CAR RENTAL SERVICE INFORMATION SYSTEM
FOR EXECUTIVE CAR RENTAL SERVICE CO., LTD.

by

Mr. Haripon Buapet

A Final Report of the Three - Credit Course
CS 6998 System Development Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
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Project Title   Car Rental Service Information System for Executive Car Rental
                       Service Co., Ltd.

Name   Mr. Haripon Buapet

Project Advisor   Air Marshal Dr. Chulit Meesajjee

Academic Year   March 2001

The Graduate School of Assumption University has approved this final report of the three-credit course, CS 6998 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.
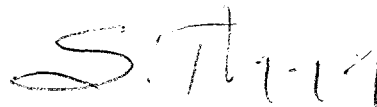
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ABSTRACT

This project report presents the study of a car service company. The present operation of this company is a manual system and the main objective of the project is the computerization of the whole system.

The project covers all phases of the system analysis and design starting from finding information requirement from the users. This proposed system is designed to solve the existing problem. New organization chart, context diagram, and dataflow diagram are also proposed. Output designs are also provided in this report. Economic cost comparison between existing system and proposed system are shown, and the implementation procedure

ACKNOWLEDGEMENTS

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I. INTRODUCTUON

1.1 Background of the Project

Executive Car Rental Service Co., Ltd. is a medium size company that provides service about car rental. It is located at Ramkhamhaeng Road and opened since 1997. The mission of the business is to provide service for the customer to be the most comfortable. It begins with selecting the best care, providing service to the customer as friendly as they can and maintaining the care to be always new.

According to high competition in this service market, Executive Car Rental Service need to improve its present operation to be much more effective. The main important factor which can make the business success is fast service of information. It means that Executive Care Rental Service could have more customers if the information can be updated and available to inform customer faster than its competitors.

From this point of view, the company will have a plan such; The first is to expand and join with other companies as Pattaya Car Rental company, Songklar Car Rental company, Chiang Mai Car Rental company, and Korat rental company formed in the car rental business that provide service to the customer who are Thai and foreigners. The mission of the joint venture company uses the concept as "Provide the most comfortable through out all routes of Thailand." The second is to purchase some personal computer and programs to help in the operation with their associates (Pattaya Car Rental company, Songklar Car Rental company, Chiang Mai Car Rental company, and Korat rental company) but unfortunately, the owner and staffs have little experience in using the computer. Then, the program has to be developed in the simplest and easiest format user friendly, less amount of paper work, and enable the staff to work effectively and efficiently.

This project was developed to study in order to serve the above mentioned purposes. The program was produced by using HTML, ASP, Java and VB Script to facilitate the users to operate their work in the most convenient way and surely give the most effective and efficient result.

1.2 Objectives of the Project

The main objective of this project is to make more understanding of the existing system in order to design the new system to improve as the follow items:

(1) To provide data and process online through the Internet.

(2) To reduce time spend for creating and filling documents and records.

(3) To reduce resource used for creating paperwork (record and document reports)

(4) To improve workflow of the system efficiently.

(5) To reduce inventory area for document and reports kept.

(6) To reduce cost of stationary.

(7) To provide better query of information.

(8) To merge related information with consistency and centralization.

(9) To reduce redundant data and information.

(10) To make more accurate information available at any time.

(11) To make more convenient to people to review and update data and information.

1.3 Scope of the Project

The project will cover major parts of the Executive Car Rental Service System, which included:

(1) Issue Customer Reservation.

Employ computerized information system which provides all requirements information about rental including cars, operation and charge rate promptly to assist customer to make decision easier.

Handle confirmed and canceled reservation entries.

(2) Issue Customer Reservation.

Promptly updates the availability of cars in garage.

(3) Update customer information.

Promptly updates the customer information.

(4) Create rental Charge Slip and Receipt.

(5) Create Manage Report.

1.4 Deliverables

The deliverables of this project are as follows:

(1) Project introduction.

    (a) Background of the project

        (1) Context diagram.

        (2) Dataflow diagram.

    (b) Objectives.

    (c) Scope.

(2) Description of the current system.

    (a) Background of the existing system.

    (b) Current problem and areas improve.

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(3)   Description of the new proposed system.

    (a)   System (User) requirement.

    (b)   System Design.

    (c)   Hardware and Software requirement.

    (d)   Security and control.

(4)   Project implementation.

    (a)   Overview of project implementation.

    (b)   Test plan and result.

(5)   Conclusions and recommendations.

1.5   Project Plan (Include Gantt chart)

See attach Gantt Chart.

No.	Task Name	December				January				February			
		1	2	3	4	1	2	3	4	1	2	3	4
I.	Analysis of the Existing System	←				→							
1	Define the Objectives and Scope	▨											
2	Study the Existing System		▨										
3	Identify the Existing Problems			▨									
4	Study the Existing Computer System			▨									
5	Develop Context Diagram				▨								
6	Develop Data Flow Diagram					▨							
7	Cost and benefit Analysis						▨						
II.	Analysis and Design of the Proposed System						←	→					
8	Web Interface Design							▨					
9	Report Design							▨					
10	Database Design								▨				
11	Network Design							▨					
12	Program Design							▨					
III.	Implementation of the Proposed System									←			→
13	Coding									▨			
14	Testing										▨		
15	Hardware Installation									▨			
16	Software Installation											▨	
17	Conversion												▨

Figure 1.1.   Project Plan of Car Rental Service Online.

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II. THE EXISTING SYSTEM

2.1 Background of the Company

Executive Car Rental Service wishes to computerize its car reservation system and its invoicing system. The company operates from a single location.

All vehicles are taken from that location and returned to that location. Although, the company is, at present, concerned only with private cars, it may wish to branch out into other form of vehicle rental at a later date and would like to be able to use the same reservation system.

The company has several different models of cars in its hire fleet, from different manufacturers. The models are grouped into a small number of price classes. At anytime, the company should have several cars for each model listed in its advertising.

The company has a number of different rental plans available to customers. These include a daily time and kilometer rate, a daily rate which includes unlimited kilometers, corresponding weekly rates and a special weekend rate to attract non-business customers.
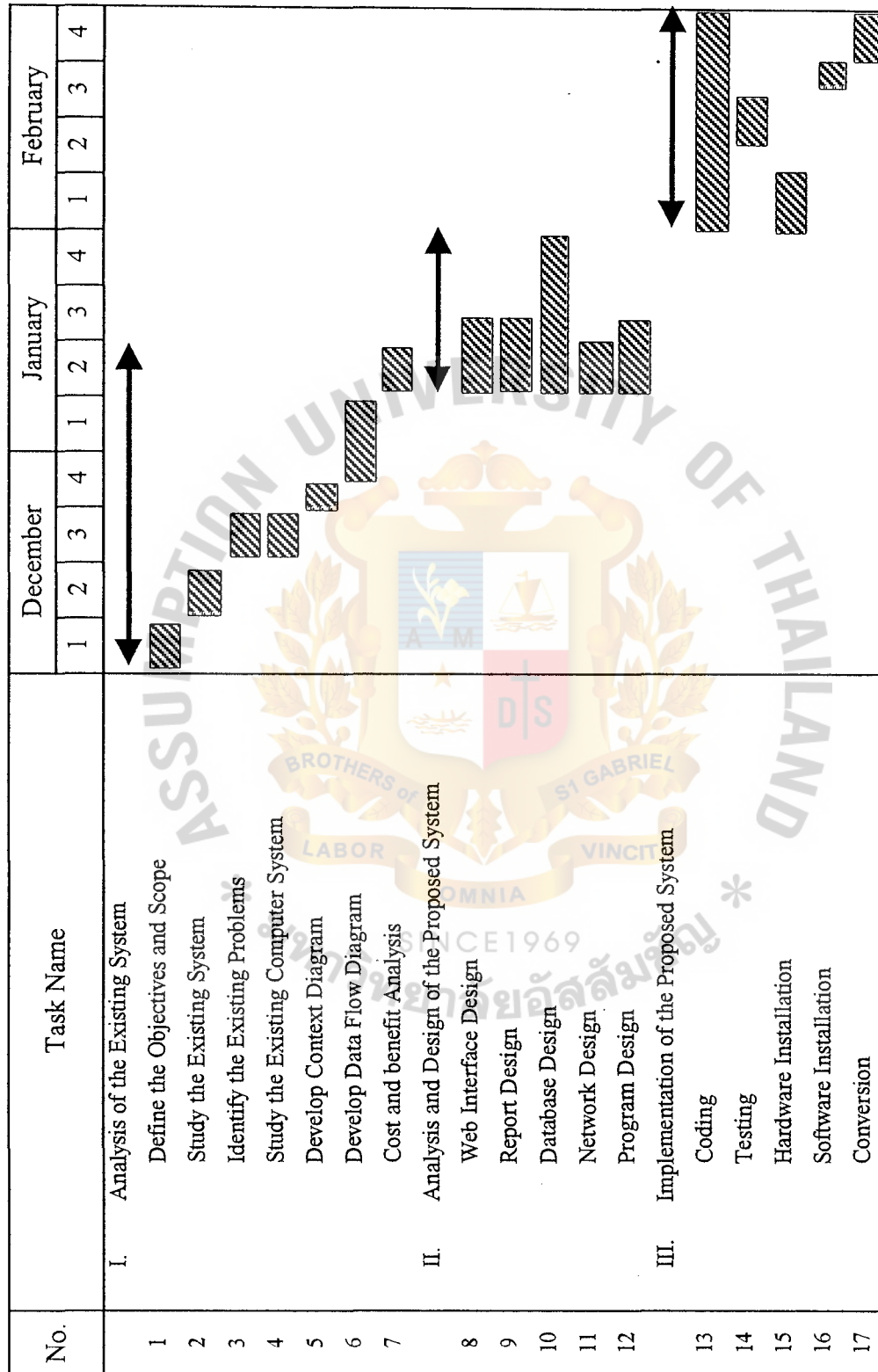
The tariff charged by the car hire company is established in advance for a given planning period. The tariff for a given model depends on the price class; the type of customer and the charging plan chosen. Business customers get special discount on the normal rates but not on the special weekend rate.

The company finds it important to have available on the options which may be fitted on certain models of cars, such as automatic, or normal gear change, two or four doors and saloon (sedan) or hatch back. The information on what is actually fitted to the cars in the hire fleet must correspond to the information on option provided by the

supplier of the car. There is no charge for such options but a customer will often request on option when reserving a car and the company wishes to try to meet this request.

In addition to the fitted option, there are optional non-fitted extras, such as roof rack, trailer and child seats, which customers may request and for which the company does make a special charge. Certain kinds of optional insurance are also handled as extra charge. The tariff for such chargeable is established in advance for the same planning period as for the car rental.

A customer may make his or her own reservation directly with the company or may use a travel agent. Alternatively, the customer's company may handle the reservation. The reservation may specify certain fitted options as well as certain chargeable extras, The means of payment is normally noted at the time the reservation is made.

Sometime a reservoir wishes to make a block booking for several cars and to have the invoices for all rentals on the reservation handled together. As soon as a car is checked out to the customer, an invoice is opened. A single invoice may cover one or more rentals.

The company is willing to accept reservation for a given advance period. It knows when new cars will be available and wishes to be able to rent them out as soon as possible after they are delivered. A car is allocated to a reservation according to its known availability.

A car may or may not be available for hire on a given day. Hire cars need frequency preventive maintenance and in addition, any damage to a ca has to be repaired as possible. The company wants the reservation system to keep track of car availability on each day by recording in the system, the various kinds of events that can

happen to a car between the date on which it is acquired and the date on which it is disposed of.

To minimize the cost of cars maintenance and reduce the problems of cars reparation the owner has decided to make a long-term contract with a garage that has a good relationship to take responsibility of cars reparation and maintenance.

The company wants the system to be reasonably foolproof. The thing that can happen to a car can only occur in a prescribed sequence. A car cannot be returned by a customer before it has been taken out, for example.

Normally a customer will settle the invoice when the car is returned but, in some cases, the invoice must be sent to a company (such as the customers's employee). When the customer pays by credit card, the amount involved has to be billed to the credit card company, together with other rentals using the same kind of credit card.

2.2 Current Problems and Areas for Improvement

In the car rental service the availability of cars is the most important factor that has to be updated on time. The important question needed to be answered is how to keep the information about cars availability as soon as possible in order to be provide for all involved departments. In the study it was found that it takes a lot of time in carrying papers or reports of cars availability from the garage to Maintenance Department and when customers made a call Customer Service department have to check cars information with Maintenance department which all information are in the form of papers. There are the causes of slow operations and may make customers upset. Another problem that need to be solved is how to issue rental charge slips and receipts quickly and correctly.

Due to the joint company composing of five companies that provide service around Thailand, each has its own style to do business including format and process.

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Some of them may still use activities run manually. These created a lot of paper and reports that bring tracking problem and ineffective practice. Beside, this also spends a lot of resource and time for paper work. Others may bring computers to run the business but it is a stand-alone system. However, if each company still uses their own system to do business, the following problems may be occur:

(1) There is redundancy in data, processes and workflow.

(2) Format of data and information has variety; no standard. It depends on each company.

(3) It may generate redundancy of data and information at multiple place and unintentional loss, hence searching data and information is difficult and taking too much time.

(4) Company spends a lot of time and paper to create a lot of paper works with limited manpower (for example daily, weekly and monthly report). We should keep track of customer needs.

(5) Data are very expensive. It may be lost or damaged due to lack of the right method and care to manage them.

(6) It is inconvenient for people to review, update, add and delete because of difficult of finding due to a lot of records kept.

To solve the above mentioned problem, a system is designed to improve the operations. The data can be updated by using modem to updated information of cars availability at the end of each day. By using LAN and Internet in the office, all data updated in the program can be shared to all involved parties, so we don't have to waste time asking information any more. Customer Service department can answer customers' question promptly by retrieving updated data from computer.

Area under study:

For this project, the area under study covers an entire business since, at the present, Executive Car Rental Service Co,. Ltd. has not yet organized its operations into divisions, departments, or even sections. Every staff works for all, each one has no clear-cut responsibility, In other words, it is a real family business system.

The study covers from the first step of work up to the delivery process. Manpower is also one of the problems that the project has to study, aiming at collecting each personal data including the education background, start or hire date, salary, working performance or grade job evaluation.

2.3   Existing Business Functions

All works of Executive Car Rental Service Co., Ltd. are presently done manually. There are three clerks standby for customer's call and inform information to customer that the car and options requested by customer are available or not. All customer information will be recorded or updated. They will follow up the reservation until it is resulted to be confirmed, or cancelled and then provide information to other involved departments and update information.

Before delivery of car staff must recheck with the garage, which is an external party that has a long-term contract of repairing and maintenance contract with Executive Car Rental Service Co., Ltd. again whether the car is in a workable status. If it passed this step of checking, the car will be delivered to customer. Otherwise, they have to be repaired before being available for using.

For delivery, all cars will be handled to customer with key and checked delivery order. When the car is returned it will be again checked and moved to the garage to keep it in good condition. Then the details of using car and its option will be used to calculate rental service charge to customer according to the tariff rate.

From the current organization chart shown in Figure 2.1, it can be seen that the owner is the one who takes all responsibility of the company. There is no divisions, departments or even section. As a result, the owner has a lot of burden in controlling the company and of course, there are many ways for employees to cheat the company because the working system is not well and the owner does not have enough time to take care of the entire operation in a short period.

Since the owner has a plan to expand the distribution areas up-country and other districts, so the organization chart of the company has been recognized as shown in Figure 2.2, including three department; Customer Service, Maintenance department, and Accounting department. Details of these are given in the next paragraphs;

Customer Service department:

By using a new computerized system only two clerks are needed to standby for customers' calls to provide information for the car that customer requested and to follow up the customers' reservation until the reserves are confirmed or cancelled. The details of conformed reservation must be updated in the program in order to be sharable to Maintenance and Accounting department that needs information to continue their own job.

Maintenance department:

All customers' reserve requirement will be sent to this department to prepare the reserved cars and check their workable status by cooperating with the garage for reparation needed or complex maintenance which need skills. There should be three staffs at this point.

Accounting department:

After reservation has been confirmed, all details of reserve information will be used to calculate the rental service charge by using tariff rate, and the rental charge slip

will be handled to customer. For customers who pay cash, all processes must be managed by a cashier. All rental charge slips must be managed by a cashier. All rental charge slip must be input into the program to summarize the rental service charge volume in each month.

Executive Car Rental Service Co., Ltd.
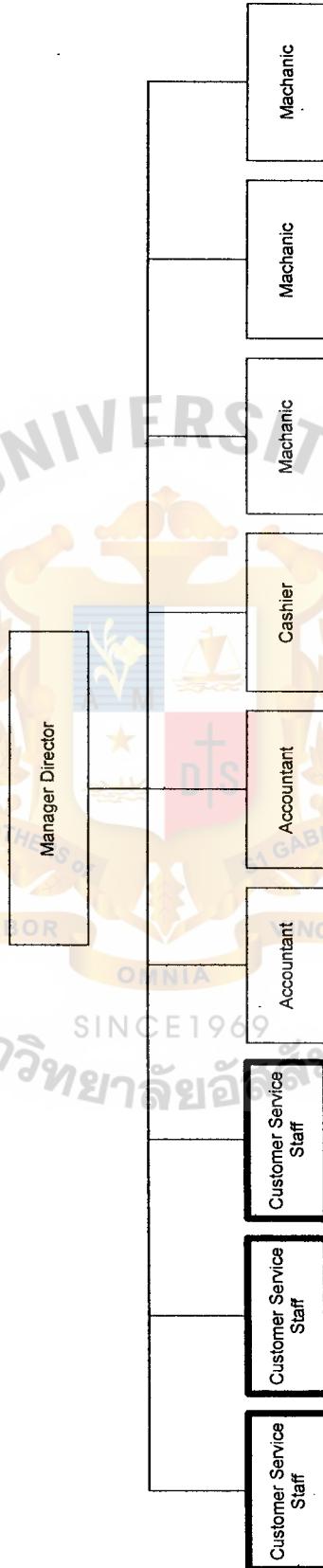

Figure 2.1. Organization Chart of Executive Car Rental Service Co., Ltd. (Existing System).
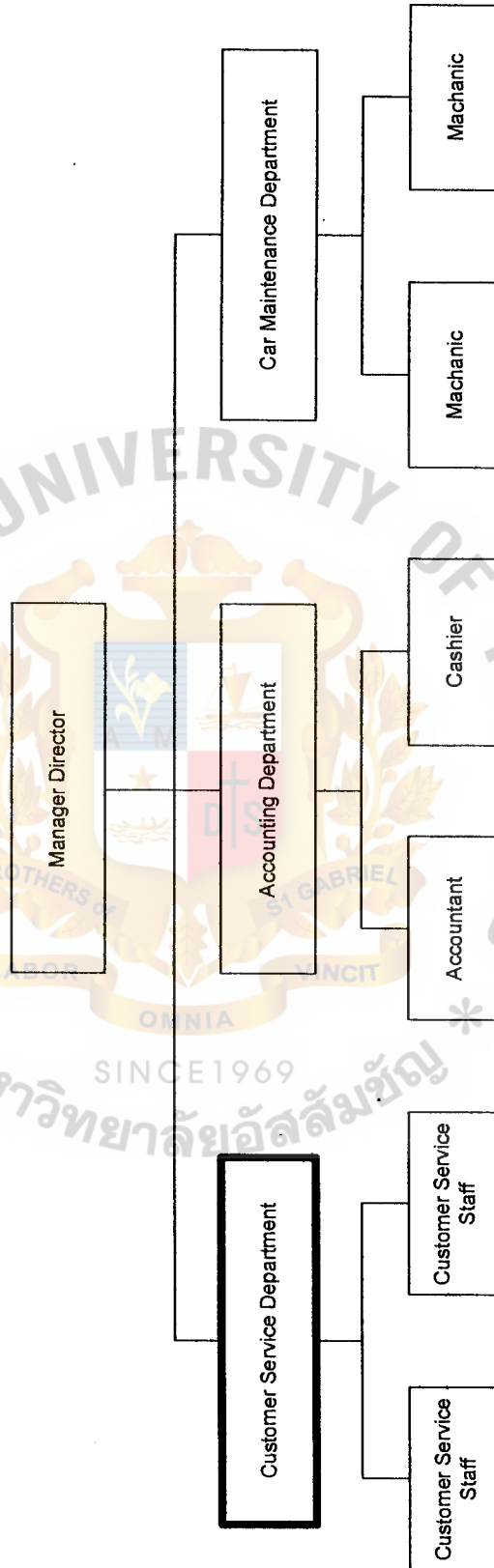
Executive Car Rental Service Co., Ltd.

Figure 2.2. Organization Chart Of Executive Car Rental Service Co., Ltd. (Proposed System).

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III. THE PROPOSED SYSTEM

3.1 System Specification

The proposed system will provide the car rental service with a computerized information system instead of the current manual system. Furthermore, the intended system can be beneficial to the company at both management and operational levels.

For the management tier, it will provide more accurate and up-to-date information more rapidly with immediate access to any data.

For the operational level, it will provide a better working environment with an improved clear step-by-step working process, which will lead to minimal redundancies and thus increase employee goodwill.

Users Requirement:

After reviewing and evaluating the existing system, there still exist some user requirement that needs to be attended to by the proposed system. Those user requirements can be concluded as follows:

(1) Design of backup and recovery software. Depending on technology does not mean a hundred percent perfection, on the other hand, there is always unpredictable problems occurring at any time. Therefore, backup and recovery software should be provided for users in case of emergency and there is no system support available.

(2) Reliable security and control management. Computerized system comes along with risks and there is no complete solution for it. Therefore, steps for security and control management should be well enough to prevent any risk that might occur to the system.

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(3) Accurate and consistent procedure to update and eliminate information. Such procedures should be provided, as this is on-line system, updating and eliminating information are considered major functions of the system.

(4) Facilitation of management due to on-line and real-time service by the Internet. Every processes of the rental system should be easy and provide well-organized alternatives in order to manage, i.e. when there is any interaction with either external entities or internal entities, the proposed system should fully support any subject related to the system.

(5) Ease of usage. The proposed system should be designed to be precise and clear to use so that it will not take too long time for users to get used to it.

(6) Provision for on-line processing. Backup network and other facilities needs for online processing i.e. telephone lines, Internet Provider Service, should be fully provided at all time.

As the computerized system means to work with technology, users should have the abilities to develop, control and solve or improve the system at some level. The users of the proposed system should be:

(1) A manager who uses outputs as his material in order to make profits to the company.

(2) Customers, Customer Service staffs and Mechanics who work directly with the system by using inputs as their material in order to do their jobs.

(3) Accountants are authorized to view necessary data in order to carry out their jobs effectively.

3.2 System Design

System design is the evaluation of alternative solutions and the specification of a detailed computer-based solution. It is also called physical design. There are a variety of techniques in developing the proposed system and in this case, the structural approach is used to accomplish this development. In this Car Rental Online system, system design includes process design, structure chart design, file design, input design, output design, interface design, as well as a data dictionary. The details are as follows:

(1) Process Design

The proposed system uses the Context Diagram to profile the data flow diagram depicting as entire system as a single process with its major inputs and outputs in order to define the scope or boundary of the project. The Context Diagram of the Proposed System is shown in Figure 3.1. The data flow diagram is used as a primary tool in structured analysis that graphically illustrates a system's component of the proposed system so that users and management will be able to understand. Dataflow Diagram Level 0-1 of the Proposed System is shown in Appendix F. Data flow diagram of the proposed system will involve three parties that are:

(a) Customer

(b) Customer Service Staff

(c) Mechanic

There are six main processes that are:

(a) Select Car process.

(b) Reservation process.

(c) Rental process.

(d) Return process.

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(e)   Automatic Cancel Reservation process.

(f)   Add New Car process.

(2)   Structure Chart Design

Structure chart is the primary tool used in structured design. It shows how the program has been partitioned into smaller more manageable modules, the hierarchy and organization of those modules and the communication interfaces between modules. It consists of rectangular boxes, which represent the modules and connection arrows, which represent data flow in each process. Structure Chart of the Proposed system is shown in Appendix H.

(3)   File Design

Files of the proposed system are Customer file, Rental file, Rental Charge file, and Car file. These files are presented in the table and each table consists of names, attribute names, column names and primary key. Elements that fall into element in many structures should be placed together into a structured record. File Specification is shown in Appendix C.

(4)   Input Design

As accurate input is critical to successful processing, file maintenance, and output, input design needs to be done carefully. Car Rental online uses on-line input that captures that data at their point of origin in the business and directs the inputting of that data to the computer. This input is, therefore, direct. If data are entered incorrectly, the computer's edit program will detect the error and immediately request users to re-enter. Input screen always have a graphic looking appearance, referred to as a graphical user

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interface (GUI) that should enable users to easily complete and facilitate any needed information. Input Design is shown in Appendix A.

(5)   Output Design

Output should be designed to be simple and clear to read and interpret as it is the best justification for the system. Output will be printed if needed, but will mostly be kept in the computer in the form of report, stored in Rental Report File. Output Design is shown in Appendix B.

(6)   Interface Design

Interface design is the specification of a conversation between the system user and the computer. This conversation generally results in either input or output-possibility or both. There are several types of user interface styles. Nowadays, with recent movements toward designing systems with graphical user interface (GUI), a blending of all styles can be found. Interface Design is shown in the Input and Output Design.

(7)   Data Dictionary Development

Data dictionary is a document that supports data flow diagram. It contains all terms and their definitions for data flow and data stores that relate data flow and data stores with the exception of the process that are defined separately through the use of process description.

The deliverable of data dictionary is to study the existing data element and add new requirement data elements that are necessarily included in the system. Data dictionary is shown in Appendix E.

(8)   Process Specification Design

The process specification is created for primitive processes on a data flow diagram as well as for some higher-level processes (that to a child diagram). This process specification is shown in Appendix D.

(9)   Module Specification

A module is a group of executable instructions with a single point of entry and a single point exit. Module specification is shown in Appendix G.
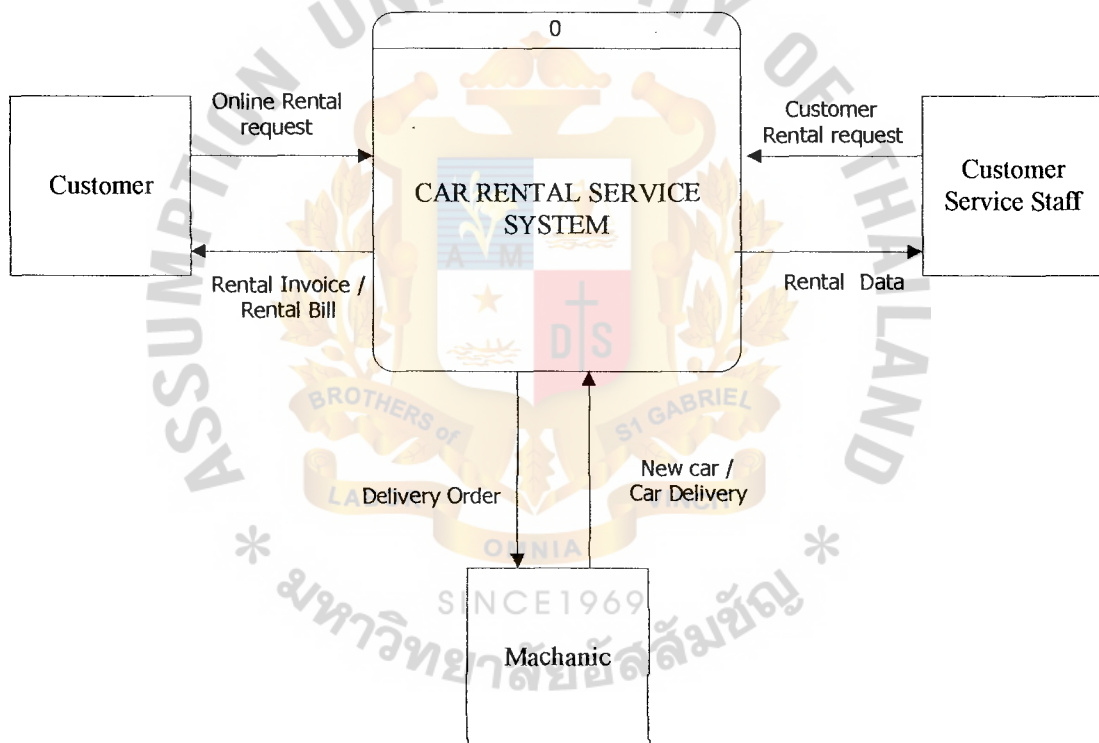

Figure 3.1.   Context Diagram of the Proposed System.

3.3 Hardware and Software Requirement

Table 3.1. Hardware Requirement and Specification.

Personal Computer	Specification
Processor	AMD Duron 750 MHz.
RAM	Hitachi 128 MB SDRAM
Hard Disk	Seagate Baracuda ATAII 20.1 GB.
Floppy Disk Drive	Sumsung 1.44 MB
Main board	Micro Star MS6330/100
VGA Card	Innovation TNT M64 TV OUT
CD-ROM Drive	Asus 52X.
Monitor	MAG 570FD 15"
Keyboard	P.A
Mouse	P.A Windows compatible
Server	IBM Nefinity 3500 M2D
Hub	3 COM 10/100 16 UTP port
LAN Card	3 COM 3c9053-TX
Dot Matrix Printer	Epson LQ-300
Ink-Jet Printer	Lexmark Z32
Scanner	Cannon Scan D660C (CIS) (1200*2400 dpi Resolution)

Table 3.2. Software Requirement and Specification.

Software	Specification
Microsoft Window 200 Service Pack.	Operating System
Microsoft Window Millennium.	Operating System
Microsoft Internet Information Server 4.0.	Application Software
Microsoft Exchange Server 5.5.	Application Software
Microsoft SQL 7.0.	Application Software
Microsoft System Management Server 1.2	Application Software
Microsoft Front Page 2000	Application Software
Macromedia Dream Weaver 4.0	Application Software
Adobe Photoshop 6.0	Application Software
Macromedia Flash 5.0	Application Software
Microsoft Internet Explorer 5.5	Web browser
Netscape communicator 6.0	Web browser

3.4 System Security and Control

Computerized security and control for the proposed system (Car Rental Online) are as follows:

(1) There must be password for login in order to prevent unauthorized users from accessing the system.

(2) All data files and system program must be stored on the secondary storage medium to ensure the correctness of data and system operation in case of operation failure.

(3) Modification including writing, changing, changing status, deleting, and creating can be done only by authorized people or only in authorized ways.

(4) Data correction must be made immediately after errors on the data listing reports are found.

(5) Backup copies must be created every time and should be kept separately in a secure place and also labeled.

(6) Remark the input that has been approved to ensure against any redundancies.

(7) The computer office must be securely locked with security access control. Backup site and backup network are required.

(8) Distribution of reports must be controlled to ensure that they are delivered to the proper destinations.

(9) Produce only the required output reports.

(10) There must be exact ways for destroying any unwanted media used and produced is the system.

3.5 Cost and Benefit Analysis

The purposed system is designed to ideally minimize the cost and to maximize the benefit as much as possible within the shortest payback period. Cost and Benefit analysis is, therefore, necessary as a technique to estimate the candidate solution to ensure that the selected solution serves the system requirement the most.

The cost analysis of the proposed system is concerned with development cost and operation cost excluding any hardware and software needed by the client site whereas the benefit analysis is concerned with tangible and intangible benefits.

Cost Analysis:

(1)   Development Cost: are usually one time costs that will not recur after the project has been completed.

Hardware	Baht
3 sets of Personal Computer.	84,315
1 Dot Printer.	9,042
2 Ink Jet Printers.	5,900
1 Scanner	6,640
Communication	
Server.	108,600
Hub	12,500
LAN Card	7,200
Software	
MS BackOffice Software	40,000
Other Applications Software	20,803
Total amount of Hardware and Software costs	295,000

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Personnel	Baht
1 System Analyst	100,000
1 Database Specialist	50,000
1 Programmer	30,000
1 Web Master	40,000
1 Graphic Designer	25,000
Total amount of personnel costs	245,000

Implementation	
System Development Cost	50,000
Training Cost	5,000
Total amount of Implementation	55,000
Total amount of development costs	595,000

(2) Operation Cost: can be estimated only once specific computer-based solution have been defined.

Personnel	Baht
1 Web Master	200,000
Expenses	
Continued paper 9"*11	2,000
Diskette 3.5 DSHD (Maxwell).	2,000
Overhead Cost (e.g. utilities and telephone service)	40,000
Internet Provider Service Cost.	8,700
Other Office and Computer Supplier.	10,000
Total estimated cost of operation costs	62,700

Benefit Analysis:

(1) Tangible Benefits: those that can be easily quantified

    (a) Fewer processing errors. Whenever errors occur, it means time wasting as some processes need to be redone. Such wanted time usually causes the delay of other processes which leads to lose on the customer orders that come in during those period. Therefore fewer processing errors enabled the company to accept and respond to more customers in each hour. The estimated amount of such benefit is at 30,000 Baht.

    (b) Increased rentals. The system provides one more alternative to the customers by reserving car via Internet. This is not to expand the company's target, but also to offer the customer service staffs more time to concentrate on company' s old group of customers. Both benefits bring about three times of total rent of manual system. The

estimated rent of the company after changing to the proposed system can be quantified at the amount of service staffs is at 250,000 Baht.

(c) Reduced expenses. Such expenses are, for example, office suppliers, transportation, advertisement and postal service. The estimated amount of reduced expenses is at 2,000 Baht.

(d) Reduced Customer service staff. The estimated amount from reducing customer service staffs is at 2,000 Baht.

(e) Reduced part-time employee. The estimated amount from reducing customer service staffs is at 13,000 Baht.

(f) Reduced overtime wage. As the working process is more accurate and well organized, working overtime is rarely needed. The estimated amount from reducing overtime wage is at 2,000 Baht.

(g) Decreased response time. This means faster service to the customer that leads to customer goodwill and longer relationship. Such results make it easier for the company to promote car for rent. The estimated amount of decreased response time is at 2,000 Baht.

(h) Elimination of job steps. As mentioned before in this project customers rental had to go back and forth through each section repeat in order to finish one rent. The Proposed system solves this problem be offering better workflow as shown in Figure F.1. DFD of the Proposed System level 0. This estimated of job steps enabled the company to reduce any unnecessary factors as mention above.

Total estimated amount of Tangible Benefits 500,000 Baht.

(2)   Intangible Benefits: those can be easily quantified

(a)   Future expansion capabilities, E-commerce is a strong future trend of doing business, hence, the Proposed System is a major factor that will open the company to the world easier.

(b)   Increased efficiency and accuracy in work process. This is because every work process is designed to server users requirement at the most.

(c)   Improved working environment. The Proposed system enables the company to reorganize the office space and to eliminate any unnecessary cluster of paperwork.

(d)   Increased customer goodwill. Better and faster service leads to longer and better relationship with customer.

(e)   Improved employee moral. When every work process is done in the way we intend, it automatically motivates employees to work harder willingly.

(f)   Better decision-making. The Proposed System is designed to produce output at both management and operation level which will serve better decision making for the management level. This will lead to improvements for the company.

Payback period:

Payback analysis technique is a method for determining if and when the investment will pay for itself. From payback analysis, the proposed system has a very short payback period that is about 1.4 years.

Return On Investment (ROI) = (1,431,776 – 828,244 / 828,244)

= 0.728 * 100 = 73%

Cost and benefit analysis of the proposed system is shown in Table 3.3 and Figure 3.2 The comparison between Cost of the Existing system and the Proposed system also

shows that, in the long run, the company will spend less amount of budget in each year using this computerized system. Cost of the Existing system and the Proposed System shown in Table 3.4 and Figure 3.3.

Table 3.3. Cost and Benefit of the Proposed System, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Development Cost	595,000					
Operation Maintenance Cost		62,700	64,000	65,000	66,000	67,000
Discount factor for 12%:	1.00	0.893	0.797	0.712	0.636	0.567
Time-adjusted cost (adjusted to present value)	595,000	55,991	51,008	46,280	41,976	37,989
Cumulative time-adjusted costs over lifetime	595,000	650,991	701,999	748,279	790,255	828,244
Benefit derived from operation:	0	500,000	560,000	640,000	720,000	800,000
Discount factors for 12%	1.00	0.893	0.797	0.712	0.636	0.567
Time-adjusted cost (adjusted to present value)	0	446,500	446,320	455,680	457,920	453,600
Cumulative time-adjusted costs over lifetime	0	446,500	892,820	1,348,500	1,806,420	2,260,020
Cumulative lifetime-adjusted cost & benefit	-595,000	-204,491	190,821	600,221	1,016,165	1,431,776

30

Table 3.4. Cost of Existing and the Proposed System, Baht.

Cost Items	Years				
	1	2	3	4	5
Existing System:					
Staff (9 Staffs) (increase 5% per year)	245,000	257,250	270,113	283,619	297,800
Office Supplies Cost (increase 5% per year)	30,000	31,500	33,075	34,729	36,882
Offce Equipment Cost	290,000	290,000	290,000	290,000	290,000
Utility Cost (increase 5% per year)	20,000	21,000	22,050	23,153	24,311
Total Cost	585,000	299,750	615,238	631,501	648,493
Cumulative Cost	585,000	1,384,790	2,199,986	3,031,484	3,879,982
Proposed System:					
Hardware Cost	234,197	234,197	234,197	234,197	234,197
Software Cost	60,803	60,803	60,803	60,803	60,803
Installation Cost	10,000	-	-	-	-
Development Cost	40,000	-	-	-	-
Office Equipment Cost	4,000	4,000	4,000	4,000	4,000
Staff (5 Staffs) (increase 5% per year)	245,000	230,000	241,500	253,575	266,224
Maintenance Cost (increase 10% per year)	28,700	31,570	34,727	38,200	42,020
Office Supplies Cost (increase 5% per year)	10,000	10,500	11,025	11,576	12,155
Training Cost	5,000	4,000	4,000	4,000	4,000
Utility Cost (increase 5% per year)	40,000	42,000	44,100	46,305	48,620
Total Cost	677,700	617,070	634,352	659,656	672,019
Cumulative Cost	677,700	1,294,770	1,929,122	2,588,778	3,260,797

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Cumulative Cost, Baht
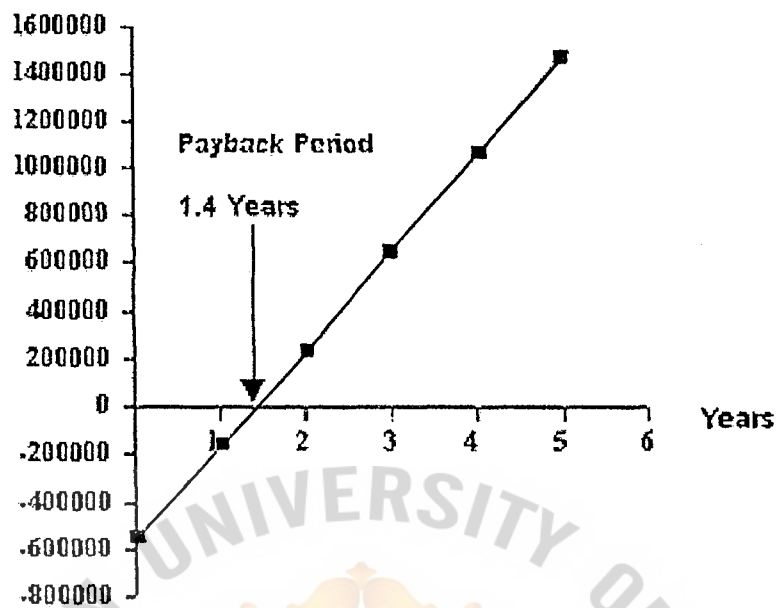
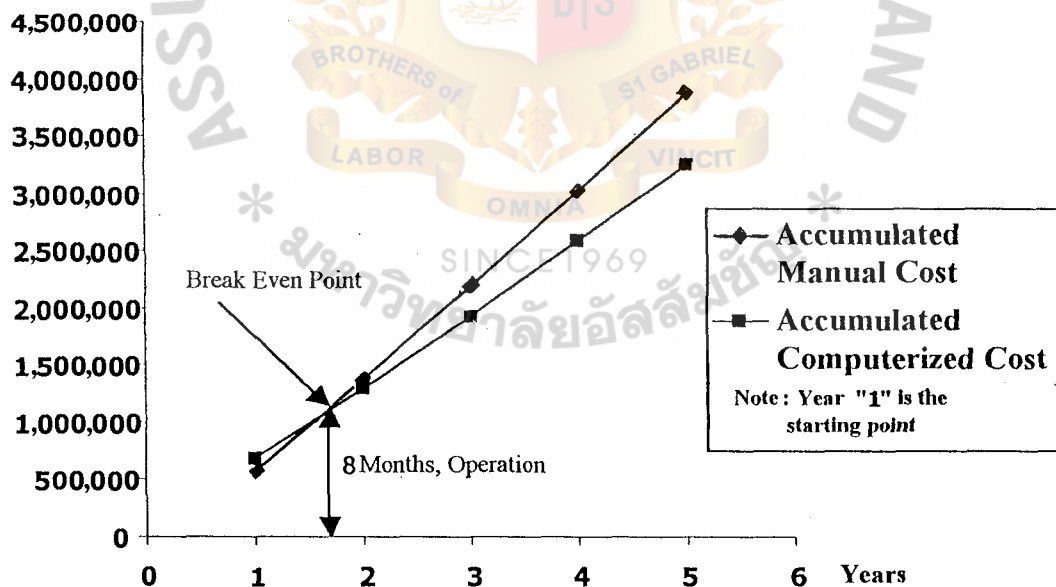Figure 3.2.   Cost and Benefit Analysis of the Proposed System.
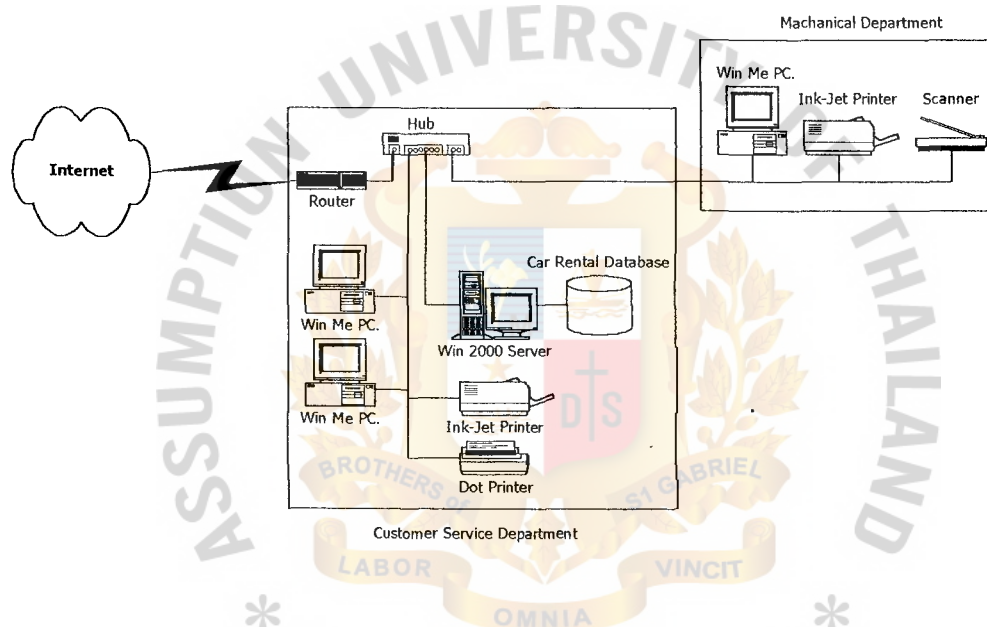

Figure 3.3.   Cost of the Proposed System.

Figure 3.4.   System Configuration of Proposed System.

IV.   PROJECT IMPLEMENTATION

4.1   Overview of Project Implementation

After the management accepts the new system, the implementation will be started. Implementation of the new system is a major step as it is often the most difficult part of this project. It consists of the installation of the new system and the removal of the current system. It is concerned with hardware, software, and people-ware.

During the implementation, unexpected problems often occur. Solutions to these problems usually require modification to the original design. The implementation processes consist of four stages that have to be performed in sequence. The four stages of implementation are as follows:

(1)   Programming

All needed application program will be written and/or ready to perform any computerized operating functions.

(2)   Testing

Testing of specific program, subsystem and total system is essential to quality assurance. Testing must be done before the system is activated. Testing stage involves the following:

(a)   Testing individual program

(b)   Data testing

(c)   Link testing

(d)   Module testing

(e)   User acceptance testing

(f)   System testing

These testing will be described in details in title 4.2 Test Plan and Result.

(3) Installation

Hardware installation usually involves vendor especially in case of on-line and real time system. While software installation involves loading all written application program onto the computer and getting them ready for operation.

(4) Training

User training can be classified into:

(a) Overview training: all people in the organization must learn, or get some knowledge benefits to cooperate with the user of the system.

(b) Details training: only users of the system must participate to know how to operate the system

The well-designed and technically elegant systems can succeed or fail because of the way they are operated and used. Therefore, training provided to personnel is very critical to successful implementation.

4.2 System Testing

As this electronic rental system is directly related to Web Site of the company, it is essential to have a quality assurance. Normally, these are what should be primarily tested.

(1) Test the rental process starting from users visiting the Web Site until the page of filling the rental form.

(2) Test the scalability of server with a large amount of data.

(3) Test the affect of Web Site to the back end system.

(4) Test timeliness in responding e-mail

(5) Test personnel and other supports to the system.

These plans can be technically described as follows:

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(1)   Testing individual program. It is completed during the programming task by the development team. Program testing concentrated on the programs themselves in an attempt to make sure that each program works properly.

(2)   Data testing. The testing consists of running a new or modified program which is to be working correctly with sample data. The sample data should be enough to cover all the conditions the program will encounter in its predictable future.

(3)   Link testing. This is to test the upstream and downstream feeds between different program and program modules. Theses test concentrate on the relationship between programs to ensure that the data created by one program are corrected relatively to the program that follows it.

(4)   Module testing. It is the process of testing the individual module that makes up the work program. This test consists of ensuring that the interfaces between modules working as they should and that these individual modules do not have an adverse effect on one another.

(5)   User Acceptance testing. It is users' responsibility to make their own data to test the system that meets requirements.

(6)   System testing. This is to ensure that all programs of the new system work together as they should. Acceptance evaluates the extent to which the new system meets user requirements under normal operating conditions, this is of ten the last chance to test and re-link the program before the software is converted from development to operations.

(7)   Operation acceptant testing. This is to ensure that the proposed system will function in the environment without adversely affecting the existing system.

Testing was successfully completed from module testing through integration testing. The errors found during the tests were ones that were fixed. The system performance should meet the stated objectives.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Such redundancies, duplicate documents, inaccurate, customer and available car records, time consuming from irregular workflow, and a significant amount of budget spent on paperwork are the result of the manual operation system. During the analysis phase, it is obvious that the information derived from the proposed system could support the top management in the decision-making process in order to gain competitive advantage. From the Cost and Benefit analysis, the proposed system is definitely beneficial to the company in a very short payback period, This Car Rental Online system has completed all the phases of System Development Life Cycle method and has achieved its objective and scopes with satisfying performances.

Table 5.1. The Degree of Achievement between the Proposed System.

Process	Existing System	Proposed System
Update and Maintain record process	40 mins	10 mins
Selecting Car process	20 mins	5 mins
Reservation process	20 mins	10 mins
Rental process	20 mins	10 mins
Return process	30 mins	15 mins
Produce Report process	45 mins	10 mins
Checking Car Available process	30 mins	5 mins
Total	3hrs. 25 mins	1hr. 5 mins

From the Table 5.1, it is clearly different in the total number of spending time in achievement of the both by existing system uses about 3 hrs. 25 mins and proposed system uses about 1 hr. 5 mins. Due to every processes of the existing system runs manually based on the paper; there is redundancy in data and processes, format of data and information has variety, and there is a problem about document lose. It creates the problem for the employee to searching and coping with the data and information. The job in each process uses too much time and hardly to finish in the short period. Beside, it is inconvenient for people to review, update, add, delete, and produce report because of difficult of finding due to a lot of record kept.

The proposed system is designed to improve the operations. The data can be updated by using modem to update information about cars and customers at the end of each day. By using LAN, Internet technology in the office, all data updated in the program can be shared to all involved parties, so we don't have to waste time asking and finding any information. The customer service employee can answer customers' question promptly by retrieving updated data from computer. Beside the proposed system also provides reservation online for any customers to reserve car by themselves, roughly calculates rental charge for them, and provides query tools for the user both manager, employee and customer to get any requirement reports. This is a reason why the proposed system can save time about 3 times of the existing system.

5.2 Recommendations

Problems usually come along with charges, hence, there must be plans and practices for every single section of the company in order to be ready for the conversion from the existing system to the proposed system.

Some recommendations for the success of the implementation of the proposed system are as follows:

(1) Everyone in the company should fully realize and be prepared for every step of conversion during the implementation period.

(2) There should be a suitable person to directly respond to and handle the new computer system for efficiency in implementing the project.

(3) Auto mail for an immediate response to customer is considered very necessary for online rental system.

Further enhancements of the system design and implementation for the company are:

(1) Development of security payment system.

(2) Development of maintenance system.

(3) Development of higher technology in order to gain trust from customer.

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APPENDIX   A

WEB INTERFACE DESIGN

Figure A.1.　Main Menu Screen.

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Executive - World Class Fleet Categories - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back · · Search Favorites History

Address http://www.executive.mweb.co.th/worldclass/index.htm

Executive Rental

Reservations Desk
WorldClass Fleet
Frequent Travelers
Locations
Rental Car
Return Car
Add New Car
Tips & Guidance
About Executive

Site Map
FAQ / Help
Contact Us

List update: 4 Dec 2000

WorldClass Fleet

Executive Car Rental offer the youngest fleet in Thailand, with an average age of less than 10 months. Great pride is taken in the fleet, which is regularly serviced to ensure comfort and safety of customers who can be assured that their late model vehicle will be presented clean after a 20 point safety check before each rental.

Passenger Cars
Passenger cars are on the fleet for no longer than two years, and include the latest products from Honda, Toyota, Suzuki, and Chevrolet. All of the Budget fleet is air-conditioned, is fitted with AM/FM radio cassettes and has power steering (except ECARs).

Mini Vans
For customers traveling as a group or with friends, Budget has 12 seat Toyota mini vans and Chevrolet Zafira MPV available. These vehicles are comfortably appointed with dual air-conditioning.

Fleet Examples

Internet

Figure A.2.   Select Car Screen.

Figure A.3.   Select Car Screen (Continued).

Figure A.4.   Reservation Screen.

Figure A.5.   Reservation (Intended Itinerary).

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Figure A.6.   Reservation (Intended Itinerary)(Continued).

Figure A.7.   Reservation (Checked Car Available).

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Figure A.8.   Enter Your Details Screen.

Figure A.9.   Enter Your Details Screen (Continued).

Figure A.10.   Modification Reservation Screen.

Figure A.11.   Cancel Reservation Screen.

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Figure A.12.   Contract Us Screen.

APPENDIX   B

REPORT DESIGN

Figure B.1.   Verify Your Itinerary Screen Report.

Figure B.2. Verify Your Itinerary Screen Report (Continued).
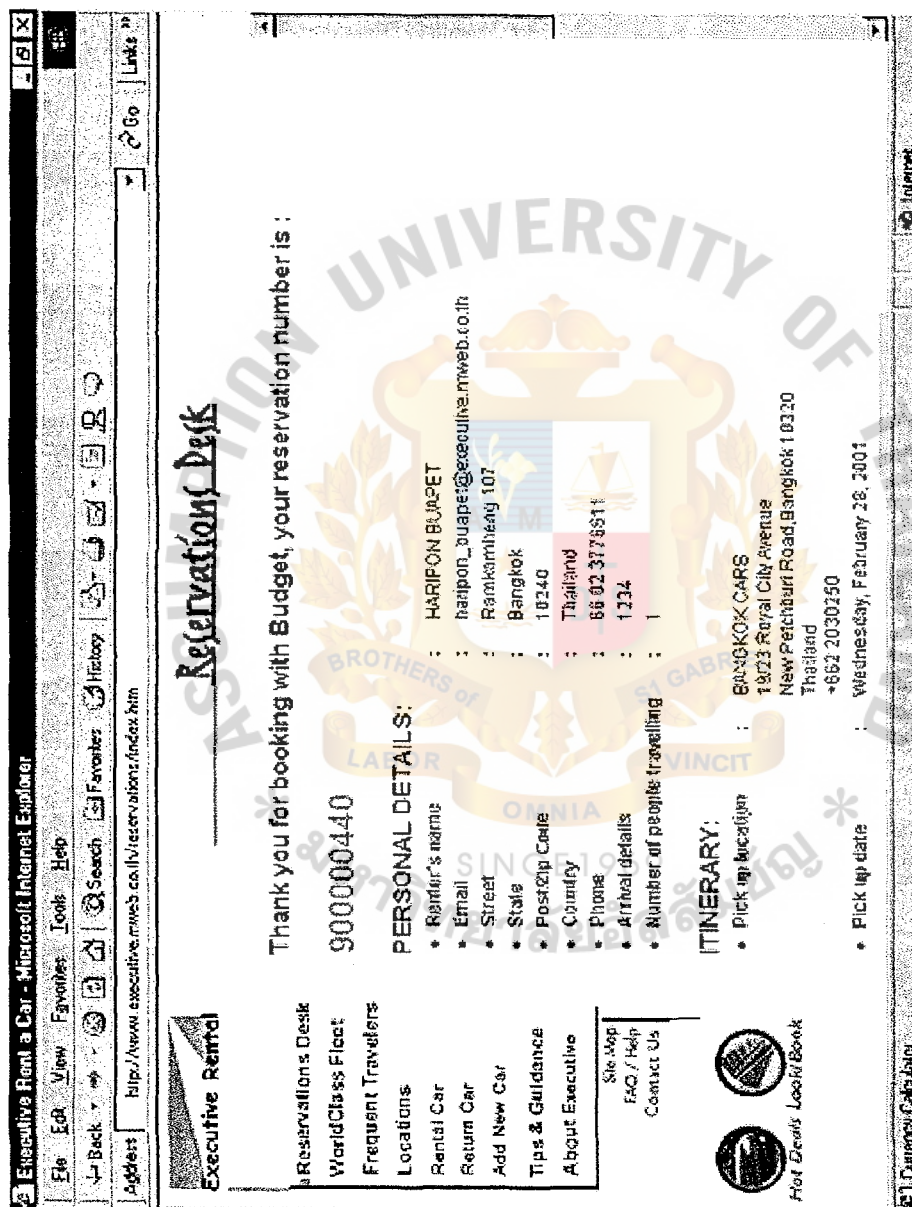
54

Figure B.3. Verify Your Personal Screen Report.

Figure B.4. Make booking Screen Report.

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Figure B.5.   Make booking Screen Report (Continued).

Executive - Hot Deals - Microsoft Internet Explorer

File Edit View Favorites Tools Help

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Address http://www.executive.mweb.co.th/travelers/deals/hote_thai.htm

Go Links »

Executive Rental

Reservations Desk
WorldClass Fleet
Frequent Travelers
Locations
Rental Car
Return Car
Add New Car
Tips & Guidance
About Executive

Site Map
FAQ / Help
Contact Us

Last update: 4 Dec 2000

Hot Deals

Thailand Super Saver Rates (Inclusive)
QUOTE BCD NUMBER: F000105

SIPP Code	Vehicle Type Example	3-6 Days Daily Rate (Baht)	7+ Days Daily Rate (Baht)
MFMR	Suzuki Caribian — 4WD 1.3 Man.	1,375	1,200
ECAR	Toyota Soluna — Sedan 1.5 Auto	1,500	1,300
CCAR	Toyota Corolla — Sedan 1.6 Auto	1,800	1,500
CFAR	Suzuki Vitara — 4WD 1.6 Auto	2,000	1,750
ICAR	Toyota Corona — Sedan 2.0 Auto ABS A/B	2,200	1,900
FCAR	Honda CR-V — 2.0 Auto ABS A/B	2,700	2,350
FC&R	Honda Accord	2,700	2,350

Internet

Figure B.6.   Car Price Rate Screen Report.

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WorldClass Fleet
Make a Reservation

Includes

- Unlimited mileage (kilometers)
- Free delivery and pickup within metropolitan areas
- Loss damage waiver (LDW). A charge of Baht 5,000 will apply in the event of any non-recoverable loss or damage.
- V.A.T.
- One way rental is available between all Budget Thailand locations for 3 day minimum hires
- Frequent flyer program points.
- Fleet average age less than 12 months old.
- All vehicles are fitted with airconditioning and radio cassette.

Available

- Personal Accident and Effects Insurance available at Baht 100 per day.

Not included

- Fuel is not included in rates.

Figure B.7.   Rental Condition Screen Report.

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┌─────────────────────────────────────────────────────────────────────┐
│  �                                                                 │
│  Executive Rental              Reservation Slip                      │
│  ────────────────                                                    │
│                                                                      │
│  900000440                                                           │
│                                                                      │
│  Personal Details:                                                   │
│  Renter's name              : Haripon Buapet                         │
│  Email                      : haripon_buapet@hotmail.com             │
│  Street                     : Ramkamheng 107                         │
│  State                      : Bangkok                                │
│  Post Zip Code              : 10240                                  │
│  Country                    : Thailand                               │
│  Phone                      : 66 02 3776611                          │
│  Number of people traveling : 1                                      │
│                                                                      │
│  Itinerary:                                                          │
│  Pick Up location           : BANGKOK CARS                           │
│  Pick Up date               : Wednesday, February 28, 2001           │
│  Pick Up time               : 09:00                                  │
│  Type of vehicle            : Compact Car Auto A/C (CCAR)            │
│  Drop Off location          : PATTAYA                                │
│  Drop Off date              : Friday, March, 2, 2001                 │
│  Drop Off time              : 09:00                                  │
│                                                                      │
│  Rate : 1,482 Baht per day, 494 Baht per hour (Unlimited Kms per day │
│  included).                                                          │
│  Estimated cost of Rental: 3,364 Baht (2 days).                      │
│  Insurance is required at 200 Baht per day, with an excess of 500 Baht.│
│  All quotes are in Thai Baht and are subject to VAT.                 │
└─────────────────────────────────────────────────────────────────────┘
```

Figure B.8.   Reservation Slip.

```
Executive Rental                    Rental Slip


900000440

Personal Details:
Renter's name              : Haripon Buapet
Email                      : haripon_buapet@hotmail.com
Street                     : Ramkamheng 107
State                      : Bangkok
Post Zip Code              : 10240
Country                    : Thailand
Phone                      : 66 02 3776611
Number of people traveling : 1


Itinerary:
Pick Up location           : BANGKOK CARS
Pick Up date               : Wednesday, February 28, 2001
Pick Up time               : 09:00
Type of vehicle            : Compact Car Auto A/C (CCAR)


Rental Payment             : 3,364 Baht.
Insurance                  : 400    Baht.
Total Payment              : 3,764 Baht.
```

Figure B.9.   Rental Slip.

Executive Rental

Rental Invoice

900000440

Personal Details:

Renter's name	: Haripon Buapet
Email	: haripon_buapet@hotmail.com
Street	: Ramkamheng 107
State	: Bangkok
Post Zip Code	: 10240
Country	: Thailand
Phone	: 66 02 3776611

Itinerary:

Pick Up location	: BANGKOK CARS
Pick Up date	: Wednesday, February 28, 2001
Pick Up time	: 09:00
Type of vehicle	: Compact Car Auto A/C (CCAR)
Drop Off location	: PATTAYA
Drop Off date	: Friday, March, 2, 2001
Drop Off time	: 011:00

Rental-Payment	: 3,364 Baht.
Insurance	: 400 Baht.
Charges	: 200 Baht.
Total Payback	: 200 Baht.

Figure B.10.   Rental Invoice.

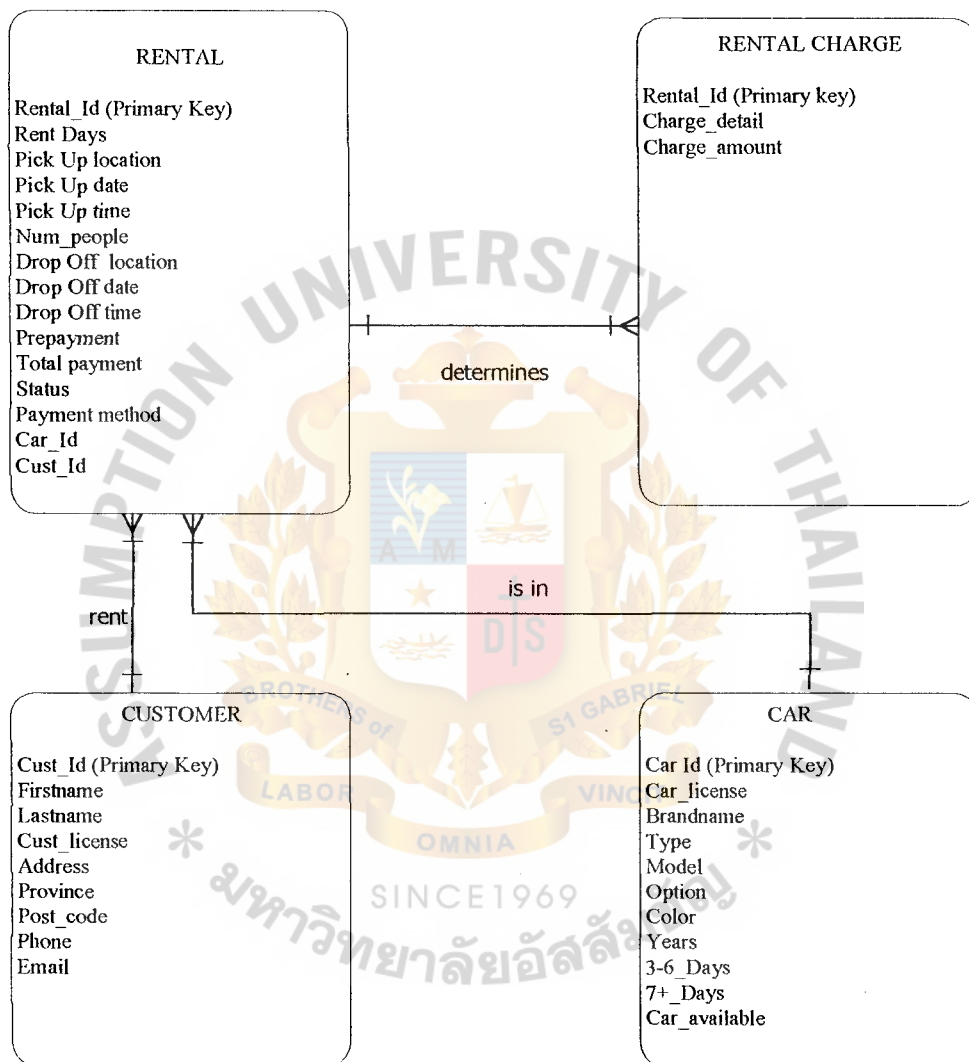| Executive Rental		Car Available		
Code	Vehicle Type		3-6 days	7+ day
MFMR	Suzuki Caribian (4WD 1.3 Man)		1,375	1,200
CFAR	Suzuki Vitata (4WD 1.6 Auto)		2,000	1,750
ECAR	Toyota Soluna (Seadan 1.5 Auto)		1,500	1,300
CCAR	Toyota Corola (Seadan 1.6 Auto)		1,800	1,500
ICAR	Toyata Corona (Seadan 2.0 ABS/AB)		2,200	1,750

Figure B.11. Car Available Report.

APPENDIX   C

DATABASE DESIGN

Figure C.1.   ER Diagram of Car Rental Service Online.

Customer Table

Cust_Id	Text[10]
Firstname	Text[20]
Lastname	Text[30]
Cust_license	Text[10]
Address	Text[50]
Province	Text[30]
Postcode	Text[5]
Phone	Tex[15]
Email	Tex[10]

Rental Table

Rental_Id	Text[10]
Rental_days	Text[2]
Pick_up_time	Time (HH/MM)
Pick_up_date	Date (DD/MM/YY)
Pick_up_location	Text[50]
Drop_off_time	Time (HH/MM)
Drop_off_date	Date (DD/MM/YY)
Num_people	Integer
Drop_off_location	Text[50]
Status	Confirm/Cancel
Prepayment	Integer
Total_payment	Integer
Payment_method	Cash/Visa/Master
Car_Id	Text[10]

Cust_Id	Text[10]

Rental Charge

Rental_Id	Text[10]
Charge_details	Text[50]
Charge_amount	Integer

Car Table

Car_Id	Text[10]
Car_license	Text[10]
Brandname	Text[30]
Type	Text[50]
Model	Text[30]
Option	Text[50]
Color	Text[15]
Year	Text[4]
3-6_Days	Integer
7+_Days	Integer
Car_Available	Integer

APPENDIX D

PROCESS SPECIFICATION

PROCESS 1.1   Find Match Car

Precondition: Customer Search Requirement.

Post condition: Match Car.

Process:

Begin

Get car requirement.

Compare requirement with car data in the database.

Show a list of match car.

End.

PROCESS 1.2   Calculate Estimated Rental Charge.

Precondition: Match car data.

Post condition: Estimated Rental charge

Process:

Begin

Find suitable discount rate.

Get car charge / day

Get rental data.

Sum car rent charge minus with discount.

Show total estimate rental charge.

End.

PROCESS 2.1   Enter Reservation data

Precondition: Reserve requirement.

Post condition: Bring reserve data to calculate rental charge.

Process:

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Begin

    Get Customer data.

    Get Reserve data.

    Get Car requirement data.

    Update Customer data.

End.

PROCESS 2.2   Calculate Rental Charge

Precondition: Reserve and cars' requirement data.

Post condition: Rental Charge.

Process:

Begin

    Find suitable discount rate.

    Get car charge / day

    Get reserve data.

    Sum car rent charge minus with discount.

    Show total estimate rental charge.

End

PROCESS 2.3   Confirm Reservation

Precondition: All rental charge.

Post condition: Confirm reservation

Process:

Begin

    Get confirm or cancel.

    If cancel then

Delete reserve data and customer data.

Else confirm then

Update rental charge

Update confirm reservation to rental

Set car available = "no"

End

PROCESS 3.1   Retrieve Reservation information

Precondition: Completed reservation information

Post condition: Rental charge.

Process:

Begin

Get reservation data

Show reservation information

Show total rental payment

End.

PROCESS 3.2   Receive Payment

Precondition: Complete payment.

Post condition: Issue rental invoice to the customer.

Process:

Begin

Update rental payment (Cash or credit) and amount of payment.

Update delivery place and delivery time.

Print Rental invoice

Print Delivery order

End.

PROCESS 4.1   Return Car

Precondition: Car delivery and Rental invoice

Post condition: Update car return

Process:

Begin

Get rental data and rental payment data.

Enter return date, return date and return time.

Set car available = "yes"

End.

PROCESS 4.2   Calculate Post charge

Precondition: Return data

Post condition: Create rental bill

Process:

Begin

Check return data with rental data.

If overdue date or time then

Calculate post charge

Calculate payback money.

Print Rental bill

End.

PROCESS 5.1   Search Overdue Reservation Records

Precondition: Overdue date 2 days

Post condition: Overdue reserve record

Process:

Begin

Find null payment from rental records

Compare rental date with current date

If result >= 2 days then

Go to process 5.2

Else Exit Automatic cancel reservation process.

End.

PROCESS 5.2   Cancel Reservation

Precondition: Overdue date records

Post condition: reservation record and Update car available = "yes"

Process:

Begin

Get overdue records from process 5.1

Delete reserve data and rental payment

Set car available = "yes"

End.

PROCESS 6.0   Add New Car

Precondition: New car data

Post condition: Create new records in the car table

Process:

Begin

Enter new car data.

Update new car to the car table.

End.

APPENDIX   E

DATA DICTIONARY

DATA DICTIONARY

Table E.1. Data Dictionary of Car Rental Online.

Dataflow Name	Meaning
Car Data	Car license + Brand name + type + Model + Color + Years + Charge Rate + Car Available
Car delivery/Rental invoice	Rental data + Complete payment amount
Customer Data	Customer ID + First name + Last name + Driver license + Address + Province + Post Code + Username + Password + Email
Complete payment	Reserve data + Credit or cash + Payment amount
Delivery Order	Rental car data + Rental data
Estimated rental charge	Total Rental charge
Issued Data	Issued time + Prepayment + Cash/Credit
New Car	Car data
Overdue reservation	Rental data + Rental s' car + Rental charge
Rental charge	Charge details + Charge amount
Rental Data	Rental date + Rental days + Issue place + Return place
Rental invoice	Rental data + Complete payment amount
Reserve request	Rental data + Complete payment amount
Return bill	Rental data + Post charge + Payback amount
Return data	Return time + Return date
Search request	Car data + Rent date + Rent days + Delivery place + Return place

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APPENDIX   F

DATA FLOW DIAGRAM
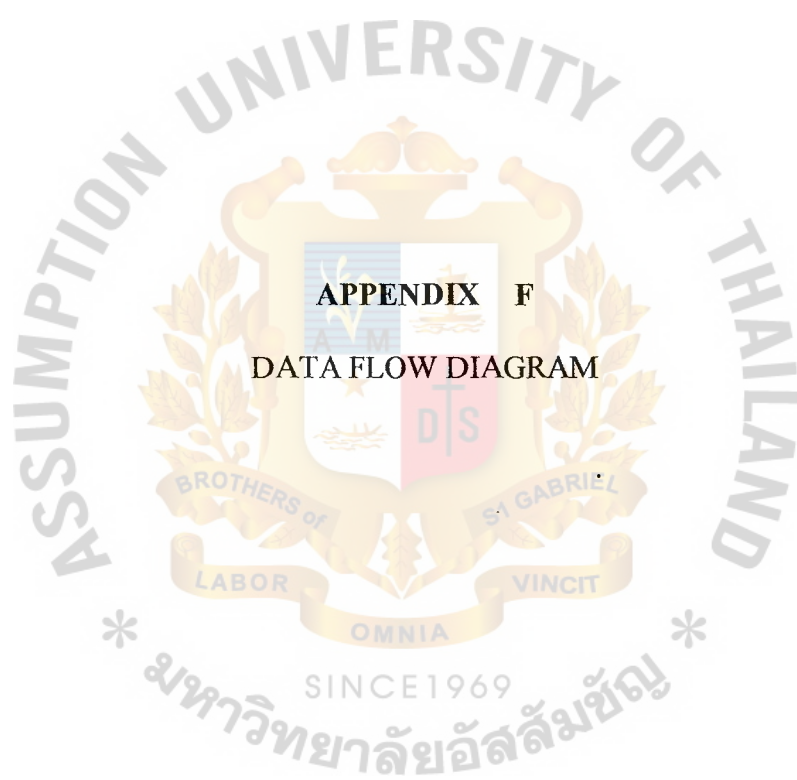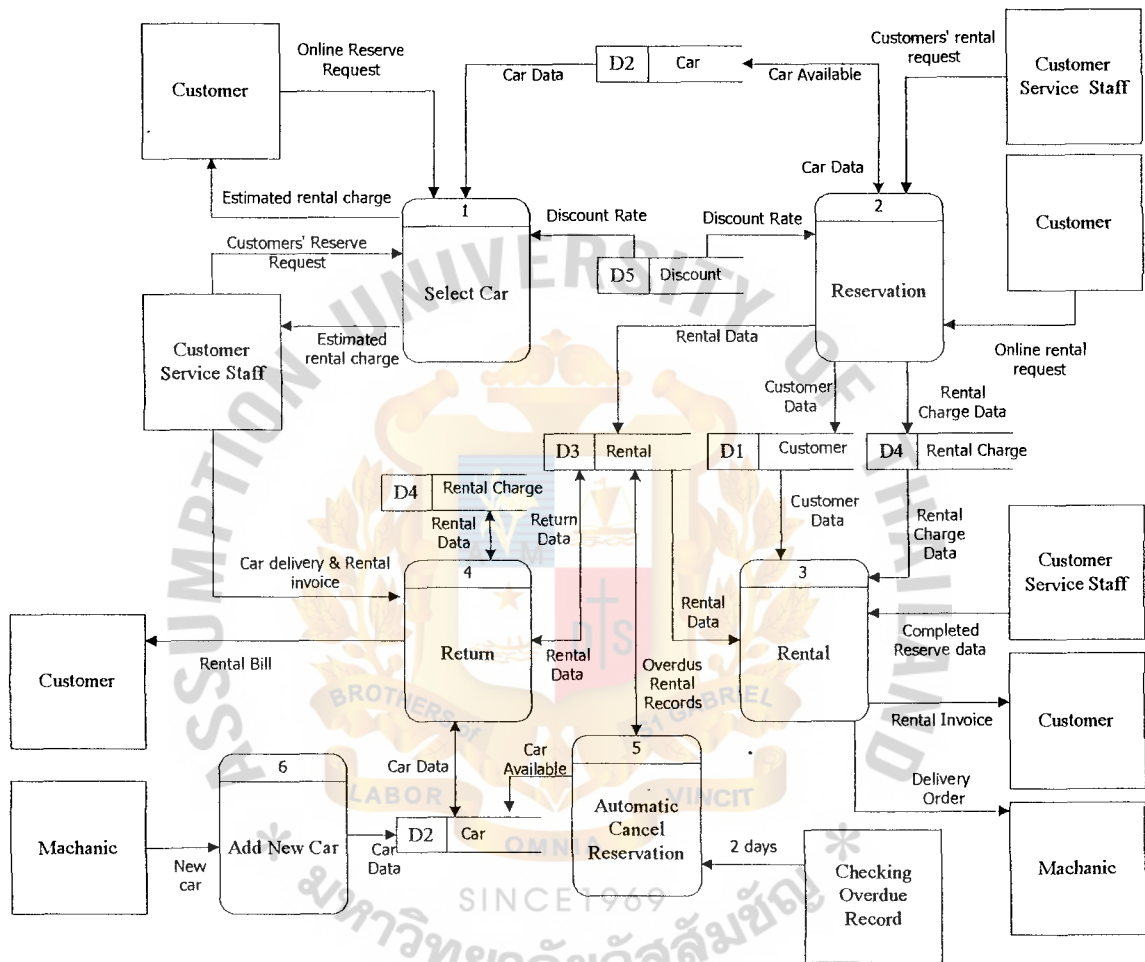
Figure F.1.   DFD of Car Rental Online System (Level 0).

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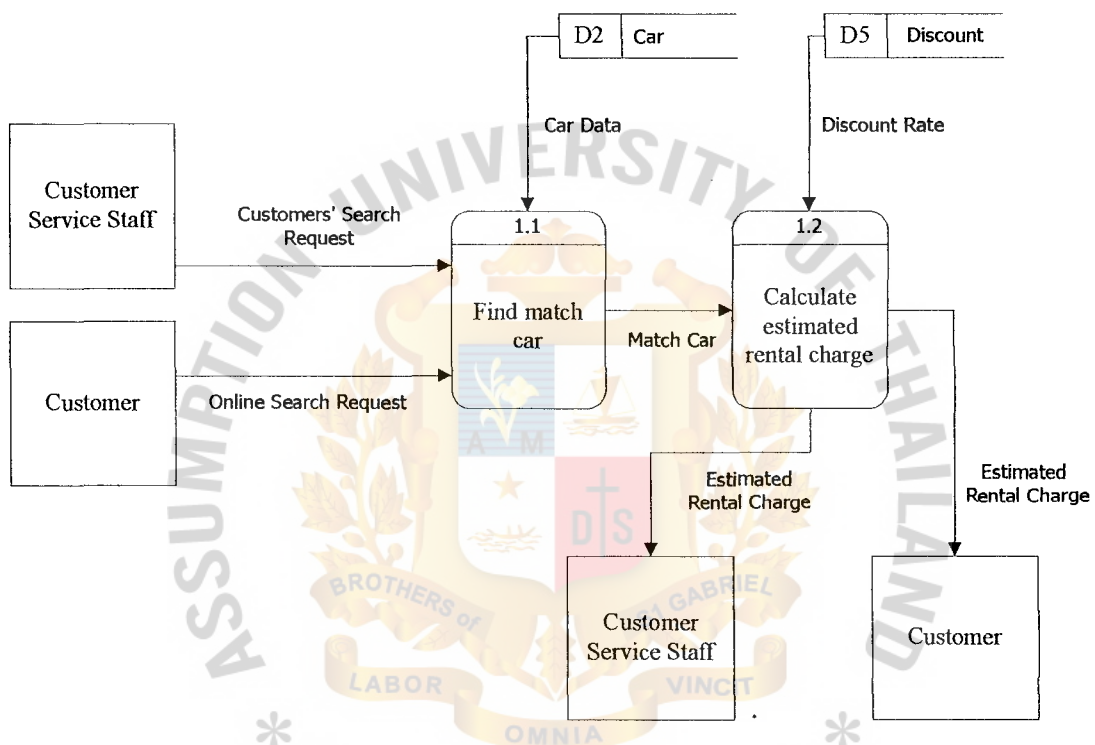
Figure F.2.   DFD of Select Car Process of Car Rental Online System.
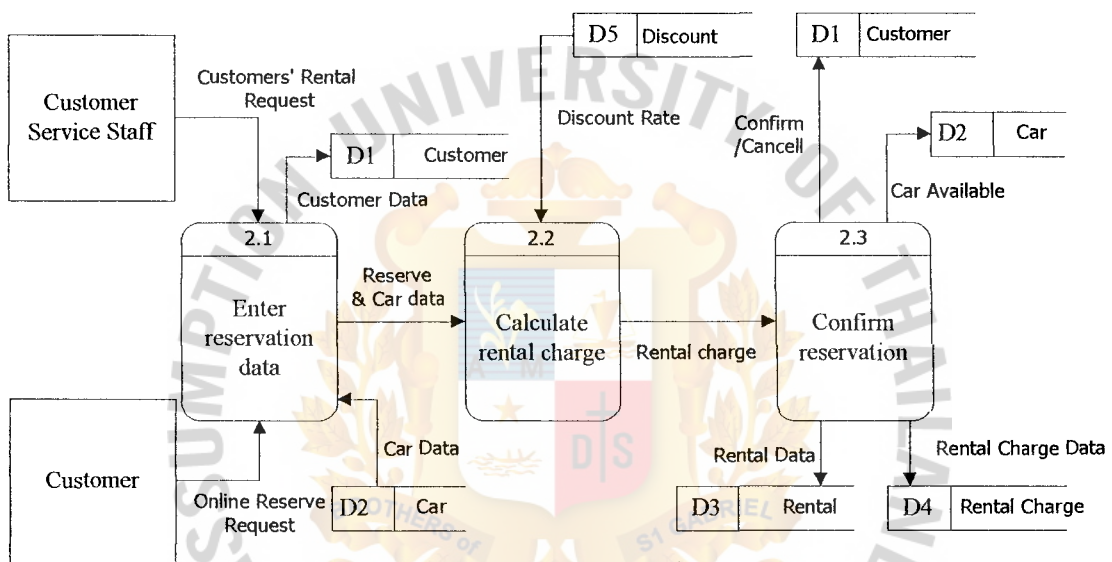
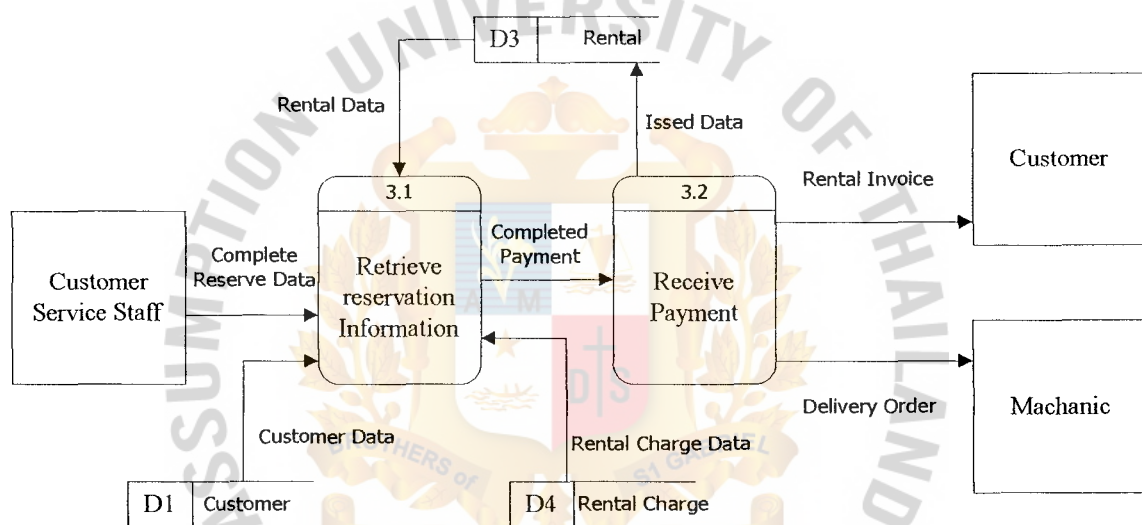Figure F.3. DFD of Reservation Process of Car Rental Online System.

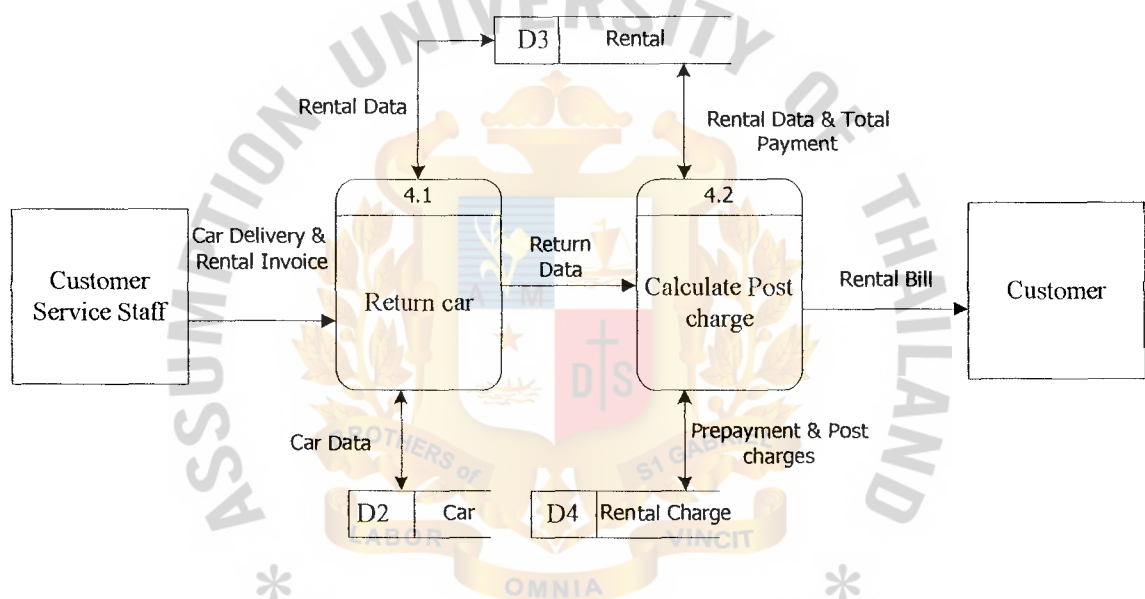Figure F.4.   DFD of Rental Process of Car Rental Online System.

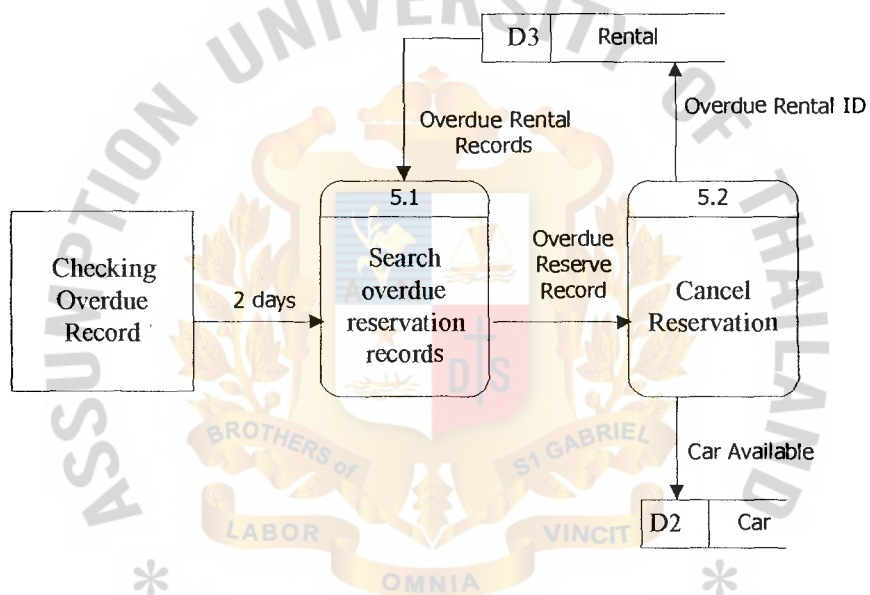Figure F.5.   DFD of Return Process of Car Rental Online System.

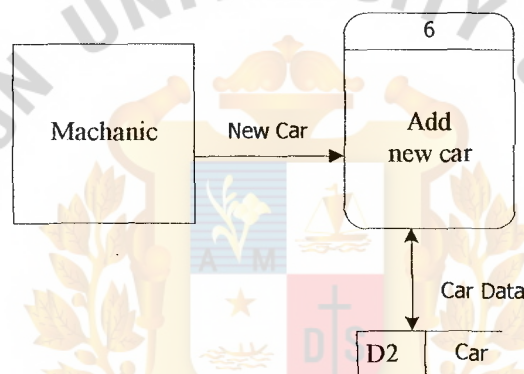Figure F.6.   DFD of Automatic Cancel Reservation of Car Rental Online System.

Figure F.7.   DFD of Add New Car of Car Rental Online System.

APPENDIX   G

MODULE DESIGN

MODULE 1: Select Car

PURPOSE: Find customers' car requirement and calculate estimated rental cost

USES: Car data and Rental data

RETURN: Car information and Rental information

FUNCTION DETAILS:

    (1)   Find Match Car

    (2)   Calculate Estimated rental charge

MODULE 2: Reservation FUNCTION DETAILS:

PURPOSE: Reserve car, record customer information, shoe rental charge and get

    reservation confirm from the customer

USES: customer data car data and rental data

RETURN: reservation confirm and reduce car available

FUNCTION DETAILS:

    (1)   Enter Reservation Data

    (2)   Calculate Rental Charge

    (3)   Confirm reservation

MODULE 3: Rental

PURPOSE: Check confirmed reservation of the customer, record rental payment,

    issued Rental invoice to customer and issued Delivery Order to

    mechanic.

USES: Completed reservation information, Payment.

RETURN: Rental invoice, Delivery Order

FUNCTION DETAILS:

    (1)   Retrieve reservation information.

(2)   Receive payment

MODULE 4: Return

PURPOSE: Calculate post charge and add car available

USES: Car delivery and Rental invoice

RETURN: Rental bill

FUNCTION DETAILS:

    (1)   Return Car

    (2)   Calculate Post Charge

MODULE 5: Automatic Cancel Reservation

PURPOSE: find overdue reservation records and cancel overdue reservation
          Records

USES: Overdue date 2 days

RETURN: Delete overdue reservation, related data and add car available

FUNCTION DETAILS:

    (1)   Search Overdue Reservation Records

    (2)   Cancel Reservation

MODULE 6: Add New Car

PURPOSE: Add new car data to the car table

USES: New car data

RETURN: Create new car records

FUNCTION DETAILS:

    (1)   Add New Car
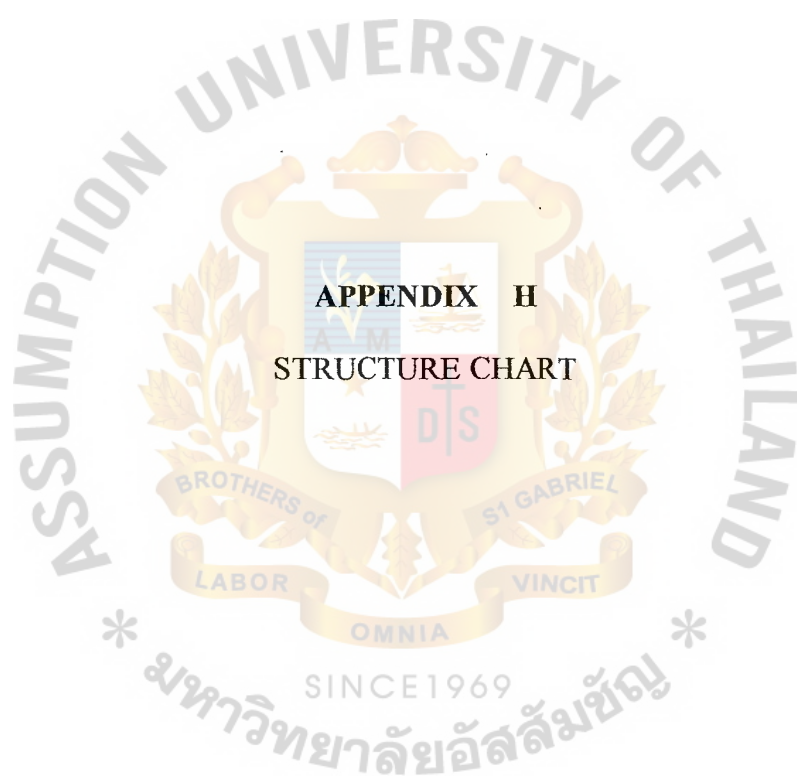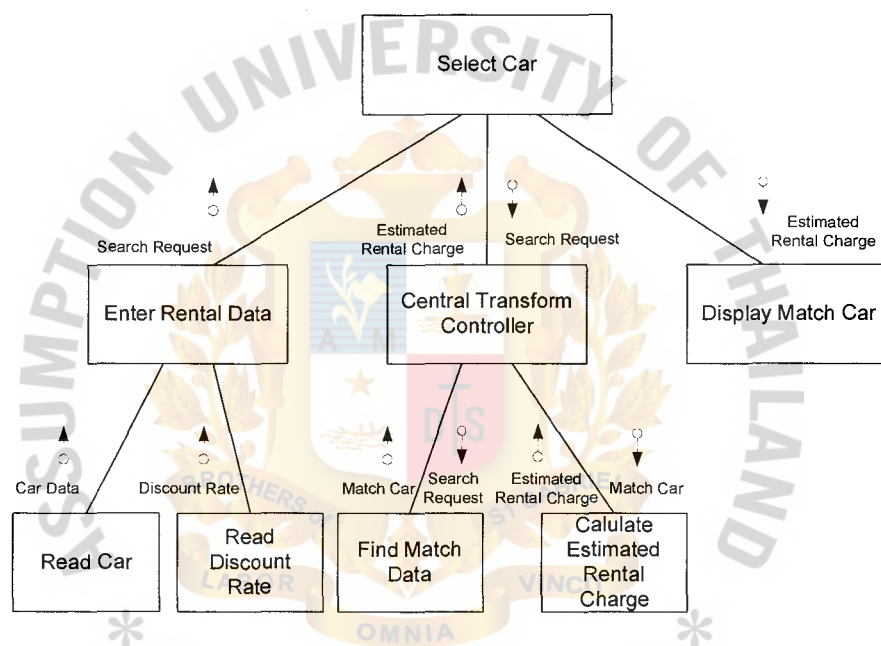
APPENDIX   H

STRUCTURE CHART

Figure H.1.   Structure Chart of Select Car of Car Rental Online System.
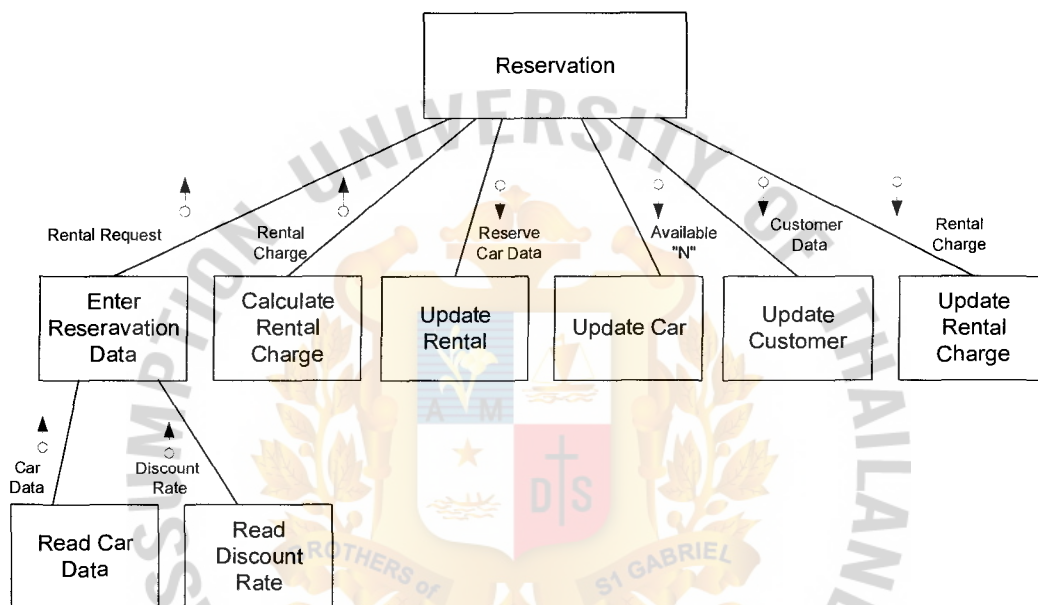
Figure H.2.   Structure Chart of Reservation Car of Car Rental Online System.
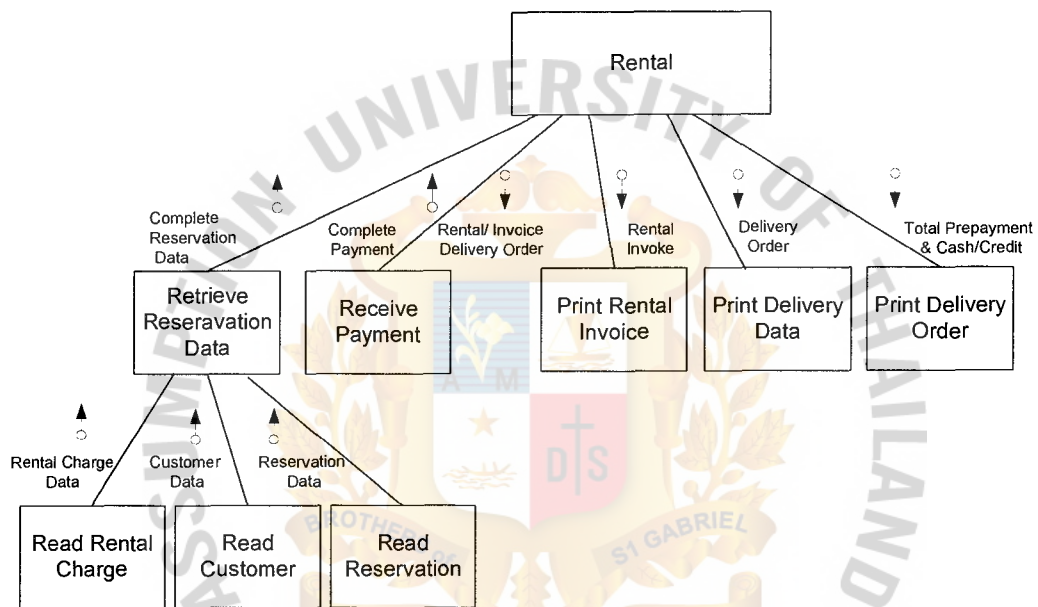
Figure H.3.   Structure Chart of Rental Car of Car Rental Online System.
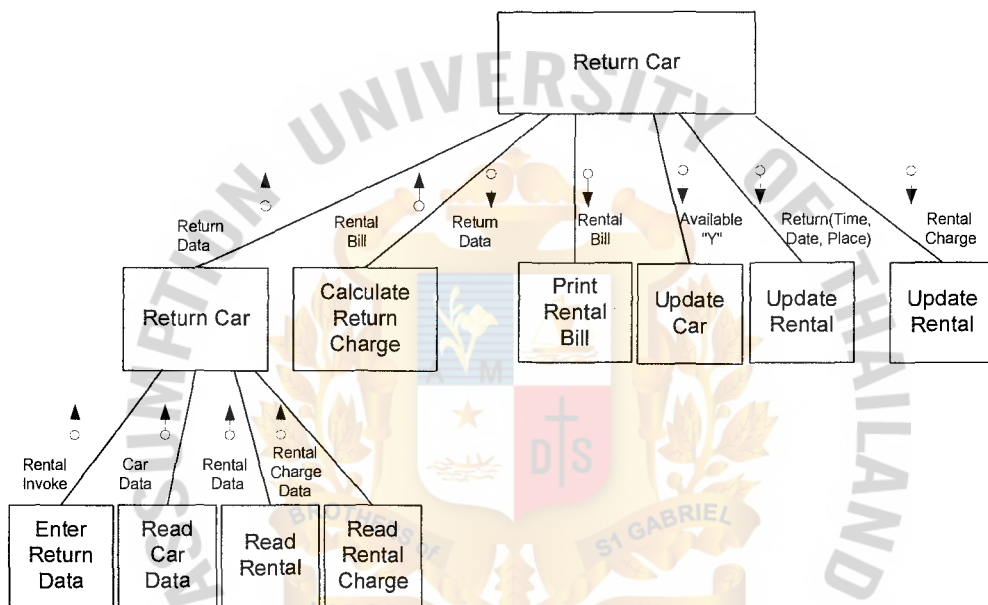
Figure H.4.   Structure Chart of Return Car of Car Rental Online System.
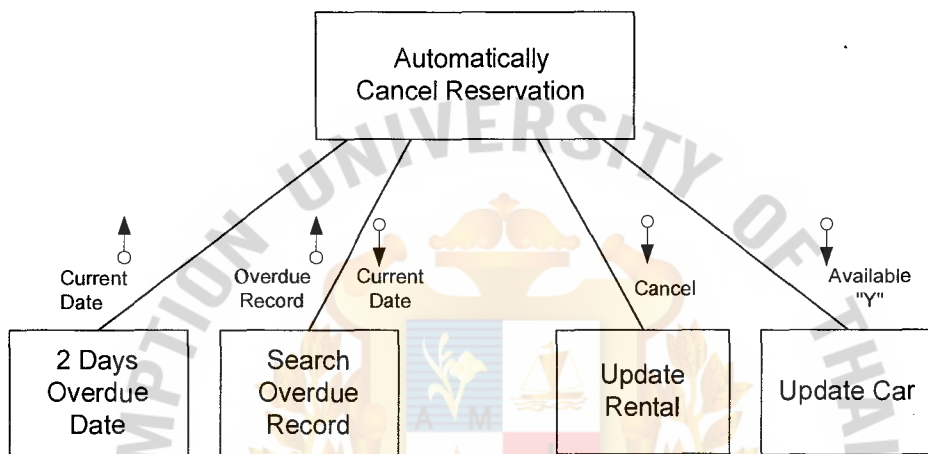
Figure H.5.   Structure Chart of Automatic Cancel Reservation of Car Rental Online System.
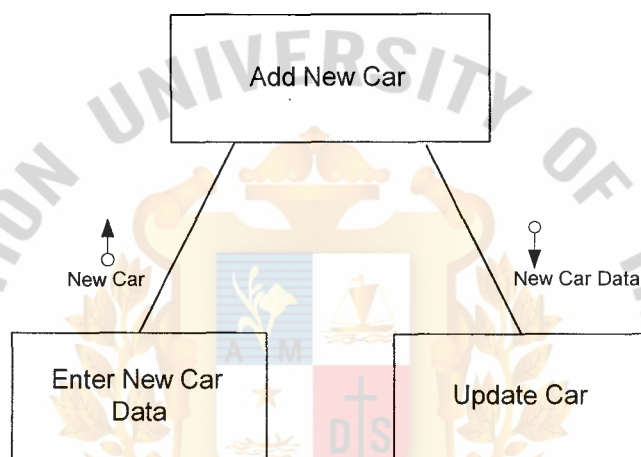
Figure H.6.   Structure Chart of Add New Car of Car Rental Online System.

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