Criminal Suspect Face Construction Application

by

Siti Rabiatul Aisyah Radzuan

Dissertation submitted in partial fulfilment of

the requirements for the

Bachelor of Technology (Hons)

(Information & Communication Technology)

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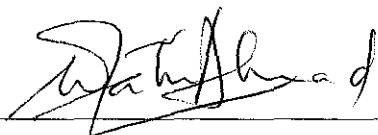Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

Criminal Suspect Face Construction Application

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A project dissertation submitted to the
Computer Information Science Programme
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Approved by,

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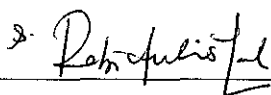Assoc Prof Dr Wan Fatimah Wan Ahmad

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
MAY 2011

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have been undertaken or done by unspecified sources or persons.

SITI RABIATUL AISYAH RADZUAN

ABSTRACT

Facial composite is no longer new term into criminal law. Facial composite is an alternative methods acted as a visual likeness representation of the criminal's face structure. Most of the police officers in both local and international country have been practicing this method as one of their methods to identify the criminal suspect's face. This paper presents the study of the several face construction methods as well as to develop a face construction application that meets the requirements. Typically, the witnesses often are facing difficulty in describing the criminal suspects' face. It is due to they might be influenced by many factors such as emotions which in a way resulted in not accurate information or description. This paper focuses on the study of the Royal Malaysian Police Officer and the crime witnesses of violent crime (homicide/murderer) cases, highlighting on the Face Construction, a method used by the police officers to construct the criminal suspect's face. Apart from that, the study carried out has been based on research methodology used which is Iterated Waterfall Model which consists of five phases; Requirements, Design, Implementation, Testing and Maintenance. SwishMax has been used as a platform to develop the project; Criminal Suspect Face Construction Application. As for findings part, Usability Testing emphasize on five aspects has been conducted in order to test the usability of the application which resulted in 54% of design layout, 38% of functionality, 70% of ease of use, 65% of satisfaction, 43% of outcome/future use and 40% of error/system reliability.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Few years ago, the mass media have been replete with many types of crime and violence reports such as snatch thefts, rapes, murders, child abuse, kidnappings as well as numerous fatal road accidents which have been occur within Malaysia. The current crime situation nowadays seem to be worrisome issue within the police leadership due to it is not only a major statistical element in the criminal justice system, however it impact the confidence level of the public towards police officers' capability (The Report of The Royal Commision To Enhance The Operation And Management Of The Royal Malaysia Police Officer, 2005).

Statistic of crime has been increased in Malaysian as verified by arising index crimes statistics and depreciation of the Public Safety Index stated in Malaysian Quality of Life Index (MQLI) 2004. According www.rmp.gov.my, Royal Malaysian Police Officer came out with the number of crime issue occurred in Malaysia year between 2000 up to 2006.
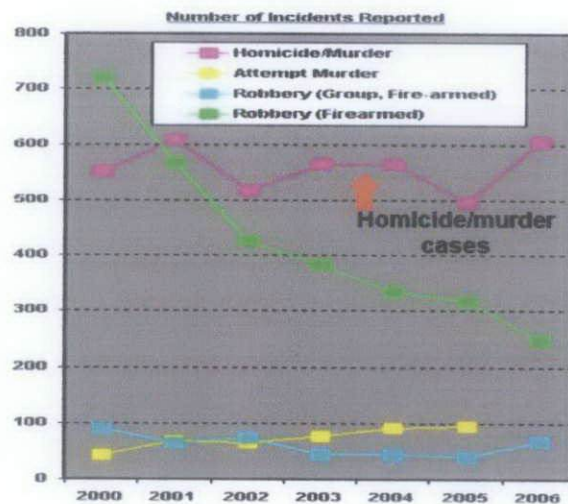

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Figure 1: Number of Incidents Reported; 2000-2006

In Figure 1, the arrow indicates the homicide/murder cases that have been occurred in Malaysia since 2000 up until 2006. T homicide/murder cases shown that the rate of the crime occur is unstable which are there were increasing and decreasing in a big gap of rate as regards to the respective year. However, another cases such as attempt murder, robbery (Group, Fire-armed) and robbery (fire-armed) show that they are gradually increasing, decreasing, decreasing respectively.

In order to solve each of the crime cases occurred, police officers have used many of ways as their investigation methods, for instance, analyzing the crime location, interrogating the witnesses and bystanders and etc. The witnesses have become one of the most important elements for any crime cases as they are one of the sources that police officers gain information from.

Facial composite is an illustration image constructed based on the memory of the eyewitnesses. Ellis (2010) defines facial composite as a criminal's graphic representation as regards to memory and description recalled by the witnesses. The most conventional ways to construct the criminal suspect face is by using the hand-sketching method, involving the sketch artist who often specialized and have many experiences in compositing. According to the Inspector Jimbai Anak Bala, Criminal Investigation Department Officer at Kuala Lumpur Police Headquarters said that image constructed helps them to slightly narrow down the scopes (Yoon, 2008).

However, due to the rapidly technology changes, many software company has been developed the facial construction software. This software method has be widely applied in the international level but in Malaysia, the police officers still practicing the conventional method; hand-sketching method. Typically, the software method would be consisting with various types of each respective feature as faces, eyebrows, eyes, noses, mouth and hair.

1. 2 Problem Statement

1.2.1 Problem Identification

During interrogation session, the witnesses often face the difficulty to describe

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the criminal suspect's face which always leads to the accuracy of the information given. It is due to the difficulty to describe the face structure itself and also the witnesses are influenced by certain factors such as emotions. For instance, those victims that being in an anger situation tends to exaggerate the criminal suspect's face features which in way would lead to the inaccuracy description. Apart from that, it would impact on the police officer's side as they would face a hard situation to construct the exact face features corresponding to the details given. Hence, these factors would contribute to the complexity in portraying the suspect's image.

1.2.2 Significance of the Project

Instead of using the conventional methods, the face composite software method is able to assist the police officer or sketch artist to construct the suspect's face structure. A computerized version seems to be more significant as it provides a list of facial features to be selected by the witnesses during the interrogation session. Hence, it improves the communications skills of the witnesses and helping them a much easier way in providing much accurate information.

A computerized version seems to be more significant as it would ease the police department in distributing the image to the media and other police stations while the hand-drawing need to undergo the scanning session to be kept in the database.

1.3 Objectives and Scope of Study

This study emphasizes on the three objectives which are:
1. To investigate several face construction methods
2. To develop the face construction prototype base on the design requirements
3. To test the usability of the prototype

The scope of the study is on the Royal Malaysian Police Officer and the crime witnesses of the homicide and murder which focusing on the methods be used during the investigation/interrogation session. Critical review on related information will be included in a way to figure out the requirements needed for the project, for instance, a list of facial structure.

The study seems to be relevance as the crime statistics has been increased year by year and the demands of the computer software been increasing regards to rapidly changes in the technology industry. The difficulty of the study is to obtain the specific design requirements such the facial feature list that suit to the Malaysian as well as the police department.

1.4 Relevancy of the Project

The study seems to be relevance as the crime statistics has been increased year by year. Apart from that, it is due to the high demands of the computer software be increasing as regards to the rapidly changes in the technology industry. Therefore, there is an essential on developing the project as the main purpose of facial composite is helping the police office keep tracking down the criminal as Malaysia police officer yet to practice the facial composite software in their investigation.

Besides that, computer version is consists of a list of facial structure that would enable to assist both sides in constructing the respective suspect.

1.5 Feasibility of the Project within the Scope and Time frame

The feasibility of the project will be determined by conducting a series of study and research which include the interview session with the police officers. The developer seems to face the difficulties in fulfill the design requirements suited to the police department. Other than that, the developer would face difficulty in determining the face features list that need to be included in the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Facial composite is a graphical representation of a criminal which relies on the memory and portrayal by the witnesses. The Association of Chief Police Officers (Scotland) (ACPO(S)) defines facial composite as "made up of various parts or blended" and "as bearing close similarities, characteristics and resemblances to the person portrayed (pg.2)." Facial composite frequently been used as one of the investigation methods used by the police officers in tracking down the criminal mostly related to a serious crime such as homicide or murder which cases in which cases that there is no photographic evidence (i.e.: Closed-circuit television (CCTV)). Malaysia police officers has implemented the composite methods in the case of The Kampung Baru Moloestra, aka Catman, which the image released is not a photograph but a composite, a drawing combining different facial features until they portray the suspect (Yoon C. M., 2008).

The facial composite may be generated into two versions; hand-sketching version or computer-generated sketching (by using the face composite computer software). The hand-sketching version involves sketch artist where this artist will hand-constructed the criminal's face composite based on the description given by the witnesses. The artist would use pencil or crayon as drawing tools which sometimes involve sketching and painting.

As technologies has been increased, many software, system, application, etc been developed in offering people the alternative ways of solving the problems; not excluded for facial composite too. In 21st century, the facial composite computer software was already existed. This software has been practiced by the international police officer but still not been used by Malaysia. Malaysia is still using the most basic method of facial composite; hand-sketching. Facial composite software offers the police department an alternative to construct the criminal's face features. Other than that, it assists the witnesses by allowing them to dynamically choose the facial features from the database

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which are matched to the suspect.

This computer software has widely been used within the international country. Hand sketching once being as the primary means in facial composite area, but modern computer method become much more popular and taking place starting of 21st century (Ellis J. , 2010). The computer software for composite production is more sophisticated which consists of a set of facial features (i.e. eyes, noses, hair) for example Indentikit 2000 and FACES which have been applied in United States. Principally, the construction result obtained will be circulated within a police force to generate lines of enquiry.

The computer version is rather better than the hand-drawing version due to several factors:

Table 2.1: Comparison on computer and hand sketching facial composite

Types / Criteria	Facial Composite (Computer-generated version)	Facial Composite (Hand-sketching version)
Communication capability	• Helps the witnesses in describing the type of each facial feature. - The witnesses capable of picking up the facial features which is coincided to their memory.	• Witnesses face difficulties of describing the face structure of the criminal. Though the sketch artist would guide and assist them but still incidence of miscommunication occur is existed.
Technology implemented	• Technology implemented into the computer software development (i.e. programming languages, software and hardware used as the tool). Computer usage resulted in making use of more sketch art (Burdi J. , 2010).	• Make uses of manual method; using pencil, crayon as the tools.
Benefit	• Able to circulate the result into the police force and media to generate lines of enquiry.	• Need to undergo the scanning step for the result to be kept in database and being distributed.

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Usually, the witnesses needed to recall back their memory during describing the criminal facial composite which will be sketched by the artist. At the first phase, the composite would be presented to the witnesses but then they propose amendments to create the best possible likeness of the facial composite. It has been clearly stated that the verbal description and visual memories are different (Davies, 1983). The verbal description provided by the witnesses is important to assist the police officers to investigate the cases. According to the http://www.psypress.com, eyewitness's identification is an important component of evidence, prosecution and plea negotiation for many cases. And this accurate information provided would help the judgments to be effectively carry out.

Therefore, by using the computer software, it would able to imply the verbal description to the visual memories. It is due to up to certain particular situation, the visual memories are hard to be interpreted in verbal description. By having the computer software it would help the witnesses to be more well-described by having the chance to interpret the description by choosing the facial features from data base provided.

The computer software available for the composite purpose is becoming more sophisticated and consists with a various type of facial features that allow the users to resize and positioned (if any). This includes Identikit 2000 and FACES which already be practicing in the United States while Electronic Facial Identification Technique (E-FIT) and PROfit be using in the United Kingdom. These contemporary methods (computer software) have been the issue of some certain evaluations. A research had been carried out in the 1970s and 1980s to evaluate the methods used (Davies, Ellis and Shepherd, 1978). Most of available facial composite software implied theory of memory recall. The carried research involved the "fake" witnesses where they would be exposed to a photograph (criminal's face image) but then they were required to describe and construct the given criminal's face structure by using the composite software. The images sketches were evaluated using likeness ratings or matching the composites to the prearranged image before. In truth, the composite system has been improved the facial composite method about 20% of the time (Brace et al., 2000; Bruce et al., 2002; Davies et al., 2000;

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Frowd et al., 2004c). These systems were deemed to be of benefit by including features that includes databases of features as an approach of selection and breeding of the facial form (Hancock, 2000).

Still there has been issue arise regards to the facial composite software; how accurate the software works as the software relies on the description and memory recall by the witnesses. Numerous factors can be a threat to the accuracy of the eyewitness composites such as exposure time to the crime, target distinctiveness, emotions, delay following procedure which each of the factor has their role play in producing accurate facial composite (Kranich, 2007). It cannot be denied that a witnesses' memory would become weaker after a period of delay time which resulting in a relatively poor description as well as low quality of the composite. However, the police officer has taken an alternative way to assist the witnesses to recall the information by using the Cognitive Interview (Geiselman, Fisher, Mackinnon, & Holland, 1986). Hence, by working on the composite construction which contain of recall elements; selecting facial features and supported by the recognition interview; determine either a composite face may be recognizable to another person may be beneficial to the police officers to obtain much accurate image.

Research on the value of composite production systems has concentrated on the reasons behind the poor images performance in relation to facial recall ability from memory. Specifically, research has focused on the question of whether it is the systems themselves that are inflexible and ineffective, whether it is the witness with the poor recall ability and descriptive powers. Early research by psychologists into the effectiveness of composite systems centred on the sketch artist in comparison with the IdentiKit and PhotoFit systems. Davies (1983) refers to the difference between the sketch and composite systems, respectively, as a choice between a realistic and life-like portrait, which may be wrong in detail but readily related to faces stored in memory and a schematic representation which conveys only what is known and, because of its simplicity will trigger recognition.

Besides that, the successful of the composite software also relies on the talent of the police officer who are responsible to construct the image. For instance, the police officer in the United Kingdom, who are using PROfit or E-FIT will identifying the

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subset of features based on the eyewitnesses' verbal description. It is due to the contemporary systems contain too many features to be inspecting. Then, the composite face, the best matches the description presented to the witnesses. Witnesses then would suggest amendments to create the possible likeness representation of the suspect. Therefore, according to the Davies (1983), it has been established that the verbal description is differ from the visual memories.

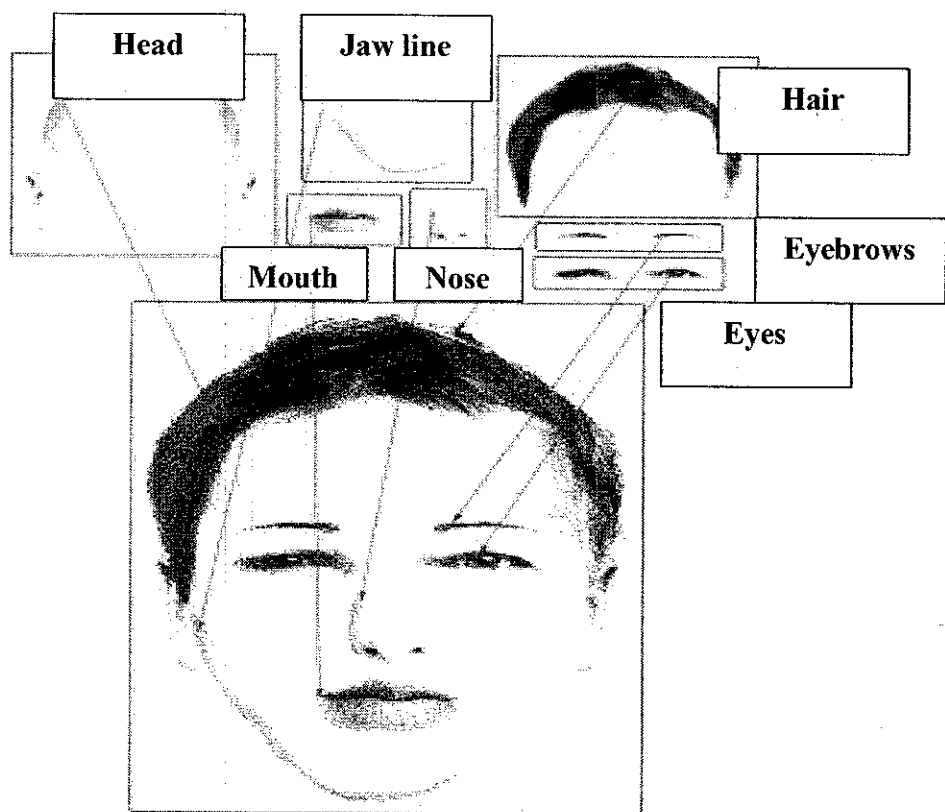Figure 2.1 shows an example of facial composite, made up by each facial feature.

Figure 2.1: An example of facial composite, made up of its facial feature
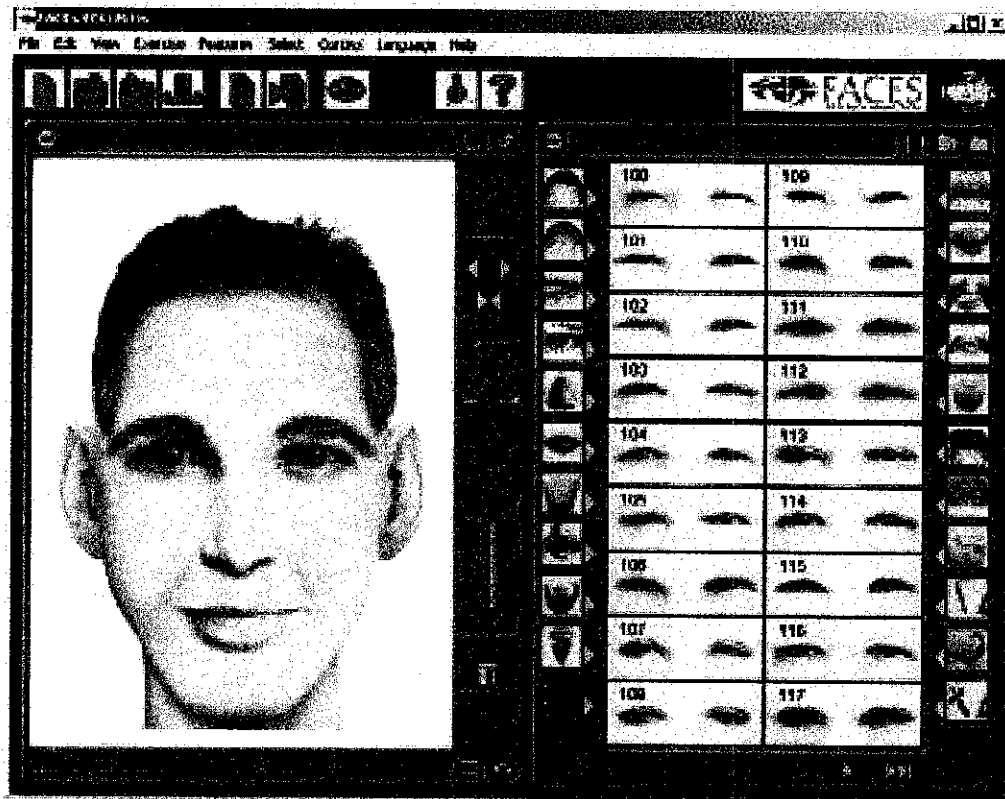
Figure 2.2: FACES: Facial Computing Software

Figure 2.2 shows an example of facial computing software be using in the United States (US).

2.2 Usability Test

According to Nielsen (1993, p. 165), usability testing is the most essential method and inimitable under the reason that, it is the only means that allow the developers in obtaining direct and detail information on the users' performance and experience with the product tested.

By using in a range of five to seven users, it is sufficient to test on the products in a way to identify the users' performance and satisfaction towards the products as well as problems they encountered during performing the test.

There are many methods can be used in conducting the usability test such as interview, observations, heuristic, questionnaires, etc. However, the observations and questionnaire methods are seem to be most relevant method in testing the facial composition application. It is due to heuristic method requires involvement of the

professional usability experts reviews on the product.

By using the interview/observations method, the application is able to be tested by having a few one-on-one sessions with the users. During observations part, the behavior and performances of the users being observed while questionnaire will be filled up by the users once the testing is done. The list of questionnaires given indicates their feedback towards the project. There is also possibility to conduct both types of session at the same time.

CHAPTER 3

METHODOLOGY

3.1 Research Methodology and Tools Required

3.1.1 Development Life Cycle

The system Development Life Cycle (SDLC), processes of creating, developing and altering the system which in a way that developers as a model and methodology to develop the systems.

The project adopts a waterfall model development life cycle which is segmented into five phases. The first phase is mainly focuses on research task while the other phases involve the development stage. The phases involved in waterfall model as below:
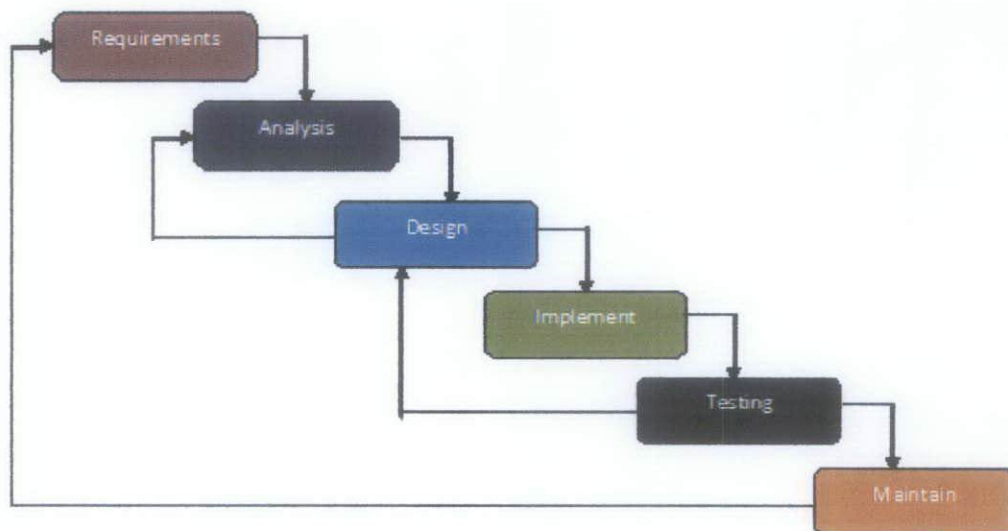

Figure 3.1: Iterated Waterfall Model

3.1.1.1 Requirements

The first phase is considered to be the most crucial stage as any misinterpreting step and information may lead to arising problems during the development phases. This project focuses on developing the facial construction application to be used by the police officers as their alternative ways to construct the criminal suspect's face.

Hence, the author has analyzed the requirements for the proposed project such as:

- Related information of the proposed project
- Required function and design type
- Performance and interfaces of the prototype

The project is initiated with a detailed background study on composite drawing. Related methods in composite drawing as computer or hand composite drawing are studied to figure out the differences (i.e. strengths and weaknesses issues) of both methods. The differences of both methods are carried out to be compared.

3.1.1.2 Design

The design phase is the designing process where the specifications of the system is about to be implemented. Specifications of the system include how the system would be carried out (i.e. properties and methods), the software and hardware involved and etc. interconnection between the required software are recognized for a connection to be made. To sum it up, along this stage, the overall design structure is identified.

The design of the application has been decided which in a way to have two main scenes. The first scene is the main page of the application works slightly similar like welcoming page. It contains an enter button which lead the user to the next page. The second page is the most crucial one as the most function of the application are located there. It consists of the type of facial features to be selected for facial composition purpose.

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3.1.1.3 Implementation

This stage also known as coding and verification phase where the actual software development takes place. The design in the second phase is translated into the codes. This stage also classifies the right programming language is chosen.

The design mentioned above has been translated into the codes by using Swish Max platform. There are a lot of implementation process be involved along during the development phase. It is due to the earlier versions are not really meet the requirements and satisfaction. Details of the codes would be attached in the appendix section during the final one.

3.1.1.4 Testing

Once the prototype has been completely developed, a testing will be conducted to ensure that the complete prototype meets the requirements of the users. Meeting the user requirements is vital as it is one of the objectives of the project being carried out. Hence, the usability testing is be chosen to run a test to determine the direct interaction between user and the prototype. The usability testing would measure on the ability and the capability of the user while using the prototype. Therefore, the objectives of the project may or may not be accomplished as regards to the performance of the user.

3.1.1.5 Maintenance

Maintenance is the final phase of the waterfall model where the software is already been deployed. After the software has been deployed, maintenance work needs to be carried out due to:for any changes or enhancements in future which involve the entire process to be restarted.

- Meet the future changes needed by the users
- For enhancement purposes to expand on the efficiency of the performance as well as to encounter the error

3.2 Project Activities

3.2.1 Work Plan

Table 3.4 indicates the project work plan regards to the development of the project.

Table 3.1: Project Work Plan

Requirement Phase	- Study on research topic
	- Carry out research on the selected topic
	o Related information and issue on selected topic
	   o Design requirements
	   o Hardware and software to be used

Analysis Phase	• Brief study on the project, identify the accuracy of the information gathered, references, citations
Development Phase (Design, Implementation, Testing and Maintenance)	• Identification on prototype overall structure. • Translation of design into codes. • Assessment and testing on the prototype. • Study on the expected results. • Re-testing of the prototype (if bugs encountered). • Assessment of the result. • Completion of the research.

3.2 Gantt Chart

Figure 3.2 shows the Project Gantt Chart.

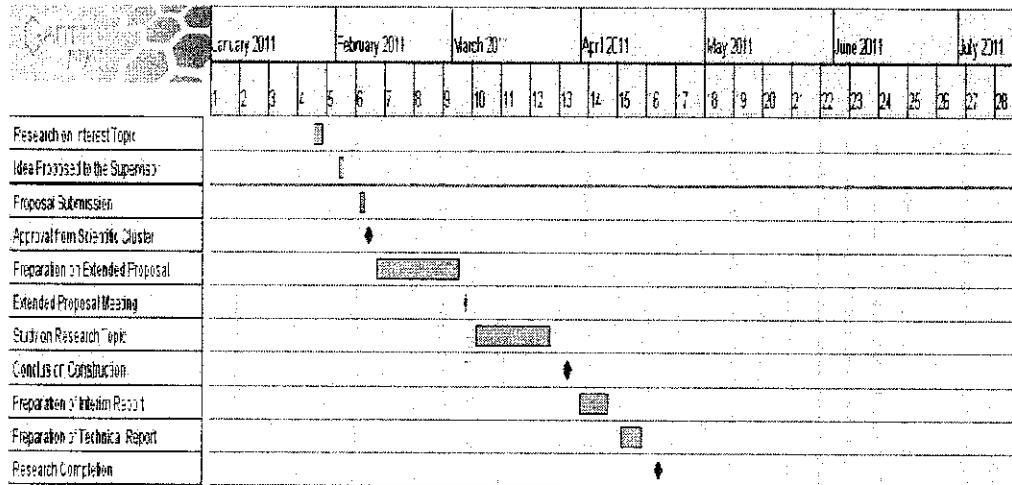
Figure 3.2: Project Gantt Chart

3.3 Tools/Equipment

1. Swish Max
2. Flash Player

Instead of using the Macromedia Flash, Swish Max has been chosen as the medium of developing the application due to a few reasons. Generally, both Flash and Swish can perform the same functions and produce the same outcome; an exported file .swf. Apart from this similarity, both tools still have same important differences in term of their attributes. Table 3.2 indicates the differences between Flash and Swish Max.

Table 3.2: Differences between Flash and Swish Max

Criteria / Tools	Flash	Swish Max

Learning curve	• Higher learning curve - Which imply a higher degree of difficulty in terms of learning process. - But still, it provides the user a wide selection after the user learned on how to utilize it.	• Lower learning curve - Meaning that Swish has a lower degree and simpler to learn. - Provides other uses once the learning step is done.
Ease of use	• Commonly be used by the serious and committed flash designer.	• Applicable for those who intend to develop a simple and fast manner application.
Target Market	• Suitable for the business of serving the web design needs of clients which in a way the output of using Flash will impress them.	• Suitable for the sell products and simply promote the goods purpose. Which Swish will fit the animation needed.

Flash Player is required where the application going to be used as conditions to ensure that .swf files can be displayed.

3.4 Interview

An interview has been conducted with a police officer to identify the information regarding the methods they be using in investigating the cases. Below is the list of questions that being asked during the interview session.

1. What method do police officers often used to construct the suspect's face?
2. Does is it hard to manual construct the image based on the verbal description?
3. Is there any reasons why Malaysian Police Officer yet to apply the facial composite software?
4. Do you think facial composite software might be able to support the police investigation?

5. In your opinion, which method would be more beneficial to both police officers and witnesses?

6. Do you think that the facial composite software will replace the duty of the sketch artist in the future?

7. Is there any possibility that Malaysian Police Officer will use the facial composite software as part of their investigation methods?

3.5 Usability Testing

Usability testing has been chose in testing the usability testing on the prototype. Table 3.3 shows list of the questionnaire be distributed to the users while the usability testing be performed.

Table 3.3: List of Questionnaire

Criteria	1	2	3	4	5
Design/Layout					
Interface of the application is pleasant to use					
Information organization presented is clear					
Functionality					
The application has all the functions and capabilities					
The application flow is smooth					
Ease of Use					
It is simple to use this application					
It easy to understand this application					
The information provided is clear					
Satisfaction					
I felt comfortable using this application					
I enjoyed constructing the image through this application					
Overall, I am satisfied with this application					
Outcome/Future Use					
I was able to complete the task quickly					
I could not complete the task in a given time frame					
I believe I could become more productive by using this application					
Errors/System Reliability					
Mistakes done are easily to be recovered					

The questionnaire has been divided into ix elements which are the design/layout, functionality, ease of use, satisfaction, outcome/Future use and errors/system reliability

with a range of five (1: Totally disagree up until 5: Totally agree) has been included to identify the users' feedback after having the usability testing

CHAPTER 4

RESULTS AND DISCUSSION

The author had conducted an interview session with a police officer from Bukit Aman, Kuala Lumpur. Below are the results being obtained from the interview session.

1. **What method do police officers often used to construct the suspect's face?**

   For now, we (police officers) are having our own sketch artist which he or she may or may not one of our police members. Usually their services are needed when a crime cases occur where no CCTV is available. For instance, for the cases like kidnapping, raping, murder as well as robbery. Hence, the police officers require their services to construct the suspect's facial structure correspond with the description given by the witnesses or the crime victims. Therefore, the police officers are really appreciating for those who are giving their cooperation in helping the police officers. However, we are aware that the international police already practicing the facial composite software method in their investigation methods.

2. **Does is it hard to manual construct the image based on the verbal description?**

   Actually, it is not that hard to manually construct the image. However, it turns to be complex when the witness is facing difficulty of facing the facial features. Besides, the witnesses might be under unstable emotions such as fear or anger. Therefore, it takes time to construct the most accurate image as well as waiting for the witnesses to be calm before providing the information.

3. **Is there any reasons why Malaysian Police Officer yet to apply the facial composite software?**

Basically, there is no specific reason of why we yet to practice this method. However, it can be because of seriousness level of the crime occurred. The crime cases occurred in Malaysia still can be considered as light rather than international level which involve with many serious level of the crime. Hence, there is a need for them to adapt the composite software to improve their efficiency to solve those particular serious cases.

4. **Do you think facial composite software might be able to support the police investigation?**

It would probably yes as the most of the facial composite software method providing its user with a list of facial features which these features might be able to assist the witnesses to properly describe the face structure. It is due to difficulty to describe the face structure as there are more than thousands of facial features that differentiate one from another.

5. **In your opinion, which method would be more beneficial to both police officers and witnesses?**

There is no exact answer for this question as the police officer still does not practicing the software method, however, as personal opinion; the facial composite software method might be the best options for both parties as the witnesses is able to select the facial features provided in the software and it make an easy way for police officer to construct the image based on the selection and description.

6. **Do you think that the facial composite software will replace the duty of the sketch artist in the future?**

It depends on the situation as police officers might require them to deal with the software as they have more experience in compositing. Besides that, there is a possibility that the police officers might hire them for compositing purpose.

7. Is there any possibility that Malaysian Police Officer will use the facial composite software as part of their investigation methods?

Yes but depending on the others perspective too as a lot of process and discussion need to undergo to adapt a new method. Apart from that, if Malaysian Police Officer decides to use this method, then a lot of training need to be conducting to ensure that the police officer in charge of this task is getting used to the software or hiring any sketch artist that are familiar with the software.

Based on the interview session, it can be concluded that, the Malaysian Royal Police Officers are not using the facial composite software yet due to the seriousness level of the crime occurred in the country compare to other international countries.

Apart from that, the Malaysia Royal Police Officers already have their own respective "witnesses/eyes" or more being known as their spies in helping them tracking the criminals. Generally these "witnesses/eyes" group are random people in that particular area. Some of them had committed into the crime before and others are public citizen that having a good and strong relationship with the police officers. The ex-convicted are much familiar with those respective crime situations as they have been in that kind of situation before. By using this kind of method, the police officers are having a great opportunity in understanding the situation as well as tracking the criminals involved with a help from their "witnesses/eyes".

Due to these reasons also, it clarifies the reason of why the Malaysian Royal Police Officer yet still to implement the software method as well as the reasons of why the needs of algorithm to prove the validity of the image constructed are not fully necessary.

4.1 Facial Structure Categories

Each facial feature consists of different form of face structure. For example, eyebrows itself consists of more than one type which each type of them are different from one another in term of the outlines, angle and so on. Below are list of each facial features that has been used in the Criminal Suspect Face Construction Application.
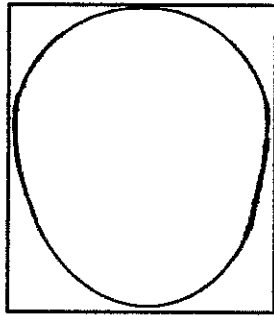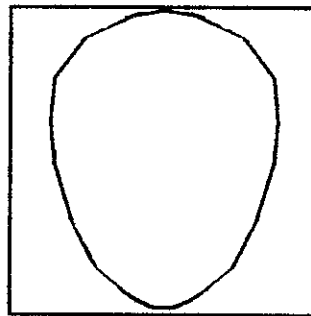
Faces:

Figure 4.4: Face 1

Figure 4.5: Face 2

Eyebrows:

Figure 4.6: Eyebrows 1
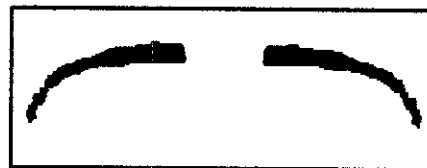

Figure 4.7 Eyebrows 2

Figure 4.8: Eyebrows 3

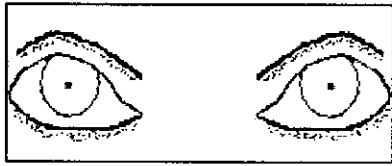Figure 4.9: Eyebrows 4

Figure 4.10: Eyebrows 5
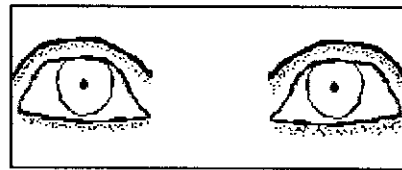
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Eyes

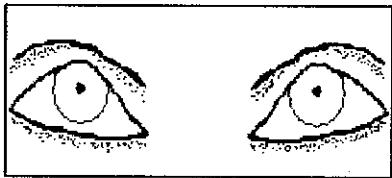Figure 4.11: Eyes 1

Figure 4.12: Eyes 2
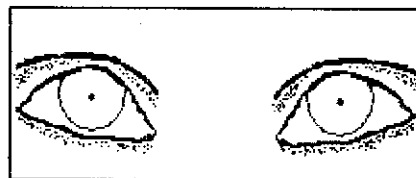

Figure 4.13: Eyes 3
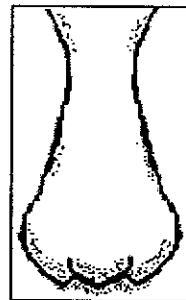

Figure 4.14: Eyes 4
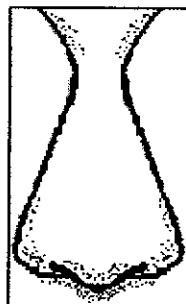
Noses

Figure 4.15: Nose 1
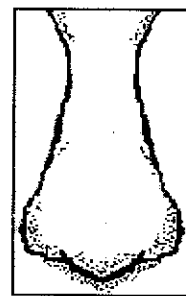

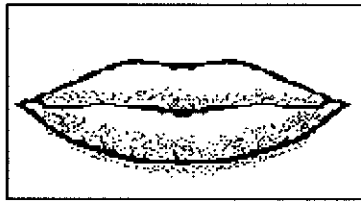Figure 4.16: Nose 2

Figure 4.17: Nose 3
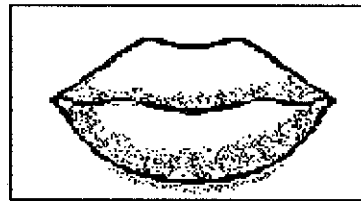

Figure 4.18: Nose 4
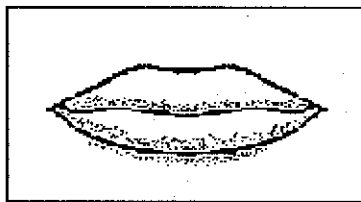
Mouth

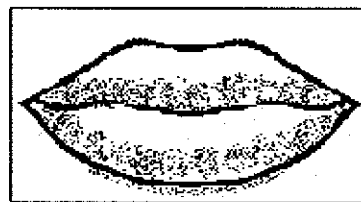Figure 4.19: Mouth 1

Figure 4.20: Mouth 2

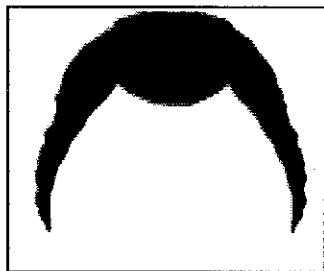Figure 4.21: Mouth 3

Figure 4.22: Mouth 4

Hair
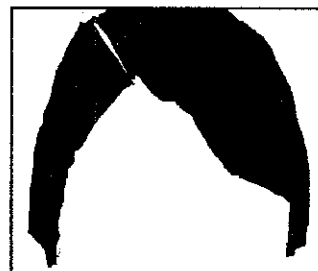
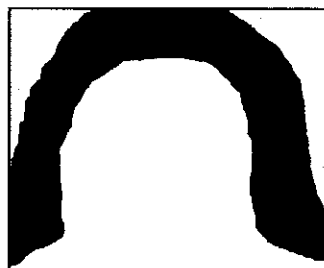

Figure 4.23: Hair 1

Figure 4.24: Hair 2

Figure 4.25: Hair 3

The differences of each type of facial structure would possibly give the user a chance to structure a high quality image. This due to the chances given to the user to dynamically and repetitively choose the best facial features which suit with the description provided. These features are important to both police officer and witnesses in constructing the most accurate images portraying the criminal's face.

The next part is the snapshot of the application that has been developed. The application is still in the process of developing as certain function still does not properly functioned. The application snapshots below were the first template be developed for the first progress report update. However, generous of comments gained upon the interactive and attractive of the designs.

4.2 Early Sketches

Figure 4.26 and 4.27 are the early sketches during the designing phase.

Figure 4.26: Welcome Page (Early Sketches)

Figure 4.2 indicates the overall application which consists of each of the facial features; faces, eyebrows, noses, etc. Each facial feature consists of different form of face structure.
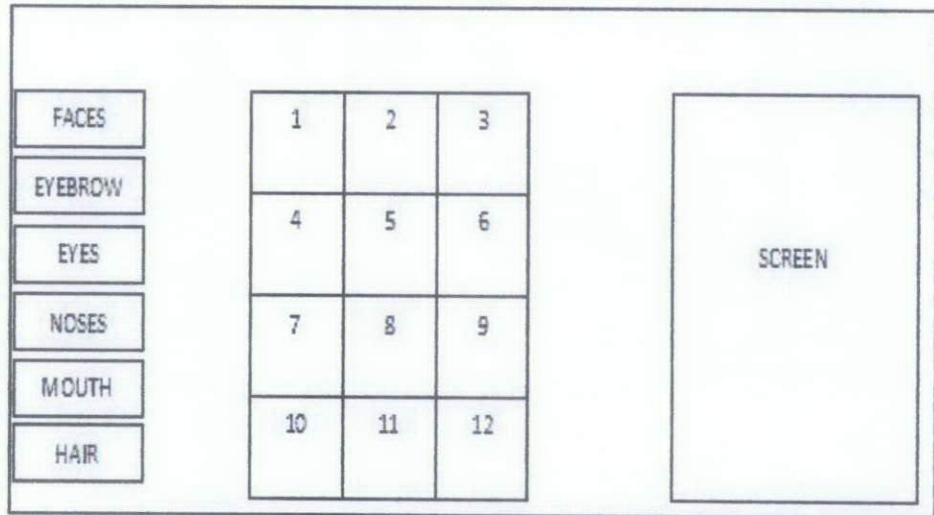
Figure 4.27: Application Page (Early Sketches)

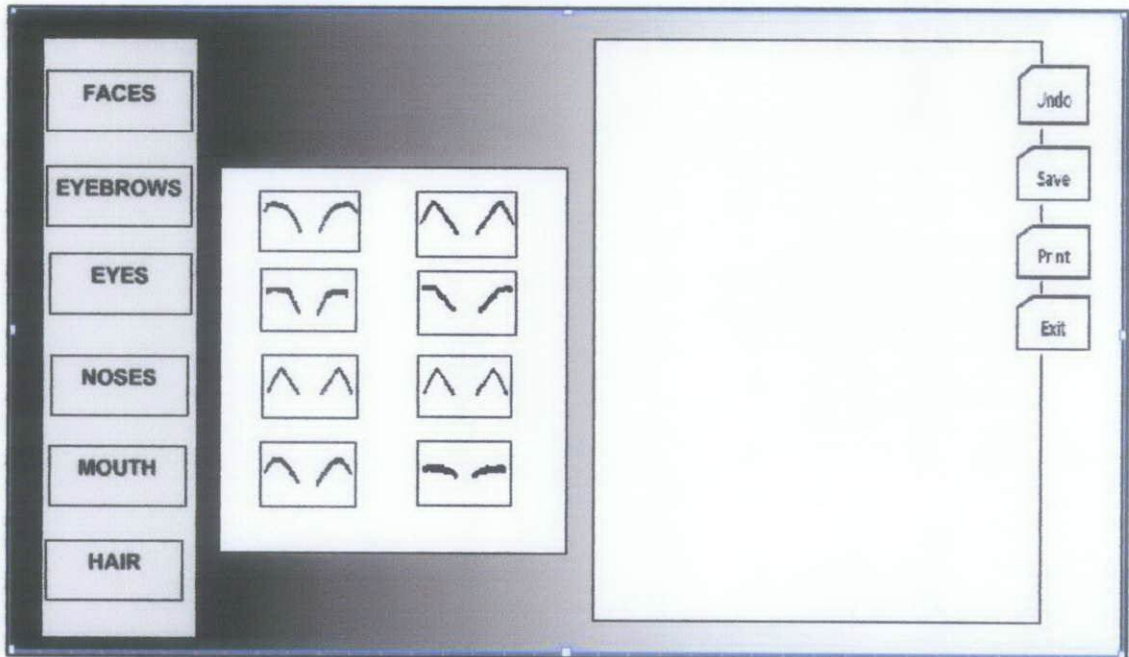## 4.3 First Design

Figure 4.28: First Page

Figure 4.29: Second Page

Figure 4.28 and 4.29 were the only progress of the application during the progress update session. Due to comments gained, a lot of changes are required to make on the application to ensure that the interfaces and design of the application are attractive, interesting and be able to capture the users' attention and meet their satisfaction level.

4.4 Second Design

Figure 4.30, 4.31 and 4.32 are the second design been developed upon the comments gained correspond to the first design. The second design is added with the function button as Enter Button and Exit Button to indicate a clear flow of the application.

Figure 4.30: Main Page (Second Design)

Figure 4.30 shows that the main page or welcoming page of the Criminal Face Recognition Application which are now the topic is already refined to the Criminal Suspect Face Construction Application. Once the Enter Button is clicked, the user will be linked to the next page. The Enter Button here embodies the link between the first page and second page.
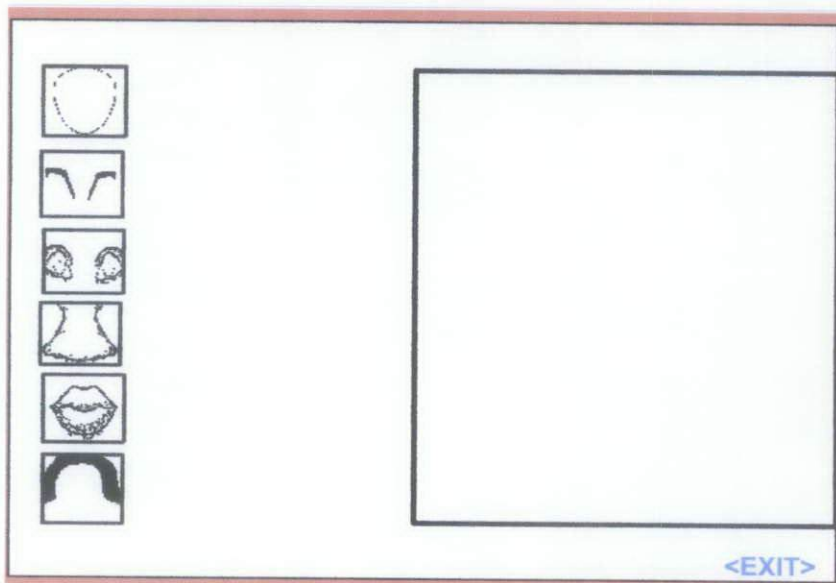

Figure 4.31: Application Page (Second Design)

Figure 4.31 shows that the application page where all the facial features are listed down. As stated above, there are six types of facial features; faces, eyebrows, eyes, noses. In a case, user rolls over the mouse on the any facial features, then a text will appear indicating what type of facial structure that user has rolled over.
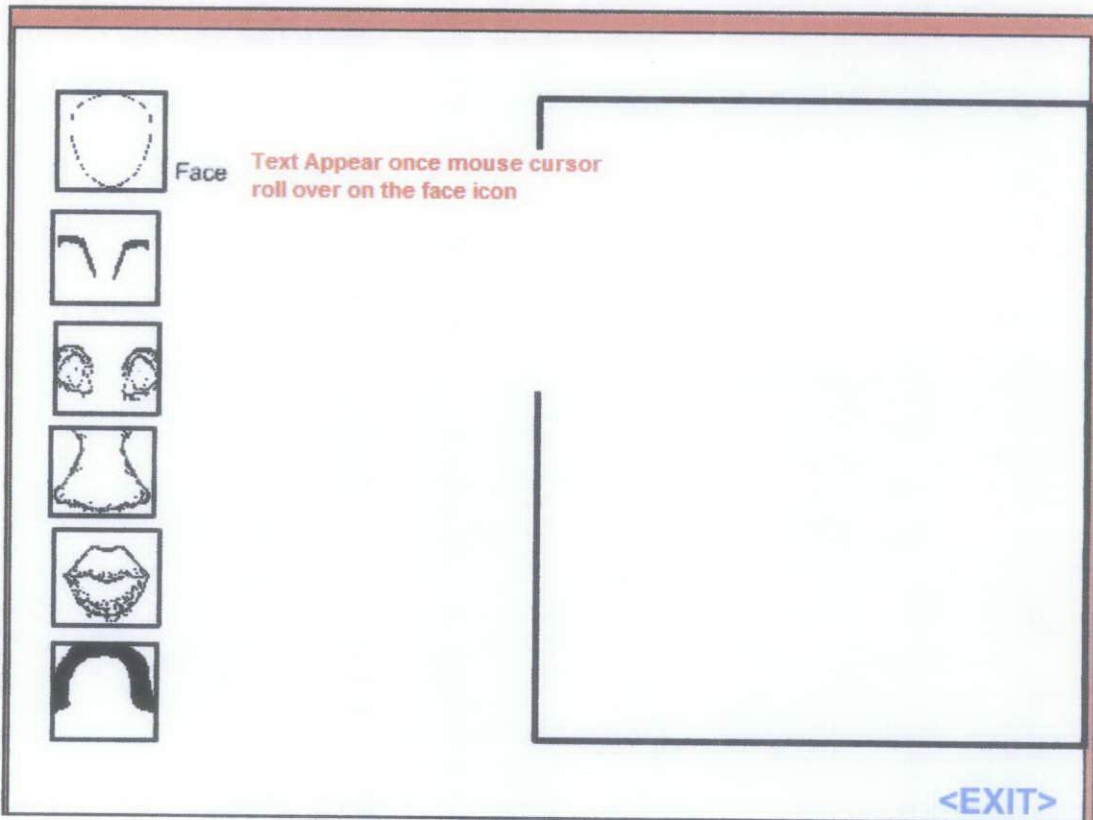
For example:

Figure 4.32: Application Page II (Second Design)

The function of the text appear is added for the purpose of assisting the users to keep aware each type of facial features they would choose. Besides that, it is also to avoid from confusion issue as the image provided may not portray what the user perceive. A notable example is the sixth image: Hair icon. The hair icon may be perceived as faces type instead of hair options.

4.5 Project Deliverables

The project planned is successfully executed upon prior comments gained from the supervisors and people around. Starting from Figure 4.33 up to Figure 4.41 are the main interfaces that have been designed during the development process of the Criminal Suspect Face Construction Application.

Final Design

Figure 4.33 indicates the Welcome page of the application.

Figure 4.33: Main Page (Final Design)

Differ from prior designs, the final one has been included with the login interfaces. The login interfaces require the users to insert their id and password to enable them to be link to the second page. As this application scope is to be used by the Police Officers, hence the login is necessary due to each police officer has their own identification number. Therefore, it is easy to keep track which police officer is in charge of the particular constructed image.
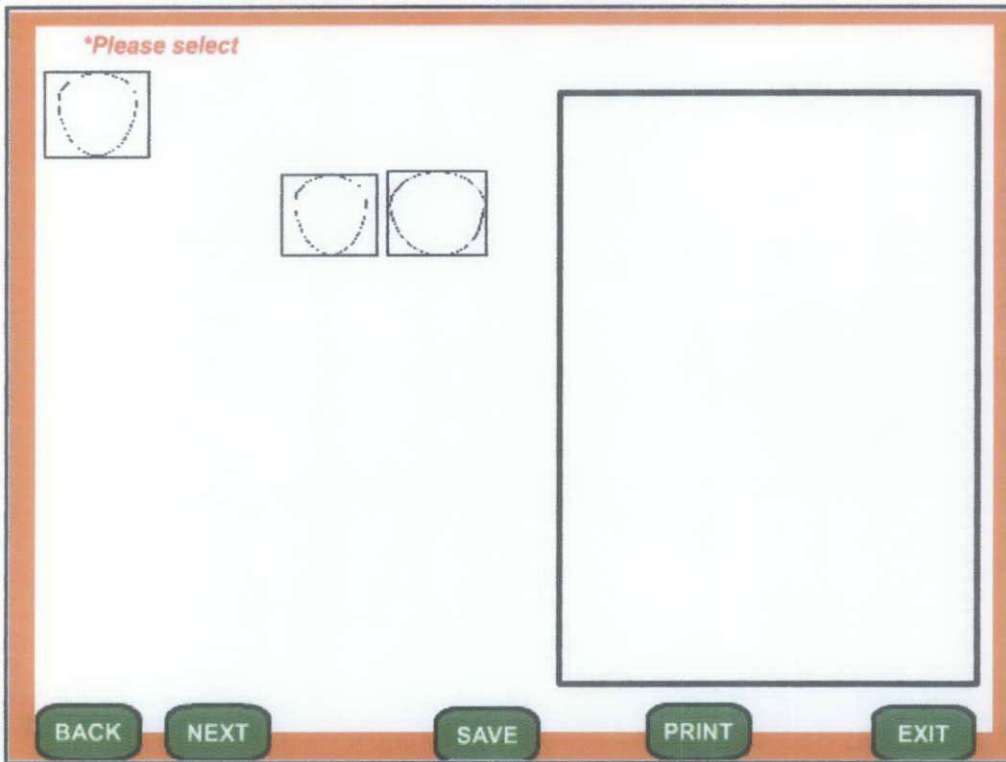
Figure 4.34: Second page (Final Design)

Figure 4.34 indicates the second page of the final design. Once the Enter Button from the previous page is clicked, then user will be linked onto this page. Instead of listing down all the facial types in one row, the developer has decided to list down one by one. This way would be much easier for the users to choose by only focusing on this type of features moving on to another part.

Assumption: User choose faces 1

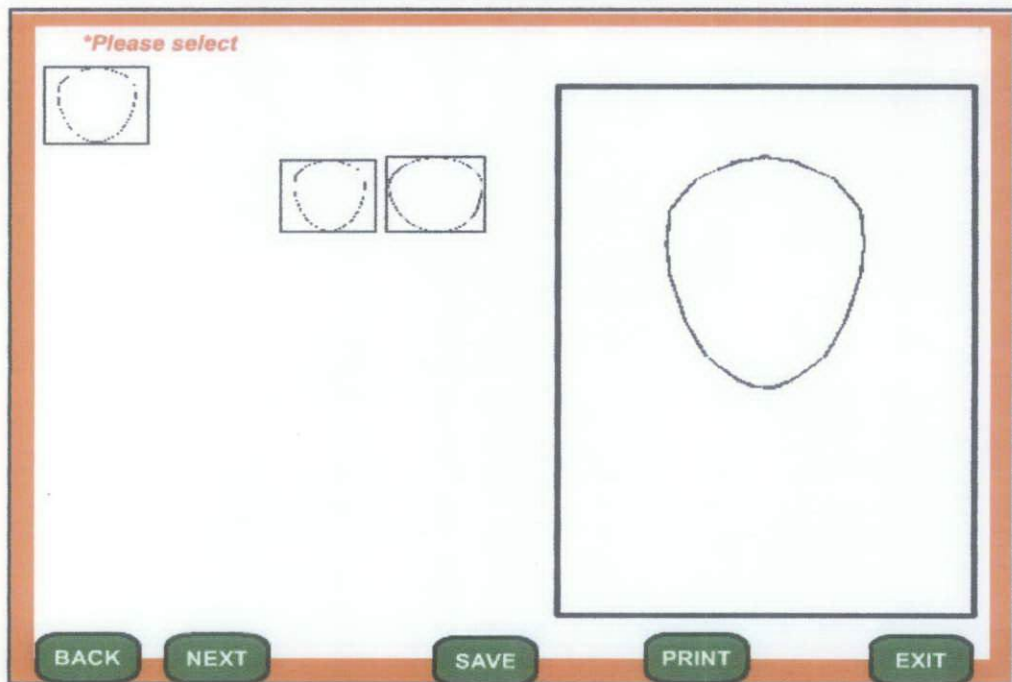Figure 4.35 indicates the face types chosen by the user.

Figure 4.35: Face Page

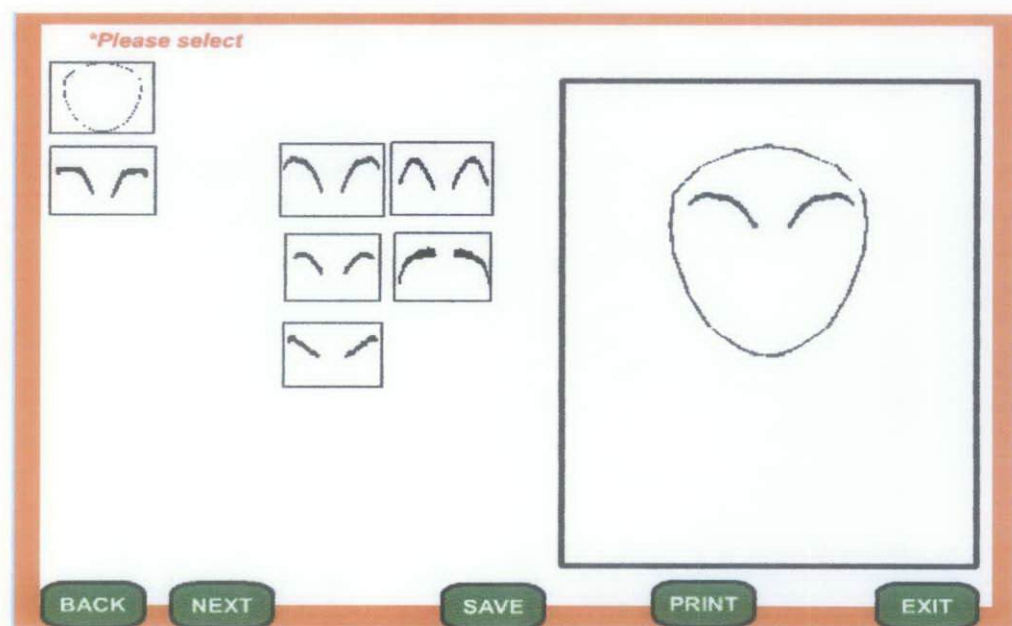Then, Button Next needs to be click, to move on to the next page.

Figure 4.36: Eyebrows Page

Figure 4.36 shows that list of eyebrows be used. There are five types of eyebrows been used. Similar to the faces type, users are required to choose one of the five eyebrows type to proceed to the next part. Be assumed that, user is already chose the eyebrows 1.
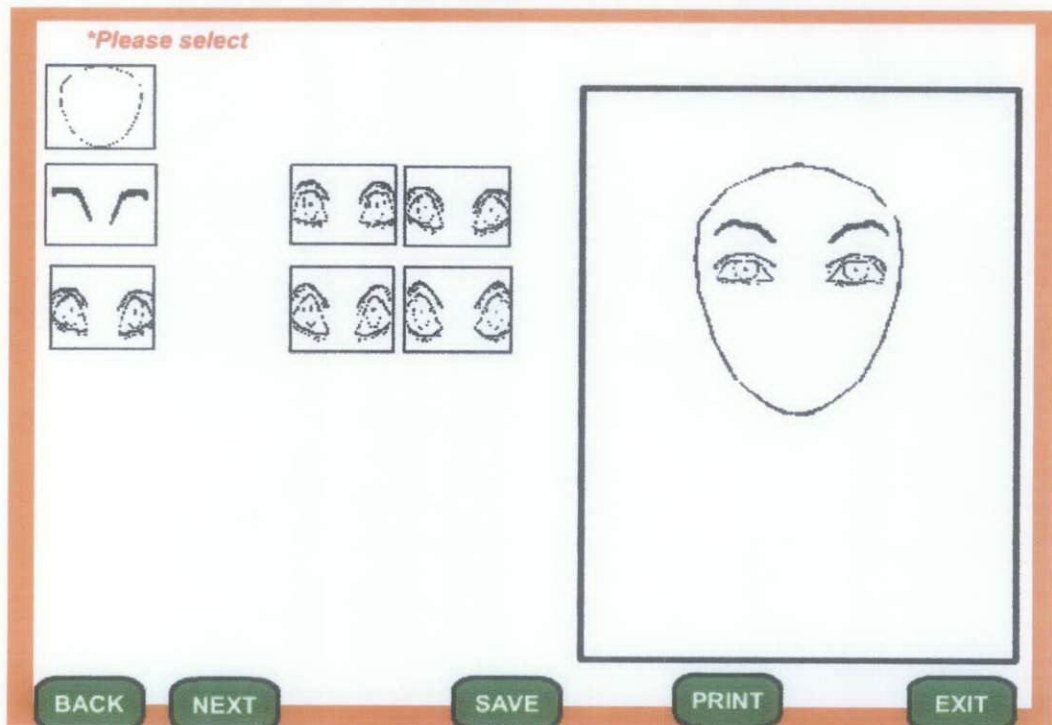

Figure 4.37: Eyes Page

Figure 4.37 is where the eyes options are listed down. There are four types of eyes that can be chose by the users. Assuming that, user is already chose the eyes 1. As usual, user will click the Next Button to proceed with the next facial features.
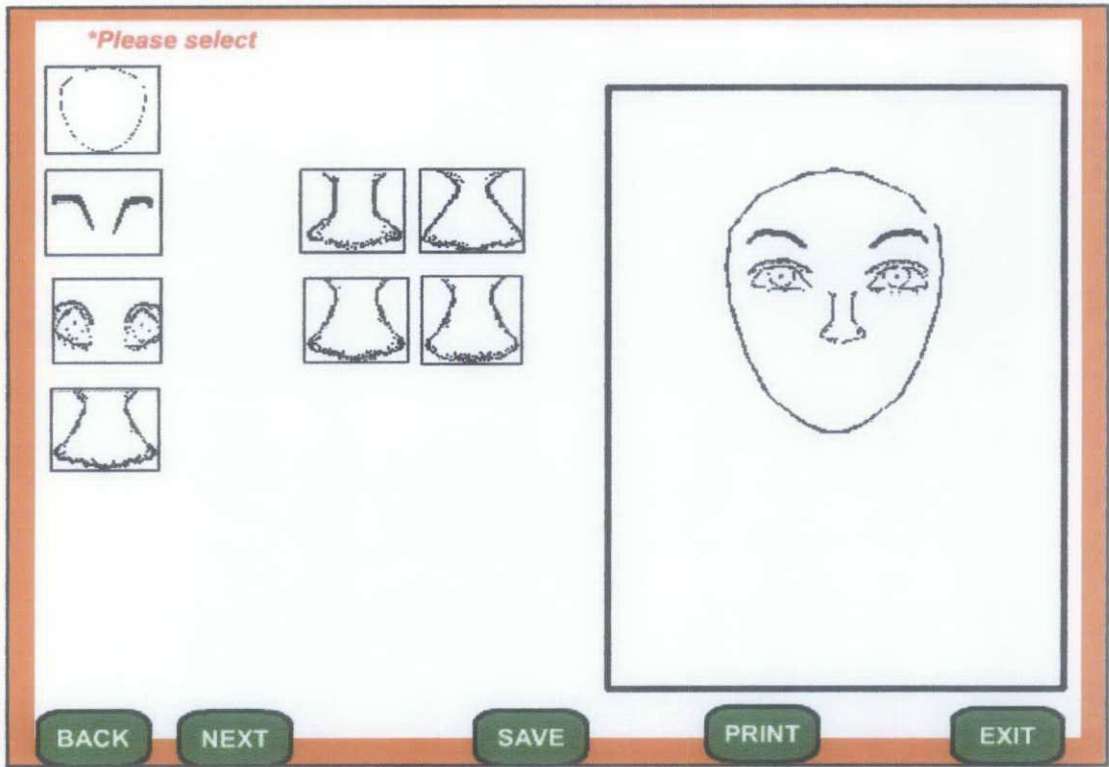
Figure 4.38: Noses Page

Figure 4.38 consists of types of noses be offered. There are four choices of noses with different shapes and sizes. The image constructed at the screen indicates that the user has already chose noses type number 3.
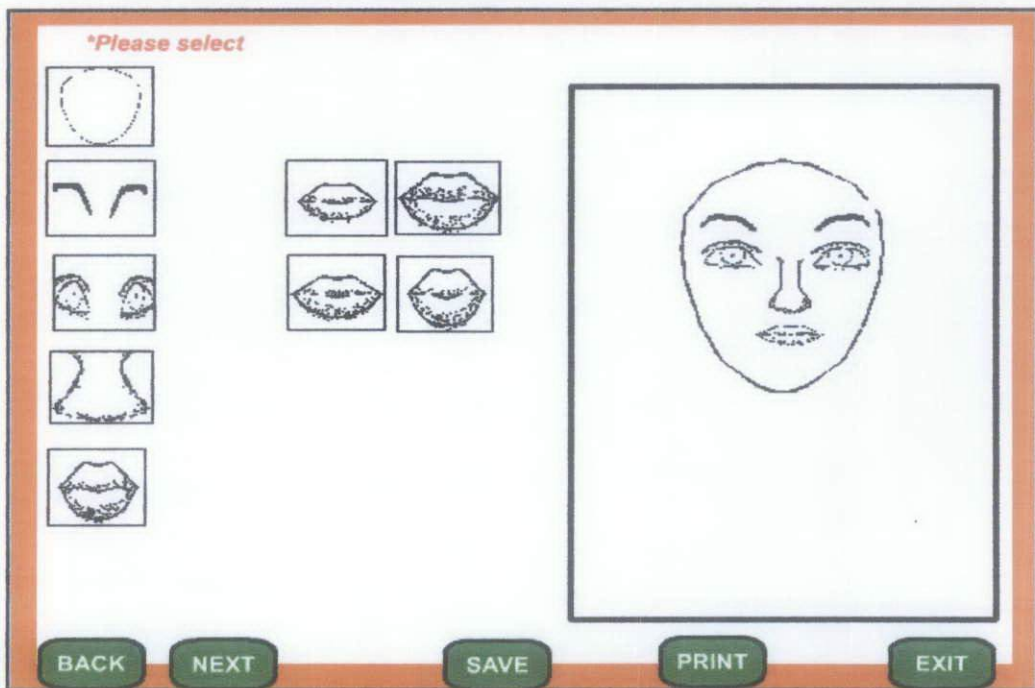
Figure 4.39: Mouth Page

In Figure 4.39, be assumed that the user chose the mouth 1 among the four type options be provided. The next button will link the user to final facial features part which is the hair segment.
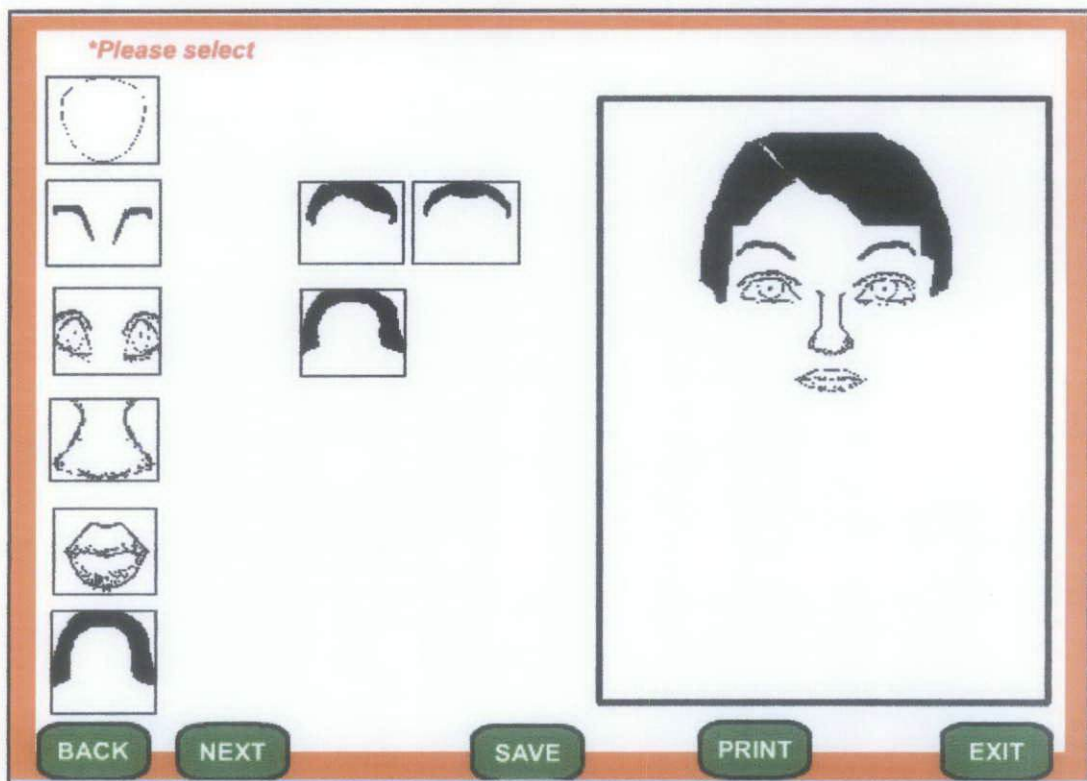
Figure 4.40: Hair Page

Figure 4.40 indicates that the user is successfully constructed an image. The Next Button provided at this page would link the user to the final page; Image that is successfully constructed. The Back Button provided at each page allows the user to undo the action. If the Back Button be clicked at this current page (Hair Page), therefore, user will turn back to the Mouth Page, indicates the user to choose the mouth once again. This back button applies the same basic flow corresponding on the user's current page.
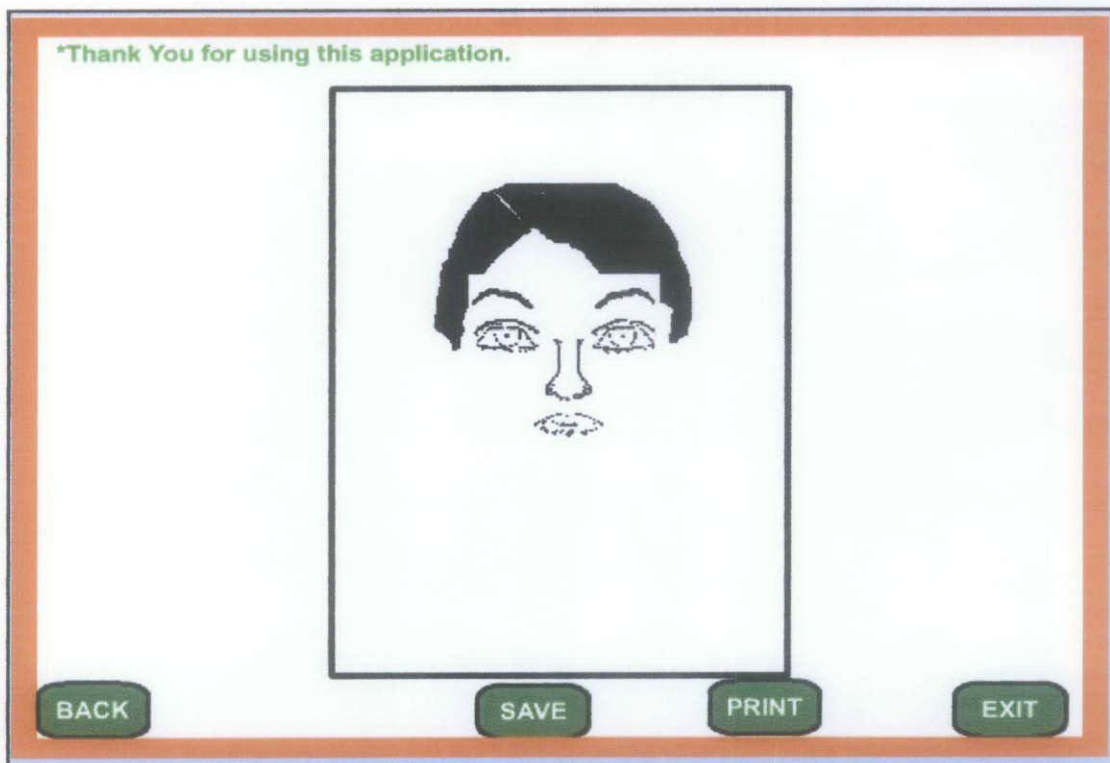
Figure 4.41: Final Page

Figure 4.41 is the final page that presenting the image has been constructed. To exit from this page, user just only needs to click the Exit Button which will connect back to the main page (welcoming page).

4.6 Usability Testing

As mentioned in methodology part, Usability Testing has been chosen in order to test on the usability of the prototype. The usability has been conducted among five users which each of users were given a specific time to hands-on testing on the Criminal Suspect Face Construction Application.

Figure 4.42: Usability Testing Results

Figure 4.42 shows that the percentage of the usability testing which focusing on six types of elements as indicated in the graph above. The results for the usability testing on all of the six elements as below:

i.   Design layout (54%)

ii.   Functionality (38%)

iii. Ease of Use (70%)
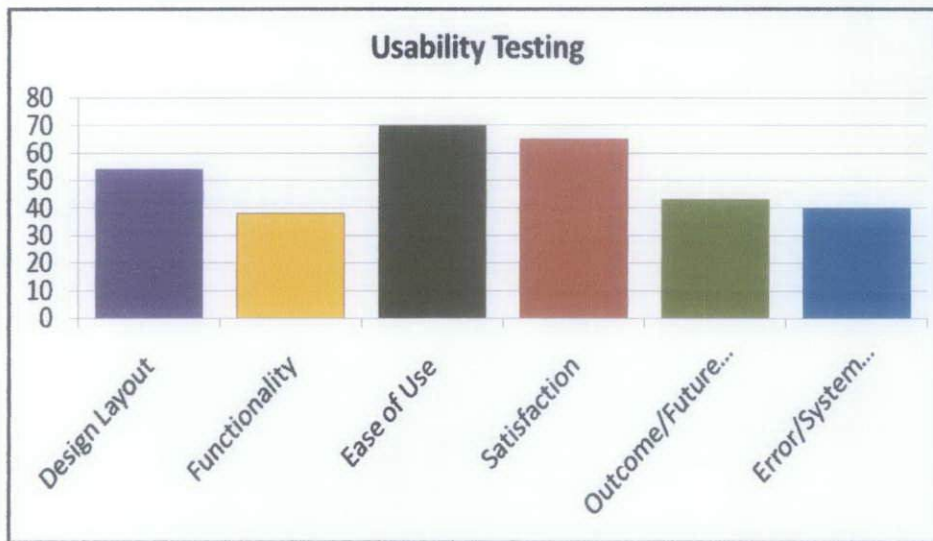
iv.   Satisfaction (65%)

v.   Outcome/Future Use (43%)

vi.   Error/System Reliability (40%)

The elements of design layout, ease of use and satisfaction have a percentage above 50% under the reason that final interfaces are simple and easy to be used. Hence, the user does not getting lost while using the application. The simple interfaces and flow of the application provides user an easier way to move on from one part to another part. The functionality, outcome/future use, error/system reliability gained below 50% percentage because of the moment usability was conducted, there were certain function buttons that were not properly functioned. Apart from that, there were certain bugs and errors encountered during the usability testing which require a modification upon the users' feedback.

CHAPTER 5

CONCLUSION

5.1 Conclusion

Criminal Suspect Face Construction Application is an alternative for the police officer and the witnesses in a way helping them to construct the criminal's face. Though Malaysian Royal Police Officers are still not practicing the software method but still they are successfully solve the crime cases.

However, there is a need for them to implement this method in term of helping the witnesses to brief the criminal's face as well as improving the communication between both parties; Police officers and witnesses.

This is due to the capability of the software in helping the witnesses to describe the criminal's face in easier way as the software method does have various of facial structure types that going to be guiding the witnesses. This will result in much accurate description in helping the police officers tracking down the respective criminals.

The three objectives of the project which are:

- To investigate several face recognition methods

  Has been achieved in comparing the manual sketching of face construction with the digital sketch of face construction.

- To develop the face recognition prototype based on the design requirements

  Is able to develop a Criminal Suspect Face Construction Application based on the design requirements and also upon the comments given.

- To test the usability of the prototype

  A usability testing has been successfully conducted among five users focusing on six elements. Details of the usability testing can be referred in the section 4.5 Usability Testing.

In conclusion, the developer hopes that this application would contribute to the environment as one of the effort in making ease and solve problems in the society's life.

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5.2 Recommendation

In order to make the application is more useful in various ways, below are recommendations that can be applied for future enhancement.

- Include a function that enables the users to sketch on the complete constructed image. For example, rescale functions that allows user to resize the image and respective facial features.

- Having a database that keep a real image that can be used to compare the validity of the mage been constructed. Although this issue does not really matter, however by having a database, it will prove the efficiency of the application.

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