Car – 4 –U : WEB BASED CAR PURCHASING SEARCH SYSTEM

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A Final Year Project, submitted as a partial requirement for the degree of Computer Science, Faculty of Computer Science and Information Technology, University of Malaya, Kuala Lumpur. 2000/2001

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ABSTRACT

This report is about a web based car purchasing search system Car - 4 - U. Car - 4 - U consists of three main modules which are the administrator module, the dealer module and the public user module. The administrator module is for the developer to maintain the system, hence a user name and password will be needed to log in.

A developer will be able to add new data regarding cars, delete any unwanted or purchased cars, update existing data, change password and view the feedback entered by users in the administrator module.

The dealer module is for the car dealers to be able to input the data of the vehicles for sale, update data of any cars up for sale, or even to remove the vehicles that are already sold.

The third module, the public user module, is for users in general. Users are able to search by entering a keyword into the form and the page will display the results. Car - 4 - U does not carry out sale or purchasing of cars via the web, but only acts as the middleman between the interested buyers and the respective car dealers.

There are also added features in Car - 4 - U. One of them is the random search. By just clicking on the random button, data of a randomly chosen car will be displayed. Another feature is the feedback page. Users are able to evaluate the system or

provide any suggestions, which will help the administrator in maintaining and further improving the website.

The main reason for choosing the Internet approach is because of the popularity and benefits of a web application. It is definitely faster and easier to search for your car via the web rather than to drive around the whole country looking for your dream car.

Besides that, with tools like Microsoft FrontPage98, an attractive web application can be created. Furthermore, with its administrator module as part of the system, a developer can easily enhance the performance of the system from time to time.

Finally, Car - 4 - U is expected to help users in accommodating to the users time schedule and convenience in searching for the perfect vehicle.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The role of the Internet in Car purchasing.

With the explosion of the Internet in the 20th century, more information is kept, accessed, maintained on computers. With tremendous improvement regarding cost of ownership, the value of data has risen sharply as the cost of computer equipment has declined.

What is the importance of an online car purchasing search system?

The Internet is currently being used and abused by users all over the world. Be it music, movies, money, property, data and even vehicles everything can be obtained via the net. Some firms have setup car purchasing sites but due to problems like transaction safety and delivery have however seen the cease of such sites.

With that, the next probable solution would be a car search system for buyers intending to purchase a vehicle to his or her convenience. Without the hassle of online monetary transactions, is much more reliable and efficient, due to the fact that

a buyer can virtually pinpoint the location of the car dealer without having to drive around.

What is Car – 4 – U ?

***Car – 4 – U* (Online Car Purchasing Search System)** is the title for an online search system that has been developed recently. Car – 4 – U consists of the search box, random and feedback button and an online help to guide the users of Car – 4 – U. Besides that, the developer of Car – 4 – U will help to update, add and delete cars and also view feedback by users. All these features are developed in Car – 4 – U.

1.2 Objectives

Among the objectives that are to be achieved with the development and implementation of Car – 4 – U are as follows:

- To design and develop an efficient record management system that can be modified online from time to time with the latest updates.
- To design and develop an attractive web-based vehicle search system.
- To design an interactive Graphical User Interfaces (GUI) in the user module thus making Car-4-U a user-friendly application.
- To enable the application to interact with a dynamic database system.

1.3 Scope of project

Car – 4 – U has been divided into three main modules, which are the public interface module, dealer module and administrator module. Basically the public interface module will be used by the public especially those who are in the computer field to find out whatever cars they are looking for. Certain people who are involved in maintaining the system on the other hand can only access the administrator module. Meanwhile, the dealer module will only be accessible to the car dealers who register and obtain a login name and password. They will then be able to add, modify or delete any car from their records.

1.3.1. The public user interface

The public user interface of the system has the search site which will help the users to search the database. The searching process will work in two different ways. One if the user knows the particular car they are looking for, they are able to get the data almost automatically provided it is in the database. Secondly, if the users are not sure of the specifications, they can key in any particular keyword such as the make or even the price of the car and the searching process will find all the cars that match the query.

Users might also want to look at any car selected randomly. Car – 4 – U has a special feature, which allows this. There is a random button that can help users to randomly pick any car from the database.

For administration purpose, users can submit their feedback regarding the system.

1.3.2 Dealer Interface Module

The dealer module will be used by car dealers and individuals who wish to sell their cars. Once logged in to the module, authorised users will be able to add new cars, update existing car data, delete any cars that are already sold and view public user feedback.

1.3.3 Administrator Interface Module

People who are involved in maintaining the system will use the administrator module. In order to log in the module, a login name and a password is necessary. An administrator is allowed to change his password whenever he wants because there is a special feature to do this.

Besides that, the administrator module also allows authorised users to add new cars, update existing data and view public user feedback.

1.4 Significance

1. Car – 4 – U helps users to search for their dream car to their preference and convenience without having to raise a single sweat.

2. Car – 4 – U helps users at any level to have a better grip of the system without even needing much computer knowledge.

3. Car – 4 – U has many ways to search for the cars.

4. Since it is an online system, Car – 4 - U can easily accessed by anyone by just accessing the net. This is an added benefit for those who are prone to search the net for information.

5. Car – 4 – U will give a chance to users to submit their views or help the administrator update the database with new cars or to upgrade the system for better performance and user satisfaction.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Purpose

1. To gather information about the system we intend to develop.

2. Evaluate existing systems on the same topic so that a better product can be developed.

3. Comparison of a few software, tools and approaches is important for the best outcome. Without this analysis, we would not be able to identify the strengths and weaknesses.

2.2 Approach

Information Gathering

In order to attain information to build the system there a few main resources that I took into account. This part of the proposal is very important for further development of the system therefore it involved a lot of research. Information sought for this project is from four main resources, are described as follows:-

2.2.1 Search engine

In today's world, one can acquire information about basically everything through one of the most popular informative source, which is the Internet. Search engines used to gather information on Car - 4 - U are as follows:-

www.yahoo.com

www.infoseek.com

www.altavista.com

www.excite.com

www.msn.com

www.msdn.microsoft.com

Mainly, all these search engines were used to:-

1. Find out the existing car purchasing search systems available on the net.

These systems are evaluated based upon the features they have and how user friendly they are. Key words that are used for this purpose are car-purchasing, on-line car dealers and the respective car companies such as BMW, Volvo, Toyota etc.

2. Find out the software available for web development

The limitations and strengths of most wed development software are considered for the selection of software for the development of Car - 4 - U. The main keywords used were web development software, Frontpage98, PowerBuilder, Visual Interdev 6.0, Active Server Pages and Microsoft Access.

3. Find out the programming tools for web development.

Some of the scripts found are quite useful. For example, limitations and efficiency of VBScript and JavaScript are checked so that there would not be many problems when using the scripts for developing Car - 4 - U. Since Car - 4 - U needs a database, the database connectivity was understood to avoid problems in future.

4. Find out steps in developing a good web site

In developing web pages, there are certain requirements that have to be fulfilled. Therefore, search engines were used to find some tips in the net.

2.2.2 Library resources

Library resources, mainly books were found from the main library of University Malaya. Books on web development software were read to put more strength on the findings in the net.

Besides that, dictionaries available in the library were helpful in the sense that they provide a clearer picture of arranging the data in a more meaningful manner. Since Car - 4 - U is a search engine, more stress was given on this field when looking for appropriate examples.

System Analysis and Design books helped to understand the methodology for designing a system. These books were helpful also in the designing phase of the system such as creating data flow diagram (DFD), flow chart and Gantt chart.

Some of the web development books in the library were useful in order to gain knowledge in creating a more meaningful and professional-looking web site.

Understanding of database systems is important for developing Car - 4 - U. Therefore books on database applications were read and analysed.

2.2.3 Bilik Dokumen

Another source for gathering information is the Bilik Dokumen in the Faculty of Computer Science and Information Technology. In the Bilik Dokumen I found some documentation by the seniors and some of my peers, which are relevant to my project. I manage to analyse a few search engines and some web based applications.

Some of the reports were useful in the sense that they provide information regarding the software used and the tools needed for any particular software.

Besides that, the documentation gave a brief idea on how to go about in developing a system from scratch, which is very important at the beginning stage of developing a new system.

The resource in Bilik Dokumen consists of reports on several different kind of applications including the web-based ones. So, this gave me a chance to compare a few web-based projects, which I could use as the best approach for developing Car - 4 - U.

2.2.4 Interviewing

An information-gathering interview is a directed conversation with a specific purpose that uses a question-and-answer format. The five major steps in interview preparation are shown in Figure 5.2. These steps include a range of activities from gathering basic background material to deciding whom to interview.

Steps in planning the interview :-

1. ***Read Background Material***
2. ***Establish Interviewing Objectives***
3. ***Decide Whom to Interview***
4. ***Prepare the Interviewee***
5. ***Decide on Question Types***

A few interview sessions were done with the dealers from e few second-hand car companies and users, mainly students and my relatives.

2.3 Findings

2.3.1 Search engine

Software

1. **http://codeweb.8m.com/powerbuilder.html**

These resources are for the beginners who want to learn the Power-builder programming. Also there are a lot of materials for the intermediate and advanced programmers and also a large number of complete source codes and tutorials.

2. **http://msdn.microsoft.com/vinterdev**

This site tells everything about using Visual InterDev and helps to create pages in ASP. It also provides courses on Visual Basic and the latest updates of Visual InterDev 6.0. The source for sample end-to-end solutions built with Visual Studio to help developers learn and understand application architecture and design. Besides that, there are also some good samples and downloads for users.

3. **http://www.aspdeveloper.net/VInterDev/page1.asp**

This site provides tutorial lessons on Visual Interdev. To be more precise, in this tutorial I was able to learn how to create a web site with Visual InterDev and then add a database to the ASP-enabled site using Visual InterDev wizards.

4. **http://www.srminc.com/events/visual-interdev.htm**

This site provides search slides from Visual InterDev Technical Solutions. This puts more strength on the information found in the above slide regarding Visual InterDev.

5. **http://www.itlibrary.com**

This site provides thousands of pages from books and reference materials. This online library provides books on computer references on any field for example programming languages, databases, security, web and network services, operating systems, hardware and many more.

6. **http://www.nusasite.co.id/services/interdev.html**

This NusaSite tells about the benefits of using Visual Interdev as a tool for web application.

7. **http://www.cnet.com/Content/Reviews/JustIn/Items/0,118,103,00.html**

This is site on Microsoft Access. Through the readings in this site I found out that Microsoft Access is a good and flexible database tool and therefore considered using it for Car - 4 - U.

Web Designing

1. **http://members.aol.com/absteadle**

This site is useful in the sense that it helps to design a good web site. Some of the benefits of using this site is that it provides considerations for designing a good web site, web site basics and considerations for documentation.

2. **http://www.earth.com/bad-style/**

This page serves in some way as an educational tool for users learning HTML. This collection is in no way comprehensive, just some of the more common problems encountered in homepage design.

Existing Vehicle-Purchasing Search Systems

1. **http://www.ecar.com.my**

Title: eCar.com.my – Largest Automobile Portal in Malaysia

This pre-launch site promises a new frontier in online purchasing in Malaysia with 2000 new and used cars available. This site enables users to search by make and model of the car along with customer's preference of location and price.

2. **http://m-www.com/my/myautomi.htm**

Title: Malaysia Automobile Industry Website.

This MSC status company highlights trade and products information on the automobile industry in Malaysia. They also provide information on manufacturers, exporters and dealers of automobiles in Malaysia. Other highlights include accessories, repairing, painting and supplies.

3. http://www.yuvrajgroup.com/

Title: Yuvraj Motors

This India based company aims to make the buyers and sellers meet with the help of Internet technology. There are also painting, car-rental, denting and financial services provided for the customers. The Yuvraj Group also has been instrumental in providing the maximum number of vehicles in the Indian consumer market. They also have a record of having the best after sales service.

Other sites

1. **www.whatis.com**

A cross-referenced internet glossary with links to related sites. A word oriented view of the web.

2. **www.informit.com**

This is an online bookshelf site, which provides a wide variety of computer books which can be downloaded for free or even purchased. Besides that, it also provides all the new releases during the month.

3. **http://www.learnasp.com/**

This site contains lots of useful information and tips about using ASP. Features include articles, code samples, book reviews, and information about ASP-related classes. This site also hosts all of the documentation installed with IIS3, IIS4, and related products.

4. **http://www.asp-zone.com/**

This site tells about ASP in detail from what is actually ASP to ASP news, top ten ASP sites and ASP articles.

2.3.2 Books

1. System Analysis and Design, 1979

This text combines concept and practice in one volume and gives a broad yet specific treatment of the makeup, analysis, design, and implementation of systems projects. It uses a practical approach to real-life situations based on the author's years of experience in the field.

2. System Analysis and Design, 1999

This book emphasizes on the designing phase of a system in detail, the methodologies and teaches the proper way to write a proposal.

3. Software Engineering, A Practioner's Approach, 1992

This text consists the method to design a system. For example, the architectural design, functional and non-functional functions of a system.

2.3.3. Bilik Dokumen

Online Dictionary: ODOCT

An online dictionary on computer terms, which I used as reference in report writing. This system is developed my batch mate in the Faculty of Computer Science and Information Technology.

2.4. Analysis

2.4.1. Designing a Web Site

General guidelines for designing Web Sites

1. Use professional tools

The usage of web editors such as Microsoft's FrontPage or Adobe's Page Mill will definitely assist in the designing. These tools are definitely worth the price. You will be able to explore your creativity and will be able to end up with a better looking web site.

2. Study Other Web Sites

Look at web sites you think are engaging. Analyse whatever design elements are being used, and see how they are functioning.

3. Use the Resources That the Web Site has to offer.

Look at Web sites that give hints on design. One such site is **www.clever.net/gomer/tips.htm**

4. Examine the Web sites of Professional designers.

Some of the design houses are listed in Table 2.1 along with some of the often visited and praised web sites they developed.

Design House	*Its Web Address*	*Sites it Designed*
Archetype	www.cmdesigns.com	www.sundancefilm.com
Avalanche systems	www.avsi.com	www.superbowl.com
		www.elektra.com
Organic online	www.organic.com	www.yahoo.com
		www.macromedia.com
Vivid studios	www.vivid.com	www.sony.com

Table 2.1 Software houses along with the web they developed

5. Plan Ahead

Good Web Sites are well thought out.

Good screen design

There are four guidelines for a good screen design.

- **Keep the screen simple**
- **Keep the screen presentation consistent**
- **Facilitate user movement among screens**
- **Create an attractive screen**

Bad Style for Designing Homepage

Probably the one rule is that you should not use "Click here" to point to a document. Keep in mind that not everyone can "click" (e.g., some people are using non-graphic browsers) and also consider that you or someone else might ever print out the document and on paper, "click here" just seems silly, therefore, it is best if the text of the link actually has something to do with the content. It also makes bookmarks/hotlinks work much better.

Don't make everything a header just because you want it to be bold, this is not portable and looks really awful unless the user has exactly the configuration you use. Using Netscape's >FONT< tag is also problematical. Users that want real page and font control really want Style-Sheets. Users that want real page layout should certainly demand Style-Sheets from their browser.

Don't split highlighting/formatting elements with structural markup. The only problem here is that it's simply invalid HTML and some browsers will terminate it for you, giving the end user the undesired result of loosing some of the markup that you, the author, intended. Yes, it works on Netscape and MS Internet Explorer but that's because they are playing games with their parsing of the HTML.

All document content must be inside the <BODY>...</BODY> tags. <TITLE> is a special case because it is not part of the content of the document; it is meta information about the document. Also note that TITLE's should be context-free

(e.g., I should be able to use your TITLE to link to your document or in a bookmark without having to add any additional information).

For example, Company Information is a poor TITLE, better would BSDI Company Information.

And finally, the biggest style error (which actually has little to do with HTML) is that people do not pick URL's for their pages that are permanent. How many links have you tried to follow where it ended up that the other end was simply gone or worse, the author had simply renamed the page and makes you hunt for it. Web publishers really need to start planning ahead so they will not need to rename URL's at a later date.

Please -- Don't move URL's around if you can possibly avoid it.

2.4.2 Software

Software Evaluation

Software evaluation is done based on all these factors. (*Kendall & Kendall, 1999*)

performance effectiveness

Able to perform all required tasks

Able to perform all tasks that may be desired at some time in the future

Well design display screens

Adequate capacity

performance efficiency

Fast response time

Efficient input

Efficient output

Efficient storage data

Efficient back-up

easy to use

Satisfactory user interface

Help menus available

Readme files for last minute changes

Flexible interface

Adequate feedback

Good error recovery

flexibility

Options for input

Options for output

Usable with other software

quality of documentation

Good Organization

Adequate online tutorial

Web site with FAQ

manufacturer support

Technology support hotline

Newsletter/email

Web site with downloadable product updates

Benefits and Limitations of the software considered.

1. Microsoft FrontPage2000

Microsoft FrontPage2000 includes a number of technical breakthroughs that provide users a fast and easy way to create and manage professional Web sites.

New Features

- easier installation
- **WYSIWYG** table support
- hypertext markup language (HTML) frames support,
- Auto Recalculate Links
- WYSIWYG image alignment
- enhanced integration with Microsoft Office
- HTML Frames Support
- Auto Correct Backlinks
- WebBot™ components
- Entire Site Search
- Email Forms
- Hit Counters
- Hover Buttons
- Shared Borders
- Discussion Webs
- FrontPage Themes
- Easy to create great-looking Web sites

Benefits

Intuitive, leading-edge features help users create professional Web sites, without extensive programming. Intelligent design assistance and innovative imaging tools make it easier than ever to build great-looking Web sites.

Flexible, open support for the latest Web technologies gives users the power to create the most compelling, original sites on the World Wide Web.

Effectively manage Web content and site structure

Comprehensive management tools that allow users to quickly plan and organise their site.

Automatic hyperlink maintenance gives users the freedom to manage their site without worrying about broken hyperlinks.

FrontPage2000 helps users quickly and easily update the content and look of their entire Web site. Flexible collaboration features let users to work with others to create and manage their site.

Seamlessly integrate existing content and familiar applications. Tight integration with Microsoft Office makes users productive from the very start. Compatibility with the most popular Web browsers makes it easy to design and develop web sites for any audience.

Cross-platform server support ensures broad compatibility and wide acceptance of the FrontPage Server Extensions.

2. PowerBuilder

Benefits ***(http://codeweb.8m.com/powerbuilder.html)***

- **DataWindow**

The primary strength of PowerBuilder is its proprietary device called DataWindow. Some people have called it a product within a product. Others are still discovering new uses for it. It is the primary means by which a PowerBuilder application talks to the database. It has built-in features to format data for display, allow different edit-styles, validate data entered by user, generate appropriate SQL based on the changes made by a user and also the RDBMS it is talking to and scores of other such invaluable features.

- **Object-Oriented (OO):**

PowerBuilder is an object-oriented language. Though it is not purely an object-oriented language, it supports inheritance in most of the areas, permits encapsulation and enables polymorphism. Because of these reasons, it is possible to architect your applications in such a way as to reuse code within and across applications. If you make use of OO features, it also makes it easier to maintain that application.

- **Native Drivers:**

Though ODBC (Open DataBase Connectivity) is good for accessing multiple databases through a common gateway, it covers only the common minimum features of these databases. PowerBuilder provides native drivers for all the major RDBMSs, such as Oracle, Sybase, Informix, DB2, MS SQLServer...etc., so that you can take advantage of the power of these applications.

- **Cross Platform:**

You can write a code once and run that application on all the flavours of Windows, namely Windows 3.1, Windows for WorkGroups, Windows 95 and Windows NT. You can also use the same code to run the application on Mac and Sun Solaris Unix.

- **Web-enabled:**

With PowerBuilder 5.0 and the Internet add-ons, you can build an application, which can access data in an RDBMS through a browser, whether it is on the corporate intranet or on the Internet.

3. Microsoft Access 2000 (for database)

Microsoft Access is able to create Web-ready databases from the desktop. Users have always been impressed by how simple it is to create very powerful database applications using Microsoft Access. The development environment, VBA (Visual Basic for Applications), is easy to learn and has a nicely intuitive object model.

Microsoft's commitment to Web integration is clearly articulated in Microsoft Access 2000. Hyperlinks can be used in databases to link to almost anything: other parts of the database, Office documents, and (of course) to Web sites. Tables, forms, reports, even queries can be saved in HTML format. The Publish To The Web Wizard facilitates this task, and simplifies the creation and publishing of dynamic, data-enhanced Web pages. It's even possible now to connect to a Web page, treating it as an external, read-only data source. Changes made to the page are reflected in the database.

Integration with the Office 2000 suite has been greatly enhanced. The Office Assistant answers questions and gives advice when needed. The interface has had a minor face-lift, including a new Web toolbar, though the differences are not drastic. Those already familiar with earlier versions of Access--especially Access 95 and 97--should immediately feel right at home in Access2000.

Speed is not an issue, either: Access's Jet database engine is very fast. Microsoft has increased performance significantly over previous versions of Access—by no longer attaching empty modules to forms without coded enhancements, and by using hyperlinks rather than code for form navigation.

Access has always been network-aware. Databases can be attached across the wire, and many enterprise database products--including SQL servers--can use Access as a front-end through ODBC. Access's replication features have been augmented with

the ability to replicate select records from a table rather than the whole thing, and by the ability to replicate using ftp.

While it has had competitors, various versions of Access from 2.0 onward have been--by far--the market-leading desktop databases, and not without reason. Access 2000's ease of use, flexibility, and support for SQL back-ends through ODBC make it an excellent choice.

2.4.3. Methodology Review

Comparison between Prototyping and System Development Life Cycle (SDLC).

Complaints about going through the SDLC centres around two main concerns, which are interrelated. The first concern is the extended time required going through the development life cycle. As the investment of the analyst time increases, the cost of the delivered system rises proportionally.

The second concern about using SDLC is that user requirements change over time. During the long interval between the time the user requirements are analysed and the time that the finished system is delivered, user requirements are evolving. Thus, because of the extended development cycle, the resulting system maybe criticised for inadequately addressing current user information requirements.

It is apparent that the concerns are interrelated, since they both pivot on the time required to complete the SDLC and the problem of falling out of touch with user requirements during subsequent development phases. If a system is developed in isolation from users (after initial requirements analysis is complete), it will not be up to their expectations.

A consequence of the problem of keeping up with user requirements is the suggestion that users cannot really know what they do or do not want until they see

something tangible. And in this traditional SDLC, it is often too late to change an unwanted system once it is delivered.

To overcome these problems, some analysts propose that prototyping be used as an alternative to the system development life cycle. When prototyping is used in this way, the analyst effectively shortens the time between ascertainment of information requirements and delivery of a workable system. Additionally, using prototyping instead of the traditional system development life cycle might overcome some of the problems of accurately identifying user information requirements. *(Kendall & Kendall, 1999)*

2.4.4 Existing on line car purchasing search systems

The Mercedes Benz *official Home page*

This site is created using ASP pages and through my experience of using this website, I personally feel that this is one of the best car sites available on the net. Its simplicity, attractiveness and interactivity attracted my attention and this site would be a model to create Car – 4 – U. But, it still has a few drawbacks that I am considering to improve in Car – 4 – U. This site does not have a feedback button for user suggestions. Also being an international site, maybe is the cause for slow loading graphics and also corrupted images of the cars. However they more than make up for it by the excellent usage of Macromedia Flash in displaying the dropdown menus.

ECar.com.my - Largest Automobile Portal in Malaysia

This is a very new but good site has many good features such as the search and the feedback, but still lacks in the presentation of the page. Basically, there are two ways to search. A user needs to enter a single word, lower case, no accents or spaces, and press submit. This is a fast look up in an index using either an exact match (default), or full sub-string search (floating) -- all sub-strings will match. The site is still taking some time to progress, as it is hardly a few months old and maybe by the next year could see some improvement to the quality of the site.

By using this site, I have realised the need for simplicity in presentation. Therefore, I would be more cautious in creating Car – 4 – U so that it will be an impressive system.

2.4.4. Interview with users

There were a few interview sessions done with a few users to get a clearer idea of what is expected from the project. From what I understand, there are a few important aspects, which needed specific consideration. The areas are highlighted below :-

attractiveness

One of the key factor in designing web sites is the attractiveness of the Graphical User Interface (GUI). If the users find screens appealing, they are likely to be more productive. Screens should draw users into them and hold their attention. A screen should never be crowded. Using multiple screen windows or hyperlinks is far better off then jamming everything onto a screen or page. By creating screens that are easy to grasp at first glance, one appeals to both inexperienced and experienced users. With the advent of Graphical User Interface (GUI) it is possible to make input screens very attractive.

Examples:

Different Types Fonts

Types of fonts are another way to make screens attractive to users. Different styles enhance differentiation among categories. For instance thick, sans serif type styles

can be used to denote main categories and to give screens a modern look. Larger type can indicate captions for data entry fields. Thinner type with serifs can be used to designate subcategories on the same screen and provide a more conservative look. *(Kendall & Kendall, 1999)*

Using colour in Screen Design

Colour is an appealing and proven way to facilitate computer input. Appropriate use of colours on display screens allows you to contrast foreground and background, to highlight important fields, to feature errors and to call attention to many other special attributes.

Highly contrasting colours should be used for foreground and background. This helps users grasp what is presented quickly without straining. Specifically the top five most legible combinations of foreground lettering on background are (starting with the most legible combination):

- *Black on yellow*
- *Green on white*
- *Blue on white*
- *White on blue*
- *Yellow on black*

As can be gathered from these possible foreground and background combinations, bright colours should be used for foregrounds, with less bright colour for the background.

Colours should be used to highlight important fields on screens. Fields that are important can be coloured differently from the rest. When creating web-based applications, hyperlinks are usually colour-coded to show users that a hypertext path can be taken. Hyperlinks can be made to change colour after a user has clicked on them once with the mouse. This colour-coding prevents users from pursuing previously used hyperlinks and thus helps organise their search and save them valuable time.

User friendly

The system created should not involve any complications when using it. Users of the system can involve inexperienced or experienced users. Therefore, the system should be made simple and precise.

Online Help

There should be a help page for the users would be able to find out information regarding the appropriate way of using the system. Without these guidelines, users might miss some of the important features available in the system.

2.4.6. Programming Tools

Active Server Page

An Active Server Page (ASP) is an HTML page that includes one or more scripts (small embedded programs) that are processed on a Microsoft Web server before the page is sent to the user. An ASP is somewhat similar to a server-side include or a common gateway interface (CGI) application in that all involve programs that run on the server, usually tailoring a page for the user. Typically, the script in the Web page at the server uses input received as the result of the user's request for the page to access data from a database and then builds or customises the page on the fly before sending it to the person who requests for the page.

ASP is a feature of the Microsoft Internet Information Server (IIS), but, since the server-side script is just building a regular HTML page, it can be delivered to almost any browser. You can create an ASP file by including a script written in VBScript or JScript in an HTML file and then renaming it with the ".asp" file suffix. Microsoft recommends the use of the server-side ASP rather than a client-side script, where there is actually a choice, because the server-side script will result in an easily displayable HTML page. Client-side scripts (for example, with JavaScript) may not work as intended on older browsers. (**www.whatis.com**)

JavaScript

JavaScript is an interpreted programming or script language from Netscape. It is somewhat similar in capability to Microsoft's Visual Basic, Sun's Tcl, the UNIX-derived Perl, and IBM's REXX. In general, script languages are easier and faster to code in than the more structured and compiled languages such as C and C++. Script languages generally take longer to process than compiled languages, but are very useful for shorter programs.

JavaScript is used in Web site development to do such things as:

- ***Automatically change a formatted date on a Web page***
- ***Cause a linked-to page to appear in a popup window***
- ***Cause text or a graphic image to change during a mouse rollover***

JavaScript uses some of the same ideas found in Java, the compiled object-oriented language derived from C++. JavaScript code can be imbedded in HTML pages and interpreted by the Web browser (or client). JavaScript can also be run at the server as in Microsoft's Active Server Pages (ASPs) before the page is sent to the requestor. Both Microsoft and Netscape browsers support JavaScript, but sometimes in slightly different ways. *(**www.whatis.com**)*

VBscript

VBScript is an interpreted script language from Microsoft that is a subset of its Visual Basic programming language. VBScript can be compared to other script languages designed for the Web, including:

i. Netscape's JavaScript

ii. Sun Microsystem's Tcl

iii. The UNIX-derived Perl

iv. IBM's REXX

In general, script languages are easier and faster to code in than the more structured, compiled languages such as C and C++ and are ideal for smaller programs of limited capability or that can reuse and tie together existing compiled programs.

VBScript is Microsoft's answer to Netscape's popular JavaScript. Both are designed to work with an interpreter that comes with a Web browser - that is, at the user or client end of the Web client/server session. VBScript is designed for use with Microsoft's Internet Explorer browser together with other programming that can be run at the client, including ActiveX controls, automation servers, and Java applets. Although Microsoft does support Netscape's JavaScript (it converts it into its own JScript), Netscape does not support VBScript. For this reason, VBScript is best used for intranet Web sites that use the Internet Explorer browser only. *(**www.whatis.com**)*

Database Connectivity : ODBC

Open Database Connectivity (ODBC) is a standard or open application-programming interface (API) for accessing a database. By using ODBC statements in a program, you can access files in a number of different databases, including Access, dBase, DB2, Excel, and Text. In addition to the ODBC software, a separate module or driver is needed for each database to be accessed. The main proponent and supplier of ODBC programming support is Microsoft.

ODBC is based on and closely aligned with the Open Group Standard Structured Query Language (SQL) Call-Level Interface. It allows programs to use SQL requests that will access databases without having to know the proprietary interfaces to the databases. ODBC handles the SQL request and converts it into a request the individual database system understands. *(**www.whatis.com**)*

2.4.6 Review on Existing Search System in FSKTM

ODOCT

I found a report written by my batch mate who has created an online dictionary system. This report is important for my literature review since my project is on the same search aspect except that Car – 4 – U is a car purchasing search system whereas ODOCT is an online dictionary with a search system for terms.

Through my evaluation, I found out that in the public user module of ODOCT, there is random search and also feedback where they're an opportunity for users to evaluate and give their opinions. Since, these two important features are important, they are considered in Car – 4 – U. With these added features Car – 4 – U will serve a better purpose as a search engine.

CHAPTER 3

METHODOLOGY

3.1. Project Description

As mentioned earlier report, Car – 4 – U consists of three important modules, which are the public user interface module, the dealer module and the administrator module.

The public user module consists of a few features, which are the search, random search, help and feedback. In my research on the existing car purchasing search systems, I could not find all these features in one particular site. Some of the systems might have a few of them but not all. Therefore, Car – 4 – U is more complete and users will be able enjoy the added benefits.

Another added feature, which is difficult to find in most online car systems, is the random button. This will allow users to search for a random car if they are not looking for any specific car.

The administrator module on the other hand, consists of a few important features for maintenance purposes. These include the login box, update cars, add cars, delete cars, view feedback and change password.

In conclusion, Car – 4 – U is a special web based search system consisting most of the important features in the same web site.

3.2. Approach to System Development

The approach used in developing Car – 4 – U is prototyping. Generally, there are four guidelines in developing a prototype.

- **Work in manageable modules**
- **Build the prototype rapidly**
- **Modify the prototype in successive iterations**
- **Stress the user interface**

Working in manageable modules

A manageable module is one that allows users to interact with its key features yet it can be built separately from the other system modules. Module features that are deemed less important are purposely left out of the initial prototype.

There were three main modules in the development of Car – 4 – U, the public user interface module, the dealer module and the administrator module. Since each of these modules is quite wide, they were divided into a few sub-modules which were developed separately.

As for the public user module, the sub-modules were the search box, random search, and feedback. Once all these modules were successfully developed using the prototyping approach, they were gathered into one interface so that the users select the options according to their needs.

As for the dealer module, the sub-modules were dealer login, logout, update cars, add new cars, delete cars, change password and view feedback by users. Each of these sub-modules were developed and tested separately. Again, once all these sub-modules were successfully developed and tested, they were gathered together into one interface and that is the dealer interface.

As for the administrator module, the sub-modules were admin login, logout, update cars, add new cars, delete cars, change password and view feedback by users. Each

of these sub-modules were developed and tested separately. Again, once all these sub-modules were successfully developed and tested, they were gathered together into one interface and that is the administrator interface.

Building the Prototype Rapidly

Speed is essential to the successful prototyping of an information system. After a brief analysis of information requirements, working models for the prototype were constructed. The prototype took less than a week to put together. Putting together an operational prototype both rapidly and early in the system development life cycle allows the analyst to gain valuable insight into how the following steps in the project should go.

Time allocation for building each sub-module should be short since there are many other sub-modules need to be designed. To manage time, a Gantt chart was used. With software like FrontPage2000, a prototype can be developed quickly as it is easy to learn and use.

Modifying the Prototype

A third guideline for developing the prototype is that its construction must be able to support modifications. Making the prototype modifiable means creating it in modules that are not highly interdependent. If this guideline is observed, less resistance is encountered when modifications in the prototype are necessary.

Once each of the modules were developed, they were tested with users so that they meet the user requirements. If the users were not satisfied with certain criteria, the modules were then modified according to their needs. This process took place for each module before they were linked together so that they will not be highly interdependent.

The prototype is generally modified several times, going through several modifications. Change in the prototype should move the system closer to what users say is important. Each modification necessitates another evaluation by users.

Stressing the user interface

The last stage of prototyping is to link all the independent working modules in an appropriate interface for the users to access. For Car – 4 – U, there are three main interfaces, which are the public user interface, the dealer interface and the administrator interface. Generally, there are four guidelines for well-designed screen. They are : -

- **screens must be kept simple**
- **screens must be consistent from screen to screen**
- **screen design must facilitate movement between screens**
- **screens must be attractive**

The user's interface with the prototype and eventually the system is very important. At this stage the goal of the analyst is to design an interface that both allows the user to interact with the system with a minimum of training and fuss; and allows a maximum of user control over represented functions.

3.2.1 Prototyping Stages

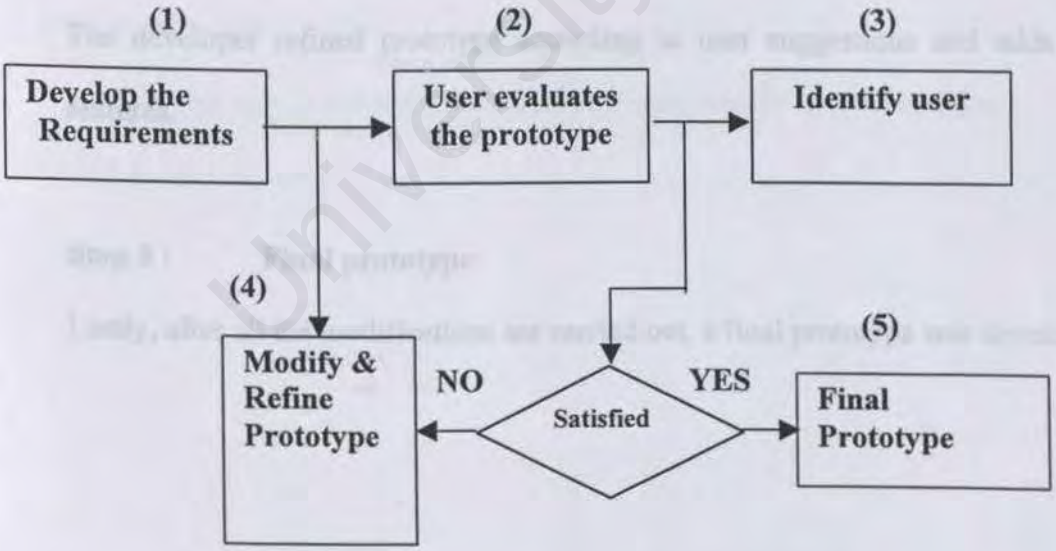

Figure 3-1 : Stages In Prototyping

Step 1 : Identify User Requirements

Beginning of the development, whereby, gathering of requirements was done to come up with a requirement specification stating all requirements of users from the system.

Step 2 : Develop the prototype

A prototype system was constructed.

Step 3 : User evaluates the prototype

The user was involved in this step for evaluating and testing the prototype. If unsatisfied, users suggested modifications.

Step 4 : Modify and Refine prototype

The developer refined prototype according to user suggestions and adds in new features.

Step 5 : Final prototype

Lastly, after all the modifications are carried out, a final prototype was developed.

3.3 Justification

3.3.1 Advantages of Prototyping

- system developed more quickly
- system respond to changes more easily
- users are more involved in the system ,so the developer spends less effort in information gathering
- many end-user computing tools and software are suitable to be used with prototyping
- development costs are low

3.3.2 Application/suitability

- simple systems
- small systems
- when the user is not able to state all the requirements in the beginning
- for risky systems

3.4. System Requirements

It is necessary to draw out the system's requirements to provide a guideline for developing the system. A requirement is a feature of the system or description of something the system is capable of doing in order to fulfill the system's purpose.

The system's requirements for this project were determined for the three separate modules. The type of requirements for a project is normally separated into functional requirements and the non-functional requirements.

3.4.1 Functional Requirements

A functional requirement describes an interaction between the system and its environment. It also describes how the system should behave given a certain stimuli. The functional requirements for Car – 4 – U were separated between the three modules.

- **Public user module**

The main functions of public user module were encapsulated as a search function.

Search

Key in

User can key in the keyword of the vehicle they are looking for. This helps users to search in a faster and efficient way.

Random

Random button is useful for users to select a particular car randomly and its data would be called up randomly.

Feedback

A feedback form is needed for users to suggest means and ways to improvise or update the system. Feedback is necessary for users opinions or suggestions regarding Car – 4 – U.

❑ **Dealer Module**

This module is specifically for the dealer and other users to conduct maintenance and other operations onto the system. Therefore, a login name and password protects this module to avoid unauthorised users.

Among the functions in this module are :-

Update new cars

Car sales progress very rapidly and there is a need to get updated with the latest numbers of car sales. Therefore, a dealer needs to update existing data in the database according to the latest information in the from his company's sales.

Add new cars

As time passes, there will always be a need to improve the database with the latest entry. As time passes, more and more cars will need to be added on to the database as this business is such. This feature is especially for this purpose.

Delete cars

A dealer is able to delete useless cars' data in the database to save space for newer cars. Once a car from the site is sold, it will eventually be taken off the site.

View feedback

As mentioned in the public user module functions, a Car – 4 – U user can submit their feedback regarding the system by filling in the feedback form. A dealer, on the

other hand, may need to look and evaluate the feedback by users. Therefore a page to view users feedback is created in the dealer module.

Change password

To ensure data integrity, a password has to be entered before a user can access the dealer module. Dealers are allowed to change their passwords anytime they think there is a need for it to ensure security. This feature is very necessary for multiple dealers from a same company who would be using one account or even to prevent competitors from adjusting each other's data.

❑ **Administrator Module**

This module is specifically for the developer and other administrators to conduct maintenance and other operations onto the system. A login name and password protects this module to avoid unauthorised users from intruding the system.

Among the functions in this module are :-

Update new cars

If there is a need for the administrator to update the fields, then this feature enables the admin to carry out spring-cleaning in the database.

Add new cars

This feature is specially for the purpose of adding on more cars from personal contacts that might not even be car dealers but any individual who would like to sell their car.

Delete cars

An administrator is able to delete useless car from the database to save space for more recent cars. Even though this feature might not be so useful, it is important to be prepared for possibilities. There definitely would be the event of dealers who do not update their data.

View feedback

A Car – 4 – U user can submit their feedback regarding the system by filling in the feedback form. A developer needs to look at and evaluate the feedback by users. Therefore a page to view users feedback is created in the administrator module.

Change password

To ensure data integrity, a password has to be entered before a user can access the administrator module. Administrators are allowed to change their passwords anytime they think there is a need for it to ensure security.

3.4.2 Non-Functional Requirements

A non-functional requirement describes a restriction on the system that limits the choice for constructing a solution to the problem. These solutions will narrow down the selection of programming languages, platform or implementation techniques or tools.

Among the non-functional requirements of Car – 4 – U are :-

Graphical User Interface (GUI)

Graphical User Interface allows direct manipulation of the graphical representation on the screen, which can be accomplished with keyboard input or a mouse. The key to GUI is the constant feedback on task accomplishment that it provides. The users of Web sites are unknown to the developer, so a design must be clear-cut.

User Friendly

Associated to the previous requirement, this function also allows users to operate the system with ease. This is done by providing the necessary commands, help and display feedback. Some of the importances of feedback are shown in Figure 3-2.

Feedback is Needed to Tell the User That:
• *The computer has accepted the input*
• *The input is in the correct form*
• *The input is not in the correct form*
• *There will be a delay in the processing*
• *The request has been completed*
• *The computer is unable to complete the request*

Figure 3-2 :The Importance of Feedback

Security

This requirement ensures that only authorised users can access the administrator module. Data integrity is maintained by asking users enter valid passwords before entering the module. Therefore, login and logout pages were created in Car – 4 – U.

Login

A user need to login to the administrator module in order to make changes in the database. Since this module is only for authorised users, a user needs to have a login name and a password to access the module.

Logout

Once logged in to a system, it is very important to log out of the system so that it will not be accessible by any unauthorised users. Thus, a developer needs to click on the logout button before leaving the computer.

Online Help

This help system will help users navigate around the site and use the system effectively without encountering any problems.

3.5 Tools Used

3.5.1 Hardware

1. A computer with a minimum requirement of hardware as below was needed to develop Car – 4 – U :

   8 MB of memory

   600 MB of storage

   a Pentium II

2. Printer : LaserJet6L

A printer was needed to print all the reports and documentation regarding Car – 4 – U.

3.5.2 Software

- ***Microsoft FrontPage2000***

  For Client applications (Interface and Processing)

- ***Microsoft Internet Explorer version 5.0***

  As a Browser to run the system

- ***Microsoft Access 2000***

  For storage of data

- ***Microsoft Windows 98***

  Operating System

- ***Microsoft Image Composer 1.5***

  Create Images for Web

- ***Microsoft Word 2000***

  Documentation

- ***Personal Web Server***

  Web Server

Why FrontPage2000?

FrontPage2000 was chosen as the as the main tool for the development of Car – 4 – U because of its benefits which are better than PowerBuilder. The details are shown in chapter 2.

3.5.3 Programming Tools

- ***Active Server Pages***
- ***VBScript***
- ***JavaScript***
- ***HTML***

- ***Microsoft Windows 98***

  Operating System

- ***Microsoft Image Composer 1.5***

  Create Images for Web

- ***Microsoft Word 2000***

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Why FrontPage2000?

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3.5.3 Programming Tools

- ***Active Server Pages***
- ***VBScript***
- ***JavaScript***
- ***HTML***

CHAPTER 4

SYSTEM DESIGN

Design phase is the stage of system development where the requirements for the system are translated into the system characteristics.

4.1 System Design

4.1.1 Prerequisites for Systems Design

System design is conducted after careful evaluation of the following requirements:

- ***User requirements***
- ***Hardware requirements***
- ***Systems requirements***

User Requirements

In designing new systems, the analyst must consider the requirements of the major user, as well as other users, and determine the extent of their dependence on the new system. Cost is often a major constraint, which implies that a new system seldom meets the requirements of all users. In the end, a balance between cost and performance must be incorporated for an overall satisfactory system design.

In determining the user's requirements, an understanding must be reached as to what can be expected of the system. Although it is the users responsibility to spell out what is needed, this phase is often delegated to the system's analyst for a final decision. Thus, the computer professional whose orientation is of analysis and design of systems conveniently specifies the user's requirements.

Hardware Requirements

Systems design requires an evaluation of the processing methods used by the new system. Of the methods available, computer-based systems design is the most complex. Then, it is important that the systems analyst be familiar with the computer system's capabilities and limitations and alternative ways of achieving optimum efficiency of system operation.

Systems Requirements

The primary systems requirements are economy, flexibility, reliability, simplicity, and acceptability. That is a system must be economical to operate, flexible enough to accommodate future change and capable of producing reliable output acceptable to the user.

Economy

Traditionally, the analyst is expected to design a system that will meet the user's requirements at the lowest cost possible.

Flexibility

The new systems should incorporate features that make it possible to modify any aspect of the system when necessary. In addition to meeting the user's present requirements, new systems should accommodate changes in future requirements without the need for a major or frequent update.

Simplicity

A simple, yet flexible system designed to serve the needs of the user at a reasonable cost would be ideal.

Reliability

Reliability refers to the confidence the user has in the output of the new system. An analyst must assume a total responsibility for securing a reliable system.

Acceptability

Throughout the design phase, it is extremely important to secure the acceptance and support of all users who will be affected by the new system. The performance of most reliable systems can also be threatened without the user's co-operation and support.

To summarise, a new system is designed through a creative effort of the analyst. A new system should satisfy a particular user's requirement without adversely affecting the information's requirement of the users.

4.1.2 Architectural Design

The primary objective of architectural design stage is to develop a modular program structure that represents the control relationships between modules. In addition, architectural design melds program structure and data structure defining interface that enables data flow throughout the program. Diagrams below represents the architectural design for Car – 4 – U, public user module, the dealer module and the administrator module.

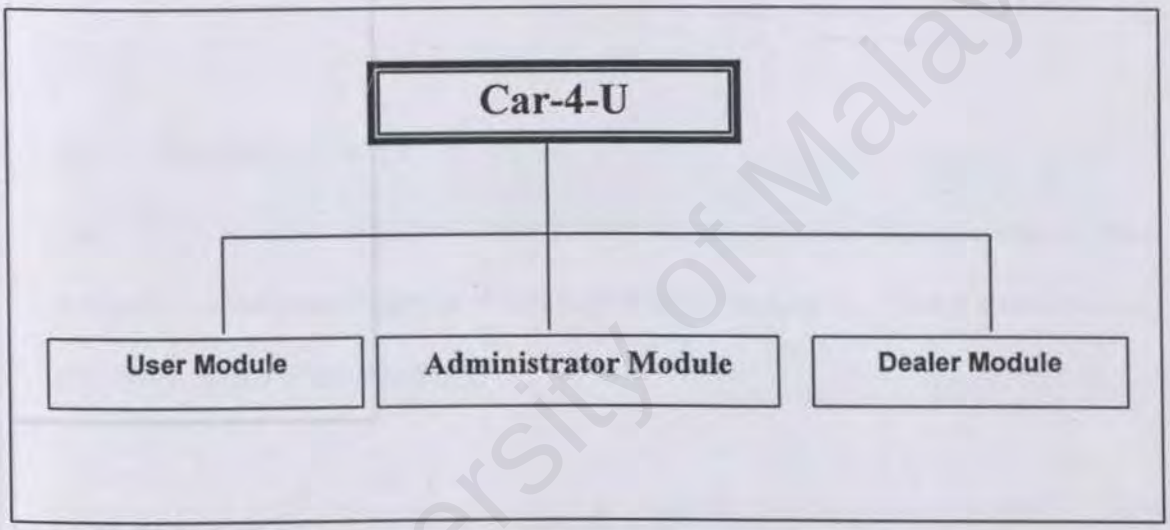

Figure 4-1: Architectural Design of CAR - 4 - U

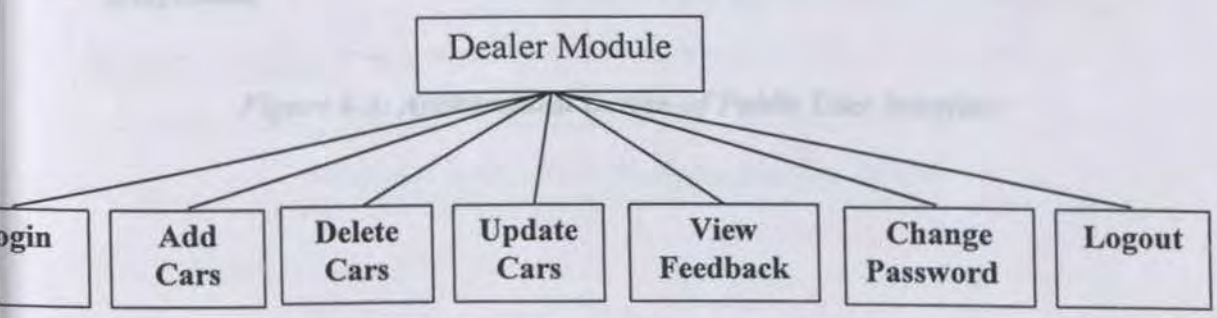

Figure 4-2 : Architectural Design of Dealer Module

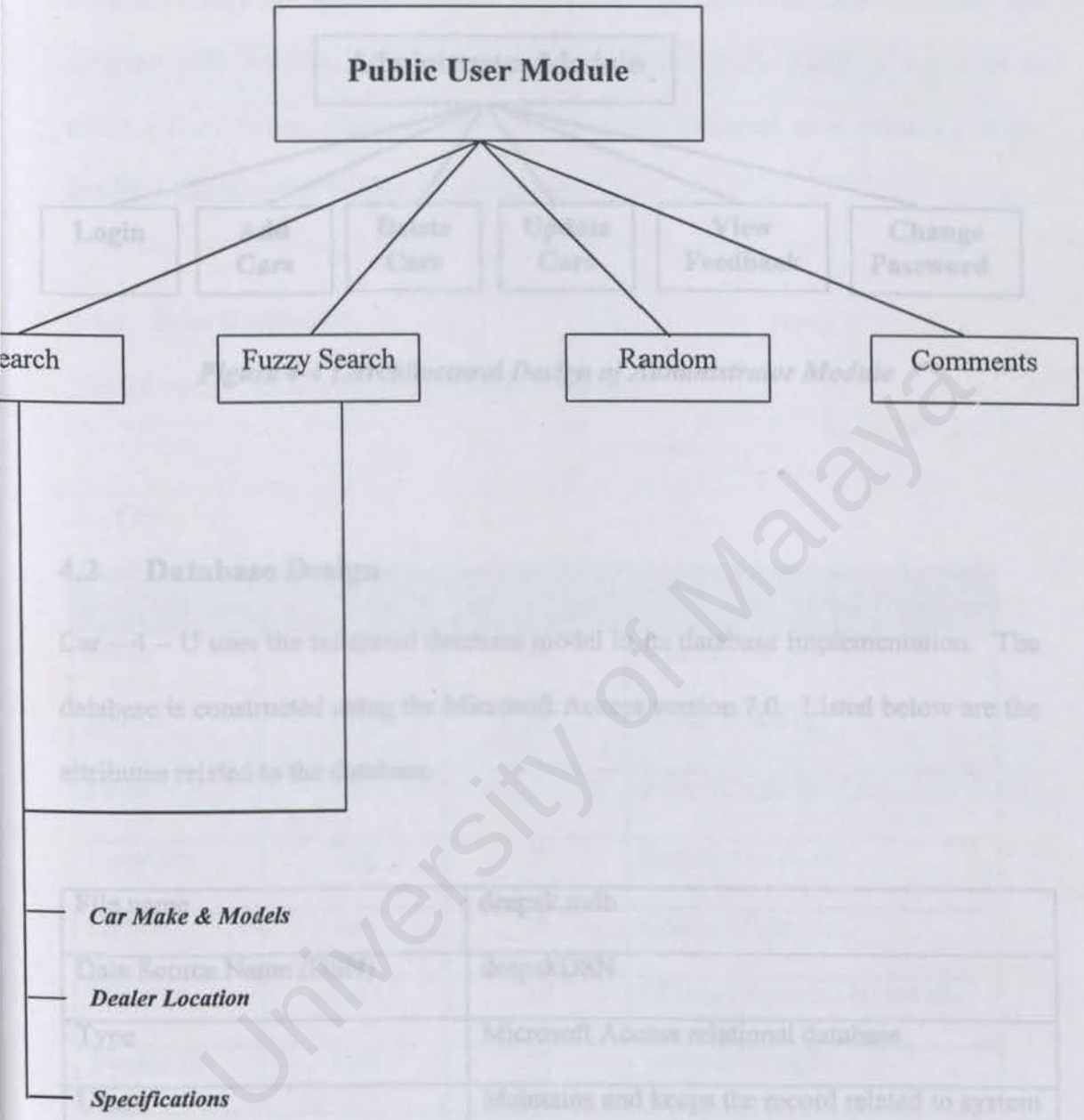

Figure 4-3: Architectural Design of Public User Interface

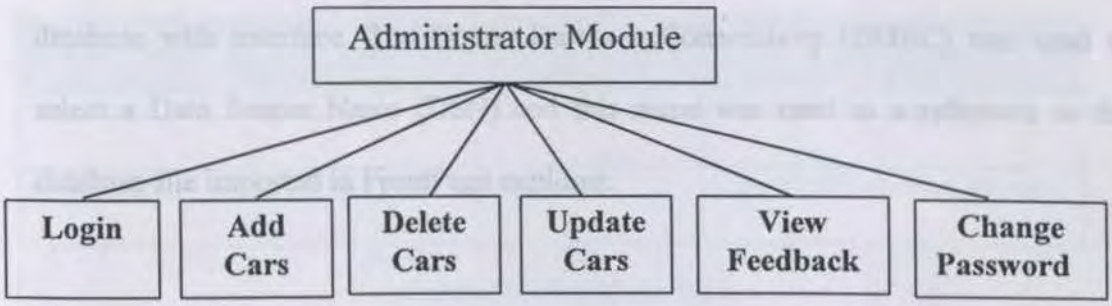

Figure 4-4 : Architectural Design of Administrator Module

4.2 Database Design

Car – 4 – U uses the relational database model in its database implementation. The database is constructed using the Microsoft Access version 7.0. Listed below are the attributes related to the database.

File name	deepak.mdb
Data Source Name (DSN)	deepakDSN
Type	Microsoft Access relational database
Usage	Maintains and keeps the record related to system
Number of tables	6

Table 4.1: CAR - 4 - U Database General Profile

Integration between Microsoft Access and FrontPage 2000 was done to connect the database with interface. The Object Database Connectivity (ODBC) was used to select a Data Source Name (DSN) and this name was used as a reference to the database file imported in FrontPage explorer.

4.2.1 Data Dictionary

The following tables were created in the database:-

1. Cars

Field Name	Field Type	Field Size	Description
Make	Text	50	Make of the car
Model	Text	30	Model of the car
Price	Num	8	Price offered for car
Location	Text	50	Location of dealer
Colour	Text	50	Colour of the car
Mileage	Text	50	Mileage travelled by the car
Dealer ID	Text	50	Name of dealer

Table 4.2: Cars table

This is the main table in the database. It contains all the cars data in the system. Since there are only seven fields, which are necessary in the database, therefore only one table was created for the cars. This has made the storage of information simple and straightforward.

2. Feedback

Field Name	Field Type	Field Size	Description
Email	Text	50	Email of the user
Comments	Text	255	Comments entered by user

Table 4.3: Feedback table

This table stores the feedback entered by user so that it can be displayed when the administrator chooses to see it. To avoid junk messages, the comments field is set to only accommodate 255 characters.

3. Admin

Field Name	Field Type	Field Size	Description
Admin_ID	Text	50	Administrator name
Admin_pword	Text	50	Administrator password

Table 4.4: Admin table

Table for entry and verification of passwords.

4. Dealer

Field Name	Field Type	Field Size	Description
Dealer ID	Text	30	Dealer Identification
D_Name	Text	30	Dealer's name
D_password	Num	8	Dealer's password
Location	Text	50	Location of dealer
D_company	Text	50	Company name
D_Address	Text	50	Company's address

Table 4.5: Dealer table

Table for dealer's details that are kept in the six required fields.

4.2.2 Data Flow Diagrams (DFD)

Through a structured analysis technique called data flow diagrams (DFD), the system analyst can put together a graphical representation of data processes throughout the organisation. The data flow approach emphasises the logic underlying the system. By using combinations of only four symbols, the system analyst can create a graphical depiction of processes that will eventually provide solid system documentation.

Four basic symbols are used to chart data movement on data flow diagrams. They a double square, an arrow, a rectangular with rounded, and open-ended rectangle (closed on the left side and open-ended on the right), as shown on Figure 4.5 An

entire system and numerous subsystems can be depicted graphically with these four symbols in combination.

The double square is used to depict an external entity that can send data or receive data from the system. The arrow shows movement of data from one point to another, with the head of the arrow pointing toward data's destination. A rectangle with rounded corners is used to show the occurrence of a transforming process. Processes represent work being performed within the system and should be named clearly so that it is easier to understand what the process is accomplishing.

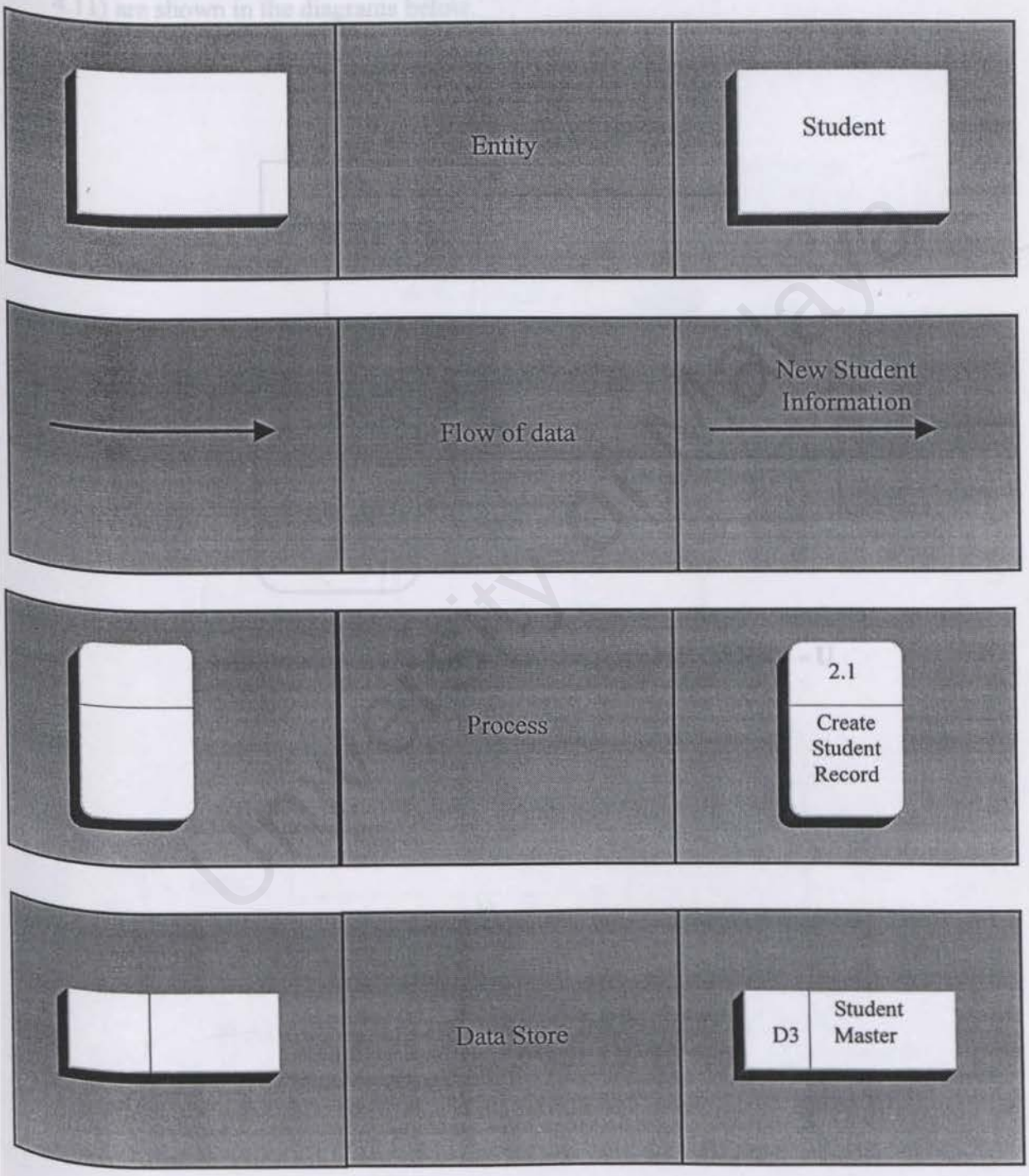

Figure 4.5: Basic Symbols of Data Flow Diagrams

The DFD's drawn for CAR - 4 - U with the context diagram (Figure 4.6), Level 0 DFD (Figure 4.7), and the Level 1 DFD's (Figure 4.8, Figure 4.9, Figure 4.10, Figure 4.11) are shown in the diagrams below.

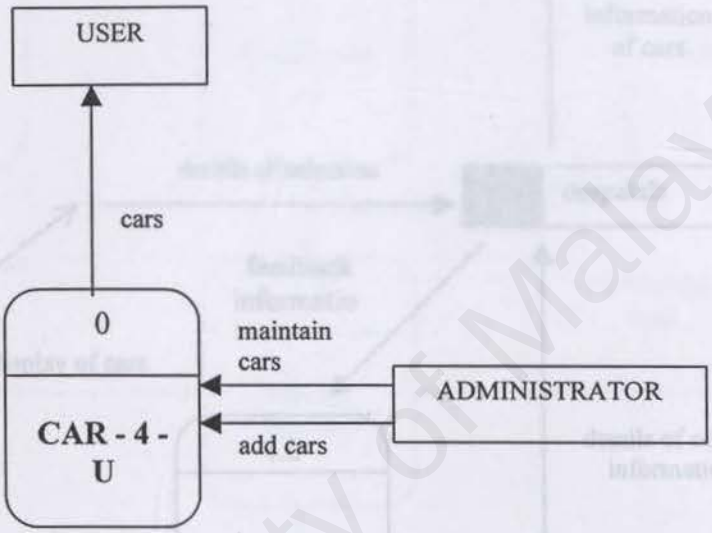

Figure 4.6: Context data flow diagram for CAR - 4 - U

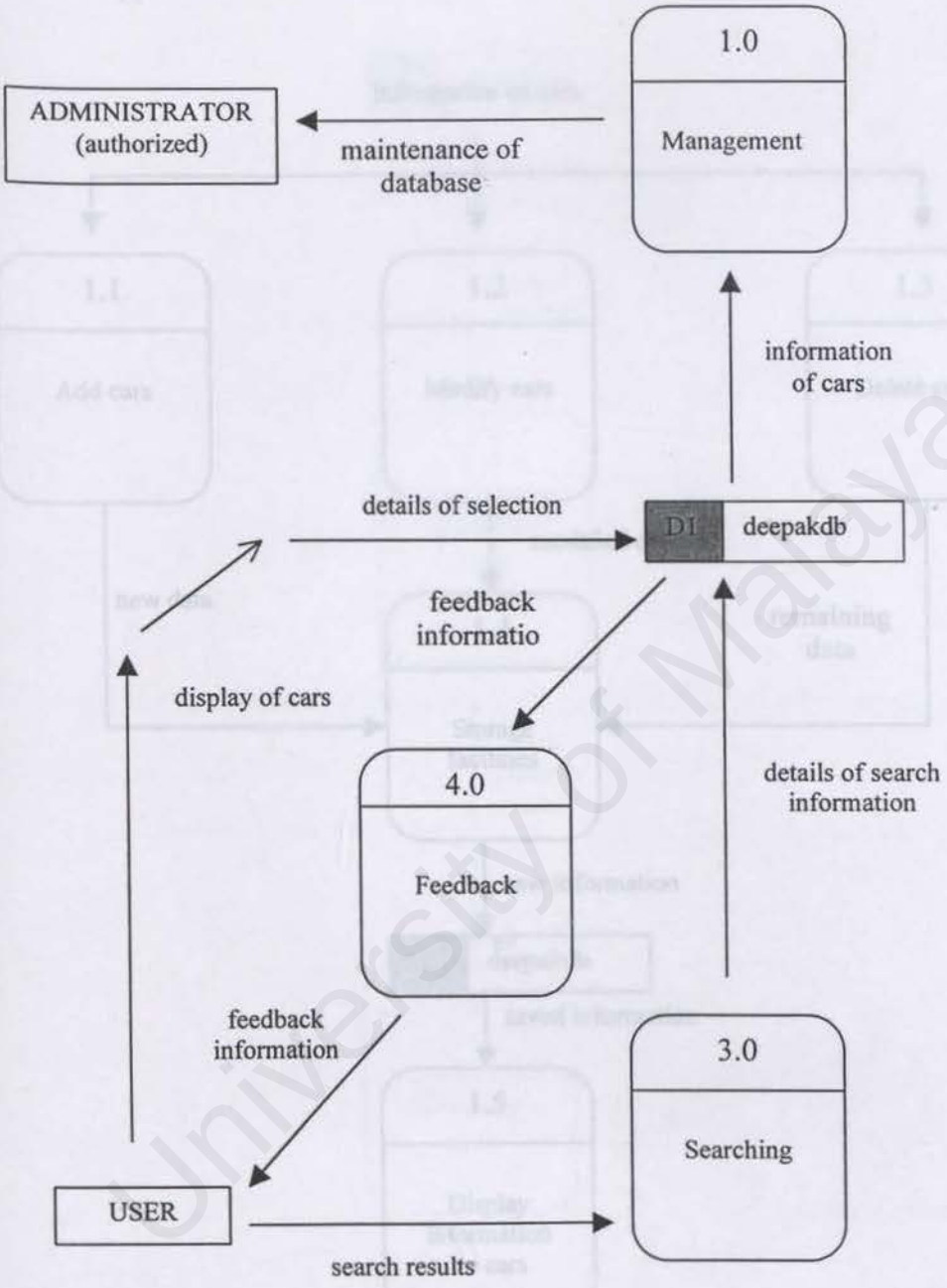

Figure 4.7: Level 0 Data Flow Diagram of CAR - 4 - U

In the above diagram the administrator is assumed to already have obtained authorisation by logging in into the administration module.

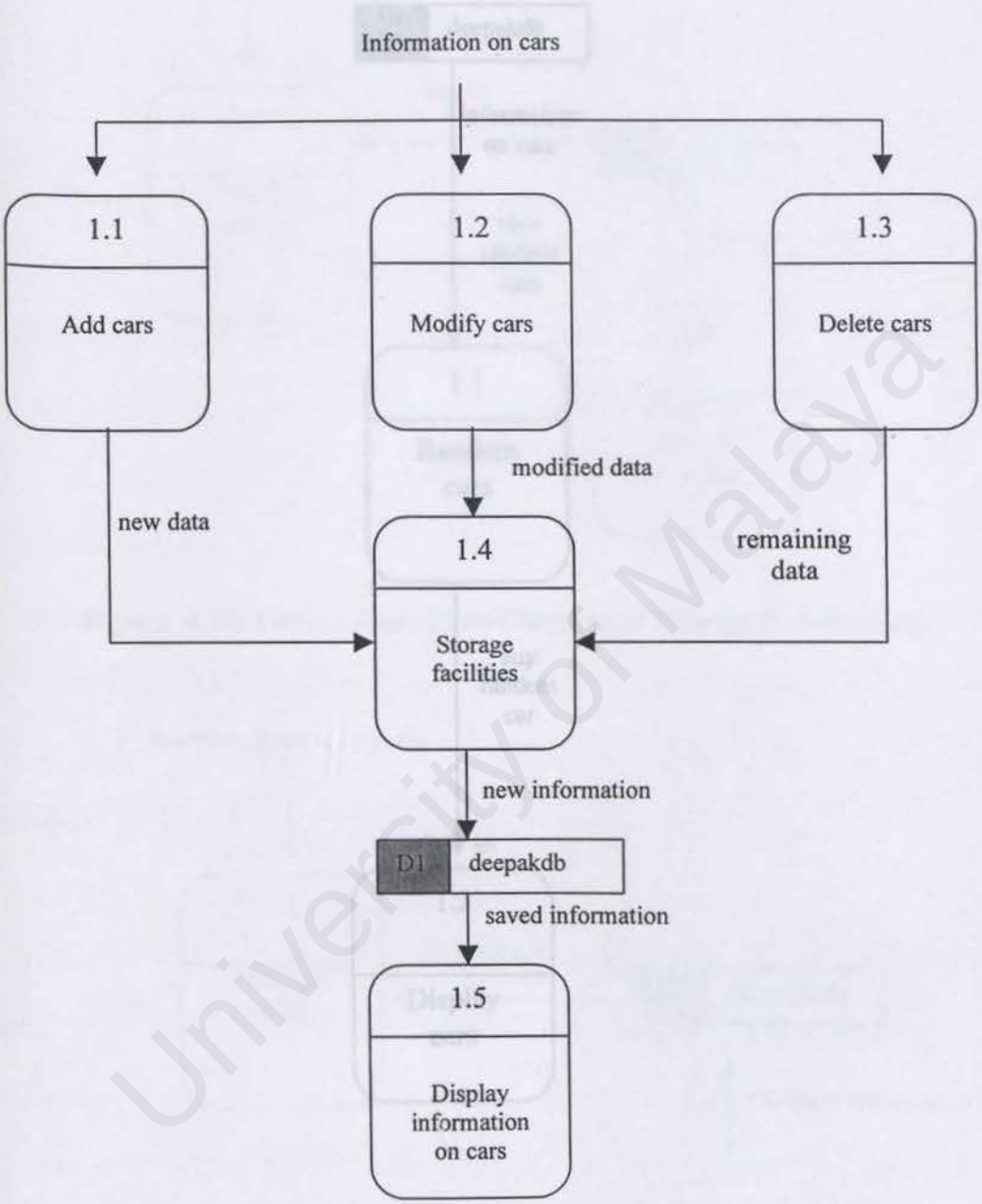

Figure 4.8: Level 1 Data Flow Diagram of Process 1: Management

Figure 4.9: Level 1 Data Flow Diagram of Process 2: Random Cars

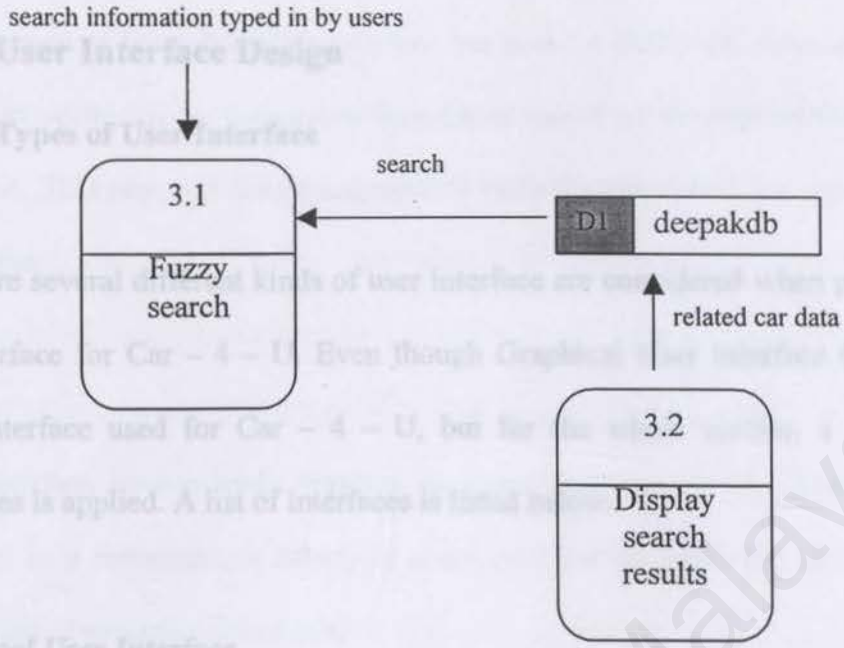

Figure 4.10: Level 1 Data Flow Diagram of Process 3: Searching

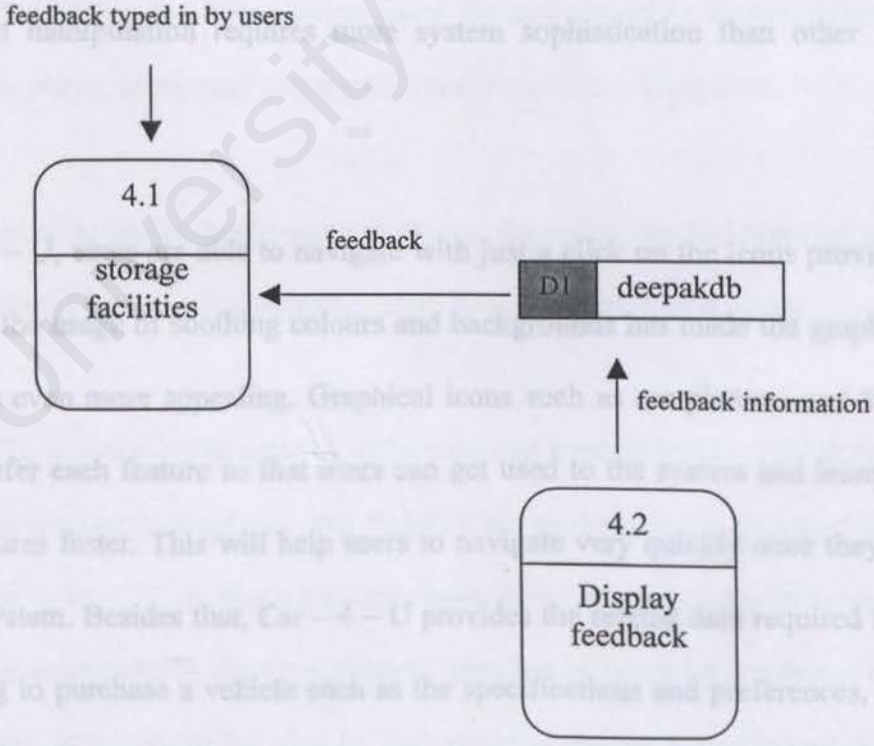

Figure 4.11: Level 1 Data Flow Diagram of Process 4: Feedback

4.3. User Interface Design

4.3.1. Types of User Interface

There are several different kinds of user interface are considered when preparing for the interface for Car – 4 – U. Even though Graphical User Interface (GUI) is the main interface used for Car – 4 – U, but for the whole system, a selection of interfaces is applied. A list of interfaces is listed below.

Graphical User Interface

Graphical User Interface allows direct manipulation of the graphical representation on the screen, which can be accomplished with keyboard input, a joystick, or a mouse. Direct manipulation requires more system sophistication than other user interfaces.

With Car – 4 – U, users are able to navigate with just a click on the icons provided. Furthermore, the usage of soothing colours and backgrounds has made the graphical user interface even more appealing. Graphical icons such as car pictures and logos are used to refer each feature so that users can get used to the system and learn the different features faster. This will help users to navigate very quickly once they are used to the system. Besides that, Car – 4 – U provides the related data required for a user inquiring to purchase a vehicle such as the specifications and preferences, plus the location of the car dealer so as to ease the user. All these are displayed in different rows in a table, which helps them find information in just a second.

The creation of Graphical User Interface has posed a challenge, since an appropriate model of reality or an acceptable conceptual model of the representation must be invented. This required combining several skills that stretched the capability of the developer.

Menus

This interface appropriately borrows its name from the list of dishes that can be selected in a restaurant. Similarly, a menu interface provides the user with an on-screen list of available selections.

In responding to the menu, a user is limited to the options displayed. The user need not to know the system but does need to know the task should be accomplished. To best utilise the menu, users must know which task they desire to perform.

Menus can set up to the keyboard entry or mouse. Selection can be identified with a number, letter or a keyboard, or users can click on a selection with a mouse.

In Car – 4 – U, a menu which consists of buttons and hyperlinks is prepared to help users navigate through the system. The Public User mode menu is prepared on the frame of Car – 4 – U so that users can view them all the time. Whereas the administration menu will be shown only once users log in to the administrator mode, in other words, it is only to be used by authorised users. So to is the case for the dealer menu.

Form-Fill Interface

Form-fill interfaces consist of on-screen forms or web-based forms displaying fields containing data items or parameters that need to be communicated to the user. On screen forms are set up to show what information should be input and where. Blank fields requiring information can be highlighted with inverse or flashing characters. The user moves the cursor from field to field by a single stroke of the arrow key, for instance.

Input for on-screen field can be alphanumerically restricted, so that users can only enter letters where a term is required. Form input for screens can be simplified by supplying default values for field and then allowing users to modify default information if necessary.

In Car – 4 – U, there are a few forms prepared for the users to fill in. In Public User mode, there are simple forms for search and also a form for comments if the users feel like giving some comments about Car – 4 – U. But, this form is not necessary to be filled. These forms are all validated to display quick error messages if the users happen to fill them inappropriately.

In administrator mode, there a few important forms are prepared for the administrator to change the contents of the database. Most of these forms have default values to facilitate the administrator. This is done to save time and avoid errors. Car – 4 – U consists of only very simple forms for users and administrator, therefore there will not be any complications involved in submitting the correct and viable details.

4.3.2. Dialog and Desktops

Dialog is the communication between the computer and a person. Well-designed dialog makes it easier for people to use a computer and leads to less frustration with the computer system. There are several key points for designing good dialog. They include:-

1. Meaningful communication, so that user understands what people are entering and people understands what the computer is presenting or requesting.
2. Minimal user interaction
3. Standard operation and consistency

Communication

In Car – 4 – U, information is presented clearly to the user. This includes presenting an appropriate title on each screen, minimizing the use of abbreviations, and providing a clear user feedback.

User instructions (most of them are in one line) are supplied regarding details on each screen of Car – 4 – U.

Easy to use help screens are provided. In Car – 4 – U, there are two main help screens. One in the public user interface and another on in administrator interface. All the available functions in Car – 4 – U are described in these two help screens so that users can utilise all the features thoroughly.

Minimal User Action

Keying is often the slowest part of a computer system, and good dialog will minimize the number of keystrokes required. In Car – 4 – U, this is accomplished using many different ways.

1. Keying few characters instead of the whole word.

In Car – 4 – U, other than keying in the whole term, users can use fuzzy search to look for the definition. This is rather friendly, as users do not need to know the exact model or specifications of the car. The inquiry program is designed is such a way that users needs only to enter only the first few characters of item description. The program displays a list of matching cars, and when the operator chooses one, the matching record is displayed.

2. Retrieving data that is already stored.

For Car – 4 – U administrators, there is not much work involved in deleting and modifying information. They can chose a car by just clicking on the ones that need changes or need to be deleted. All the relevant information on the cars will be displayed in a form. Then administrator can just delete or modify necessary information.

Standard Operation and Consistency

The operation should be consistent throughout its set of different screens and in the mechanisms for controlling the operation of the screen throughout different applications. Consistency makes it easier for the users to learn how to use new portions of the system once they are familiar with one component. Consistency is achieved in Car – 4 – U by :-

1. Locating titles in the same places on all screens.
2. Exiting each program by the same menu option.
3. Standardising the colour used for all screens. Error messages are typically displayed in maroon. The background colour used for all screens is the same (black).
4. Standardising the use of icons for similar operations when using a Graphical User Interface.

4.3.3. Feedback for Users

All systems require feedback, in order to monitor and change behaviour. Feedback usually compares current behaviour with predetermined goals and gives back information describing the gap between actual and intended performance.

When users interface with machines, the usually compares current behaviour with predetermined goals and gives back information describing the gap between actual and intended performance.

When users interface with machines, the still require feedback about how their work is progressing. As designers of user interfaces, system analysts need to be aware of human need for feedback and build it into the system. In this context, feedback typically refers to feedback from online systems-typically text.

In Car – 4 – U, feedback was used in the situations below:-

Acknowledging Acceptance of Input

The first situation in which users need to feedback is to learn that the computer has accepted the input. For example, after filling in the comments form, users are notified that the input has accepted.

If request is invalid, users are notified so that they can try again with valid data. For each of the search feature, an error page is prepared to notify users.

Acknowledging That a Request is Completed

Users need to know when their request has been completed and new request may be input. In Car – 4 – U, a specific feedback message is displayed when an action has been completed by a user. For example, in the administrator mode, after adding, deleting or modifying any data, a message will be displayed to confirm the operation.

Notifying That A Request Was Not Completed

Feedback is also needed to let the user know that the computer is unable to complete a request. The user can then go back and check to see if the request has been input

correctly. In Car – 4 – U, for example if the user enters invalid login name to enter the administrator mode, a notification will be displayed to inform the user.

4.3.4 Flow of HTML documents in CAR - 4 - U

The main documents in CAR - 4 - U are all linked so that, users can accesses them easily. However, the administration pages are only accessed if the user has a valid user name and password.

The flow of documents is shown in Figure 4.12 in the next page.

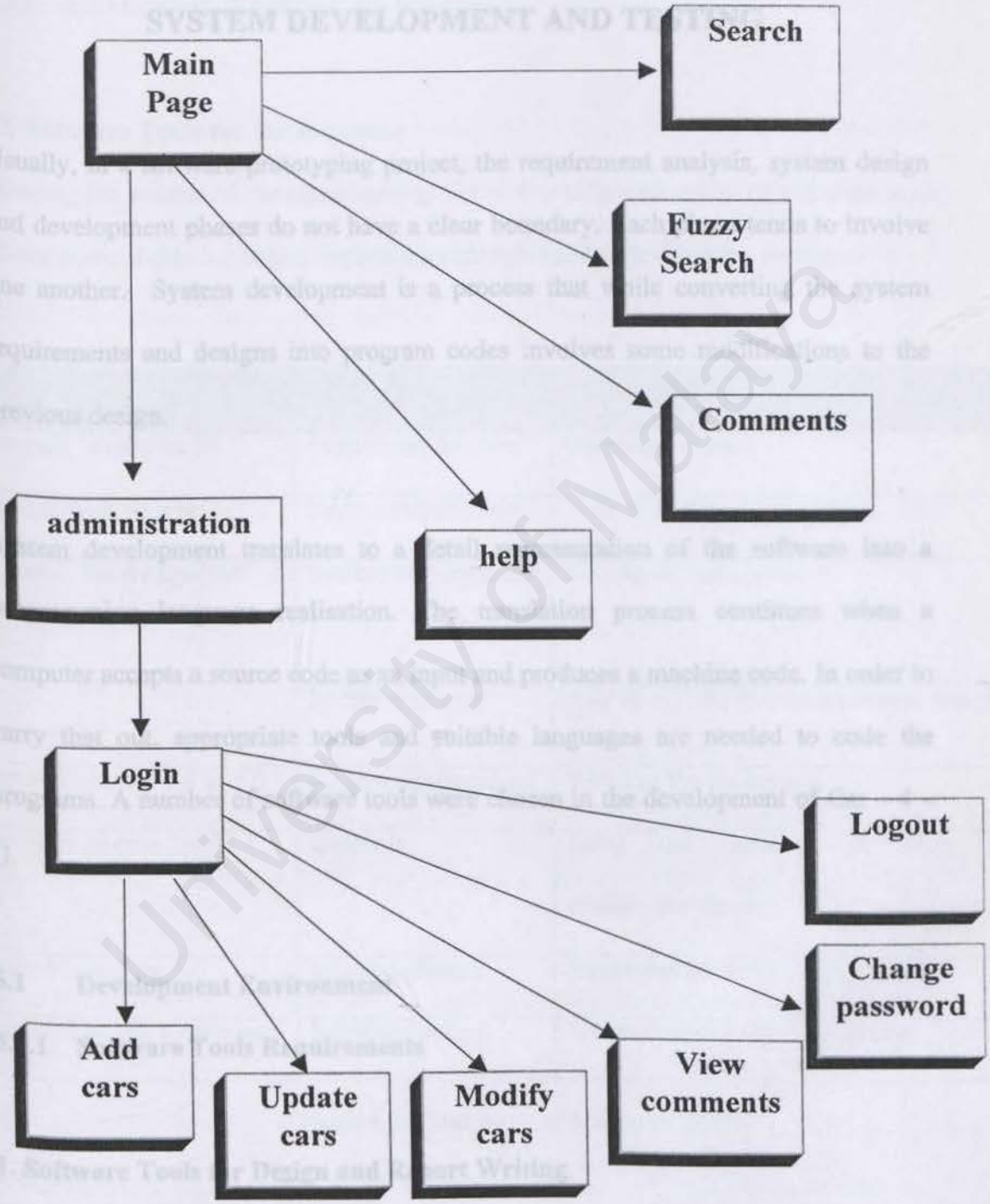

Figure 4.12: Web page that can be linked from all web pages

CHAPTER 5

SYSTEM DEVELOPMENT AND TESTING

Usually, in a software prototyping project, the requirement analysis, system design and development phases do not have a clear boundary. Each phase tends to involve one another. System development is a process that while converting the system requirements and designs into program codes involves some modifications to the previous design.

System development translates to a detail representation of the software into a programming language realisation. The translation process continues when a computer accepts a source code as an input and produces a machine code. In order to carry that out, appropriate tools and suitable languages are needed to code the programs. A number of software tools were chosen in the development of Car – 4 – U.

5.1 Development Environment

5.1.1 Software Tools Requirements

1. Software Tools for Design and Report Writing

The design process involves the drawing of structure charts, data flow diagrams and other drawings that form the foundation of the software development. The purpose of this graphic based logical design is to provide an overall view of the system and

interconnection between the modules. The tools used here are Microsoft PowerPoint 2000 and Microsoft Word 2000 for Windows.

2. Software Tools for Development

During the course of development for Car – 4 – U, a vast array of software tools were used. Table 5.1 below depicts the software used to develop the system.

Software	Module	Description
Microsoft Windows 95	System requirement	Operating system
Personal Web Server	System requirement	Web Server host
Microsoft FrontPage2000	System development	Coding the homepages
	Interface design	ASP & HTML document layout design.
Internet Explorer 5.0 or 5.5	System development	Viewing the homepage
Microsoft Access 2000	Database	Build the database to store and manipulate the data
Adobe Photoshop 5.0	Interface design	Image design and manipulation
Microsoft Image Composer	Interface design	Image design and manipulation

Table 5.1: Summary of Software Used

5.2 Development of Car – 4 – U

5.2.1 Web-pages Development

Although Car – 4 – U is classified as a web application, all its information are still being coded into HTML and ASP document before being presented to the browser. Languages used to develop the document are HTML and VBScript. Server-side scripts are inserted into these documents to allow server-side processing. Client-side scripts are written mostly to perform validation on text input by user.

The challenge of coding in ASP, VBScripts and HTML is of determining and separating the HTML source code from the scripting counterpart. For client-side scripting, they must be delimited by the <SCRIPT>...</SCRIPT> tags. For server-side function scripting, the RUNAT parameter must be set to Server so that the client-scripting engine doesn't execute it. Scripting delimiters <%...%> is also used for server-side execution. Codes located within these delimiters are invisible to the client and are only executed in the server, hence its name server-side scripting.

To create images and animated graphics, Adobe Photoshop 5.0 and Microsoft Image Composer were used.

Preparation of a HTML and ASP document involves an endless cycle of testing and modifying the ASP source codes, loading of the file in the browser for viewing and validating; then going back to make further changes where necessary. As listed

above, two tools are used for preparation for these documents. The reason two tools were used was quite unintentionally and will be highlighted in the next section.

JavaScript was used for form validations and animations in Car – 4 – U.

- **Microsoft FrontPage 2000**

Microsoft FrontPage 2000 was used as the software for development of Car – 4 – U. There were many features in FrontPage 2000 that benefited in the development phase. The database file was easily imported into the FrontPage explorer; therefore database retrieval and storage could be done easily. In FrontPage editor, forms were created using the features provided. Inserting images and background for the interface were easily done in the editor.

FrontPage2000 also allows asp files to run provided they are kept in the executable folders and named with asp extension. Basically, FrontPage2000 is an easy-to-use software with an ability to create large, interactive web sites that uses database integration. FronPage2000's inability to debug applications was not a problem since Car – 4 – U does not consist of pages with thousands of lines of codes. Therefore, error messages were corrected immediately by looking at the line it occurred.

Creating a web site using FrontPage2000 is not a complicated task since it has all the necessary features to facilitate in the designing process.

5.2.2. Coding Approach

Good programming skills produce a reliable and easy to maintain system. A good coding style always requires :-

1. Readability

The source code should be able to be read by other programmers and also non-programmers without any difficulties. This requires :-

- Selection of identifier (variables and labels name)
- Composition of comments
- Organisation of the overall program

2. Good Naming Technique

This means that names given to variables, controls and modules should provide for easy identification for the programmer. The naming convention should be created with coding consistency and standardization in mind.

3. Internal Documentation

Internal documentation contains information directed at someone who will be reading the source code of your programs. Thus, summary information is provided to identify the program and describe its data structures, algorithms and control flow. Usually, this information is placed at the beginning of each component in a set of comments called the header comment block.

An example of header comment block is attached in the appendix. It is written in the sample source code for random function.

Coding in Car – 4 – U provides an internal documentation so that other programmers easily understand the codes.

4. Modularity

In a modular design, the components have clearly defined inputs and outputs, and each component has a clearly stated purpose. Thus, it is easy to examine each component separately from the other to determine whether the component implements its required tasks. Moreover, modular components are organized in a hierarchy, as a result of decomposition or abstraction, so that we can investigate the system one level at a time. For these reasons, we try to design our software so that it is as modular as possible.

Components are said to be arranged in different levels of abstraction. The levels of abstraction help us to understand the problem addressed by the system and the solution proposed by the design. By examining the levels from the top and working down, the more abstract problems can be handled first and their solution carried through as the detailed description is generated.

Modularity also hides details. An advantage of this information hiding is that each component hides a design decision from others. Thus, if design decisions are likely

to change, the design as a whole can remain intact while only the component design changes.

Abstraction and information hiding allows us to examine the ways in which components are related to one another in overall design. We strive in most designs to make the components independent of one another.

To recognise and measure the degree of component independence in a design, we use two concepts: coupling and cohesion.

Coupling

We say that two components are highly coupled when there is a great deal of dependence between them. Loosely coupled components have some dependence, but the interconnections among components are weak. Uncoupled components have no interconnections at all; they are completely independent.

Cohesion

In contrast to measuring the interdependence of components, cohesion refers to internal "glue" with which a component is constructed. The more cohesive a component, the more related the internal parts of the component are to each other and to its overall purpose. In other words, a component is cohesive if all elements of the component are directed toward and are essential for performing the same task.

5.2.3 Coding Style

Coding style is an important attribute of source code and it determines the intelligibility of a program. An easy to read source code makes the system easier to be maintained and enhanced. The elements of style include internal (source code level) documentation, method for data declaration and approach to statement construction.

The following lists down some of the styles used during the coding of Car – 4 – U :-

1. Selection of meaningful identifiers (variables and labels) name.
2. Description and appropriate comments, written in the source code.
3. Indentation of codes increases the readability of source code.

5.3 System Testing

Testing is performed to ensure that the programs are executed correctly and conforms to the requirements specified. It provides a method to uncover logic error and for testing system reliability. The strategies used for testing are unit testing, integration testing and system testing.

Validation

System testing validates the requirements. Validation ensures that the system has implemented all of the requirements, so that each system function can be traced back to a particular requirement in the specification. That is, validation makes sure that the developer is building the right product (according to the specification).

Verification

System testing also verifies the requirements. Verification ensures that each function works correctly. Verification checks the quality of the implementation.

For Car – 4 – U, in general 3 types of testing are performed:-

- Unit Testing
- Integration Testing
- System Testing

5.3.1 Unit Testing

Steps taken in unit testing:-

1. First, examine the code by reading through it, trying to spot algorithm, data, and syntax faults. You may even compare the code with the specifications and with your design to make sure that you have considered all relevant cases.

2. Next you compile the code and eliminate remaining syntax faults.

3. Finally, you develop test cases to show that the input is properly converted to the desired output.

In unit testing, we examine each of these steps one at a time.

During the unit testing phase of Car – 4 – U, all small or big functions and subroutines were tested to check for coding or logical errors. The three basic steps stated above were followed during the unit testing of Car – 4 – U.

5.3.2 Integration Testing

In Car – 4 – U, this strategy involves combining modules one by one, that is using the incremental integration approach. Therefore, the system that is constructed is tested in small segments where errors are more likely to be tested completely because they are easily isolated and corrected and a systematic test approach may be applied. Moreover the interfaces are more likely to be tested completely too.

5.3.3 System Testing

System testing is actually a series of different test whose primary purpose is fully exercising the computer-based system. System testing is to ensure that the system is functioning well under a larger system. Performing system testing on Car – 4 – U was to ensure that all system elements have been integrated and perform the functions as required.

System Testing Process

There are many steps in testing a system :

1. Function testing
2. Performance testing
3. Acceptance testing
4. Installation testing

A function test of Car – 4 – U checks that the integrated system performs its functions as specified in the requirements. For example, a function test of fuzzy search verifies that the search function lists out all the matching cars and links to the details.

Performance test of Car – 4 – U compares the integrated components with the non-functional system requirements, including security, accuracy, speed and reliability.

An acceptance test was done to make sure that the system meets users understanding of the requirements, which may be different from the users. For Car – 4 – U, some of my friends were asked to test the system, so that they can give their opinion regarding the system.

At the moment, installation test could only be carried on the localhost, since Car – 4 – U is not published on the Internet. The users were asked to test the system as an

online search system. This final test is done to ensure that the system is working without flaws on the actual site.

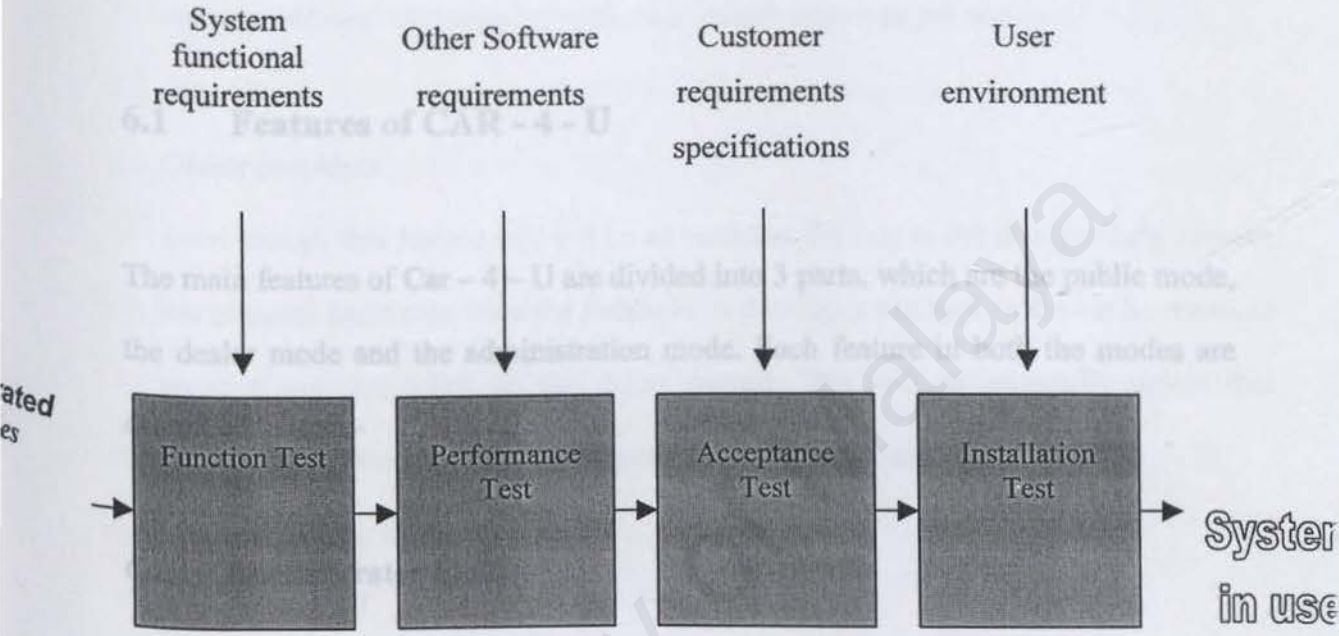

FIGURE 5.1 : Steps in testing process

CHAPTER 6

SYSTEM DESCRIPTION

6.1 Features of CAR - 4 - U

The main features of Car – 4 – U are divided into 3 parts, which are the public mode, the dealer mode and the administration mode. Each feature in both the modes are described below :-

6.1.1 Administrator Mode

Login

At the main menu of the administrator interface, there is a login button that is necessary for a user to gain access to the module. Therefore, an authorised user has to fill in a login name and a password to enter the module.

Update existing data

Whenever there is a need to update existing data, a developer can select any particular car's data and modify it. Besides that a user can also update its specifications and characteristics by filling in the appropriate fields in the form.

Add a new car

A developer can also add new cars in the database, since Car – 4 – U has the flexibility to do that. There is a particular from which the developer needs to fill in order to add new cars together with their specifications as per required.

Delete cars/data

Even though this feature will not be as useful as the others but it might help remove unnecessary car's data from the database. A developer can type in the car he wants to remove and then click on the delete button. This will automatically delete that particular car from the database together with all the details relevant to it.

View Feedback

There is a feature in the public user module where the users can fill in their feedback regarding Car – 4 – U and suggest any recommendations as to the service provided by the website. In order to view all feedbacks, a developer can click on the feedback button and the details can be seen in tabular form. From here the developer can enhance the system if necessary.

Change password

To ensure integrity, a password needs to be changed from time to time. A developer can change his/her password anytime whenever necessary. This can be done by filling in a form where particulars like login name, old password and new password will be required. By submitting all these details a user can easily login using a new password.

6.1.2 Dealer Functions

Login

At the main menu of the dealer interface, there is a login button that is necessary for a dealer to gain access to the module. Therefore, an authorised user has to fill in a login name and a password to enter the module.

Update existing data

Whenever there is a need to update existing data, a dealer can select any particular car's data and modify it. Besides that a dealer can also update its specifications and characteristics by filling in the appropriate fields in the form.

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6.1.3 Public User Functions

Search

A user is able to search for his or her particular car by keying in a particular keyword in the search text box and then clicking on the submit button. The system will soon provide the fill list of details for the closest match as requested by the user. A user can either key in using uppercase or lowercase letters. If the cars typed in are not in the database, the system will notify the user about it.

Fuzzy Search

If a user is not quite sure of the model or specifications of a particular car, they need not to worry since Car – 4 – U has a special feature which helps the user to search the data by just keying in the first few characters. With this the system will list down all the cars starting with those letters. All these cars will have hyperlinks to the results page. In the results page, users can view the details of the car selected.

Random

The random button will allow a user to select a car from the database randomly. It can be any car that is available in the database. What a user need to do is just click on this button and a page with a randomly chosen car together with its details will be displayed.

Feedback

A user can evaluate the system by clicking on the feedback button on the main screen and by filling in a form that requires only the user's e-mail and the comments. Users can also suggest way to further improve the search or even the layout and display of the site. The feedback form has the particulars below:-

- **Comments**
- **Email**

It is important for the users to fill in the entire fields name and email because there might be a need to contact the particular person if more details are required regarding his or her suggestions.

6.2 System Strengths

1. Speed of rapid development.

Car – 4 – U was developed in about three months. In real life, speed rapid development is important because systems that usually require a gestation period to develop may be outdated even before it is ready to be used.

2. Windows Platform

Browser used to run Car – 4 – U is Internet Explorer 5.0. It is a compatible browser to run under the Windows operating system. Windows platform is the most popular operating system used by most people (about 80% of PC users). Thus, Car – 4 – U can be accessed by most people provided they have Internet Explorer installed on their machines.

3. User Friendly Interface

Car – 4 – U has a very user-friendly interface. It is easy to use even by inexperienced users. All the features are labeled in the simplest way possible, so that users will not be left wondering about the use of each feature. With interesting icons and titles

describing each feature, users will find Car – 4 – U an interesting search system to use.

4. Ease of control and manipulation.

Since Car – 4 – U uses a frame approach, it is easy to use and control each feature. Users can easily choose an appropriate way to search.

5. Minimal keyboard and spelling skills required.

There are multiple ways of searching in Car – 4 – U. If users do not know the exact details of the car they are looking for, they can use the fuzzy search option. Users can also search without typing even a single character. They can get whatever they are looking for by just clicking on appropriate links.

6. Case Insensitive.

Users are allowed to search with lowercase letters, uppercase letters or a mix of cases. The database will be able to find the matches, regardless of the case typed in.

7. Consistency

The menu for the features are always on top, therefore it provides consistency. Besides that, Car – 4 – U also uses a standard background for all the pages and also a similar table for displaying the details. With this, users will not be confused while searching. This will also help users to learn their way about the system in a very short period of time.

8. Online Help

Car – 4 – U also has an online help feature, which can help users if they need any help while using Car – 4 – U. This is an important feature so that Car – 4 – U can be of full use to the users.

9. Security over the web

Since Car – 4 – U is an online search system, security for administrator is an important feature. Therefore Car – 4 – U has a login page for the administrator. Only authorised users are able to access it.

10. Maintenance

Car – 4 – U has an administrator menu, which allows administrator to add new data, update existing data and delete any unwanted data. All these can be done without accessing the database because all these changes are allowed in the interface. Administrator need not worry to perform these entire tasks since they can be done in a very simple way. For example, to delete and modify any data, the particular data can be selected on the interface itself.

In this case, administrators are not required to provide data ID field, before they can delete or update. This causes an inconvenience, as they have to view the data to know the data ID. Since administrator can update the database, Car – 4 – U will be an up-to-date and current database.

11. Consist of most common features needed in a search system.

Car – 4 – U has many important features embedded into one system. This eliminates the need to use many different search engines. Users can select many options to search. Furthermore, Car – 4 – U has a random feature to allow users to select any car randomly from the database. This is suitable if users are unsure as to what car they are looking for.

12. Contact Person

Users can contact the administrator by filling in the feedback form. So, Car – 4 – U allows communication between users and developer. This is certainly important, if users would like to inquire something about Car – 4 – U.

6.3 System Limitations

1. Speed of data retrieval

Since Car – 4 – U is an online system, sometimes data retrieval can be very slow, depending on the accessibility of the server. Therefore, sometimes it can take some time to search for a particular car.

2. Web Browser

Only Internet Explorer, version 5.0 and above can be used as the web browser for the system. This is because of the inability of other web-browsers in displaying ASP codes or pages.

3. Limited Graphic Illustrations

Sometimes, users will understand the system better if graphical illustrations or even photos of the vehicles were provided. Since, Car – 4 – U only provides a tabular form of results, it might not be ideal for everyone.

6.4 Future Enhancements

1. Provide illustrations.

Graphical illustrations can be provided with each car so that a user can have a better option of the vehicle.

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Car – 4 – U has a very user-friendly interface. It is easy to use even by inexperienced users. All the features are labeled in the simplest way possible, so that users will not be left wondering about the use of each feature. With interesting icons and titles

describing each feature, users will find Car – 4 – U an interesting search system to use.

4. Ease of control and manipulation.

Since Car – 4 – U uses a frame approach, it is easy to use and control each feature. Users can easily choose an appropriate way to search.

5. Minimal keyboard and spelling skills required.

There are multiple ways of searching in Car – 4 – U. If users do not know the exact details of the car they are looking for, they can use the fuzzy search option. Users can also search without typing even a single character. They can get whatever they are looking for by just clicking on appropriate links.

6. Case Insensitive.

Users are allowed to search with lowercase letters, uppercase letters or a mix of cases. The database will be able to find the matches, regardless of the case typed in.

7. Consistency

The menu for the features are always on top, therefore it provides consistency. Besides that, Car – 4 – U also uses a standard background for all the pages and also a similar table for displaying the details. With this, users will not be confused while searching. This will also help users to learn their way about the system in a very short period of time.

8. Online Help

Car – 4 – U also has an online help feature, which can help users if they need any help while using Car – 4 – U. This is an important feature so that Car – 4 – U can be of full use to the users.

9. Security over the web

Since Car – 4 – U is an online search system, security for administrator is an important feature. Therefore Car – 4 – U has a login page for the administrator. Only authorised users are able to access it.

10. Maintenance

Car – 4 – U has an administrator menu, which allows administrator to add new data, update existing data and delete any unwanted data. All these can be done without accessing the database because all these changes are allowed in the interface. Administrator need not worry to perform these entire tasks since they can be done in a very simple way. For example, to delete and modify any data, the particular data can be selected on the interface itself.

In this case, administrators are not required to provide data ID field, before they can delete or update. This causes an inconvenience, as they have to view the data to know the data ID. Since administrator can update the database, Car – 4 – U will be an up-to-date and current database.

11. Consist of most common features needed in a search system.

Car – 4 – U has many important features embedded into one system. This eliminates the need to use many different search engines. Users can select many options to search. Furthermore, Car – 4 – U has a random feature to allow users to select any car randomly from the database. This is suitable if users are unsure as to what car they are looking for.

12. Contact Person

Users can contact the administrator by filling in the feedback form. So, Car – 4 – U allows communication between users and developer. This is certainly important, if users would like to inquire something about Car – 4 – U.

6.3 System Limitations

1. Speed of data retrieval

Since Car – 4 – U is an online system, sometimes data retrieval can be very slow, depending on the accessibility of the server. Therefore, sometimes it can take some time to search for a particular car.

2. Web Browser

Only Internet Explorer, version 5.0 and above can be used as the web browser for the system. This is because of the inability of other web-browsers in displaying ASP codes or pages.

3. Limited Graphic Illustrations

Sometimes, users will understand the system better if graphical illustrations or even photos of the vehicles were provided. Since, Car – 4 – U only provides a tabular form of results, it might not be ideal for everyone.

6.4 Future Enhancements

1. Provide illustrations.

Graphical illustrations can be provided with each car so that a user can have a better option of the vehicle.

CHAPTER 7

CONCLUSION

7.1 Problems encountered

1 Lack of knowledge in web based applications.

ASP coding

Most of the ASP coding problems was encountered in the early stages of project development. This is because of the ambiguity and initial lack of understanding of the language. As the project developed, a better understanding of most of the ASP coding was obtained and problems encountered in the early stages were solved easily.

2 Matters concerning security over the web.

Car – 4 - U has to emphasise on the security aspect of the Internet since it is a web-based system. Learning about this caused delay in preparing the system.

7.2 Solutions to problems

1 Books

To learn how to code in ASP, books on ASP and HTML were used. This helped me to understand the ASP commands.

2 Searching on the internet

Some of the web sites referred helped me to gain knowledge on ASP codes and VBScript. Besides that, sites on security helped me on the security aspect of Car – 4 – U.

3 Discussions with supervisor

Through discussions with my supervisor, I learnt the best way to present the information to users.

5. Learn to work independently.

This experience was very different from other assignments, as I had to work independently and all sorts of new tensions were also experienced.

6. Skills in writing documentation.

I gained knowledge of the proper format of documentation.

7. Skill in time management.

I was able to finish the system on time.

7.4 Conclusion

This system was completed successfully with its strengths and limitations as mentioned earlier. Generally, it is a user-friendly system and is easily understood.

Through this system, I understood the software engineering part of a system and this will help a lot in developing future projects.

I am glad that all the way in developing this project, my supervisor was always there to give me guidance from time to time.

APPENDIX E

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