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JUDUL **BUS MANAGEMENT SYSTEM**

SESI PENGAJIAN: **2004/2005**

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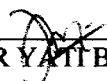
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BUS MANAGEMENT SYSTEM

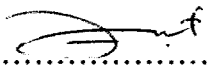
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MARCH, 2005

I declare that this thesis entitled “Bus Management System” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ABSTRACT

Bus Management System is an integrated electronic management system. This system ensure that the management process of this can company are smoothly done. This system will also help in decreasing error mostly cause by human mistake. This system was developed as one of the solution to transfer from current manual practices to a more systematic computerized system. This system will be developed by using Microsoft Visual Basic and Microsoft Access. Briefly there are two main modules for this system. The first module will be the Driver Management module and the second module will be Bus Management Module. However this thesis will just describe about Bus Management Module. In this module, the function that will be developed include, bus registration, maintenance record, and reminder. For this research, the case study been done in Transnasional Kuantan.

ABSTRAK

Sistem Pengurusan Bus merupakan satu sistem pengurusan elektronik yang bersepadu. Sistem ini membolehkan semua urusan berkaitan pengurusan sesuatu syarikat bas dapat dijalankan dengan lancar. Sistem ini juga membantu mengurangkan kesalahan yang berlaku khususnya yang disebabkan oleh kecuaiian manusia. Sistem pengurusan bas ini dibangunkan sebagai salah satu cadangan penyelesaian bagi menukarkan kaedah manual yang diguna pakai kini kepada kaedah berkomputer yang lebih tersusun. Sistem ini akan dibangunkan menggunakan perisian Microsoft Visual dan Microsoft Access. Secara umum terdapat dua modul utama yang akan dibangunkan untuk sistem ini. Modul pertama ialah modul pengurusan pemandu dan modul yang kedua ialah modul pengurusan bas. Walau bagaimanapun tesis ini hanya akan membincangkan berkenaan modul pengurusan bas. Di dalam modul ini, fungsi – fungsi yang akan dibangunkan merangkumi, pendaftaran bus, rekod baik pulih bas, dan fungsi peringatan. Untuk tujuan kajian ini, kajian kes telah dilakukan di Transnasional Kuantan.

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LIST OF ABBREVIATIONS

ACCESS	- Microsoft Access
ASP	- Active Server Pages
BMS	- Bus Management System
COM	- Component Object Model
HTML	- Hyper Text Markup Language
HTTP	- Hypertext Transfer Protocol
IDE	- Interactive Development Environment
LAN	- Local Area Network
MATRADE	- Malaysia External Trade Development Corporation
PC	- Personal Computer
SQL	- Structured Query Language
SSL	- Secure Socket Layers
TCP	- Transfer Control Protocol
TLS	- Transport Layer Security
VB	- Visual Basic
WWW	- World Wide Web

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will briefly describe about the Bus Management System (BMS). This is one of proposed solutions that can be used by many express bus companies especially in Malaysia. Major aspects that will be discussed include background of the system, problem statement, objectives of the project and scope of the project.

1.2 Background

The decade of the 1990s will undoubtedly be remembered as a period that witnessed an incredible diffusion of information technology through a massive and unanticipated spread in the use of personal computers (PC) and local area networks (LAN), the maturing of the Internet, and the development of the World Wide Web (WWW) and its enabling browser interface software. It was a decade that saw the emergence of networking and the widespread sharing of information, of the transformation from personal to work group computing, and of enterprise architecture and integrated systems. In short, the 1990s was a time when the power of computing and document creation passed out of the hands of traditional centralized providers of data and into the hands of individual workers

In this modern and globalize world a lot of thing might change. The way human works are no longer the same. In this modern world speed and reliability is a key to success. People start to rely on computer technology in order to accomplish their desire. Computer applications have been such important tools that slowly eliminate the use of current manual system which take more time. In fact in doing business, a lot of entrepreneurs used internet and computer applications to increase their revenue and decrease the cost.

The change has also given big impact to the business of many express bus companies especially in Malaysia. The idea of e-Ticketing is part of solutions that has been implemented widely by most of express bus company. In deed the profit grows because people may easily buy the ticket anytime, anywhere. Moreover most of the house in Malaysia own at least one computer that can connect to the internet. More than that, the number of PDA and Smart Phone user increase every year and it will keep on increasing. In fact when Malaysia transit from a developed to a modern country by year 2020, these technologies is a must for everyone. Level of lifestyle will also change and the goodies will be available to everyone.

The early days of computing, from the 1950-1970s, were dominated by small business and massive mainframe computers (used primarily for scientific applications), which managed data inputted from punched cards, produced massive amounts of paper printouts, and supported an attached network of a few local and remote terminals. [CDollar92] However nowadays according to a survey done by Malaysia External Trade Development Corporation (MATRADE), in Malaysia there is about 3 million active internet user in 2001 and expected to increase up to 6 million active internet user by year 2005 [MATRADE 5,Jun 2001]. Than Maxis in their press statement in Utusan Malaysia stated that there is 5 million Maxis user from 11 million mobile users in Malaysia. Therefore there is a big market for any e-Ticketing System developer.

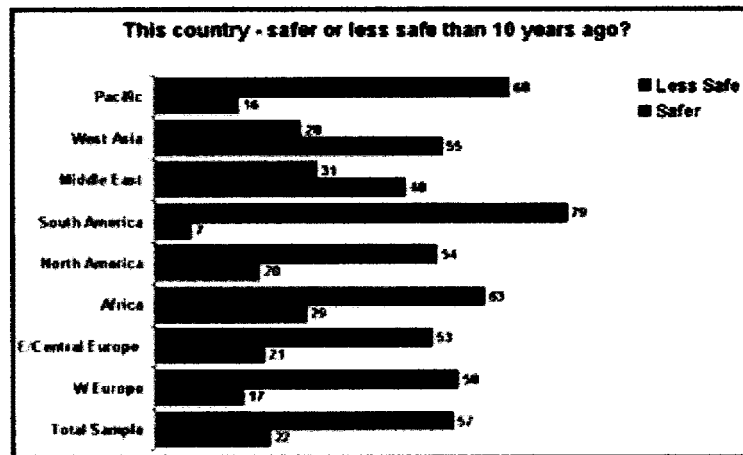


Figure 1.1: Statistic on safety

(Source: World Economists Magazines)

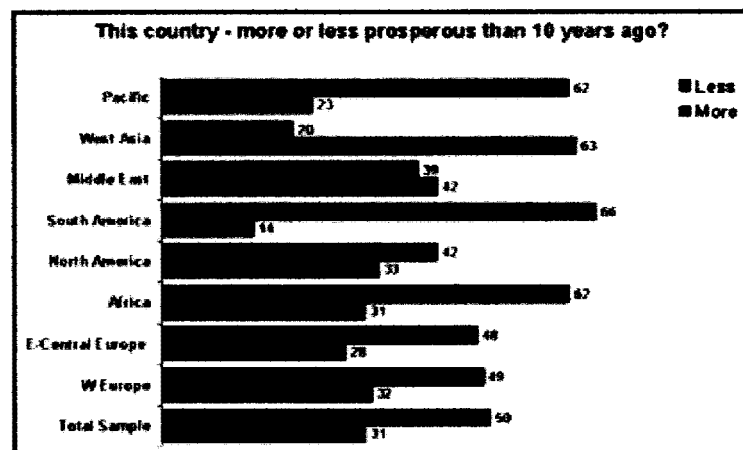


Figure 1.2: Statistic on prosperity

(Source: World Economists Magazines)

Based on figure 1.1 and figure 1.2, we can see that West Asia (including Malaysia) have shown a positive growth in safety and prosperity to the nation. This will increase the number of foreign investors to our country and provide more opportunities in technology and applications development.

However, besides these numerous systems, most of express bus companies don't invest on the management side. The management process still been done manually by

the manager or his personal assistant. Registration a new driver and bus are still done manually. In addition the schedule still set manually by the manager using a big white board that can be viewed by all. Record-keeping are also not maintain properly. Most of operational data are kept in a file and stored in cupboard. Some other tasks that is also done manually like payment and driver leave. Therefore a system that can be used to manage these entire tasks is needed by them in order to prevent any fault that may cause customer dissatisfaction.

As part of the solutions, Bus Management System is suggested for a small office management tools. Most of express bus company wouldn't invest too much on the electronic management system for their company. Therefore a standalone system is suitable for them because it won't cost them so much. This system is developed by using Microsoft Visual Basic 6.0 which provides a simple interface for the user. Microsoft Access used as it database which is one of the simplest and efficient Database Management System (DBMS) developed by Microsoft. Moreover, databases typically maintain only the current value for any given data element. As a result, in a typical transaction processing system, inviolate business records are difficult, if not impossible, to locate and retrieve. The user of the system will only for the Manager and his personal assistant or anyone that have been authorized by the manager.

Bus Management System will include the buses information, drivers' information, maintenance record and reminder. Search function are also added so that manager can search for bus information that has been stored in the databases.

For the purpose of this research, Transnasional Kuantan has agreed to give any relevant information needed. This includes any interview session, share of data, share of material and any that they can provide. They will also provide any relevant working procedure as it not against the company policy. In addition they will also give authorization to researcher to be at their workshop for any research purpose.

1.3 Problem Statement

In Transnasiona Kuantan, most of the driver information kept in a file. Therefore it is quite hard for them to search the driver information when needed. Moreover it uses a lot of papers in and increase of data lost because no backup provided for the data. Some of the data is quite hard to read because the form was filled up by hand writing. There is also another problem where some of the form has been screwed by dust and widow net.

The problems that occur in Bus Information is that to track its maintenance record. Most of the bus was sent will be maintained at list 4 times in year. By using a manual form, each bus must have its own maintenance record file. Problems that occur to this manual system are to store the maintenance record file and to find it back. It takes quite a time in order to find the correct maintenance record when needed.

Reminder is also a problem. In current system, manager will write the reminder at the white board. Reminder include road tax expired, PUSPAKOM check, driver's license dead line. The usage of white board may cause human mistake for example spelling, hand writing and others. More over if the manager is on leave, driver may forgot the maintenance date because they usually didn't went into the office.

1.4 Objectives

There are three main objectives that must be achieved by developing the system. These objectives are implemented through the use of some familiar function in Visual Basic and Microsoft Access. These objectives are as follows:

1.4.1 To set reminder needed for the bus

One of the objectives that must be achieved is to create a pop up to remind the manager about any import date. Pop up include PUSPAKOM check and bus number. This pop up will keep on popping until necessary action taken by the driver/manager.

1.4.2 To record all maintenance activities

Maintenance is one of the crucial parts in Bus Management System.

Maintenance record ensures the safety on passenger. Moreover it can help the manager to plan necessary budget for maintenance. Maintenance record is important to ensure that the bus in a good condition, therefore a systematic maintenance record must be developed. The maintenance record is added with search function so that manager can view maintenance history. Maintenance record will also include any changed part and the budget used for doing maintenance.

1.4.3 To implement search by using recursive

Search is one of important element in an Information Management System.

Users need a search technique that can shorten the respond time. Recursive is one of the searching styles that can be used to get faster result. Moreover quite few people used recursive in database search. Most of developer used sequential search because it is much easier than the others including recursive techniques.

1.5 Scope

There are a few scope been identified in order to complete the system. Some aspect will be very crucial and some are not. This part wills discus the scope of the system that will be developed which is the Bus Management System.

1.5.1 Case Study

This system done using material and data provided by Transnasional Kuantan. For the purpose of research the route that will be implement are only for Kuantan – Kuala Lumpur and Kuala Lumpur - Kuantan. The number of drives and bus is similar with the data in Kuantan branch. However the data use are not an actually data but same data types. The calculation made also based on actual calculation that been used currently by Transnasional Kuantan.

1.5.2 User

An authorize user will be the manager of Transnasional Kuantan and his personal assistant. They are they only person that have access to the system and can do all task in the system. However they have the rights to give authorization to other staff to use the system in any cases. Thus they cannot change the structure of databases created. However a presentation of the system can be made to members for headquarter as long as no business purpose on the system.

1.5.3 Data Range

The data range is only for 100 drivers and buses. More than that will cause a slow respond from the system. This is because when using a Recursive Binary Search, more variables are needed in order to sort and search the data. The use of too many variables can cause the system to respond poorly.

1.5.4 Limitation

Limitation for the system will include the data and the user. Only 100 data can be stored and only manager and his personal assistant can use the system. This is just for small office management system, therefore 100 data is quite a big number that it have.

1.5.5 Reminding

Reminder must be set according to the date and keep on popping until action taken and the task complete. For example maintenance reminder will keep on popping until the maintenance record been updated.

1.5.6 Maintenance Information

A complete maintenance record system must be developed. This is to ensure that the bus is in good condition. This also may help Transnasional Kuantan to calculate the budget use for maintenance

1.5.7 Integration

This driver's information system must be integrated with the bus information system so that a complete system is set up. Then the schedule can be set up by using automatic method.

CHAPTER 2

LITERATURE REVIEW

This chapter will discuss about project definition, comparison with other products, tools and references. This chapter will also briefly define some similar products that have been widely used in the market. In fact it also contains details and comment that have been given by some of the researcher whom studying in this field. Their ideas and methods of research are also defined in this chapter as basic ideas for further research done. Some reviews of techniques used are also discussed in this chapter.

2.3 Project Definition

This system is an Enterprise content management system (ECMS). Enterprise content management system consists of a core content management system, with additional capabilities to manage a broader range of organizational information. This often consists of document management, records management, digital asset management or collaboration features [CMb 2004-04].

The project named as Bus Management System. It will be develop by using Microsoft Visual Basic 6.0 and Microsoft Access as it Database. User of the system will be Branch Manager of Transnasional Kuantan and his Personal Assistant. However this

system can be used by anyone authorized by the manager. There are three major parts of the system which are Bus Information System, Maintenance Record and Reminder. The system is only for management of small office used.

This system is standalone system and only used one personal computer. The workstation to run this software will be the manager computer itself. It doesn't connect to any other branch. In other words this is not an integrated system. Therefore no further research had been done on network and communications fields because there is no support needed. In fact all reports are sent manually to headquarter by the manager every month.

The main objective of the system is to computerize all the manual works done by the branch manager. This may prevent data lost because most of computerize data will be back up. This also may prevent data lost during catastrophe or accident occurs. Moreover Transnasional can easily reduce their budget on the paper cost. In fact the use of space will be more beneficial because they are no longer used of locker to store all the maintenance and drivers' information. As a result it will produce a more conducive and comfortable workplace.

2.2 Studies of current system

The transportation group of companies is the largest operator of public bus transportation in Malaysia. With the most extensive coverage throughout Peninsular Malaysia, the stage bus operations and inter-city express services operate under a common banner, "Transnasional". The nationwide network is serviced by a fleet of more than 1,200 buses that cover 234 routes generating over 5,200 trips daily. This translates to around 55 million passengers annually. Transnasional is operated by nine subsidiaries that are strategically located to provide comfortable, reliable and most importantly, safe transportation to all its passengers Operating under NADICORP Holdings Sdn Bhd that

established in 1998, Transnasional Express Sdn Bhd has more than 30 years of experience servicing millions passengers all over the nation, the largest leading transportation operator in Malaysia

At this time, Transnasional Express for Kuantan branch still not has any computerized management system. All of the operation is done manually and kept in written document. The operation is base on decision that make by the operation officer. Bus and driver scheduling is assigned by operation officer manually. There are 60 drivers and 23 buses. 46 drivers have their own bus and every bus has 2 permanent drivers. Working day for the driver is 6 days a week. Usually, every driver has 3 to 4 trip per day. They are also having overtime or extra trip. Extra trip is depending on the number of passenger and the bus availability. The company also hire commando driver where the commando driver is responsible to take over the permanent driver's duty if the permanent driver is not available.

Driver license expiration is just recorded in the driver profile. There is no system that can alert the administrator about the license expiration date. The license renewing is depending on the drivers themselves. While the bus road tax and insurance is under the company responsible. It also does not have a system that can alert the administrator about the expiration date

2.3 Studies of existing system

This part will describe some of the electronic system that subjected to many express bus companies. There are a few example of systems that are widely use by many express bus companies in order to achieve their business goals. Some of the systems are not made for Bus Company in Malaysia. However for this research purpose, some of them are compared in term of operational features.

2.3.1 Plusliner System

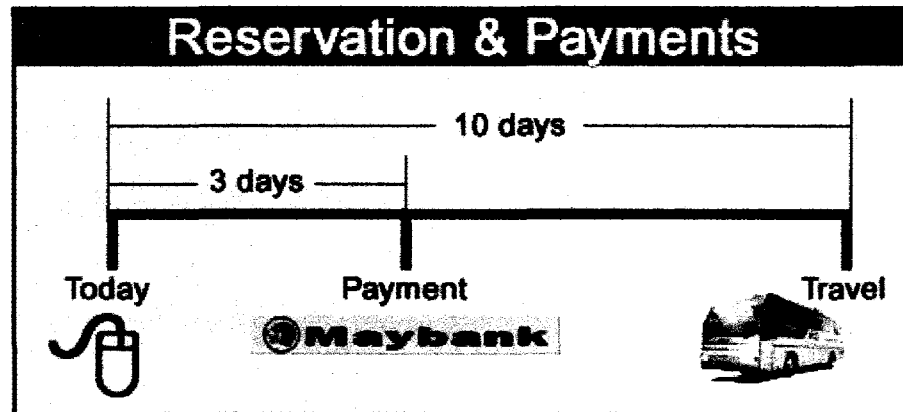


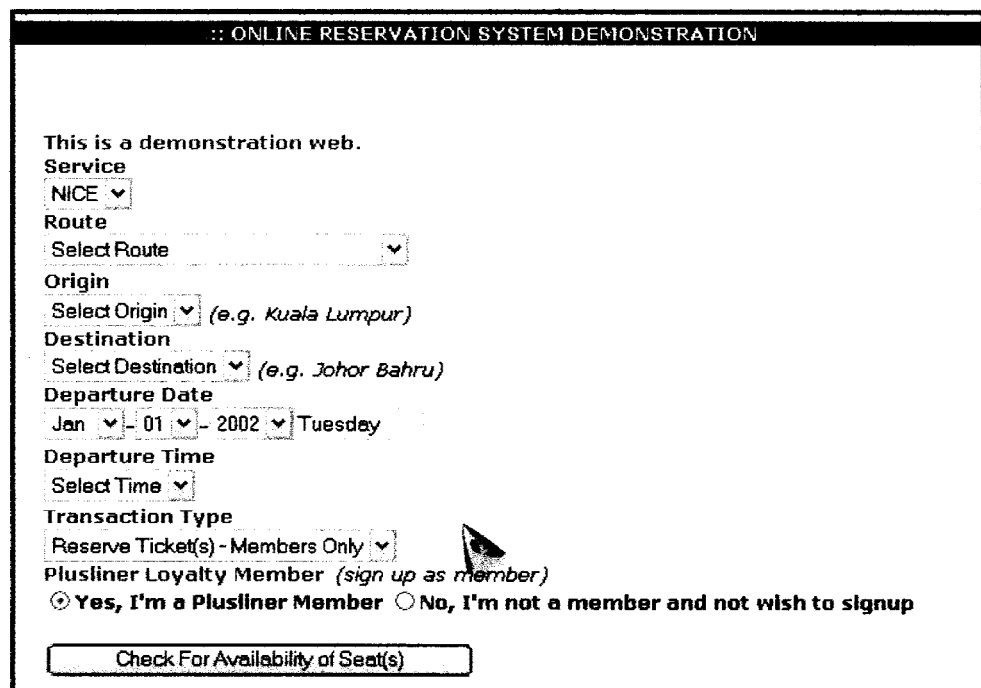
Figure 2.1: Plusliner Reservation & Payments

Figure 2.1 shows an example of reservations system that had been developed by Plusliner. The system is a web based system that had been developed by using Microsoft Active Server Pages language. Active Server Pages, Microsoft's technology to enables HTML pages to be dynamic and interactive by embedding scripts, i.e. either VBScript or JScript, Microsoft's alternative of JavaScript. Since the scripts in ASP pages (suffix .asp) are processed by the server, any browser can work with ASP pages regardless of its support for the scripting language used therein [Gates2001].

The main purpose of this system is to enable user to reserve or buy ticket online through the internet. This system is not mend to manage the bus or the driver. The only concern of the system is that user can get their ticket without queuing at the ticket counter. Moreover most of the Malaysian now prefers a fast and reliable ways in conjunction with the modern lifestyle that rely in speed and money. Thus most Malaysian will use an internet system to do a lot of works even shopping.

Because this is a web based system developed is using ASP language so it can also be access through PDA and Smart Phone. In fact in Malaysia, the market of mobile communications especially PDA and Smart Phone grown since year 2003[Siemens03]

For the database, Plusliner is using Oracle database because it has to cater a lot of data in period of time. It also implements the concurrent control method in order to ensure no data redundancy. Therefore a server is needed to store the data base and also a secure room to place the server. As a result, this system cost them quite a big money in order to ensure that it give a real satisfaction to the customers. However, revenue that they have is much compare to their investment for the system.



The screenshot displays a web interface titled "ONLINE RESERVATION SYSTEM DEMONSTRATION". It contains a form for booking a bus ticket. The form includes the following fields and options:

- Service:** A dropdown menu with "NICE" selected.
- Route:** A dropdown menu with "Select Route" selected.
- Origin:** A dropdown menu with "Select Origin" selected, followed by the text "(e.g. Kuala Lumpur)".
- Destination:** A dropdown menu with "Select Destination" selected, followed by the text "(e.g. Johor Bahru)".
- Departure Date:** A date picker showing "Jan", "01", and "2002", followed by the day "Tuesday".
- Departure Time:** A dropdown menu with "Select Time" selected.
- Transaction Type:** A dropdown menu with "Reserve Ticket(s) - Members Only" selected.
- Plusliner Loyalty Member:** A text label with the instruction "(sign up as member)".
- Member Selection:** Two radio buttons: "Yes, I'm a Plusliner Member" (which is selected) and "No, I'm not a member and not wish to signup".
- Submit Button:** A button labeled "Check For Availability of Seat(s)".

Figure 2.2: Example of Plusliner Interface

Figure 2.2 shows an example of Plusliner e-Ticketing Interface using Microsoft ASP language.

For safe transaction, Secure Socket Layers (SSL) is implemented. All important data such as password and account number is encrypted when the transaction done. SSL ensure that the data transferred securely because it involves online transaction. Once anything happens, the customer can sue the company. Moreover they can cause the customer to lose reliability to the bus company.

The Secure Sockets Layer (SSL) is a commonly-used protocol for managing the security of a message transmission on the Internet. SSL has recently been succeeded by Transport Layer Security (TLS), which is based on SSL. SSL uses a program layer located between the Internet's Hypertext Transfer Protocol (HTTP) and Transport Control Protocol (TCP) layers. SSL is included as part of both the Microsoft and Netscape browsers and most Web server products. Developed by Netscape, SSL also gained the support of Microsoft and other Internet client/server developers as well and became the de facto standard until evolving into Transport Layer Security. The "sockets" part of the term refers to the sockets method of passing data back and forth between a client and a server program in a network or between program layers in the same computer. SSL uses the public-and-private key encryption system from RSA, which also includes the use of a digital certificate [Cusack00]

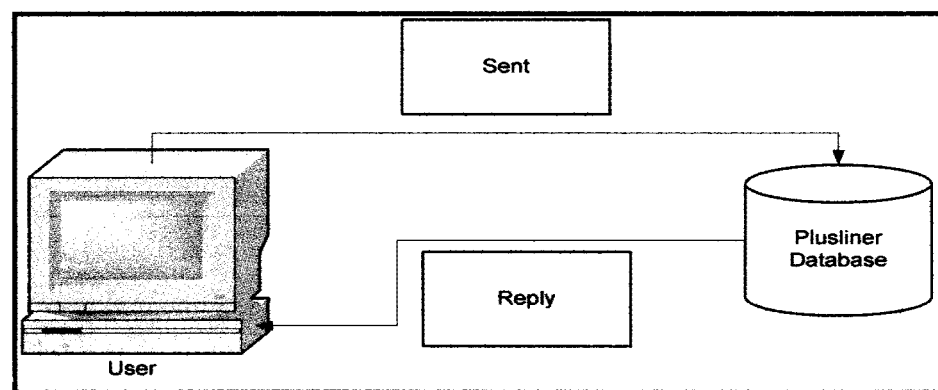


Figure 2.3: Plusliner Transactions

Figure 2.3 shows flow if the system that been used by Plusliner. User will interact directly with the database at Plusliner. User will send their requirement either to book or purchase the ticket. Database then will give the availability of the ticket that been requested by the user.

2.3.1.1 Plusliner Terms of Use

- Reservation of Plusliner and NiCE tickets(s) is strictly the privilege of registered Plusliner Loyalty Programme members of which the Annual Processing and Administration Fee has yet expired.
- Reservation is only allowed 10 days before travel, up to a period of 3 months.
- Payment for reserved ticket(s) must be made within 3 days from the reservation date, failing which - the reservation will automatically be cancelled without prior notice.
- The Confirmation Slip for online transactions must be printed and exchanged for a valid ticket on the date of travel, at the respective sales counter.
- No refunds, cancellations or transfers are applicable to reservations and purchases made through this website.
- A maximum of 5 seats may be reserved per transaction, limited to a total of 5 seats allocated per trip for web transactions. Additional reservations can only be made one working day after payment of the previous transaction.
- Reservations and Purchases through this website are currently only applicable to NiCE Executive Coach services only.
- Payments for reservations and purchases through this website are currently available only through Maybank2U.com, Maybank Phone Banking, Maybank Credit Card (through Maybank2U.com), and by direct payments at Maybank branches within Malaysia only.

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2.3.2 Nadi.com

Inter-city Express **PLAN YOUR JOURNEY IN 4 EASY STEPS**

step 1 **step 2** **step 3** **step 4**
Destination **Routing** **Ticket Agents** **Print**

Where do you plan to go?

From : Kuantan
To : Kuala Lumpur
Day : Monday

-> step 2

Figure 2.4: Nadi.com Interface

Figure 2.4 shows an example of a system that been developed by nadi.com for Transnasioanal Experss Bus. This system is also known as 4 steps plan. Differ with Plusliner system, users are not allowed to select departure time. They can only select the origin place, their destination and the day they want to travels. Moreover this system is only to view the bus, not t buy or book any tickets.

Nadi. Com has an idea of developing Transnasional e-pay so that customer can still buy ticket without going to the ticket counter. However the system can only be used in some selected Mesra Petronas Stations. This system is quite different from the Plusliner system. In this system user have to go to Petronas and request for ticket. Then

the attendance will check for available ticket from the data base and give it to the customer. Then customer will pay the ticket price to the attendance.

Inter-city Express

PLAN YOUR JOURNEY IN 4 EASY STEPS

step 1

Destination

step 2

Routing

step 3

Ticket Agents

step 4

Print

Locate the ticketing outlets nearest to your home.

> State

:

Kuala Lumpur

▼

> Area

:

Putrajaya

▼

PETRONAS OUTLET(S)

Address	Contact No.
Stesen Petronas PT 1442, HS(M) 668, Mukim Dengkil, 43860 Presinct 9, Putrajaya, Wilayah Persekutuan. Kuala Lumpur.	Phone: +603 - 88889115 Fax : +603 - 88889116 Mobile: +6017 - 8878990

step 2 ←

→ print

Figure 2.5: Example of Petronas Equip with E-pay

Based on figure 2.5 we can see that this system provide the user will information of the nearest Mesra Petronas Stations that they can purchase ticket by using e-pay system

Nadi.com didn't implement SSL in their system. This is because no money transaction had been done. In fact transaction has done manually between attendance and customer. Then a representative from Transnasiona comes to the station every week to collect the money. Therefore no online money transaction process occurs.

Nadi.com use ASP.net in their development, the database used is Oracle. Communication occurs between the attendance and only the server. So the respond time will be faster because there is only small number of Mesra Petronas Stations that involved in the system.

From both systems we can conclude that current automated system stress more on ticket transaction. However, lack of concern on management may cause mistake in current automated system. Therefore, there must be a system to manage the bus and drivers.

2.3.3 EZ maintenance CMMS maintenance software

EZ maintenance is a complete management tools that enables user to manage transport according to registration number. There are two main parts which is the equipment maintenance and vehicles maintenance. Below will describe the function and benefits that EZ maintenance provide for the user.

2.3.3.1 Maintenance Records

This system will provide an information about the maintenance need by any vehicles that been registered to the system. The main items to measure the maintenance

need will be the odometer for the transport. Its also include the selection that enables user to exclude weekends in the calculations. Moreover, if driver don't do maintenance of the appropriate date, the must fill a reason that will be noted by their supervisor for further actions.

2.3.3.2 Locate Records

This system also allows user to record any maintenance record that been stored in the database. The key will be the registration number (vehicles number) because every vehicle has their number. It also provides an electronic sign which enables the user to proceed with any process.

2.3.3.3 Work orders

EZ Maintenance will produce a work order for each individual vehicle service to be completed. This work order can contain step by step instructions on how to perform a particular service, coupled with a required parts and materials list. The work order can be printed, and contains a signature line for the person performing the work to sign confirming the work has been done in accordance with the specifications. All procedures and materials can be put on a work order on a "point and click" basis from drop down menus.

2.3.3.4 Reports

EZ maintenance will also provide report to the user. There are two types of report which are full report and types report. User may also look for daily, weekly or monthly report. This report can be printed or email if any body need it. Examples of Interface used in EZ Maintenance; please refer appendix a.

2.4 Tools

This part will discuss on what are the tools that will be used for developing the Bus Management System and what are the advantages of it. As been stated before, this is a standalone system. Therefore it's only used a simple and small medium developments tool. The costs to develop this software are also not too high because of these tools used. Moreover Bus Company won't invest so much on this management site compare to e-Ticketing business.

2.4.1 Interface

Bus Management System will be developed by using Visual Basic 6.0 for the interface. Interface created by using standard form. Items in the form are made according to the items given by Transnasiona Kuantan. However some are not because the needed forms are not available or stored at headquarter. These are some advantages of using Visual Basic [McMOHAN]:

- The structure of the Basic programming language is very simple, particularly as to the executable code.
- VB is not only a language but primarily an integrated, interactive development environment ("IDE").

- The *VB-IDE* has been highly optimized to support rapid application development ("*RAD*"). It is particularly easy to develop graphical user interfaces and to connect them to handler functions provided by the application.
- The graphical user interface of the *VB-IDE* provides intuitively appealing views for the management of the program structure in the large and the various types of entities (classes, modules, procedures, forms ...).
- *VB* provides a comprehensive interactive and context-sensitive online help system.
- When editing program texts the "IntelliSense" technology informs you in a little popup window about the types of constructs that may be entered at the current cursor location.
- *VB* is a component integration language which is attuned to Microsoft's Component Object Model ("*COM*").
- *COM* components can be written in different languages and then integrated using *VB*.
- Interfaces of *COM* components can be easily called remotely via Distributed *COM* ("*DCOM*"), which makes it easy to construct distributed applications.
- *COM* components can be embedded in / linked to your application's user interface and also in/to stored documents (Object Linking and Embedding "*OLE*", "Compound Documents").
- There is a wealth of readily available *COM* components for many different purposes

2.4.2 Database

A database refers to a collection of interrelated data, plus a set of programs to access, modify, and maintain the information. A database's primary function is to store

and manage large amounts of information. When used with a document imaging system, the database contains the key search words which are mapped (pointed) to the associated documents. The integrity of this relationship must be maintained in order to retrieve a document.

According to a study by Gartner Dataquest, in 2001 the three major databases were Oracle (32%), IBM DB2 (31.6%), and Microsoft SQL Server (16.3%). But the management of databases gets more complicated with sub specialization: UNIX, Windows, Linux, MVS, Open VMS, NUMA-Q, OS/2 and AS/400. Where the prices of the three major databases are comparable, skills required to maintain them are a different story. "Database expertise is a costly thing and is usually in short supply. Make no mistake about it: this is a long-term commitment, as switching database vendors is an extremely painful and costly procedure," according to Alex Kriegal and Boris Trukhnov, authors of The SQL Bible.

Because this is a small system, Microsoft Access been used as the database. Moreover there are not much data that is needed to store in a database. Microsoft Access is also easy to manage and can cooperate well with Microsoft Visual Basic. In fact the cost of using it is much cheaper than using Oracle.

Microsoft Access is also simple to use, the embedded SQL code enables user to create tables easily. It also provides simple solutions for the user to define primary key, relations and etc. Moreover users may also create a query without knowing SQL language. It also can automatically create report for the user.

2.4.3 Searching

This part will compare the searching style that have been used and what searching style will be used for Bus Management System

2.4.3.1 Sequential Search

Most popular approach used in database search. Most developer used sequential search because it is easy to program. Most used is the SELECT STATEMENT that can be implemented easily using SQL Statement.

However this search will take quite a long time of the data is at the end of the database. This may also cause system to hang if the data is too much in the database.

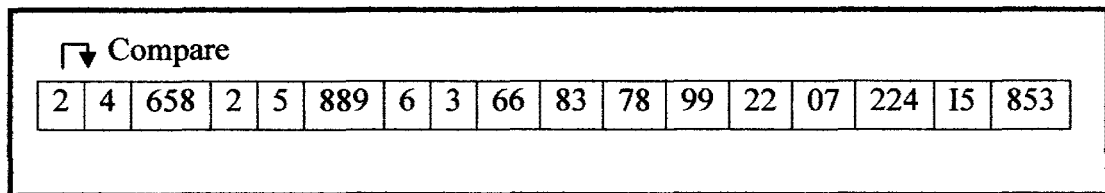


Figure 2.6: Sequential Search

2.4.3.2 Recursive (Binary Search)

According to DS Malik[2002] a *binary search tree* is a recursively defined data structure that simplifies the process of conducting binary searches by marking appropriate bisection points structurally instead of requiring them to be computed. Unlike an array, it also allows for the efficient insertion of new items in the data structure during program execution

A binary search tree B either is empty or consists of a datum (typically a record that includes a key field) and two binary search trees L and R , called the left and right subtrees of B . Either or both of these subtrees may of course be empty. An invariant condition of every non-empty binary search tree B is that if its left subtree L is not empty, the key of the record stored at L is less than the key of the record stored at B (or precedes it in some conventional ordering of the key data type), and similarly that if B 's right subtree R is not empty, the key of the datum stored at R is greater than the key of the record stored at B . This invariant must be preserved whenever the contents of a binary search tree are changed [grin96].

Some examples of recursion code can be fine in the Internet. Moreover a lot of researches have been done in recursive fields. In Pascal the code are more likely as in figure 2.7 below.

```

type
  Element = record
    Key: KeyType;
    { and presumably other fields }
  end;
  BinarySearchTree = ^Component;
  Component = record
    Datum: Element;
    Left, Right: BinarySearchTree
  end;

```

Figure 2.7: Pascal Algorithm

In order hands we can define recursion binary search according to this algorithm. This is the basic rules in doing the recursive algorithm that can be used to execute it:

```

CODELINE1  N=0;
CODELINE2  IF N=<10 THEN DO WRITE LETTER;
CODELINE3  ELSE GOTO CODELINE6;
CODELINE4  N=N+1;
CODELINE5  GOTO CODELINE2;
CODELINE6  ...some other instruction

```

Figure 2.8: Recursive Algorithm

As shown in figure 2.8, here, the instructions labeled CODELINE2 through CODELINE5 are recursive until the condition of N having the value of 10. "IF N=<10" means "If N has a value less than 10." "N=N+1" means "Add 1 to the current value of N."

Implementing the binary search may shorten the respond time. This is because the data will be divided into to part which is lower and upper part. In hypothesis, the respond time will be half than the sequential search. This is because only half of the data are searched in order to find the items. However this may not very clear according to any constraint especially with the tools selected.

However implementing C language in Microsoft Access may cause system error. This is because most of searching functions in Access are done by using Microsoft SQL Statement. Moreover the use of select statement may provide a fast and reliable solution. Somehow this error can be fixed by defining the right algorithm into the database.

CHAPTER 3

METHODOLOGY

This chapter will discuss on what are the method will be used in developing the system. Some aspect that will be discussed is the phases in software development plan. It will also describe every activity done during every phase. In additions, it will provide details of the system during development.

3.1 Software Development Model

This system will be developed by using waterfall model. Waterfall model is easy to understand. The next phase started after finish of the previous phase. Therefore it could avoid fault during development process. Moreover waterfall model provide a step by step solutions to solve any problems.

Waterfall model can be divided into five main phases. They are analysis phase, Planning Phase, Design Phase, Coding & Testing Phase and Implementation Phase. Each and every activity is done according to a specific timeline to avoid overdue. As a result a system result a well structured plan must be develop to ensure this project meets its goals. In fact it is hoped that user will be satisfied with the system because it can help them to manage their job well.

3.1.1 Analysis

An Interview session has been conducted with the manager of Transnasional Kuantan. Discussion made about the current system. Matters which also discussed are about the workflow inside the company. Some other aspect that also been discussed are how data is stored, payment, schedule, drivers' management and etc. Discussion also made on what are the problems with current manual system Then an electronic solutions are proposed to overcome all the problems that been stated.

Besides interview, research done through the internet. Current system that exists compared to the new system. Basic ideas of how Bus Company runs their business are also gathered from the internet. Comparisons are also made in order to find the best method to be implemented in order to finish the system.

In business aspect, some research been done to see the future of this business. Some magazines that been used is Economics, "Dewan Ekonomi and TIMES. Company website are also surfed in order to find any relevant information and the policy if that company. In fact the terms of use for some workflow are also studied to accomplish this project.

Samples of questionnaires can be found in appendix b for further information. This questionnaire is to get information about current practices and their taught on new proposed system.

3.1.2 Planning

During the planning phase, the first job is to manage the time well. Therefore a proper Gant Chart has been made. In additions, all resource are determine a according to

the requirements. Therefore a study been done to identify what is the main concern of the user. What are the user really wanted and how it can be done?

During the planning phase, one off the main concern is the hardware and software specifications. All hardware that needed to developed the system been identified with the best requirement that it should have to perform the task. Then a best tool is defined to be use in the development phase. The main objective is this system can respond well and doesn't cost so much to the company.

During planning phase scope of the system been discussed among the researcher. Then two main modules were identified and divided so that it can be easily developed by the developer.

For further details on the development & implementations plan, please refer appendix c. The Gant Chart will show the plan for the system.

3.1.3 Design

The third phase is the design phase. In design phase the flow of the system created. One of the ideas is to use Unified Modeling Language (UML). UML is a tools developed to helps understanding the system.

The first thing to do is to look at overview of the system; therefore a complete Use Case is need. Here the actor will be the manager of Transnasional Kuantan or anyone that has been authorized by the manager.

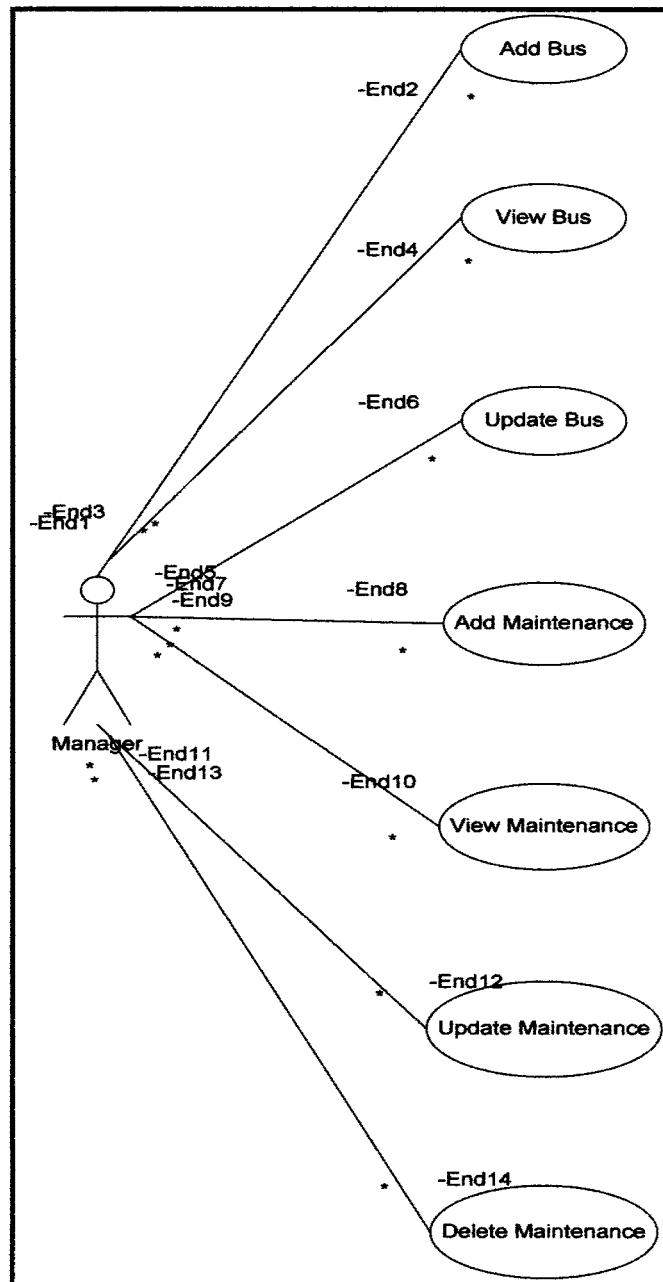


Figure 3.1: Use Case

Figure 3.1 below shows the Use Case diagram for Bus Management System. There are 7 activities that can be done by the manager. These tasks are defined from the requirements study done during the analysis phase. Sequence diagram included in appendix D

3.1.4 Coding and Testing (Black Box & White Box)

Here all the code been developed. In this system, two type of code that is really important. The first type will be the SQL for Microsoft Access Database. However by using wizard, most of the codes are automatically generated by computer. Therefore most of SQL codes are not coded by the developer. However developer defines the relations of each tables based on the Primary Key defined. Figure 3.2 below show the relationship of tables involved.

bus_info : Table							
bus_no	engine_no	chasis_no	driver_1	driver_2	valid_from	valid_to	
KPK 9200	EC 1214	98998	D003	D004	3/16/2005	3/17/2010	
main_no	main_date	main_type	examiner	inviocce	main_part	cost	
	3/6/2006	PUSPAKOM	RAHMAT	IV9918	GEAR	\$1,000.00	
AC222	3/8/2006	WORKSHOP	ALI	IV9090	TYRES	\$800.00	
*						\$0.00	
- WEB 7468 M123456 MN5/1234567 D004 D005 3/31/2005 4/28/2010							
main_no	main_date	main_type	examiner	inviocce	main_part	cost	
AC111	3/6/2006	PUSPAKOM	SYAHNIZAM	IV1234	GEAR	\$1,000.00	
AC123	6/7/2007	PUSPAKOM	HELMY	IV9999	BREAK	\$21,000.00	
*						\$0.00	

Figure 3.2: Tables Relationships

Next is to code by using Visual Basic. Most of the code can be found in the internet. Some changes should be made in order to suit it with the program. The code is done by using Standard Library method. Most off the class are predefined by Visual Basic Compiler. This Standard Library basically is some method used in C/C++ class.

The all code been tested. There are two type of testing implemented here, the first one is black box testing and the other one is white box testing. Both testing must be done in order to ensure that the system is bug free. Moreover it is to ensure that the system is reliable and perform all tasks well.

The purpose of black box testing is to ensure that system give the right outputs. There is no concern about the rules. The only concern is that system responds correctly to every input given to them.

In white box testing, all rules been tested. Any broken rules will be reported and then fix so that system can run smoothly. In fact system is test in a simple small module so that it is easier to detect if an error occur.

3.1.5 Implementation

System implement into a work station. Work station is a personal computer that been used by the branch manager. Therefore no network support is needed because this computer doesn't interact with other. Figure 3.3 shows samples code used in the comparing respond time using different search techniques.

```
Public Function Hash(ByVal S As String) As Long
Dim h As Byte
Dim i As Long
h = 0
For i = 1 to Len(S)
h = h + Asc(Mid(S, i, 1))
Next i
Hash = h
End Function
```

Figure 3.3: Hash Comparing Algorithm

3.2 Software Specifications

Table 3.1: Software Specifications

	Software Name	Version
1	Microsoft Visual Basic	6.0
2	Microsoft Access	97 or Higher
3.	Rational Rose Enterprise Edition	2000 or Higher
4.	Microsoft Office	2002 or Higher
5.	Microsoft Visio	2002 or Higher

3.3 Hardware Specifications

Table 3.2: Hardware Specifications

	Hardware	Comment
1	CPU	Pentium 4
2	RAM	128 MB
3	Hardisk	80 GB
4	Printer	-
5.	Monitor	14" or Higher

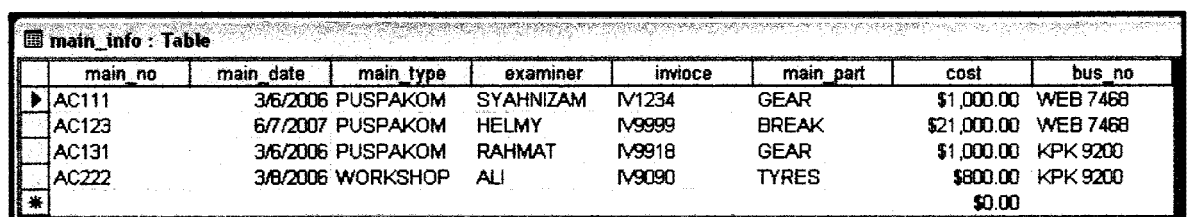
CHAPTER 4

RESULT

This chapter will be discussed about the expected result from the developed system. This report will be divided into two major parts. The first part will discuss on how the input and output process occur. This part stress more on the black box testing ignoring the rules set inside the system. The second chapter will discuss on the data flow of the system. This include data management, data storage and data relations. This aspect will concern more on the white box testing and include numbers of formal testing for the data. Below are the results of test done.

4.1 Insertion

All data that been insert into the database are successfully stored. There is no duplicated that as the primary key been defined. All required popup are also set and working as coded. In fact the data inserted to the correct fields inside the database. The data also relate to each others according to its relation as been discuss in previous chapter.



The image shows a screenshot of a database application window titled 'main_info : Table'. It displays a table with the following data:

	main_no	main_date	main_type	examiner	inviocce	main_part	cost	bus_no
▶	AC111	3/6/2006	PUSPAKOM	SYAHNIZAM	IV1234	GEAR	\$1,000.00	WEB 7468
	AC123	6/7/2007	PUSPAKOM	HELMY	IV9999	BREAK	\$21,000.00	WEB 7468
	AC131	3/6/2006	PUSPAKOM	RAHMAT	IV9918	GEAR	\$1,000.00	KPK 9200
	AC222	3/6/2006	WORKSHOP	ALI	IV9090	TYRES	\$800.00	KPK 9200
*							\$0.00	

Figure 4.1: Example of Data Inserted

Figure 4.1 shows an example of a database. All the data are inserted in a correct field and no data are redundant according to the primary key (main_no).

4.2 Output

All data can be output and display properly. There is no error occur during the display process. The data are also display in a correct order. Moreover if update process occur, the newest data will be display

VIEW MAINTENANCE

VIEW MAINTENANCE RECORD

Bus No. : WEB 7468 3/21/2005 7:52:02 AM

Maintenance Record

	main_no	main_date	main_type	examiner	invoice	main_part
	AC111	3/6/2006	PUSPAKOM	SYAHNIZAM	IV1234	GEAR
	AC123	6/7/2007	PUSPAKOM	HELMY	IV9999	BREAK

Figure 4.2: Examples of view

4.3 Deletion

All the data that is no longer need have been deleted from the database. Deleted data didn't cause any error to the system. If the data delete relate with other tables, that data will also be deleted by the system. Command used for deletion process is as below:

```
Private Sub Command2_Click()  
    a = MsgBox("Are you sure ?", vbYesNo, "Delete ?")  
    If vbYes Then  
        Data1.Recordset.Delete  
    End If  
    a = MsgBox("Data Delete!", vbInformation, "Delete")  
    Me.Hide  
    Form4.Show  
End Sub
```

Figure 4.3: Deletion Algorithm

4.4 Searching

The searching method by using recursive cannot be implementing here. This is because the tools that been used is not mend to support binary search. However this aspect has been neglected during the literature study and cause the system to malfunction if recursive binary search is implemented.

The main reason why binary search cannot be implemented is because of the SQL select statement. Access has provided a SQL query purposely to search any data inside the database. Therefore the use of other searching techniques may cause the system not responding or result a very slow respond times.

However this binary search can be done to other databases such as MYSQL database and using PHP language. This can result a much easier search than the select statement although the code are quite long compare to the select statement.

4.5 Discussion

Bus Management System can provide computerize solutions that can be used by Transnasional in order to manage their daily workflow. The maintenance records are also much easier to find when needed. Moreover the payment and schedule are now provided automatically to the manager.

However the objectives to implement recursion cannot be done. This is because the tools used cannot support the recursive binary search. It may cause the system to hang or respond poorly. Therefore this type of search cannot be done by using selected tools. However data still can be search by using the Microsoft SQL statement provided by Microsoft Access Library.

4.6 Constraint

There are some constraints when developing the system. Two major part of constraint which the human and environment constraints. However only some constraint will be stated in this report.

4.6.1 Time Constraint

The main constraint is to allocate enough time for the research. In fact the time given is quite short. Moreover it required a lot of time especially in doing literature review and study case. Somehow this system is managed to be delivered on time although there are some problems especially in the recursive part of the system. Moreover there are also a lot of academic burden that must be finish according to the schedule. Therefore time is the most crucial part in developing this thesis and also the system.

4.6.2 Knowledge

There is not very much bus maintenance software in the marker, therefore it quite difficult for doing research. Moreover some of the methods are not well known. In fact not all information can be gathered to develop the system. The language been used also need a lot of study to be done. Therefore a lot of meeting been made especially with the lecturer in order to understand some of the function.

4.6.3 Technical Problems

The most part is this thesis is to research, how ever because of the internet facilities is not perform very well so do the research. However most research done by looking at book, journal and etc. Some other technical problems may occur because of human fault such as blackout and etc. Sometimes there are virus that attacking the workstation and cause the workstation to be repaired.

4.6.4 Experience

One of the problems is that most of researchers don't have any experience in developing a thesis. Moreover there are no references that can be used in order to produce good and well organized thesis writing. However this can be manage by doing discussion with supervisor and research at other university.

CHAPTER 5

CONCLUSIONS

This chapter will conclude all the process done in developing this thesis for Bus Management System. Other aspect will be discuss include lesson learned and further research.

5.1 Further Research

According to this thesis, there are some other fields can be research in Bus Management System. Some of them are like auto calculate maintenance based on odometer reading. If the odometer reaches certain kilometer, a reminder will pop up to remind the manager that bus is need for maintenance. Sometimes maintenance done by referring to odometer will be more efficient.

This system can also be developed as a network system. By doing this, manager will no longer has to send report to headquarter manually. This can reduce operational cost. However the company must have ability to invest for the infrastructure.

In other hand, this system perhaps can give information about the bus route. Where is the nearest R&R along the way. It also can provide information regarding other service center in the area.

Lastly, still many functions can be develop under this system to ensure that it meet the user requirement and satisfy the user.

5.2 Lesson Learned

The most important thing to do a research is to understand how the current system works. This can be done by using journals or reference by other researcher. Moreover there are a lot of source that is available in the internet. This resource can be used in order to complete the research.

Then to create a good thesis, there must be a lot of discussion done especially with the supervisor. This is to ensure that our thesis is in a correct format. Moreover it can prevent from any misinformation about the research.

The last thing that is very crucial is to manage time wisely. All deliverables must be submitted according to its due date. A good plan and a working plan can avoid the system overdue. As a result this may increase customer satisfaction.

5.3 Conclusion

Bus management system enables the manager to add new bus, check maintenance record, and reminder for any maintenance. This system is a standalone system that is developed using Microsoft Visual Basic and Microsoft Access. The method of development used is Waterfall, this system have reach most of its objectives. However there are still a lot of researches that can be done in the future. Finally thanks to all the giving support in order to have this thesis done. Thank you

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APPENDIX A

EZ MAINTENANCE EXAMPLES INTERFACES

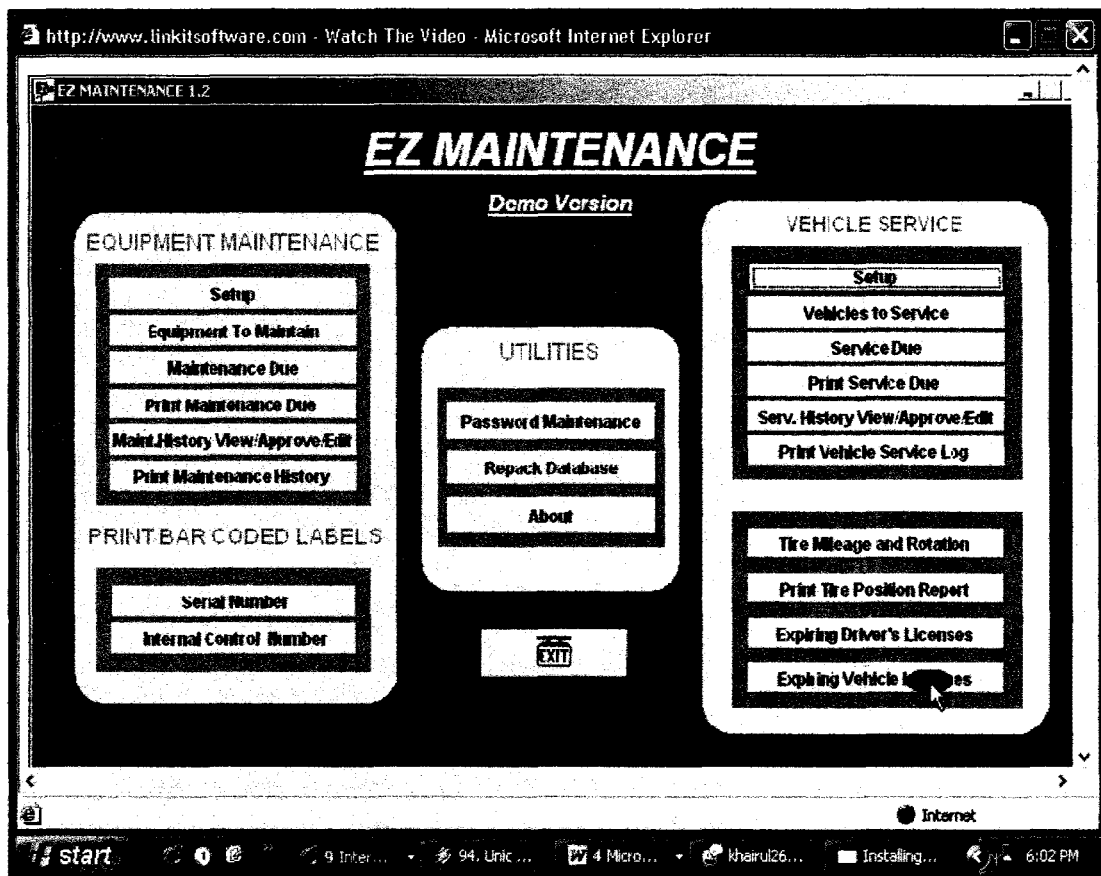


Figure A.1: EZ Maintenance CMMS maintenance software main interface

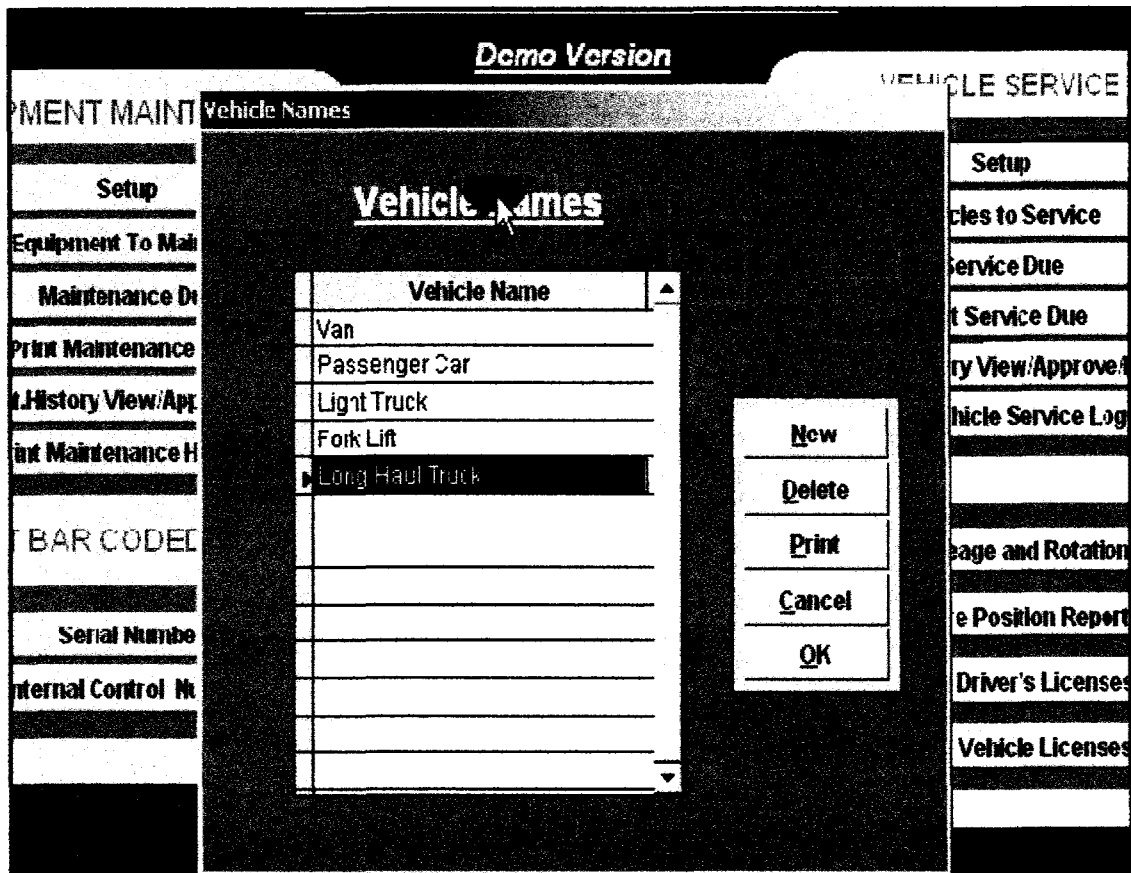


Figure A.2: Vehicle Names Interface

Drivers

Locate:

Driver No.:

Driver No.	First Name	Last Name	Address	City	State	Zip Code	Phone
123	Robert	Smith	2134 West St	Los Angeles	CA - California	98666	8775551212
124	Mary	Poindexter	1414 Windon	El Segundo	CA - California	90087	8182239987

Figure A.3: List of drivers in drivers interface

Driver Information

Driver No. SSN Address

First Name Date of Birth City

Last Name Date of Hire State

Phone Zip

Licenses | **Incidents**

License Name	License No.	Expiry Date	State
Class A Passenger	PA2245990	07/10/02	CA - California
Class B Truck	9678756TGG	08/05/02	CT - Connecticut
Class C Truck	HGTY38976	11/15/03	OH - Ohio

Figure A.4: License expiration information in Driver Information interface

Driver No. SSN Address

First Name Date of Birth City

Last Name Date of Hire State

Phone Zip

Licenses | **Incidents**

License Name	License No.	Expiry Date	State

Figure A.5: Add Driver

APPENDIX B
SAMPLES OF FORM AND QUESTIONNAIRES

INTERVIEW DOCUMENTATION

Name of System: BUS MANAGEMENT SYSTEM

Page 1

Date: 23/2/2005

Prepared by: MOHD RAHMAT B. MOHD NOORDIN

Title: INTERVIEW WITH MANAGER

Purpose: USER REQUIREMENT

Location: TRANSNASIONAL KUANTAN

REQUEST FOR INFORMATION SERVICES

Date:

System enhancement:

Title:

Department:

Location:

New system:

e-mail:

REQUEST FOR:

URGENCY:

☐ Correction of system error

☐ Immediate attention required

☐ System enhancement

☐ Handle in normal priority sequence

☐ New system

☐ Defer until new system is developed

DESCRIPTION OF REQUESTED SYSTEMS SERVICES:
(ATTACH ADDITIONAL DOCUMENTS AS NECESSARY)

(To be completed by the Information Technology Department)

☐ Approved

Assigned to IT contact person:

User:

Urgency code (1 low to 5 high):

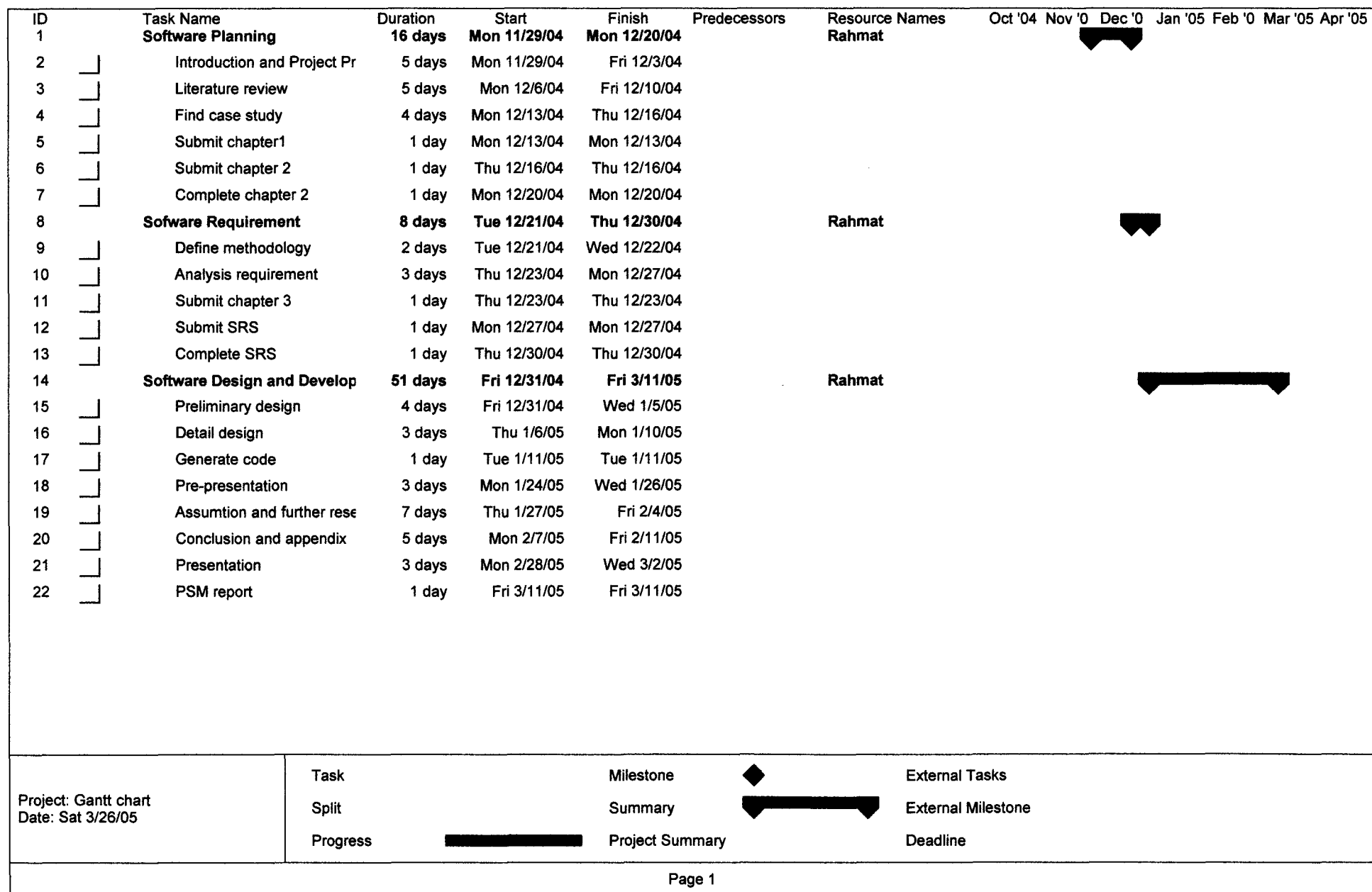
☐ Modified (see attached notes)

☐ Rejected (see attached notes)

Date:

Action:

APPENDIX C
PROJECT GANTT CHART



APPENDIX D SEQUENCE DIAGRAM

D.1 Add Data

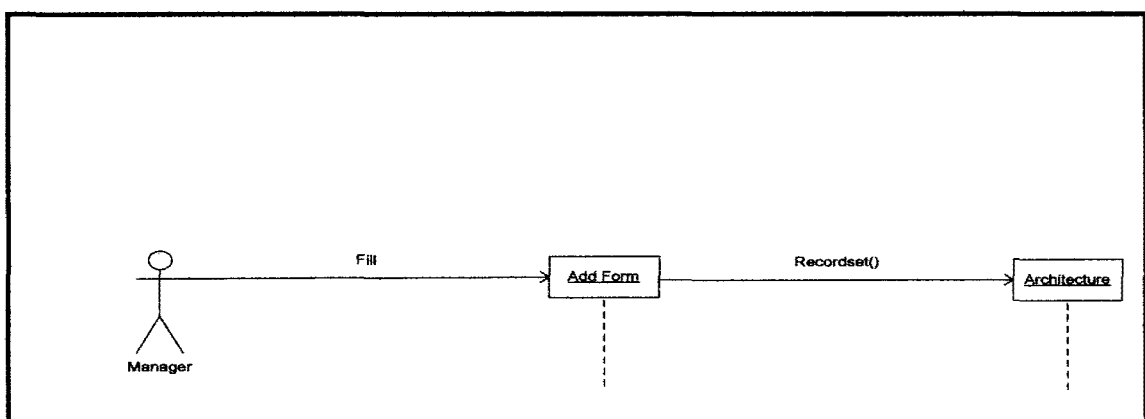


Figure D.1 Add Data

D.2 Update Data

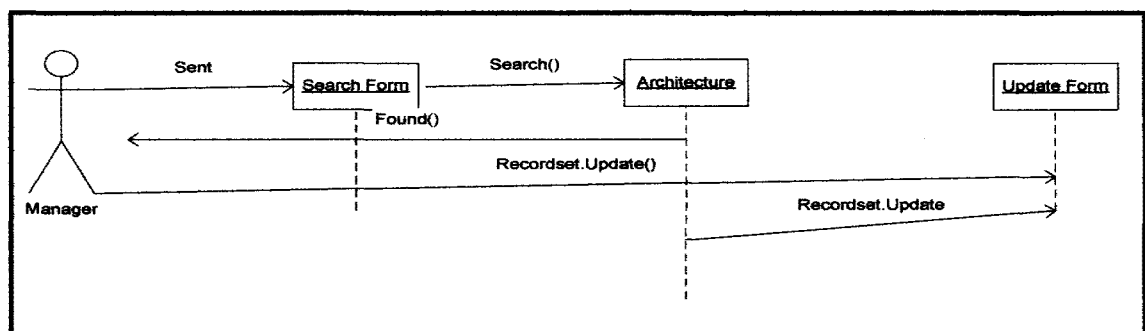


Figure D.2 Update Data

D.3 Delete Data

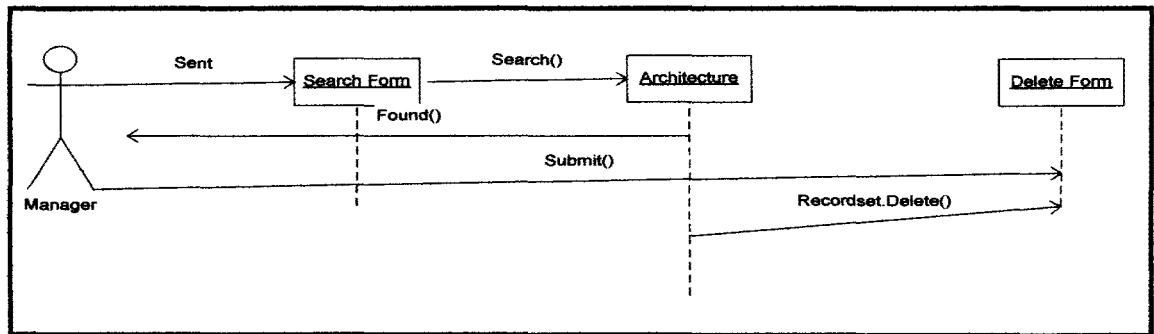
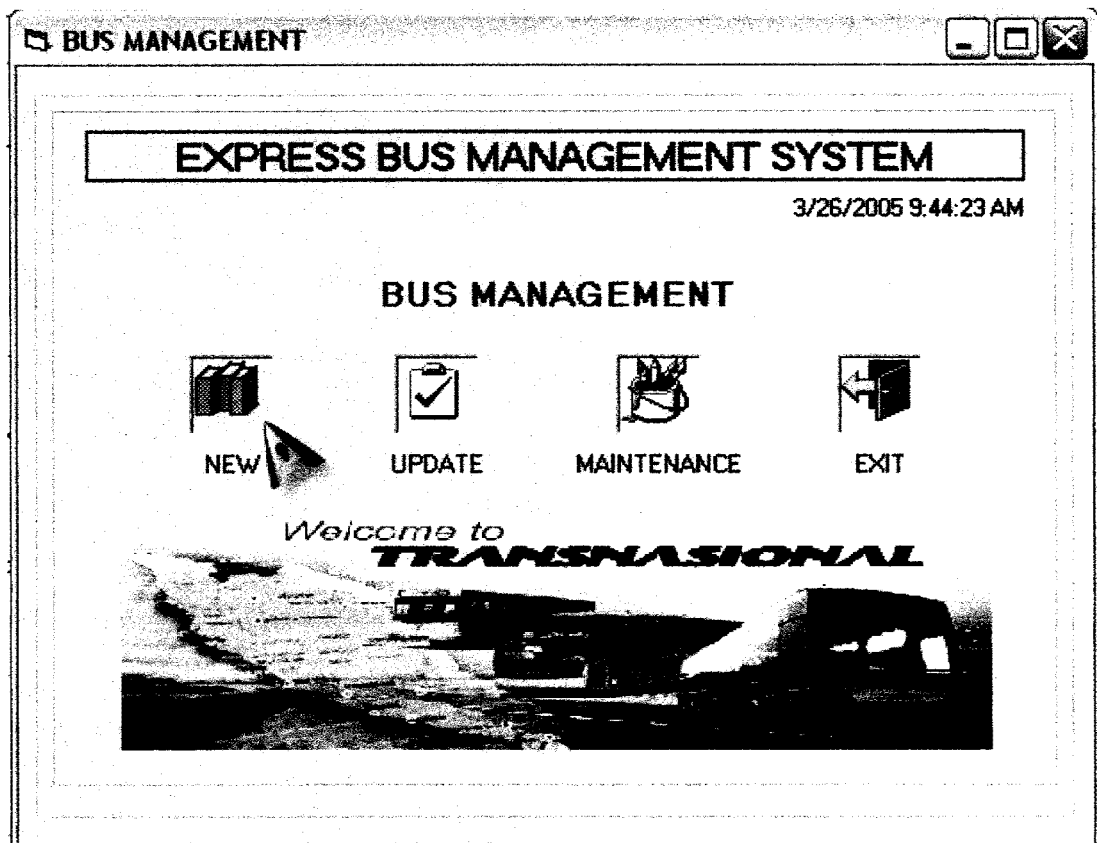


Figure D.3 Delete Data

APPENDIX E USER MANUAL



1. Click new to add bus

ADD BUS 3/26/2005 9:47:12 AM

ADD BUS INFORMATION

Bus Information

Bus No. : Driver 1 :

Engine No. : Driver 2 :

e.g (M301555)

Chasis No. :

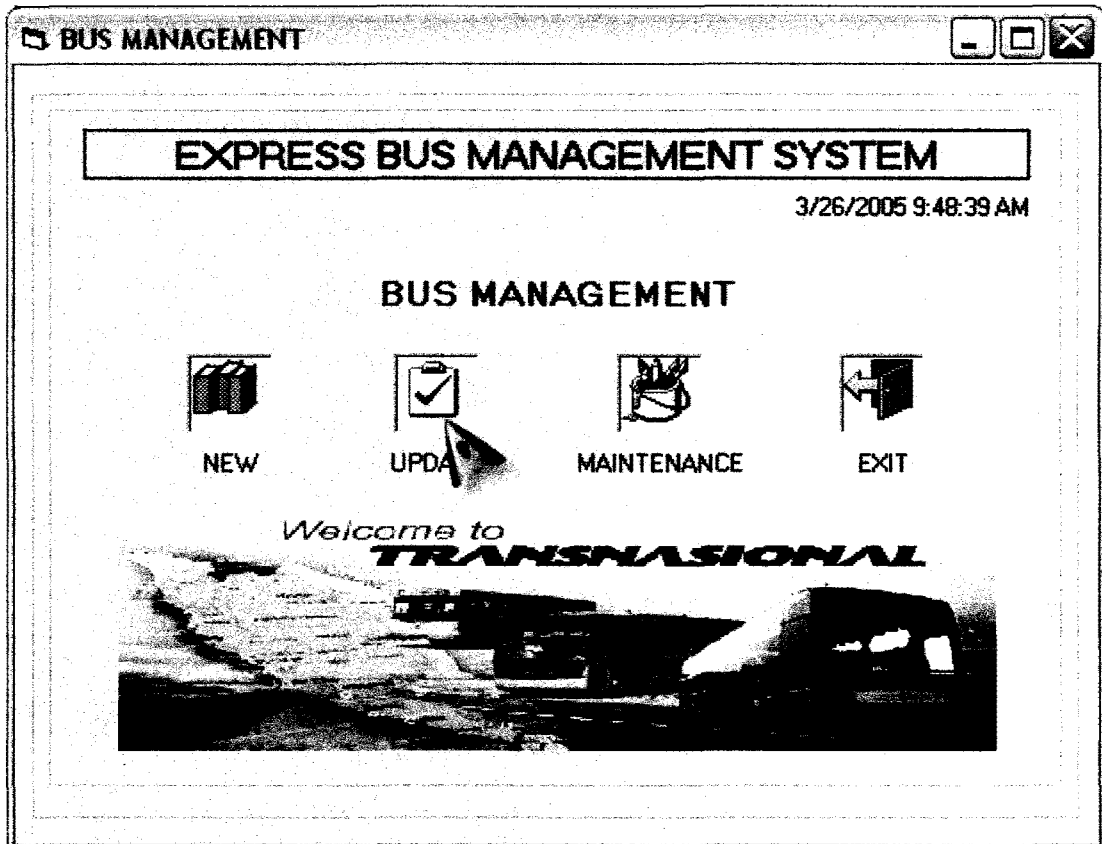
e.g (GN5/1531216)

Validation

From : 3 /16/2005 Until : 3 /17/2010

(Estimated use for 5 years only)*

2. Fill all required Information



3. Click "UPDATE" to update bus info

UPDATE BUS

UPDATE BUS INFORMATION

Bus No. : **Go!** 3/26/2005 9:49:39 AM

Update **Cancel**

4. Enter bus no then click "Go!"

UPDATE BUS

UPDATE BUS INFORMATION

Bus No. : WEB 7468 3/26/2005 9:56:23 AM

Bus Information

Bus No. :	WEB 7468	Driver 1 :	D004
Engine No. :	EC 1878 e.g (M301555)	Driver 2 :	D005
Chasis No. :	17672 e.g (GN5/1531216)		

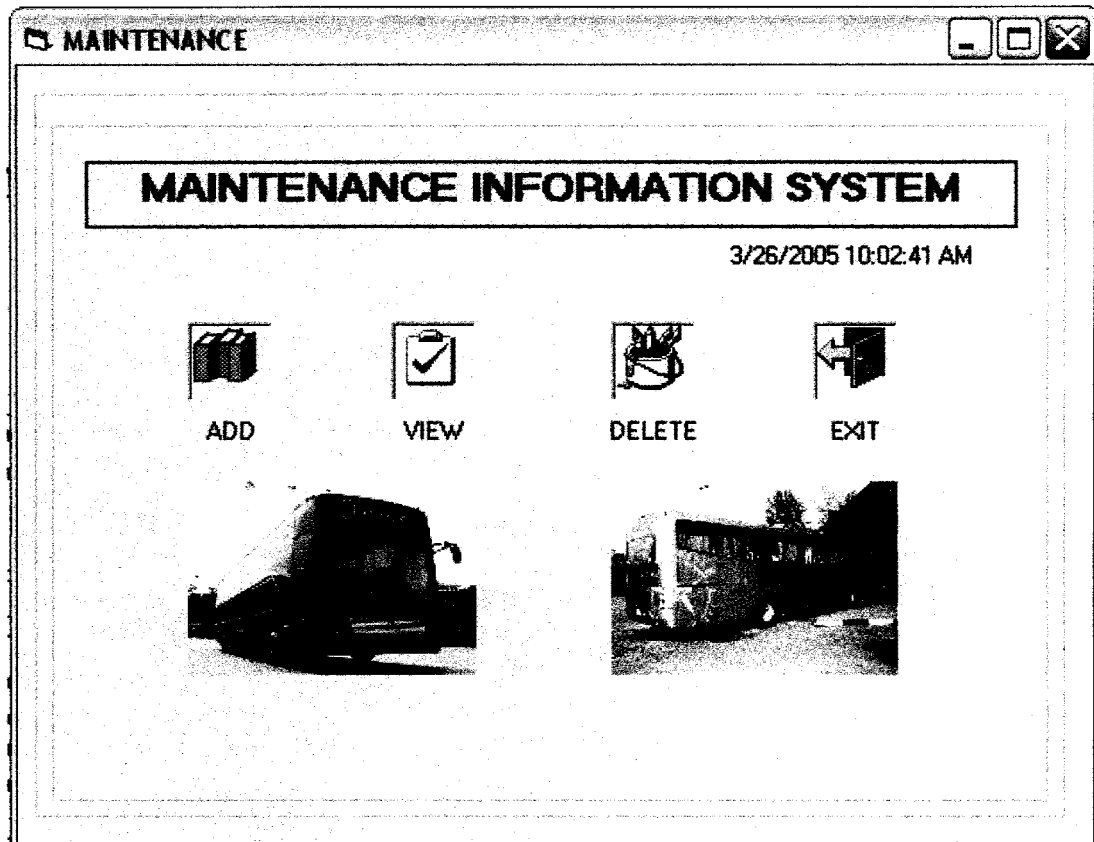
Validation

From :	3 /31/2005	Until :	4 /28/2010
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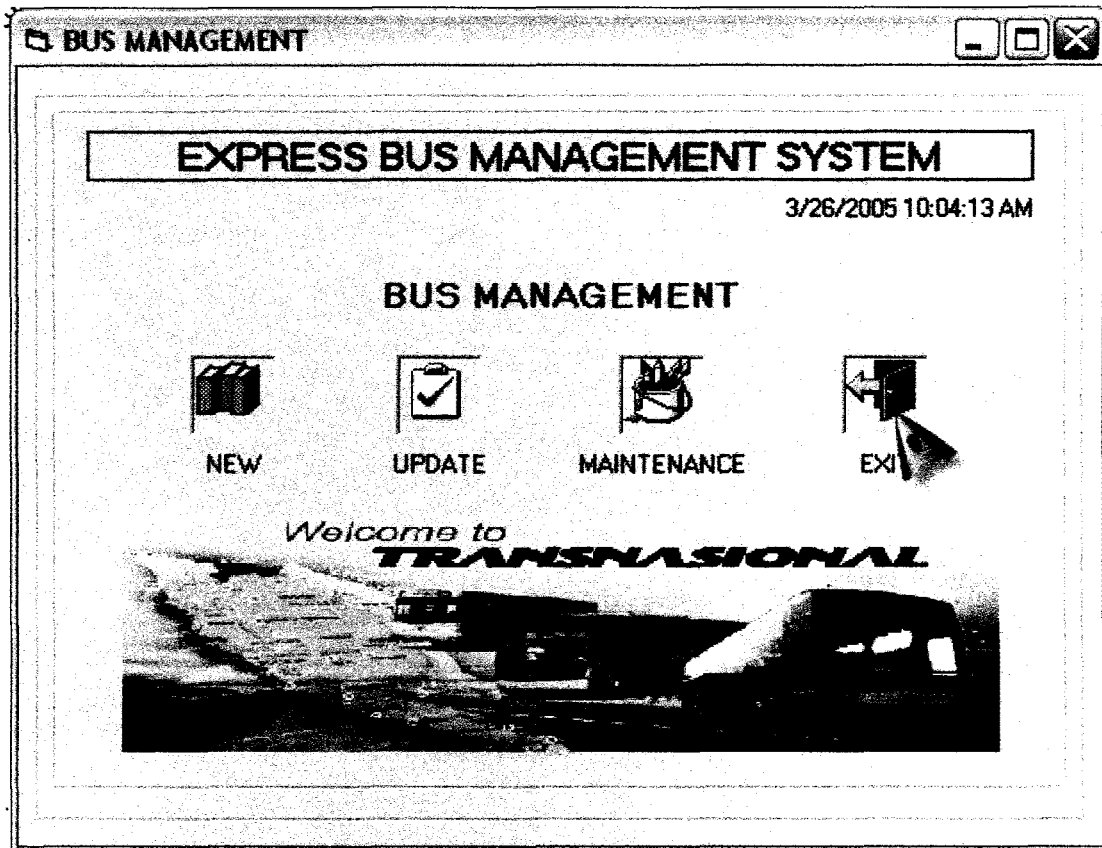
5. Update required info then click "Update"



6. Click "MAINTENANCE" to enter maintenance module



7. Select any maintenance functions, click EXIT to back to main page.



8. Exit to quit system