



**FACULTY OF COMPUTER SCIENCE AND  
INFORMATION TECHNOLOGY  
UNIVERSITY OF MALAYA**

**WXES 3182**

**VIRTUAL HAIRSTYLE STUDIO  
(V-HAIR)**

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## ABSTRACT

**Virtual Hairstyle Studio** is an interactive hairstyle simulation program for the saloons and customers. Virtual Hairstyle Studio is also named as **V-Hair**. Virtual Hairstyle Studio is developed using Visual Basic 6.0, Microsoft Access 2000, Adobe Photoshop 6.0 and Macromedia Flash MX. We would often listen that “I wonder how would I am going to be the haircut or hair colour ”. Normally it is difficult to make up our mind to select which haircut or hair dyeing colour whenever we attempt to change new image. Thus, **V-Hair** is aimed to overcome the uncertainty by providing an interesting visualization to saloon’s customers. V-Hair is absolutely risk-free for customers to try on any hairstyle anytime visually. In addition, V-Hair also is able to tell customers ‘what face shape suites what hairstyle ’ in the perfect way. Tips for solutions to hair’s problem and hair care hints can be found in V-Hair as well. Since there is not many similar systems available in the local market, Virtual Hairstyle Studio is undoubtedly will provide an attractive service to any saloons which adopt this system.

## \*\*\*\*\* ACKNOWLEDGEMENT \*\*\*\*\*

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## Chapter 1- INTRODUCTION TO V-Hair

### 1.1 Project Overview

**Virtual Hairstyle Studio** is also known as **V-Hair**. It is a PC-based application software that facilitates hairstyle simulation. It is a stand-alone program that specifically focuses on Asian hairstyle. **V-Hair** is developed towards hair beauty saloons, hairdresser's shops and at different women or men's clubs as well.

The customer can try out different hairstyles using simulation function to see virtually which hairstyle suits him/her the best **V-Hair** helps the client to make up decision in selecting the perfect haircut, style, and color based on their own face-type, sex and age.

**V-Hair** allows different devices for picture input: web cameras, digital photo cameras, scanners, etc. **V-Hair's** database includes 80 ++ hairstyles for men and women

Besides that, **V-Hair** includes the hair care tips and "what face shape suites what hairstyle in the perfect way" information. Client can refer to **V-Hair** regarding their hair or scalp's problem. **V-Hair** will tell them the way to protect and solve their problem. "Face shape VS hair style" will tells clients in details when they click on specific face shape in graphic illustrations.



### **Virtual Hairstyle Studio's criteria:**

#### **It's easy**

With just simply click on the thumbnail of hairstyle from the interface, the customer can experience with various desired hairstyle. No special computer experience is needed to master it.

#### **It's fun**

A client's face will be automatically fixed with the selected hairstyle. They are allowed either to print out eight hairstyles they have chosen in a single sheet of paper or save it in softcopy and bring back home.

## **1.2 Project Motivation**

The following explained why Virtual Hairstyle Studio is developed:

#### **Not many equivalent systems available in local market.**

In present, the interactive hair simulation program is still in the phrase of research in Asia country. In fact, the hairstyle imaging software have already existed and are popular for several years in western country. However, there are only a few of this kind of product released in Asian market, wherever is hardly found in Malaysia.

#### **Blends hair industry into IT stream**

Promotes computer technology towards hair saloons, institutions and clients.

#### **Enhance client's outlook**

Client will have the opportunity to preview exactly what a new style will look like on her or him. The client no more need to resort imagination to visualize a new style's appearance. Their image with the new style can be viewed on the screen and they can print it in seconds!!!

#### **Improve Saloon's business and glamour**

With this program, the clients no need to flip through magazines or style's books. Most probably, more clients will be drawn to saloon as the flexibility of the power to put "any hairstyle on any customer" with an absolutely risk free trial. And perhaps, clients will keep mentioning the saloons that use the digital imaging technology and recommending it to all their friends and relatives.

#### **An interesting and new research area**

There are no previous years students involved in such system before. Furthermore, this project demands lot of interactive manipulation and more entertaining for the user.

### **1.3 Project Objectives**

The hair saloons would have often heard a client say "I've been thinking about trying some haircut or color but I'm just not sure how I would look". Thus, **V-Hair** is specially programmed to show them exactly how they would look as a red head, blond, short, curly or any other style they might like to try.

**V-Hair** is developed as interactive imaging software for the hair beauty saloons in order to blend local hair industry into the flow of IT stream by offering this cutting edge technology

## 1.4 Project Scope

The main features of **V-Hair** is scoped as :

### ❑ User-Friendly interface

**V-Hair** emphasizes on user-friendly interface design in order to cater with the end user's requirement who has only a little computer knowledge or even do not know at all.

### ❑ Input Devices

**V-Hair** is designed to capture the actual picture of the client through input devices such as twain-complaint or non-twain digital camera, scanner and web camera.

### ❑ Database

**V-Hair** has more than 80 hairstyles for men and women. They are organized into four collections (wedding, parties, casual and formal styles) and can be accessed by hair length (long, medium, short) and also hair type (straight, wavy). Meanwhile, client can view the hair care tips (splits end, dandruff, hair loss, grey hair, etc) and get the hints on “what face shape suits what hairstyle in the perfect way ”

#### ❏ **Output**

A client is allowed to have the printout of their hair simulation result. 8 images of selected hairstyles that had been saved as thumbnails are ready to print out.

#### ❏ **Maintenance**

Saloon’s management can update and add new hairstyle to **V-Hair’s** library. Besides that, **V-Hair** also keeps track of client’s record such as client’s name, contact number, email and images of hairstyle selected on the previous visit.

## **1.5 Project Limitation**

Limitations are the boundaries that restrict the process of system development. Thus, it is imperative to identify the project’s limitation in order to ensure the project outcome can be seen and measurable. The **V-Hair** project’s limitations are listed as the following:



#### ✧ Time Constraint

**Virtual Hairstyle Studio** has to be developed in the period of 8 months. Hence, research on 3D animation function (head rotation for front, side and back view) is suspended.

#### ✧ Source Constraint

Due to the limited source and knowledge, the virtual make-up and virtual slimming course are not covered. As for the hair gallery, photo of men's hairstyle is indeed limited. Hair accessories, spectacles, colour contact lens is not included in **V-Hair**.

### 1.6 Project Schedule

Project scheduling is a particular demanding task for software development. A project schedule was outlined to ensure the specific task would be complete on time.



Figure 1.1 : Gantt Chart of Virtual Hairstyle Studio

## 1.7 Chapters Summary

The main chapters of this project is briefly describe as following:

### *Chapter One - Introduction*

An overview of Virtual Hairstyle Studio is roughly drafted in the beginning, followed by Project Motivation, Project Objective and Goal, Project Scope, Project Limitation and Project Schedule in sequence.

### *Chapter Two - Literature review*

An explanation about topic related to Virtual Hairstyle studio such as hair rendering, hair animation, hair modeling. The general information about interactive imaging software, multimedia components are discussed.

Researched papers and relevance articles from web site are documented as well. A review of existing software and other similar web project are represented.

### *Chapter Three – Methodology*

Software process model for developing Virtual Hairstyle Studio is concerned in this chapter. The fact-finding methods carried out to gain information for **V-Hair** and analysis of interview's result are stated.

### *Chapter Four – System Analysis*

Functional and non-functional requirements for **V-Hair** are identified. Besides that, the run-time requirements and system development tools determined is explained.

### *Chapter Five – System Design*

System functional chart, Context Diagram, Data Flow Diagram, Database Design, System Interface Design of **V-Hair** are figured out consecutively in system design phase.

2.1 Introduction

The purpose of this chapter is to provide a comprehensive overview of the current state of research in the field of [insert field]. This chapter will discuss the theoretical background, research methodology, and findings of the literature review. The chapter will also discuss the research objectives and the research questions. The chapter will also discuss the research methodology and the research findings. The chapter will also discuss the research methodology and the research findings.

2.2 System Definition

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## **Chapter 2– LITERATURE REVIEW**

### **2.1 Introduction**

Literature review is an early research about a system development. It includes comparison, reference, observation, and reviewer that either related or not to a biography of a person or personality. The main purpose of carrying out literature review is to ensure the system developing by author meets the requirement of all aspect including software specification, methodology, and end user expectation.

### **2.2 System Definition**

Hairstyle is a determining factor of a person's first impression when meeting someone [LaFrance 2001]. Thus, hair important aspect of personal is an identity, but hair modeling remains a major obstacle in realistic human face synthesis.

Since the pioneering work by Csuri et al.[1979], researchers have developed a number of hair modeling systems. These systems are categorized based on hairstyles to which they are best suited. High level editing tools support curling, scaling, and copy / paste, Surface modeling methods can use high-density data acquired from range scanners. Such model acquisitions are not yet practical for hair since we lack suitable volumetric scanner technologies.

The recent work by Grabli et al. [2002] attempts to automatically reconstruct hair models from photographs. Although promising, the approach is still in its inception stage and does not recover complete hair models.

Strand hair models [Anjyo et al. 1992; Daldegan et al. 1993; Hadap and Thalmann 2001; Lee and Ko 2001; Rosenblum et al. 1991] allow every hair strand to be explicitly designed. However, manual modeling of individual hair strands is extremely tedious. Designing just the key hair strands can consume five to ten hours [Thalmann and Hadap 2000].

Thus, strand hair models are often coupled with dynamics simulations. External parameters such as gravity, wind forces, and stiffness affect the global shape of the final hair model. However, the dynamics methods are often limited to relatively simple hairstyles and complex hairstyles are not easily modeled, even after repeated trial and error iterations of minutes or hours of simulation. Problems arise from the complexity of real human hairstyles, often created by hairstylists with extensive efforts such as curling and combing. Structured and discontinuous clusters (e.g., braids, combing effects) are difficult to model with strand hair models, whereas stylistic strand variations are difficult to achieve with cluster/wisp hair models.

### ✧ **Modeling in 3D**

Modeling software creates an imaginary 3D space for the designer to work in.

Building 3D models from scratch is time-consuming, but there are short-cuts. Some 3D graphics companies sell ready-made wireframes, which the designer can adapt. The alternative is to use a 3D digitizer to take a wireframe from a real object. The designer can move and reshape object in the 3D space of the program.

### *What is hair modeling?*

Hairstyle modeling consists of three parts:

- a) Define an ellipsoidal hull of the head model, which can be considered as a rough approximation of the head. Then also specify the region of hair pores on the ellipsoid
- b) Calculate hair bending, this process also includes collision detection between each hair and the ellipsoid
- c) Cut hair and modify with slight adjustment, in order to get desired shape in the final image.

### **Rendering**

Once the model of the console is ready, the computer's 3D space is turned into a photographer's studio by adding the lights and camera. The wireframe model still only shows an outline. To see the solid console under the lights, a picture is taken with a camera. This is called rendering. Rendered image enables to try out different surface textures, such as concrete, wood, or ivory on the model, and to adjust the wireframe and lighting. There are 3 main rendering methods, includes *flat shading*, *curved shading* and *ray tracing*.

#### **Flat shading and Curved shading**

Both are quick ways to test the wireframe, camera position, and lighting. It provides opportunity to experiment with colors and surface textures.



## Ray Tracing

It is used to create the final image. It is by far the slowest technique, but it accurately draws in the shadows, reflections and highlights in the scene.

### *What is hair rendering?*

Hair models in framework are explicitly rendered; every hair strand is drawn as polylines. This section describes methods tailored to render such explicit models for interactive modeling purpose.

**Shading Model:** The lighting calculation provided in OpenGL is disabled and shading is calculated in software, using the anisotropic shading model by Kajiya and Kay [1989]. The shaded color is computed at each point of the line segments and colors are interpolated with OpenGL. Other shading models such as that in [Goldman 1997] could be equally applicable.

**Self-shadowing:** Self-shadowing is an essential cue to depict volumetric hair (Figure 2.1). We use our opacity shadow maps algorithm [Kim and Neumann 2001], a fast approximation of deep shadow maps [Lokovic and Veach 2000].

Since shadows are view-independent, they can be computed once and cached for reuse while the user interactively changes views.





Figure 2.1 Effects of shadows and level of detail.  
Images were captured during interactive user sessions.

A: front lighting      B: back lighting.

**Anti-aliasing:** Since hair strands are very thin, it is important to draw them smoothly with correct filtering. The anti-aliased line drawing option in OpenGL alone is not sufficient since the correct result depends on the drawing order [McReynolds 1997]. Our visibility ordering algorithm, inspired by [Levoy and Whitted 1985], determines the drawing orders for poly-lines segments of hair strands based on the distance from the camera .

### ✧ Animating 3D model

To create a moving character, the animator starts by building it as 3D model. The first step in producing an animation of any kinds is

#### 2.2.1 What is 3-Dimensional Geometric and Modeling Transformations?

Methods for geometric transformations and object modeling in 3D are extended from 2D methods by including considerations for the z coordinate. The extension for 3D rotation is less straightforward. Type of transformation:

- o Translation
- o Rotation
- o Scaling

- o Others : Reflection , Shear

## 2.3 Off the-self software / R&D on existing software

### 2.3.1 Nausoft imaging software Designer2000

#### Features Overview

**Nautilus Designer 2000** enable user to cut, lengthen, lighten, darken, change the color of customer's hair to create a hairstyle tailored specifically for customer. These powerful editing features allow user to modify the existing styles and add them as new styles to user's library for future use in Nautilus.

**Nautilus Designer 2000** can automatically rotate a client's head on-screen according to the hairstyle view. It is professional imaging software that can work with front, side and back hairstyle views.



Figure 2.2a Screenshot of Nautilus Designer 2000



Figure 2.2b : Snapshot of Nautilus Designer 2000

The scope of **Nautilus Designer 2000** are:

#### **Taking Client Photo**

- o work with any TWAIN-compatible picture source (video camera, digital video camera, digital still camera, scanner)
- o Picture resizing, Zoom in/out;
- o Picture editing ( hue, brightness, contrast, a range of art tools for make up and blending )

#### **Hairstyle imaging**

- o more than 900 hot styles- automatic simulation of 3D views
- o Automatic search of styles with different categories: gender, age, style, hair type, hair length
- o Numeric database search
- o creation of a new hairstyles
- o artwork with hairstyle,



- o mirroring images, automatic client's head rotation
- o hairstyle transforming and resizing
- o has a built-in hair analysis module.
- o automatic lock stretching
- o outcome storage in image gallery

### **Hairstyle Color imaging**

- o wide color palette
- o dyeing of selected locks
- o dyeing of all styles in a preset color create your own palette

### **Miscellaneous services:**

- o 500 models of glasses and sunglasses
- o color contact lenses
- o Provides a virtual make-up feature
- o Performs eyeglasses and contact lenses imaging

### **Minimum System Requirements**

CPU Intel Pentium 166\RAM 32MB\HDD 2.1 GB\CD-ROM\ 2 MB SVGA video card
15"Monitor with 1024x768 resolution
Color printer
Digital Photo camera with resolution 640x480



### 2.3.2 eImagePro

#### Features Overview

**eImagePro** is an advanced professional imaging software solution for Beauty Salons and Schools, Image Centers and Spas. The **eImagePro** is designed to capture the actual picture of the client and visually stimulate the clients to purchase the hairstyle, hair color or cosmetic changes to enhance their self-image and to improve the salons profitability. **eImagePro** helps the client to select the perfect haircut, style, and color based on their own face-type, sex and age.



Figure 2.3 : Screenshot of eImagePro

**The following are the scope of eImagePro :**

- ☛ **Input devices :** video cameras, digital photo cameras, scanners, etc.
- ☛ **Database :**

- o over 900 + supreme quality hairstyles
- o 500 eyeglasses and sunglasses
- o color contact lenses, moustaches and beards
- o unlimited choices of color selection.

**Platform used :** Windows 95/98/Me/NT/2000/XP.

#### **Miscellaneous services:**

- o Extremely powerful virtual make-up.
- o Eyeglasses and sunglasses selection.
- o Color contact lenses selection.
- o Skin care treatment outcome simulation.
- o Virtual weight loss simulation.

#### **Minimum System Requirements**

CPU Intel Pentium 166\RAM 32MB\HDD 2.1 GB\CD-ROM\ 2 MB SVGA video card
--

15"Monitor with 1024x768 resolution
-------------------------------------

Color printer
---------------

Digital Photo camera with resolution 640x480
--

The screen shot below displays the option of functions provided by eImagePro:

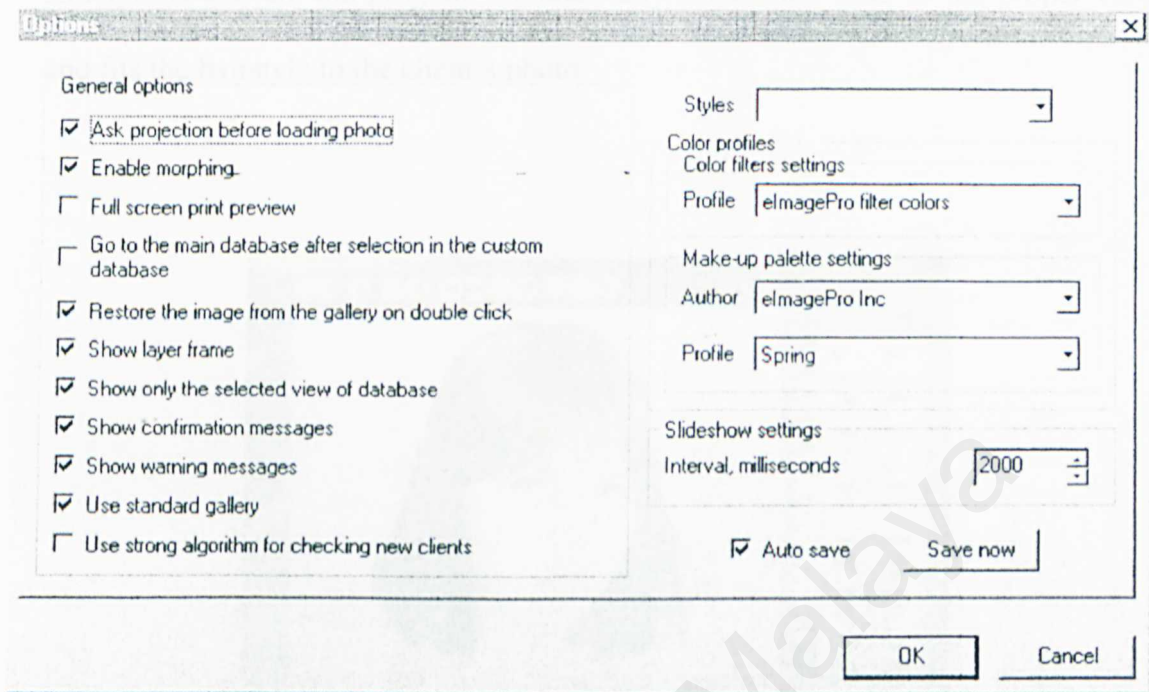


Figure 2.4 : The functions of eImagePro

### 2.3.3 Salon Styler Pro

#### Features overview

Salon Styler Pro is a powerful imaging program for professional use in beauty salons, hairstyling schools, and by makeup artists and cosmetic surgeons. In a digital makeover session user can quickly fit clients with hairstyles from Salon Styler's database of 1,000s of hairstyle choices. Plus, user can apply makeup from the most popular seasonal color pallets and much more

Salon Styler Pro works with three view of the client for 3D simulation. When a hairstyle is chosen, the program automatically rotates the head to the proper view and fits the hairstyle to the client's photo.



Figure 2.5: Screenshot of Salon Styler Pro

### The scope of SalonStyler :

#### Database :

- more than 850 hairstyles for men, women and children
- In total there are more than 46,750 choices ready to try with a click of the mouse.

#### Hairstyle Imaging :

- organized into six collections (wedding, parties, everyday styles, etc)
- can be accessed by hair length, angle of view, hair type (smooth, wavy, etc) or by hairstyles with and without bangs



- o can cut, lengthen, add body, reshape, lighten, darken, color individual locks,
- o change the color of the hairstyle to customize it for user's customer
- o These powerful editing features allow you to modify the existing styles and add them as new styles to your library for future use in **Salon Styler Pro**.

### **Input devices :**

- o TWAIN type camera (virtually all digital cameras except for Sony and Olympus) – client's photos are loaded directly into **Salon Styler** and are ready for a digital make over session
- o non-TWAIN cameras :-the photos must first be saved to the system's hard drive and then can be opened in **Salon Styler Pro**

### **Video Training**

- o a complete step-by-step video lesson that will walk through all aspects of the program
- o A person with no special computer experience can sit down and watch the lessons, experiment with the program and within an hour master the program.
- o Eliminates wade through thick program manuals

### **Miscellaneous features:**

- o can change a photo to preview the results of plastic surgery or weight loss

- o comes with an extensive library of designer eyewear, mustaches and beards
- o can easily add own hairstyles to **Salon Styler Pro's** database
- o wide array of ways of displaying **Salon Styler Pro's** makeovers, from slide shows were one image morphs into another for a Hollywood effect, to multi image layouts.

### System Requirements

Screen resolution	15"Monitor with 1024x768 resolution
Processor	CPU Intel Pentium 166
Memory	RAM 32MB
Hard Disk	HDD 2.1 GB
Video Card	2 MB SVGA video card
Input Device	Digital Photo camera with resolution 640x480

### 2.3.4 Maggi Hairstyle & Cosmetic Software

#### Feature Overview :

- o Shows the user with fashionable hairstyles
- o Changes color of hairstyles dynamically
- o Customizes hairstyle to user's face
- o Adds new hairstyles
- o Changes color of eyes
- o Apply lipstick, lipliner and shades
- o Changes face complexion
- o Exports and prints the completed pictures
- o Exchanges images with another applications by clipboard.

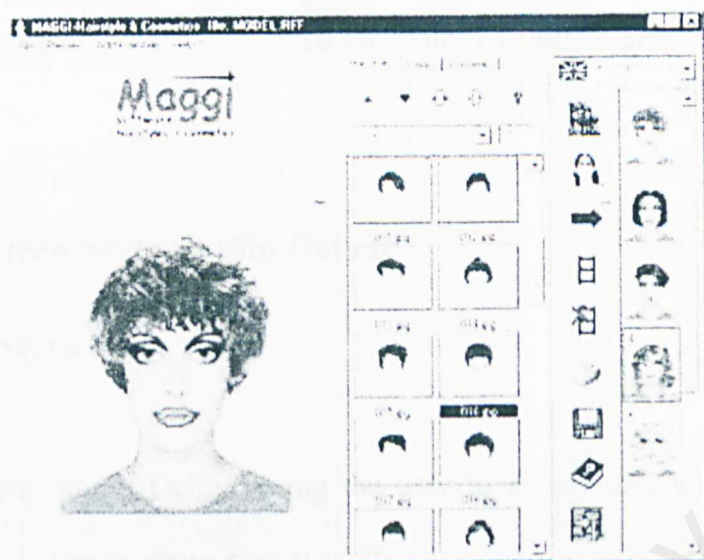


figure 2.6 : Screenshot of Maggi Hairstyle & Cosmetic Software

#### Input Type :

- o Works with common image formats: **BMP, JPG, TIF, PCX, GIF**
- o Supports **TWAIN** - compliant scanners and digital cameras

#### Miscellaneous features :

- o Program interface supports the following languages: English, German, French, Spanish and Italian.

#### Minimum hardware requirements

Operation system:	Windows 95 or later
Computer:	IBM or compatible
Processor:	486DX-66MHz or better

RAM:	8 MB
Free disk space:	5 MB
Video card:	16 bit color (64 000 colors)

### 2.3.5 Seventeen Style Studio Deluxe

#### Feature Overview

Seventeen Style Studio Deluxe bring the user to experiment with the hottest in today's hippest hairstyle, from formal to classic cosmetics and accessories to create a new look for every mood

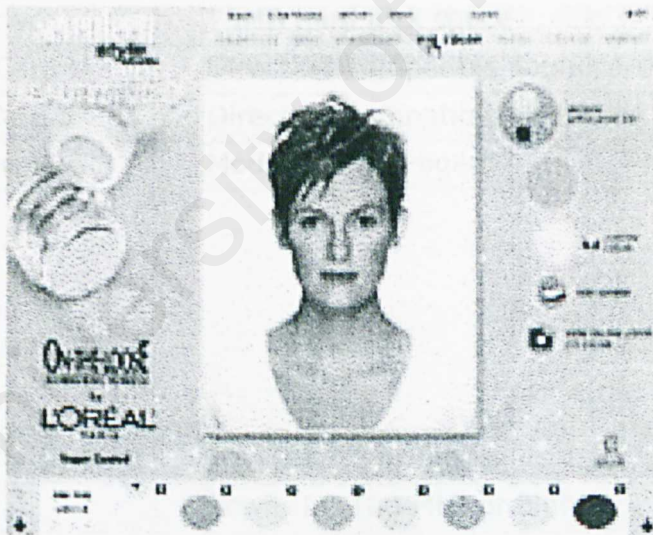


Figure 2.7 : Screenshot of Seventeen Style Studio

**Input Type :** KODAK Picture Disk or KODAK PHOTONET™ Online.

#### **Miscellaneous features :**

- o **Customize makeover:** Be among the first to experiment with the newest makeup from L'Oreal®.



- o **Try on accessories:** Top off look with the latest in hats and sunglasses from Roxy
- o Quiksilver® and add some extra dazzle with trend-setting jewelry from Seventeen.
- o **All dressed up:** after getting the look, pair user face with the hottest fashions and style scenes, or put it on the cover of Seventeen

**Platform :** PC CDROM

**System Requirement :**

✓ **PC**

Operating system:	Windows® 95/98
CPU:	Pentium® 133 or higher
CD-ROM Drive :	2x CDROM
Memory :	32MB RAM
Hard Drive:	75MB hard disk space
Sound Card :	DirectX® compatible soundcard
Video Card :	DirectX® compatible videocard
Input Devices	Mouse and keyboard

✓ **MAC**

Operating System	Mac OS 7.6 or higher
CPU	Power PC 100 Mhz or higher
CD-ROM Drive	CDROM Drive
Memory	24MB RAM
Video Card	Monitor with support for thousands of colors

## 2.4 Studies carried out

### 2.4.1 Interactive Multi-resolution Hair Modeling and Editing [Tae and Ulrich 2002]

Human hair modeling is a difficult task. This paper presents a constructive hair modeling system with which users can sculpt a wide variety of hairstyles. Multi-resolution Hair Modeling (MHM) system is based on the observed tendency of adjacent hair strands to form clusters at multiple scales due to static attraction.

In MHM system, initial hair designs are quickly created with a small set of hair clusters. Refinements at finer levels are achieved by subdividing these initial hair clusters. Users can edit an evolving model at any level of detail, down to a single hair strand. MHM's goal is an interactive hair modeling system that allows a user to easily and quickly design a wide range of hairstyles (Figure 1 illustrates an example hairstyling process).



Figure 2.8: An example multi-resolution hair design procedure.

Each hair model results from interactive multi-resolution editing operations.

1. The user roughly designs a hairstyle with about 30 high-level clusters.

2. One hair cluster (inside the ellipse) is subdivided and made curly.
3. The curly cluster is copied onto other clusters.
4. The bang hair cluster (inside the ellipse) is subdivided and refined.
5. Final hair model after further refinements.



Figure 2.9: Designing a complex hairstyle.

The hair model (left) consisting of 940 clusters at three levels of detail was created after the photograph shown in the middle (image courtesy of <http://www.hairboutique.com>).



Figure 2.10: the skeleton curves at each level of detail.





Figure 2.11: The hairstyle (left) is modeled after the image (right)  
(bottom, <http://www.hairboutique.com>)

#### **2.4.2 A Prototype of Hairstyle Simulation System [Miyata and Kurokawa 2001]**

The prototype of hairstyle simulation system automatically recognizes an input face image and fits a stored hair image to it. The images, which are all two-dimensional and in color, are input from a video camera. First, the face area is extracted from the face image by means of color segmentation. Next, color reference data and edge information are used to extract the various parts of the face, such as the eyes and mouth, from the recognized face area. The target hair image is resized and rotated in accordance with these data, and is then transformed by an image-warping operation to fit the face image.

This project pursues a hairstyle simulation system that automatically recognizes an image input of a face and fits a stored hair image onto it.

#### **Required Data for Hairstyle Composition Process**

- ❑ **Feature Data of Face Image**



The face boundary (region FR) and the position of the facial parts, each tail of eye (LE and RE), under nose (UN), chin (JP) and top of the head (HT) are used as feature data of a face image.

These data are specified manually by means of a pointing device, such as a mouse, or extracted automatically by means of an image recognition process.

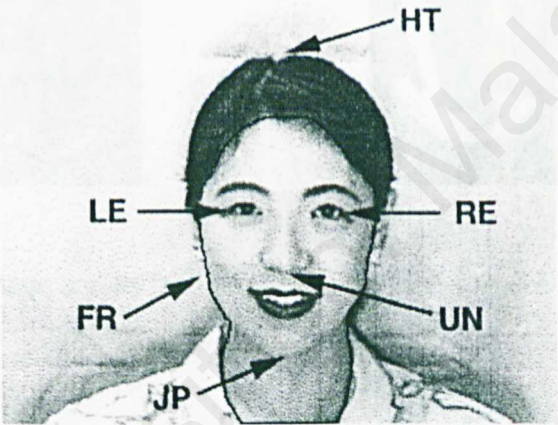


Figure 2.12: Feature Data of Face Image

**Hairstyle Image and its Feature Data**

The hairstyle images are taken from directly in front, and are modified by cutting the face region, leaving the fuzzy boundary area such as the forehead and coloring the background area blue using a photo-retouching software. The masking image which specifies the boundary area is also defined.

The feature data of the hairstyle image are defined with the feature data of the face region and that of the hair region. The feature data of the hair region are pairs of the position of a feature point and its attribute. These feature data are used in the hairstyle image fitting process.



Figure 2.13: Hairstyle Image and its feature points



Figure 2.14: Masking Image

## Facial features extraction

### ❑ Facial region detection

Firstly, the facial region is extracted from the camera captured color image. The facial region (including neck) is treated as one group of the skin colored region.

### ❑ Initial segmentation.

The input image is segmented by region growing method.

### ❑ Facial region candidates set creation and selection.

The initial segmented regions which has a nearly skin color are gathered and combined to create the facial region candidates set. The facial region is determined among these candidates set by testing their convex hull's degree of symmetry, density, etc.

#### **Face contour extraction by using active contour model (SNAKES).**

Using the above facial region as an initial state, active contour model (SNAKES) is converged to the final facial contours.

#### **Extraction of the eyes, mouth, etc.**

By using adaptive threshold, the both of eyes candidate regions and mouth candidate regions are detected. Determine the facial vertical axis by the eyes and mouth, the chin, nose, and top of the head positions are searched as a point where the projected edge values take the local maximum.



Figure 2.15: Example of extraction results

### **2.4.3 Adapting existing hair models**



"Laser cut, razor cut, chopped-and-channelled. Curled up, slicked back, hanging in the eyes." ["Hairstyles and attitudes", Timbuk3]

Constructing new hair models from scratch is a fairly complex process and one that requires a non-trivial amount of skill. It is often easier to take an existing model and modify it in a modeling program.

The process of modifying an existing model is not strictly a step-by-step process. This tutorial will therefore be presented in the form of a series of pointers.

## **Booleans**

If the modeling program supports Boolean operations, these can be used to chop away the parts of the hair that is not needed. The general technique is to create a primitive (typically a cube), align it with the part of the hair model that wish t to cut away and then apply a Boolean that subtracts the primitive from the hair model

## **2.5 Analysis on Technology Used in Developing Multimedia Package**

### **2.5.1 Relational Multimedia Authoring Tools**

#### **Image editing**

##### **Adobe Photoshop 6.0**

###### **Changing image size and resolution**

Once user has scanned or imported an image, user may want to adjust its size. In Photoshop, the Image Size command lets user adjust the pixel



dimensions, print dimensions, and resolution of an image; in ImageReady, user can only adjust the pixel dimensions of an image.

### **Opening and importing images**

User can open and import images in various file formats. The available formats appear in the Open dialog box, the Open As dialog box (Windows), or the Import submenu.

### **Saving images**

The saving options that are available to user vary between Photoshop and ImageReady. The primary focus of ImageReady is producing images for the Web.

## **Macromedia Director 8.5**

Macromedia Director 8.5 Shockwave Studio brings robust, high-performance 3D to the Web. Below are several new features of Director 8.5 Shockwave Studio:

- ✓ Support for interactive three-dimensional (3D) graphics.
- ✓ Enhancements to the Shockwave Multiuser Server and Xtra that enable server-side scripting, multithreading, and file access. Using server-side scripts can dramatically simplify multiuser movies by placing most of the required logic on the server

- ✓ Support for Flash 5 and additions to Lingo that provide control over the new features of Flash 5 movies
- ✓ perform many basic 3D operations using Director 8.5's built-in 3D behaviors
- ✓ The faster the image processing, the better the results. The ability to adjust for client-side processing power makes Director 8.5 ideal for Web delivery

### **Using 3D behaviors overview**

Macromedia Director 8.5 Shockwave Studio includes a library of behaviors that allow to build and control a 3D environment without any knowledge of Lingo. While scripting is still required for complex projects, users can build simple 3D movies with behaviors alone

### **Create 3D text**

Director 8.5 lets users to import and create 3D models and text. To create 3D text, user has to create 2D text and then use the Property Inspector to give it depth.

### **Working with models and model resources overview**

It covers the Lingo commands and properties used to work with models and model resources. The commands and properties given here in tabular form may also be found in alphabetical form, with accompanying syntax, definitions, and examples, in 3D Lingo Dictionary

User can create models within Director 8.5 Shockwave Studio. Spheres, boxes, planes, cylinders, and particle systems can be created either with Lingo or with Director 8.5 behaviors.

Accessing properties and commands of a model or any other node type requires that the node be on the Stage or explicitly loaded with the `preLoad()` or `loadFile()` command.

## **3D authoring tools**

### **REALFUR 2.0**

RealFur is the solution for creating and rendering various types of fur.

RealFur 2.0 is based on a mental ray geometry shader technology, which translates into very fast rendering. The new geometry shader controls the fur color, illumination, reflection, refraction, shadowing and allows the rendering of millions of polygons without having to display them in the 3D authoring application (i.e. Softimage|3D).

#### **What is so good about REALFUR 2.0?**

RealFur means just that-it's REAL. The splines are given a geometry just before rendering so in the final result the fur automatically behaves like the other objects in the scene; so you get features like collision detection, self shadowing, support shadows and much, much more.

#### **What about rendering?**

It's fast, the fastest fur solver commercially available in Softimage.

## What about quality of the final images?

Well, REALFUR 2.0 supports MENTAL RAY 2.1 so you get the very best quality available. Look at these features for example that are all yours:

- ✓ Motion Blur for photo realism
- ✓ Shadows to cast shadows
- ✓ Refraction to refract light
- ✓ Reflections to reflect the world around it
- ✓ Area Lights to cast smooth and accurate shadows
- ✓ Anti-aliasing to decide how smooth fur is
- ✓ Z-Channel for layer positioning
- ✓ Final Gathering for real illumination

## Anything else?

Render an INFINITE number of fur models each with totally different furs simultaneously

- Create many different types of fur on the same model;
- Comb each fur length on a model in different directions;
- Color differentiation of tip and base for subtle effects;
- Control the fur rigidity, movements and tension to maximize photo realism;
- Render millions of polygons without having to display them in Softimage;
- Control the fur shape, placement and direction over a model surface;
- Use a texture rgb channel to control hair bending and direction interactively;



## Why should I get RealFur 2.0?

RealFur 2.0 is the only commercially available solution in Softimage and the only fur tool to support Mental Ray

## Figaro

**Figaro** is Phoenix Tools' latest and most innovative Fur/Hair solution. Developed as a result of the matured experience with the previous RealFur editions of which it addresses the limitations, enhances potentialities and improves usability to generate a complete and powerful solution for realistic Fur/Hair simulations.

- The result is a complete package covering fur, short and long hair generation, combing, animation and rendering.
- **Figaro** is well integrated as a plug-in in Softimage|3D, it provides the utilities to export and render your work inside XSI.
- Moreover, **Figaro is completely Maya compliant** as it allows you to export your *Maya Fur set-up* into **Softimage**, giving life to your furry character by adding realistic dynamic behavior and rendering the scene with Phoenix Tool's advanced geometry shader technology taking advantage of the best from mental ray render.

The compatibility with Maya Fur has been developed both at modeling (geometry) and illumination model (shader) level. **Figaro** reads the Maya fur parameters both explicit and the ones driven by maps and pass them to our plug-ins and shaders.

**Figaro** provides a wide range of tools to satisfy the most complex fur/hair simulation needs, including arbitrary positioning of control hairs and hair cutting tools.

**Figaro** is introducing a modeling by obstacle approach. It means that you can use any object as tool for changing the hair shape; for instance a cylinder with a certain amount of stitches for creating a curl of chunk of hair.

## ❏ **SOFTIMAGE®|3D**

SOFTIMAGE®|3D is Softimage's legendary 3-D character animation product for the film, commercial/broadcast and games development markets.

SOFTIMAGE|3D v.4.0 features robust, production-proven organic modeling, legendary character animation tools and high-quality photorealistic rendering – providing a perfect first step into the world of 3-D production.

New version 4.0 offers a range of new features with an emphasis on game authoring including multiple UV texturing, vertex color authoring and polygon hide/unhide tools.

## 2.5.2 Relational Programming Languages

### Microsoft Visual Basic 6.0

Visual Basic as a language is considered HIGH Level. Almost all commands are English. MIDDLE level languages like C++, using sometimes cryptic commands and syntax, allow you to create very powerful and often faster Windows programs. There is a workaround to this, see below. LOW level language basically are Assembly. Some severe masochist go beyond Assembly to write HEX and BINARY programs.

Visual Basic 6.0 (VB6) is the most productive tool for creating high performance windows application. The integrated Visual Database Tools and RAD environment promote productivity by allowing fast application development. VB 6 could create applications for both client and server-side components that are optimized for throughput by the world-class /visual C++ 6.0 optimized native-code compiler (Office Software International, 2000).

VB 6 introduces the powerful new standard database access method, ADO (ActiveX Data Objects) to access the library database. All OLEDB drivers such as SQL Server™ 6.5+, Oracle 7.3.3+, Microsoft Access, ODBC, and SNA Server have been embedded into VB. The ADO allows high-speed access to any ODBC- or OLE DB-compliant database. [Thayer, 1999]

Visual Basic 6.0 provides a complete set of tools for integrating databases with any application, known as Visual Database Tools. The Visual Database Tools of the Visual Basic simplify operations like database design and the extraction of information from a database. They are not programming tools but tools to help in



preparing the application for coding. The Data View Window and the Query Designer are two of the Visual Data Tools. The Data View Window provides a way of maintaining any database connections and the Query Designer is an interactive database query interface that enables almost any type of SQL statement designing. [Petrosos, 2002]

A new productive Data Environment Designer in the Visual Basic 6 is a design time tool used to set up data access for the application. It is a very sophisticated interface that that allows table-style query design, easy generation of complex SQL code and a live results preview [Internet.com Corporation, 2000]

Visual Basic 6 supports mobile computing that enables the development of client/server application that work with databases. The Visual Basic project is able to bundle into a distributable package, either a compressed CAB file or an executable setup program by using the Packaging and Development Wizard. In addition to creating a standard installation process, it will also include the file and programs to allow users to uninstall the application if they want to [Thayer,1999]

## ■ Java™ Technology

The Java™ platform is based on the power of networks and the idea that the same software should run on many different kinds of computers, consumer gadgets, and other devices. Since its initial commercial release in 1995, Java technology has



grown in popularity and usage because of its true portability. The Java platform allows you to run the same Java application on lots of different kinds of computers

The idea is simple: Java technology-based software can work just about everywhere. Java technology components don't care what kind of computer, phone, TV, or operating system they run on.

Programs written in the Java programming language run on so many different kinds of systems thanks to a component of the platform called the Java virtual machine or "JVM™" -- a kind of translator that turns general Java platform instructions into tailored commands that make the devices do their work.

## ■ C++

C++ is a general purpose programming language with a bias towards systems programming that

- is a better C
- supports data abstraction
- supports object-oriented programming
- supports generic programming

## C++ Applications

Here is a list of systems, applications, and libraries that are completely or mostly written in C++. Naturally, this is not intended to be a complete list. It is a list of systems, applications, and libraries that a reader might have some familiarity with, that might give a novice an idea what is being done with C++.

**Significant Language Features**

Object-oriented programs are easier to understand, correct and modify. Many other object-oriented languages have been developed, including most notably, Smalltalk. The best features of C++ are:

- C++ is a hybrid language-it is possible to program in either a C-like style, an object-oriented style, or both.
- C++ programs consist of pieces called classes and functions. User can program each piece User may need to form a C++ program.
- The advantage of creating user’s own functions and classes is that user will know exactly how they work. User will be able to examine the C++ code.

**2.5.3 Relational Database**

The file management programs and the database management system (DBMS) are two widely used database types.

Table 2.1: Type of Database

Type	Advantages	Disadvantages
File Management Program	<ul style="list-style-type: none"><li>• Less Complex</li><li>• Less Expensive</li><li>• Easier to use</li></ul>	<ul style="list-style-type: none"><li>• Create flat files that unable linking with other files</li></ul>

Database Management System	Relational database	Relational database
	<ul style="list-style-type: none"> <li>Integrate database from multiple files</li> <li>Ensure data integrity</li> <li>Reduce data redundancy</li> <li>Security</li> </ul>	<ul style="list-style-type: none"> <li>Obtain expensive software</li> <li>Obtain large hardware configuration</li> </ul>
	Object-oriented Database	Object-oriented Database
	<ul style="list-style-type: none"> <li>can incorporate sound, video, text, graphics</li> <li>well suited for multimedia applications</li> </ul>	<ul style="list-style-type: none"> <li>Very complex</li> <li>Costly</li> </ul>

The database management systems (DBMS) can link data from several files. The relational database and object-oriented databases are two widely used type of DBMS. Below are the explanation of some popular DBMS:

### ❖ Microsoft Access

#### What is Microsoft Access?

Microsoft Access is a popular relational database management system (RDBMS) for creating desktop and client/server database applications that run under the Windows operating system. This database is easy to use. As a component of the Professional and Developer editions of Microsoft Office 2000 and XP Suite, Access has the same look and feel as other Office products, like Word and Excel.

Access stores an entire database application within a single file. An Access **.mdb** file can contain data objects, like tables, indexes and queries, as well as application objects like forms, reports, macros, and visual basic code.



## **Oracle 9i Database**

Oracle 9i Database is the latest database product from Oracle Corporation. It provides transparent application scalability by sharing cluster-wide caches for coordinated data access. It also includes business intelligence capabilities. With its open framework, programmatic access, centralized management, and multi-channel delivery of Internet services can be provided to users.

Besides that, Oracle 9i database is designed with integrated manageability that creates a complete business view of all components powering e-business processing. As any other database software in the market, Oracle 9i provides multiple layers of security to prevent any unauthorized access to the database. Oracle 9i is compatible with UNIX and Windows NT [Oracle, 2001]. But, the cost of the Oracle software is more expensive compared to other database software.

### **Advantage of Oracle**

- ✓ It can be difficult to administer. But its complexity makes it very robust.

There is almost nothing that you cannot do in Oracle (unlike Access).

- ✓ Oracle is specifically designed for multi-user applications.
- ✓ Oracle's very good transactional control which allow thousands of users can access the same data without any problems due to.

- ✓ Oracle can also handle large amounts of data. In fact, Oracle 8i can handle up to 512 peta bytes of data!

### **Disadvantage of Oracle**



- × It is very complex
- × But applications are not developed nearly as quickly.

## **MySQL**

MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL), the most popular language for adding, accessing, and processing data in a database. Because it is open source, anyone can download MySQL and tailor it to their needs in accordance with the general public license. MySQL is noted mainly for its speed, reliability, and flexibility.

The MySQL relational database system was first released in January 1998. It is fully multi-threaded using kernel threads, provides application program interfaces (APIs) for C, C++, Eiffel, Java, Perl, PHP, Python, and Tcl, allows for many column types, and offers full operator and function support in the SELECT and WHERE parts of queries. MySQL currently runs on the Linux, UNIX, and Windows platforms.

## ✧ **Microsoft SQL 2000**

Microsoft SQL 2000 is an enterprise-level database and is the latest version of Microsoft SQL 7. It is enhanced with Extensible Markup Language (XML) support that enables data return in XML and also enables XML be used to insert, update, and delete values in the database. SQL Server 2000 supports enhancements to distributed

### 3.1 Introduction

Software development is a systematic way of a certain, well-defined and repeatable process to develop software. It involves a series of proprietary techniques, tools and the execution of a set of steps to build a software system. The software development process is a series of steps to build up and simplify the software development process. (Baker, 2000)

### 3.2 Software Development Life Cycle (SDLC)

Software Development Life Cycle (SDLC) is a process of software development, which includes the phases of analysis, design, implementation, and support. It is a process of software development that involves the development of software from the initial requirements to the final deployment.

- Waterfall Model
- Spiral Model
- V Model
- Prototyping Model
- Iterative Development Model
- Incremental Model
- Rapid Development Model
- Agile Model

Among the available models, Waterfall and Prototyping Model are chosen for

development of the system. The reason for this is that

these models are easy to understand and

implement. The Waterfall Model is a

linear model of software development

## **Chapter 3 -Methodology**

### **3.1 Introduction**

A methodology is a systematic way of accomplishing certain task and may be defines as a collection of procedures, technique, tools and documentation aids to help the software developer to speed up and simplify the software development process.

[Michael, 1999]

### **3.2 System Development Life Cycle (SDLC)**

Software Development Life Cycle (SDLC) consists of generic phases: planning, analysis, design, implementation, and support. The most popular software process model that have been proposed over the years are:

- Waterfall Model
- Waterfall Model with prototyping
- V Model
- Prototyping Model
- Operational Specification Model
- Transformation Model
- Phased Development Model
- Incremental and Iterative Model
- Spiral Model

Among the available models, Waterfall and Prototyping Model are chosen for discussion.

### 3.2.1 Waterfall model

In developing a system, it is going through a process called life cycle. Waterfall model is structured as a cascade of phases, when the output of one phase constitutes the input to the next one. Each phase, in turn, is structured as a set of activities that must be executed by different people concurrently.

Waterfall life cycle model comprises the following phases as show in figure 2.1:

- **Requirements Analysis**

Analyzing the software problem at hand and identifying all the possible constraints. Then, concludes with a software requirement specification

- **Design Specification**

Overall system architecture is decomposed from the software system. The system design partitions the requirements into hardware or software.

- **Coding and Module Testing**

Defined algorithms are transformed into a computer-understandable language in the coding phase. Module testing involves verifying each coded module behaves according to the specification.

- **Integration and System testing**

Interconnects modules and check the entire system embedded in its actual hardware environment.



- **Delivery and Maintenance**

System becomes operational and deliverable to users. Detection and repair of bugs will be carried out to improve the system.

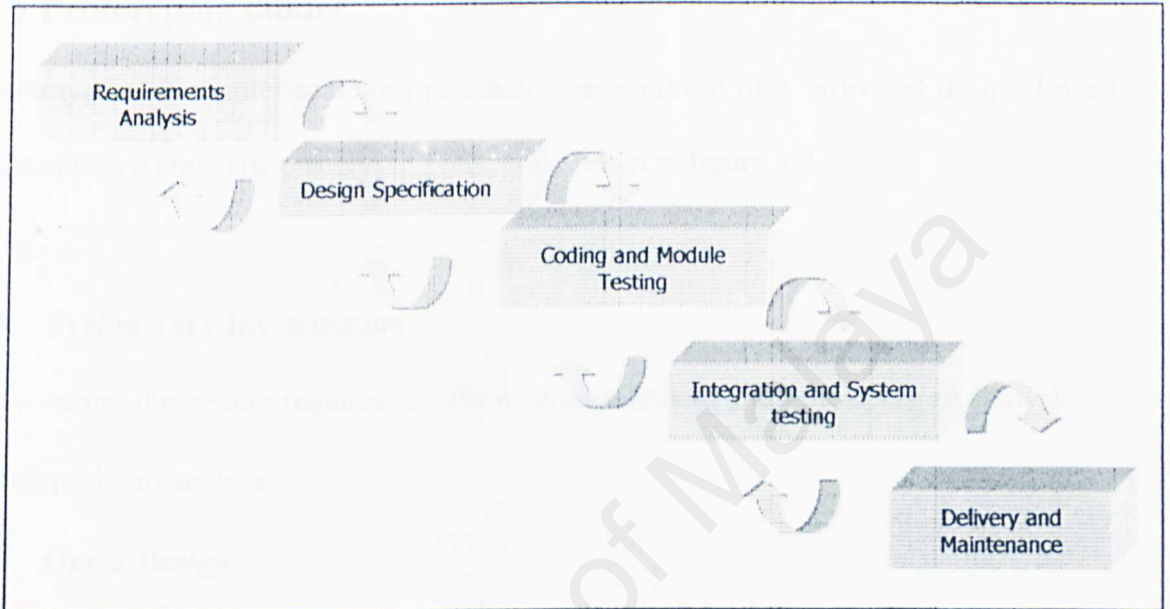


Figure 3.1 Waterfall Life Cycle Model

### **Advantages of Waterfall Model**

- ✓ Forces a discipline process to avoid the pressures of code writing before it is known what is to be built.
- ✓ Easier for developer to lay out what to do
- ✓ Easy to explain to whom are not familiar with software development

### **Disadvantages of Waterfall Model**

- ✗ No process for error correction after the final requirement is released
- ✗ No early feedback from customer

- × Subsequent changes to design and code are not addressed
- × Over emphasis on planning that could not provide quick response in a fast moving target arena.

### 3.2.2 Prototyping model

A prototype is a smaller-scale, representative or working of a proposed design for an information system. The prototyping model is shown in figure 3.2:

- **Preliminary Investigation**

To ensure the system requirement through requirement analysis, decision analysis and problem analysis.

- **Quick Design**

All or part of system construct quickly to understand or clarify issues

- **Develop Prototype**

Identify new requirement and give feedback on the design

- **Prototype Evaluation**

System is coded and alternatives are discussed, with possible iteration through requirements and design again.

- **Refine Requirement**

Revise requirement to make sure the system still has any problems and errors.

- **Evaluated**

The initial design is revised until come to a common agreement

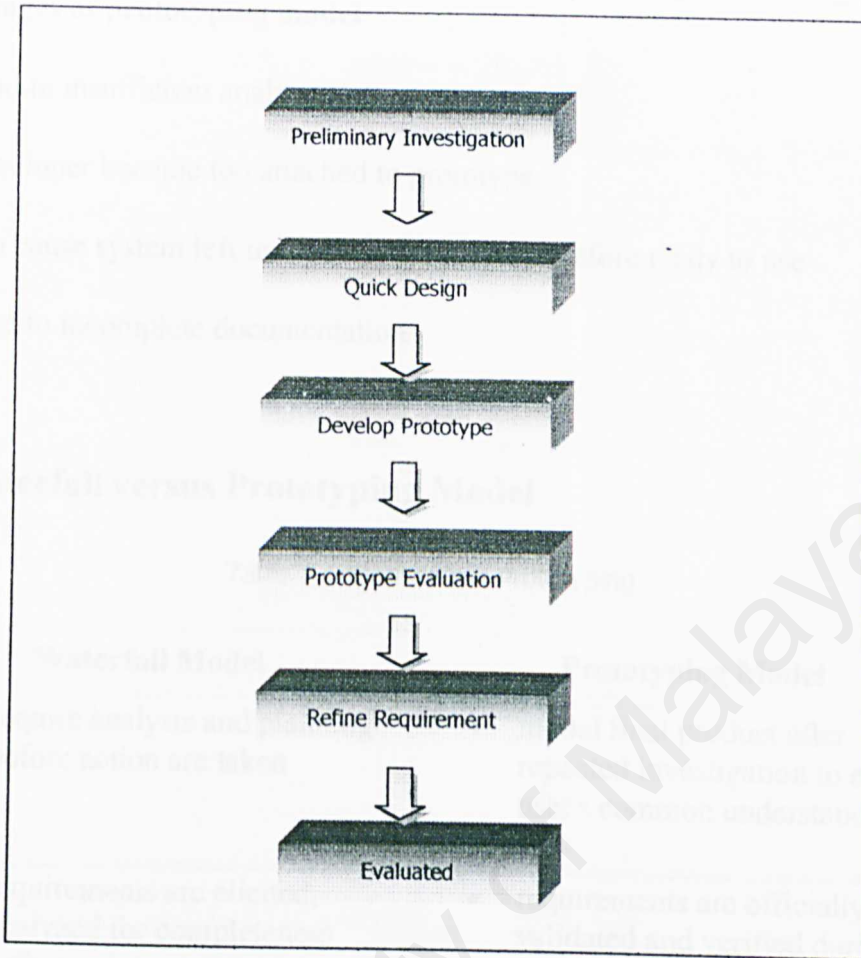


Figure 3.2: Prototyping Model

#### Advantages of prototyping model

- ✓ Reduce development time and cost
- ✓ Reduce risk and uncertainty
- ✓ Require user involvement
- ✓ Developer receive quantifiable user feedback
- ✓ Result in higher user satisfaction
- ✓ Exposes developer to potential future system enhancement

**Disadvantages of prototyping model**

- × Lead to insufficient analysis
- × Developer become too attached to prototype
- × Can cause system left unfinished / implement before ready to use
- × Lead to incomplete documentation

**3.2.3 Waterfall versus Prototyping Model**

Table 3.1 Waterfall vs Prototyping

Waterfall Model	Prototyping Model
<ul style="list-style-type: none"><li>• require analysis and planning before action are taken</li></ul>	<ul style="list-style-type: none"><li>• model final product after repeated investigation to ensure user's common understandings</li></ul>
<ul style="list-style-type: none"><li>• requirements are elicited, analyzed for completeness before going on to system design</li></ul>	<ul style="list-style-type: none"><li>• requirements are officially validated and verified during system testing</li></ul>
<ul style="list-style-type: none"><li>• no correction allow after final requirements released</li></ul>	<ul style="list-style-type: none"><li>• an iterative process</li></ul>
<ul style="list-style-type: none"><li>• emphasis on planning</li></ul>	<ul style="list-style-type: none"><li>• emphasis on users</li></ul>

**3.2.4 Conclusion on methodology**

In a nutshell, Rapid Application Development (RAD) strategy was selected for the Virtual Hairstyle Studio software development. RAD will enable



software to be developed rapidly via prototyping model. The main factors that driven to adopt RAD approach are describe as below:

Virtual Hairstyle Studio has a relatively small amount data processing. It deeply emphasize on the user interface design which sticks to “What you see, what you get” concept. Thus, prototyping approach would be best suit the system development.

Second, prototyping provide a clear and definite strategy to improve understanding of what is needed and what is proposed. Moreover, the feature of iteration allows repeated investigating on requirement, design and system. Hence, prototyping produce a satisfactory and high quality final output.

### **3.3 Techniques Used for Information Gathering**

Information gathering plays a significant role in the process of system development.

These are the fact-finding techniques carried out throughout the requirement analysis:

- ❑ Documentation and Printed Media
- ❑ Web Searching
- ❑ Interviews and Questionnaires
- ❑ Guidance of Lecturer

#### **3.3.1 Documentation and Printed Media**

The main reference resource for WXES 3181 thesis report writing is past year student's report in the documentation room of FSKTM. These previous

years thesis reports are the shortest and the fastest way to understand the whole system development layout.

Printed media such as newspaper and magazines: *Cleo, Sister Pictorial, New Tides, Lady Mix Mook, Bella, IN Hair* are the resources provide the latest, updated and trend of hairstyle information. The hairstyle information is needed to build hairstyle database of Virtual Hairstyle Studio.

### 3.3.2 Web Searching

Web searching is the wonderful fact-finding method. The existing similar hairstyle simulation project and hairstyle imaging software can be easily found via World Wide Web. It is greatly helpful in giving ideas and guidance to develop the features of Virtual Hairstyle Studio. Some of the web site's URL are listed below:

- [www.thehairstyler.com](http://www.thehairstyler.com)
- [www.nausoft.com](http://www.nausoft.com)
- [www.clairol.com](http://www.clairol.com)
- [www.hairpro.com](http://www.hairpro.com)
- [www.cybersalon.com](http://www.cybersalon.com)
- [www.cachebeauty.com](http://www.cachebeauty.com)
- [www.hairboutique.com](http://www.hairboutique.com)
- [www.ingo-martin.de](http://www.ingo-martin.de)

Besides that, the detail information of authoring tools for multimedia system can be found abundantly through the search engine especially Google and Yahoo.

### 3.3.3 Interviews

An interview is a directed specific purpose conversation in question-and-answer format. The interviewee's opinion and feeling about the current issue regarding the system is precious to reveal the requirement.

### 3.3.4 Guidance of Lecturer

Marvelous opinion for developing the features of Virtual Hairstyle Studio was given by project supervisor, Assoc. Prof Dr. Ow Siew Hock. Dr. Ow had spent her time in guiding and assisting the project team directly and indirectly of the way to develop a system. The previous years seniors' systems were demonstrated in order to provide rough idea for outlining our project respectively.

## 3.4 Interview Results Analysis

Interviews were conducted in SS2 area and Section 14 to gather the hairstyle information. The targeted respondents are saloon managers, supervisors and hairstylists who have experience in hair dressing field. Interviews have been carried out via telephone call ::: *Cultural Cut* and walk-in interview ::: *Thomas & Guys Hair Salon & School*, *MTH Saloon* and also *Crimpers Sdn Bhd*. Below are the listings of saloon that had been interviewed:

Table 3.3: List of the Saloons visited

Saloon's Name	Interviewee	Experience In Hair Industry	Web site
THOMAS & GUYS' HAIR SALON & SCHOOL	Mr. Thomas	20 Years	<a href="http://www.thomasandguys.com">http://www.thomasandguys.com</a>
MTH SALON	Mr. Billy Lim	19 Years	<a href="http://www.go-hc.com">http://www.go-hc.com</a>
CRIMPERS	Ms. Christine	9 Years	----
Cultural Cut	Ms. Liana	6Years	----

### 3.4.1 Statistical Result of Computer Technology Exposure Of Saloons

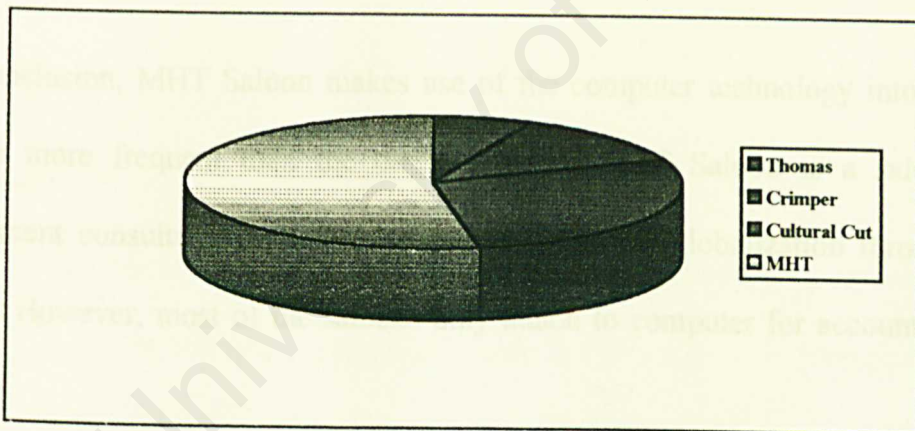


Figure 3.3: Percentage of computer technology exposure



3.4.2 Statistical Result of Computer Usage Or System Applied in Saloons

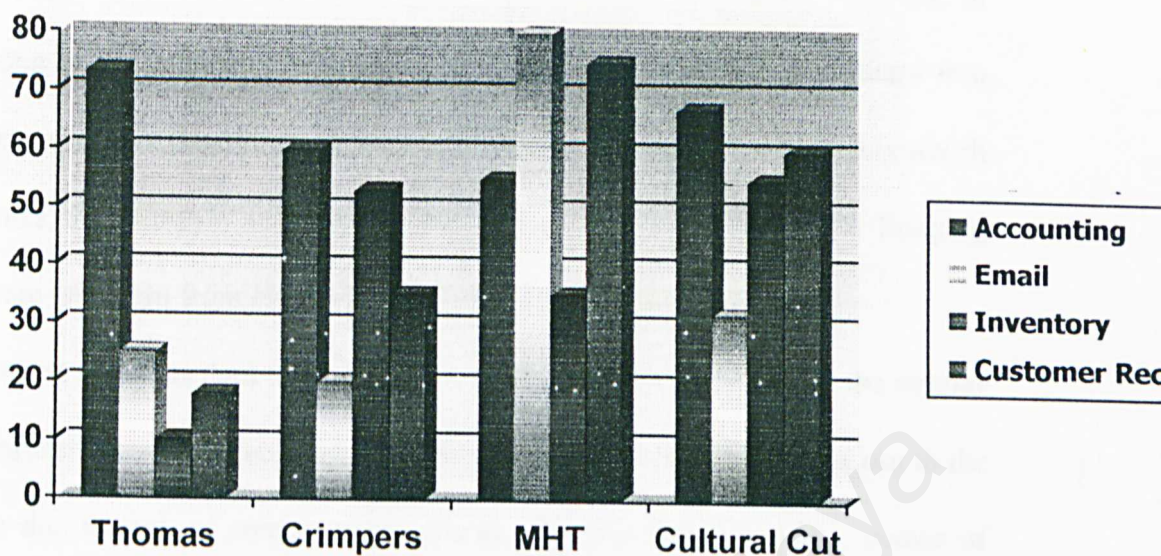


Figure 3.4: Type of PC usage or system applied in saloon

As a conclusion, MHT Saloon makes use of the computer technology into its business more frequent than the others. Due to MHT Saloon is a saloon management consultancy which promotes hair network globalization through Internet. However, most of the saloons only attach to computer for accounting purpose.

These results indicate that the majority of saloons are still prefer to use traditional method to keep track of the customer records and inventory rather than trying the latest computer and information technology.

### **3.4.3 Awareness Of Hairstyle Imaging Programs in the Market**

85% of the interviewee had heard about the Hairstyle Simulation Program. In fact, one of the saloons :: *Cultural Cut* have already adopted the system into business since six months ago. Cultural Cut is the first saloon in Malaysia which promotes the hairstyle imaging system to its clients. The Hairstyle Imaging Software is bought from HairZ-TECH, United State in US \$475.00.

Meanwhile, Thomas And Guys Hair Saloon & School also possesses the similar imaging software for three years. Unfortunately, the system was not in use in the saloon due to lack of computer knowledge. Besides that, Mr. Billy, owner of MHT Salon had ever heard about this kind of program before. Whereas, Ms. Christine from Crimpers had not been heard about hairstyle imaging program.

## **3.5 Summary**

System Development Methodology is crucial to define procedures, technique, tools and documentation which simplify the software development process.

Technique Used for Information Gathering and Interview Results Analysis is stated as well.

## 4.1 Introduction

System analysis is an early phase in the development of a new technology. It is the process of identifying the requirements for a system and the functional and non-functional requirements of the system. It is the process of identifying the requirements for a system and the functional and non-functional requirements of the system. It is the process of identifying the requirements for a system and the functional and non-functional requirements of the system.

## 4.2 Functional Requirements

Functional requirements describe what the system must do and its performance. Functional requirements are the requirements that describe the system's behavior. They are the requirements that describe the system's behavior. They are the requirements that describe the system's behavior.

## 4.3 Non-Functional Requirements

Non-functional requirements describe the system's quality attributes. They are the requirements that describe the system's quality attributes. They are the requirements that describe the system's quality attributes.

## 4.4 Data Requirements

Data requirements describe the system's data needs. They are the requirements that describe the system's data needs. They are the requirements that describe the system's data needs.

## Chapter 4 System Analysis

### 4.1 Introduction

System Analysis is an early phase in system development. It is a fact-finding phase that involves identification of functional and non-functional system requirement. System Analysis should be specify in order to reduce the complexity of the system and to comprehend the flow of system easily. System Analysis starts with data collection.

### 4.2 Functional Requirements

Functional requirement describes interaction between system and its environments. Functional Requirement is the expected services of system. Overall, the functions of V-Hair described as following:

#### ❏ V-Hair Maintenance

- Allow saloon management to enter V-Hair via user ID and password
- Allow record retrieval regarding customer's previous visit
- Allow saloon management to update or add new hairstyle into library

#### ❏ V-Hair Simulation

- Allow clients to load their own photo into V-Hair
- Allow clients to choose their favorite hairstyle
- Allow clients to choose their favorite hair coloring



Allow clients to view the hairstyle simulation results

**V-Hair Information**

- Allow user to read the hair care tips
- Allow user to acquire the hints on “what face shape suits what hairstyle in the greatest way”
- Allow user to get the solution of hair problems

**V-Hair Help**

- ➔ Allow user to get the help from V-Hair when they are in doubt or uncertain
- ➔ Allow user to comprehend the function of each button in V-Hair

**V-Hair Print**

- ➔ Allow clients to print out the hairstyle simulation results (maximum 8 images in single sheet)

The following table explains the functional requirement of **V-Hair** in general:

Table 4.1: Functional Requirement of **V-Hair**

<p><b>Input Function</b></p>	<p>V-Hair must accept the following input:</p> <ul style="list-style-type: none"> <li>o User login ID,</li> <li>o Password,</li> <li>o Hair Images,</li> <li>o Hair Care Tips,</li> <li>o Client Photo</li> </ul> <p>Input Devices:</p> <ul style="list-style-type: none"> <li>o Keyboard,</li> <li>o Scanner,</li> <li>o Digital Camera,</li> <li>o WebCam</li> </ul>
<p><b>Output Function</b></p>	<p>V-Hair must generate the following outputs:</p> <ul style="list-style-type: none"> <li>o selected hairstyle</li> <li>o selected hair color</li> <li>o selected hair tips</li> </ul> <p>The output can be view at:</p> <ul style="list-style-type: none"> <li>o screen</li> <li>o printout</li> <li>o exported as another format</li> <li>o save into diskette</li> </ul>
<p><b>Processing Function</b></p>	<p>V-Hair must perform the following processes:</p> <ul style="list-style-type: none"> <li>o validate login ID</li> <li>o validate password</li> <li>o Load client's photo</li> <li>o Display hairstyle</li> <li>o Save selected hairstyle</li> </ul>

<b>Storage Function</b>	<p>V-Hair must maintain the following data:</p> <ul style="list-style-type: none"> <li>o password</li> <li>o new hairstyle</li> <li>o new hair tips</li> </ul>
<b>Control Function</b>	<p>V-Hair must enforce the following controls:</p> <ul style="list-style-type: none"> <li>o security</li> <li>o authorization</li> <li>o Log-in</li> </ul>

### 4.3 Non-functional Requirements

Non-functional specifications are the restrictions and constraints on the system that limits out choices for constructing a solution to problems. The non-functional requirement of Virtual Hairstyle Studio are listed as following:

#### Modularity

It involves the process of breaking down the programming codes into several logical and manageable portions. Each individual is functionally cohesive. Thus, it is easier to maintain. Moreover, it is easier to grasp as it is a self-contained sub-system that anyone could comprehend the module by looking at its code listings.

## **Efficiency**

A good response time towards a user's request and a good discussion environment should be reached so that no delay and inefficiency occur. The response time should be within a reasonable internal time where all desirable information should be available to users at any point in time. User should be kept waiting for a long time for the results.

## **Security**

Security of the entire system is vital as it prevent loss of confidentiality or privacy, theft and fraud. Thus, authentication towards entrants of the system should be strengthened. Database security is also another important element to protect the database against intentional or unintentional threats.

## **User-friendliness**

Every member requires an interactive and easy-to-use interface. Therefore, a systematic and standard GUI features such as field description for each component should be built for convenience of user. Usage of suitable and meaningful captions and icons help the user to use the system with more confidence. Besides that, a help file will be created to assist the new and inexperienced users to use the system. Generally the design of all the interfaces will conform to the following criterion:

- **Consistent**, in term of screen design and error messages displayed.



- High degree of **understandability** and avoid memorization of events and command.
- **Simplicity** that refers to keeping screens properly uncluttered in a manner that focuses the user's attention.
- **Attractiveness** – infers that users should enjoy using or attracted to use the system due to their appealing design.

#### ❏ **Reliability and Accuracy**

These features ensure every user of Virtual Hairstyle Studio received desired results. Measures are taken in order to ensure all queries are sent to the exact users and also provide the precise information.

#### ❏ **Data Integrity**

It is one of the important aspects that should be focused. Data Integrity refers to the validity and consistency should also be defined to reduce the risk of occurring data inconsistency.

#### ❏ **Maintainability and expandability**

These enable system to be understood, corrected, adapted or enhanced. Maintainability is the degree to which architectures, data, or procedural design can be extended.

## **4.4 System Development Tools**

After several literature researches carried out in Chapter 2, some system development tools have been selected based on their features and capabilities. The remainder wrote-up describes the tools chosen:

#### **4.4.1 Programming Language**

##### **Visual Basic 6.0**

Visual Basic 6.0 (VB6) is the programming language chosen to develop V-Hair seeing that VB6 is the most productive tool for creating high performance windows application. The integrated Visual Database Tools and RAD environment promote productivity by allowing fast application development. VB 6 could create applications for both client and server-side components that are optimized for throughput by the world –class /visual C++ 6.0 optimized native-code compile. The others advantages and features of VB6 has been discuss in Literature Review.

#### **4.4.2 Database**

##### **Microsoft Access 2000**

Microsoft Access 2000 is the DBMS selected for the V-Hair development. The powerful features provided by Microsoft Access 2000 are:

##### **Integration with Microsoft Enterprise Solutions**

Access 2000 is integrated with the **Microsoft Enterprise Solutions** including Microsoft Visual Studio. Therefore it is compatible with Visual Basic 6.0 as one of the tools in the Microsoft Visual Studio [Petroutsos, 2000].

### **Ease of Use**

It provides graphical tools, wizards, tips, tricks and improves Help to user when using the software [Hallogram publishing,1999]

### **Compact on close**

Based on the threshold defined, Access 2000 will automatically compact the databases when the user exits to preserve disk space [Hallogram publishing, 1999]

### **Seamless integration with SQL Server**

Microsoft Access 2000 includes built-in Microsoft SQL Server™ integration with a built-in Upsizing Wizard that can convert an Access file to a full SQL database with no programming required. [Microsoft Corporation, 2000]

### **Advantage of Microsoft Access**

- ✓ This package is affordable as it is part of Office Professional
- ✓ **easy to use.** Most of the work in Access is done through wizards and GUI tools. One can quickly develop a small, single user database with this one.

### **Disadvantage of Microsoft Access**

- × MS Access is not very good for a multi-user application.
- × It is not very robust.
- × Do not have good multi-user transactional control.

- × In addition, Access cannot handle large amounts of data.
- × All of the data in the database is stored in a single file and that has its limitations.

### 4.4.3 Authoring Tools

**Adobe Photoshop 6.0, Director 8.5 and Macromedia Flash MX** are the image editing tools that selected for Virtual Hairstyle Studio. The features of those tools have been explained in Chapter 2 Literature Review.

## 4.5 Run-time Requirements

The run-time requirements are the requirements that have to do with the hardware and software needs that must be fulfilled in order to maximize the performance of the system.

### 4.5.1 Development hardware requirements

- **Computer:** IBM compatible Computer
- **Processor:** AMD T-Bird 1.33GHZ Processor
- **Memory:** 256 MB SDR Memory chip
- **Display Card:** WinFast GeForce2 MX64
- **Input Device:** Canon Scanner D646U ex

### 4.5.2 Development software requirements



- **Microsoft Windows 2000** as development platform
- **Microsoft Access 2000** for database management
- **Microsoft Visual Basic 6.0** to implement coding
- **Macromedia Flash** for interface design
- **Macromedia Director 8.0** for interface design
- **Microsoft Word 2000** for documentation
- **Adobe Photoshop** for graphics and photo editing

#### 4.5.3 Client hardware requirements

##### Minimum Requirement

- **Computer:** IBM or compatible
- **Processor:** 486DX-66MHz or better
- **Hard disk:** 20 MB HD and above
- **Video card:** 2 MB SVGA video card
- **Memory:** 32 MB and above recommended
- **Input devices:** either - Digital Photo camera with resolution 640x480 or  
- Web Camera or  
- Scanner.
- **Output devices:** printer

##### Optimum System Requirements

- **Computer:** CPU Intel Pentium IV 1.8G or above
- **Memory:** RAM 128MB
- **Hard Disk:** HDD 60GB
- **Monitor:** 17" Monitor with 1024x768 resolution
- **Printer:** Photo quality color printer
- **Input Device:** Digital Photo camera with resolution 1024x768 or more

- **Video Card:** Video Color Palette High Color (16 Bits) or above

#### 4.5.4 Client software requirements

- **Operation system:** Windows® 95, 98, Me, NT, 2000, XP
- **Photo Editor:** Adobe Photoshop or equivalent

#### 4.6 Summary

In conclusion, system requirement for instance functional and non-functional requirements, run-time requirements for development and client along with development tools are determined.

5.1 Introduction

System design is a process of defining the structure and organization of a system.

It involves the selection of components, their interconnections, and the overall architecture of the system.

The design process is iterative, involving the refinement of the design as more information is gathered.

The design process is also influenced by the constraints of the system, such as time, cost, and resources.

The design process is a key part of the system development process, and it is essential for the success of the project.

The design process is a key part of the system development process, and it is essential for the success of the project.

5.1.1 Logical Design Systems

Logical design systems are systems that are designed to meet the requirements of the system.

They are designed to be flexible, scalable, and easy to maintain.

5.1.2 User's Requirements

User requirements are the needs and desires of the users of the system.

They are the basis for the design of the system, and they are essential for the success of the project.

5.1.3 Data

Data is the information that is used by the system to perform its functions.

It is essential for the design of the system, and it is essential for the success of the project.

5.2 System Functionality Design

System functionality design is the process of defining the functions that the system must perform.

It involves the selection of the functions that the system must perform, and the design of the system to perform those functions.

The design process is iterative, involving the refinement of the design as more information is gathered.

The design process is also influenced by the constraints of the system, such as time, cost, and resources.

The design process is a key part of the system development process, and it is essential for the success of the project.

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## **Chapter 5: System Design**

### **5.1 Introduction**

System Design is a process to convert the conceptual ideas from requirement specification in system analysis into more technical specification. System Design is done in order to determine the features of the system component and processes in a system, and its appearance to the user. System Requirement defined in the previous chapter is translated into a system specification to build a complete and executable system. The objectives of system design are listed below:

- Specify Logical Design Element

Detailed design specification with specific logical elements that describe that features of a system such as input, output, database and process.

- Meet User's Requirements

Meet user need in term of appropriate procedures and performance, proper presentation, accurate and reliable results and overall reliability.

- Ease Of Use

Build an easy-to-use application with ergonomic design that requires favorable human engineering, physically comfortable and contribute to user effectiveness.

### **5.2 System functionality Design**

System functionality design is presented in a form of hierarchy chart. It is used to identify the major modules that act on data at the high levels of Virtual Hairstyle Studio.



The components at high level can be broken down into sub-modules or functions when necessary.

### 5.2.1 System Structure Chart

Structured Charts display the top-down design of a system. Main functions form the initial component part of structured chart, which can be broken into sub-component in details. Virtual Hairstyle Studio consists of three sub-modules as shown in Figure 5.1.

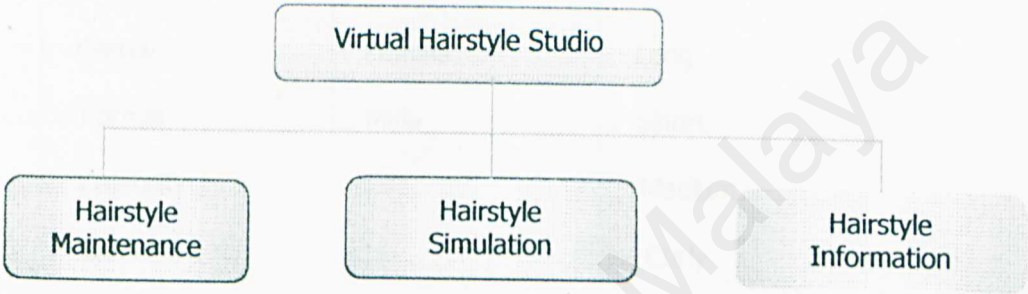


Figure 5.1: Structure Chart Of Virtual Hairstyle Studio

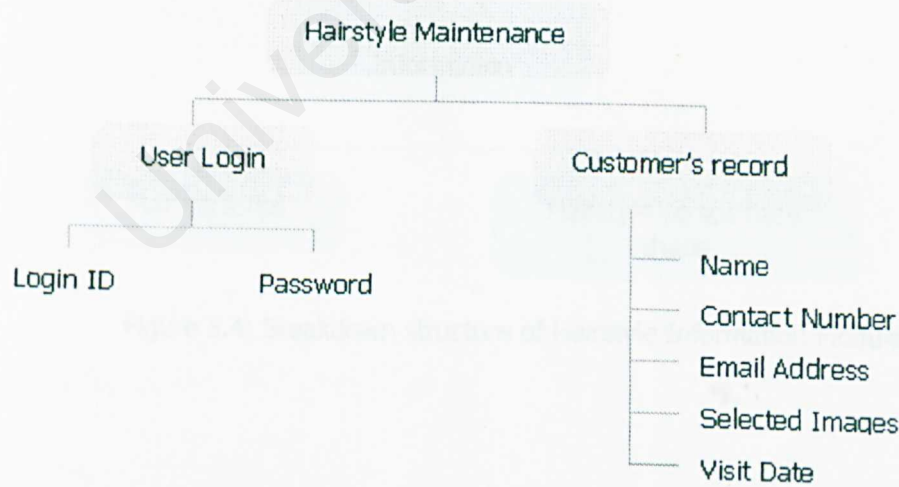


Figure 5.2: Breakdown structure of Hairstyle Maintenance Module

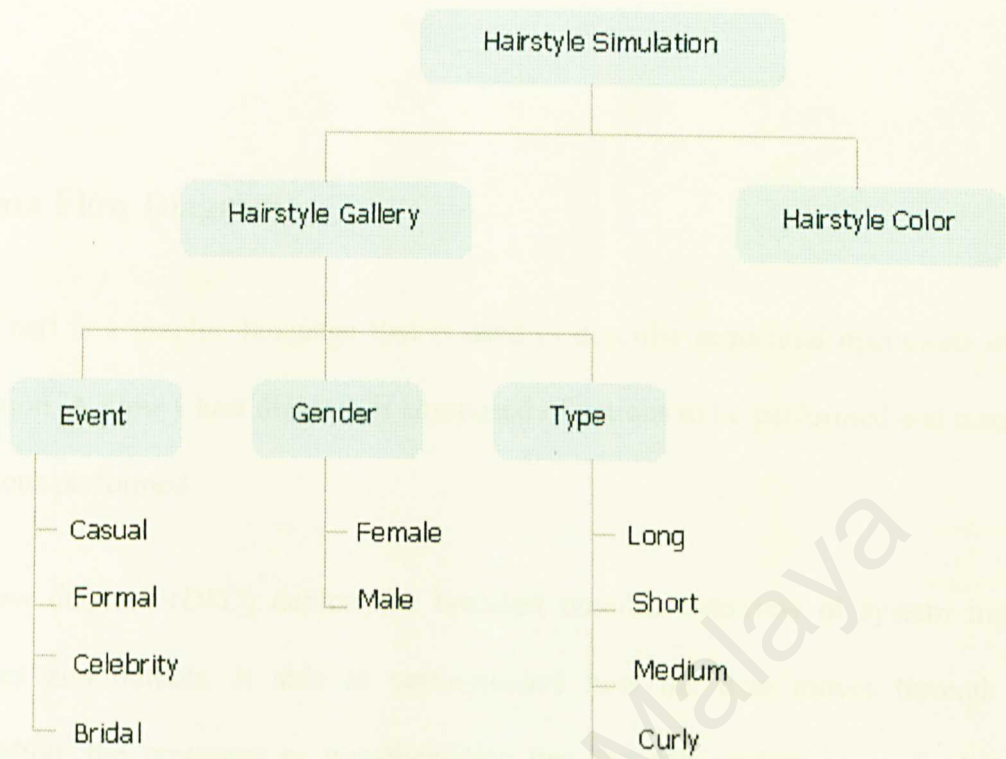


Figure 5.3: Breakdown structure of Hairstyle Simulation Module



Figure 5.4: Breakdown structure of Hairstyle Information Module

### 5.3 Data Flow Diagram

Flow Chart is a graphic language that is used to describe sequential operations in an application. A Flow Chart diagram is composed of actions to be performed and tests on the actions performed.

Data flow diagram (DFD) depicts the broadest possible overview of system inputs, processes and outputs. It able to conceptualize how the data moves through the organization, the processes or transformation that the data undergoes, and what the outputs are

The data flow approach emphasizes the logic underlying the system. The data flow approach has four chief advantages over narrative explanations of the way data moves through the system

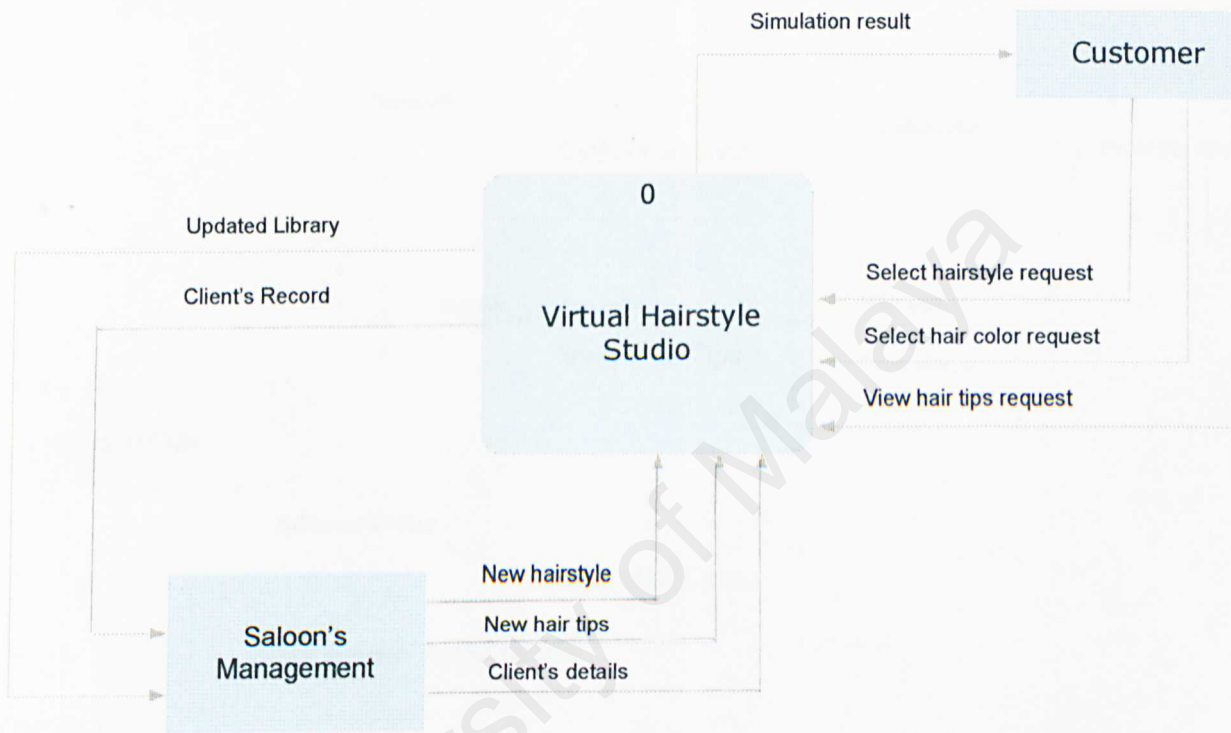


Figure 5.5: Context Diagram Of Virtual Hairstyle Studio



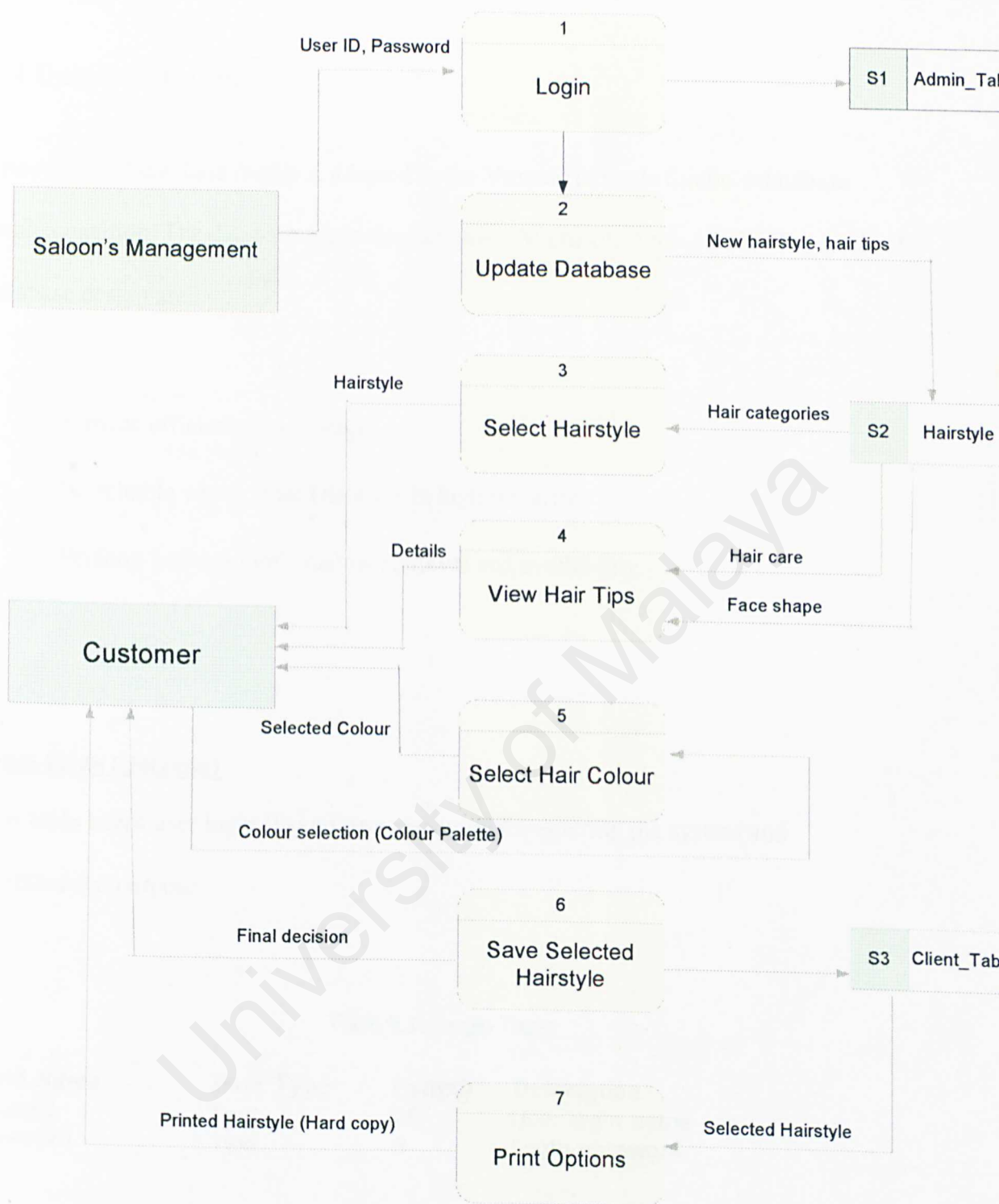


Figure 5.6: Data Flow Diagram Level Zero Of V-hair

## 5.4 Database Design

The relational database model is adapted in the Virtual Hairstyle Studio's database implementation. The database is constructed using Microsoft Access 2000. The goals of database design are:

- Provide efficient data storage
- Be reliable where stored data are in high integrity
- Perform powerful information retrieval and availability.

### Login Table (tblLogin)

This table keeps user login ID and user password for entering the system and maintenance purpose.

Table 5.1: Login Table

Field Name	Data Type	Length	Description
LoginID	Text	20	User login name
Password	Text	8	Login password

### Hairstyle Table (tblHairstyle)

This table contains the images of various hairstyle depend on Gender, Event and Type.

Table 5.2: Hairstyle Table

Field Name	Data Type	Length	Description
HairstyleID	AutoNumber	Long	Identification of hairstyle
Gender	Text	10	Gender of client
Event	Text	50	Type of event
Type	Text	100	Type of hair
Images	Text	100	Path of images

#### **Face Shape versus Hairstyle Table (tblFaceShape)**

This table contains the model of face shape and the relevant hairstyle description.

Table 5.3: Face Shape Table

Field Name	Data Type	Length	Description
FaceShapeID	AutoNumber	Long	Identification of face shape
FaceType	Text	50	Type of face shape
Description	Memo	2000	Contents of hairstyle regarding face shape
Images	Text	100	Path of relevant images

#### **Hair Care Information Table (tblHairCare)**

This table restores the hair problems, solutions and the graphic images of related hair problem.

Table 5.4: Hair Care Table

Field Name	Data Type	Length	Description
HairCareID	AutoNumber	Long	Identification of hair care
HairProblem	Text	50	Type of Hair Problem
SolutionDesc	Memo	2000	Contents of guidance to take care about hair
Images	Text	100	Path of images of specific subject

**Client Data table (tblClient)**

This table keeps track of the customer record.

Table 5.5: Client Data Table

Field Name	Data Type	Length	Description
ClientID	AutoNumber	Long	Identification of customer
ClientName	Text	100	Name of the client
ContactNo	Text	20	Contact number of client
EmailAdd	Text	100	Email address of client
SelectedImage1	Text	100	Path of the first hairstyle chosen
SelectedImage2	Text	100	Path of the second hairstyle chosen
SelectedImage3	Text	100	Path of the third hairstyle chosen
SelectedImage4	Text	100	Path of the fourth hairstyle chosen
SelectedImage5	Text	100	Path of the fifth hairstyle chosen
SelectedImage6	Text	100	Path of the sixth hairstyle chosen
SelectedImage7	Text	100	Path of the seventh hairstyle chosen
SelectedImage8	Text	100	Path of the eighth hairstyle chosen
Date	Date/Time		General date of the hairstyle had been saved



## 5.5 User Interface Design

Interface design is the specification of a conversation between the system user and the computer. A good, ease to use and user-friendly interface will make user's job easier and more pleasant [Hawryszkiewicz, 1988]. Therefore, the graphical user interface will be incorporated into the application.

Interface design covers both input and output to the computer. The input interface must capture all the data needed for the system without any errors. Therefore the interface must contain protection against error entering of the system. Besides that, input must well lie out and easy to understand and use. They must use precise names and allow abbreviations where necessary to speed up input. The output design must ensure that all data needed by users is provided by the output in an easy-to-read layout. [Hawryszkiewicz, 1988]

### 5.5.1 Screen Design

A good screen design reduces interface complexity as perceived by the user. The screen design for the *Virtual Hairstyle Studio* will follow the following guidelines. [Fertuck, 1997]:

#### □ Concreteness

It is easier to work with concrete object than with an abstract concept. Icons that perform a specific function will be use to achieve this purpose.

### **Visibility**

It is easier to operate an interface with the commands rather than remember options from the language syntax. People have highly developed powers of pattern recognition but relatively poor memory. Therefore, commands, functions keys, options and help will be visible on the screen.

### **Interactive**

Interactive interfaces are better than batch interfaces because they provide continual feedback and make very limited demands on people's short term memory. Each field on the input screens will be checked as entered and the user can be notified of error immediately.

### **Simplicity**

The best guideline for screen design is KISS – Keep It Simple Simon. Design element will be used judiciously.

### **Context sensitivity**

The option and commands that are available on the screen should depend on the current state of a screen. Commands that are inappropriate in the current mode of operation should not be made available.

Below are the user interface drafts of Virtual Hairstyle Studio:

The hair simulation consists of hairstyle selection and hair colour selection which are shown in Figure 5.7 and Figure 5.8.

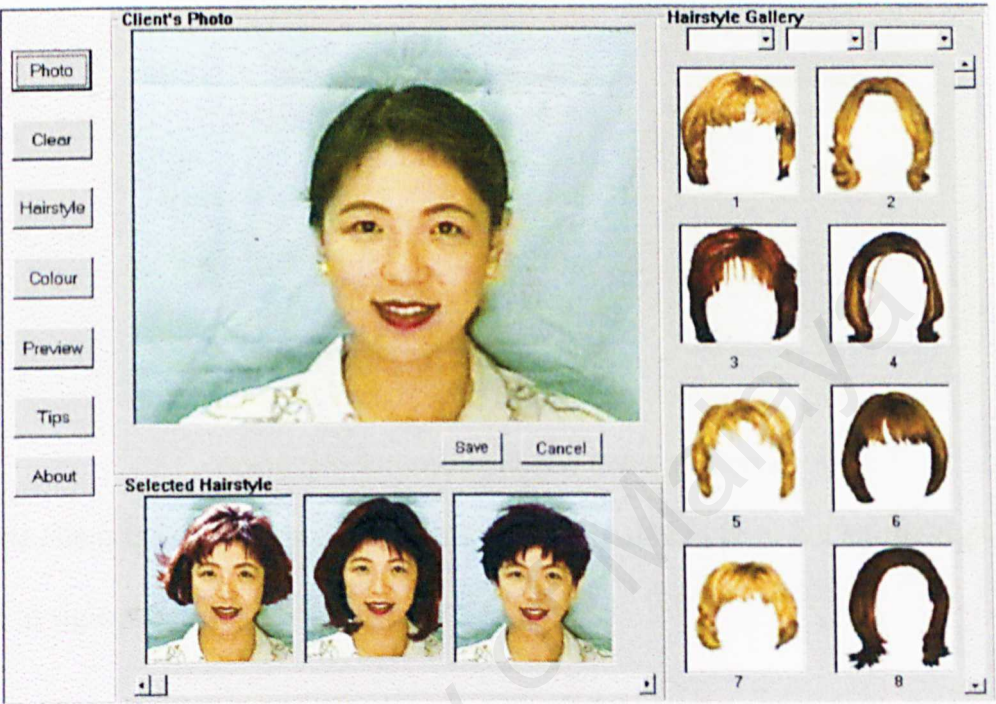


Figure 5.7: Screenshot of Hairstyle Selection



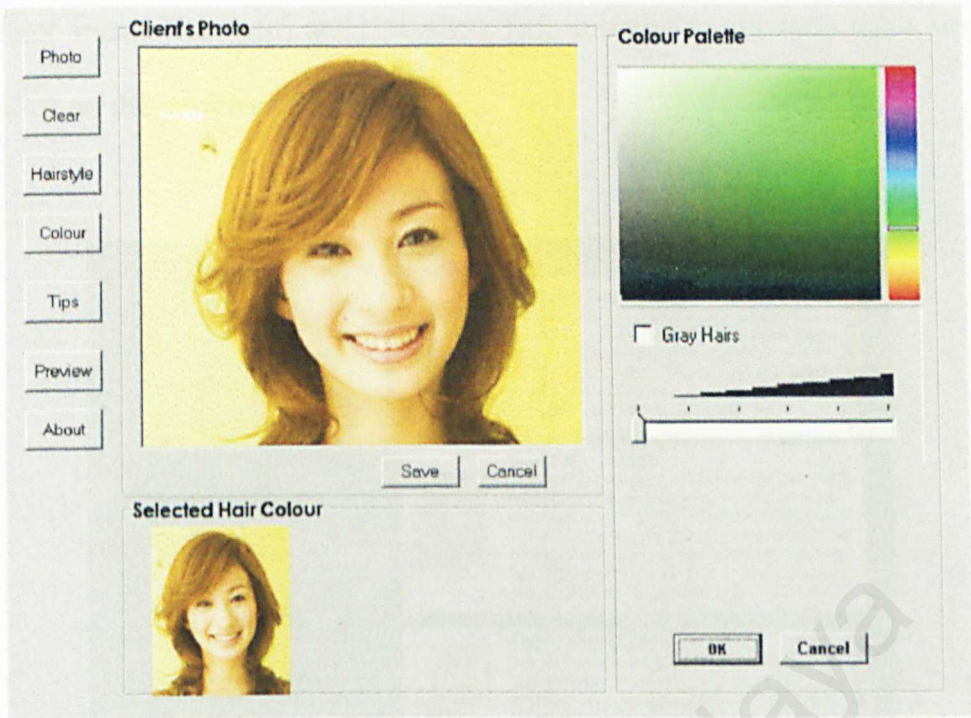


Figure 5.8: Screenshot of Hair Colour Selection

After the client satisfy with his/her selection, V-Hair able to print out all the eight images in sigle sheet



Figure 5.9: Screenshot of Hairstyle Selection Preview



“Face shape versus Hairstyle” and Hair Care Tips is available to clients just a single mouse-click on the preferred topic.



Figure 5.10: Screenshot of Face shape versus Hairstyle

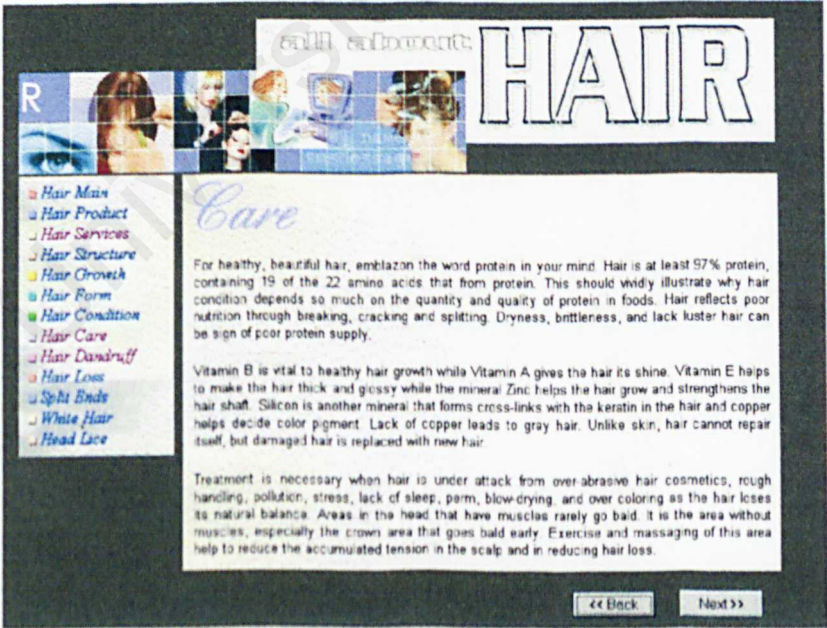


Figure 5.11: Screenshot of Hair Care Tips

## 5.5 Summary

System design performs a noteworthy part before any implementation is conducted. Overall system flows and system development concept will be visibly figured out during the system design phase.

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## Chapter 6: System Implementation

### Chapter Six

### System Implementation

System implementation is the process of implementing the system. It is the process of converting the conceptual model into a working system. It is the physical realization of the system.

The system implementation process is the process of converting the conceptual model into a working system. It is the process of converting the conceptual model into a working system. It is the process of converting the conceptual model into a working system.

#### 6.1 Development Environment

Before developing a system it is a must to have a development environment. The development environment is the environment in which the system is developed. It is the environment in which the system is developed. It is the environment in which the system is developed.

#### 6.2 Hardware Configuration

The following hardware configuration has been used in developing the system.

- Computer: Dell Inspiron 15 5515 Laptop
- Processor: Intel Core i5-11350H Processor
- Memory: 16 GB DDR4 Memory
- Display Card: NVIDIA GeForce RTX 3050
- Input Device: Canon Wireless Mouse

## Chapter 6: System Implementation

### 6.1 Introduction

System implementation for vHair is the acquisition and integration of the physical and conceptual resources that produce a working system. It is the physical realization of the database and application designs of vHair. This chapter will discuss about the steps and methods taken to implement the system that was design earlier in the previous chapter.

### 6.2 Development Environment

Before developing a system it is a must for the developer to ensure that the software or the hardware which will be used in the process of developing the system is really available. The hardware and software tools used to develop and documented the entire vHair is discussed as below.

#### 6.2.1 Hardware Configuration

The following hardware specifications had been used in developing vHair:

**Computer :** IBM compatible Computer

**Processor :** 1.33 GHz AMD T-Bird Processor

**Memory :** 256 MB SDR Memory chip

**Display Card :** WinFast GeForce2 MX64

**Input Device :** Canon Scanner D646U ex



### 6.2.2 Software Configuration

Plenty of software tools are used in designing the structural of the system and writing the report for documentation purpose. The design process involves the drawing of the structured chart and other form of the foundation of the software development. A vast array of software tools are listed as below:

Table 6.1: Client Data Table

Software	Usage	Description
Microsoft Windows 2000 Professional	System Requirement	Operating System
Microsoft Visual Basic 6.0	System Development	System Coding
Microsoft Access 2000	System Development	System database to store and manipulate data
Adobe Photoshop 6.0	Interface Design	Graphic Design Authoring tools

### 6.3 System Development of vHair

This section explained the development of vHair, which focuses on the analysis of usage of the technology and development tools that had been used. The system will be evolved from scratch design to a run able application. Below are the developments steps carried out during the system development.

#### 6.3.1 Database Development

Microsoft Access 2000 is selected as the Database Management System (DBMS) for this vHair. It allows developer to create easy-to-use database solutions quickly. By using

this DBMS, database structure, validation rules, defaults, relationships and referential integrity could be done easily.

The data structure of each table is declared as well as the primary key is set. Hence, the database is able maintained from time to time by add in some necessary constraints.

### **a. Connecting Database using ODBC**

There are three ways to open a Connection Object within ADO:

- By Setting the Connection String property to a valid Connect string and then calling the Open() method. This connection string is provider- dependent.

- By passing a valid Connect string to the first argument of the Open() method.

- By passing the ODBC Data source name and optionally user-id and password to the Connection Object's Open() method.

To connect to data using ODBC, an ODBC data source name (DSN) is used. DSN is a method of standardizing database connectivity.

It is the fastest type of DSN because the connection information is stored in Windows Registry. The code below was applied in visual basic as a connection to the database.

```
Public sysDB As New ADODB.Connection
Public rsAdd As New ADODB.Recordset

Public Sub openDB()
    Set sysDB = New ADODB.Connection
    Dim strConn As String
    strConn = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" & App.Path & _
        "\vHair.mdb;Persist Security Info=False"
    sysDB.Open strConn
```

End Sub

Figure 6.1: Connection to database coding

## b. Accessing Database for Application System (VB)

The ADO object model defines the base objects you work with to perform specific actions in your ultimate quest to access data. The base objects, such as Connection, Recordset can be created independently of one another and are related in a hierarchical sense.

**Recordset Object** – A Recordset Object represents any group of records – whether it is the result of a query or the entire contents of a table. This is the object use for almost all data access.

**Connection Object** – It represents the actual session established with the database. Open() and Close() are the two methods that frequently used.

Below are the sample code of Recordset object taken from the project.

```
Dim rsAdd As New Recordset

Private Sub btnAdd_click()
    openDB

    rsAdd.Open "SELECT * FROM customer ORDER BY customerID", sysDB, adOpenDynamic, & _
    adLockOptimistic

    .....

    rsAdd.Close
    sysDB.Close
End Sub
```

Figure 6.2: Accessing database for VB system application



### 6.3.2 Interface Development

Attractive interface is important to attract users. The interface of *Virtual Hairstyle Studio* is created using active-X control or components available in toolbox such as pictureBox, image, coolbar, buttons, option buttons, shape, label and so on.

#### a. Graphics Tools

Adobe Photoshop 6.0 is the main graphic tool that is used to create or edit graphics. Most of the hairstyle images, banner, interface images in the project are created with the tool. In Adobe Photoshop, everything is editable and unused graphics can be modifying to be a useful graphic. For this project, graphics are modified and exported to be a .gif or .jpg format in order to reduce the size of the graphic.

### 6.3.3 Application Development

The vHair application development involves code generation that translates all the algorithms into VB programming language instructions. A few programming principles have been employed in coding the program to ensure the system consistency, maintainability and readability. The programming principles being followed in the development of vHair are as following:

- » Choosing meaningful variable names, procedure names and parameter variable names helps a program to be “self-documenting” without excessive use of comments.



All declarations are placed at the beginning of procedure and declarations are separated from the executable statements in that procedure with a blank line to make the declarations stand out and contribute to program readability.

### a. Categorizing of hairstyle through combo box

Below are the sample code taken from project regarding Hairstyle categorization.

```
sSQL1 = "SELECT * FROM tblHairstyle WHERE "

If frmHairCategory.Combo1.Text <> "" Then
    sSQL1 = sSQL1 & "Gender LIKE '" & frmHairCategory.Combo1.Text & "' AND "
End If

If frmHairCategory.Combo2.Text <> "" Then
    sSQL1 = sSQL1 & "Type LIKE '" & frmHairCategory.Combo2.Text & "' AND "
End If

If frmHairCategory.Combo3.Text <> "" Then
    sSQL1 = sSQL1 & "Event LIKE '" & frmHairCategory.Combo3.Text & "' AND "
End If

If frmHairCategory.Combo4.Text <> "" Then
    sSQL1 = sSQL1 & "Style LIKE '" & frmHairCategory.Combo4.Text & "' AND "
End If

sSQL1 = Left(sSQL1, Len(sSQL1) - 5)

openDB

rsHairCategory.Open sSQL1, sysDB, adOpenStatic

While Not rsHairCategory.EOF

    ThumbIndex = ThumbIndex + 1

    imagePath = App.Path & "\hair2\" & rsHairCategory.Fields!Path

    addMe imagePath

    rsHairCategory.MoveNext

Wend
```

Figure 6.3: Accessing database for hairstyle categorization

## b. Overlay of hair image and client's photo

Below are the sample code of images overlaying using image list component.

```
With imlClient
    .ListImages.Clear
    .ListImages.Add , , frmSimulation.imgClient.Picture
    .ListImages.Add , , frmHairSelected.picHairMain.Picture
    .MaskColor = RGB(256, 256, 256)
End With

If i <= 6 Then
    imgMix.Picture = imlClient.Overlay(1, 2)
    imgThumb(i + 1).Picture = imlClient.Overlay(1, 2)
Else
    MsgBox "You have already selected 8 hair style"
End If
```

Figure 6.4: Overlaying two layer of images using image list

## c. Setting background hair image to transparent

This function acquires process of calling Windows API functions from a Visual Basic application. Declaration statement is needed to call the routines in any Dynamic Link Library (DLL). Microsoft Windows is itself a collection of DLLs, so Visual Basic can call almost any of the functions in the Microsoft Windows Application Programming Interface (API). By calling these routines the background region of hairstyle will appear transparent. Below are some of the examples of declare statement applied

```
Public Declare Function SetWindowRgn Lib "User32" (ByVal hwnd As Long, ByVal hRgn As Long,
ByVal bRedraw As Boolean) As Long
Public Declare Function ReleaseCapture Lib "User32" () As Long
Private Declare Function CreateCompatibleDC Lib "gdi32" (ByVal hdc As Long) As Long
Private Declare Function DeleteDC Lib "gdi32" (ByVal hdc As Long) As Long
```

Figure 6.5: Declaration statement to call windows API functions

Below is the module of setting transparent background of selected hairstyle form.

```
Public Function MakeRegion(picHair As PictureBox) As Long
```

```
' Make a windows "region" based on a given picture box picture. This done by  
' passing on the picture line-by-line and for each sequence of non-transparent  
' pixels a region is created that is added to the complete region.
```

```
Dim x As Long, y As Long, StartLineX As Long  
Dim FullRegion As Long, LineRegion As Long  
Dim TransparentColor As Long  
Dim InFirstRegion As Boolean  
Dim InLine As Boolean ' Flags whether we are in a non-transparent pixel sequence  
Dim hdc As Long  
Dim PicWidth As Long  
Dim PicHeight As Long
```

```
hdc = picHair.hdc  
PicWidth = picHair.ScaleWidth  
PicHeight = picHair.ScaleHeight
```

```
InFirstRegion = True: InLine = False  
x = y = StartLineX = 0
```

```
' The transparent color is always the color of the top-left pixel in the picture.  
' If you wish to bypass this constraint, you can set the transparent color to be  
' a fixed color (such as pink), or user-configurable
```

```
TransparentColor = GetPixel(hdc, 0, 0)
```

```
For y = 0 To PicHeight - 1  
  For x = 0 To PicWidth - 1
```

```
    If GetPixel(hdc, x, y) = TransparentColor Or x = PicWidth Then
```

```
      ' We reached a transparent pixel
```

```
      If InLine Then
```

```
        InLine = False
```

```
        LineRegion = CreateRectRgn(StartLineX, y, x, y + 1)
```

```
      If InFirstRegion Then
```

```
        FullRegion = LineRegion
```

```
        InFirstRegion = False
```

```
      Else
```

```
        CombineRgn FullRegion, FullRegion, LineRegion, RGN_OR
```

```
        ' Always clean up your mess
```

```
        DeleteObject LineRegion
```

```
      End If
```

```
    End If
```



```
' We reached a non-transparent pixel  
Else
```

```
    If Not InLine Then
```

```
        InLine = True
```

```
        StartLineX = x
```

```
    End If
```

```
End If
```

```
Next
```

```
Next
```

```
MakeRegion = FullRegion
```

```
End Function
```

Figure 6.6: Making background region transparent

## 6.4 Summary

The most important things in the system implementation are development environment and system development. The development environment consists of hardware and software requirements. Generally, the system development consists of database development, user interface development and application development.



Software testing is one of the main phases in the Software Life Cycle model. In this phase, the purpose is testing and debugging a system to detect defects and bugs of a system. These mistakes are usually done in a systematic manner during development.

System testing verifies that elements are working properly and overall system performance and objectives are achieved. Testing is focused on testing system. The objective is to find the system's faults.

System testing ensures that the behavior of the system is in accordance with the user's requirements and the developer's expectations.

To compare the expected behavior with actual responses. Typically, during a system test, it is important to ensure that the system is working as intended.

## 7.2 Unit Testing

In this stage, testing will be performed on the smallest component of the system, the unit. Each unit is tested separately to ensure that it is working correctly. This is done by testing each unit separately and then testing the system as a whole.

### 7.2.1 Testing Data Manipulation to Record Maintenance

In this, all of the unit tests will be independently tested to:

- Open and close connection to the database
- Insert new record into database
- Retrieve data from database
- Update the existing data in the database

## Chapter 7: System Testing

### 7.1 Introduction

Software testing is one of the main phases in the Waterfall Life Cycle model. In this phase, the process of testing and debugging are done to detect defects and bugs of a system. These processes are usually done incrementally with system development.

System testing verifies that elements are functioning properly and overall system performance and objectives are achieved. Testing is focused on finding faults. The objectives to test this system are:

- To ensure that the hairstyle chosen by customer is saved according to the users' preference in the database.

- To compare the expected outcome with the actual outcome. Eventually, debug it to enhance its functionality and capability.

### 7.2 Unit Testing

In this stage, testing will be concentrated on the smallest component of the system for testing. Each individual component is tested independently without other system components, to ensure that each module operates correctly.

#### 7.2.1 Testing Data Manipulation in Record Maintenance

In vHair, all of the units were tested independently which are:

- Open and close connection to the database
- Insert new record into database
- Retrieved data from database
- Update the existing data in the database

Validate of user input data before saving into record

Execution of SQL statements

A set of customer's details (dummy data) was key in into record in order to verify that all the data entered was saved into database and is available when retrieving

Cust	Name	Sex	HandphoneNo	EmailAdd	Address	Photo
1	Steven Ma	Male	012-6548527	steven@info.com	1,Jal Sultan Ismail	D:\wxes3182\wHair_alpha\Mod
2	Eevon Teoh	Female	019-3352697	avon@cosmetics.co	25,Jln SS2/105	C:\images\hairModel\23.jpg
3	Selina Jaccobs	Female	013-6442357	selina@rocket.com	6946, Imbi Street	C:\hairModel\23.jpg
4	Carmen Ling	Female	016-5537951	ivy@usa.net	336, Lembah Klang	C:\hairModel\23.jpg
5	Tommy Sim	Female	017-4675689	tommy@runi.co	Perda Centre	D:\wHair_alpha\related\faceOv
6	Zambay	Male	017-5567895	Zambay@usa.net	26,taman Bintang	D:\wxes3182\wHair_alpha\rela
7	Irene	Female	013-8567998	irene@tmnet.my	Tmn Sentosa	C:\wxes3182\wHair_alpha\rela
8	Henry Tham	Male	016-7836998	henry@nokiaclub.com	Bee Garden	D:\wHair_alpha\related\faceOv
9	Gebere	Male	012-2344466	gebere@wonder.ca	Taman Pertua	D:\related\faceOval.jpg
10	Sammy Cheng	Female	012-6625879	sammi@rocketmail.cor	Jln Ooi Yoke lin	D:\related\faceOval.jpg

figure 7.1: The testing set of data from database.

## 7.2.2 Testing Display Module

It is referred to the user login and database testing to ensure that each data which user key in is stored accurately and correctly to the correspondence database. A set of sample raw data is created for the testing purpose in this module. The process includes iterate the checking on the duplicated data in database to ensure that each data entered is valid and ease the redundancy and duplication problem. The control objects such as option button, combo box and text field are tested too to ensure the correct functionality respectively. The display modules consist of hairstyle customization, hair care information display, face shape versus hairstyle tips.

Name:

Date Visited:  ID:

Email:

Contact No:

Handphone:

Address:

Photo:

Selected Hairstyle:

Selected Hairstyle	End	Debug	Help

Navigation:

figure 7.2: Example of testing to seek for bugs

```

Private Sub Form_KeyDown(KeyCode As Integer, Shift As Integer)
Select Case KeyCode
Case vbKeyRight, vbKeyDown:
    Select Case Pos + 1
        Case 1: imgFaceRound_Click
        Case 2: imgFaceRect_Click
        Case 3: imgFaceHeart_Click
        Case 4: imgFaceSquare_Click
        Case 5: imgFaceTria_Click
    End Select
Case vbKeyLeft, vbKeyUp:
    Select Case Pos + 1
        Case 2: imgFaceOval_Click
        Case 3: imgFaceRound_Click
        Case 4: imgFaceRect_Click
        Case 5: imgFaceHeart_Click
        Case 6: imgFaceSquare_Click
    End Select
Case vbKeyReturn:
    Select Case Pos 'Starts from 0
        Case 0: MsgBox "1 st Option Selected", vbInformation, "This One"
        Case 1: MsgBox "2 nd Option Selected", vbInformation, "This One"
        Case 2: MsgBox "3 rd Option Selected", vbInformation, "This One"
        Case 3: MsgBox "4 th Option Selected", vbInformation, "This One"
        Case 4: MsgBox "5 th Option Selected", vbInformation, "This One"
        Case 5: MsgBox "5 th Option Selected", vbInformation, "This One"
    End Select
End Sub

```

figure 7.3: The breakpoint in brown color is used in code checking and testing



### 7.3 Integration Testing

When all components have been unit-tested, the next step is ensuring that the interfaces among the components are defined and handled properly. This step is called **integration testing** or module testing, which verifies that all the components work together as described in the module or system design specifications.

Since all the modules have been tested and have been declared bug free, the modules will combine one by one according to the called modules. Each integration is checked again to ensure there is no error.

### 7.4 System Testing

The final testing procedures carried out is system testing. System testing is totally varied from unit testing and integration testing. System testing is necessary since it is able to ensure the entire program, either the modified program, still works. It plays an important role in integrated system testing and requirement specification verification. *Virtual hairstyle Studio* undergoes 2 types of system testing:

#### a. Function Testing

Each function can be associated with those system components that accomplish it. For some functions, the parts may comprise the entire system. Function testing is performed in a carefully controlled situation and compares the system's actual performance with its requirements.

## b. Performance Testing

Once has determined that the system performs the functions required by the requirements, turn to the way in which those functions are performed. Thus, functional testing addresses the functional requirements, and performance testing addresses the non-functional requirements. The performance tests for vHair are listed as below:

**Timing tests** – evaluate the requirements dealing with time to respond to a user and time to perform a function.

**Configuration tests** – analyze the various software and hardware configurations specified in the requirements.

**Quality tests** – evaluate the system's reliability, maintainability and availability which include calculation of mean time to failure and mean time to repair, as well as average time to find and fix a fault.

**Volume tests** – address the handling of large amounts of data in the system to make sure that the system reacts appropriately when data sets reach their maximum size.

**Human factors tests** – investigate requirements dealing with the user interface to the system such as examine display screens, messages, report formats and other aspects that may relate to ease of use.

## 7.5 Testing Analysis

Through the testing stage, there were a few errors being found in the newly developed vHair. The errors were mostly from the programming coding and the functional design of the system. Those errors caused the system run incorrectly and also invoked bugs and

problems to the other functions of the system. Therefore, testing is one of the most important stages in development of vHair

## System Evaluation

### 7.6 Summary

There are many techniques that can be used to test the code components. Testing looks for faults, sometimes by forcing code to fail and then seeking the root cause. The goal of testing in vHair is to find faults, not to prove correctness. Indeed, the absence of faults does not guarantee correctness.

University of Malaya

## 8.1 Introduction

This chapter will highlight some of the problems encountered throughout the development of a small business system, and will discuss the role of the system evaluator. It will also discuss the evaluation of systems to identify possible strengths and weaknesses, and to provide a basis for improvement.

## 8.2 Problem Encountered and Solutions

### 8.2.1 Problem Encountered in Determining programming language

#### Problem

Choosing a suitable technology will not be a trivial matter for all small businesses. They must consider their own strengths and weaknesses, and the requirements of the system to be developed. They must also consider the cost of the system, and the time and resources required to develop it.

#### Solution

To make sure that the system is developed in a suitable programming language, the system evaluator must first identify the requirements of the system. They must then consider the strengths and weaknesses of the system, and the requirements of the system. They must also consider the cost of the system, and the time and resources required to develop it.

The system evaluator must then consider the requirements of the system, and the strengths and weaknesses of the system. They must also consider the cost of the system, and the time and resources required to develop it.

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The system evaluator must then consider the requirements of the system, and the strengths and weaknesses of the system. They must also consider the cost of the system, and the time and resources required to develop it.



## Chapter 8: System Evaluation

### 8.1 Introduction

This Chapter will highlight some of the problems encountered throughout the development of *Virtual Hairstyle Studio*, as well as the solution that had been taken to solve it out. Meanwhile, the evaluation of system to identify system strengths and limitations is included.

### 8.2 Problem Encountered and Solutions

#### a. Difficulties in determining programming language

##### Problem

Choosing a suitable technology and tools was a critical process as all tools possesses their own strengths and weaknesses. In addition, the availability of the required tools for development was also a major consideration

##### Solution

To make sure the suitable tools are chosen, primarily, the system requirements is defined. Then, research based on the needs was done by searching the Internet and also look out for the similar existing program in order to get a better understanding of the system. Eventually, VB has been chosen of its strength in easy-to-use.

## **b. No prior experience in the programming languages chosen**

### **Problem**

Due to prior inexperience in Visual Basic, there was a learning curve in understanding how the VB objects work. It is a time-consuming job in getting handy in a new environment how to use the objects to build the required functionality of the application. These objects are the Active-X components made available in tool box in VB environment. Besides that, coding to call the API functions in Dynamic Link Library (DLL) is also a head-spinning part.

### **Solution**

The best way of learning VB during this project was going through some of the VB examples available on the VB reference books, e-Book, Internet and also Microsoft's web site. Those examples are simple and easy to understand how VB works within its components.

## **c. Difficulties in making image background transparent and overlay the images**

### **Problem**

As a beginner, graphic manipulating application such as *making image background transparent, overlay images together* is not an easy job. Furthermore, the programming language used is not rich in supporting graphic processing. This is a major problem as the concept of an object-oriented application is somehow different from data manipulating program which inclines to relational programming.

### **Solution**

As a result, an exhaustive effort was done on searching the basic understanding and skills that are necessary to meet the development requirements. The efforts include reading up on the concept of API and Active-X component as well as User Control, surfing the Internet for information and joining forum and seeking help in Expert Exchange from Internet, asking senior's opinion and also course mate's help.

### **8.3 System Strength**

#### **a. Ease of Use Graphical User Interface**

*Virtual Hairstyle Studio* is featured with an attractive and easy to use graphical interface. Most of the operations can be done by the functions of click.

#### **b. User-friendly**

The system is considered as user friendly and data integrity. Its interfaces are intuitive where the users can easily get accustomed to the system's concept-based style.

#### **c. Print and save the favorite hairstyle**

Users can click their favorite hairstyle to fit on their face virtually. Then, users can save, and print the selected hairstyle.

#### **d. Searching and update Record function**

Authorized users can search the all the customer records. For example, user is allowed to search a customer's details through "Find Record" function in Record Maintenance.



In addition, users also can look for the all of the customer's record via "View record" according to their name alphabetically. The records are displays through data-binding methods. This will save a lot of time to enter the related data in order to check the whether the customer record is kept in database or not.

#### **e. Auto generated ID**

System will auto generate an ID for a new customer record. This can avoid user's mistake in creating a repeated ID unintentionally.

#### **f. Administration of User**

Authorized users are allowed to access to the administration part of the system. They can add, delete and update the customer data. They can control the people to access the system.

A custom authentication system also created to prevent unauthorized users from viewing pages that they are not allowing to access. Users can only enter the hairstyle simulation after login their customer's ID and name.

#### **g. Transparent**

System is transparent, as users do not need to know where the database resides, how the system is structured, etc. For example, users do not need to know how to retrieve from and insert records into the database. All they need to do are clicking the keywords or enter the data and then view query results.



### 8.3 Limitations & Weakness of System

Despite some of the system strengths mentioned previously, there are limitations, which cannot be researched and developed due to time constraint.

Those limitations are:

- Password is not encrypted and this result in high vulnerability of password.
- The colour of printed images is not optimized. Print Option function is not provided. Therefore, colour setting or adjustment is not available.
- The measurement between the images of customer photo and hairstyle is not matching while saving. The overlay images are distorted. As a result, the output of the overlay images does not fit customer's face well.
- Hairstyle Simulation is only working perfectly in .gif or bitmap file for the input of the customer photo. Hence, it has the format restriction problem and not flexible enough. Thus, the customer photo has to be converted into .gif or .bmp format first before trying the hairstyle simulation.
- Insufficient Functionality

Due to time constraints, Virtual Hairstyle Studio does not reflect the hairstyle coloring section that proposed previously. It only provides the basic and limited functions. Besides that, features of twain capture through digital camera or scanner is not supported in vHair as well. Thus, users have to manually get the photo of a customer using another image editing software such as Microsoft PaintShop Pro, Photoshop and etc. Hairstyle simulation do no support redo function.

## **8.4 Recommendation for Further Study/Research**

### **Solution to the existing vHair limitation**

Since vHair still have some vulnerability in running its hairstyle simulation module, remedy and solution should be taken to solve to problems first and foremost before enhancing exclusive features to vHair.

### **3D simulation for Head Rotation**

vHair does not support any animation for hairstyle simulation for the moment. Thus, in future enhancement, vHair is recommended to works with three view of the client for 3D simulation. When a hairstyle is chosen, the program automatically rotates the head to the proper view and fits the hairstyle to the client's photo.

### **Color Selection**

Color palette is suggested to be added to enrich the vHair's hairstyle simulation. Since hair coloring plays the significant role in hairstyle customization.

### **Twain support**

For the future enhancement, vHair is recommended to be able support TWAIN-compliant scanners and digital cameras in order to load the customer photo directly into the working window.

### **Enhance Database of hairstyle**

Increase the volume of hairstyle database in vHair extensively to cater the customer preference. As possible, hair accessories, glasses, men's beard, mustaches are recommended to be included.

## **8.5 Knowledge and experience Gained**

Knowledge and experiences have been gained throughout the development of this system:

1. Enhanced creativity and initiative in developing the most appropriate system for end-user.
2. Sharpened problem solving skill by finding solution to all problems that are faced during the development of the system.
3. Learnt the skills of using the authoring or graphic design tools such as Adobe Photoshop.
4. As the project progressed, so did the number of clearer views on VB concepts and maintaining and configuring Microsoft Access.
5. This project has provided the golden chance to experience using the techniques, paradigms, and approaches learned from System Analysis & Design and Software Engineering courses in the second year and third year study respectively.

## **8.6 Project Conclusion**

As a conclusion, this project fulfilled most of the objectives and requirements as determined during system analysis phase except for the hair coloring modules.

This application provides hairstyle simulation functions, customer record maintenance, hair tips providing functionality.

## **8.8 Summary**

System evaluation is an important task that needs to be done for every system. In vHair, the system evaluation includes problems encountered and solutions, system strengths, system limitations, future enhancement, and knowledge and experience gained.



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University of Malaya

## Appendix A

## Interview Form

Purpose: This form is designed to find out information regarding the current state of the user's knowledge of how to use the system to develop a final prototype system.

## Section A

## Interview Background

Subject's Name

Interviewer Name

Gender

Male

Female

Current Position

Experience in the field

years/months

(\* Please elaborate your answer)

## Section B

1. (a) Do you use any Computer Based system to manage your school business?

Yes

No

(\* If No, please skip to Question 2)

2. If Yes, what are the functions provided by the system?

(\* you may tick more than one option)

☐ manage the curriculum - syllabus☐ maintain student/graduate records, logs, daily school report☐ printing letter/report☐ managing website (marketing customer, social new friends, press forum)

Others, please specify

## Interview Form

Purpose: The interview is conducted to find out information regarding the current state of hair salon and trend of hairstyle in order to develop Virtual Hairstyle Studio Project.

### Section A

#### Interviewee Background

Saloon's Name : \_\_\_\_\_  
Interviewee Name : \_\_\_\_\_  
Gender : ☐ Male ☐ Female  
Current Position : \_\_\_\_\_  
Experience In this Field : \_\_\_\_\_ years / months \*

(\* Delete whichever not applicable. )

### Section B

1. (a) Do you use any computer-aided system to manage your saloon business?

☐ Yes ☐ No

( If No, please proceed to question 2. )

(b) If Yes, what are the functions provided by the system?

( \* you may tick more than one options )

- ☐ keeping the customer information
- ☐ inventory control (product's records, tools, daily sales report, etc)
- ☐ printing bills / receipt
- ☐ promoting business (informing customer about new hairstyle, promotions)

Others, please specify : \_\_\_\_\_

(c) What is the Operating system used?

☐ Microsoft Windows 95 / 98 / NT

☐ Microsoft Windows 2000 / Millennium / XP

☐ Macintosh

Others, please specify : \_\_\_\_\_

2. (a) Do you own a PC at home?

☐ Yes

☐ No

( If No, please proceed to question 3. )

(b) If Yes, what are the purposes of using the PC?

☐ Chatting / entertainment

☐ searching information / surfing Internet about hairstyle

☐ email

Others, please specify : \_\_\_\_\_

3. (a) Have you ever heard about Virtual Hairstyle Studio ?

☐ Yes

☐ No

( If No, please proceed to question 4. )

(b) If Yes, In your opinion, what do you think 'Virtual Hairstyle Studio' is?

( \* you may tick more than one options )

☐ a system that automates day -to-day operations of a saloon

☐ a system that provides hairstyle simulation and hair care guidance for customer

☐ a system that promotes the product of saloon.

Others, please specify : \_\_\_\_\_



4. (a) Do you conduct any saloon lessons?

☐ Yes

☐ No

( If No, please proceed to question 5. )

(b) If Yes, what are the tools that you use to teach the students?

☐ overhead projector

☐ PowerPoint presentation

☐ handouts / lecture's notes

Others, please specify : \_\_\_\_\_

5. In your opinion, what is the main function of a Virtual Hairstyle Studio?

☐ selection of the most appropriate hairstyle for customers

☐ to provide an interactive teaching method to the trainees

☐ to keep track of customer records

☐ suggest most suitable hairstyle regarding the customer's face shape

☐ lessons / hints / guidance on how to take care of their hair.

Others, please specify : \_\_\_\_\_

6. The criteria for choosing hairstyle that you wish to appear in Virtual Hairstyle Studio? ( \* you may tick more than one options )

☐ popularity / trends of hairstyle

☐ hair coloring selection

☐ movie stars hairstyle

☐ hairstyle on event (bridal / formal / casual / celebrity)

Others, please specify : \_\_\_\_\_

7.(a) Do you consider customer's preference?

☐ Yes

☐ No

If No, please give the reason

(b)\* If Yes, what are the customer favorite hairdo? ( \* you may tick more than one options )

i) pattern of cutting

☐ short

☐ long

☐ punk

☐ layered

ii) Perm

☐ curly

☐ ionic perm

☐ wavy

iii) Color

☐ brown

☐ reddish

☐ gold

☐ metal

Others, please specify :

8. How do you guide the customer in the selection of hairstyle?

( \* you may tick more than one options )

☐ show hairstyle sample (photos)

☐ professional consulting (verbal advice)

☐ hairstyle magazine

☐ no information provided

Others, please specify :

**Section C**

1.a) Would you like to use this type of hairstyle imaging system?

☐ Yes

☐ No

If No, please give the reason:

b) If Yes, how much are you going to invest in such system?

☐ RM 1,000 - 2,500

☐ RM 2,500 - 3,500

☐ RM 3,500 - 5,000

☐ above RM 5,000

\*~~~~~THANK YOU~~~~~\*

customer's record management, how many tips and how many views (reports) at each view, presents about 50% chance of being tips for both female and male in the database. The result of biographic simulation can be either save into database or print out on long printed according to customer preference.

## 2.0 Run Time requirements

Universal Biographic Studio requires the following software and hardware during its run time environment.

### Software

- Operating system: Windows® 95, NT, 2000, XP
- Photo Software: Adobe Photoshop or equivalent

### Hardware Minimum Requirement

- Computer: Pentium compatible
- Processor: 486/586/686/PIII or better
- Hard disk: 20 MB, 1GB and above
- Memory: 16MB and above recommended
- Input devices: either - Digital Photo camera with resolution 640x480 or  
- Web Camera or  
- Scanner
- Output devices: printer



## 1.0 About vHair

*Virtual Hairstyle Studio*, also known as vHair consists of hairstyle simulation, customer's record maintenance, hair care tips and face shape versus hairstyle as well. vHair possesses about 80++ choices of hairstyles for both female and male in its database. The result of hairstyle simulation can be either save into softcopy or print out or keep in record according to customer preference.

## 2.0 Run Time requirements

*Virtual Hairstyle Studio* requires the following software and hardware during its run time environment.

### Software

- **Operation system:** Windows® 95, 98, Me, NT, 2000, XP
- **Photo Editor:** Adobe Photoshop or equivalent

### Hardware (Minimum Requirement)

- **Computer:** IBM or compatible
- **Processor:** 486DX-66MHz or better
- **Hard disk:** 20 MB HD and above
- **Memory:** 32 MB and above recommended
- **Input devices:** either - Digital Photo camera with resolution 640x480 or
  - Web Camera or
  - Scanner.
- **Output devices:** printer

### 3.0 Starting vHair

To start *Virtual Hairstyle Studio*, double click the vHair desktop Icon or access it through the Start menu (on the lower left of your screen) by clicking "Start" > "Programs" > "vHair" > "vHair".

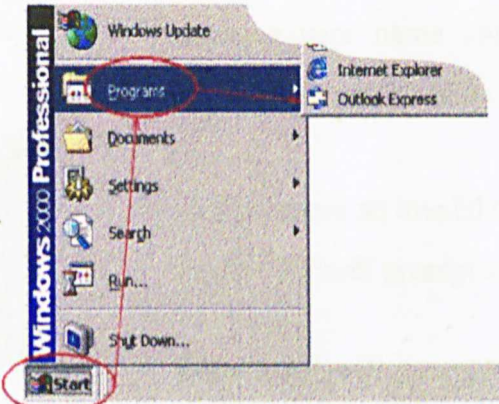


Figure 1.0 Way to start vHair

### 4.0 Login to vHair

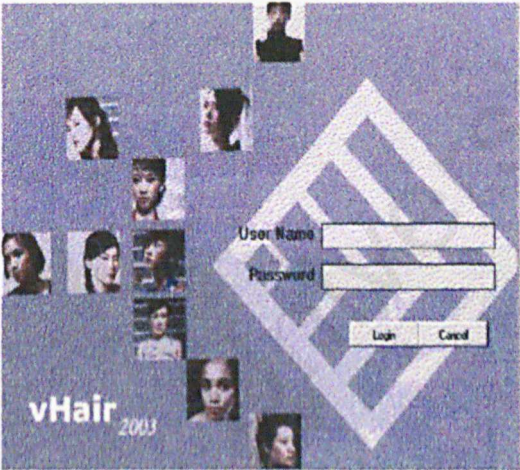


Figure 2.0 vHair Login

Figure 2.0 is a Login screen that allow authorized user to login. User can login by entering their username and password and followed by hitting the login button.





Figure 2.1 Incomplete Login

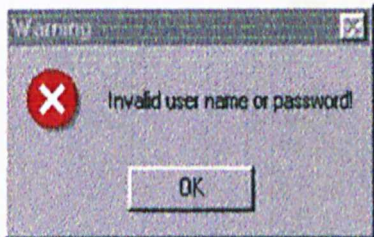


Figure 2.2 Invalid Login



Figure 2.3 Re-enter Login

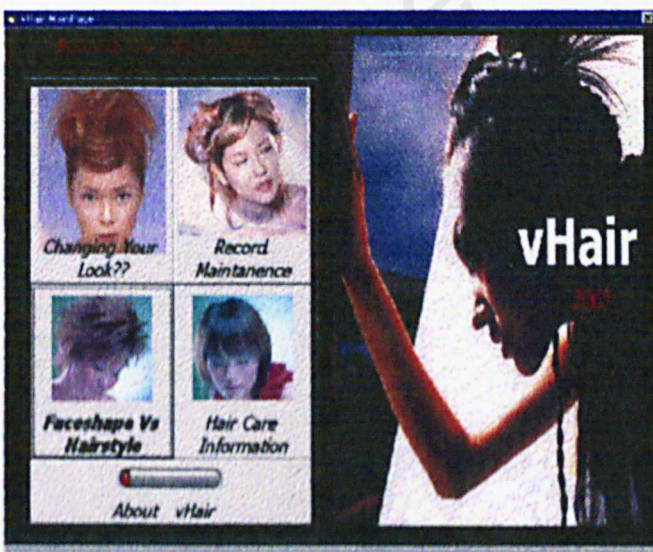


Figure 2.4 vHair Main Menu

The following two cases may lead user failed to be redirected to Main page

i) User click on the “Login In” button without entering user name and password. *Figure 2.1* will prompt out to acknowledge user.

ii) User enter an invalid username or password. *Figure 2.2* will prompt out as an error message.

*Figure 2.3* will prompt out after error message. User will be redirected back to Login Screen by clicking “OK” button.

*Figure 2.4* will be shown after successful login. vHair have five buttons:

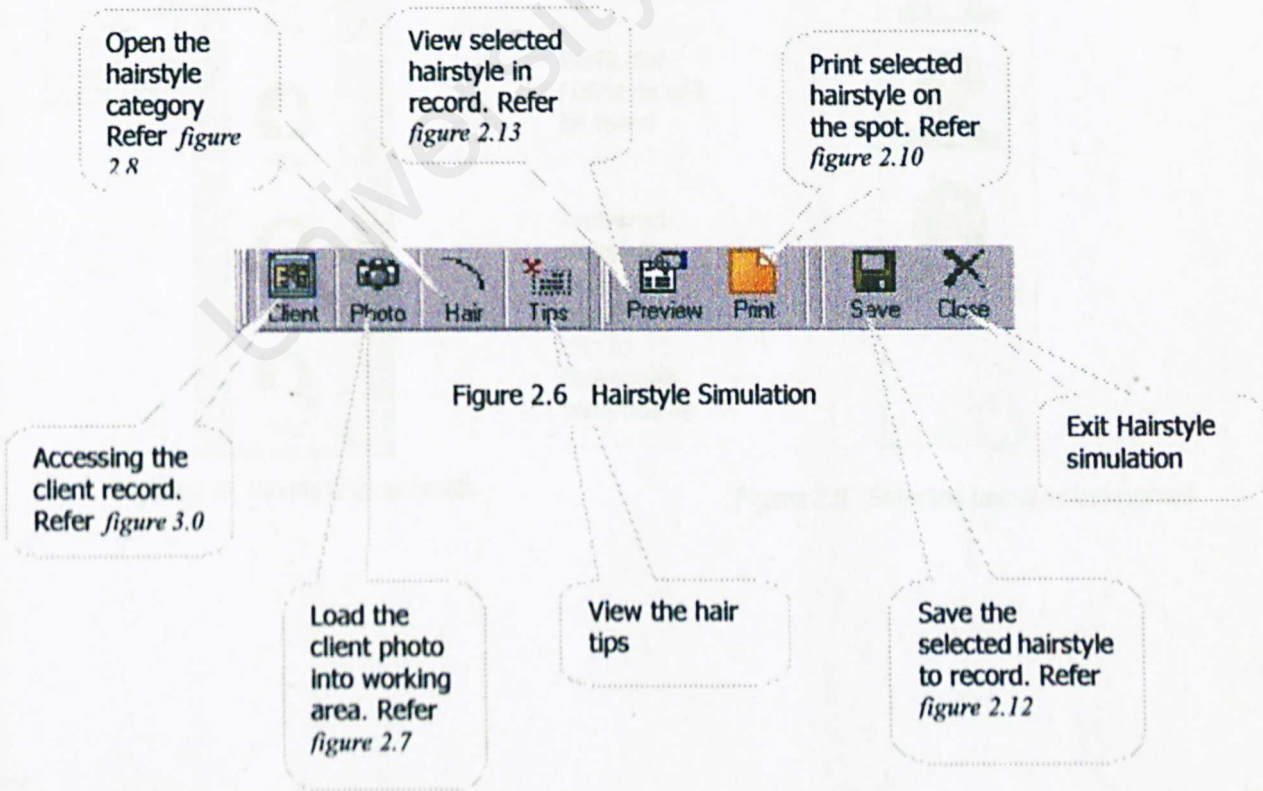
- i) “Changing Your Look??” – entering hairstyle simulation
- ii) “Record Maintenance”
- iii) “Faceshape vs Hairstyle”
- iv) “Hair Care Information”
- v) “About vHair”

Tapping on these buttons will direct the user to respective page

4.1 Hairstyle Simulation



Figure 2.5 is the hairstyle simulation page where user can try on various type of hairstyle after loading their photo to the working area.





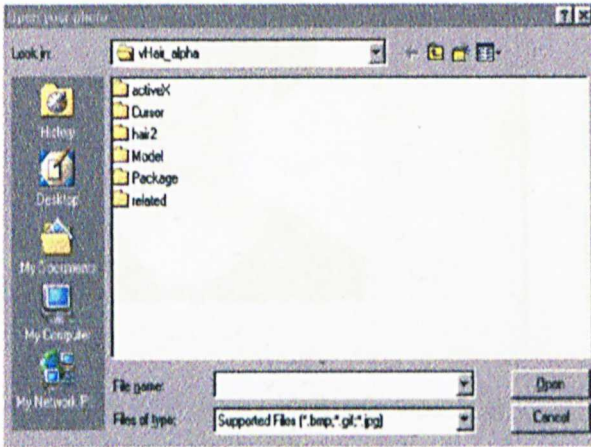


Figure 2.7 Open Customer Photo

Figure 2.7 appear when clicking the “Photo” button in toolbar on top of hairstyle simulation page.

Customer’s photo will be loaded after fixing the particular photo to the filename field followed by clicking “Open” button

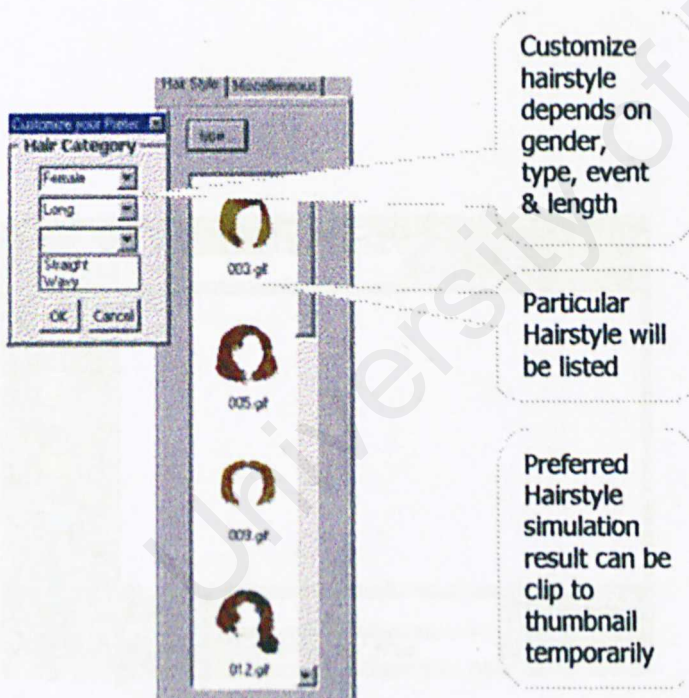


Figure 2.8 Hairstyle thumbnails



Figure 2.9 Selected hairstyle thumbnails



Figure 2.10 Selected hairstyle view after clicking the thumbnail.

"Add to Print" button will send the image for printing.

"Save" button will keep the selected hairstyle into record.



Figure 2.10 Print selected hairstyle after clicking "Add to Print" button.

"Add" button will add the selected hairstyle to printing



Figure 2.11 Save selected hairstyle into specific filename after clicking "Save" button in Hairstyle View.



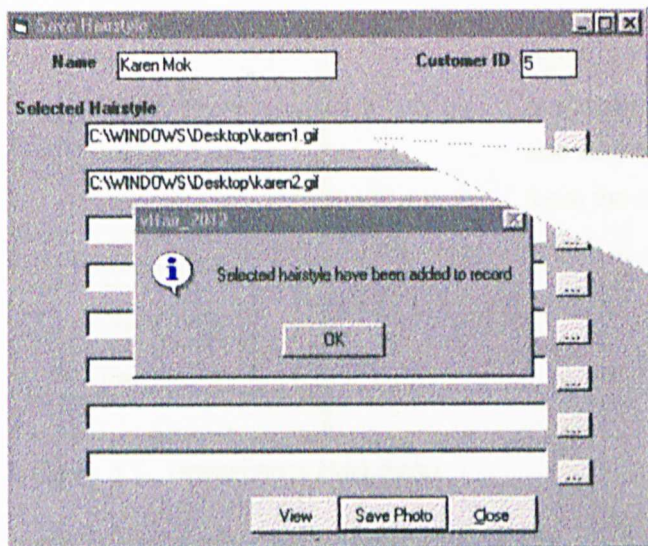


Figure 2.12 Save selected hairstyle to record

Maximum 8 result of favorite hairstyle can be save into record.

Click "Save Photo" will add the particular hairstyle to record.

Click "View" will show the selected hairstyle from record. Shown in *figure 2.13*

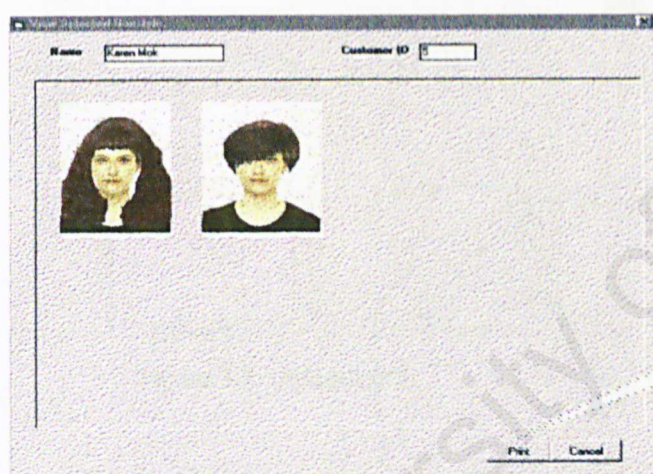


Figure 2.13 Printing Selected Hairstyle form Record

Click "Print" will the in selected hairstyle in record

## 4.2 Customer Record Maintenance

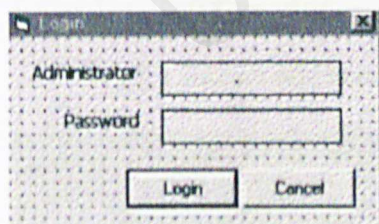


Figure 3.0 Administrator Login

*Figure 3.0* Administrator Login to customer record. Only authorized user are allowed to access the maintenance site.

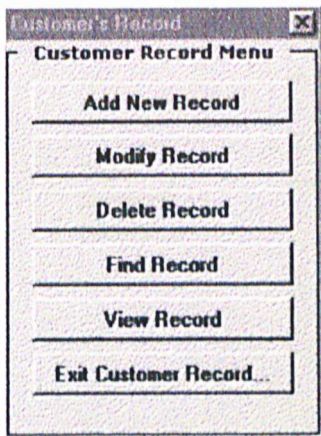


Figure 3.1 Maintenance Main menu

Figure 3.1 Record Maintenance main menu. Administrator is allowed to add new, edit or update , delete, find and also view customer record. Click "Exit Customer Record" to leave the maintenance page.

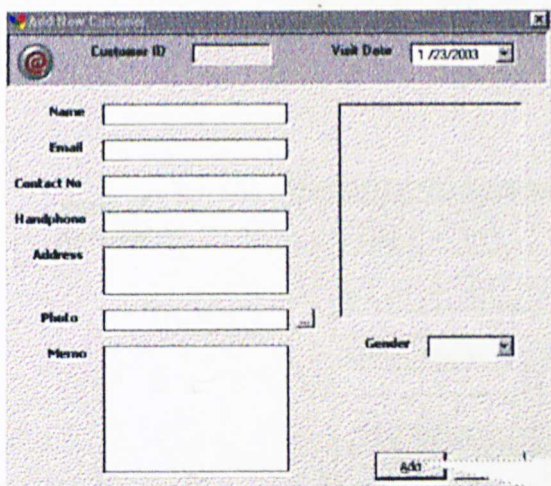


Figure 3.2 Add Record

Figure 3.2 Administrator Login to customer record. Only authorized user are allowed to access the maintenance site.

Click "Add" after finish key in detail. The following message *figure 3.3, figure 3.4, figure 3.5* will be prompt out in sequence.

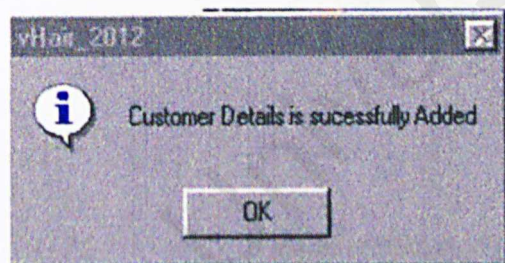


Figure 3.3 Success Add in message box

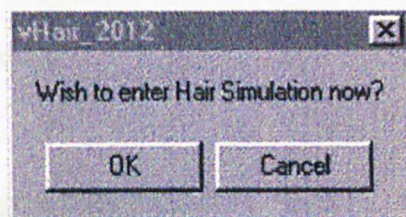


Figure 3.5 Entering hairstyle Simulation

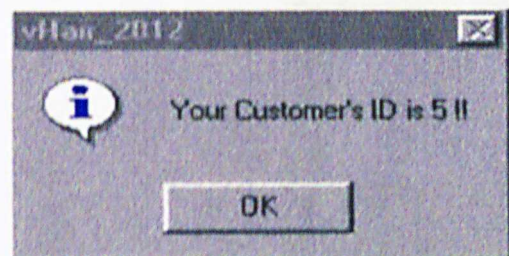


Figure 3.4 Customer ID Message box



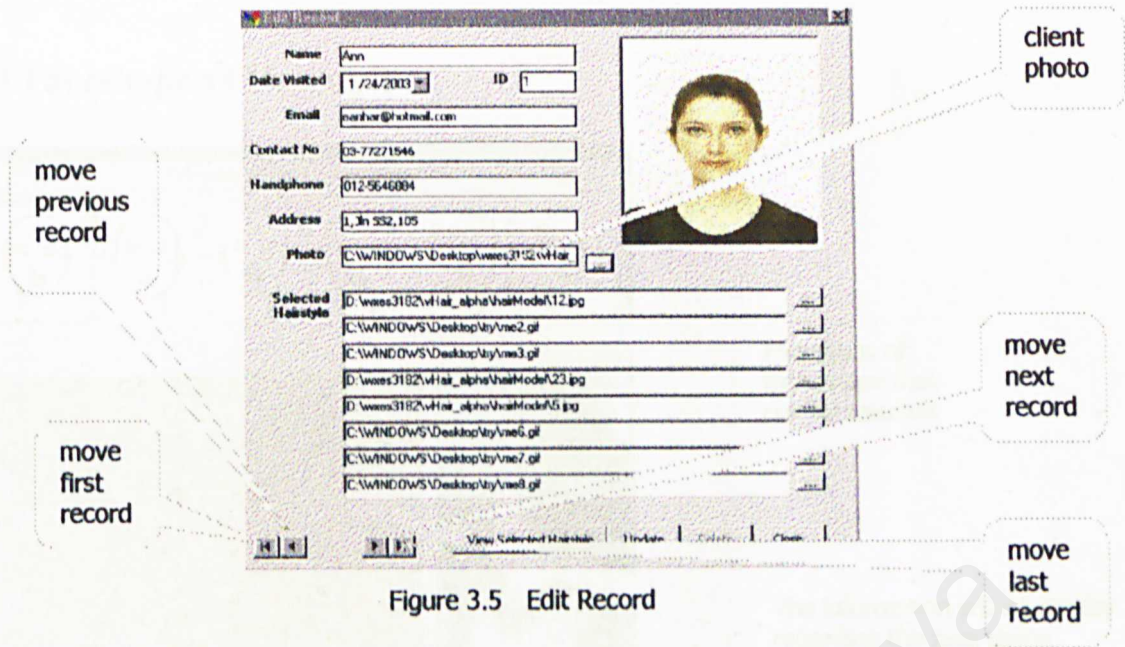


Figure 3.5 Edit Record

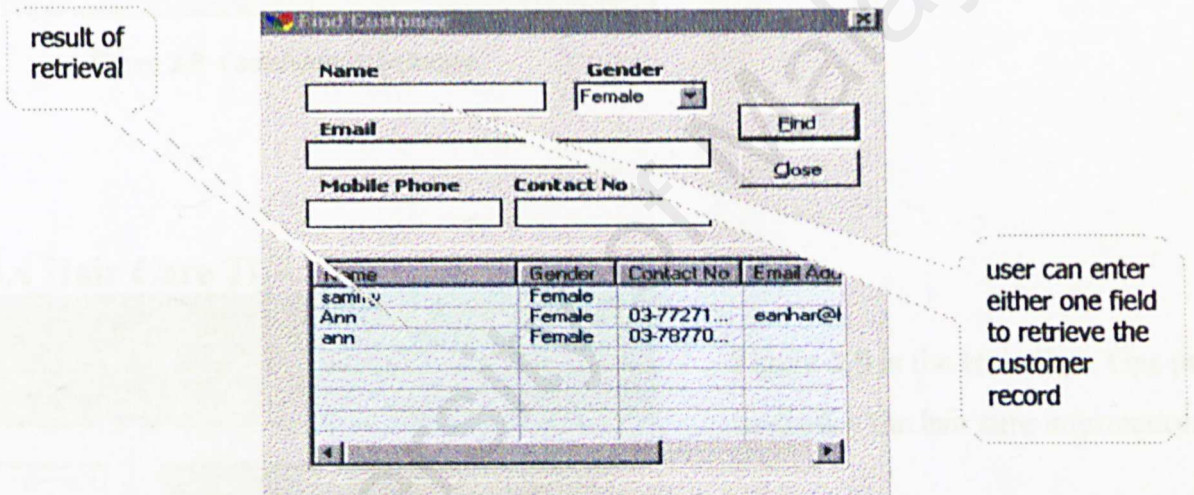


Figure 3.6 Find Record

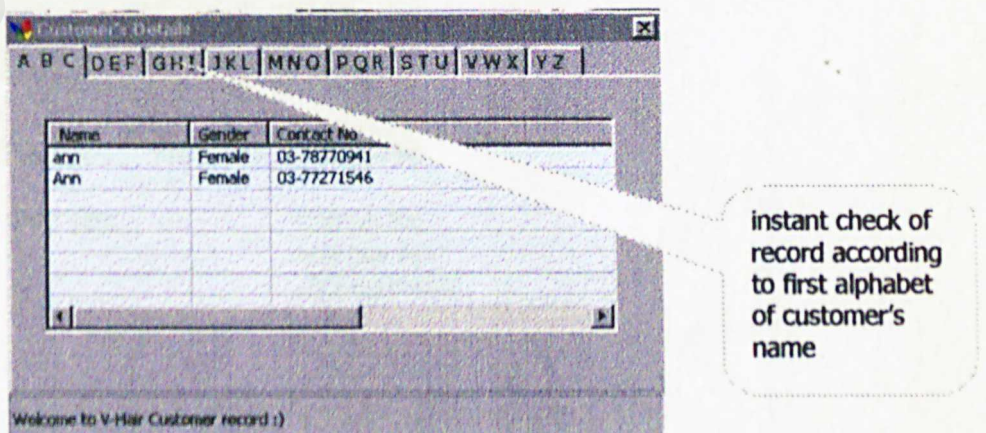
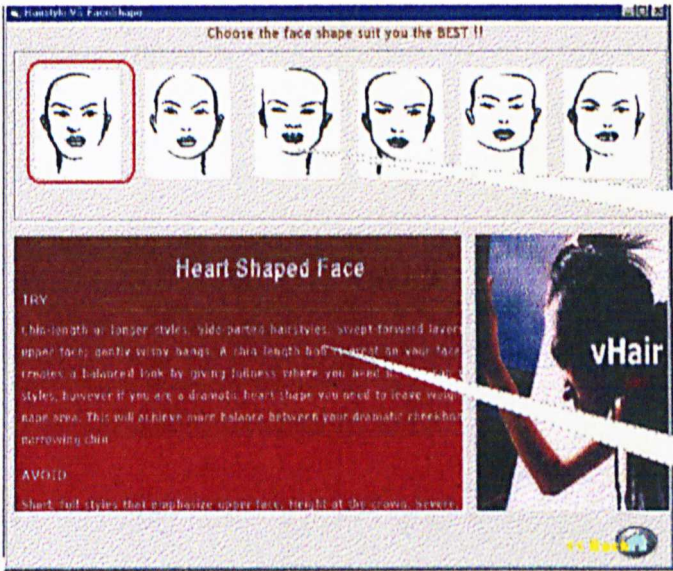


Figure 3.7 View Record

### 4.3 Faceshape vs Hairstyle



Five types of face shape that can be selected

The information will be display regarding the face shape chosen

Figure 3.8 Faceshape vs Hairstyle

### 4.4 Hair Care Tips

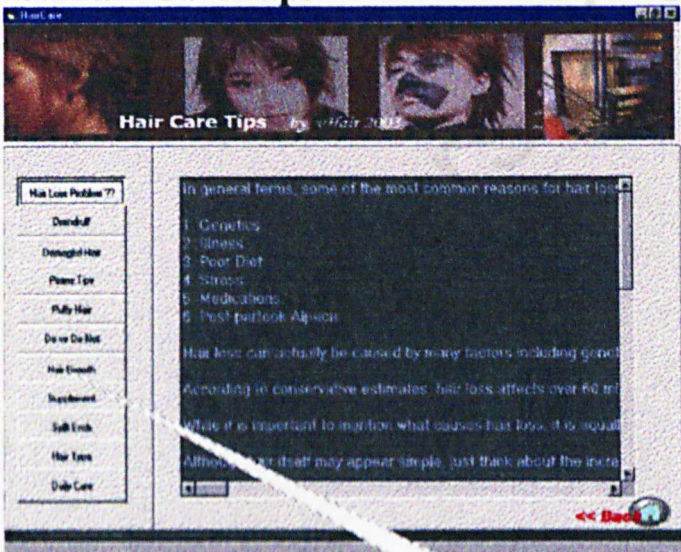


Figure 3.9 is the Hair Care Tips page to display the hair care information.

Figure 3.9 Hair Care Tips

Choose the hair tips by clicking button