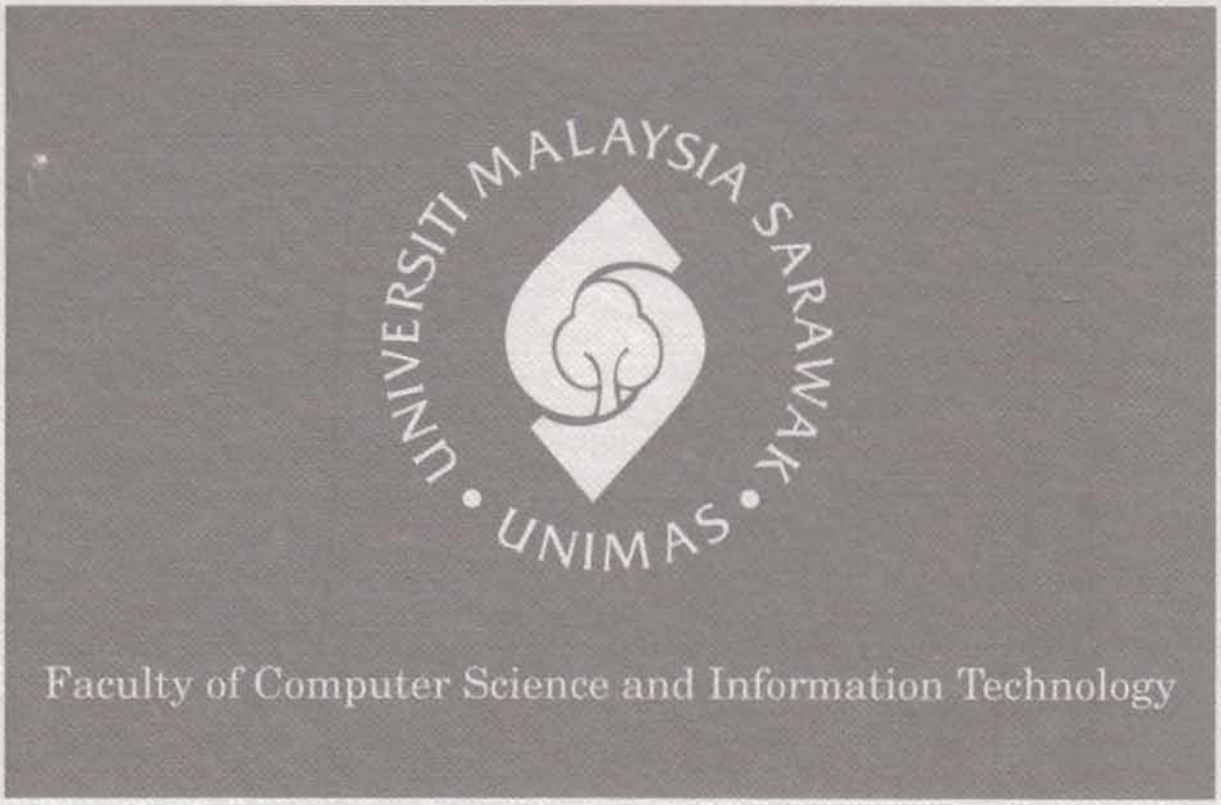

UNIMAS e-TRAFFIC SYSTEM

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Bachelor of Computer Science with Honours
(Software Engineering)
2006

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

UNIMAS e-traffic system is developed to computerize the manual system for applying vehicle sticker. UNIMAS e-traffic system is used by administrative assistants at the Security Division in UNIMAS to set and generate stickers' serial numbers as well as manipulate the information of applicants such as staff, visitors and students. Moreover, they will also know which stickers assign to whom and view the photos of applicants. Besides, UNIMAS's map also include in a system to allow administrative assistant to see the zones in temporary campus. In addition, the pictures of type of stickers and sign boards also include in the system. Sticker renewal can also be done automatically by using the system.

This system aims to provide better solution by using a computerized system and an efficient and systematic management environment within the Security Division. With this system, it helps the administrative assistants to save their time and increase their work performance. They can store the data in systematic ways and retrieve the data easily. Furthermore, the use of physical storage space for keeping records, files and documents can be reduced where all the records are stored at the database of the system. Hence, the system streamlines the operation at Security Division.

ABSTRAK

Sistem e-trafik UNIMAS dibangunkan untuk menukarkan proses permohonan pelekat kenderaan secara manual kepada sistem pengkomputeran. Sistem e-trafik UNIMAS digunakan oleh pentadbir di unit keselamatan di UNIMAS untuk menetapkan dan menghasilkan nombor siri pelekat kenderaan di samping memanipulasi data pemohon seperti staf, pelawat dan pelajar. Selain itu, mereka juga akan mengetahui pemilik pelekat kenderaan masing-masing dan melihat gambar foto pemohon. Peta UNIMAS dengan zon-zon sekali juga akan dipamerkan dalam sistem untuk memudahkan pentadbir merujuk zon-zon yang terdapat di kampus sementara. Tambahan lagi, gambar-gambar jenis pelekat kenderaan dan petanda jalan juga dipamerkan dalam sistem. Pembaharuan pelekat kenderaan juga boleh dilakukan secara automatik dengan menggunakan sistem ini.

Sistem ini bertujuan untuk menyediakan penyelesaian yang lebih baik dengan menggunakan sistem pengkomputeran dan persekitaran yang lebih efisien dan sistematik di unit keselamatan. Dengan adanya sistem ini, ia membantu pentadbir untuk menjimatkan masa dan meningkatkan pencapaian kerja. Mereka boleh menyimpan data secara sistematik dan data boleh dicapai dengan mudah. Penggunaan penyimpanan data secara fizikal, fail-fail dan dokumen-dokumen dapat dikurangkan kerana semua data akan disimpan dalam pangkalan data sistem tersebut. Kesimpulannya, sistem ini mampu meringkaskan proses operasi di unit keselamatan.

CHAPTER 1: INTRODUCTION

1.1 Introduction

As the world moves towards the technology era, many tasks and duties are completed electronically. The idea to develop UNIMAS e-traffic system emerged because of recurrent issues that appear at security division in UNIMAS. Everybody who wishes to enter UNIMAS campus needs to register their vehicle as their permit. This is one of the rules in UNIMAS and must follow to ensure there is no trespassing and for public safety guide. Hence, the staff, students and visitors need an effective way to register vehicle stickers and administrative assistants at security division need a computerize system to manage and organize the vehicle sticker registration records efficiently.

1.2 Problem Statement

There are several drawbacks of the traditional method which is the manual system currently used by the security division. The usual process to apply for vehicle sticker is that applicants need to go to the security division to get a form and fill it. After that, they have to submit the form together with photocopy matric card, employee card or identity card, insurance policy or green card and driving license. The administrative assistant will verify it and keep it in a file. After two years, they once again need to go to security division and renew their vehicle stickers, the administrative assistant need to search through various files on the shelves in order to find their information and it is time consuming. This will affect the applicants especially the students because some of them may miss their class when they try to get the new stickers as the operation at the security division is done during office hours only.

With increasing number of students' intake every year, the number of applicants for vehicle stickers will also increase. The number may increase to thousands and this will create problem if current manual system is being used. Therefore, a smart and flexible system where record can be viewed, retrieved and saved automatically must be developed. If the system is computerized, the process of updating records can be done easily and will not require a lot of physical space to allocate all applicant records in the office. Moreover, sometimes by using the manual system, the records of applicants will get lost and will have no other back up.

Because of all the problems mentioned above, the initiative was taken to build and develop a new system that is more efficient, accurate and systematic and thus give more satisfaction to the administrator who uses the system and applicants for vehicle stickers.

1.3 Objectives

- Create a computerize system for stickers application.
- Accomplish the prototype and report.
- Create a computerize system for administrative system to view UNIMAS temporary campus map, types of stickers and sign boards.

1.4 Methodology

In this UNIMAS e-traffic system project, the methodologies that will be adopted to develop this system are the incremental model and the waterfall model. The incremental model divides the system functionalities into several series of increments which are developed one at a time. After the completion of all the increments, the system can be validated as a fully functional system. The waterfall model is a systematic and sequential

approach to system development that begins at the system requirements and progresses through analysis, design, building, and testing (BrickRed, 2004).

Therefore, the incremental model is used to develop the increments one at a time where each increment is completed by using the waterfall model. The UNIMAS e-traffic system is divided into twelve increments, which are login module, main menu, setup master file, setup specification, generate sticker serial numbers, vehicle sticker application, sticker renewal, report of sticker's distribution, keep track applicants' record and lastly view UNIMAS's map, type of stickers and sign boards. The process of developing the system is shown in the following Figure 1.1.

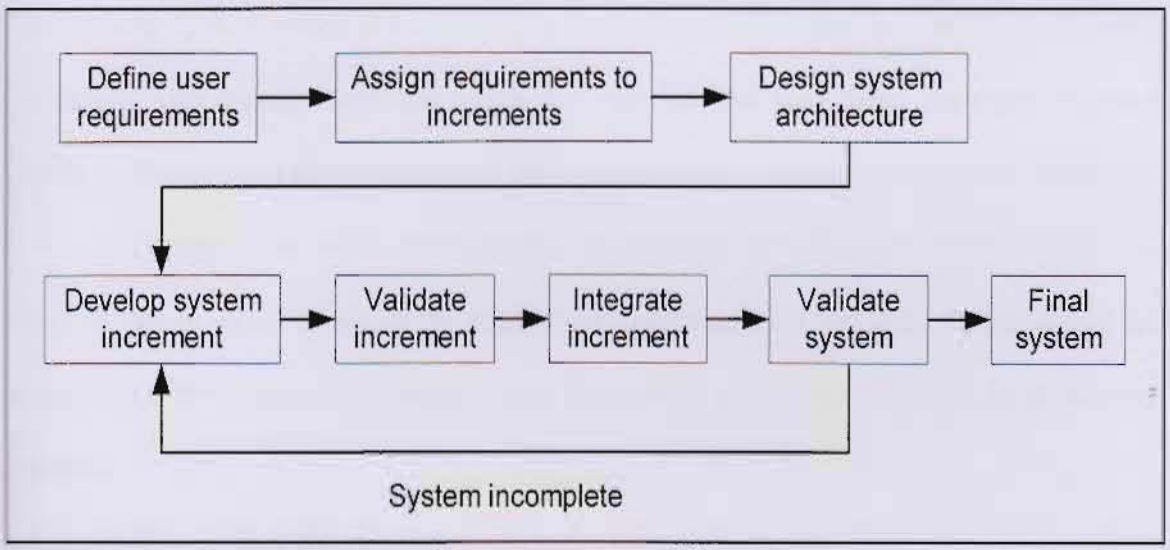

Figure 1.1: Incremental Model of the System Development (Sommerville, 2000)

By dividing the system into increments, it can be easily managed. Besides, it helps to manage the risk by spreading the risk across successive increments (BrickRed, 2004).

1.5 Project Scope

The e-traffic system of UNIMAS will be built for system administration at security division only which is situated at UNIMAS temporary campus. The functions of system consist of searching and modifying students, staff and visitors information. The

administrative assistant will be able to set the specification for the stickers and generate the stickers' serial numbers for particular session. Besides, the administrative assistant can also add the user who has bought the vehicle sticker to enable them to enter UNIMAS campus automatically in the database. In addition, the system also allows the administrative assistant to help the students, staff and visitors renew their vehicle stickers after two years. Lastly, the system will be able to produce report and display the pictures of stickers and sign boards as well as the UNIMAS temporary campus map for administrative assistant to view.

1.6 Significant of Project

The e-traffic system which is a stand alone application will make the traffic management job easier. The management can check the vehicles that have been registered without having to search from files to files and from page to page. The system can also ensure the data are accurately recorded. Furthermore, the security division of UNIMAS will also eliminate the problem of losing the road users' information. Therefore, it simplifying the process and workflow, thus reduce time for overall processes involved in a security division.

1.7 Project Schedule

This project is divided into two phases to complete the entire related chapter that is starting from Chapter 1 until Chapter 7.

During the first phase, first two chapters need to hand in, which are the Introduction and Background, as an interim report. For the second phase, it includes Chapter 3 to Chapter 7.

The project planning started from the proposal until closure of the project. It is, however based on estimated time. The overall duration for this project takes up about one year. The start date of this project is 28th of March 2005 while the finish date is estimated to end at 7th of April 2006. The timeline is broken down into many phases so that each task can be done efficiently. Refer to **Appendix A** for the project schedule.

1.8 Expected Outcome

After the completion of this system, it is expected the traffic management will save money on printing papers. The use of digital technology has replaced traditional methods of data processing, retrieval and communication.

1.9 Outline of Project Report

Chapter 1 briefly described the problems existed in the current system, the objective of the project, methodology being used, project scope, significance of project, project schedule and expected outcome. Chapter 2 contains reviews of existing systems, which are implemented in other higher learning institutions. Furthermore, an analysis is done to compare the different tools used by these institutions and the results are used as a guideline and reference in developing the UNIMAS e-traffic system. Chapter 3 is concerned of establishing the detailed requirements specification based on the problem statement. Chapter 4 discussed the system design in detail. Chapter 5 and Chapter 6 describe the implementation and report the testing and evaluation of UNIMAS e-traffic system respectively. Finally, Chapter 7 explains the achievements and probable future enhancements for this system.

CHAPTER 2: BACKGROUND

2.1 Introduction

This chapter reviews the features and functionalities of the traffic systems used by different higher learning institutions. Comparison of these traffic systems is done to obtain more appropriate features and functionalities for the proposed system as well as to have better understanding before developing the system. Moreover, reviews of the interface for these systems were carried out to assist in designing the appropriate user interface for the proposed system.

2.2 The Existing System

There are several traffic systems available in the Internet which will help in developing the proposed system. The systems to be reviewed in this chapter are Universiti Kebangsaan Malaysia (UKM) traffic system, Bilkent University Traffic Committee, University of Guelph Parking Services and University of Waterloo Parking Services. These systems were studied because the idea of features and functionalities will become very helpful in implementing UNIMAS e-traffic system. As UNIMAS e-traffic system is also designed for university use, it is appropriate to know how these systems operate. The following subsections will describe each of the existing system in more detail.

2.2.1 Universiti Kebangsaan Malaysia (UKM) traffic system

Universiti Kebangsaan Malaysia (UKM) has a traffic system which allows student and staff members to use it.

Staff and students in UKM are only allowed to register for one vehicle. If they intend to register more than that, they need to get approval from registration department. The users need to download Adobe Acrobat Reader for vehicle registration form to fill in their

particulars for applying vehicle sticker (UKM, 2004). Figure 2.1 shows a snapshot view of vehicle registration.

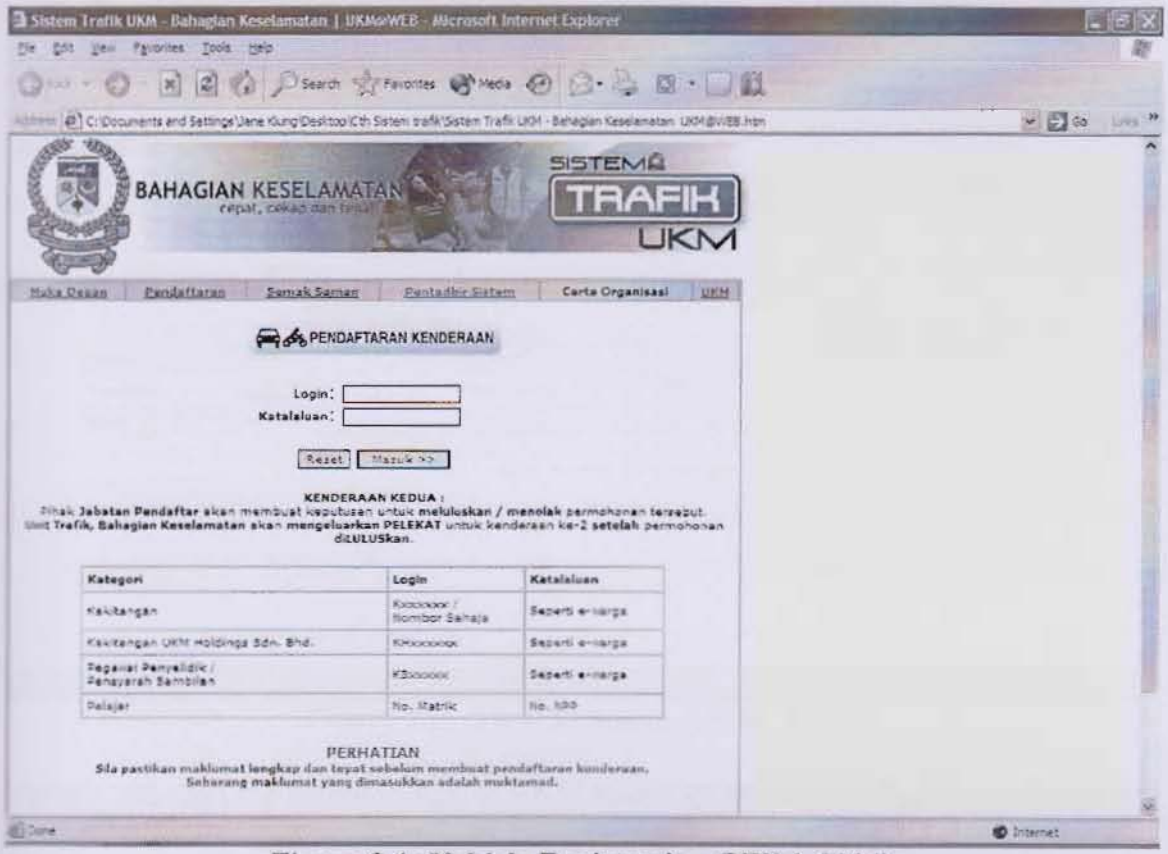

Figure 2.1: Vehicle Registration (UKM, 2004)

The system requires the users to login by entering the specific numbers for staff members and matric number mainly for the students. Besides, they also need to enter the password. This is to ensure only authorized users are allowed to access the website. However, the users can reset if they carelessly enter wrong password or login numbers.

Apart from that, the road users can view summon from the UKM traffic system. The view summon page requires the same security purpose as vehicle registration. That is the users also need to key in their own login numbers as well as password in order for them to view summon. Figure 2.2 shows a login interface for users before they can view summon.

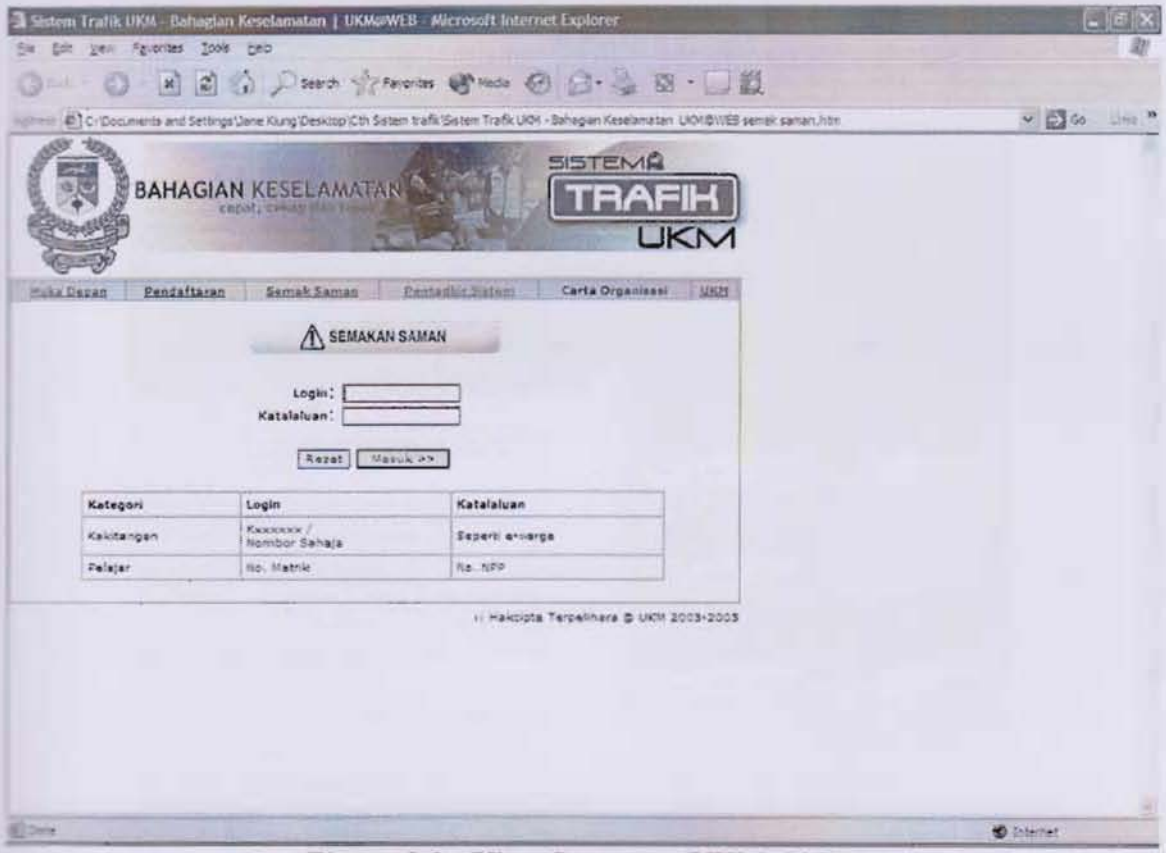

Figure 2.2: View Summon (UKM, 2004)

Overall, although the user interface of UKM traffic system is simple, it is quite organize as the layout of web page is very consistent. The text is organized properly as the important words or phases have been bolded to enable the users to scan through quickly. However, it is not suitable to exhibit all the vehicle stickers at the UKM traffic system home page. It is better to create a new button for vehicle stickers and put all the vehicles stickers in that particular page. Moreover, the vehicle stickers must be labeled to allow the users know what color of sticker is used by student, staff or others. Figure 2.3 shows the first page for UKM traffic system which display all the vehicle stickers.

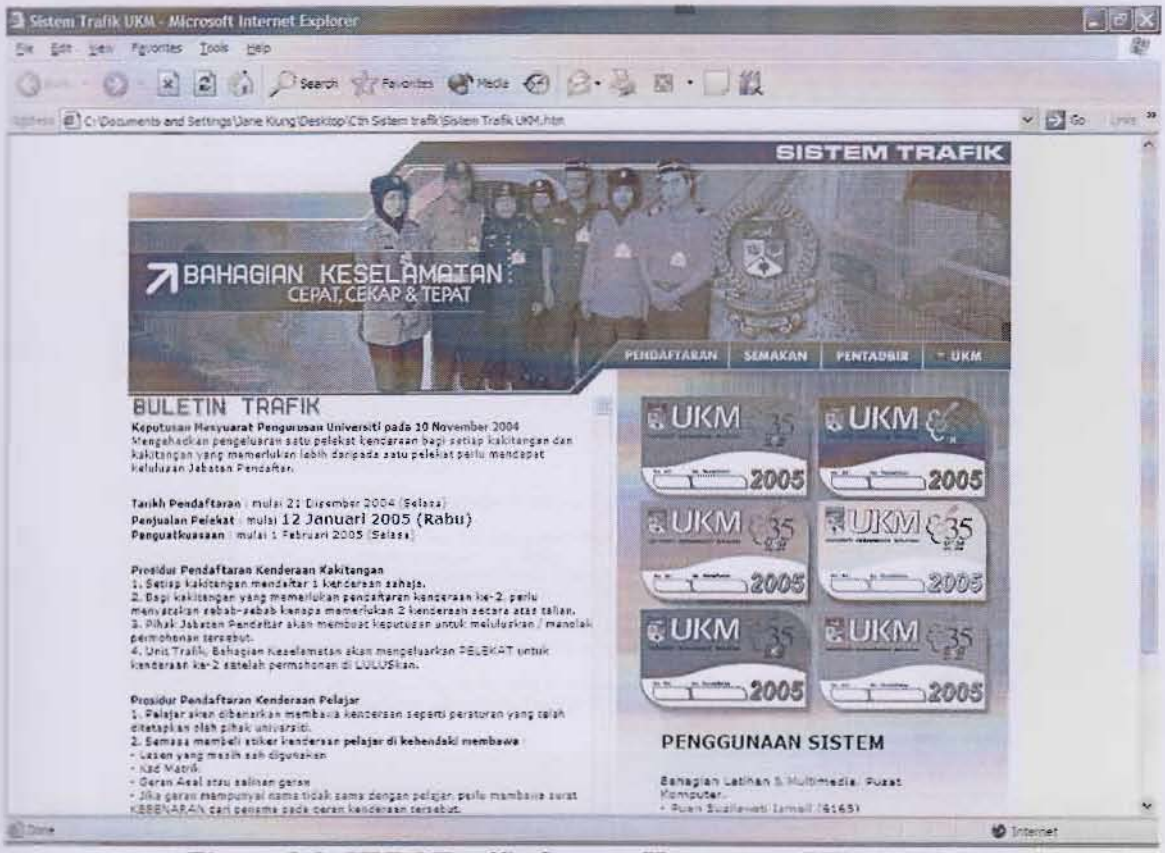

Figure 2.3: UKM Traffic System Homepage (UKM, 2004)

2.2.2 Bilkent University Traffic Committee

Bilkent University has formed the traffic committee with the mandate to ensure a safe and orderly traffic environment on Bilkent campuses for students and staff.

The system enforce the rules of the university which are a set of measures with intended to prevent traffic accidents within campus, provide parking rules to facilitate parking and minimize to the fullest extend possible the factor that lead to the loss of life and property. The students and staff of Bilkent University can view the traffic rules and regulations online as shown in the figure 2.4.

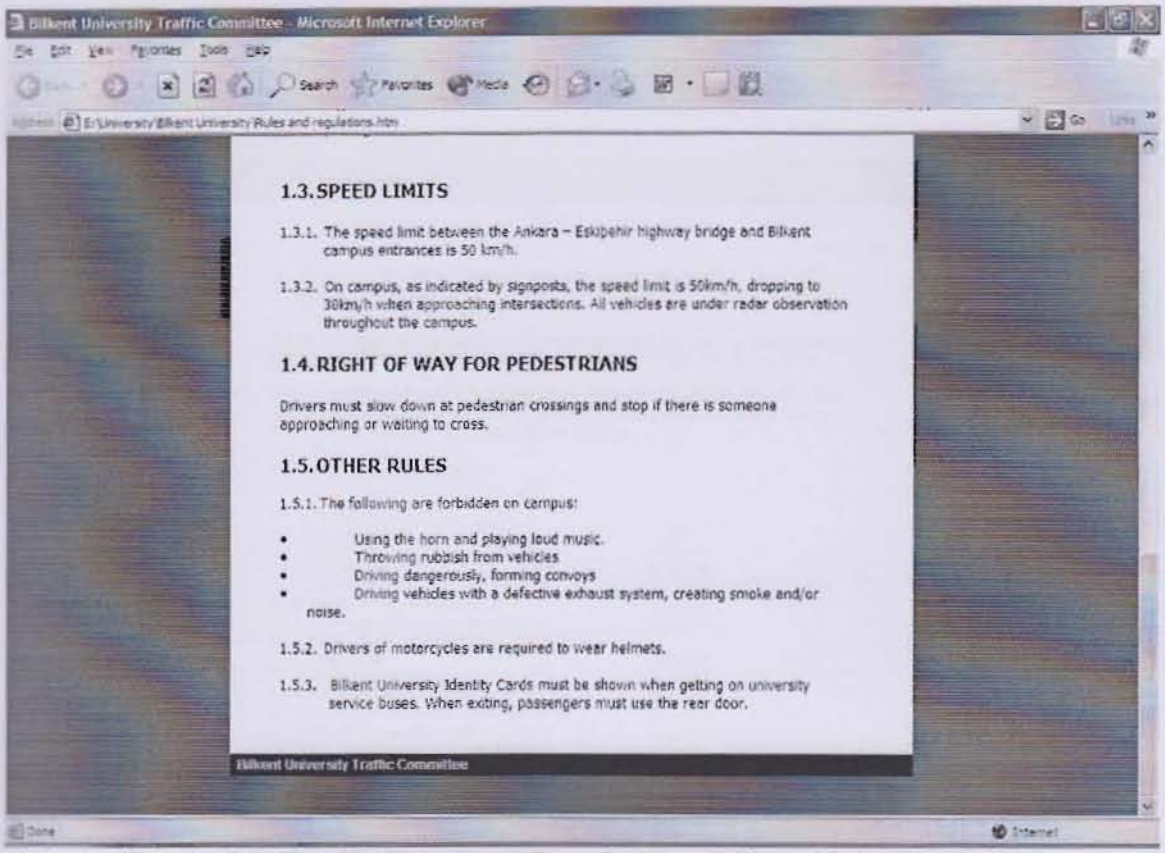

Figure 2.4: Traffic Rules and Regulations (Bilkent University, 2003)

This system also shows the amount of violation points issued to the drivers who fail to comply various types of traffic rules and regulations which has been fixed by the university. The drivers who fail to obey the traffic rules and regulations are subject to the violation points. The points system applies to all vehicles registered with Bilkent University. For vehicles which are not registered with the University, these vehicles may be permanently banned from campus. Drivers reaching a total of 15 or more points in one academic year have their sticker suspended for 3 months. If they reach a total of 15 or more points in one academic year for the second time, their stickers will be suspended for 1 year and for the third time, their stickers will be suspended for a duration not less than 3 years (Bilkent University, 2003). Figure 2.5 is an example of violation points given to road offenders of Bilkent University.

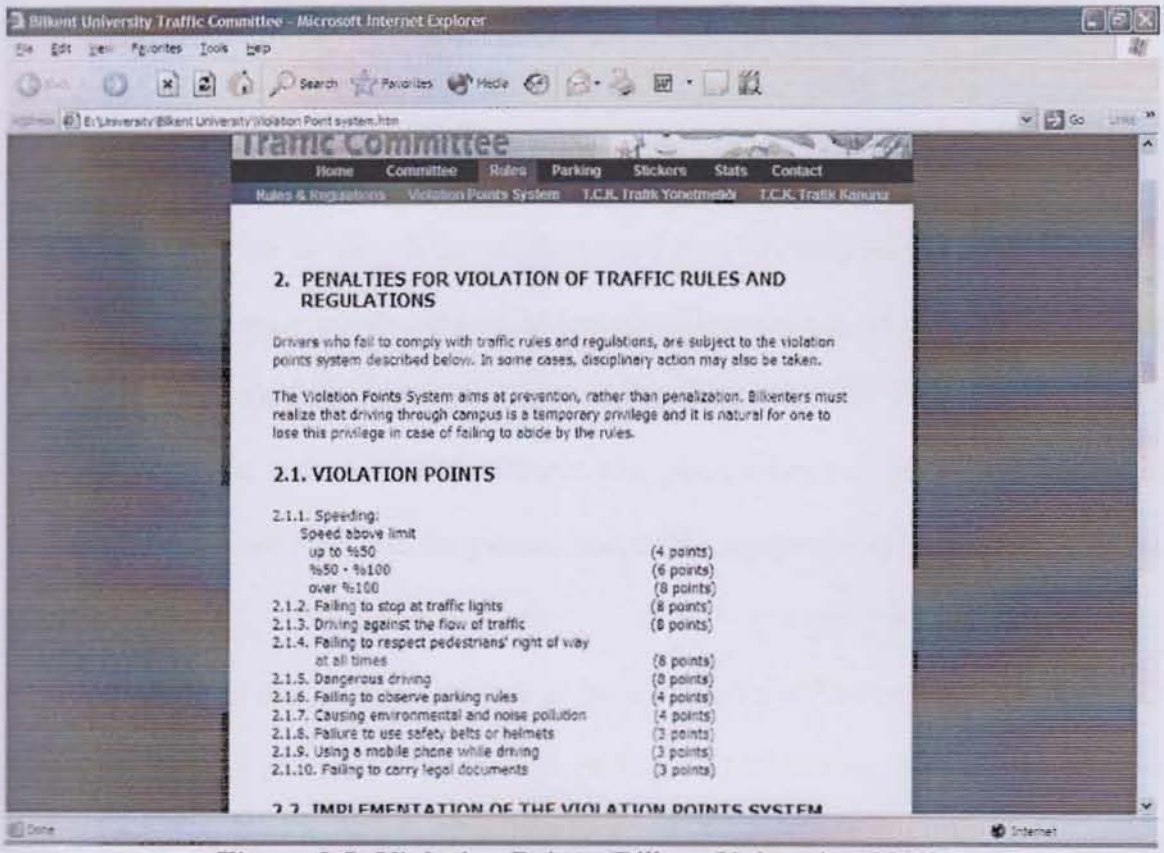

Figure 2.5: Violation Points (Bilkent University, 2003)

Furthermore, this system also allows the users to get to know how to get a sticker for their vehicles. This system does not permit the users to apply the stickers online but only enable users to view the process they need to undergo in order to get a sticker. There are five categories for stickers, namely student, personnel, assistant, alumni and company (Bilkent University, 2003). Although all the five categories of them have the same logo but they have different shape.

Bilkent University Traffic Committee has a nice interface. The buttons and texts are arranged accordingly. The system contains the navigational buttons and links in the same location. Therefore, the system has a consistent interface. It makes every page look organized. Besides, it promotes usability. The link that has been visited will

automatically become green. The important notes also have been bolded. These will attract user's attention as users can scan the pages easily.

2.2.3 University of Guelph Parking Services

The parking service is one of the services used by University of Guelph which is a campus of community police situated in Ontario. The mandate of the parking services department is to manage a multi-facility parking system for the University of Guelph community and its visitors. The department also plays a key role in the formulation of parking policy, procedures and the parking and traffic regulations (University of Guelph, 2003).

This system states that for those to park at the parking lot of University of Guelph, they need to purchase a parking permit through Parking Administration. Besides, the students may purchase permits via mail registration and permits will be mailed to their on campus mail boxes. There are various type of parking permits such as annual commuting permits, annual motorcycle permits and so on (University of Guelph, 2003). University of Guelph charges different prices for different permit type as shown as Figure 2.6 below.

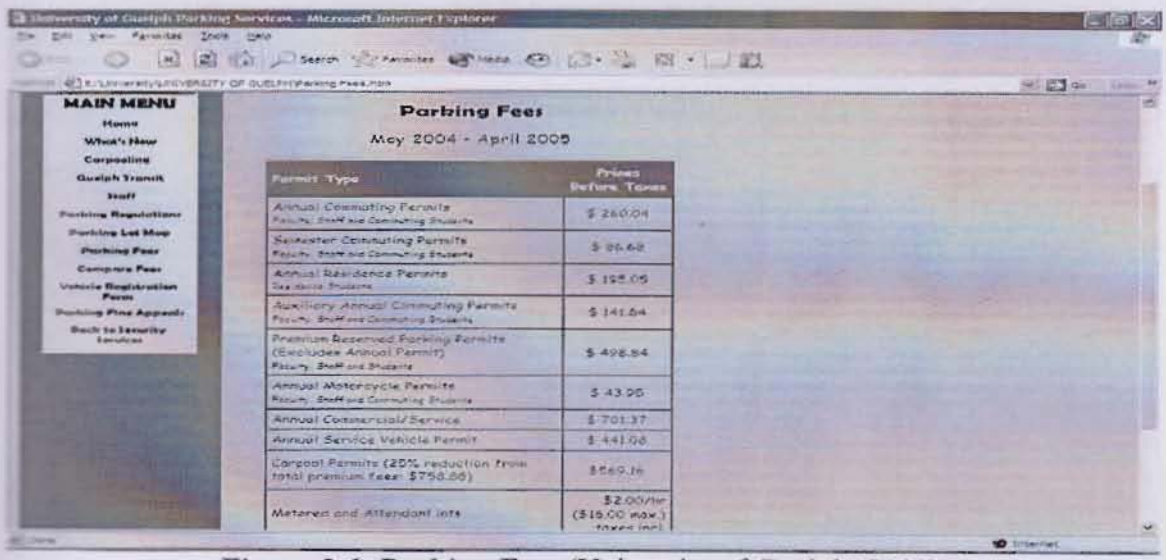

Figure 2.6: Parking Fees (University of Guelph, 2003)

In addition, this university also offers carpooling services. Carpooling programs will help to reduce the number of single occupancy vehicles traveling to campus. A carpool group will consist a minimum of 3 and maximum of 5 people who travel together. The parking permit fees for carpool will be 25% reduction from the total premium fees and they can divide the fees themselves among 3 to 5 people (University of Guelph, 2003). Hence, they can enjoy greater savings for parking permit fees!

Furthermore, this system also has its own parking regulations. It is the responsibility of the owner or operator of a vehicle to comply the regulations. Failure to comply the regulations could result in fine, the payment should be made at the Parking Administration, Trent Building, Trent Lane, University of Guelph within fourteen calendar days of the date the ticket was issued. Parking/Traffic Violation cannot be cancelled except through the prescribed appeal procedure to reduce the fine (University of Guelph, 2003). The parking appeal form is shown as figure 2.7 below.

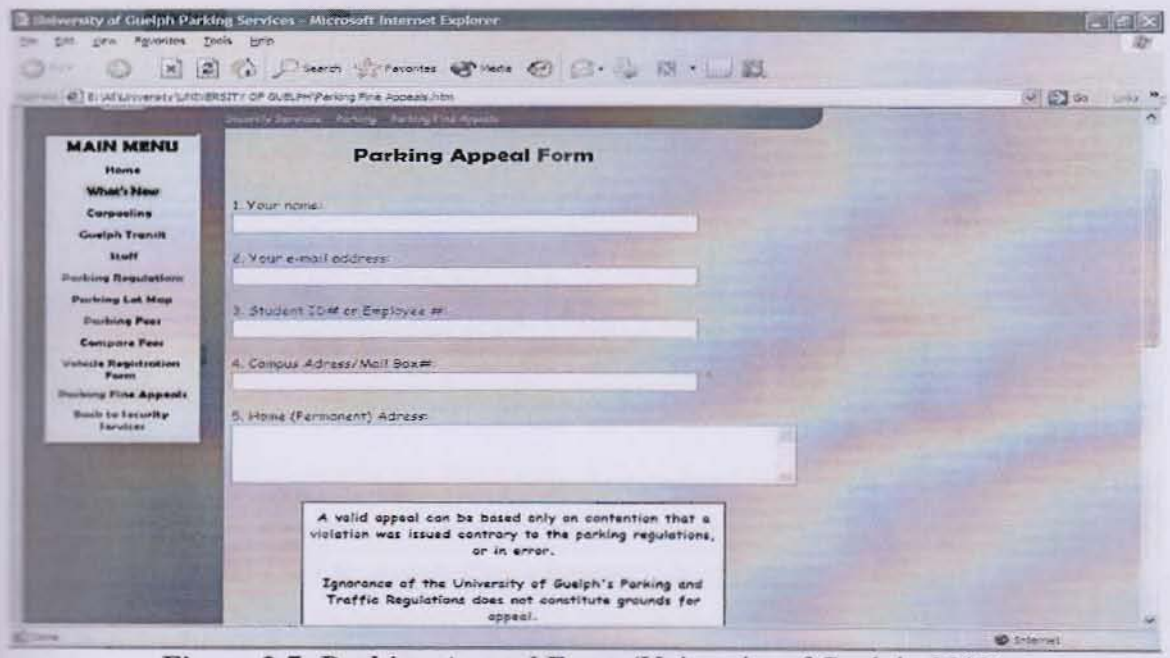

Figure 2.7: Parking Appeal Form (University of Guelph, 2003)

The interface of this system gives a bored feeling to users. It does not have any graphics. Therefore, it does not attract users. Besides, some buttons have link to pages which has more than 10 pages, the users will take long time to read it and maybe they will give up after reading for a few pages.

2.2.4 University of Waterloo Parking Services

The University of Waterloo requires all the undergraduate students, staff or those who bring their vehicles to university to purchase a permit which provides access to parking. The students can use the online application to apply for a permit. The figure 2.8 below shows the permit application.

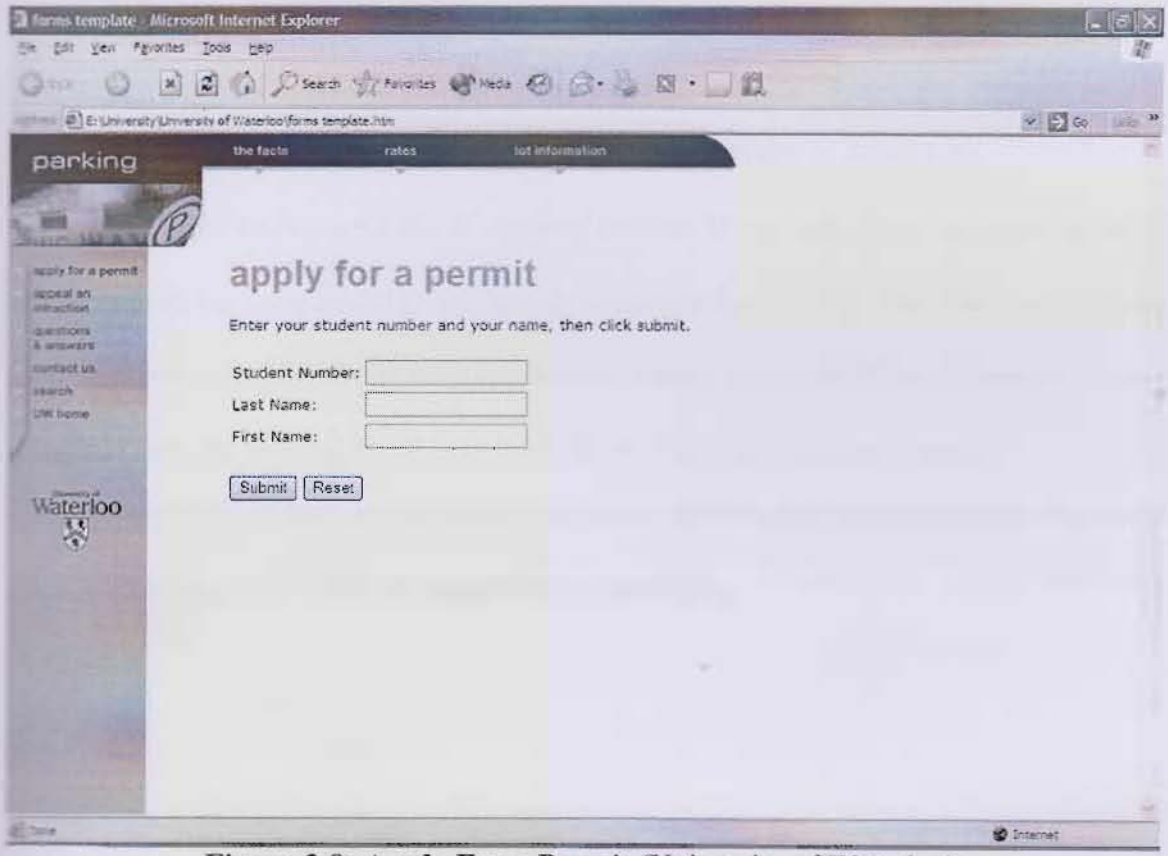

Figure 2.8: Apply For a Permit (University of Waterloo)

The system allows the fines paid within 14 days from the date the citation are issued to receive prepayment discount. Payment and fines must be made at the Parking Services

Office (University of Waterloo). However, if they still want to reduce the fine, they can fill the appeal an infraction form which is available online. Appeal an infraction has been shown at figure 2.9 below.

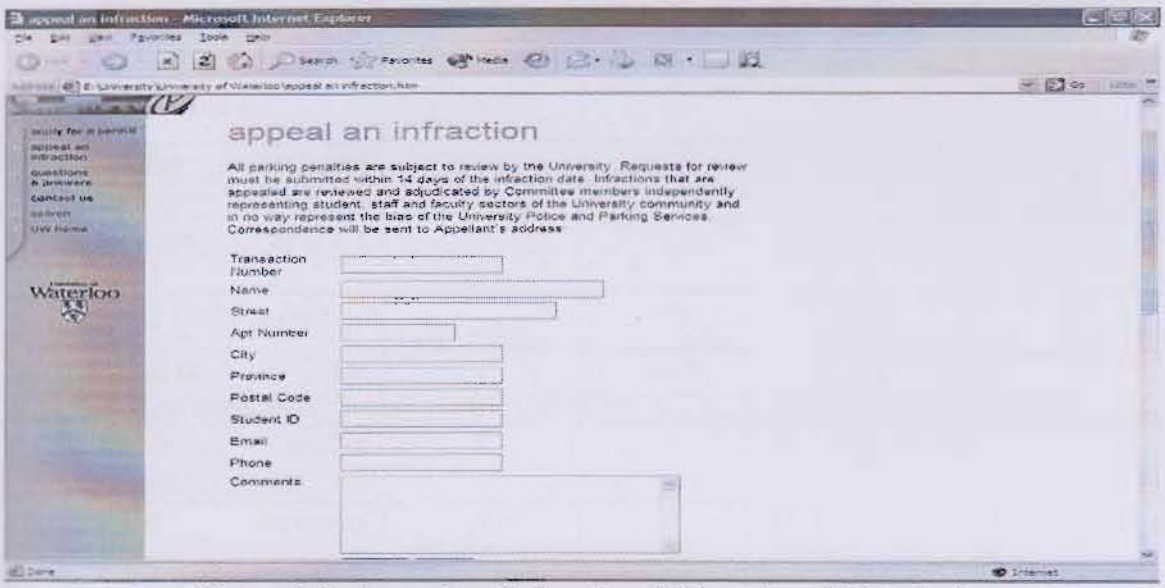

Figure 2.9: Appeal an Infraction (University of Waterloo)

This system also has a questions & answers section. If the users want to know anything about parking but were afraid to ask the administrator face to face, they can type and post their questions. Besides, the system also has the search engine to allow the users to search whatever they are looking for. Figure 2.10 shows a snapshot of search button.

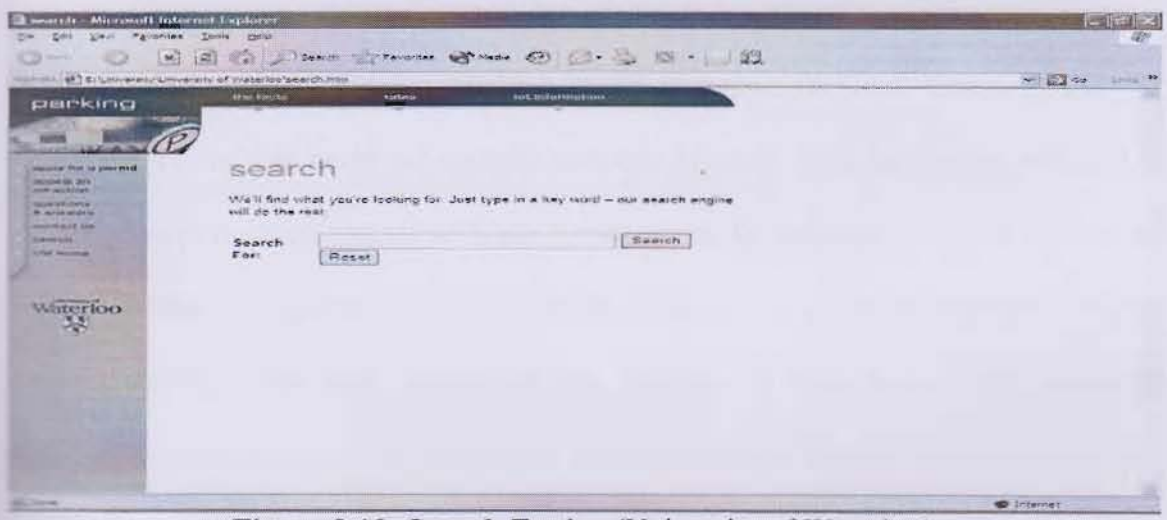

Figure 2.10: Search Engine (University of Waterloo)

2.3 Comparison Features of Review Systems

Table 2.1 indicates the features and functionalities that available in review systems.

	System / Features	UKM traffic system	Bilkent University Traffic Committee	University of Guelph Parking Services	University of Waterloo Parking Services
1	Email/ Contact	√	√		√
2	Viewing rules and regulations		√	√	√
3	Purchasing vehicle's permit			√	√
4	Paying parking fees			√	√
5	Appealing for summon reduction			√	√
6	Vehicle sticker application online	√			
7	Paying summon online	√			
8	Login process	√			
9	Carpooling services			√	
10	Questions & answers section				√
11	Search engine				√
12	Viewing violation points		√		

Table 2.1: Comparison of Features and Functionalities of the Reviewed Existing Systems

From table 2.1, most of the systems have email or contact facilities. Based on analysis done, three out of four reviewed systems have this function. This function is provided to allow the users to communicate with the management. In addition, rules and regulations function is also an important element to display. Hence, it is a common feature of traffic system. Viewing rules and regulations also consists of three out of four reviewed systems. As we know, most of the people infringe the rules because they are unfamiliar of the rules and regulations of their university.

Fifty percent from the surveyed systems have purchasing vehicle's permit, paying parking fees and appealing for summon reduction functions. The universities which have these features are University of Guelph and University of Waterloo. Two of them are oversea universities. The purpose of purchasing vehicle's permit is included in the system is to prevent outsiders from entering the campus. Besides, it is also to ensure there are enough parking spaces for students and staff. Paying parking fees are common for oversea universities and it is intended to recover the costs of maintaining and expanding the facilities such as building more parking lots, repairing the garages' roof and so forth. As for summon reduction, some people might not purposely break the traffic rules. As a result, they can appeal for deducting the fine.

There is only one out of five reviewed systems that offers the features of vehicle sticker application online, paying summon online, carpooling services, questions & answers section, search engine, login process and viewing violation points. As for UKM which is one of the local university offers the features and functionalities of vehicle sticker application and paying summon online in order to create a paperless society. Furthermore, process login which implement for UKM traffic system website provides security measure to control the access of different level of users to the system, such as staff and students. Therefore, the users are only allowed to perform activities with granted access.

Some universities may not have enough parking spaces for all the staff and students who bring their vehicles to campus so carpooling is the best way to solve this problem. Moreover, questions & answers section is another good feature implemented in traffic system because many students who have questions are shy to ask the administrators face

to face. Search engine is also another good function in implementing a traffic system. This is because it enables users to search for the information that they want faster. Lastly, some universities like Bilkent University is given violation points to road offenders rather to ask them to pay for money when being summon.

2.4 Comparison of Programming Language Used by Reviewed systems

	JavaScript	CGI/ Perl	HTML
UKM traffic system	√		
Bilkent University Traffic Committee			√
University of Guelph Parking Services	√	√	
University of Waterloo Parking Services	√	√	

Table 2.2: Comparison of Programming Language Used

Table 2.3 summarizes the programming languages used by the reviewed systems. As shown from the table above, three of the reviewed systems are developed by using JavaScript. JavaScript is an increasing popular solution nowadays.

Two of the reviewed systems use more than one programming language to develop their system. The languages that they used are JavaScript and CGI/Perl language. Bilkent University only uses HTML language to develop their system as their system does not have database. Users can only view the interface instead of key in any information.

2.5 Summary

By reviewing and analyzing the systems used by other higher learning institutions have given good insight and ideas to develop UNIMAS e-traffic system. Hence, relevant features and functionalities that are suitable to be included into UNIMAS e-traffic system are gathered.

After the comparison is done to the existing traffic systems, it is learned that most of the reviewed system have the features and functionalities of email or contact, viewing rules

and regulations, purchasing vehicle's permit, paying parking fees and appealing for deducting money pay for summon.

Besides reviewing the features and functionalities of these systems, the different programming languages used to develop the systems are also being reviewed. As a consequence, most of the systems are developed by using JavaScript language.

CHAPTER 3: REQUIREMENT ANALYSIS

3.1 Introduction

Requirement analysis is performed to gather user's requirements before developing the system. In addition, hardware and software requirements will also been described in this chapter. The objective of performing this analysis is to know how the current process of applying vehicle's stickers is done. This will help to list out possible features and functionalities that can be implemented into UNIMAS e-traffic system. As users play an important role in determining the success of the system, interview has been done to capture user requirements. Indirectly, this gives a clearer view in designing the flow of processes of this system.

The analysis result will be a guideline for testing phase which will be further described in chapter 6. Implemented system will be validated according to the requirements listed in this chapter. This ensures all the possible requirements are being implemented.

3.2 Requirements

This section describes all the requirements required in this project. The requirement is done by interviewing Head of Security Division, Encik Yaman Hassan to capture his knowledge about the current process of applying vehicle stickers. Refer to **Appendix B** for the list of questions for the interview.

According to Encik Yaman Hassan, Staff, students and visitors undergo the same process. They need to go to Security Division to get the vehicle sticker application form. Next, they need to fill in the form with their personal information and vehicle's information such as name and address of that vehicles' owner, relationship of applicant and vehicle owner, vehicle registration number, model and colour.

After they have completed filling the form, they have to pass the form to administrative assistant at Security Division together with photocopy green card or insurance policy, matric card, employee card or identity card and driving license. Then, the administrative assistant will check if the information filled by the applicants is correct. This is done by referring to the photocopy documents submitted by them. If the details are correct, the administrative assistant will give the stickers to applicants.

After two years, the applicants once again need to go to Security division by bringing the old stickers and exchange with the new one. The administrative assistant need to search for the vehicle sticker application forms they submitted two years ago in the files. If the administrative assistant find it, he or she will distribute the new stickers to road users by asking them to write down their vehicle plate number on the stickers.

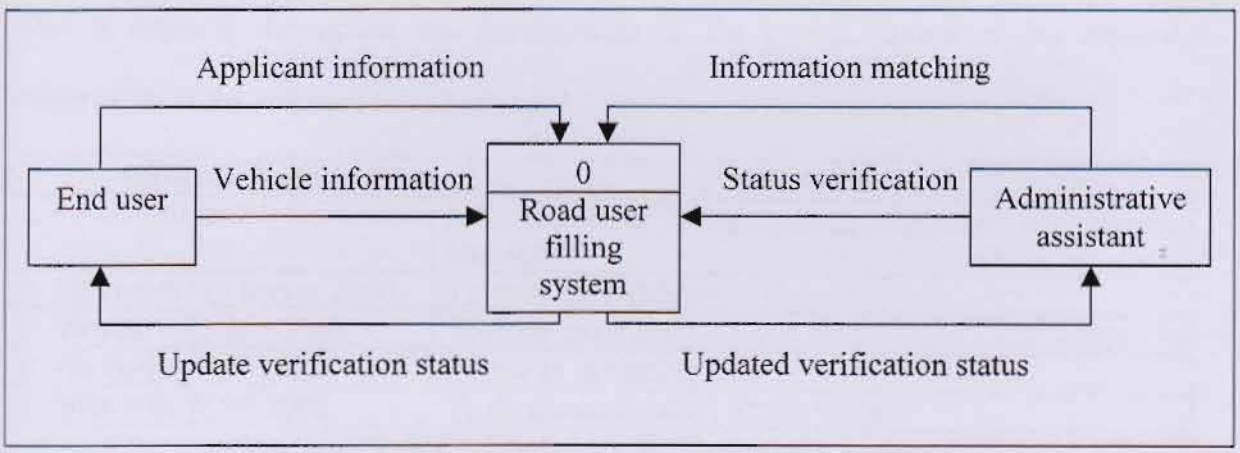

Figure 3.1: Context Diagram of Current System

Figure 3.1 shows the context diagram of the current system. The verification procedures are done manually through paper work. Therefore, it is time consuming when there is time for students, staff and visitors to change their stickers, the administrative assistants need to search from various files to find their records. Refer **Appendix C** for the flow of current system of applying and renewing vehicle sticker.

3.3 Hardware Requirements

The requirements of hardware for the proposed system should consider to make sure that there is no problems occur when implement or installing the system for users. The minimum requirements for the computer should be:

a. Processor with at least Intel Pentium III and above

b. Hard disk with at least 10GB and above

c. RAM of 128 MB and above

d. Monitors with at least 14 inches and preferred at screen resolution of 1024 * 768

e. Others (Keyboard, mouse and etc)

3.4 Software Tools

Software is the important aspect to implement this system. There is a number of software that is required throughout the development of the system. Below is the detailed description of the software have been used.

Software Type	Purpose
a. PowerBuilder 9.0	Main platform (programming language and system interface)
b. Microsoft Sql Server 2000	To store the database
c. Microsoft Project 2003	To draw gantt chart
d. Adobe Photoshop 7.0	To use as designing tools
e. Microsoft Word 2003	To do documentation of this project

Table 3.1 Software Requirements

3.5 User Characteristics

Analysis on the characteristic of users is performed to measure their level of knowledge concerning computer or software usage. This will indicate if training is required for using the system implemented. Users of the system consist of administrative assistants of traffic division. They have sure been exposed to computer usage before so they are considered as expert users, no major problems will be encountered.

3.6 Assumptions and Dependencies

All the requirements and analysis made are based on assumptions that:

a. The requirements are correct and consistent at time requirements are captured.

b. The users are the same group that provides information.

c. The security division policy does not change.

3.7 Summary

This chapter explains on all the possible requirements needed in developing this system. Hardware and software requirements needed to develop the system are being determined. It also includes the list of assumptions and dependencies where all requirements analyze are based on.

CHAPTER 4: SYSTEM DESIGN

4.1 Introduction

System design is defined as a systematic approach as a systematic approach to identifying problems, opportunities and designing a computerized information system to solve the problem (Kendall & Kendall, 2000). In this project, an effective and dynamic data entry procedure is designed to ensure that the data entered are accurate and useful. Besides, a good database design and user interface helps ensure the efficiency of the program.

4.2 System Architecture (Data Flow Diagram)

System architecture describes the designed flow of UNIMAS e-traffic system. It indicates the functions, databases, input and output in the system.

4.2.1 Context Diagram

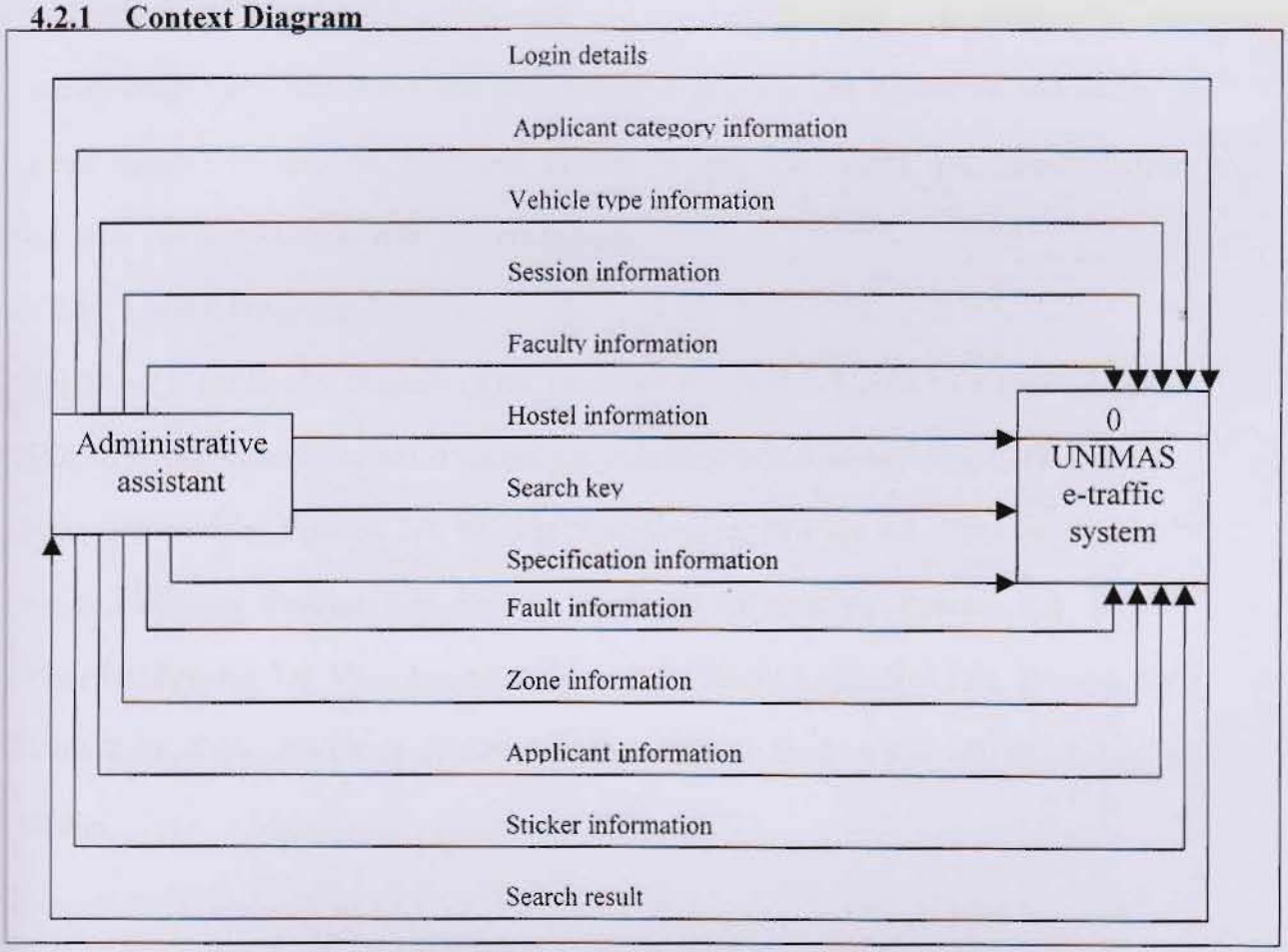

Figure 4.1: Context Diagram of UNIMAS e-Traffic System

In the proposed system context diagram as shown in Figure 4.1, the administrative assistant is required to login in order to access the system. Administrative assistant will need to setup all the information in master file and set the specification if he or she is using the system for the first time. Besides, he or she is required to generate the serial numbers first when the new stickers have been issued for particular session. Moreover, it is essential for him or her to key in the applicant information in the system. In addition, the administrative assistant can maintain and manipulate data in the database. It is possible for them to update or delete particular information in the database. For example, after one session or two years, if students, staff and visitors come for sticker renewal, the administrative assistant may search the information of them by using search key. System will search for the related information and the search result will returned to the administrative assistant. Next, the administrative assistant can update the old sticker's serial number of students, staff and visitors to new one. After that, administrative assistant can distribute the new stickers to them.

4.2.2 Level 0 Diagram

Figure 4.2 is the level 0 diagram of the processes involved in UNIMAS e-traffic system. There are nine main processes: **Process 1.0**: Administrator Assistant Login, **Process 2.0**: Setup Master File, **Process 3.0**: Set The Specification, **Process 4.0**: Generate Stickers' Serial Numbers, **Process 5.0**: Key In Applicant Information, **Process 6.0**: Sticker Renewal, **Process 7.0**: View Report, **Process 8.0**: Search Applicants' List, **Process 9.0**: View Zone, Type of Vehicle Stickers and Sign Boards. Each of this will be explain in details.

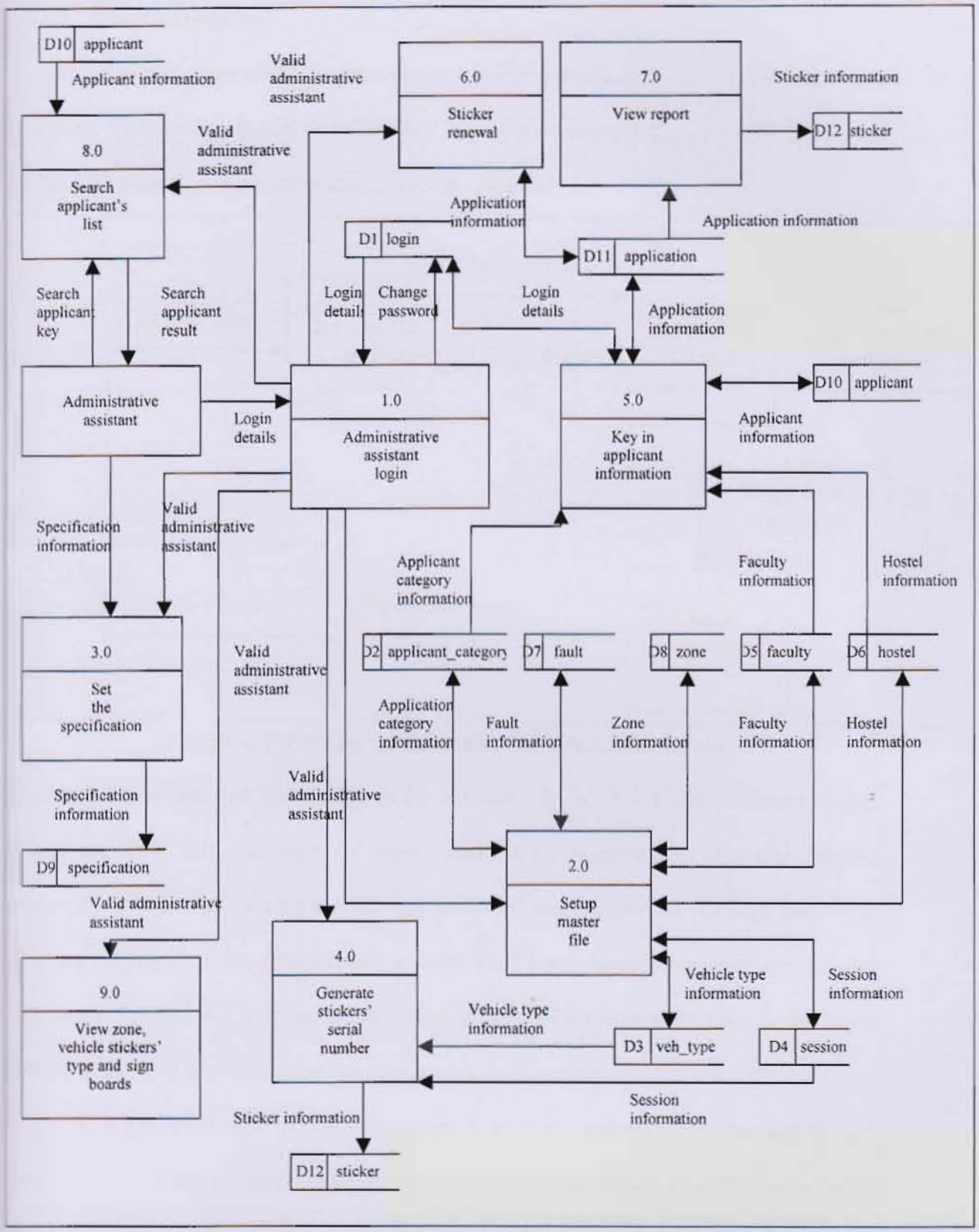

Figure 4.2: Level 0 Diagram of UNIMAS e-Traffic System

4.2.3 Level 1 Diagram

Level 1 diagram is the child diagram which is sub processes of the processed in Level 0 diagram. The child diagrams show the flow of processes in details.

4.2.3.1 Process 1.0: Administrative Assistant Login

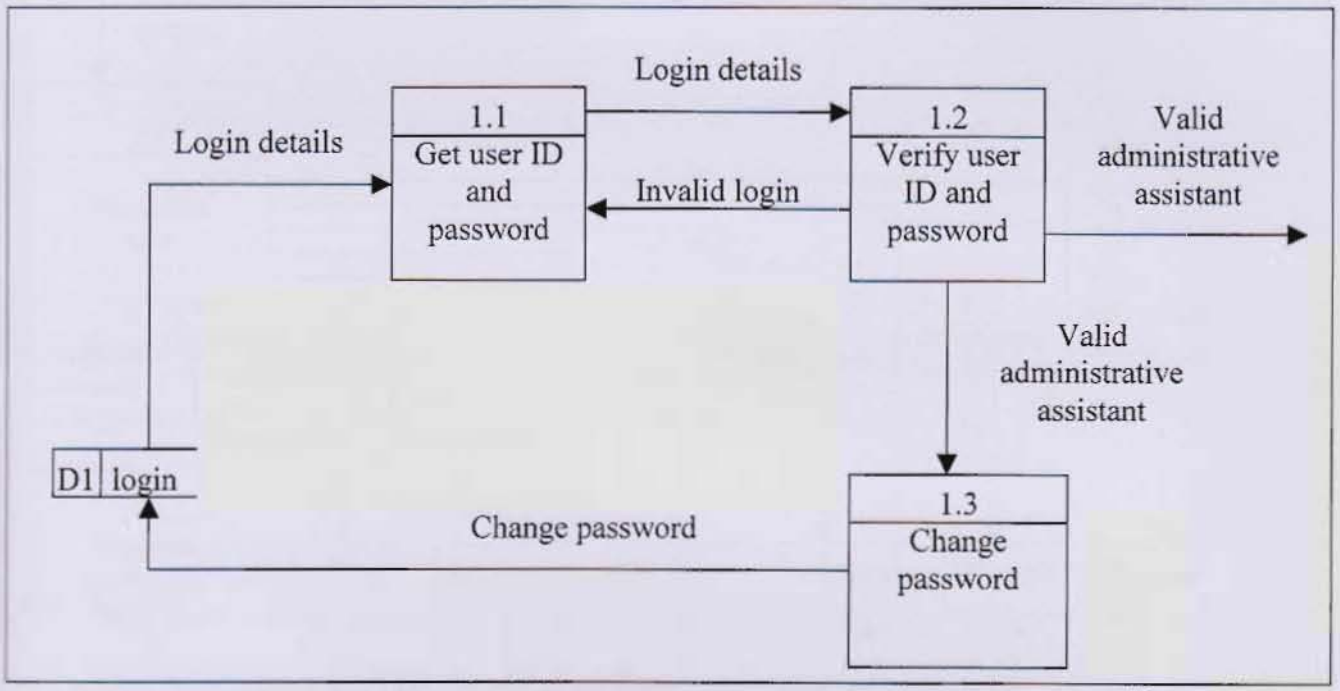

Figure 4.3: Process 1.0 Administrative Assistant Login

Figure 4.3 describes the child diagram for Process 1.0 Administrative Assistant Login. There are three sub processes for login. There are processes 1.1: Get user ID and password, process 1.2: Verify user ID and password and process 1.3: Change password. Process 1.1 required the administrator to enter their login details consist of user ID and password. Process 1.2 will determine if the system will verify and check if the login details entered by administrative assistant match the login details from the login database. If invalid login details is entered, administrative assistant need to reenter the user ID and password. He or she can only proceed to the functions in the system after the login details is validated. Process 1.3: Change password is one of the sub process designed for security

purposes. Administrative assistant can change their password in the login database from time to time.

4.2.3.2 Process 2.0: Setup Master File

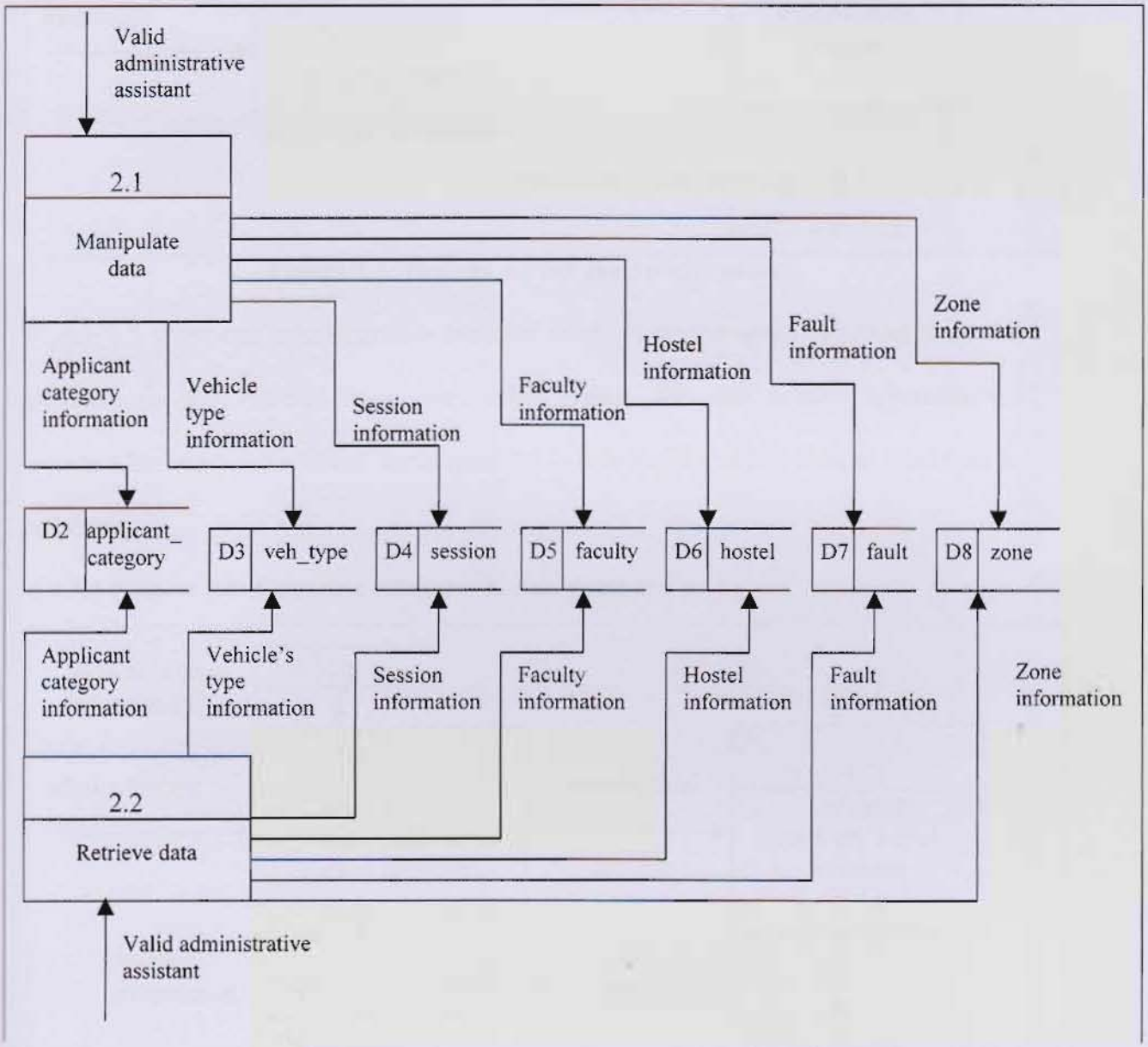

Figure 4.4: Process 2.0 Setup Master File

Figure 4.4 shows that administrative assistant has to setup the master file first before he or she can key in the particulars of applicants. The data in master file are variables that we can change from time to time.

4.2.3.3 Process 3.0: Set the Specification

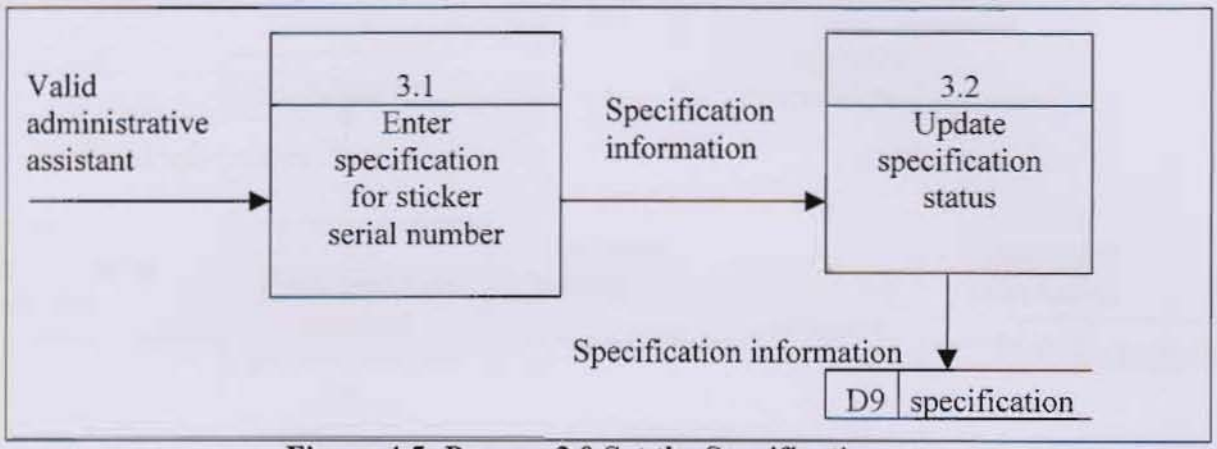

Figure 4.5: Process 3.0 Set the Specification

Figure 4.5 show that administrative assistant must set up the specification as the serial numbers for the vehicles begin with 0001. Hence, for each session administrative assistant has to set the stickers' serial numbers to four digits and it is store at specification database.

4.2.3.4 Process 4.0: Generate Stickers' Serial Numbers

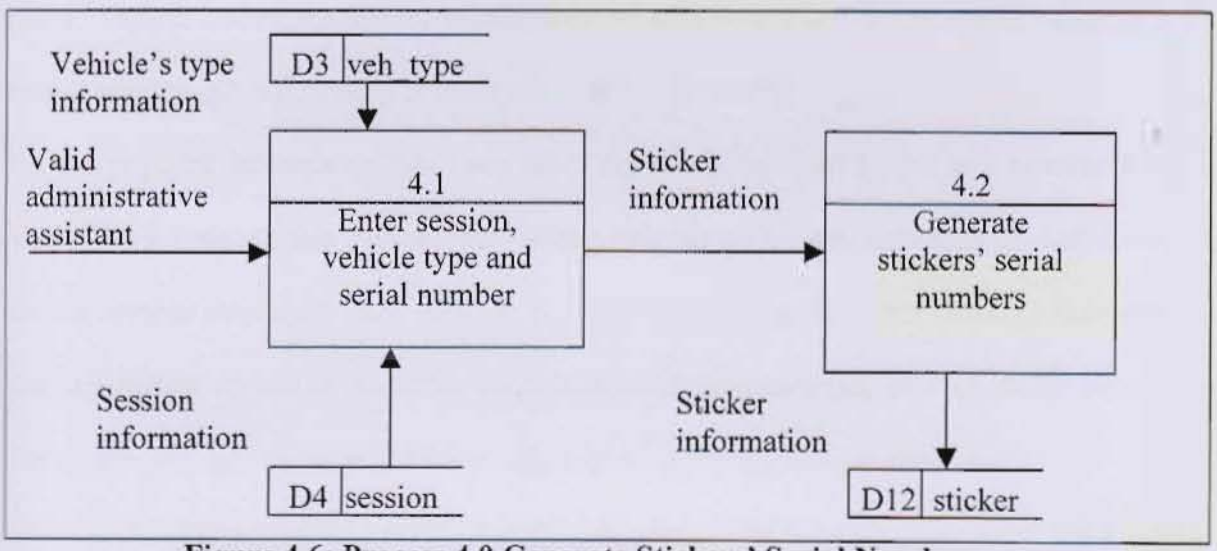

Figure 4.6: Process 4.0 Generate Stickers' Serial Numbers

When the new stickers are ready to distribute during particular session, the administrative assistant needs to generate the stickers' serial number for both the cars and motorcycles as shown in figure 4.6.

4.2.3.5 Process 5.0: Key in Applicant Information

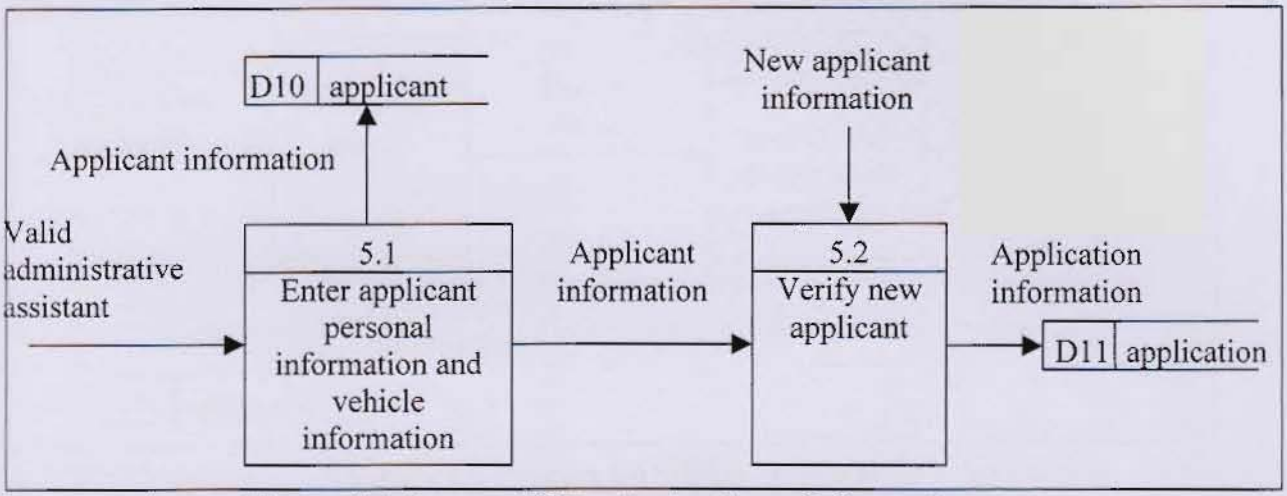

Figure 4.7: Process 5.0 Key in Applicant Information

Figure 4.7 shows the administrative assistant key in the new applicant's information in the system child diagram. He or she is required to enter the applicant personal information such as name, identity card number, matric number or staff number, telephone number and so on. Apart from that, vehicle information like vehicle owner's name, vehicle owner's address, relationship of applicant and vehicle owner, vehicle's model, colour and registration number also need to be entered.

As the required information has been filled in, it will proceed to the sub process 5.2: Verify New User. In this sub process, system will check for any existence of duplicated matric number or identity card number. System will generate the error message indicates the duplication owned by someone else. If there is no occurrence of duplication issues, the system will add the new applicant information in the application database.

4.2.3.6 Process 6.0: Sticker Renewal

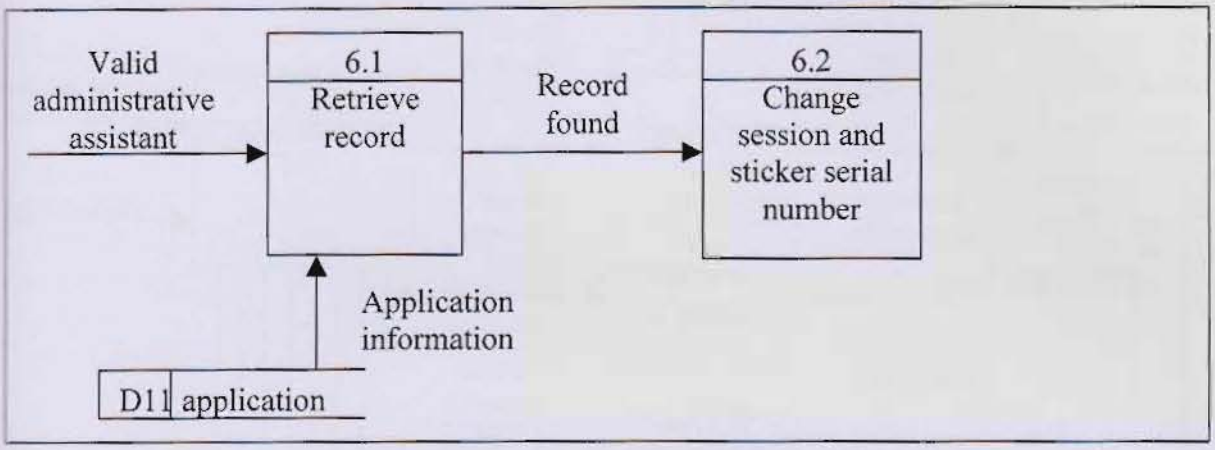

Figure 4.8 Process 6.0 Sticker Renewal

After one session or two years, the staff, students and visitors need to renew their stickers. The administrative assistant needs to key in the new serial number for them like shown in figure 4.8.

4.2.3.7 Process 7.0: View Report of Stickers Distribution

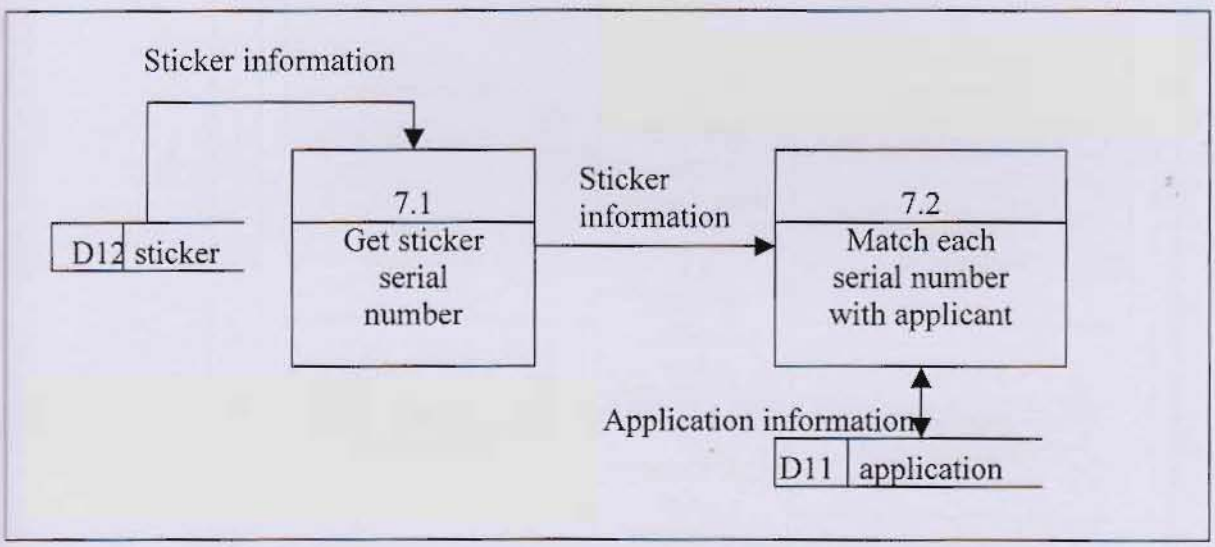

Figure 4.9 Process 7.0 View Report of Stickers Distribution

Figure 4.9 shows the report will be generated to see which sticker assign to which applicant so the administrative assistant at security division knows how many stickers have been distribute.

4.2.3.8 Process 8.0: Search Applicant's List

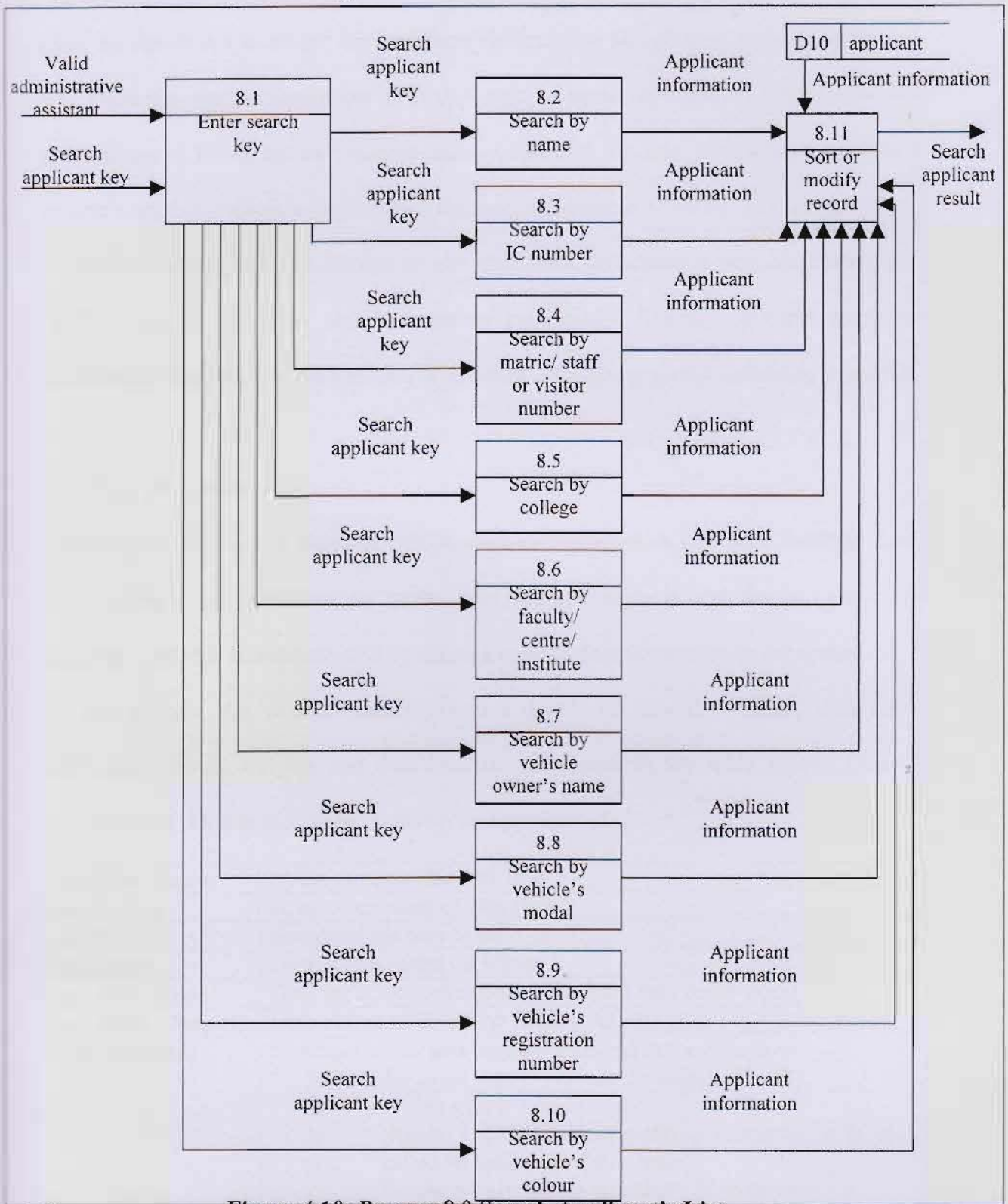

Figure 4.10: Process 8.0 Search Applicant's List

Figure 4.10 shows the search applicants' list child diagram. Administrative assistant may enter the search key to search for applicants' information as indicated at the sub process 8.1. There are several search key available such as name, IC number, matric number, staff number or visitor number, college, faculty, centre or institute, vehicle's owner name, vehicle's model, vehicle's registration number and vehicle's colour. For an example, administrative assistant can display all the applicants' information who are belongs to Faculty Science Computer and Information Technology. Search applicants result is immediately displayed to administrative assistant after being sorted according to search key.

4.3 Data Dictionary

According to Kendall & Kendall (2000), data dictionary is a reference work of data compiled by system analysts to guide them through analysis and design. The data dictionary collects, coordinates and confirms a specific data terms used in the system.

For this project, the data dictionary contains details of data flow name, data flow description, inputs, outputs and data structure as shown in the table below. Details description of the data dictionary is shown in **Appendix D.**

Data Flow Name	Name of particular data flow
Description	Brief description of data flow
Source	Source of the data flow
Destination	Destination of the data flow
Data Flow (Input)	Data input from data flow (where the data come from)
Data Flow (Output)	Data output to data flow (where the data go to)
Data Structure	Structure of the data that are involved in the data flow i. An equal sign (=) means "is composed of" ii. A plus sign (+) means "and" iii. Braces { } indicates repetitive elements, it is also called repeating groups or tables iv. Brackets [ ] indicates an either / or situation v. Parentheses ( ) represents an optional element

Table 4.1: Format for Data Flows Data Dictionary

4.3.1 Data Store Data Dictionary

Table 4.2 shows the data dictionary for the entire data store available in the UNIMAS e-traffic system. These data stores are used to develop the tables in the database for the system.

ID	Name	Description	Attributes	Data Type	Size
D1	login	Contain administrative login information	User ID (PK) Password	Varchar Varchar	15 15
D2	applicant_category	Store applicant category information	Category_no (PK) Category_name App_type (FK) Status	Int Varchar Char Char	4 255 1 1
D3	Veh_type	Store vehicle's type information	Veh_type_no (PK) Veh_type_name Status	Int Varchar Char	4 100 1
D4	session	Store session information	Session_no (PK) Session_name Status	Int Varchar Char	4 255 1
D5	Faculty	Store faculty information	Faculty_no (PK) Faculty_name Status	Int Vachar Char	4 100 1
D6	Hostel	Store hostel information	Hostel_no (PK) Hostel_name Status	Int Varchar Char	4 100 1
D7	Fault	Store fault information	Fault_cd (PK) Fault_descs Fault_method Status	Varchar Varchar Varchar Char	6 100 100 1
D8	Zone	Store zone's information	Zone_no (PK) Zone_name Status Xpos Ypos	Varchar Varchar Char Int Int	4 500 1 4 4

D9	specification	Store specification information	Session_no (PK) Pad_char Sticker_len	Int Char Int	4 1 4
D10	applicant	Store applicant information	Applicant_no (PK) Name Ic_no Designation Hostel_no (FK) Faculty_no (FK) Mail_addr1 Mail_addr2 mail_addr3 Tel_no Hphone_no Photo_file App_type (PK) Status App_category	Varchar Varchar Varchar Varchar Int Int Varchar Varchar Varchar Varchar Varchar Varchar Char Char Int	20 100 15 30 4 4 100 100 100 30 30 255 1 1 4
D11	application	Store application information	Apply_no (PK) Apply_type (FK) Applicant_no (FK) Session_no (FK) Veh_no Veh_type_no (FK) Veh_owner Colour Model Capacity Sticker_no (FK) Owner_relation Owner_addr1 Owner_addr2 Owner_addr3 Resp_name usage status	Numeric Char Varchar Int Varchar Int Varchar Varchar Varchar Varchar Varchar Varchar Varchar Varchar Varchar Varchar Varchar Char	13 1 15 4 10 4 100 20 30 30 10 30 60 60 60 255 100 1
D12	sticker	Store sticker information	Session_no (FK) Veh_type_no (FK) Colour Sticker_no (PK) Serial_no (PK) Remarks	Int Int Int Varchar Numeric Varchar	4 4 4 10 9 255

			Status Applicant_no (FK)	Char Varchar	1 15

Table 4.2: Data Store Data Dictionary

Legend
Primary Key (PK)
Foreign Key (FK)

4.3.2 Process Specification

Process specification explains the decision-making logic and formulas that transform process input data into output data (Kendall & Kendall, 2000). There are three goals in developing the process specifications: reduce ambiguity within the process, obtain a precise and accurate description and to validate the system design.

Table 4.3 shows the general structure of the process specification in UNIMAS e-traffic system. For a full process specification, refer to **Appendix E.**

Process Name	Name of particular process
Description	Brief description of process
Data Flow (Input)	Data input from process (where the data come from)
Data Flow (Output)	Data output from process (where the data go to)
Process Logic	Describe the logic or step regarding how the data flow in the process

Table 4.3: Format for Process Specification

4.4 Normalization

According to Whitten, Bentley and Dittman (2002), normalization is an analysis technique that organizes all the data attributes into a form where data redundancies never occur. There are three normalization steps which are First Normal Form, Second Normal Form and Third Normal Form. First, all repeating groups or attributes are removed and primary keys are identified. Then, all partial dependencies are removed and are placed into another relation. Lastly, all transitive dependencies are removed. **Appendix F** shows

the First Normal Form (1NF), Second Normal Form (2NF) and the Third Normal Form (3NF).

4.5 Entity Relationship Diagram (ERD)

Data in this system will be organized into entities and each of the relationships between entities is defined in an Entity Relationship Diagram as shown in Figure 4.11.

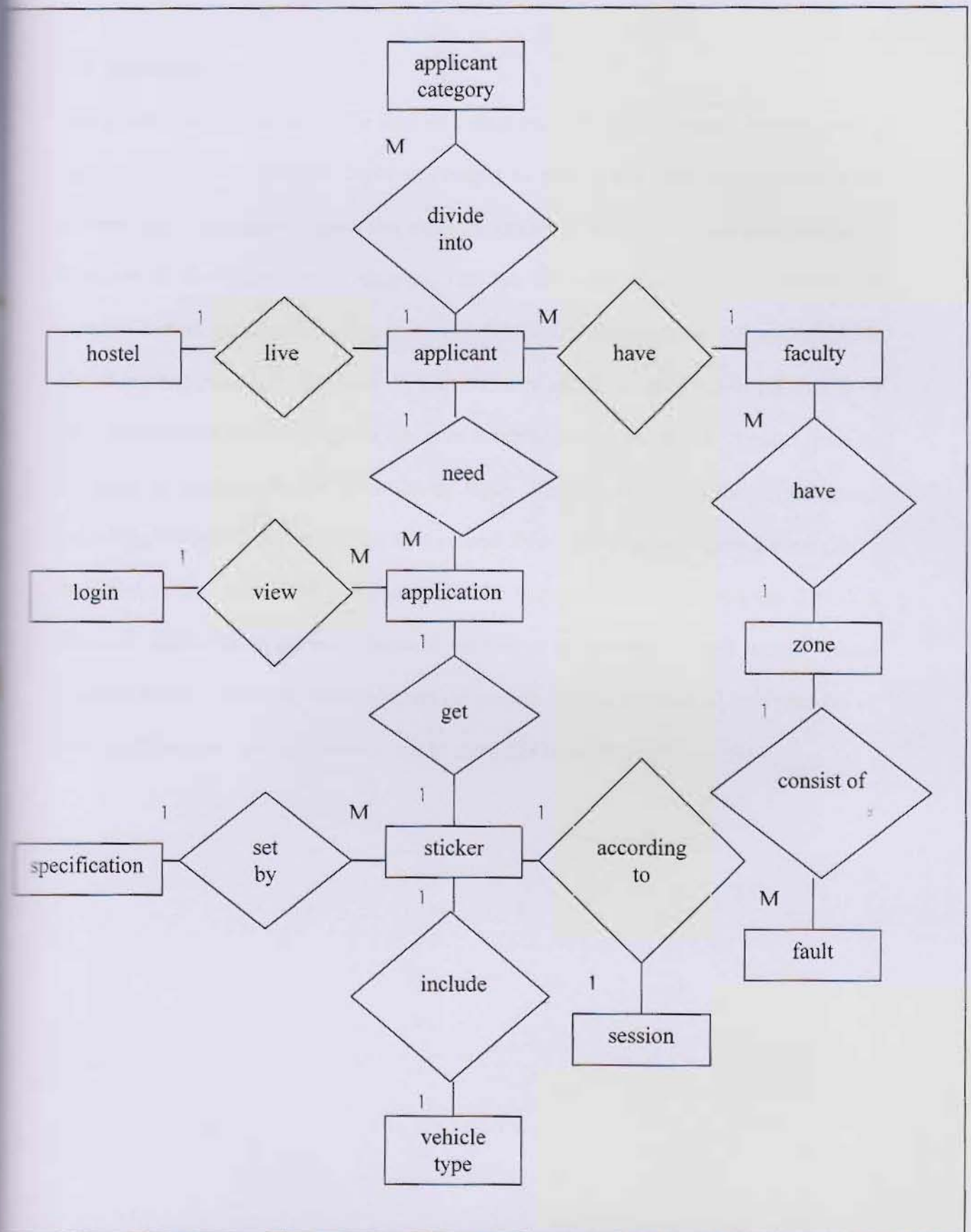

Figure 4.11: Entity Relationship Diagram for UNIMAS e-Traffic System

4.6 Summary

The system design consists of the data flow diagram (DFD). The context diagram gives a general view of the system's input and output as well as the users that involve in the system. Level 0 diagram shows the major processes in the system and each process is discussed further using Level 1 diagram. The data dictionary explains the details of each element used in the Data Flow Diagram. The function of each process and needed data is also discussed in details. Attributes in the data store and the description of the data store that will later use for building the tables in database is also listed out. Besides, process specification explains the decision-making logic. This is followed by the normalization with three normal forms, which are first normal form (1NF), second normal form (2NF) and third normal form (3NF). Furthermore, the Entity Relationship Diagram (ERD) is shown to relate the relationship between entities in the system. A well design system structure will be great help in developing the project. This is because all redundancies of data can be avoided and consistency can be sustained throughout this project.

CHAPTER 5: SYSTEM IMPLEMENTATION

5.1 Introduction

According to Kendall & Kendall (2000), the implementation system is the process for ensuring that information system can work and user can handle the system successfully. Implementation of UNIMAS e-traffic system is based on the requirement analysis and system design in chapter 3 and chapter 4 respectively. This chapter will include the system configuration, system decomposition and implementation of system modules of UNIMAS e-traffic system. It describes how configuration is performed, how UNIMAS e-traffic system is divided and implemented.

5.2 System Configuration

Some configuration needs to be done before creating the features and functionality of the system. As this involved storing data in the database, some software needs to be installed before coding phase runs. Below are the software that need in order to implement this project.

5.2.1 PowerBuilder 9.0

PowerBuilder 9.0 is the main language used for the development of this system. PowerBuilder from Powersoft Corporation is one of a new generation of application development tools. Times have changed and PowerBuilder is a part of that wave of the future. It is an object-centric graphical application development. Apart from Microsoft Windows, PowerBuilder is also available on the platform such as UNIX and Apple Macintosh. Therefore, UNIMAS e-traffic system can develop under windows that also can be used by people on other operating system. By using PowerBuilder, it helps me to

create the system that user can better understand and greatly reduce the amount of time spend for training and supporting the thousands of people using the program.

5.2.2 Microsoft SQL Server 2000

Microsoft SQL Server 2000 is used as database server for UNIMAS e-traffic system. It is the most widely implemented language for the relational database management system (RDBMS). It provides Enterprise Manager and Query Analyzer to allow design, develop, deploy and manage traffic database. Before connect UNIMAS e-traffic system to traffic database, the user must make sure that SQL Server is running. If necessary, run SQL Server Service Manager from programs first. The icon will be displayed with a green arrow if running and a red block if not running. Besides, the SQL Server Client tools can use different protocols to communicate with SQL Server. In UNIMAS traffic system, I have chose TCP/IP.

5.3 System Decomposition

System decompose involves breaking the systems feature and functionality into smaller module to reduce the complexity in developing the system. Each of these modules will be arranged into twelve increments stated earlier in Chapter 1. The increments include the development of the main menu and the authentication function of the system. Below is the sub module for UNIMAS e-traffic system. It shows UNIMAS e-traffic system module as a whole.

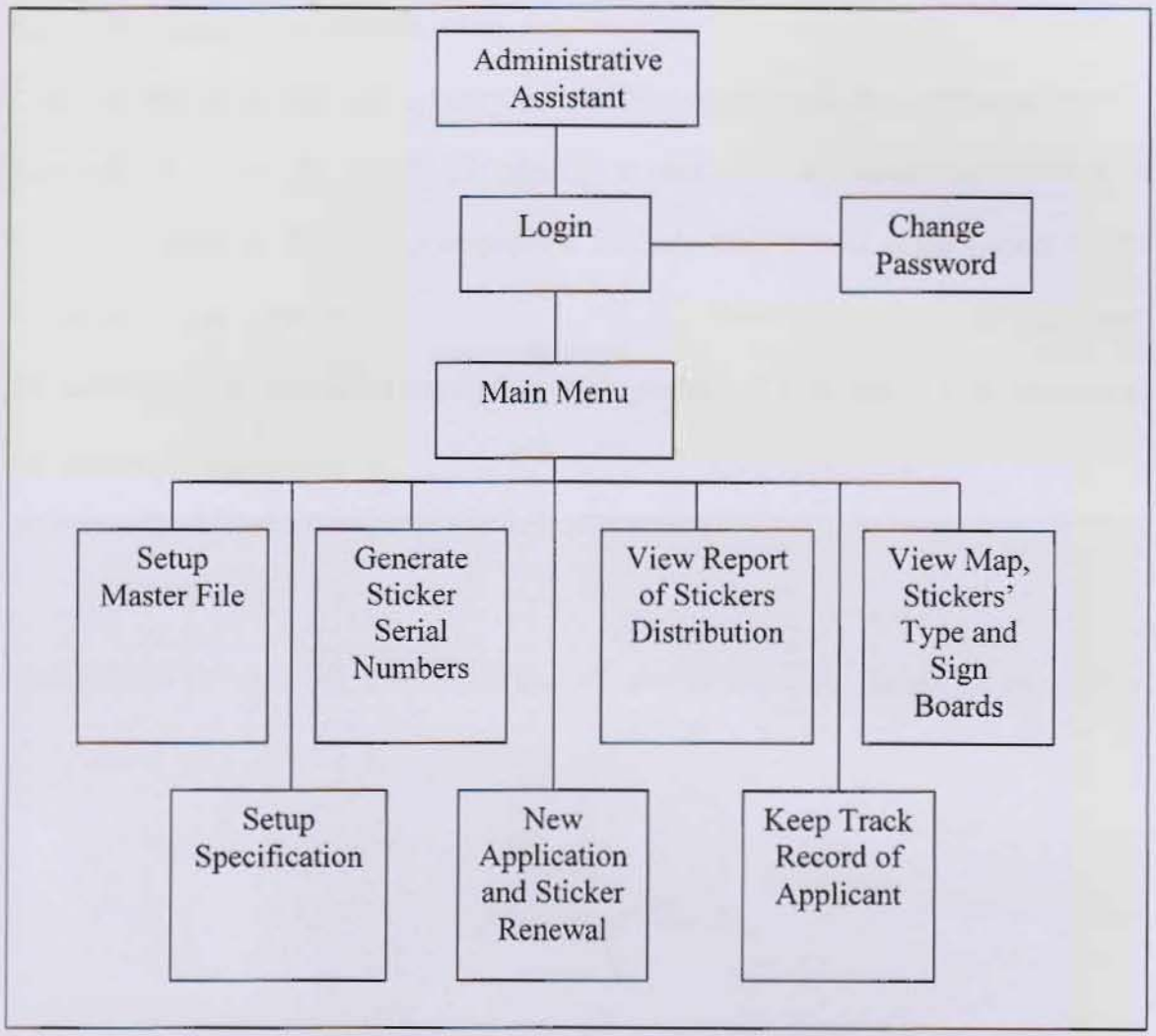

Figure 5.1: System Module for UNIMAS e-Traffic System

5.3.1 Increment 1 – Authentication

Login module is created for security purposes to ensure that only authorized user is permitted to access the UNIMAS e-traffic system. The administrative assistant at Security Division of UNIMAS is responsible for the overall control of the system. Figure 5.2 shows the user interface for login which is the first screen that appears for this system. The administrative assistant is required to enter user ID and password in order to login to main menu of the system.

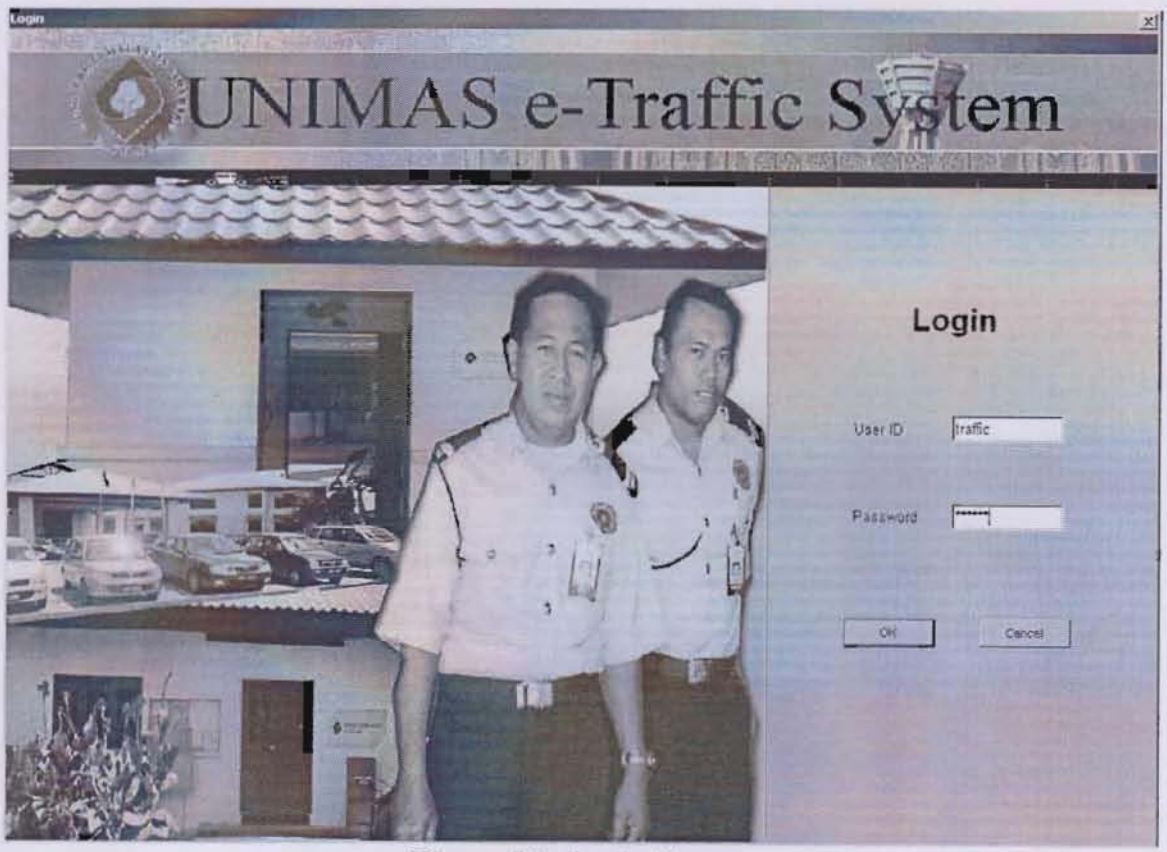

Figure 5.2: Login Screen

If user enters the invalid user ID and password, the invalid login message will appear as shown in Figure 5.3.

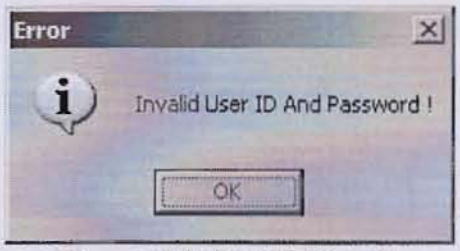

Figure 5.3: Invalid Login

5.3.2 Increment 2 - Main Menu

After the user has successfully log in the system, the system will display the main menu as shown in figure 5.4. Each icon in main menu will open up another window. For an example, after the user click on the "Setup Master File" icon, it will open another window for user to setup the variables needed for this system.

Figure 5.4: Main Menu

5.3.3 Increment 3 – Setup Master File

Before any entry can be done, the administrative assistant must setup the master file such as staff category, visitor category, student category, type of fault, zone, session, faculty/centre/institute/section, college and type of vehicles. These data can be changed from time to time to ensure it is up to date. If there is new data, the administrative can add in the new data by clicking the "Add" button. Moreover, if the data is no longer being used and the administrative assistant wants the data to be permanently removed, he or she can click on "Delete" button. However, if he or she does not want some data to appear temporary, he or she can just click on radio button "No" in "Active" column and when he or she wants to use back the data, he or she just need to click on "Yes" radio button to set the data to active being used again. After the administrative assistant performs the task, he or she must make sure to click on "Save" button so whatever they modified are being saved. The "Search" and "Retrieve" buttons are also provided to facilitate the administrative assistant in searching and retrieving data easily without to go through the data line by line. For example, if the administrative forgot what is the "fault" for the code PL 020 of "Type of Fault", he or she just needs to click on "Search" button and then type PL 020. After that, click "Retrieve" button and the "fault" which is "Memandu kenderaan tanpa cukai jalan" will be shown. The administrative assistant also can type the keyword partially if he or she forgot the whole sentence. As an example, the administrative assistant remembers there is one college name begins with A but he or she does not know the full name. Therefore, he or she can click on "Search" button and type "A}", the system wills retrieve the full sentence as "Alamanda College". Figure 5.5 shows one of variable that needs to be set in master file which is session.

Figure 5.5: Session, One of the Variable Needs to Be Set In Master File

5.3.4 Increment 4 – Setup Specification

The administrative assistant can set the specification for the stickers for particular session because the sticker serial number begins with number 0001 so he or she must set the amount digit of serial number to 4 and begin with 0.

Figure 5.6: Setup Specification

5.3.5 Increment 5 – Generate Stickers' Serial Numbers

The administrative assistant can click on "Generate Serial Numbers" icon at main menu to go to stickers' serial numbers generation window and generate the serial numbers for cars or motorcycles for a particular session. As shown in figure 5.7, the window contains all the required fields for stickers' serial numbers generation. If sticker serial number which begins with 0001 until 3000 have been generated, these numbers cannot be generated again because the serial numbers are unique and have been set as primary key. If the administrative assistant wants to generate more stickers' serial numbers, he or she must enter the serial number starts from 3001.

Figure 5.7: Generate Stickers' Serial Numbers

5.3.6 Increment 6 - New Application

Administrative assistant is responsible to key in new applicant information by clicking the "Add" button at the bottom of electronic application form. Administrative assistant needs to fill in basic applicant information as shown in figure 5.8. The "Applicant No." will be auto generated after clicking the "Save" button. The administrative assistant can also click "Search" button and enter some phases to search for desired applicant information and click "Retrieve" button to retrieve data if lazy to scroll down and look for it.

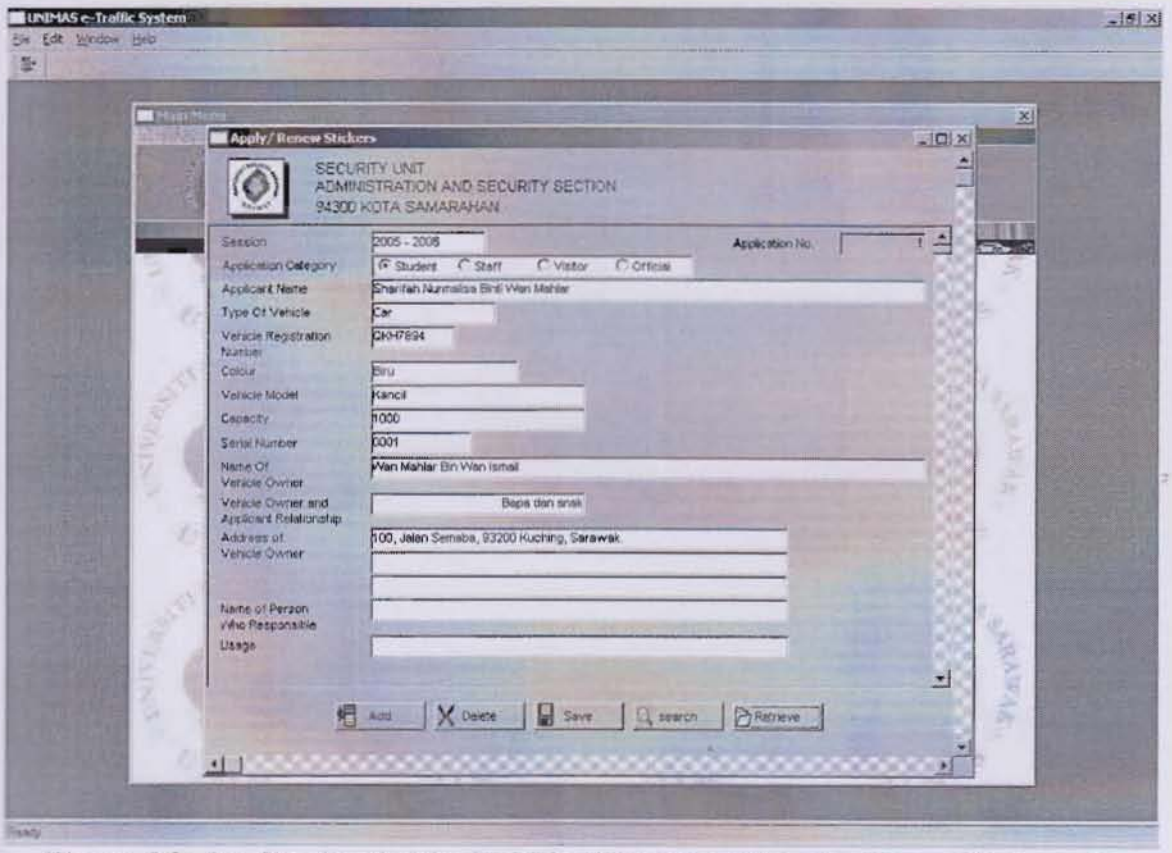

Figure 5.8: Application for the Vehicles' Stickers either for Car or Motorcycle

5.3.7 Increment 7 - Sticker Renewal

After two years or one session, when the road users want to change the new sticker, the administrative assistant just need to select the session from the drop down list in application window and key in the new sticker's serial number. For example, we can see Sharifah hold the sticker serial number 0001 from figure 5.8. After she renews her sticker in session 2006-2007, now she is holding sticker serial number 0012 as shown in figure 5.9.

Figure 5.9: Sticker Renewal

5.3.8 Increment 8 – Report of Sticker Distribution

Figure 6.0 shows stickers information which is a report that indicates which sticker is distribute to which applicant with his or her name, matric number, staff number or visitor number together with I.C. number in particular session being shown. The administrative assistants can print the report if they intend to keep the hard copy of the report.

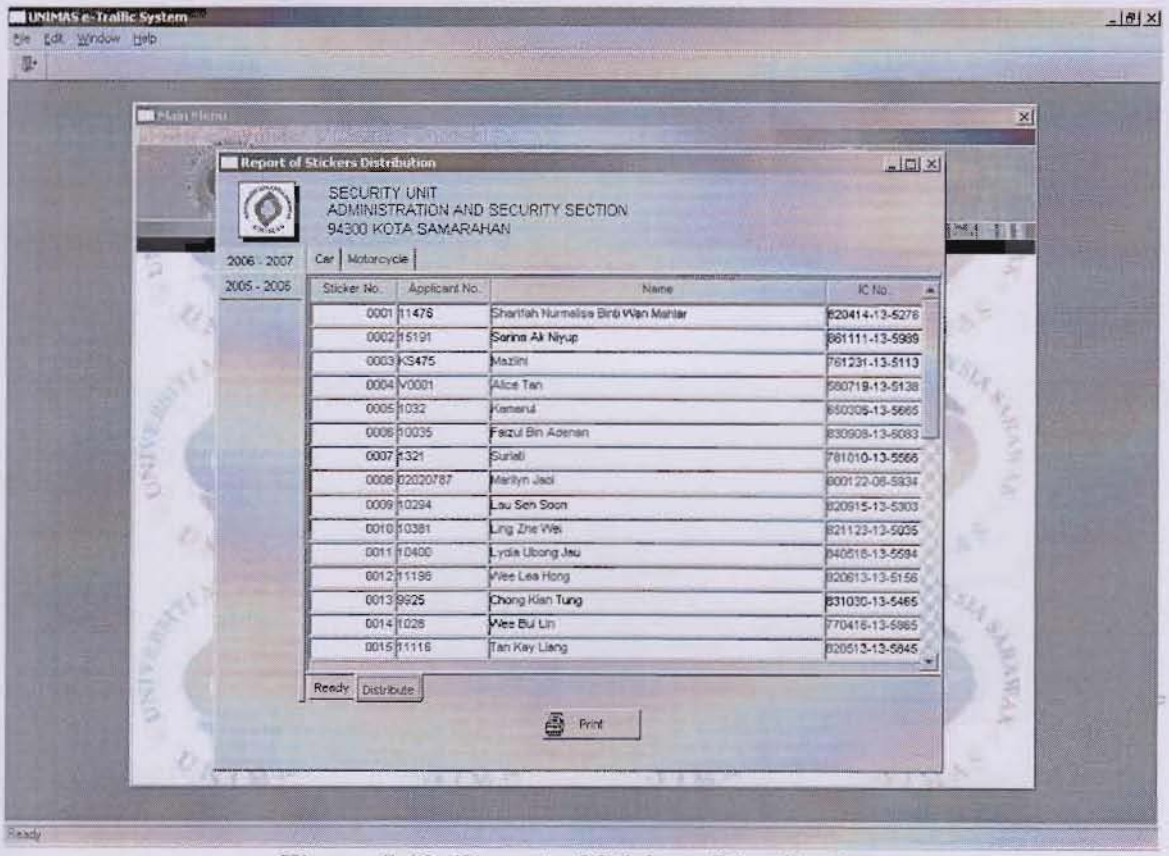

Figure 5.10: Report of Stickers Distribution

5.3.9 Increment 9 - Keep Track the Record of Applicant

When administrative assistant click on "Applicant Record" at the main menu, the interface which store the information for applicants will appear as shown in figure 6.1. For this interface, if the administrative assistant wants to add the new applicant record, he or she just needs to click on "Add" button. The "Matric Number", "Category", "Name", "Identity Card No.", "Hostel", "Faculty/Centre/Institute/Section" and "Address" are compulsory fields and must fill in. However, "Telephone", "Handphone" and "Photo" are optional fields, the administrative assistant can leave them blank. After add in new user data, the administrative assistant just need to click "Save" button to save all the data. The interface for student, staff and visitor form is almost the same.

Figure 5.11: Applicant's Record-The One Shown Above Is Student Record

5.3.10 Increment 10 - View UNIMAS Map

The administrative assistant can search and view the zone in temporary campus where the road offenders being summon as shown in figure 5.9 below.

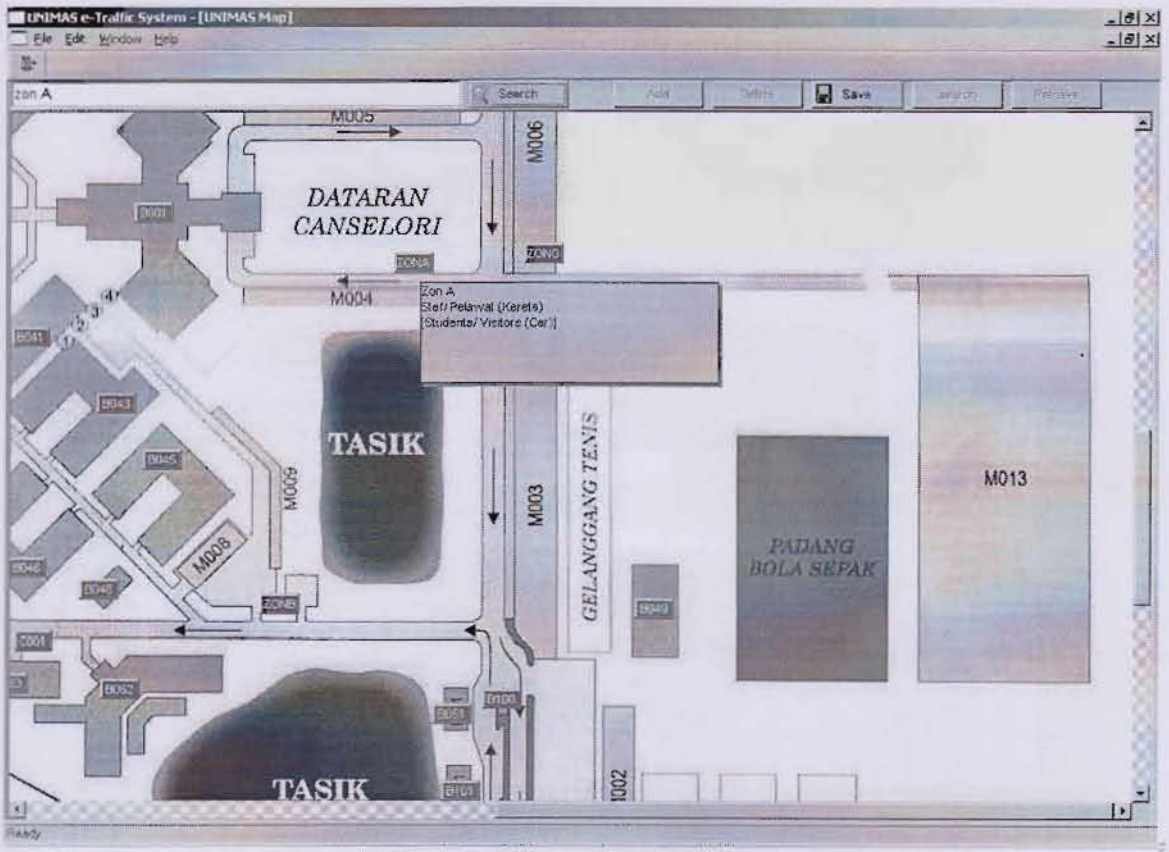

Figure 5.12: UNIMAS Map

5.3.11 Increment 11 – View Type of Stickers

Figure 5.10 shows that the administrative assistant can view all types of stickers for cars and also motorcycles available at security division.

Figure 5.13: Type of Stickers

5.3.12 Increment 12 - View Sign Boards

Figure 5.11 shows the sign boards display at UNIMAS temporary campus. The interface design for sign boards is almost the same with interface for types of stickers to ensure the consistency in system design.

Figure 5.14: Sign Boards

5.4 Summary

This chapter explains the method of developing and implementing UNIMAS e-traffic system. It also illustrates configuration required before implement UNIMAS e-traffic system. Since the methodology used for developing this system is Incremental Modal, the system is decomposed into smaller modules. This chapter also shows several previews on the modules interface in UNIMAS e-traffic system.

CHAPTER 6: SYSTEM TESTING AND EVALUATION

6.1 Introduction

This chapter focuses on the testing strategy. In order to implement a system, software development and all its activity including testing must be done iteratively. In addition, limitation upon the system will be drawn out. The objectives of testing and evaluation are to trace errors and bugs in the program, discover system's limitations and to check if the system meets user requirements.

6.2 Specification Testing

Black box testing focuses on the functional requirements of the software. This is designed to validate functional requirements without concerning the internal workings of a program. UNIMAS e-traffic system implements three types of specification testing methods which include functional testing, usability testing and performance testing.

6.2.1 Functional Testing

Functional testing is carried out on all increments as stated in chapter 5, section 5.3. This is to ensure that all the elements in every module are working as expected. All command buttons are tested to check they work correctly and function well. Besides, data is entered to each module to check for desired output.

6.2.1.1 Functional Test On Increment 1 (Authentication)

All the tables below show the functions tested and result obtained for each increment.

Test Scenario	Expected Result	Pass	Fail
Login validation (a) Type "User ID " and "Password" and click "OK" button	Administrative assistant login successfully. If invalid "User ID" and "Password", error message pops up.	√	
(b) Click "Cancel" button	The system exits successfully	√	

Table 6.1: Functional Testing for Increment 1

6.2.1.2 Functional Test On Increment 2 (Main Menu)

Test Scenario	Expected Result	Pass	Fail
Click on every pictures	Able to open all the windows	√	

Table 6.2: Functional Testing for Increment 2

6.2.1.3 Functional Test On Increment 3 (Setup Master File)

Test Scenario	Expected Result	Pass	Fail
Click "Yes" radio button for "Active" column	The status is set to active	√	
Click "No" radio button for "Active" column	The status is set to not active	√	
Click "Add" button	Able to add the variables	√	
Click "Delete" button	Able to delete the variables	√	
Click "Save" button	Able to save the variables	√	
Click "Search" button	Able to search the variables	√	
Click "Retrieve" button	Able to retrieve the variables	√	

Table 6.3: Functional Testing for Increment 3

6.2.1.4 Functional Test On Increment 4 (Setup Specification)

Test Scenario	Expected Result	Pass	Fail
Select session, key in the digit need to set for serial numbers and click "Save" button	Specification of serial numbers is set successfully	√	
Click "Delete" button	The data are able to delete successfully	√	

Table 6.4: Functional Testing for Increment 4

6.2.1.5 Functional Test On Increment 5 (Generate Stickers' Serial Numbers)

Test Scenario	Expected Result	Pass	Fail
Select session and vehicle's type from drop down list and key in the serial numbers that are going to generate. After that, click "Generate" button. Then click "Save" button.	Sticker serial numbers are able to generate successfully.	√	

Table 6.5: Functional Testing for Increment 5

6.2.1.6 Functional Test On Increment 6 (New Application)

Test Scenario	Expected Result	Pass	Fail
Register new applicant (a) Click "Add" button	Able to key in or add new applicant information	√	
(b) Click "Delete" button	Able to delete applicant information	√	
(c) Click "Save" button	Applicant's information is successfully added in the database and application number is able to generate	√	
(d) Click "Search" button and key in the information that wants to search, then click "Retrieve" button	Successfully search applicant's information through search key by • Session • Category • Name • Type of vehicle • Vehicle registration number • Vehicle colour • Vehicle model	√	

	• Serial number • Capacity • Vehicle's owner name • Relationship and retrieve the result		
Change applicant personal information and click "Save" button	Able to change applicant information and being save correctly	√	

Table 6.6: Functional Testing for Increment 6

6.2.1.7 Functional Test On Increment 7 (Sticker Renewal)

Test Scenario	Expected Result	Pass	Fail
Select the new session and key in the new serial number. Then, click "Save" button.	The new serial number that assign to applicant for new session is update successfully	√	

Table 6.7: Functional Testing for Increment 7

6.2.1.8 Functional Test On Increment 8 (Report of Sticker Distribution)

Test Scenario	Expected Result	Pass	Fail
Click on the tab of particular session, then			
(a) Click on the tab of "Car" and "Ready"	The report will list out the sticker serial numbers that already generate and ready to be assign for car applicants	√	
(b) Click on the tab of "Car" and "Distribute"	The report will list out the sticker serial numbers that already been assigned together with car applicants' details	√	
(c) Click on the tab of "Motorcycle" and "Ready"	The report will list out the sticker serial numbers that already generate and ready to be assign for motorcycle applicants	√	
(d) Click on the tab of "Motorcycle" and "Distribute"	The report will list out the sticker serial numbers that already been assigned together with motorcycle applicants' details	√	

Click "Print" button	Able to print the document	√	

Table 6.8: Functional Testing for Increment 8

6.2.1.9 Functional Test On Increment 9 (Keep Track The Record Of Applicant)

Test Scenario	Expected Result	Pass	Fail
Click on the tab of "Student" and click "Retrieve" button	Able to display all the data of students who apply for vehicle stickers	√	
Click on the tab of "Staff" and click "Retrieve" button	Able to display all the data of staff who apply for vehicle stickers	√	
Click on the tab of "Visitor" and click "Retrieve" button	Able to display all the data of visitors who apply for vehicle stickers	√	
Click "Add" button	Able to add applicant data	√	
Click "Delete" button	Able to delete applicant data	√	
Click "Search" button, then click "Retrieve" button	Successfully search applicant data through search key by • Name • Matric number, staff number or visitor number • Identity card number and retrieve the result	√	
Double click on clipboard and add photo	Able to display the applicant's photo	√	
Click the tab on the left according to alphabetical order. Next, click "Retrieve" button	Able to display the information of applicants according to their name which start with that particular alphabet	√	
Click "Yes" radio button for "Active" column	The status is set to active	√	
Click "No" radio button for "Active" column	The status is set to not active	√	

Table 6.9: Functional Testing for Increment 9

6.2.1.10 Functional Test On Increment 10 (View UNIMAS Map)

Test Scenario	Expected Result	Pass	Fail
Type in the place name or zone name in the text box and click "Search" button	Able to display the location of place or zone	√	

Table 6.10: Functional Testing for Increment 10

6.2.1.11 Functional Test On Increment 11 (View Type of Stickers)

Test Scenario	Expected Result	Pass	Fail
Click on types of sticker that want to be viewed	Able to display the picture	√	

Table 6.11: Functional Testing for Increment 11

6.2.1.12 Functional Test On Increment 12 (View Sign Boards)

Test Scenario	Expected Result	Pass	Fail
Click on the name of sign boards that want to be viewed	Able to display the picture	√	

Table 6.12: Functional Testing for Increment 12

6.3 Usability Testing

The target user of this usability testing is administrative assistant of security division. Usability testing tests user acceptance of system. User plays an important role in determining the success of usability testing. Users tried on the system to test if it fulfils their requirements. They give opinions when they do not feel comfortable with the user interface. Questions that have been asked to administrative assistant when test out the interface of the system are:

a. Is the language used is simple and easy to understand?

b. Are the buttons display clearly and the size of buttons is appropriate?

c. Are the error messages that display suitable to use in this system?

d. Is the layout of windows consistent?

e. Is the system providing clear exit?

f. Do you have any suggestions?

The result obtained and suggestions of users are listed as below.

Remarks	Suggestions
Generally the language used is simple and very easy to understand. There are no bombastic words.	None
"Search" button of UNIMAS map at the bottom of window.	"Search" button of UNIMAS map must put at the top of window so it is easier for user to key in the place or zone name without to scroll down the page.
Error message pops up when key in wrong data or data already exist.	None
All the windows entry is almost the same. Can perform add, delete, save, search and retrieve easily.	None
The windows do not have scroll bars.	Scroll bars should be included.
The exit is clear. When want to exit, just need to click exit icon or close.	None

Table 6.13: Usability Testing Result

6.4 Performance Testing

Performance testing will test the system performance when it runs on different machine or operating system. The operating systems that are tested include window 98, window 2000 and window XP. The purpose of performance testing is to know the response time or speed of the function performance for the system when it performs on different environment. After testing, the performance is fast no matter using which operating system.

6.5 Summary

Three types of specification testing are conducted in the system evaluation phase. Functional testing is used to test every function in each module. Usability testing ensures the system is developed according to the requirements of the users and enables users to fully utilize the system without any difficulty. As for performance testing, it is meant to test the performance of the system and the response time for the system to run. All these testing are evaluated and the results are obtained to achieve the objectives.

CHAPTER 7: CONCLUSION AND FUTURE WORK

7.1 Introduction

In this chapter, the features and functionality that has been successfully implemented is outlined. Moreover, future enhancements will be suggested to upgrade the UNIMAS e-traffic system capability.

7.2 Achievements

Based on the objective stated earlier in chapter 1, the objectives of building UNIMAS e-traffic system is to enable administrative assistant at security division to keep track all the stickers' application records in a computer instead of keeping them in physical files.

Based on the complete UNIMAS e-traffic system, the system has authentication function that required administrative assistant to enter user ID and password in order to log in. Apart from that, administrative assistant is able to set the specification and generate stickers' serial numbers for particular session. The record of applicants is also organized and arranged nicely by using this system. Besides, the stickers' renewal process can run smoothly. Administrative assistant can also know how many stickers have been distributed and who the stickers' owners are. In addition, the administrative assistant can view the zones and sign boards found in temporary campus as well as types of stickers in particular session.

From all the points stated above, this clearly stated that all the objectives that have been taken account throughout the development of this system have been achieved.

7.3 Problems Faced

During design phase, the flow of process and data in the system is reevaluated a few times before producing the Data Flow Diagram (DFD) and Entity Relationship Diagram (ERD) as both diagrams are the most essential components in developing the database.

Furthermore, a difficulty is encountered in scanning the vehicles' stickers because the stickers will stick on the scanner so must have scan a few times to make sure the stickers are visible and have best colour scheme.

Moreover, when halfway taking the sign boards photographs, the rain start pouring down. Hence need to use two days to capture the images of sign boards.

7.4 Future Enhancement

UNIMAS e-traffic system has a potential to be implemented for the usage of other universities as most of the procedures of applying vehicle stickers in most universities are almost the same. As we are moving towards e-society, every task is required to be done electronically. In addition, UNIMAS e-traffic system can be implemented online which definitely make it more convenient for users to access it. If it goes online, users can access and use UNIMAS e-traffic system at any computer outside campus boundaries.

7.5 Summary

This chapter addresses the achievements of UNIMAS e-traffic system which is aligned with its objectives. The problems occurred during the development and future enhancement of the system is also mentioned above.

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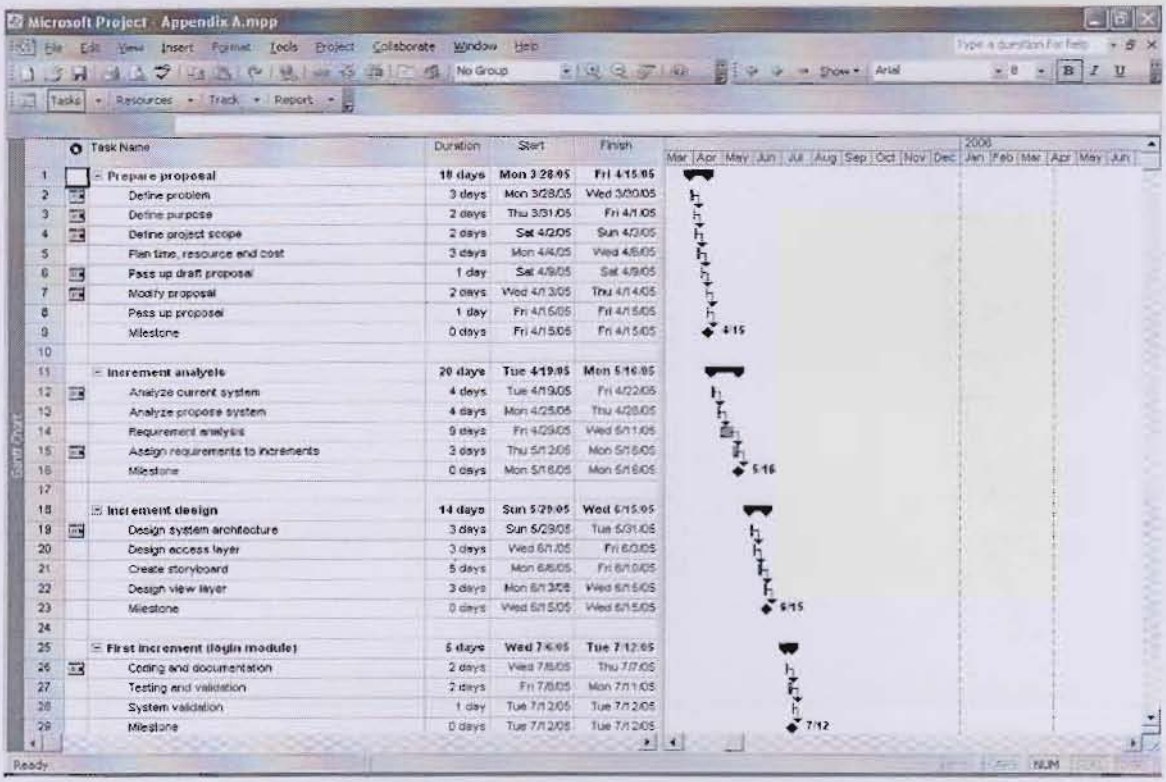
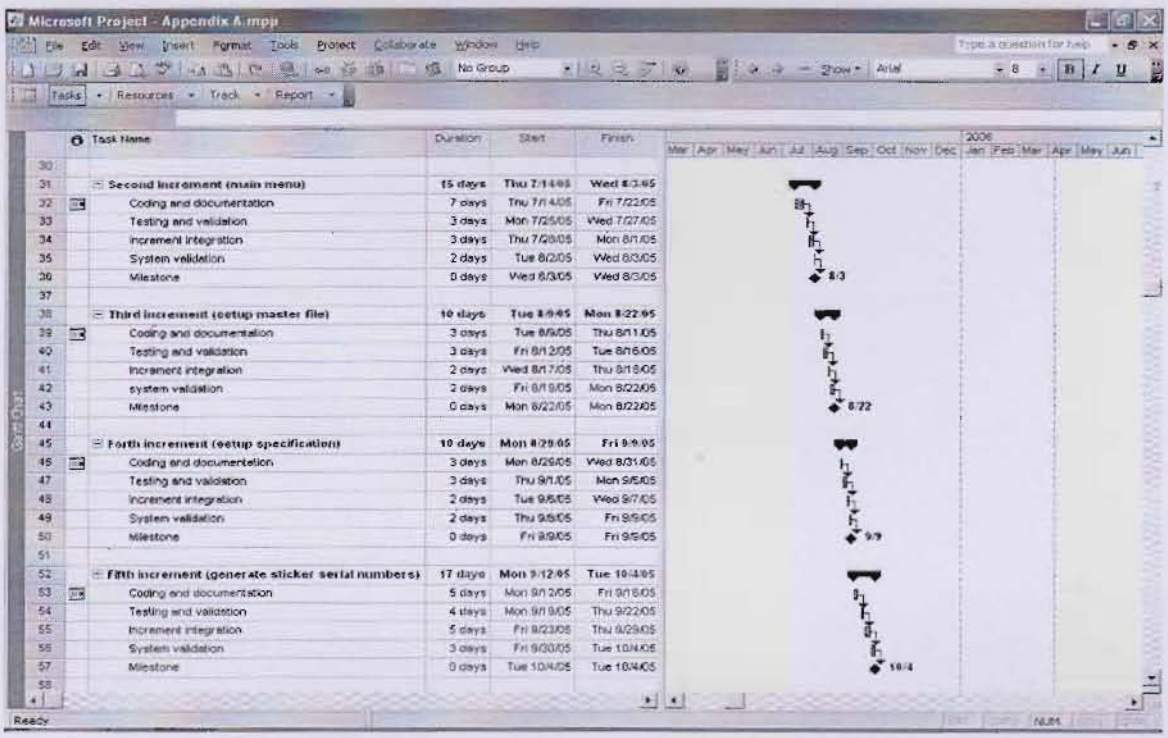
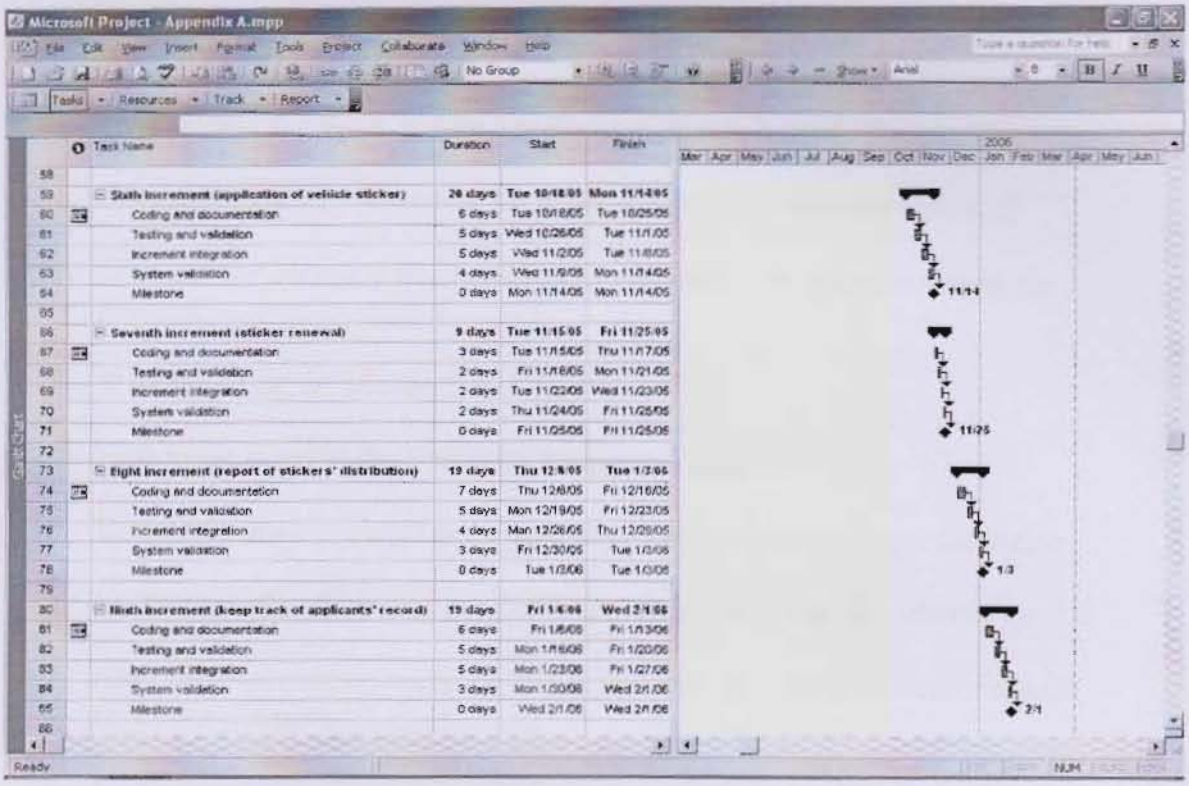
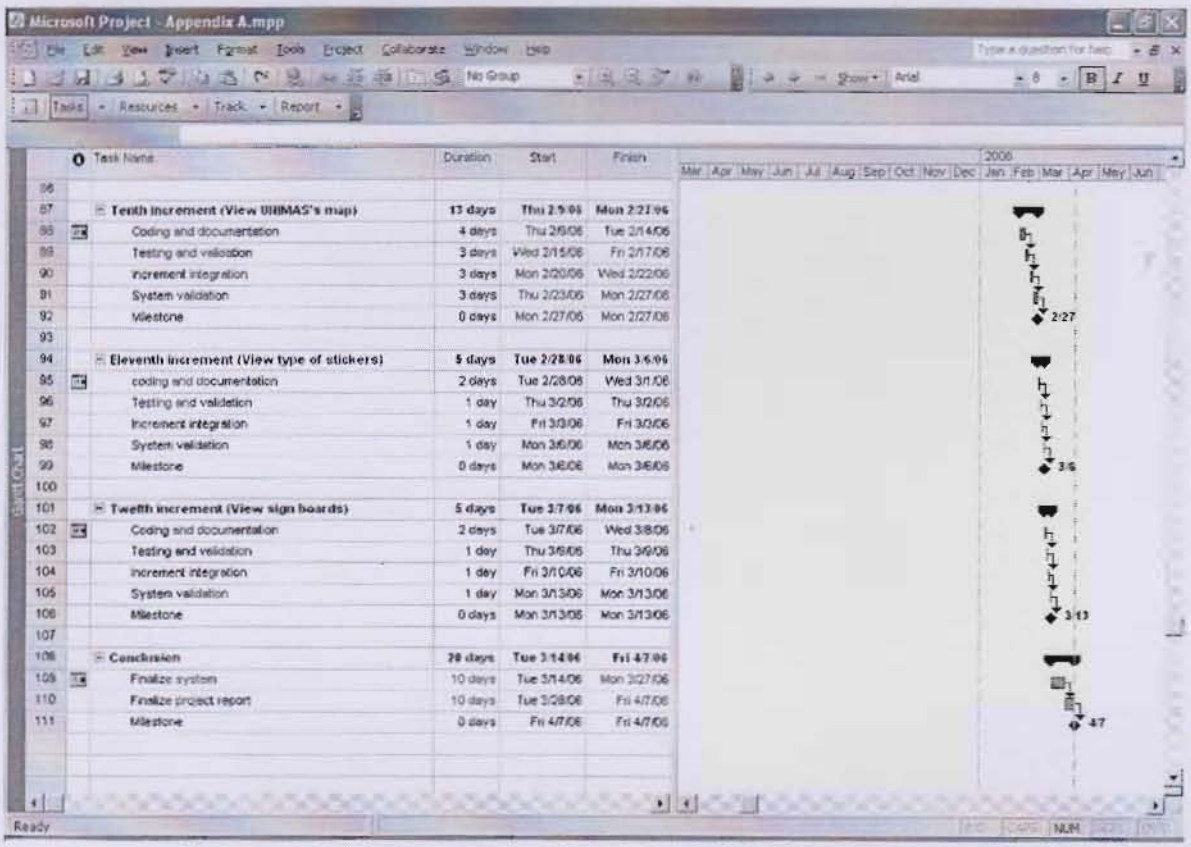
APPENDIX A: Gantt Chart






Microsoft Project - Appendix A.mpp
Task Name
Duration
Start
Finish
Sixth increment (application of vehicle sticker) 20 days Tue 10/18/05 Mon 11/14/05
Coding and documentation 6 days Tue 10/18/05 Tue 10/25/05
Testing and validation 5 days Wed 10/26/05 Tue 11/1/05
Increment integration 5 days Wed 11/2/05 Tue 11/8/05
System validation 4 days Wed 11/9/05 Mon 11/14/05
Milestone 0 days Mon 11/14/05 Mon 11/14/05
Seventh increment (sticker renewal) 9 days Tue 11/15/05 Fri 11/25/05
Coding and documentation 3 days Tue 11/15/05 Thu 11/17/05
Testing and validation 2 days Fri 11/18/05 Mon 11/21/05
Increment integration 2 days Tue 11/22/05 Wed 11/23/05
System validation 2 days Thu 11/24/05 Fri 11/25/05
Milestone 0 days Fri 11/25/05 Fri 11/25/05
Eight increment (report of stickers' distribution) 19 days Thu 12/8/05 Tue 1/3/06
Coding and documentation 7 days Thu 12/8/05 Fri 12/16/05
Testing and validation 5 days Mon 12/19/05 Fri 12/23/05
Increment integration 4 days Mon 12/26/05 Thu 12/29/05
System validation 3 days Fri 12/30/05 Tue 1/3/06
Milestone 0 days Tue 1/3/06 Tue 1/3/06
Ninth increment (keep track of applicants' record) 19 days Fri 1/6/06 Wed 2/1/06
Coding and documentation 6 days Fri 1/6/06 Fri 1/13/06
Testing and validation 5 days Mon 1/16/06 Fri 1/20/06
Increment integration 5 days Mon 1/23/06 Fri 1/27/06
System validation 3 days Mon 1/30/06 Wed 2/1/06
Milestone 0 days Wed 2/1/06 Wed 2/1/06
2006
Ready


Microsoft Project - Appendix A.mpp
Task Name
Duration
Start
Finish
Tenth increment (View UHMAS's map) 13 days Thu 2/9/06 Mon 2/27/06
Coding and documentation 4 days Thu 2/9/06 Tue 2/14/06
Testing and validation 3 days Wed 2/15/06 Fri 2/17/06
Increment integration 3 days Mon 2/20/06 Wed 2/22/06
System validation 3 days Thu 2/23/06 Mon 2/27/06
Milestone 0 days Mon 2/27/06 Mon 2/27/06
Eleventh increment (View type of stickers) 5 days Tue 2/28/06 Mon 3/6/06
Coding and documentation 2 days Tue 2/28/06 Wed 3/1/06
Testing and validation 1 day Thu 3/2/06 Thu 3/2/06
Increment integration 1 day Fri 3/3/06 Fri 3/3/06
System validation 1 day Mon 3/6/06 Mon 3/6/06
Milestone 0 days Mon 3/6/06 Mon 3/6/06
Twelfth increment (View sign boards) 5 days Tue 3/7/06 Mon 3/13/06
Coding and documentation 2 days Tue 3/7/06 Wed 3/8/06
Testing and validation 1 day Thu 3/9/06 Thu 3/9/06
Increment integration 1 day Fri 3/10/06 Fri 3/10/06
System validation 1 day Mon 3/13/06 Mon 3/13/06
Milestone 0 days Mon 3/13/06 Mon 3/13/06
Conclusion 20 days Tue 3/14/06 Fri 4/7/06
Finalize system 10 days Tue 3/14/06 Mon 3/27/06
Finalize project report 10 days Tue 3/28/06 Fri 4/7/06
Milestone 0 days Fri 4/7/06 Fri 4/7/06
2006
Ready

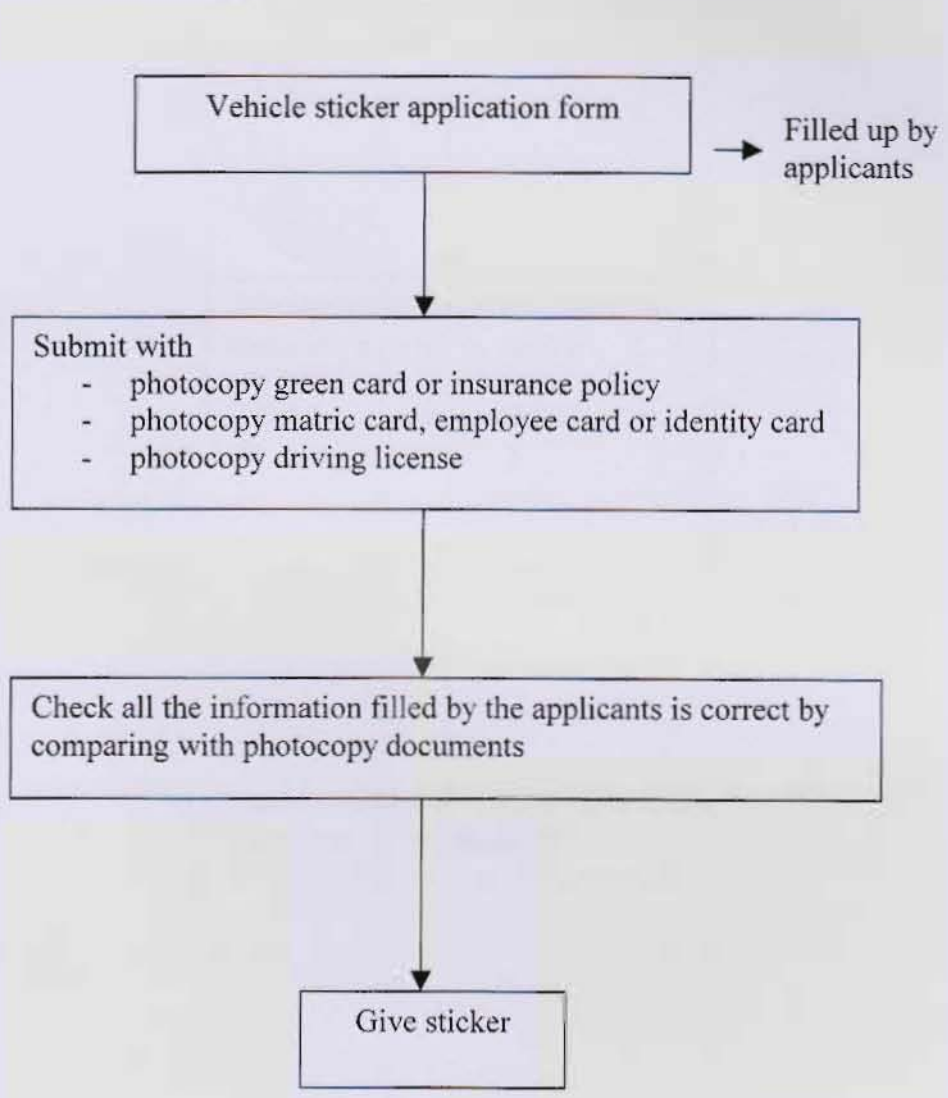
APPENDIX B: Interview Questions

Interview question for head of security division, Encik Yaman Hassan

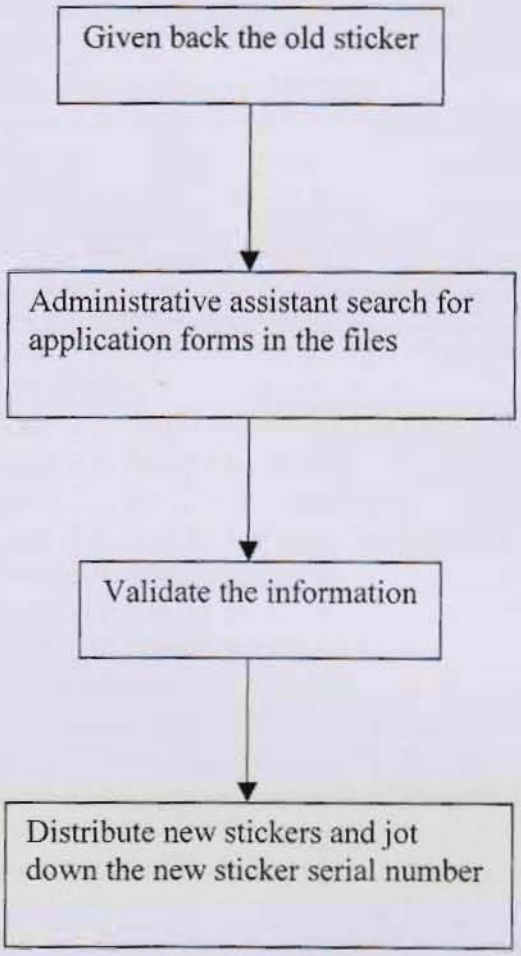
1. What is the current procedure for applying stickers at security division?
2. What are the current problems faced by administrative assistant during the process?
3. Who can apply for stickers?
4. How many zones at the UNIMAS temporary campus?
5. How much students, staff and visitors have to pay in order to get the sticker?
6. Students, staff and visitors need to renew the sticker after how many years?
7. After two years, when we renew the sticker, will the colour of sticker change or remain the same?
8. Where do administrative assistant keep track all the records?
9. What are the features the administrative assistants suggest that the new system should have?

APPENDIX C: Flow of Applying and Renewing Vehicle Stickers

Flow of Applying Vehicle Stickers



Flow of Renewing Vehicle Stickers After One Session



APPENDIX D: Data Dictionary

Data Flow Name	Login Details
Description	Contains administrative assistant login information and is used to validate authenticated user to access the system.
Source	Entity: Administrative Assistant
Destination	Process 1.0: Administrative Assistant Login
Data Flow (Input)	Login Details from Administrative Assistant
Data Flow (Output)	Login Details to Process 1.0
Data Structure	Login Details = User ID + Password

Data Flow Name	Valid Administrative Assistant
Description	Contains login status 'A' to allow administrative assistant to access system
Source	Process 1.0: Administrative Assistant Login
Destination	Process 2.0: Setup Master File Process 3.0: Set The Specification Process 4.0: Key In Applicant Information Process 5.0: Sticker Renewal Process 7.0: Key In Summon Process 8.0: Search Applicant's List
Data Flow (Input)	Valid Administrative Assistant from Process 1.0
Data Flow (Output)	Valid Administrative Assistant to Process 2.0 Valid Administrative Assistant to Process 3.0 Valid Administrative Assistant to Process 4.0 Valid Administrative Assistant to Process 5.0 Valid Administrative Assistant to Process 7.0 Valid Administrative Assistant to Process 8.0
Data Structure	Valid Administrative Assistant = Login Status

Data Flow Name	Change Password
Description	This information is needed when administrative assistants want to change their current password
Source	Process 1.0: Administrative Assistant Login
Destination	Data Store: Login database
Data Flow (Input)	Change Password from Process 1.0
Data Flow (Output)	Change Password to login database
Data Structure	Change Password = New Password

Data Flow Name	Applicant Category Information
Description	Contains applicant's category such as staff, students and visitors details and is stored in applicant_category database
Source	Process 2.0: Setup Master File
Destination	Data Store: applicant_category database
Data Flow (Input)	Applicant Category Information from Process 2.0

Data Flow (Output)	Applicant Category Information to applicant_category database.
Data Structure	Applicant Category = [staff | visitor | student]

Data Flow Name	Vehicle Type Information
Description	Contains type of vehicle such as car and motorcycle
Source	Process 2.0: Setup Master File
Destination	Data Store: veh_type database
Data Flow (Input)	Vehicle Type Information from Process 2.0
Data Flow (Output)	Vehicle Type Information to veh_type database
Data Structure	Vehicle Type = [car | motorcycle]

Data Flow Name	Session Information
Description	Store Session Information
Source	Process 2.0: Setup Master File
Destination	Data Store: session database
Data Flow (Input)	Session Information from Process 2.0
Data Flow (Output)	Session Information to session database
Data Structure	Session Information = Session Name

Data Flow Name	Faculty Information
Description	Contains all The faculties, centres and institutes name
Source	Process 2.0: Setup Master File
Destination	Data Store: faculty database
Data Flow (Input)	Faculty Information from Process 2.0
Data Flow (Output)	Faculty Information to faculty database
Data Structure	Faculty Information = Faculty Name + Centre Name + Institute name

Data Flow Name	Hostel Information
Description	Contains all the hostels name in the campus
Source	Process 2.0: Setup Master File
Destination	Data Store: hostel database
Data Flow (Input)	Hostel Information from Process 2.0
Data Flow (Output)	Hostel Information to hostel database
Data Structure	Hostel Information = Hostel Name

Data Flow Name	Fault Information
Description	Contains type of road safety faults done by students, staff and visitors
Source	Process 2.0: Setup Master File
Destination	Data Store: fault database
Data Flow (Input)	Fault Information from Process 2.0
Data Flow (Output)	Fault Information to fault database
Data Structure	Fault Information = Code + Type of Fault + Method

Data Flow Name	Zone Information
Description	Contains all the places and zones in temporary campus
Source	Process 2.0: Setup Master File
Destination	Data Store: zone database
Data Flow (Input)	Zone Information from Process 2.0
Data Flow (Output)	Zone Information to zone database
Data Structure	Zone Information = Zone Number + Zone Name

Data Flow Name	Specification Information
Description	Contains the specification that need to be set to ensure that the first sticker serial number begins with 0001
Source	Process 3.0: Administrative Assistant Set The Specification
Destination	Data store: specification database
Data Flow (Input)	Specification Information from Process 3.0
Data Flow (Output)	Specification Information to specification database
Data Structure	Specification Information = Session + Digits for Serial Number

Data Flow Name	Applicant Information
Description	Contains applicant details and is stored in applicant database
Source	Process 4.0: Administrative Assistant Key In Applicant Information Process 6.0: Sticker Serial Numbers Assignment
Destination	Data Store: applicant database Process 8.0: Search Applicant's List
Data Flow (Input)	Applicant Information from Process 4.0 Applicant Information from Process 6.0 Applicant Information from applicant database
Data Flow (Output)	Applicant Information to applicant database Applicant Information to Process 4.0 Applicant Information to Process 6.0 Applicant Information to Process 8.0
Data Structure	Applicant Information = Matric Number/ Staff Number/ Visitor Number + Category + Name + I.C. Number + Designation + College + Faculty + Address + Home Phone Number+ Handphone Number

Data Flow Name	New Applicant Information
Description	Contains New Applicant Information entered by Administrative Assistant
Source	Entity: Administrative Assistant
Destination	Data Store: applicant database Process 4.0: Administrative Assistant Key In Applicant Information
Data Flow (Input)	New Applicant Information from Administrative Assistant
Data Flow (Output)	New Applicant Information to Process 4.0

Data Structure	New Applicant Information = Session + Applicant Number + Type of Applicant + Applicant's Name + Type of Vehicle + Vehicle Registration Number + Colour + Vehicle's Model + Capacity + Serial Number + Name of Vehicle's Owner + Relationship of Applicant and Vehicle's Owner + Address

Data Flow Name	Sticker Information
Description	Contains sticker information which has been ready to assign and which already been assigned.
Source	Data Store: sticker database
Destination	Process 6.0: Stickers Serial Numbers Assignment
Data Flow (Input)	Sticker Information from Process 4.0
Data Flow (Output)	Sticker Information to Process 6.0
Data Structure	Sticker Information = Sticker Number + Applicant Number + I.C. Number

Data Flow Name	Search Applicant Key
Description	Administrative assistant search applicant information using this key
Source	Entity: Administrative Assistant
Destination	Process 8.0: Search Applicants' List
Data Flow (Input)	Search Applicant Key from Administrative Assistant
Data Flow (Output)	Search Applicant Key to Process 8.0
Data Structure	Search Applicant Key = [Applicant Name | IC Number | Matric Number | College | Faculty | Vehicle's Owner Name | Vehicle's Model | Vehicle's Registration Number | Vehicle's Colour]

Data Flow Name	Search Applicant Result
Description	Contains applicant personal information
Source	Process 8.0: Search Applicants' List
Destination	Entity: Administrative Assistant
Data Flow (Input)	Search Applicant Result from Process 8.0
Data Flow (Output)	Search Applicant Result to Administrative Assistant
Data Structure	Search Applicant Result = Applicant Information

APPENDIX E: Process Specification

Process Name	Administrative Assistant Login (Process 1.0)
Description	Validate administrative assistant's login
Data Flow (Input)	Login Details from Administrative Assistant Login Information from login database
Data Flow (output)	Valid Administrative Assistant to Process 2.0 Valid Administrative Assistant to Process 3.0 Valid Administrative Assistant to Process 4.0 Valid Administrative Assistant to Process 5.0 Valid Administrative Assistant to Process 7.0 Valid Administrative Assistant to Process 8.0
Process Logic	1. Administrative Assistant inputs user ID and password on login. 2. System verifies user ID and Password. 3. System links administrative assistant to appropriate pages. 4. If login invalid, message box pop up and system returns to login page.

Process Name	Setup Master File (Process 2.0)
Description	Administrative assistant has to setup the master file
Data Flow (Input)	Valid administrative Assistant form Process 2.0 Applicant Category Information from applicant_category database Vehicle Type Information from veh_type database Session Information from session database Faculty Information from faculty database Hostel Information from hostel database Fault Information from fault database Zone Information from zone database
Data Flow (output)	Applicant Category Information to applicant_category database Vehicle Type Information to veh_type database Session Information to session database Faculty Information to faculty database Hostel Information to hostel database Fault Information to fault database Zone Information to zone database
Process Logic	1. Administrative assistant may add data to the database. 2. Administrative assistant may update data at the database. 3. Administrative assistant may delete data from the database. 4. Administrative may retrieve data from the database.

Process Name	Set The Specification (Process 3.0)
Description	Administrative Assistant needs to set the specification for sticker serial numbers
Data Flow (Input)	Valid Administrative Assistant from Process 1.0 Specification Information from specification database

	Session Information from session database
Data Flow (output)	Specification Information to specification database
Process Logic	1. Administrative assistant chooses the session. 2. Administrative assistant enters the digits that must be appeared for vehicles' stickers. 3. The system store information in specification database.

Process Name	Generate Stickers' Serial Numbers (Process 4.0)
Description	Administrative assistant generates the stickers' serial numbers.
Data Flow (Input)	New stickers' Serial Numbers Generation from Administrative Assistant Session Information from session database Vehicle Type Information from veh_type database
Data Flow (output)	Sticker Information to sticker database
Process Logic	1. Administrative assistant selects the particular session and vehicle's type and enters the serial numbers he or she is going to generate. 2. Administrative assistant saves the data. 3. Administrative assistant using the system to generate the stickers' serial numbers.

Process Name	Key In Applicant Information (Process 5.0)
Description	Administrative assistant inserts new applicant information
Data Flow (Input)	New Applicant Information from Administrative Assistant Applicant Category Information from applicant_category database College Information from college database Faculty Information from faculty database Vehicle Type Information from veh_type database
Data Flow (output)	Applicant Information to applicant database Application Information to application database
Process Logic	1. Administrative Assistant at security division enters new applicant's information. 2. System update applicant and application database.

Process Name	Sticker Renewal (Process 6.0)
Description	Administrative assistant uses the system to renew the stickers for road users
Data Flow (Input)	Valid Administrative Assistant from Process 1.0 Application Information from application database Session Information from session database
Data Flow (output)	Application Information to application database Sticker Information to sticker database
Process Logic	1. Administrative assistant will help the students, staff and visitors to renew their stickers after two years. 2. They bring their old stickers to security division to change with new stickers.

	3. The new sticker information will store in sticker database.

Process Name	View Report of Sticker Distribution (Process 7.0)
Description	Each sticker will have unique serial number that assign to every road user
Data Flow (Input)	Application Information from application database Session Information from session database Vehicle Type Information from veh_type database
Data Flow (output)	Sticker Information to sticker database
Process Logic	1. Administrative assistant will key in the serial number distribute to each road user. 2. System stores new information in application and sticker database.

Process Name	Search Applicant's List (Process 8.0)
Description	Allow administrative assistant to search for particular applicant information
Data Flow (Input)	Valid Administrative Assistant from Process 1.0 Search Applicant Key from Administrative Assistant Applicant Information from applicant database
Data Flow (output)	Search Applicant Result to Administrative Assistant
Process Logic	1. Administrative assistant inserts search key for searching particular applicant information. 2. System refers to the database for retrieving desired result by using search key. 3. System returns search result to the screen.

APPENDIX F: Normalization

First Normal Form (1NF)

user_ID	category_no	veh_type_no	session_no	faculty_no	hostel_no

fault_cd	zone_no	applicant_no	apply_type	apply_no	sticker_no

password	category_name	session_name	faculty_name	hostel_name	fault_desc

fault_method	zone_name	xpos	ypos	active	pad_char	sticker_len

name	ic_no	designation	mail_addr1	mail_addr2	mail_addr3	tel_no	hphone_no

photo_file	app_category	veh_no	veh_owner	colour	model	capacity	owner_relation

owner_addr1	owner_addr2	owner_addr3	resp_name	usage	status	colour

serial_no	remarks

Second Normal Form (2NF)

Login

user_ID	password

Specification – sticker

session_no	pad_char	sticker_len	veh_type_no	colour	sticker_no	Serial_no

remarks	status	Applicant_no

Applicant – applicant_category

applicant_no	name	ic_no	designation	hostel_no	faculty_no	mail_addr1

mail_addr2	mail_addr3	tel_no	hphone_no	photo_file	app_type	category_no

category_name	Status

Application – veh_type

apply_no	apply_type	applicant_no	session_no	veh_no	veh_owner	colour

model	capacity	sticker_no	owner_relation	owner_addr1	owner_addr2

owner_addr3	resp_name	usage	veh_type_no	veh_type_name	status

Applicant – application

applicant_no	name	ic_no	designation	hostel_no	faculty_no	mail_addr1

mail_addr2	mail_addr3	tel_no	hphone_no	photo_file	app_type	app_category

apply_no	apply_type	session_no	veh_no	veh_type_no	veh_owner	colour

model	capacity	sticker_no	owner_relation	owner_addr1	owner_addr2

owner_addr3	resp_name	usage	status

Applicant – faculty

applicant_no	name	ic_no	designation	hostel_no	faculty_no

mail_addr1	mail_addr2	mail_addr3	tel_no	hphone_no	photo_file	app_type

app_category	faculty_no	faculty_name	status

Applicant – hostel

applicant_no	name	ic_no	designation	faculty_no	mail_addr1	mail_addr2

mail_addr3	tel_no	hphone_no	photo_file	app_type	app_category	hostel_no

hostel_name	status

Session – application

session_no	session_name	apply_no	apply_type	applicant_no	veh_no	veh_type_no

veh_owner	colour	model	capacity	sticker_no	owner_relation	owner_addr1	owner_addr2

owner_addr3	resp_name	usage	status

Application –sticker

apply_no	apply_type	applicant_no	session_no	veh_no	veh_type_no	veh_owner

colour	model	capacity	owner_relation	owner_addr1	owner_addr2	owner_addr3

resp_name	usage	status	veh_type_no	colour	sticker_no	serial_no	remarks	status

Fault

fault_cd	fault_desc	fault_method	active

Zone

zone_no	zone_name	xpos	ypos	active

Third Normal Form (3NF)

Login

userID	password

Applicant_category

category_no	category_name	app_type	status

Veh_type

veh_type_no	veh_type_name	status

Session

session_no	session_name	status

Faculty

faculty_no	faculty_name	status

Hostel

hostel_no	hostel_name	status

Fault

fault_cd	fault_desc	fault_method	status

Zone

zone_no	zone_name	xpos	ypos	status

Specification

session_no	pad_char	sticker_len

Sticker

session_no	veh_type_no	colour	sticker_no	serial_no	remarks	status	applicant_no

Applicant

applicant_no	name	ic_no	designation	hostel_no	faculty_no	mail_addr1

mail_addr2	mail_addr3	tel_no	hphone_no	photo_file	app_type	app_category

Application

apply_no	apply_type	applicant_no	session_no	veh_no	veh_type_no	veh_owner

colour	model	capacity	sticker_no	owner_relation	owner_addr1	owner_addr2

owner_addr3	resp_name	usage	status

Legend:

_____ Primary key

- - - - - - - - - - - - - - Foreign key