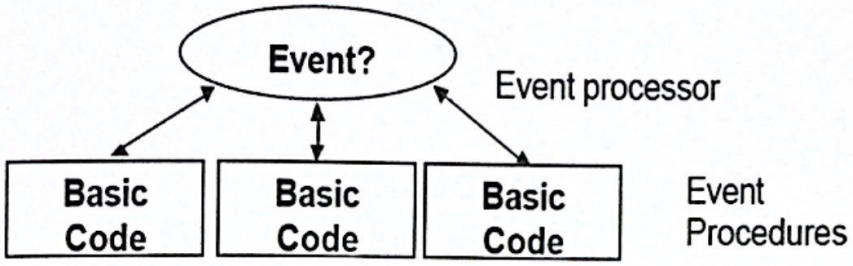


Figure 2.4: Process of Visual Basic

Some features of Visual Basic:-

i. Full set of objects - you 'draw ' the application.

ii. Lots of icons and pictures for your use.

iii. Response to mouse and keyboard actions.

iv. Clipboard and printer access.

v. Full array of mathematical, string handling, and graphics functions.

vi. Can handle fixed and dynamic variable and control arrays.

vii. Sequential and random access file support.

viii. Useful debugger and error - handling facilities.

ix. Powerful database access tools.

x. ActiveX support.

xi. Package & Deployment Wizard makes distributing your applications simple.

CHAPTER 3

METHODOLOGY

3.1 Introduction

By completing this project, two main work were carried out which are experiment towards subjects' skin moisture and design an automatic system to identify the skin moisture using MATLAB GUI.

Firstly, an experiment were carried out by taking a subject's skin moisture. There are few region will be selected which are center of forehead, right and left cheeks, right and left below eyes and lastly right and left hands. The measured data is collected and analyze. After the data has been analyze, the data will be characterize to get the threshold reading. This threshold reading is to determine on which reading is a suitable skin moisture for the each subjects. 30 subjects of PSA students are chosen to get the reading.

All the measured data will be use to create an automatic system for skin moisture by using MATLAB GUI. A system will automatically display each reading of subject's skin moisture and the recommendation for their skin.

3.2 Experiment on skin moisture

The experiment was held on 30 subjects of PSA students randomly. The device that was used to take the skin moisture is Skin Digital Moisture (skincare). The selected region to get a moisture is on center of forehead, below eyes, cheeks and hands. The experiment was taken according to the protocol. The region of each subjects' face were selected based on the manual of the device itself as shown at figure 3.1 below.

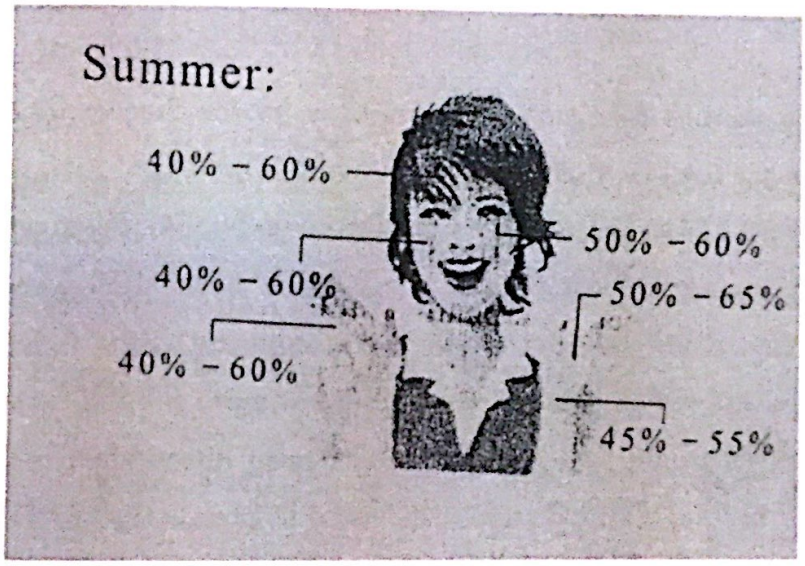


Figure 3.1: Reading range of skin moisture according to the device.

3.3 Data Collection

Data collection is taken on 30 students of JKE, PSA randomly. The data is collected experimentally. The procedure of taking the data is based on the protocol of the device itself which is Digital Monitor Moisture (skincare).

3.4 Matlab GUI

MATLAB is built around a programming language and as such it is really designed with tool - building in mind. Guide extends MATLAB's support for rapid coding into the realm of building GUIs. GUIDE is a set of MATLAB tools designed to make building GUIs easier and faster. There are few templates for GUI such as Blank GUI, GUI with Uicontrols, GUI with Axes and Menu and lastly Modal Question Dialog. For this project, the template that will be use is Blank GUI. Once the buttons and plots are in place, the Guide Callback Editor let user set up the MATLAB code that gets executed when a particular button is pressed.

3.5 Building MATLAB GUI

MATLAB GUIs are created using a tool called guide, the GUI Development Environment. This tool allows a programmer to layout the GUI, selecting and aligning the GUI components to be placed in it. Once the components are in place, the user an edit properties: name, color, size, font, text to display, and many more. When guide saves the GUI, it creates working program including skeleton functions that the user can modify to implement the behavior of the GUI. When guide is executed, it creates the Layout Editor. The large white area with grid lines is the layout area, where a programmer can layout the GUI. The layout Editor window has

a palate of GUI components along the left side of the layout area. A user can create any number of GUI components by first clicking on the desired component, and then dragging its outline in the layout area. The top of the window has a toolbar with a series of useful tools that allow the user to distribute and align GUI components, modify the properties of GUI components, add menus to GUIs and so on.

3.5.1 Cover Page

In this page there is only one push button which is 'Enter' push button. This button will allow the user to active the system. This page are welcome page for this system and this figure will be a parent figure to others children figure by making current data must be return back to the parent figure before new data occur. Figure 3.2 shows how the cover page is constructed on MATLAB GUI.

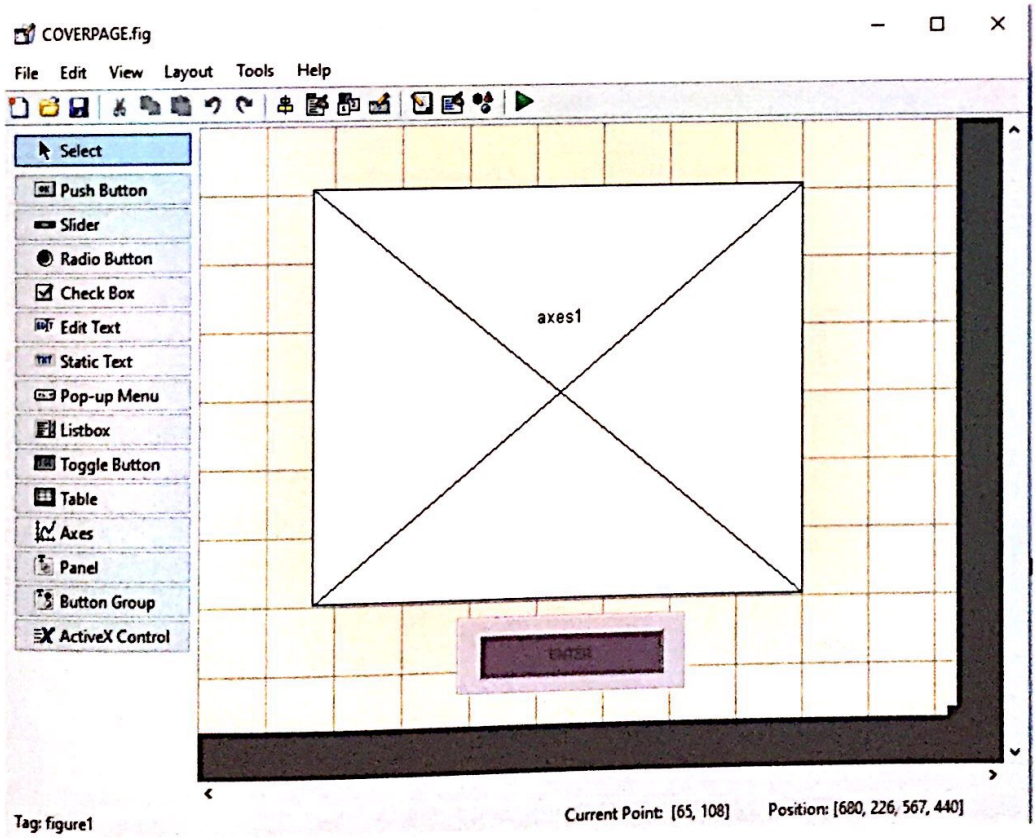


Figure 3.2: Constructed Cover Page.

3.5.1.1 Enter' button

The property Inspector enables to set property of the components in a layout. It provides a list of all settable properties and displays the current value. Figure 3.3 below shows the syntax that putting in Callback property, that to display the next page when 'Enter' button is clicked. The desired picture for the background and the cover page can be made by edit the coding in the 'editor'. The space for the 'editor' will appear after the GUI is saved and run.

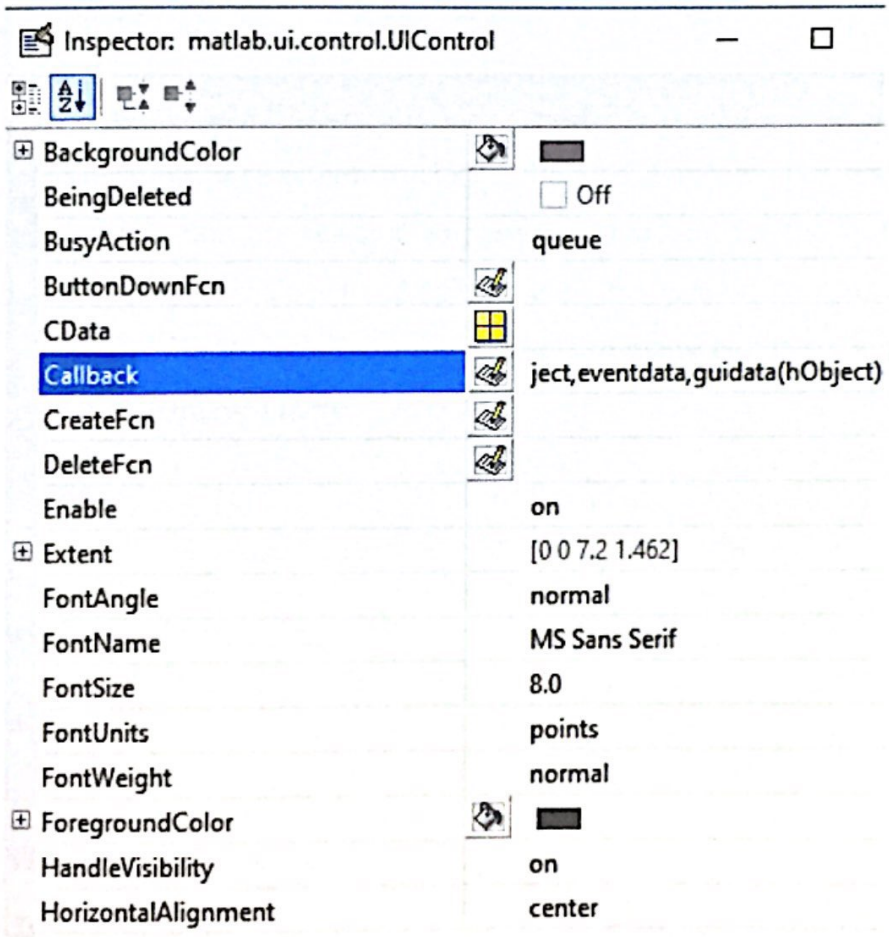


Figure 3.3: Constructed function in Property Inspector Callback.

The coding for image background on the system.

```
handles.output = hObject;

A = imread ('C:\Users\nasmahira\Desktop\Current Directory\REAL TEST\bgtest.jpg');

axes(handles.axes1);

imshow(A);
```

3.5.2 Front Page

The front page is constructed as figure 3.4 below. The text box, edit text and push button are selected to play their function for the system. Static text is used for "Insert Your Reading". To enter the value of skin moisture, edit text is used. While "Enter" is a push button. The blank box is static text where the result will displayed there.

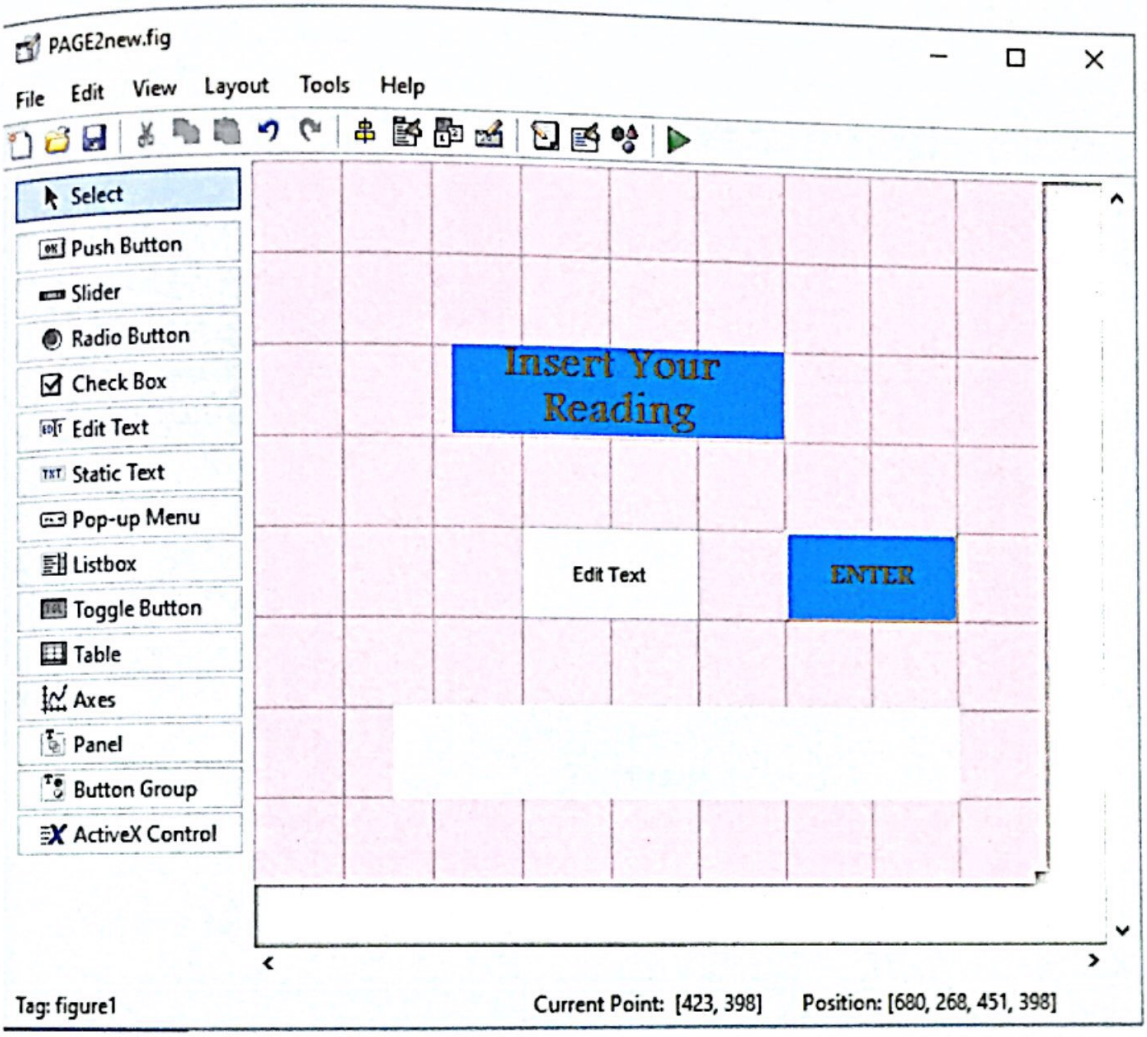


Figure 3.4: Constructed Front Page

3.5.2.1 Text Box

There are two types of text boxes, a static text box and an edit text box. For this project, both type of text boxes are used. The data that is already been created beforehand is edited in the coding of Front Page's editor. By pressing the 'Enter' button the result will be appear in the static text box. As shown in figure 3.5 static text box is constructed and edited according to the creation of the system.

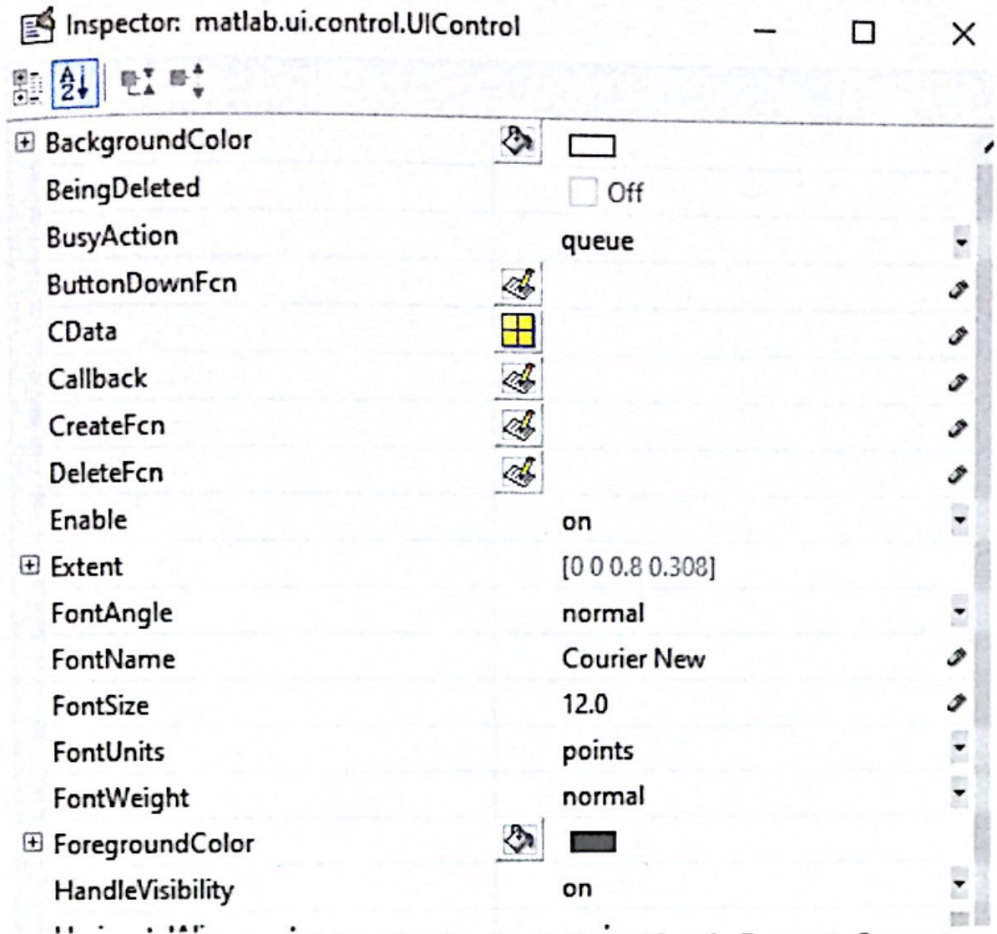


Figure 3.5: Constructed function for the static text box in Property Inspector.

As shown in figure 3.6 the 'Enter' button is constructed based on the planning in Property Inspector.

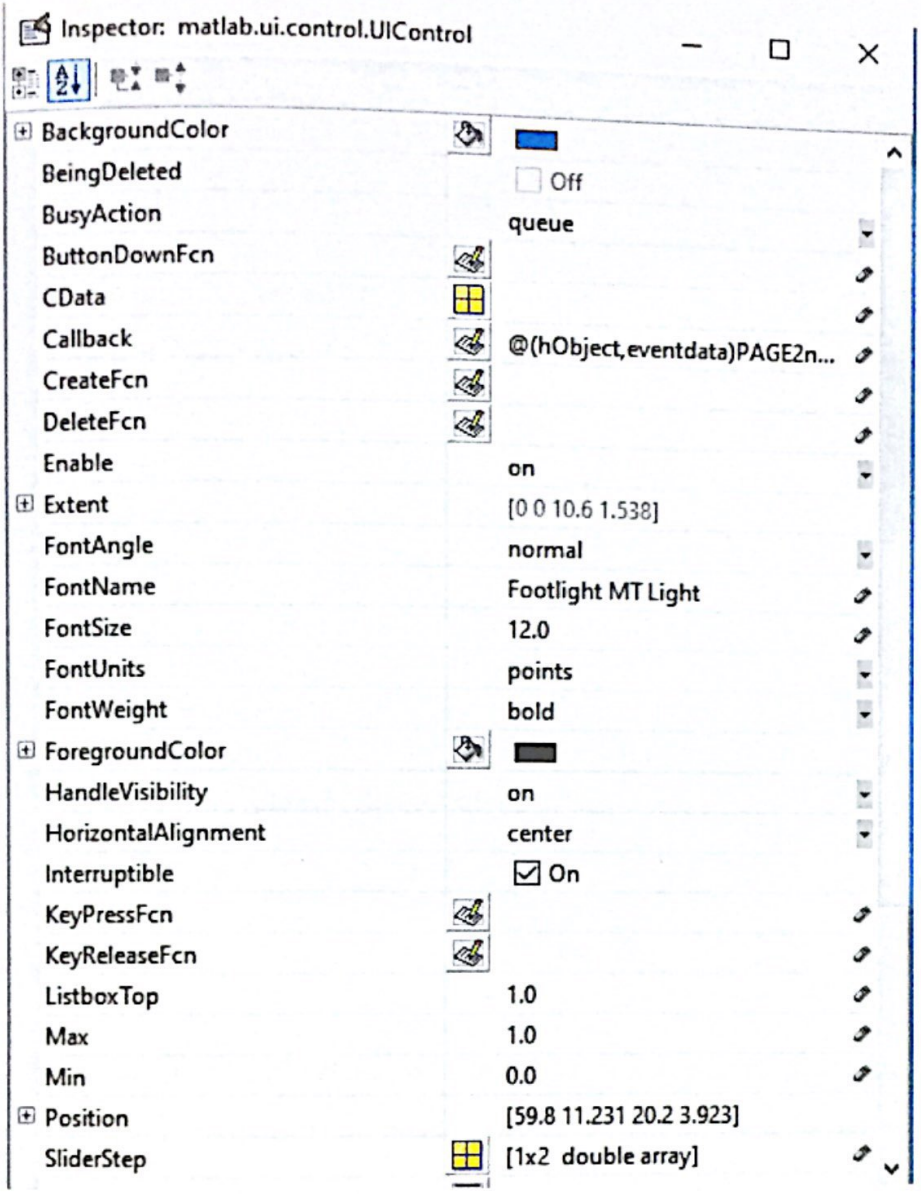


Figure 3.6: Constructed function for 'Enter' button(Front Page) in Property Inspector.

Coding for result on static text box which will appeared once the 'Enter' button is clicked.

```
value = str2num(char(get(handles.edit1,'String')));

 svalue = num2str(value);

if (value >= 1) && (value <= 40)

   s1 = 'Your score is' ;
```

```
s2 = ' Your skin is dry';

smoist = strcat(s1,svalue,s2)

set(handles.text5,'String',smoist)

% set(handles.edit1,'String','Your score is %f.\nYour skin is moist',
value); % Or dry

else

s3 = 'Your score is ';

s4 = ' Your skin is moist';

sdry = strcat(s3,svalue,s4)

set(handles.text5,'String',sdry)

end
```

As shown at figure 3.7 below, edit text box which placed at the front page to put the reading of skin moisture can be constructed based on what have been created.

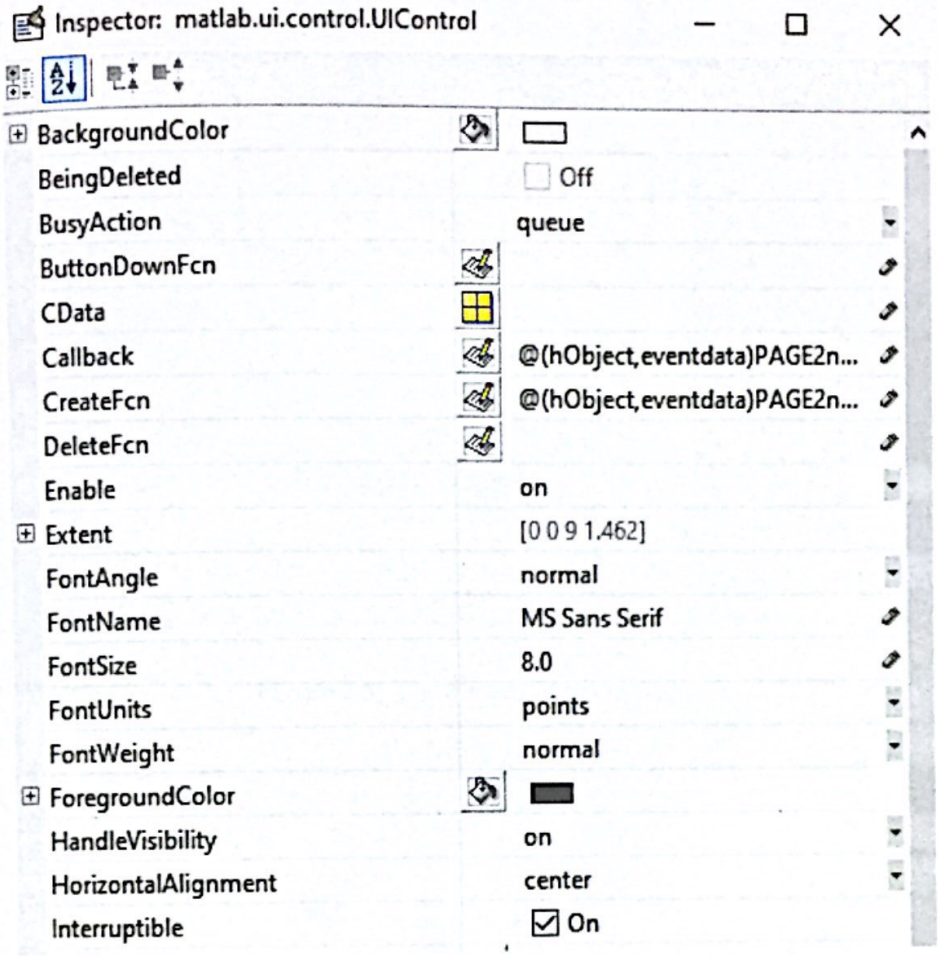


Figure 3.7: Constructed function for edit text box (Front Page) in Property Inspector.

3.5.3 User Interface

After all the pages of user interface has created. Plus, all the coding has been set up according to what is desired. The display of GUI based on what have been created. Figure 3.8 is the cover page which a user will click the enter button to open the new page. Next, figure 3.9 shows that the front page where a user can enter the skin moisture value next, the enter button is clicked. The result will be displayed on the grey blank box at the most below.

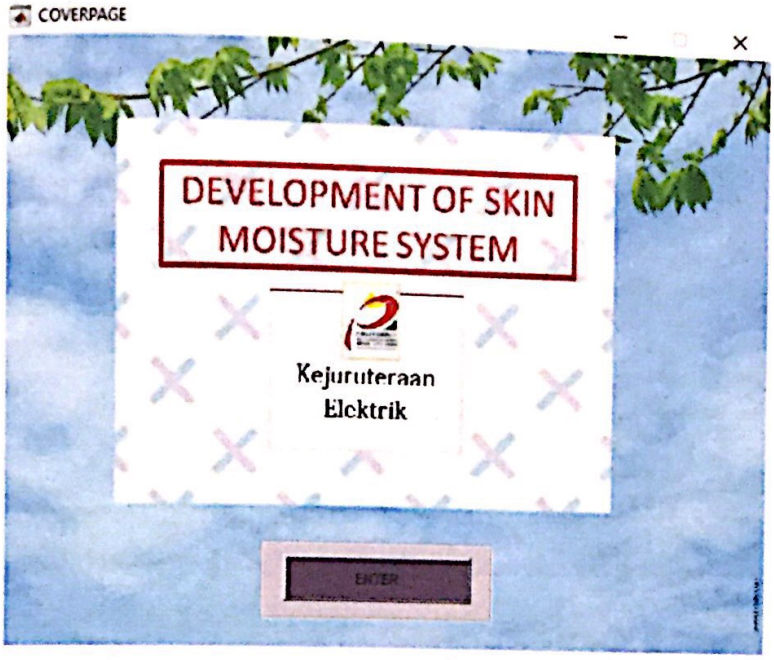


Figure 3.8: The display of cover page.

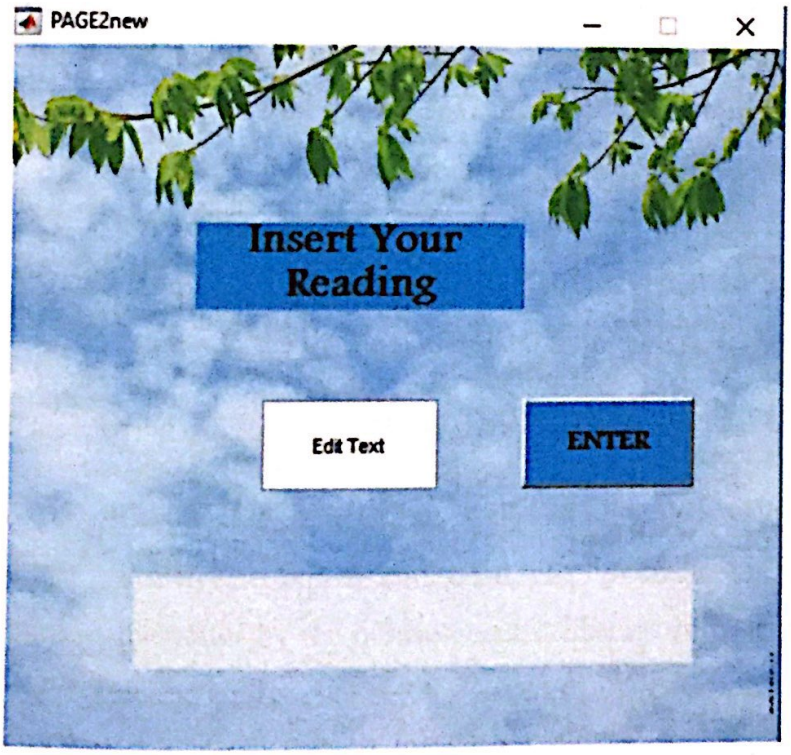


Figure 3.9: The display that will appear after the 'Enter' button at cover page is clicked.

3.5.4 Structure of a GUI program

Overall design approach:

i. Use the main function in the m-file as an action driven callback processor for graphic events.

ii. Create separate subfunctions for each desired action for functionality:

   a. Function which creates the GUI figure window.

   b. Function which deal with each type of interface.

   c. Function which perform calculations and plotting.

iii. For each object on the user interface that should respond to a mouse or keyboard event (i.e. click and return), when the object is created, its callback property is assigned a string value which typically will be the name of the m-file's main function followed by the appropriate action. Thus, the object will call back into the m-file with the input argument action.

This method of creating GUI programs has several advantages:

i. Compactness: There is only one m-file, which gets called initially from the command line to create the interface and thereafter by the mouse-event callbacks of the graphics objects on the GUI.

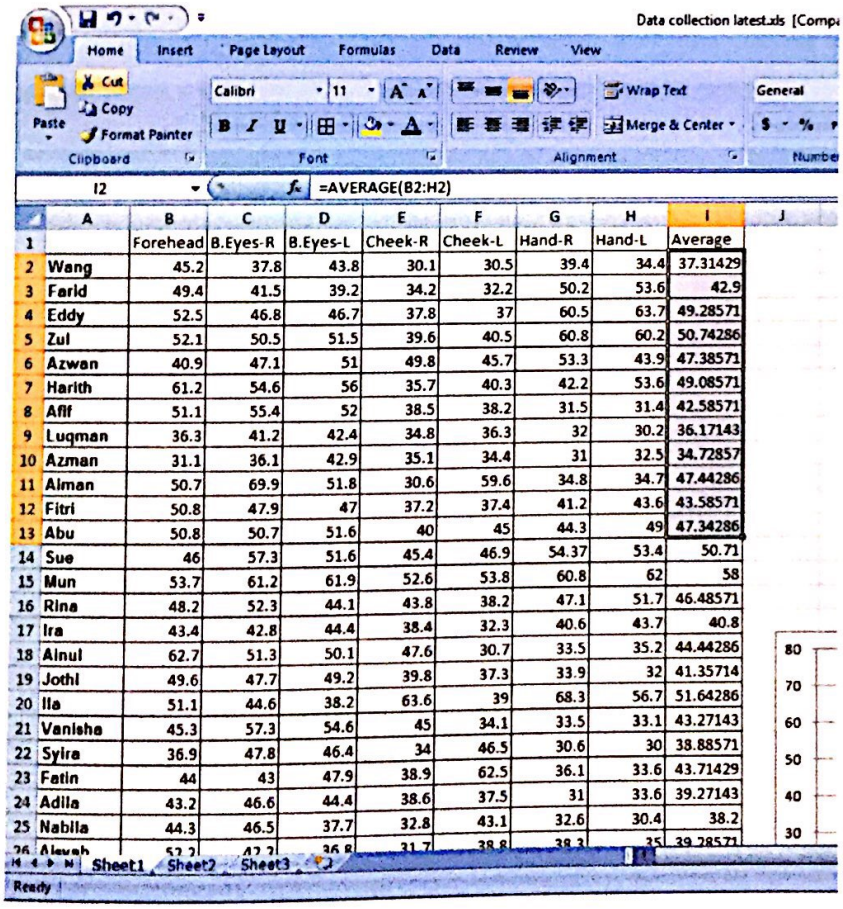
ii. Readability: It is relatively easy to read and add functionality to the program, since different functionalities are separated into different sub-functions.

iii. CPU-economy: no continuous polling for events; the m-file is only executed when a callback event occurs and exits when the

appropriate is completed.

3.6 Microsoft Excel

A Microsoft Excel is needed for the data collection an data analysis. All the data that were obtained is processed in the Microsoft Excel. A spreadsheet is essentially a matrix of rows and columns. Consider a sheet of paper on which horizontal and vertical lines are drawn to yield a rectangular grid. The grid namely a cell, is the result of the intersection of a row with a column. Such a structure is called a Spreadsheet [20]. Figure 3.10 below shows the application of Microsoft Excel where it is used for data collection.



	A	B	C	D	E	F	G	H	I
1		Forehead	B.Eyes-R	B.Eyes-L	Cheek-R	Cheek-L	Hand-R	Hand-L	Average
2	Wang	45.2	37.8	43.8	30.1	30.5	39.4	34.4	37.31429
3	Farid	49.4	41.5	39.2	34.2	32.2	50.2	53.6	42.9
4	Eddy	52.5	46.8	46.7	37.8	37	60.5	63.7	49.28571
5	Zul	52.1	50.5	51.5	39.6	40.5	60.8	60.2	50.74286
6	Azwan	40.9	47.1	51	49.8	45.7	53.3	43.9	47.38571
7	Harith	61.2	54.6	56	35.7	40.3	42.2	53.6	49.08571
8	Afif	51.1	55.4	52	38.5	38.2	31.5	31.4	42.58571
9	Luqman	36.3	41.2	42.4	34.8	36.3	32	30.2	36.17143
10	Azman	31.1	36.1	42.9	35.1	34.4	31	32.5	34.72857
11	Aiman	50.7	69.9	51.8	30.6	59.6	34.8	34.7	47.44286
12	Fitri	50.8	47.9	47	37.2	37.4	41.2	43.6	43.58571
13	Abu	50.8	50.7	51.6	40	45	44.3	49	47.34286
14	Sue	46	57.3	51.6	45.4	46.9	54.37	53.4	50.71
15	Mun	53.7	61.2	61.9	52.6	53.8	60.8	62	58
16	Rina	48.2	52.3	44.1	43.8	38.2	47.1	51.7	46.48571
17	Ira	43.4	42.8	44.4	38.4	32.3	40.6	43.7	40.8
18	Ainul	62.7	51.3	50.1	47.6	30.7	33.5	35.2	44.44286
19	Jothi	49.6	47.7	49.2	39.8	37.3	33.9	32	41.35714
20	Ila	51.1	44.6	38.2	63.6	39	68.3	56.7	51.64286
21	Vanisha	45.3	57.3	54.6	45	34.1	33.5	33.1	43.27143
22	Syira	36.9	47.8	46.4	34	46.5	30.6	30	38.88571
23	Fatin	44	43	47.9	38.9	62.5	36.1	33.6	43.71429
24	Adila	43.2	46.6	44.4	38.6	37.5	31	33.6	39.27143
25	Nabila	44.3	46.5	37.7	32.8	43.1	32.6	30.4	38.2

Figure 3.10: Microsoft Excel used for data collection.

3.7 Flowchart

Below is the flowchart for the whole project. The combination of two method which included experimental and software. The project is start with the data measurement taken from 30 subjects. The data that were measured is going to analyzed by classified the difference type of facial region of each subjects. After the data is analyzed the data will be characterized to get a threshold value. After that, a system will be created by using MATLAB software. The next part would be testing and validation. Figure 3.11 show the flowchart of the overall project.

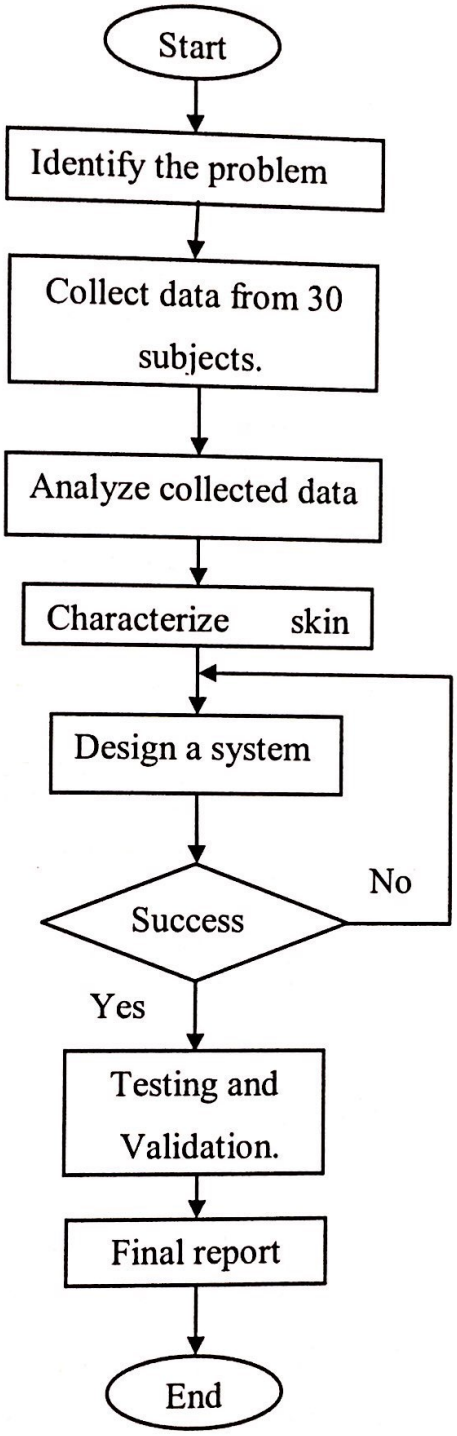


Figure 3.11: Flowchart of Development of Skin Moisture System

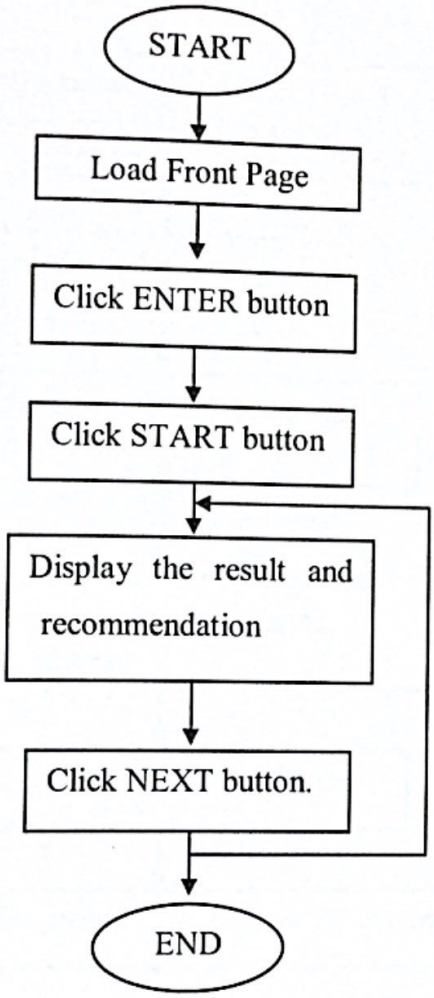


Figure 3.12: Flowchart of system design.

Figure 3.12 above shows the system design which is created by using MATLAB GUI. This is an interface where the result of subjects' skin moisture will be automatically display. Either dry or moist. The recommendation for each subject would be display too. The recommendation based on the subject's skin result either dry or moist. The NEXT button would be functioning as displaying the next subject.

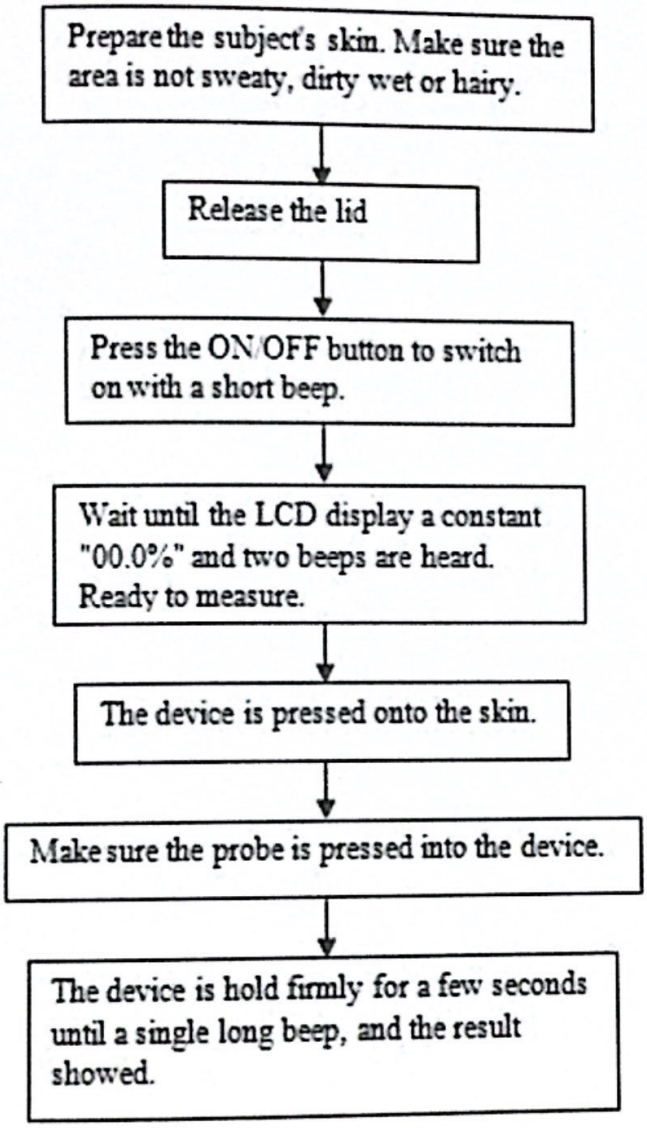


Figure 3.13: Protocol of Taking Skin Moisture On Each Subject.

Figure 3.13 shows a procedure of taking skin moisture on each individual. This protocol is based on the experiment of 'To Analysis The Digital Moisture Monitor For Skin. The experiment was held at ME007. This protocol was applied to get the skin moisture on 30 subjects.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction.

This chapter discusses the results that have been obtained from data analysis on skin moisture measurement towards below eyes (right and left) and cheeks (right and left) among 30 students. Besides that, the chapter also discusses an effectiveness of Development of Skin Moisture System towards skin moisture measurement.

4.2 Data Analysis.

From the data collection, the analysis were done to produce the graph. The region that are selected is according to the Skin Moisture Digital (skincare) device that can be obtained from ME007. Table 4.1 shows the collected of data for 30 PSA students by using Digital Moisture Monitor (skincare).

TABLE 4.1: Skin Moisture Reading Among 30 Students

Subjects	Forehead	B.Eyes-R	B.Eyes-L	Cheek-R	Cheek-L	Hand-R	Hand-L	Average
1	45.2	37.8	43.8	30.1	30.5	39.4	34.4	37.31429
2	49.4	41.5	39.2	34.2	32.2	50.2	53.6	42.9
3	52.5	46.8	46.7	37.8	37	60.5	63.7	49.28571
4	52.1	50.5	51.5	39.6	40.5	60.8	60.2	50.74286
5	40.9	47.1	51	49.8	45.7	53.3	43.9	47.38571
6	61.2	54.6	56	35.7	40.3	42.2	53.6	49.08571
7	51.1	55.4	52	38.5	38.2	31.5	31.4	42.58571
8	36.3	41.2	42.4	34.8	36.3	32	30.2	36.17143
9	31.1	36.1	42.9	35.1	34.4	31	32.5	34.72857
10	50.7	69.9	51.8	30.6	59.6	34.8	34.7	47.44286
11	50.8	47.9	47	37.2	37.4	41.2	43.6	43.58571
12	50.8	50.7	51.6	40	45	44.3	49	47.34286
13	35.4	45.4	47.6	31.1	33.2	32.7	44.3	38.52857
14	40	46.7	49.1	39.5	40.5	44	45	43.54286
15	46	57.3	51.6	45.4	46.9	54.37	53.4	50.71
16	53.7	61.2	61.9	52.6	53.8	60.8	62	58
17	48.2	52.3	44.1	43.8	38.2	47.1	51.7	46.48571
18	43.4	42.8	44.4	38.4	32.3	40.6	43.7	40.8
19	62.7	51.3	50.1	47.6	30.7	33.5	35.2	44.44286
20	49.6	47.7	49.2	39.8	37.3	33.9	32	41.35714
21	51.1	44.6	38.2	63.6	39	68.3	56.7	51.64286
22	45.3	57.3	54.6	45	34.1	33.5	33.1	43.27143
23	36.9	47.8	46.4	34	46.5	30.6	30	38.88571
24	44	43	47.9	38.9	62.5	36.1	33.6	43.71429
25	43.2	46.6	44.4	38.6	37.5	31	33.6	39.27143
26	44.3	46.5	37.7	32.8	43.1	32.6	30.4	38.2
27	52.2	42.2	36.8	31.7	38.8	38.3	35	39.28571
28	37.4	46.3	46.1	42.2	36.6	34.1	34.8	39.64286
29	59	59.4	47.8	53.4	52.6	46.9	51.1	52.88571
30	60.1	59	57.8	57.4	46.2	56.2	51.6	55.47143
Average	47.48667	49.23	47.72	40.64	40.89667	42.52567	42.93333	44.49033

4.2.1 Analysis On Gender Facial Regions.

This chapter explain the analysis of skin moisture reading according to genders on different region such as center of forehead, below eyes on left and right, cheeks on left and right, lastly hand on left and right. Each facial regions

were analyze to observe the significant of moisture on each part.

4.2.1.1 Male Subjects

Figure 4.1, 4.2, 4.3, and 4.4 shows the result of skin moisture of male subjects on seven regions Which are center of forehead, below eyes, cheeks, and hands.

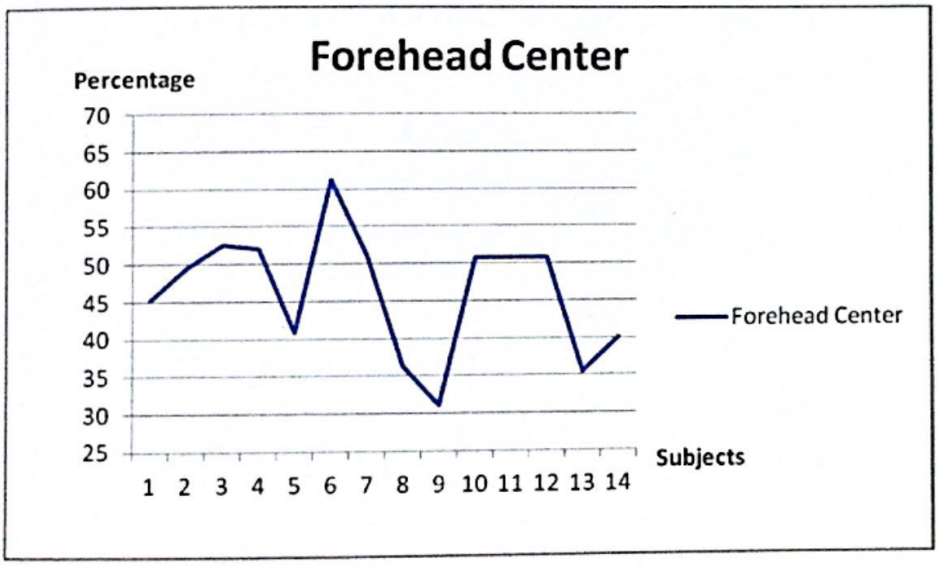


Figure 4.1: Skin Moisture On Forehead Center (male subjects)

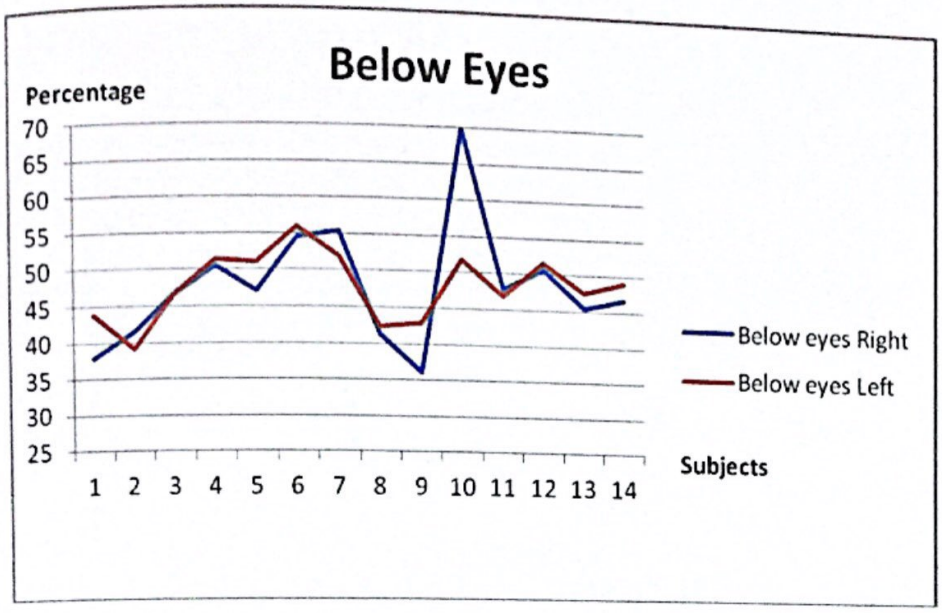


Figure 4.2: Skin Moisture On Below Eyes (male subjects)

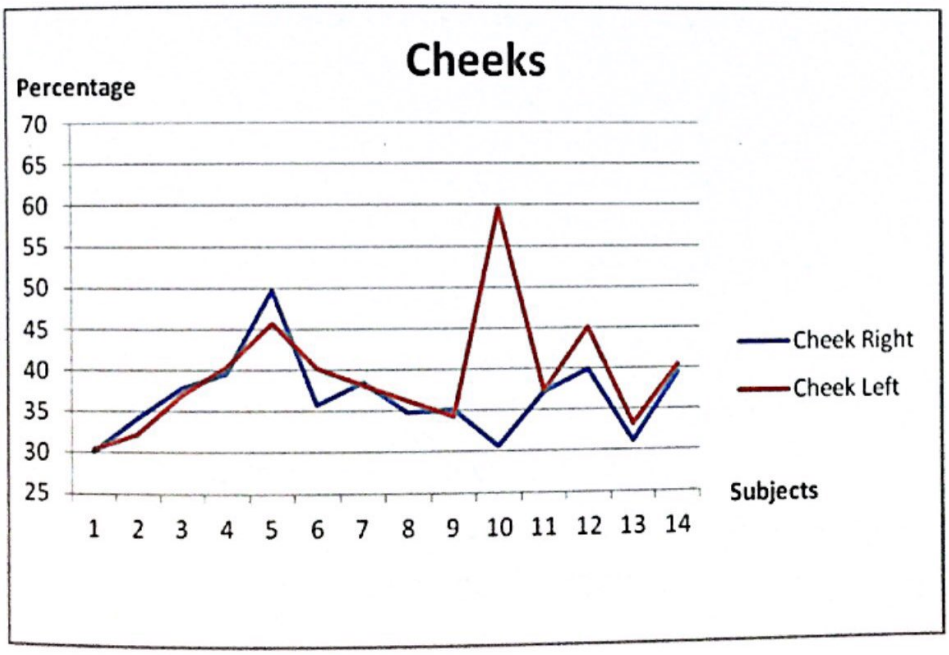


Figure 4.3: Skin Moisture On Cheeks (male subject)

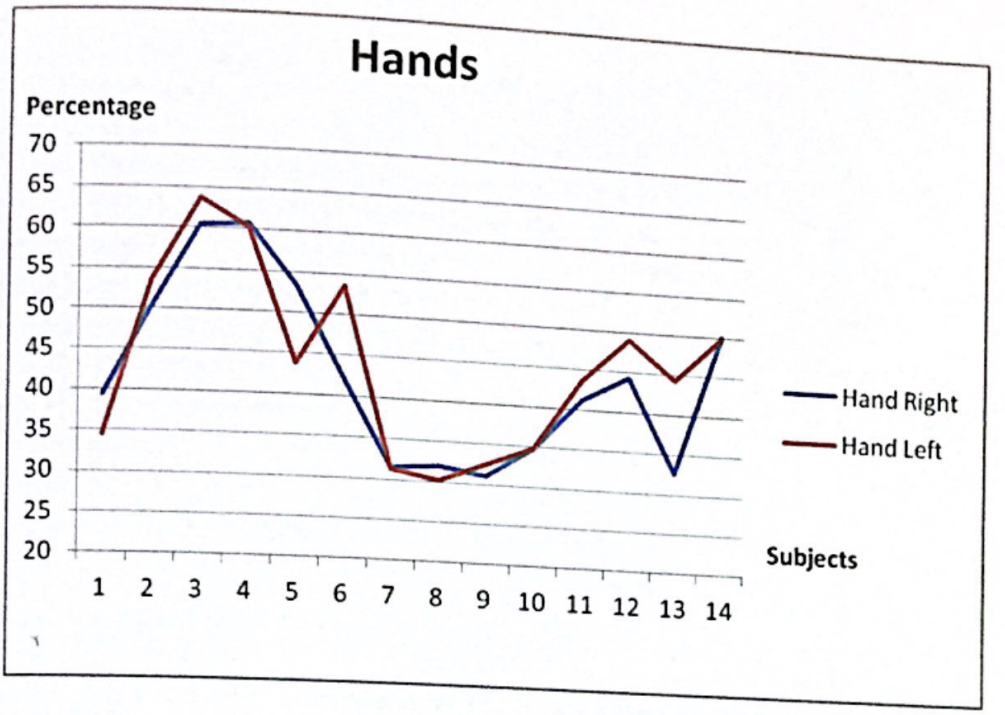


Figure 4.4: Skin Moisture On Hands (male subjects)

4.2.1.2 Female Subjects

Figure 4.5, 4.6, 4.7, and 4.8, shows the result of skin moisture of female subjects on seven regions Which are center of forehead, below eyes, cheeks, and hands.

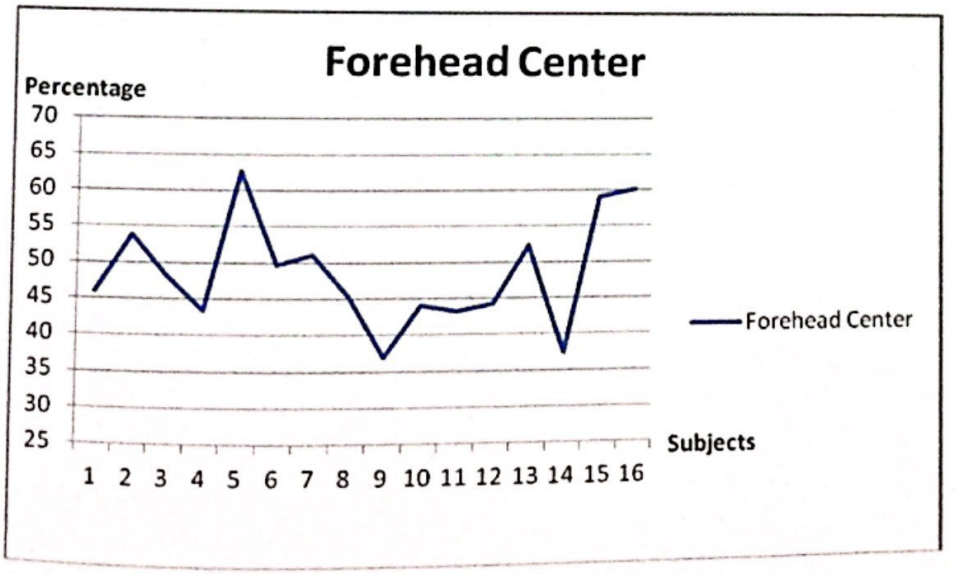


Figure 4.5: Skin Moisture On Forehead Center (female subjects)

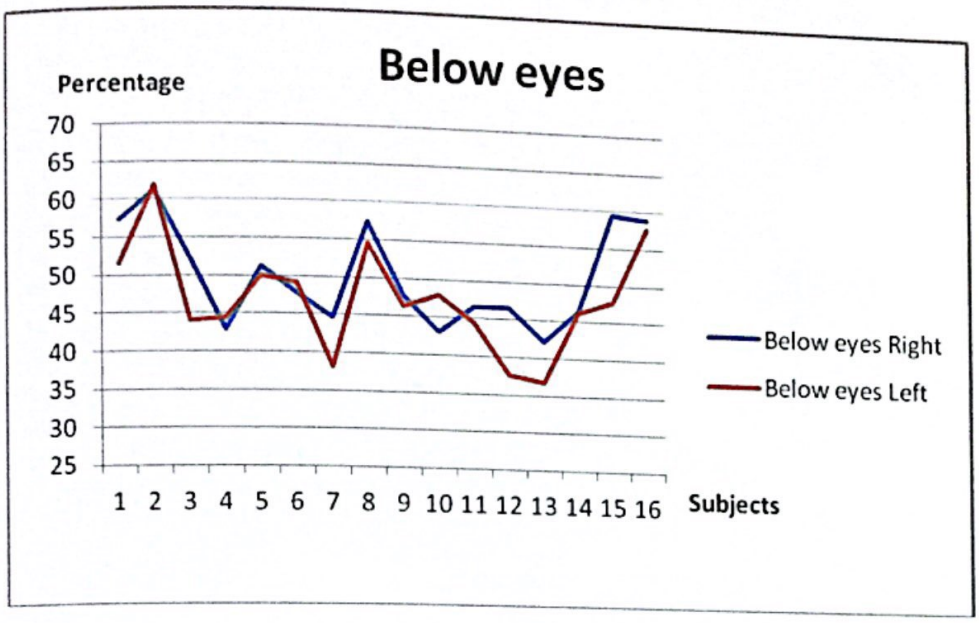


Figure 4.6: Skin Moisture On Below Eyes (female subjects)

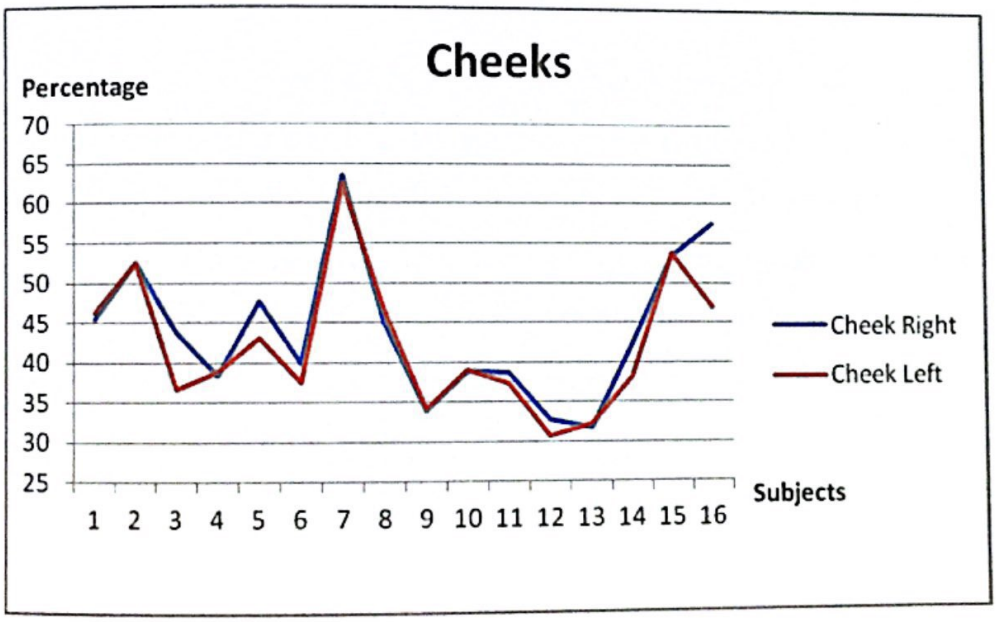


Figure 4.7: Skin Moisture On Cheeks (female subjects)

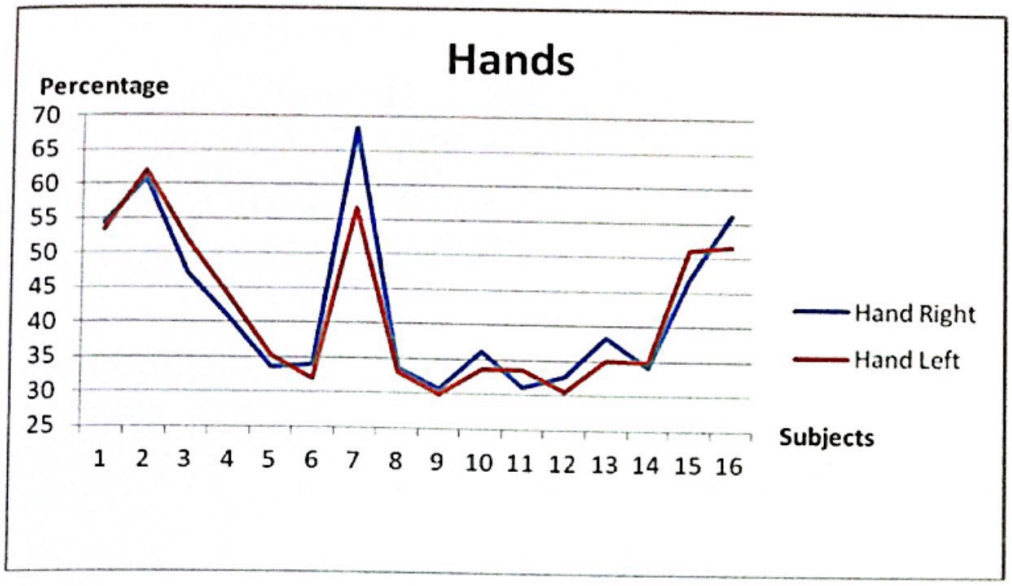


Figure 4.8: Skin Moisture On Hands (female subjects)

The graph that were obtained shows no significant of skin moisture among 30 students on seven different facial regions. The reading for right and left area on below eyes, cheeks and hands shows no difference. There might be minor subjects who had differences on their reading. But for the majority, the reading is same. After that, the reading is focused on the average reading of skin moisture on different regions of facial skin.

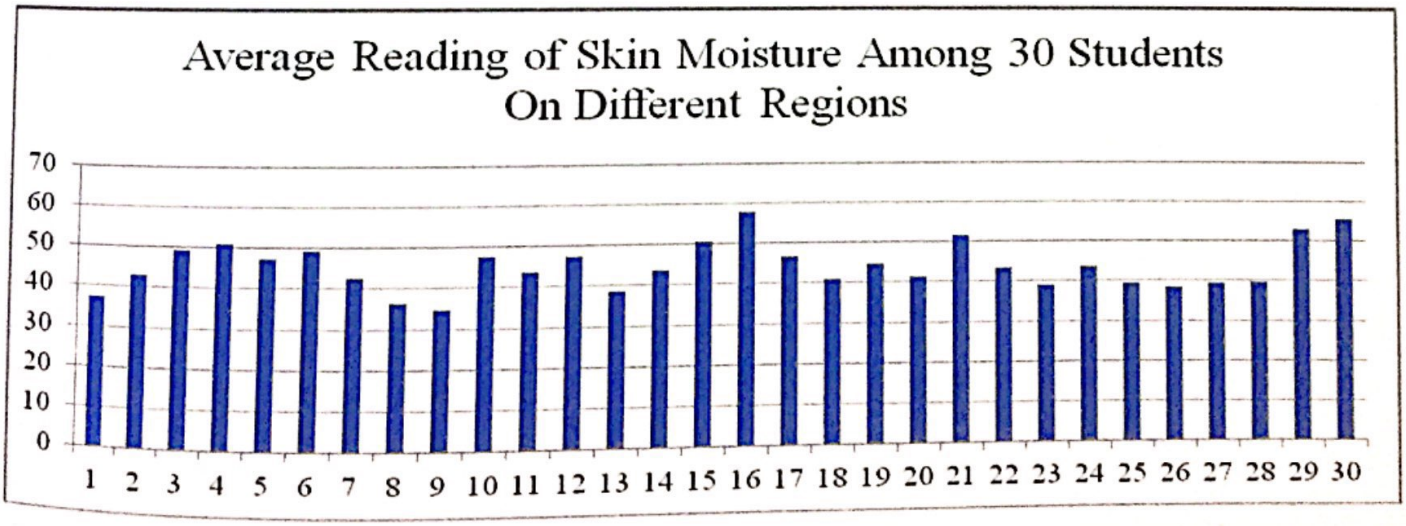


Figure 4.9: Average Reading of Skin Moisture Among 30 Students

Next, the average reading of skin moisture obtained for seven regions of facial skin among 30 students shown in figure 4.9. This graph also shows no sign of significant. Besides that, the gender factor did not show any significant on the skin moisture.

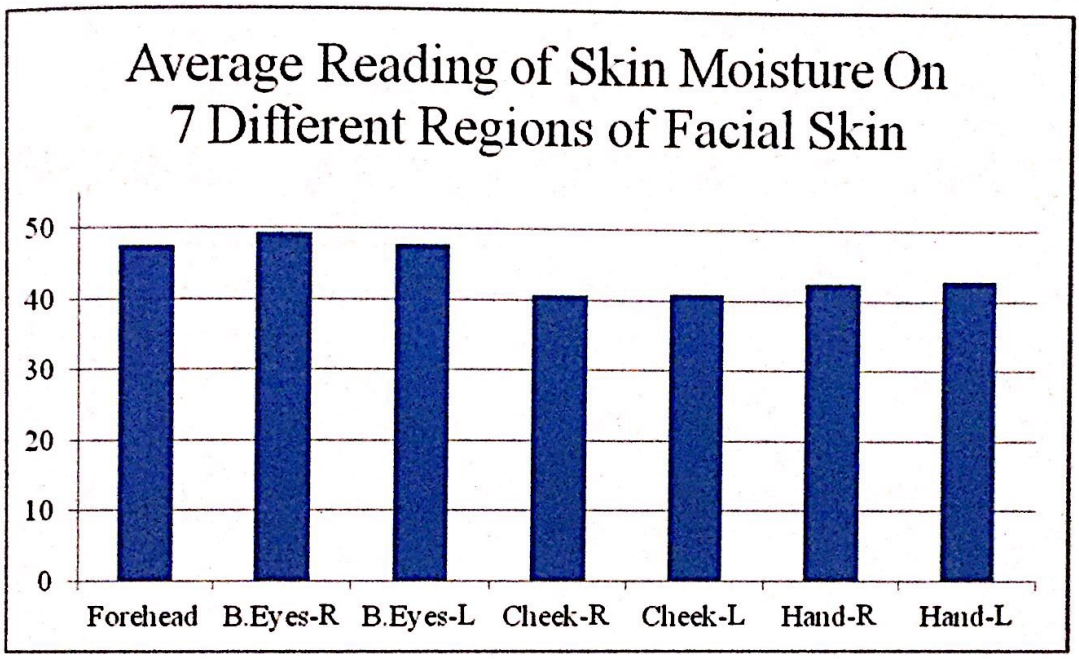


Figure 4.10: Average Reading of Skin Moisture (30 Students) Grouped Into Different Region

After that, the graph for average reading of skin moisture according to different region which is forehead, below eye right, below eye left, right cheek, left cheek, right hand and left hand is recorded. From this graph, the information that can be acquired is the highest average reading coming from below eyes while the lowest average reading coming from the cheeks shown in figure 4.10. Due to this situation, below eyes right and left, cheek right and left are selected for further research.

4.3 Selected Facial Regions

Then, the facial regions are decreased to below eyes left and right, also cheek right and left.

TABLE 4.2: Skin Moisture On Selected Facial Regions

Subjects	Below Eyes Right	Below Eyes Left	Cheek Right	Cheek Left
1	37.8	43.8	30.1	30.5
2	41.5	39.2	34.2	32.2
3	46.8	46.7	37.8	37
4	50.5	51.5	39.6	40.5
5	47.1	51	49.8	45.7
6	54.6	56	35.7	40.3
7	55.4	52	38.5	38.2
8	41.2	42.4	34.8	36.3
9	36.1	42.9	35.1	34.4
10	64.9	51.8	30.6	59.6
11	47.9	47	37.2	37.4
12	50.7	51.6	40	45
13	45.4	47.6	31.1	33.2
14	46.7	49.1	39.5	40.5
15	57.3	51.6	45.4	46.9
16	61.2	61.9	52.6	53.8
17	52.3	44.1	43.8	38.2
18	42.8	44.4	38.4	32.3
19	51.3	50.1	47.6	30.7
20	47.7	49.2	39.8	37.3
21	44.6	38.2	63.6	39
22	57.3	54.6	45	34.1
23	47.8	46.4	34	46.5
24	43	47.9	38.9	62.5
25	46.6	44.4	38.6	37.5
26	46.5	37.7	32.8	43.1
27	42.2	36.8	31.7	38.8
28	46.3	46.1	42.2	36.6
29	59.4	47.8	53.4	52.6
30	59	57.8	57.4	46.2

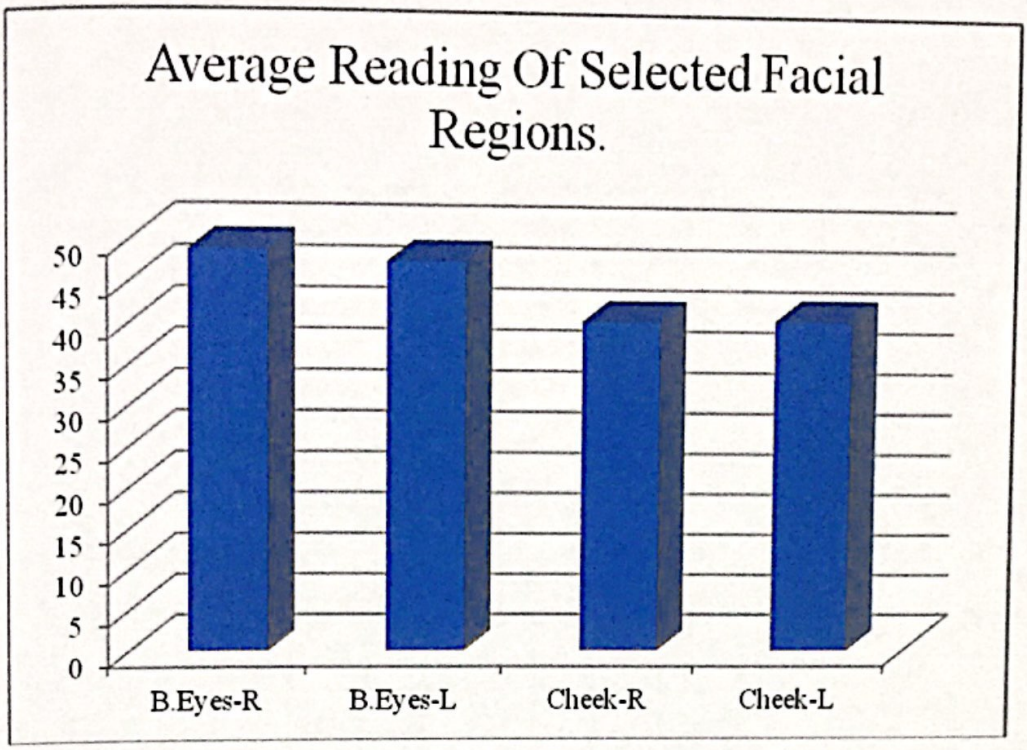


Figure 4.11: Average Reading of Selected Facial Regions.

Furthermore, for the average reading results. The graph showed the trending of slight decline from below eyes right to below eyes left and decline to right cheek until left cheek. The measured moisture on below eyes right is higher compare to the other regions. While left cheek has the lowest reading.

TABLE 4.3: Average Reading For Below Eyes And Cheeks.

Subjects	Below Eyes	Cheeks
1	40.8	30.3
2	40.35	33.2
3	46.75	37.4
4	51	40.05
5	49.05	47.75
6	55.3	38
7	53.7	38.35
8	41.8	35.55
9	39.5	34.75
10	58.35	45.1
11	47.45	37.3
12	51.15	42.5
13	46.5	32.15
14	47.9	40
15	54.45	46.15
16	61.55	53.2
17	48.2	41
18	43.6	35.35
19	50.7	39.15
20	48.45	38.55
21	41.4	51.3
22	55.95	39.55
23	47.1	40.25
24	45.45	50.7
25	45.5	38.05
26	42.1	37.95
27	39.5	35.25
28	46.2	39.4
29	53.6	53
30	58.4	51.8

The value of below eyes and cheeks for left and right regions were combined by finding the average for each of it. As shown in the above table. After that from the average table, the values of minimum and maximum of each region (below eyes and cheeks) were extracted.

TABLE 4.4: Minimum and Maximum Skin Moisture Reading of Selected Facial Regions

Facial Region	Minimum	Maximum
Below Eyes	39.5	61.55
Cheeks	30.3	53.2

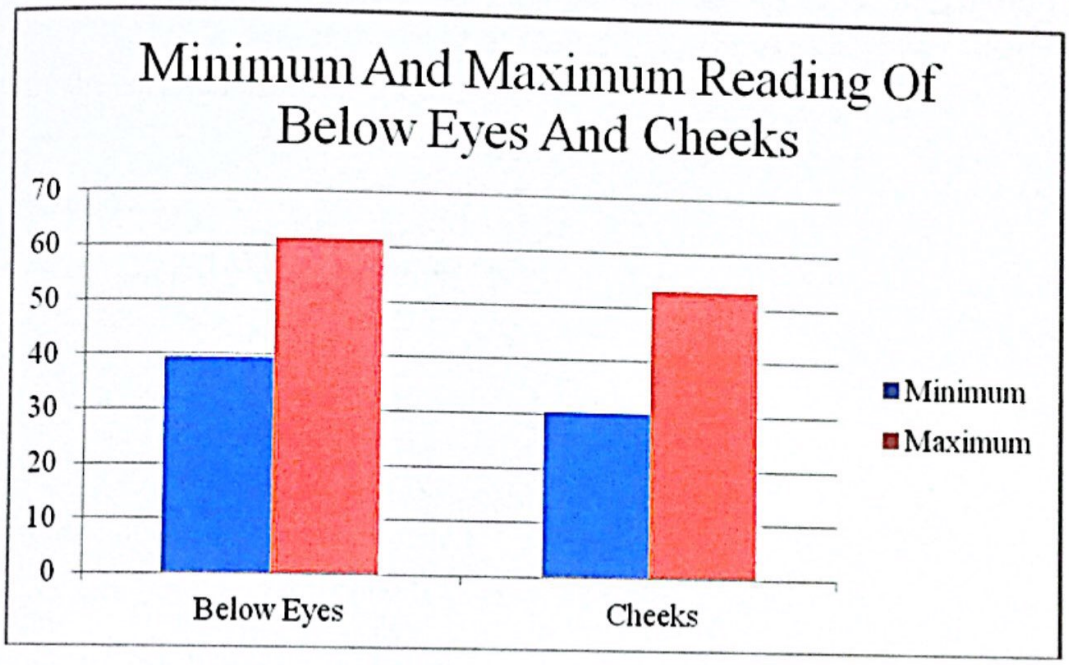


Figure 4.12: Minimum and Maximum Reading of Skin Moisture On Selected Regions.

From the above graph, both facial regions got a higher value for maximum values compare to the minimum values. Then, the values of minimum and maximum of below eyes are slightly higher than the minimum and maximum values of the cheeks.

4.4 Threshold Value

Furthermore, to develop a formula for a threshold value the values of minimum and maximum of below eyes and cheeks in Table 4.3 (c) are taken into

account. After that, since there are three ranges for the threshold value, these values are going to be divided after the differences of minimum and maximum are achieved.

Threshold Value:-

$$(\text{Max} - \text{Min}) \div 3$$

So, apply the formula. Assume the value as alpha, α

TABLE 4.5: Threshold value of below eyes and cheeks.

Below Eyes	Cheeks
7.35	7.63

Therefore, the value of ranges for dry, normal and moist are developed. As for the below eyes, the range of dry is started with adding minimum average (right and left) value of below eyes with the alpha, α. Then, the added value is add again with alpha, α value for the range of normal. While range of moist is greater than the normal value.

TABLE 4.6: Calculation of range value for below eyes.

Formula	Ranges	Below Eyes
$39.5 + \alpha$	Dry	< 46.85
$46.85 + \alpha$	Normal	46.85 - 54.2
$54.2 + \alpha$	Moist	> 54.2

TABLE 4.7: Ranges value for below eyes.

Dry	$39.5 < x < 46.85$
Normal	$46.85 < x < 54.2$
Moist	$54.2 < x < 61.55$

The same way is applied to find the range of cheeks region. Which is dry, normal and moist same as below eyes.

TABLE 4.8: Calculation of range value for cheeks.

Formula	**Ranges**	**Below Eyes**
$30.3 + \alpha$	Dry	< 37.93
$37.93 + \alpha$	Normal	37.93 - 45.66
$45.66 + \alpha$	Moist	> 45.66

TABLE 4.9: Ranges value of cheeks.

Dry	$30.3 < x < 37.93$
Normal	$37.93 < x < 45.66$
Moist	$45.66 < x < 53.2$

Lastly, due to the unit of the skin moisture of the facial region for below eyes and cheeks are same. The minimum and maximum value are combined by finding the average of it.

TABLE 4.10: Minimum and maximum value for skin moisture.

Minimum	Maximum
34.9	57.375

The threshold value for skin moisture after applying the formula of (max - min) ÷ 3.

TABLE 4.11: Threshold value for skin moisture

Threshold Value, α
7.49

TABLE 4.12: Calculation of skin moisture

Formula	Ranges	Skin Moisture
34.9 + α	Dry	< 42.39
Dry + α	Normal	42.39 - 49.88
Normal + α	Moist	> 49.88

TABLE 4.13: Range values for skin moisture.

Values	Range
Dry	$30.3 < x < 37.93$
Normal	$42.39 < x < 49.88$
Moist	$49.88 < x < 57.37$

4.5 Skin Digital Moisture (skincare) Reading Range.

The Digital Skin Moisture (skincare) provided with the reading range for different facial regions. The stated regions are forehead, below eyes, cheeks, hands, wrist and palm. At first, the experiment is conducted to measure only few facial regions such as forehead, below eyes right and left, right and left cheeks and lastly right and left hands. But then after further study, the facial region is focused on below eyes right and left, cheeks right and left.

TABLE 4.14: Reading range of different facial regions based on BIA.

Facial Regions	Reading Range (%)
Forehead	40 - 60
Below Eyes	50 - 60
Cheeks	40 - 60
Hands	40 - 60

The data collection is extracted into normal, minimum, and maximum reading. These reading are compared with the reading range provided by Digital Skin Moisture (skincare). The data that were below than reading range of the device are grouped into minimum reading. While the data that are still in the range of the device is grouped into normal reading. Then, the data that are higher or above than the range of the device is grouped into maximum reading.

TABLE 4.15: Normal Humidity Range Based On BIA.

Normal Humidity Range Based On BIA			
B.Eyes-R	B.Eyes-L	Cheek-R	Cheek-L
50.5	51.5	49.8	40.5
54.6	51	40	45.7
55.4	56	45.4	40.3
50.7	52	52.6	59.6
57.3	51.8	43.8	45
52.3	51.6	47.6	46.9
51.3	51.6	45	53.8
57.3	50.1	42.2	46.5
59.4	54.6	53.4	43.1
59	57.8	57.4	52.6
x	x	x	46.2
x	x	x	40.5

TABLE 4.16: Minimum Humidity Range Based On BIA

Below (minimum) Humidity Range Based On BIA)			
B.Eye-R	B.Eye-L	Cheek-R	Cheek-L
37.8	43.8	30.1	30.5
41.5	39.2	34.2	32.2
46.8	46.7	37.8	37
47.1	42.4	39.6	38.2
41.2	42.9	35.7	36.3
36.1	47	38.5	34.4
47.9	47.6	34.8	37.4
45.4	49.1	35.1	33.2
46.7	44.1	30.6	38.2
42.8	44.4	37.2	32.3
47.7	49.2	31.1	30.7
44.6	38.2	39.5	37.3
47.8	46.4	38.4	39
43	47.9	39.8	34.1
46.6	44.4	34	37.5
46.5	37.7	38.9	38.8
42.2	36.8	38.6	36.6
46.3	46.1	32.8	x
x	47.8	31.7	x

TABLE 4.17: Maximum Humidity Range Based On BIA

Above (maximum) Humidity Range Based On BIA)			
B.Eyes-R	B.Eye-L	Cheek-R	Cheek-L
64.9	61.9	63.6	62.5
61.2	x	x	x

4.5 System for User Interface

This project proposed an automatic system for skin moisture recognition either moist or dry. So, the system that were developed were from different software which are MATLAB and Visual Basic.

4.5.1 MATLAB GUI

The following figures are the system interface created using Matlab GUI. Figure 4.13 is the front page of them system and figure 4.14 is the page for user to enter the value at the 'Edit Text' section.

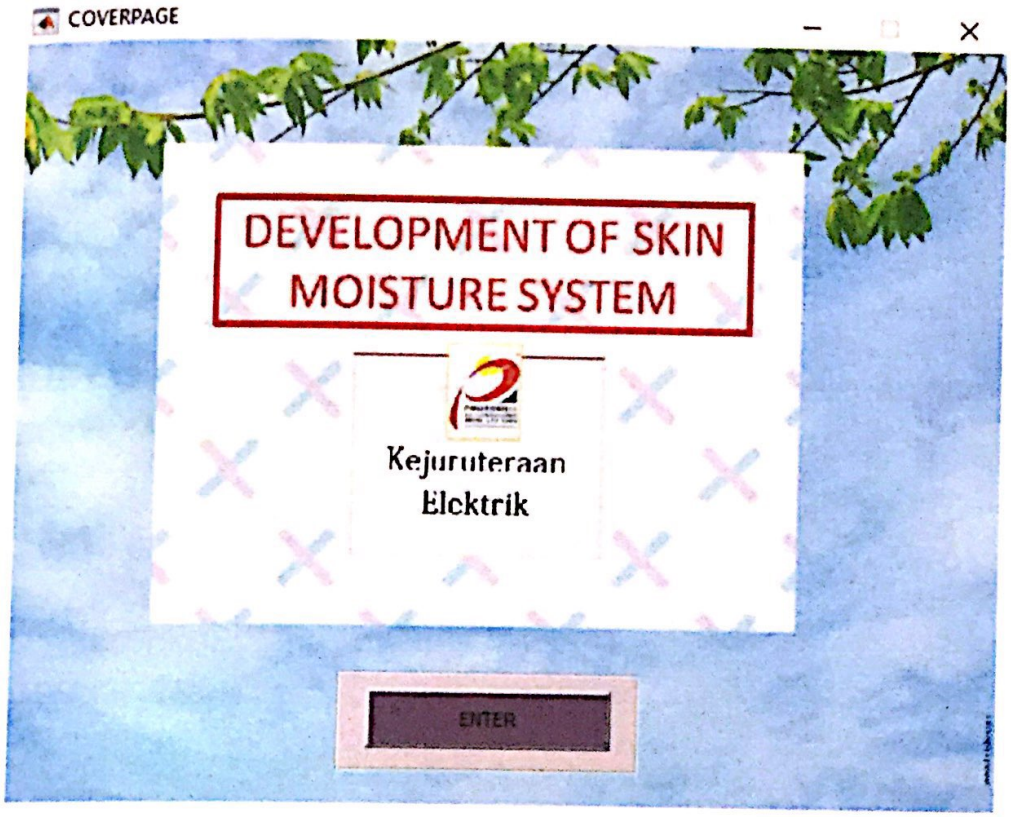


Figure 4.13: Front Page of Interface Using MATLAB

Figure 4.14: Page for user enter the skin moisture value

Figure 4.15 is the result for dry skin. The value that was filled in the 'Edit Text' box is the value taken from subject's skin moisture. The Enter button is clicked the result will appear like the figure below. Figure 4.16 is the result for normal skin and figure 4.17 is result for moist skin.

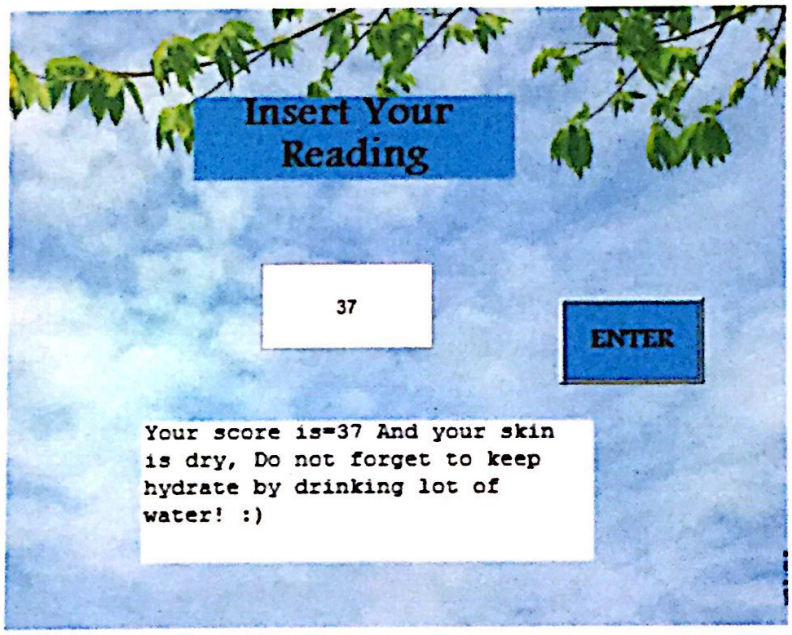


Figure 4.15: Entered a value and result for dry skin is shown.

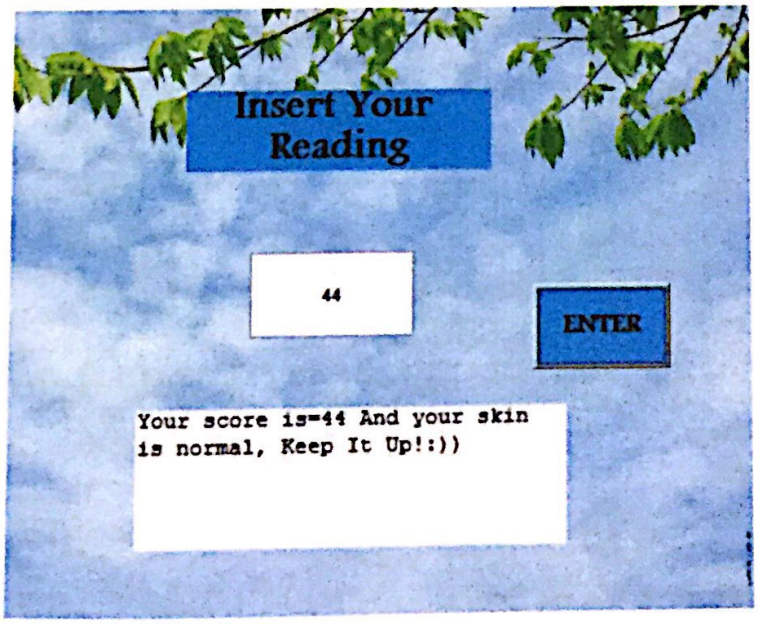


Figure 4.16: Entered a value and result for normal skin is shown.

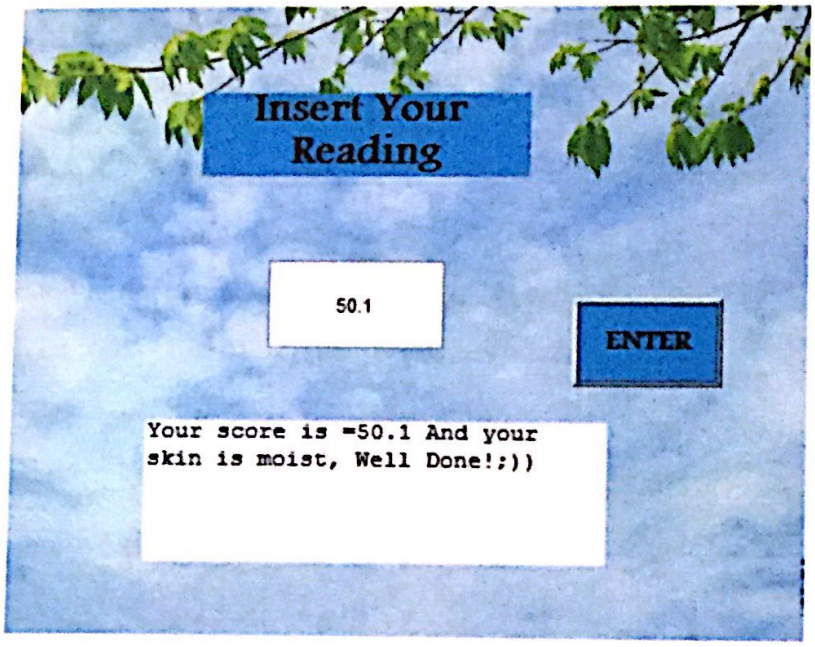


Figure 4.17: Entered a value and result for moist skin is shown.

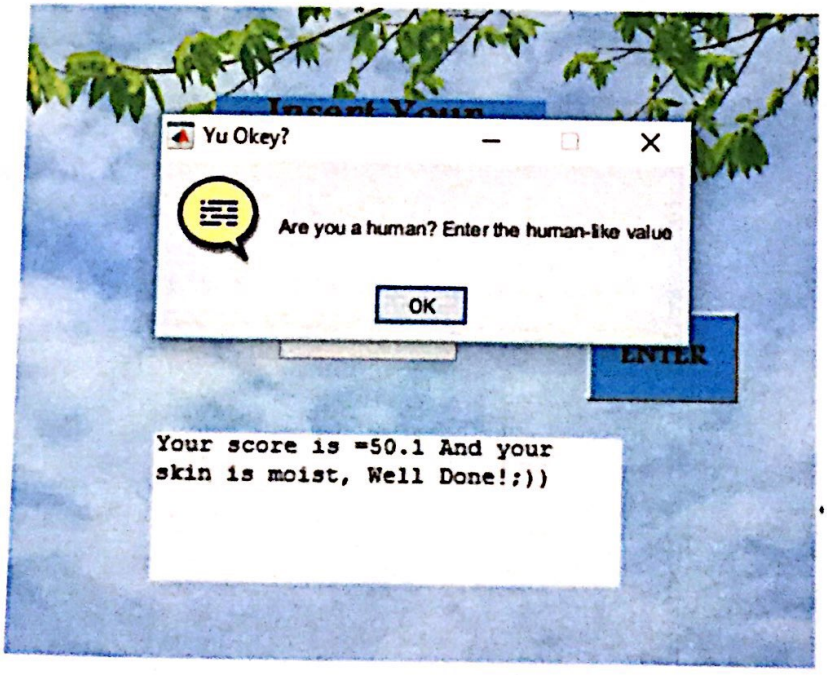


Figure 4.18: Entered a value and result for the value out of range.

4.5.2 Visual Basic

Different software can be use for the interface system such as Visual Basic. The same simple pages are created to develop possible system for the skin moisture. This can be developed into well features of system user interface. Figure 4.19 shows the front page of the interface.

Figure 4.19: Front Page for interface using Visual Basic.

Figure 4.21 and figure 4.23 are shows the values inserted into the text box. While figure 4.22 and figure 4.24 are shows the result of the inserted skin moisture values.

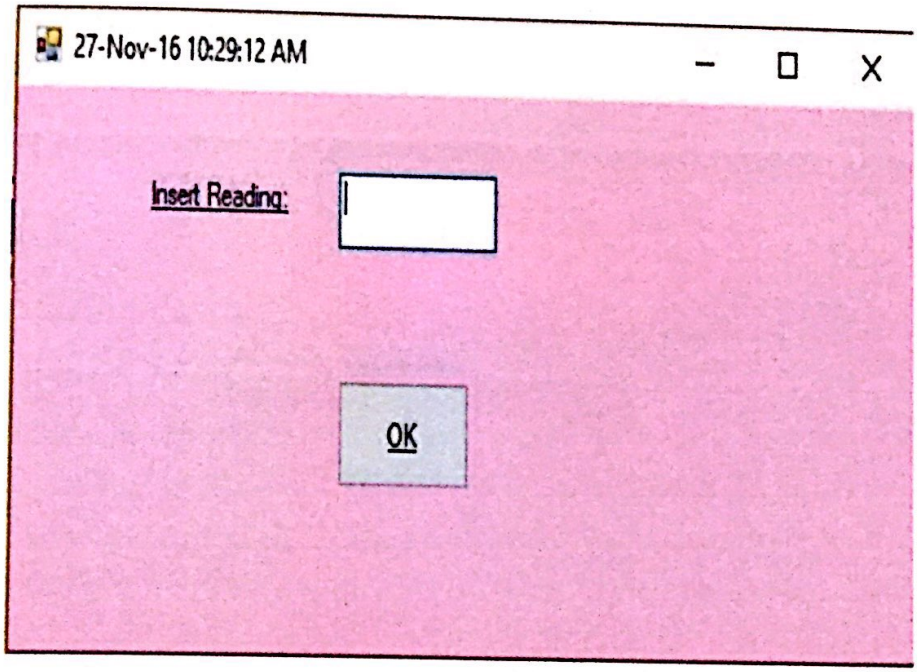


Figure 4.20: Page for user to enter the skin moisture value.

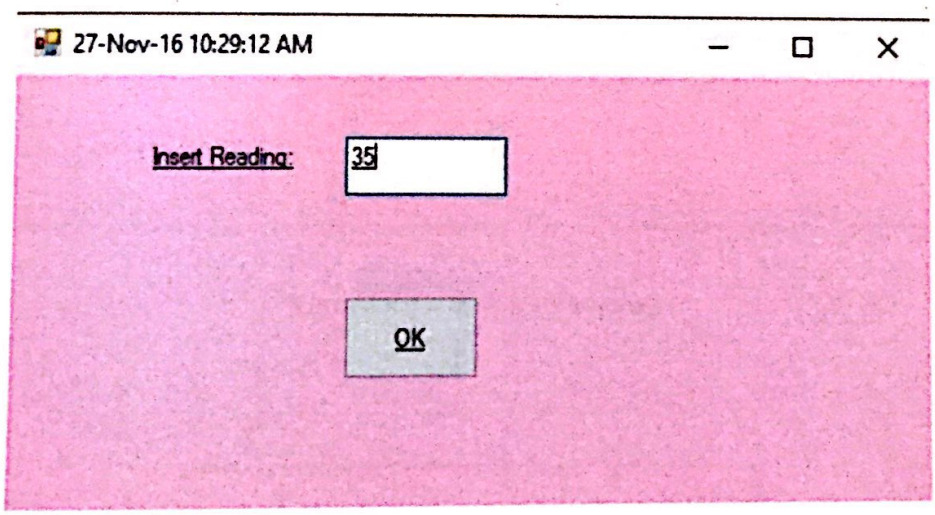


Figure 4.21: A value is entered.

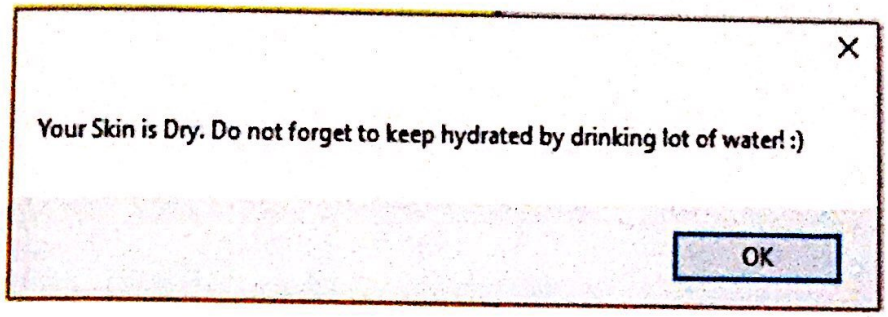


Figure 4.22: Result for dry skin.

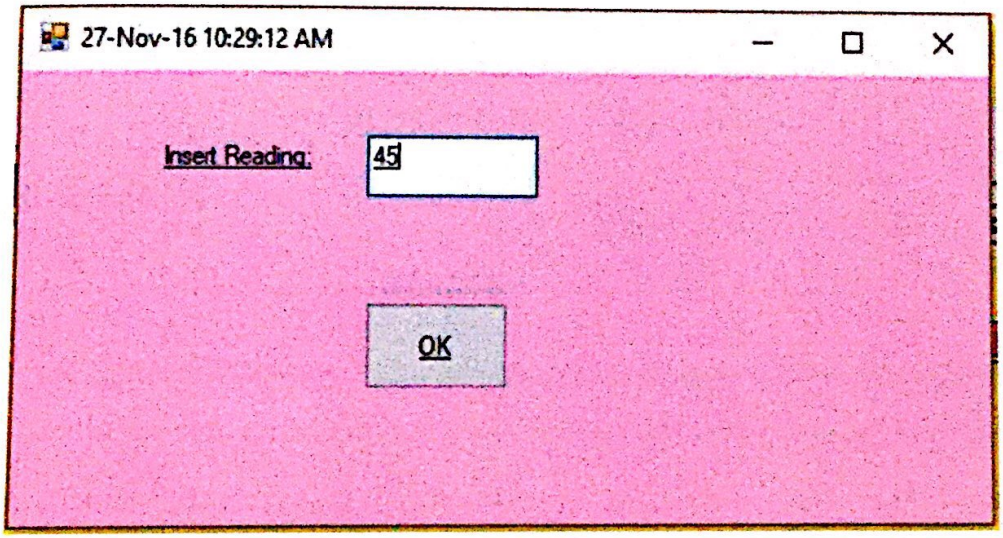


Figure 4.23: Entered a value.

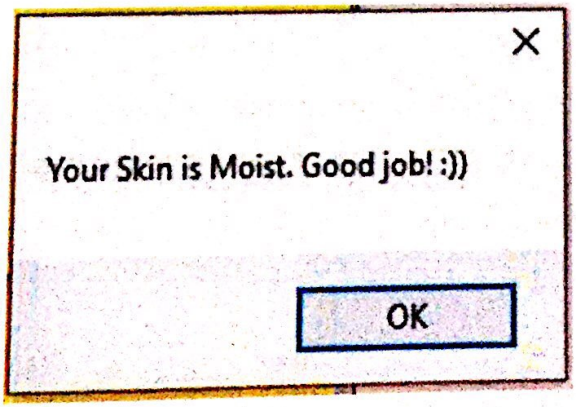


Figure 4.24: A result for moist skin

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter discussing about the conclusion of this research as a whole. There would be a future recommendation for this research that can be added for better result.

5.2 Conclusion

In conclusions, this Development of Skin Moisture System mainly based on MATLAB application in Graphical User Interface with three range values to identify the skin moisture. From the result of range values that were obtained, skin moisture can be differentiate into three values which are dry, normal and moist.

The value is based on the experimentation of 30 students randomly on two facial regions below eyes and cheeks. The obtained value from subjects were averaged to find the threshold value which then will be used for the range values. These range values is then used for building a system by using a GUI.

Then the system will show the result according to the range values obtained. There will be a recommendation for the user according to their skin type.

5.3 Future Development.

This software has been designed as a system for every user to identify their skin type and skin requirement. There still be an addiction for future which adding more skin type to the system. Moreover the system also can be made to be a system skin recognition where characterizing a gradient of facial skin according to their skin type by using MATLAB application in image processing For example, oily type of skin. The device that can be used to measure subjects skin is Sebumeter.

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```
function varargout = COVERPAGE(varargin)
% COVERPAGE MATLAB code for COVERPAGE.fig
%      COVERPAGE, by itself, creates a new COVERPAGE or raises the
existing
%      singleton*.
%
%      H = COVERPAGE returns the handle to a new COVERPAGE or the
handle to
%      the existing singleton*.
%
%      COVERPAGE('CALLBACK',hObject,eventData,handles,...) calls the
local
%      function named CALLBACK in COVERPAGE.M with the given input
arguments.
%
%      COVERPAGE('Property','Value',...) creates a new COVERPAGE or
raises the
%      existing singleton*.  Starting from the left, property value
pairs are
%      applied to the GUI before COVERPAGE_OpeningFcn gets called.
An
%      unrecognized property name or invalid value makes property
application
%      stop.  All inputs are passed to COVERPAGE_OpeningFcn via
varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows
only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help COVERPAGE

% Last Modified by GUIDE v2.5 27-Apr-2017 23:56:22

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @COVERPAGE_OpeningFcn, ...
                   'gui_OutputFcn',  @COVERPAGE_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT
```

```
% --- Executes just before COVERPAGE is made visible.
function COVERPAGE_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to COVERPAGE (see VARARGIN)

% Choose default command line output for COVERPAGE
handles.output = hObject;
 A = imread ('C:\Users\nasmahira\Desktop\Current Directory\REAL
TEST\bgtest.jpg');
 axes(handles.axes1);
 imshow(A);
 % create an axes that spans the whole gui
ah = axes('unit', 'normalized', 'position', [0 0 1 1]);
% import the background image and show it on the axes
bg = imread('C:\Users\nasmahira\Desktop\Current Directory\REAL
TEST\bg.jpg'); imagesc(bg);
% prevent plotting over the background and turn the axis off
set(ah,'handlevisibility','off','visible','off')
% making sure the background is behind all the other uicontrols
uistack(ah, 'bottom');
% Update handles structure
guidata(hObject, handles);

% UIWAIT makes COVERPAGE wait for user response (see UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = COVERPAGE_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;


% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
%close current figure
PAGE2new_handle = PAGE2new; % open GUI_2 and save the handle
delete(get(hObject, 'COVERPAGE')); % close COVERPAGE
%open the new one
```

```
function varargout = PAGE2new(varargin)
% PAGE2NEW MATLAB code for PAGE2new.fig
%      PAGE2NEW, by itself, creates a new PAGE2NEW or raises the
existing
%      singleton*.
%
%      H = PAGE2NEW returns the handle to a new PAGE2NEW or the
handle to
%      the existing singleton*.
%
%      PAGE2NEW('CALLBACK',hObject,eventData,handles,...) calls the
local
%      function named CALLBACK in PAGE2NEW.M with the given input
arguments.
%
%      PAGE2NEW('Property','Value',...) creates a new PAGE2NEW or
raises the
%      existing singleton*.  Starting from the left, property value
pairs are
%      applied to the GUI before PAGE2new_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property
application
%      stop.  All inputs are passed to PAGE2new_OpeningFcn via
varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows
only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% edit1 the above text2 to modify the response to help PAGE2new

% Last Modified by GUIDE v2.5 16-May-2017 21:13:04

% Begin initialization code - DO NOT EDIT1
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @PAGE2new_OpeningFcn, ...
                   'gui_OutputFcn',  @PAGE2new_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT1


% --- Executes just before PAGE2new is made visible.
function PAGE2new_OpeningFcn(hObject, eventdata, handles, varargin)
```

```
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to PAGE2new (see VARARGIN)

% Choose default command line output for PAGE2new
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% Choose default command line output for PAGE2
handles.output = hObject;
 % create an axes that spans the whole gui
ah = axes('unit', 'normalized', 'position', [0 0 1 1]);
% import the background image and show it on the axes
bg = imread('C:\Users\nasmahira\Desktop\Current Directory\REAL
TEST\bg.jpg'); imagesc(bg);
% prevent plotting over the background and turn the axis off
set(ah,'handlevisibility','off','visible','off')
% making sure the background is behind all the other uicontrols
uistack(ah, 'bottom');
% Update handles structure
guidata(hObject, handles);

% UIWAIT makes PAGE2new wait for user response (see UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = PAGE2new_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;



function edit1_Callback(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit1 as text2
%        str2double(get(hObject,'String')) returns contents of edit1
as a double



% --- Executes during object creation, after setting all properties.
function edit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
```

```
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns
called

% Hint: edit1 controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



% --- Executes on button press in ENTERbutton.
function ENTERbutton_Callback(hObject, eventdata, handles)
% hObject    handle to ENTERbutton (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

 value = str2num(char(get(handles.edit1,'String')));
 svalue = num2str(value);
if (value >= 35.55) && (value <= 42.175)
    s1 = 'Your score is= ' ;
    s2 = ' And your skin is dry, Do not be lazy, wear your
moisturizer! :)';
    sdry = strcat(s1,svalue,s2)
    set(handles.text5,'String',sdry)
elseif (value >= 42.175) && (value <= 49.45)
    s3 = 'Your score is= ';
    s4 = ' And your skin is normal, Keep It Up! Never miss a
moisturizer :))';
    snormal = strcat(s3,svalue,s4)
    set(handles.text5,'String',snormal)
elseif (value >= 49.45) && (value <=56.725)
    s5 = 'Your score is =';
    s6 = ' And your skin is moist, Well Done! Good Job. You can
boasting to others now~;))';
    smoist = strcat(s5,svalue,s6)
    set(handles.text5,'String',smoist)
else
   h = msgbox ('Are you a human? Enter the human-like value', 'Yu
Okey?' , 'Help');
end
```

APPENDIX B

Subjects	Forehead	B.Eyes-R	B.Eyes-L	Cheek-R	Cheek-L	Hand-R	Hand-L
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

APPENDIX C

Consent Form

Title of Study: Development Of Skin Moisture System

I understand about the information of this study and received explanation from the investigator about the purpose of the investigation including benefits and risks

I am _____. Matrix number _____. Phone number_____.

"Agree/Disagree to participate in the studies as described above.

Signature,

_____,

Date:

APPENDIX D

Borang Kebenaran

Tajuk kajian: Penambahaikan terhadap sistem kelempaban kulit.

Saya memahami mengenai maklumat kajian ini serta mendapat penjelasan lanjut daripada penyelidik mengenai tujuan penyelidikan termasuk faedah dan risikonya.

Saya _____. Kad matrik _____. Nombor telefon _____. "Bersetuju / Tidak Bersetuju" untuk menyertai kajian yang dinyatakan seperti diatas.

Tandatangan.

_____,

Tarikh: