Loading Car Rental for Express Transportation Service Information System for Phaholyothin Loading Car Rental Service Co.,Ltd.

by

Mr. Yanpol Dumkum

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
Assumption University

March 2005

Loading Car Rental for Express Transportation Service Information System for Phaholyothin Loading Car Rental Service Co.,Ltd.

by
Mr. Yanpol Dumkum

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
Assumption University

March 2005

Project Title	Loading Car Rental for Express Transportation Service Information System for Phaholyothin Loading Car Rental Service Co., Ltd.
Name	Mr. Yanpol Dumkum
Project Advisor	Air Marshal Dr. Chulit Meesajjee
Academic Year	March 2005

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.

Approval Committee:

AM Chulit Meesajjee

(Air Marshal Dr. Chulit Meesajjee)
Dean and Advisor

(Prof.Dr. Srisakdi Charmonman)
Chairman

(Asst.Prof.Dr. Vichit Avatchanakorn)
Member

(Assoc.Prof. Somchai Thayarnyong)
CHE Representative

March 2005

ABSTRACT

The Loading Car Rental Service has accelerated expansion and competition especially in car rental business. Since, the company needs to keep business growth information is important in today's business which helps to facilitate decision-making for manager. Furthermore, this project is developed from manual system to computerized system for supporting Loading Car Rental Service of Phaholyothin Loading Car Rental Service Company Limited. The computerized Loading Car Rental Service Information System processes are required to deal with several departments that have their own databases and procedures. This project develops effective information system to facilitate the processes of Loading Car Rental Service Information System.

This project is concerned with developing of the new Loading Car Rental Service management replacing the manual system. This project covers the analysis, design and implementation of computerized database management system for Phaholyothin Loading Car Rental Service Company Limited. The project uses structure analysis and design techniques to analyze and design the system which comprises of data flow diagram, data dictionary, and database system design.

ACKNOWLEDGEMENTS

Many people have made contributions to this project. The writer would like to acknowledge their efforts and thank them for their contributions.

The writer desires to express her most sincere appreciation and thanks to Air Marshal Dr. Chulit Meesajjee, her project advisor, for his valuable suggestions and advice given in preparation of this project. The writer is faithful to all the instructors who taught in the Computer Information Systems Course so that he is able to apply this knowledge to the system development project. In addition, the writer would like to specially thank the project committee members of the Graduate School for their advice and for all support provided throughout this course work.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

1.1 Background of the Project

Loading Car Rental Service Co., Ltd. is a medium size business in Thailand that provides three categories of loading car rental service such as Toyota Hilux Vigo Standard, 4 WD, Van Hiace, Commuter and truck (6 Wheel) Dyna. It was founded since 2000. The main mission is to provide loading car rental service for customer satisfaction by providing loading can rental service for moving product and home furniture movement including express transportation anywhere with convenience that the organization provides at a cheap cost charged per hour or per day. Moreover, Loading Car Rental Service Information would like to develop current operational business process from manual to computerized system that mainly supports successful function of the business as a faster rental service for customers with update information.

Furthermore, the company will also plan to extend branches at other locations to take more benefit from an increasing number of customers with other locations. So, the company will use the computer information system to assist services by means of operating the computer system in the company. In general, the application would make user easier to operate the rental service.

This project will develop the new system for the Loading Can Rental Service for more efficiency and effectiveness so that timely can be provided for customers to be more comfortable. Another alternative way is for customers to make Loading Car Service reservation to the office by phone. Otherwise, customers can come to the shop to take out loading car. In this project, the company will use the program to develop the whole functional service to facilitate to customer service staff in operating their work most conveniently with most effective result. To the increasing number of customers,

the existing reservation system is a manual one which operates inefficiently. It incurs high operating cost, especially employee salary cost for current officers and staff, and consumes a great amount of time for required information in hard copy form to respond to the customer request. This project suggests a system that will enhance the business functions in terms of data capacity and control by using a computerized database gathering and containing all necessary information related to the data collection. System analyst assists employees in gathering information correctly from the customer and store them into computerized format database in order to let every concerned departments easily retrieve data accurately.

1.2 Objectives of the Project

The main objective of the system is to understand the existing problem and analyse problems in the company in order to design the new system and improve the service as follows:

(1) To identify and analyse the existing system problem with user's requirement.

(2) To plan a new system that eliminates problems in the existing system and facilitates all system functions.

(3) To identify the data process activities of the business requirement based on the computerized system and develop the new system based on the feedback of the user requirement.

(4) To identify the business requirement system for the new system and the process need for solving the problems.

(5) To design and develop the new information system that is suitable for user regarding user-friendliness.

(6) To develop and implement the application to control all the functions.

(7) To dramatically improve the work flow of the service system for customers.

(8) To eliminate the inventory and stock of the report kept and redundant cost information.

1.3 Scope of the Project

The project will cover all main functions for the loading can rental service system which is particularly hiring Loading Car Rental Service, The system covers four sections: rental section, reservation section, return section and management information system. Generally, the service starts when a customer needs to rent a loading car from service by filling all details in the application sending their request to the staff. Then customer service staff responds with action and estimates the loading car rental fee depending on different rental periods and different loading car types.

(1) If the customers hire loading car rental, the service staff uses computerized system which provides all services depending on hours and types of loading car rental and charge rate including confirmation, reservation and cancellation

(2) In the confirmation section, it promptly checks the available loading car at the garage

(3) It promptly updates the loading car rental and update customer information detail using the loading car and location.

(4) Service staff creates the car rental charge slip with receipt and then customers pay advance regarding sign up in the slip.

(5) Finally, it creates operation reports for the manager.

1.4 Deliverables

The deliverables of the project on information system 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 for improvement

(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 attached Gantt chart

No.	Task Name	January				February				March				April			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	I. System Analysis																
1	Define the Objective and Scope																
2	Study and Identify 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. Detail Analysis and Design of the Proposed System																
8	Interface Design																
9	Report Design																
10	Layout Design																
11	Database Design																
12	Network Design																
13	Program Design																

Figure 1.1. Project Plan of Loading Car Service Information System.

II. THE EXISTING SYSTEMS

2.1 Background of the Company

The Loading Car Rental Service provides a variety of loading car rental services containing available loading car on time for supporting a great number of customers. In the former operating system, the manual system cannot respond immediately on time. It cannot check available loading cars kept in the garage because of the manual system. Customers requesting loading can rental service need to take longer time to check the available loading car in garage; therefore the staff have to face a lot of redundant and inaccurate information to respond to those customers for available loading car left. All paper reports take time to be carried to the maintenance department, then staff walk back to the front office customer to confirm car availability. All car information is kept on the paper based system. Unfortunately, customers are always upset on wasting time for checking available car responsibility. In the present system, there are many inconsistencies in loading car availability and late in providing loading car rental slip, and receipts incorrectly.

In addition, Loading Car Rental Service would like to develop a computerized operation in loading car rental service, reservation system payment and its invoicing system. The loading car can be taken form one location and returned only to same the location causing inconvenience to customer. Each branch has different customers and rental service systems not using the same customer information.

In Loading Car Rental Service, there are many kinds of vehicle models available for customers such Toyota Hilux Vigo, Van Hiace, and Hard loading (6 wheels) in the depot. The models are separately grouped in the price classes. The company has a number of different rental plans that are daily time and kilometer rate or hour time.

The rental charged by the Loading Car Hire Company is set up for special planning period and each model depending on the class and charging plan chosen by the customer, with a particular discount on business days but not weekends. In the option for available car is to fit in the certain model of the loading car such as the Hilux Vigo Standard, Cab4x2, Cab4x4 and 4WD. The customer asks for service fitting in the available car with options provided by customer service staff to the loading car or customer will ask for optional request for reservation of the loading car.

Moreover, optional loading car has non-fitted extras such as high roof, and long trailer that customers request the company to provide the service with extra charge. The rental is applied in advance in the same planning period as for additional rental. The customer can hire the loading car depending on his/her job and also customer can make reservation for their convenience. After the customer makes a reservation, the customer service staff asks for alternative payment as cash or credit.

However, customers who wish to make a booking for several loading cars need only an invoice. The company accepts the customer's reservation information for giving advances only as one invoice for all rental loading cars. The loading car is allocated to a reservation according to its known availability.

The loading car may or may not be available for customer hire on particular time so loading cars need to be maintained in the garage. Therefore, the company will arrange a reservation service to keep track of the loading car available update in the daytime by recording in the system.

The increasing performance of Loading Car Rental Service helps to minimize cost of the customer service time responses, loading car maintenance of car reparation, taking care of maintenance services and loading car availability. The company needs the system to be reasonably foolproof of the things that can happen to loading car and only

occur in a prescribed sequence. A loading car cannot be retuned by the customer before it has been taken out.

For instance, the customer settles the invoice when the car is returned but in some cases, the invoice is sent to a company, and when the customer pays by credit card, the amount in the invoice has a bill to the credit card company, together with other rentals using the same kind of the credit card.

2.2 Existing Business function

The process of Loading Car Rental Service is usually operated manually and there are three clerks for customer services and give information about loading car availability. After that the customer makes a reservation adding the option requested looking at available cars in lists. The record of the customers who make the order is kept in the record to be updated as historical information. The process of Loading Car Rental Service is according to the confirmation at the end regardless of cancellation providing information to other involved departments for update of information.

In addition, before delivery of the loading car, the staff has to check the loading car at the garage that is the ordered lists in the long term contract for repairing or maintenance with the company. Then the loading car passes the step process available for customer delivery. But the loading car needs to be repaired before being available for use.

In the part of customer delivery, all cars are arranged for the customer with the key and check the car equipment and leave from the garage and the car lists. All detailed loading cars will be used to calculate the rental charge according to customer to tariff rate.

The current organization chart is shown in Figure 2.1. The owner is the only one taking all responsibilities of the company with no division, department nor even section.

In general, the owner has great burden in controlling the company and employees are able to cheat the company sine the process in not done well. The owner does not have enough time to look after the entire operation in a short period.

Furthermore, the owner has to plan the expansion of the department and section of the work flow, at each branch in the districts. Consequently, the organization chart needs to adapt to the plan as shown in Figure 2.2., including four departments, Customer Service Department, Maintenance, Depot Department, Finance and Accounting Department and Marketing and Promotion Department. By using a new computerized system, the company will use three clerks to welcome the customers and provide customers' requests information for car availability up to reservation of loading car and the process keeps going until reservation confirmation or cancellation of the rental process. The details of the confirmed reservation needs to be updated so that the requested order is properly sent to the maintenance department and account department that needs information to keep precise information in work flow.

All requests from customers with the conditions and delivery time will be sent to maintenance department to prepare for servicing loading car and to check performed loading car parking at the end in the garage for further work as repair needs and skill needs. The accounting department performs confirmation for payment to the company and the process will ask the customer to perform credit payable function and confirm the payment or statement. All detailed reserve information will be used to calculate the rental service by using tariff and the rental charge slips will be handed to the customer. For customer who pays cash, the process is managed by cashier. The rental charge slips are recorded in the program to conclude the monthly rental service charge volume.

2.3 Current Problems and Areas for Improvement

In operation, availability of cars is a significant factor, for which the system needs to be update in real time for the availability of loading car in the garage but the staff do not know the number of loading car availability. Consequently, the company needs to develop the new proposed system to keep loading car availability information in order to provide easier rental loading car service system. In the current system, the company needs to take time in carrying the report of customer reservation to the maintenance department and when the customers make a call it takes time to check the maintenance department. Since all information is in the form of paper, it causes operations to be slow making customers inconvenient, with incorrect rental slips and invoice.

However, the company provides service in several districts with each branch with their own format application and information process, which is a manual process that creates a lot of the paper work and hard report resulting in tracking data problem and ineffectiveness. Besides, that also needs time resource for paper work. Some staff would use the computer to operate the business process, although the remaining staff still use their own system that create the problems as follows:

(1) Loading Rental Car Service is a process with much data redundancy in the work flow.

(2) Information forms are various that cause imprecise data.

(3) It has the redundancy of data and information at multiple places. The whole information system is so difficult for seeking and takes a long time.

(4) The company spends a lot of time to create daily, weekly and monthly hard paper work with limited staff.

(5) The data stores become expensive and they may be lost due to use of incorrect method processes.

(6) All staff face inconvenience to review information, insert, delete and update information because of redundant records.

Consequently, to solve the current problems mentioned, the process of loading car rental needs improvement and data need to be update on a timely basis with accurate car availability at the end of each day by means of LAN and Internet in the company's operation. All data updated in the main program would likely be shared in all activities. Hence, loading car rental service need not waste time and attract the customers. Fortunately, the front staff will prompt the customer by retrieving update data of customer or historical customer information. In the Loading Car Rental Service System, all parts of the project development cover the entire business process at the present. The Loading Car Rental Service has not yet divided its operation into division, department and section. Every staff's work has no clear-cut responsibility. The project will cover the first step of the work to delivery process. Staff has also many problems, so the project aims to collect personal information including address, telephone, start hire date and the contact of agreement, salary and working performance.

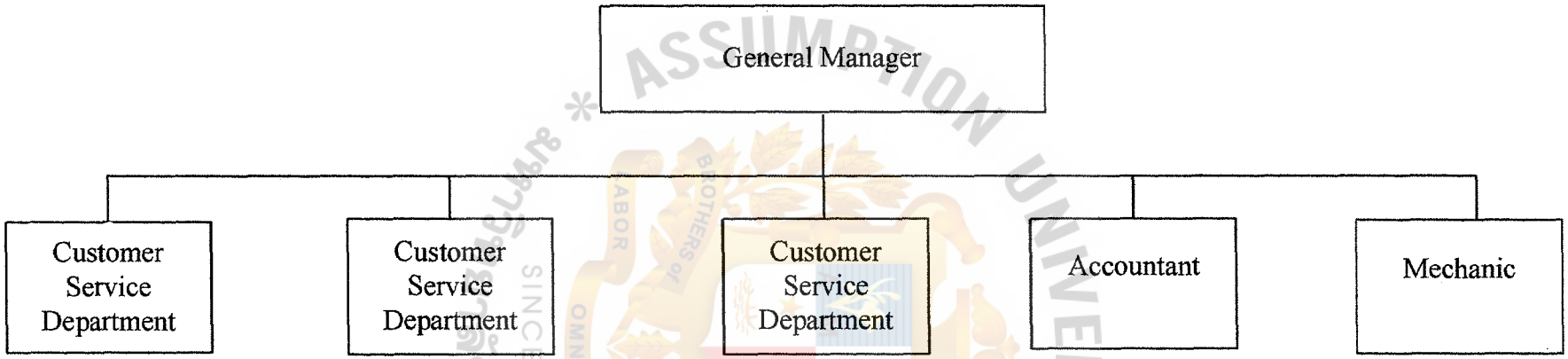

Figure 2.1. The Organization Chart of Loading Car Rental Service (Existing System)

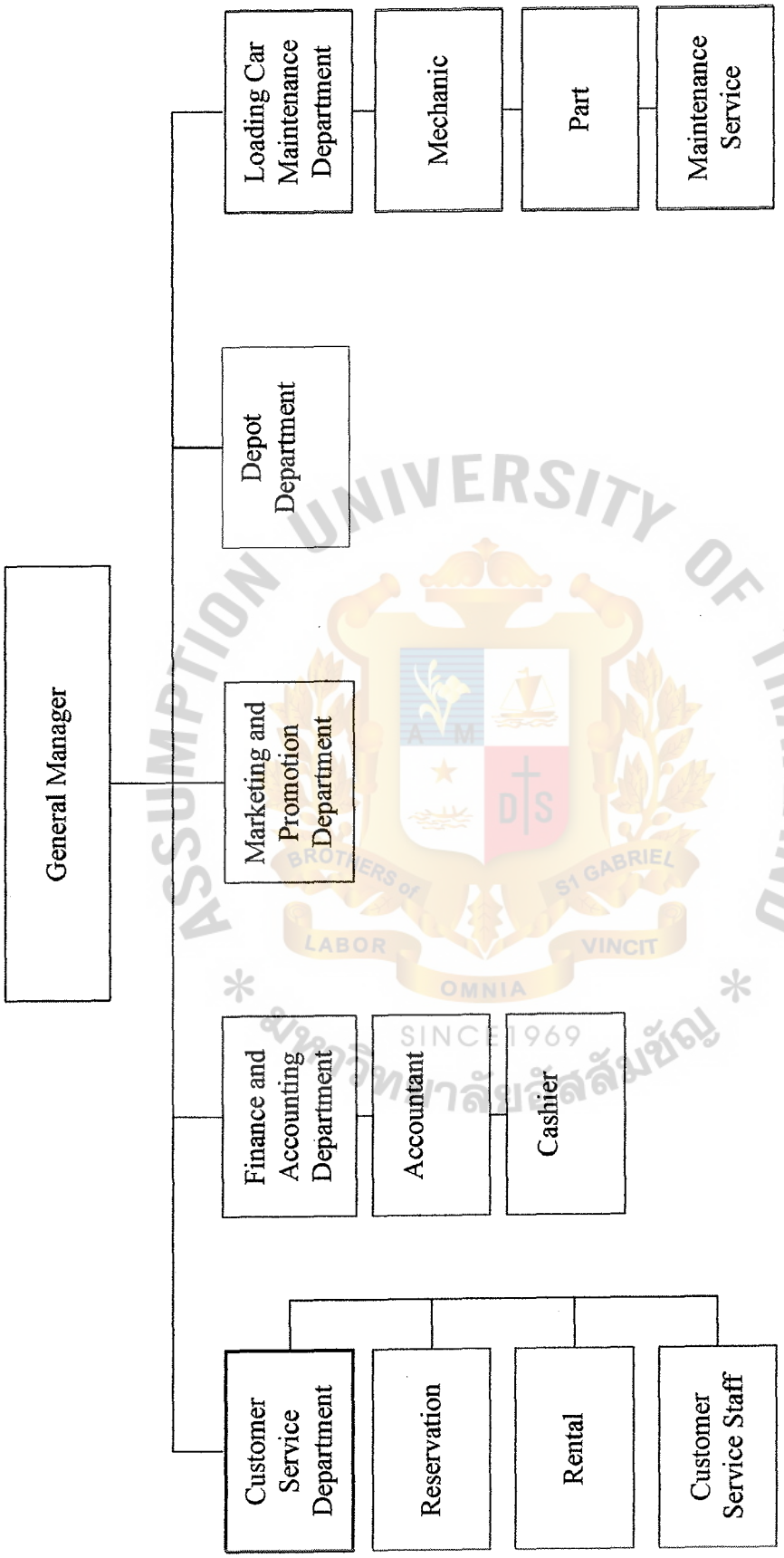

Figure 2.2. The Organization Chart of Loading Car Rental Service (Proposed System)

III. THE PROPOSED SYSTEM

3.1 System Specification

The proposed system will develop the Loading Car Rental Service with a computerized information system for the current existing system manual process. The new system will provide increasing benefit to the company. In the process function, it provides accurate information and update customer information and helps the performance to be effective, which leads to minimize redundancies and increase effective workflow.

User requirement is an important function for business requirement in reviewing and evaluating the existing system concerning development of the new system. Those user requirements can be concluded as follows:

(1) The design needs to be stable for problems may happen with new technology in some imperfect programs. The developer needs backup or storage performance to keep track of the company.

(2) Control management and reliability based on the computerized system operates with risk. It would not prevent the risk in existing operation.

(3) Consistent process needs to update information and eliminate information; such procedure should be organized online system, as updating and eliminating information are considered functions of the system.

(4) Facilitation of management is based on online and real-time in organization service by the internet; so process of Loading Car Rental Service would be easier for correct information and proper work in the organization with external environment when interacting with external contribution or inter

contribution. The proposed system will fully support any activities related to the system.

(5) For deletion, the proposed system will be designed to delete entity of entities or clear the process of incorrect entities so that it takes a long time to turn the system back.

(6) For provision for environment, back up and other facilities need to be online to connect with other branches, such as telephone line. Internet service provider is provided all operational office time.

To achieve the specified objectives, the proposed system should have the following components:

(1) Network Architecture

Network architecture in the proposed system is Clients/Sever consisting of database servers and client machines using multiple computers through a computer server with TCP/IP shown in Figure 3.1. All data are stored in the database server. Some appropriate business logic is programmed to execute on the server downloaded from the server to execute on the client. System interfaces will be controlled by the server site and instructions are executed on the server as well. Users can simply receive the data in the database by application programs via network. All client machines will be connected to the server. So client machines access the data in the database and the client machines only send database commands to be executed on the server. The results will be sent from the server to the client machine and client machines see the requested data by their application program.

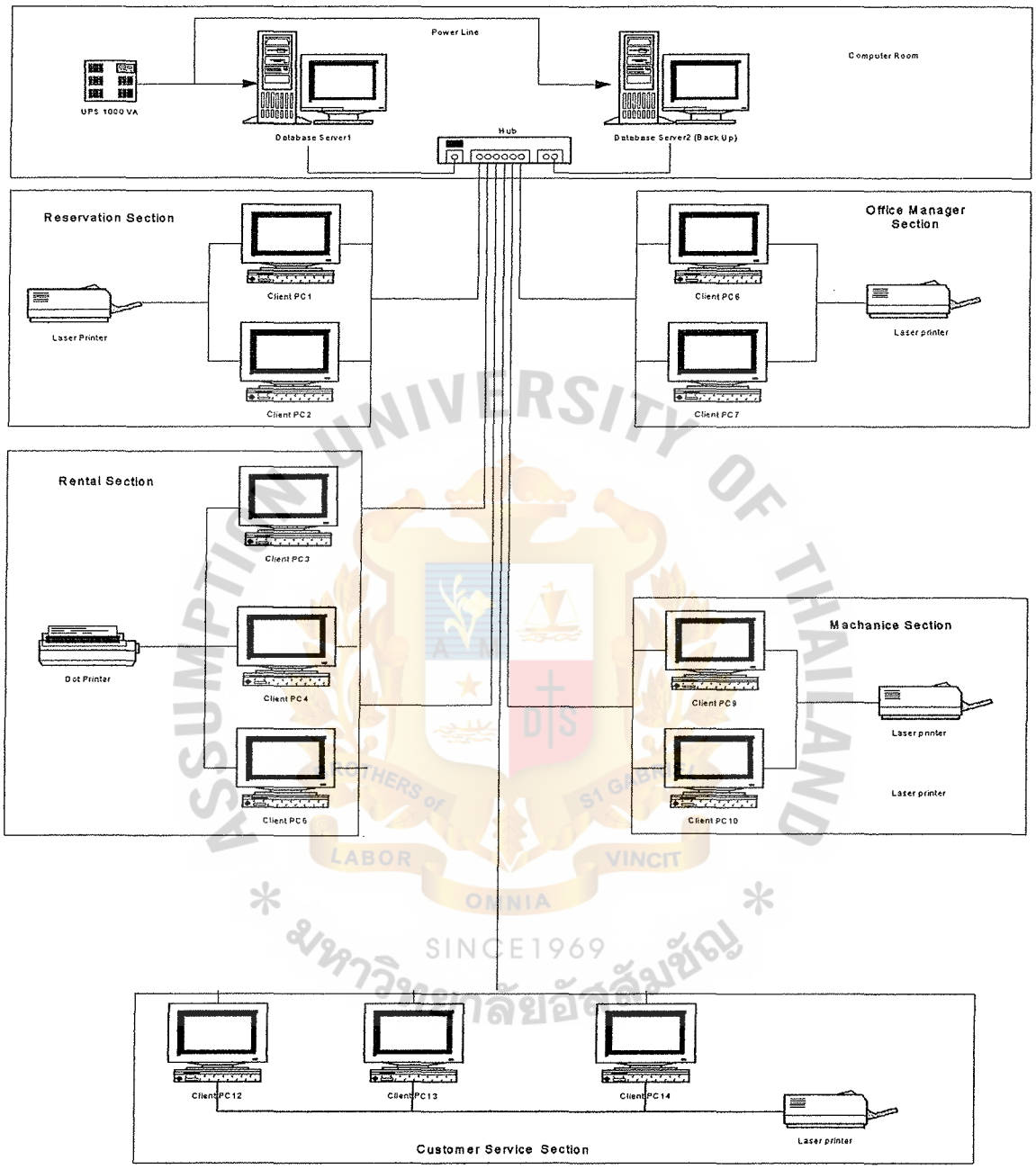

Figure 3.1. Network Architecture of Loading Car Rental Service Information System.

(2) Database Architecture

Relational Database Model is applied in this system. All data will be stored in the form of tables and relations that are integrated as the relation database. Microsoft SQL Server is used to handle access and maintenance of the stored data also to facilitate backup, recovery and security of data. The database language to be used is SQL (Structured Query Language). SQL facilitates data definition, query, and update. It is both the DDL (Data Definition Language) and DML (Data Maintenance Language).

(3) Interface Architecture

The interface architecture is online processing personal computers access to the Loading Car Rental Service Information System. The system keeps track of customers, transactions, and rental processing. The user uses a program on the client machine and if the work concerns update, insert, or delete data in the database, the program will send the database command to the database server to manipulate that data immediately. Online processing processes the data in the system up-to-date correctly. Online system enables Customer Service Staff transactions and rental process immediately. It permits greater human interaction in making decisions. The required transactions, customer information and reports are generated immediately. Online data increases the validation of data.

The client machines will be installed at Loading Car Rental Service to access and update records of customer, rental department, loading cars, payment services, maintenance and financial and accounting department for enquiry of information and generate finance and accounting transactions.

(4) Process Architecture

Microsoft Visual Basic.Net is the software language tool for developing the business application programs for the proposed system. It consists of Windows 2000 Server Microsoft Office 2000 Professional, and Microsoft SQL Server. Microsoft Visual Basic.Net is the programming language compiled for replication and execution on client PCs and connected to the server.

3.2 System Design

System design is a computerized solution the implement the technology. The specification is a variety of computer-based solutions called physical design. There is a variety of techniques in developing the proposed system as Loading Car Rental Services. The structural approach is used to accomplish this development. In the Loading Car Rental Service System, the system design includes process design, design file design, input design, output design, interface design and data directories. The details are described below:

(1) Process Design

The proposed system uses the Context Diagram to profit the data flow diagram depicting the entire system as a single process with its major inputs and outputs in order to describe the scope of the project boundary. The Context Diagram of the proposed system is shown in Figure 3.2. The data flow diagram is used to show the whole process primarily in the structure analysis that graphically illustrates a system's component of the proposed system; hence, users and management are able to gain insight of the Data Flow Diagram Level 0-1 as of the Proposed System as shown in Appendix F.

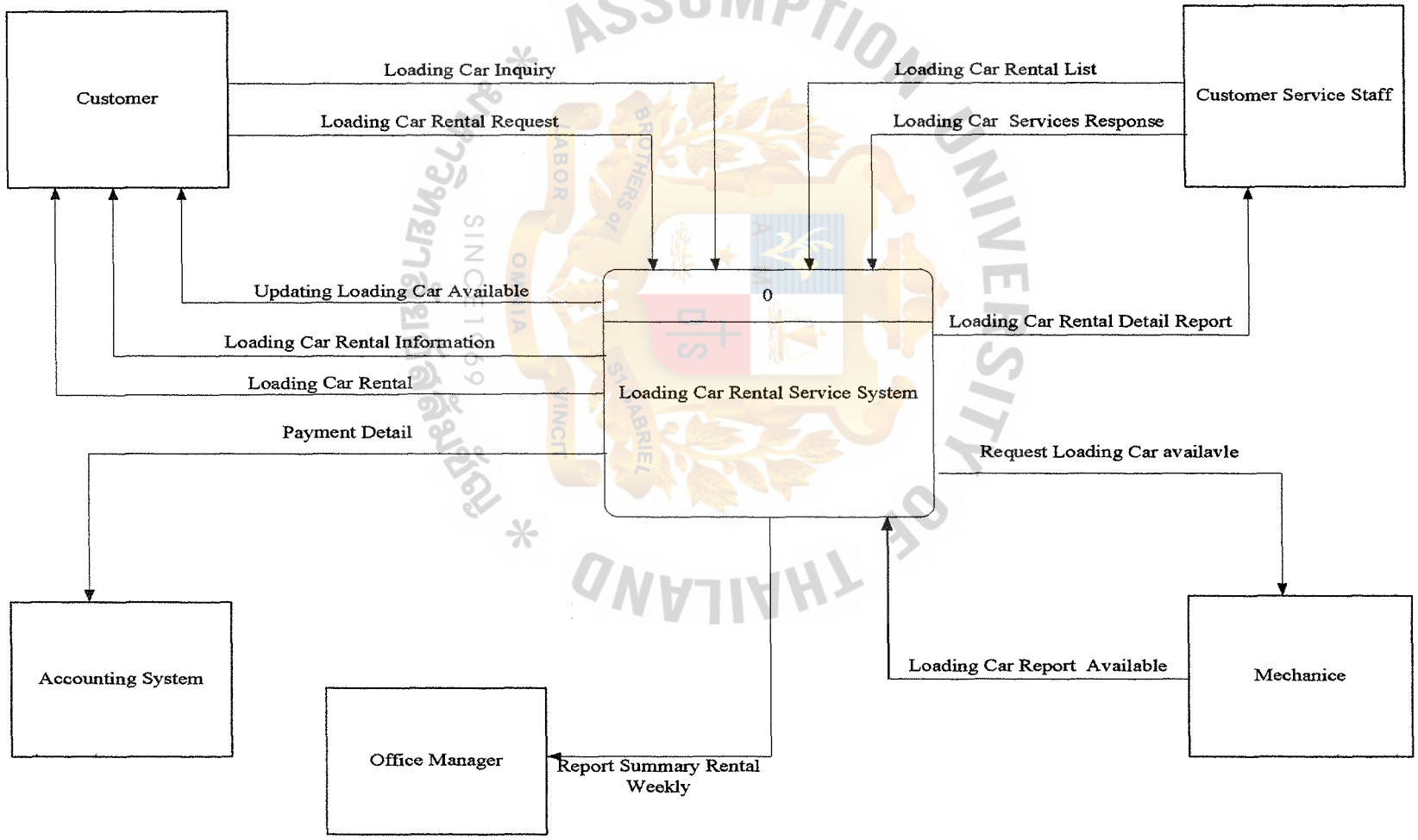

Figure 3.2. Context Level Data Flow Diagram of Loading Car Rental Service Information System.

The Data Flow Diagram of the proposed system will involve the activities below:

(a) Customer

(b) Customer Service Staff

(c) Mechanic

(d) Accounting

(e) Office Management

(f) Depot Department

(g) Marketing

(h) Office Management

There are many processes involved as listed below:.

(a) Select Loading Process

(b) Reservation Loading Car Process

(c) Rental Loading Car Process

(d) Rental Loading Car Reservation

(e) Return Loading Car Process

(f) Cancel Reservation Process

(g) Add new Loading Process

(h) Report Available Loading Car Process

(i) Customer Payment Request

(2) File Design

File proposed system is customer file, rental file, rental charge file and car file. These files are in tables and each table consists of names, column names and primary key. Elements falling into structure would be placed together in a structure record. File specification is shown in Appendix C.

(3) Input Design

The input design is significant to successful processing, file maintenance and output and input design needs. The Loading Car Rental Service System uses interface and directs the inputting of that data to the computer. This input needs intelligent design. The computer program is able to detect and check error. Input screen is graphically appropriate interface, referred to as a graphic user interface (GUI) enabling users for easy completion with facilitated information input design depicted in Appendix A.

(4) Output Design

Output Design is designed simply for clear reading and understanding as it is an adaptation for the system. Output will be printed in sequential order of customers. The output is kept in the main computer and also backup in information in the form of report stored in the Loading Car Rental Report File. The out put is shown in Appendix B.

(5) Interface Design

Interface design is the specification of a conversation between the system users and computer resulting in the input and output responsibilities. Several types of user interfaces are now graphic user interface (GUI) a blending of all interface designs as shown in the Input and Output design.

(6) Data Dictionary Development

Data dictionary is a document that supports data flow diagram. It contains all terms and their definitions both dataflow and data stores related with anticipation of the process that defines separate use of process description. The deliverable data dictionary is to study the existing data

element and add new data element that are necessarily included in the system dictionary as shown in Appendix E.

(7) Process Specification Design

The process specification is created for the primitive processes on the data flow diagram and for high-level process sometimes called child diagram. This process specification is shown in Appendix D.

3.3 Hardware and Software Requirements

For the proposed system, hardware and software specifications are the main support system design in implementing the Loading Car Service system. The cost of computer hardware and software are not too expensive relatively compared to the existing system performance. The high quality hardware and software performance is appropriate for the price and is the best way to reduce cost. The proposed system needs database server and backup server to provide services for client using a high specification in server order for information run and processed on server site. The database has more efficiency to support all business and customer data. Therefore, it needs database management system (DBMS) to manage data extracted and retrieved from different information. The following Tables 3.1 and 3.3 show details of selection of hardware and software.

Table 3.1. Hardware Specification for Database Server.

Hardware	Specification
Processor Type and Speed	INTEL Pentium IV 2.8 GHz
Cache Memory	256 KB or Higher
Primary Memory	512 MB ECC SDRAM or Higher
Hard Drive Capacity	56.6 GB or Higher
CD-ROM Drive (X)	52X or Higher
Floppy Drive	1.44 MB
Network Adapter	Fast Ethernet NIC 10/100 Wake On LAN
Display Adapter	Nvidia M64 Pro 4-APG with 32 MB-VRAM
Display	17" Flat Screen
UPS	UPS 500 VA
HUB	Office connect switches dual speed 8

Table 3.2. Software Specification for Database Server.

Software	Specification
Operating System	Microsoft Windows 2000 Server
Database Server	Microsoft SQL Server 2000
Development Tools	Visible Analyst CASE Tools, MS Visual Basic

For the Intranet Application, the client machines have enough capacity to run office automation software such as word-processing and spreadsheet. Moreover, the client machine Software Program is in-house development for the proposed system. The hardware and software specifications of client machine are shown in Tables 3.3and 3.4 respectively.

Table 3.3. Hardware Specification for Client Machines.

Software	Specification
Processor Type and Speed	INTEL Pentium IV 1.0 GHz
Cache Memory	256 KB or Higher
Primary Memory	128 MB ECC SDRAM or Higher
Hard Drive Capacity	20 GB or Higher
CD-ROM Drive (X)	52X or Higher
Floppy Drive	1.44 MB
Network Adapter	LAN Card D-Link
Display Adapter	Intel i810e with 8 MB VRAM
Display	15"Screen with JBL Speaker
2 Dot Matrix Printer	LQ 800
1 Laser Printer	HP 6L

Table 3.4. Software Specification for Each Client Machine.

Software	Specification
Operation System	Microsoft Windows 2000 Professional
Web Browser	Microsoft Internet Explorer 5.0
Application	Microsoft Office 2000 Professional Edition

In addition, database server and client machine established through the existing network configurations and network peripheral specification of the proposed system is shown in Table 3.5 below.

Table 3.5. Network Peripheral Specification.

Software	Specification
Network Topology	Star Topology
HUB	Office connect switches dual speed 8
Card	Network Interface Card
Interconnection	DataLink 1210/100 Mbps
Wiring and Cable	UTP 4 Pair CAT 5

3.4 Security and Control

A computerized Loading Car Rental Service Information System is an important service available for customer service staff who need to process customer required loading car rental service information. Satisfactory Loading Car Rental Service ability is achieved by accessing the program and also unauthorized access must be prevented from the system. The following security and controls are attained in the proposed system.

(1) Authentication must exist in the Loading Car Rental Service Information System to prevent unauthorized users from accessing the system.

(2) There is a password for login in order to prevent unauthorized users from accessing the system.

(3) User profile is needed for Loading Car Rental Service Information System to classify the group to read, update, and execute the data in the database.

(4) All Loading Car Rental Service and Programs are stored on the second storage to make sure of data correctness and system operation in case of failure.

(5) There must be back up hard disk for the data and program.

(6) Data correction must operate immediately after errors in the data listing report are found.

(7) Input Validation verifies Loading Car Rental Service Information System in each menu screen to protect the errors caused by human error.

(8) Reports must be produced on a predetermined schedule on management requests, and as needed.

(9) Distribution report is controlled to ensure that they are delivered to the proper destination.

(10) Loading Car Rental Data must be inputted, created, updated, and deleted during working hours only.

(11) There is an exact way for destroying any unwanted media used and produced in the system.

3.5 Cost and Benefit Analysis

The proposed system is designed to minimize cost and to maximize benefit in the shortest possible pay back period. Cost and Benefit analysis is a necessary technique to estimate the candidate and to ensure that the selected solution serves the system requirement. The cost analysis of the proposed system is concerned with the cost of the development and operation cost excluding the hardware and software used by client. The benefit analysis is concerned with the tangible and intangible benefits.

The cost and benefit analysis is used to determine whether the project is worth. Investing or not. The approximate inflation rate is 10% through the next 5 years. Straight line method is used in calculating the depreciation. The following are the details of the cost for the new proposed system of the Loading Car Rental Service compared to the existing manual system.

(1) Cost of Existing System

Table 3.6. Existing System Cost Analysis, in Baht.

Cost items	Years				
	1	2	3	4	5
Fixed Cost					
Personal Computer Cost 1 units	9,000.00	9,000.00	9,000.00	9,000.00	9,000.00
Laser Printer 1 unit @ 10,000	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Calculator 7 units @ 500	700.00	700.00	700.00	700.00	700.00
Software Cost	5,000.00	5,000.00	5,000.00	5,000.00	5,000.00
Maintenance Cost	-	5,000.00	5,000.00	5,000.00	5,000.00
Total Fixed Cost	16,700.00	21,700.00	21,700.00	21,700.00	21,700.00
Operating Cost					
Salary Cost:					
Loading Car Rental Service Manager 1 person @ 33,000	33,000.00	36,300.00	39,390.00	43,923.00	48,315..50
Staff :					
Supervisor 2 person @ 18,000	36,000.00	39,600.00	43,560.00	47,916.00	52,707.60
Staff 6 persons @ 13,000	78,000.00	85,800.00	94,380.00	103,818.00	114,199.8
Total Monthly Salary Cost	147,000.00	161,700.00	177,870.00	195,657.00	215,222.70
Total Annual Salary Cost	1,764,000.00	1,940,400.00	2,134,440.00	2,347,884.00	2,582,672.40
Office Supplies & Miscellaneous Cost:					
Stationery 2,000 per month	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Paper 4,200 per month	50,400.00	55,440.00	60,984.00	67,082.40	73,790.60
Miscellaneous 3,800 per month	45,600.00	50,160.00	55,176.00	60,693.60	66,762.90
Total Annual Office Supplies & Miscellaneous Cost	120,000.00	132,000.00	145,200.00	159,720.00	175,692.00
Utility Cost:					
Electricity 38,000 per month	456,000.00	501,600.00	551,760.00	606,936.00	667,629.60
Water 6,000 per month	72,000.00	79,200.00	87,120.00	95,832.00	105,415.20
Telephone 22,000 per month	264,000.00	290,400.00	319,440.00	351,384.00	386,522.40
Total Utility Cost	792,000.00	871,200.00	958,320.00	1,054,152.00	1,159,567.20
Total Operating Cost	2,676,000.00	2,943,600.00	3,237,960.00	3,561,756.00	3,917,931.60
Total Existing System Cost	2,692,700.00	2,965,300.00	3,259,660.00	3,583,456.00	3,939,631.60

Table 3.7. Five Year Accumulated Existing System Cost, in Baht.

Year	Total Manual Cost	Accumulated Cost
1	2,692,700.00	2,692,700.00
2	2,965,300.00	5,658,000.00
3	3,259,660.00	8,917,660.00
4	3,583,456.00	12,501,116.00
5	3,939,631.60	16,440,747.00
Total	16,440,747.00	-

(2) Cost of Proposed System

Table 3.8. Proposed System Cost Analysis, in Baht.

Cost items	Years				
	1	2	3	4	5
Fixed Cost (Development Cost)					
Hardware Cost:					
Computer Server Cost	34,000.00	34,000.00	34,000.00	34,000.00	34,000.00
Personal Computer Cost	28,000.00	28,000.00	28,000.00	28,000.00	28,000.00
Laser Printer 2units @ 20,000	8,000.00	8,000.00	8,000.00	8000.00	8000.00
Dot Matrix Printer 2 units@ 20,000	8,000.00	8,000.00	8,000.00	8,000.00	8,000.00
UPS 1 unit @ 8,000	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00
Total Hardware Cost	79,600.00	79,600.00	79,600.00	79,600.00	79,600.00
Software Cost	48,000.00	50,000.00	50,000.00	50,000.00	50,000.00
Network Cost	12,000.00	12,000.00	12,000.00	12,000.00	12,000.00
System Architecture Cost	300,000.00	-	-	-	-
Training Cost	60,000.00	-	-	-	-
Maintenance Cost	-	39,000.00	42,900.00	47,190.00	51,909.00
Total Fixed Cost	259,600.00	179,600.00	183,600.00	188,000.00	192,840.00
Operating Cost					
Salary Cost:					
Dealership Customer Relationship Manager 1 person @ 33,000	33,000.00	36,300.00	39,930.00	43,923.00	48,315..30
Staff:					
Supervisor 1 person @ 20,000	20,000.00	22,000.00	24,200.00	26,620.00	29,282.00
Staff 3 persons @ 13,000	39,000.00	42,900.00	47,190.00	51,909.00	57,099.60
System Engineer 1 person @ 25,000	24,000.00	26,400.00	29,040.00	31,944.00	35,134.50
Total Monthly Salary Cost	116,000.00	127,600.00	140,360.00	154,396.00	169,835.60
Total Annual Salary Cost	1,392,000.00	1,531,200.00	1,684,320.00	1,852,752.00	2,038,027.20
Office Supplies & Miscellaneous Cost:					
Stationery 1,400 per month	16,800.00	18,480.00	20,328.00	22,360.80	24,596.88
Paper 1,8000 per month	21,600.00	23,760.00	26,136.00	28,749.00	31,624.56
Miscellaneous 2,000 per month	24,000.00	26,400.00	29,040.00	31,944.00	35,138.40
Total Annual Office Supplies & Miscellaneous Cost	62,400.00	68,640.00	75,504.00	83,054.40	91,359.84
Utility Cost:					
Electricity 44,000 per month	528,000.00	580,800.00	638,880.00	702,768.00	773,044.80

Table 3.8. Proposed System Cost Analysis, in Baht (Continued).

Cost items	Years				
	1	2	3	4	5
Water 4,000 per month	48,000.00	52,800.00	58,080.00	63,888.00	70,276.80
Telephone 17,500 per month	210,000.00	231,000.00	254,100.00	279,510.00	307,461.00
Total Utility Cost	786,000.00	864,600.00	951,060.00	1,046,166.00	1,150,782.64
Total Operating Cost	2,240,400.00	2,464,440.00	2,710,884.00	2,981,972.00	3,280,169.64
Total Proposed System Cost	2,741,600.00	2,503,440.00	2,753,784.00	3,033,881.40	3,337,269.64

Table 3.9. Five Year Accumulated Proposed System Cost, in Baht.

Year	Total Computerized Cost	Accumulated Cost
1	2,741,600.00	2,741,600.00
2	2,503,440.00	4,975,040.00
3	2,753,784.00	7,728,824.00
4	3,169,972.40	10,762,705.40
5	3,033,881.64	14,099,974.5
Total	14,099,974.5	-

(3) Cost Comparison and Breakeven Analysis

Table 3.10. Comparison of the System Costs, in Baht.

Year	Accumulated Existing System Cost	Accumulated Proposed System Cost
1	2,692,700.00	2,741,600.00
2	5,658,000.00	4,975,040.00
3	8,917,660.00	7,728,824.00
4	12,501,116.00	10,762,705.40
5	16,440,747.00	14,099,974.5

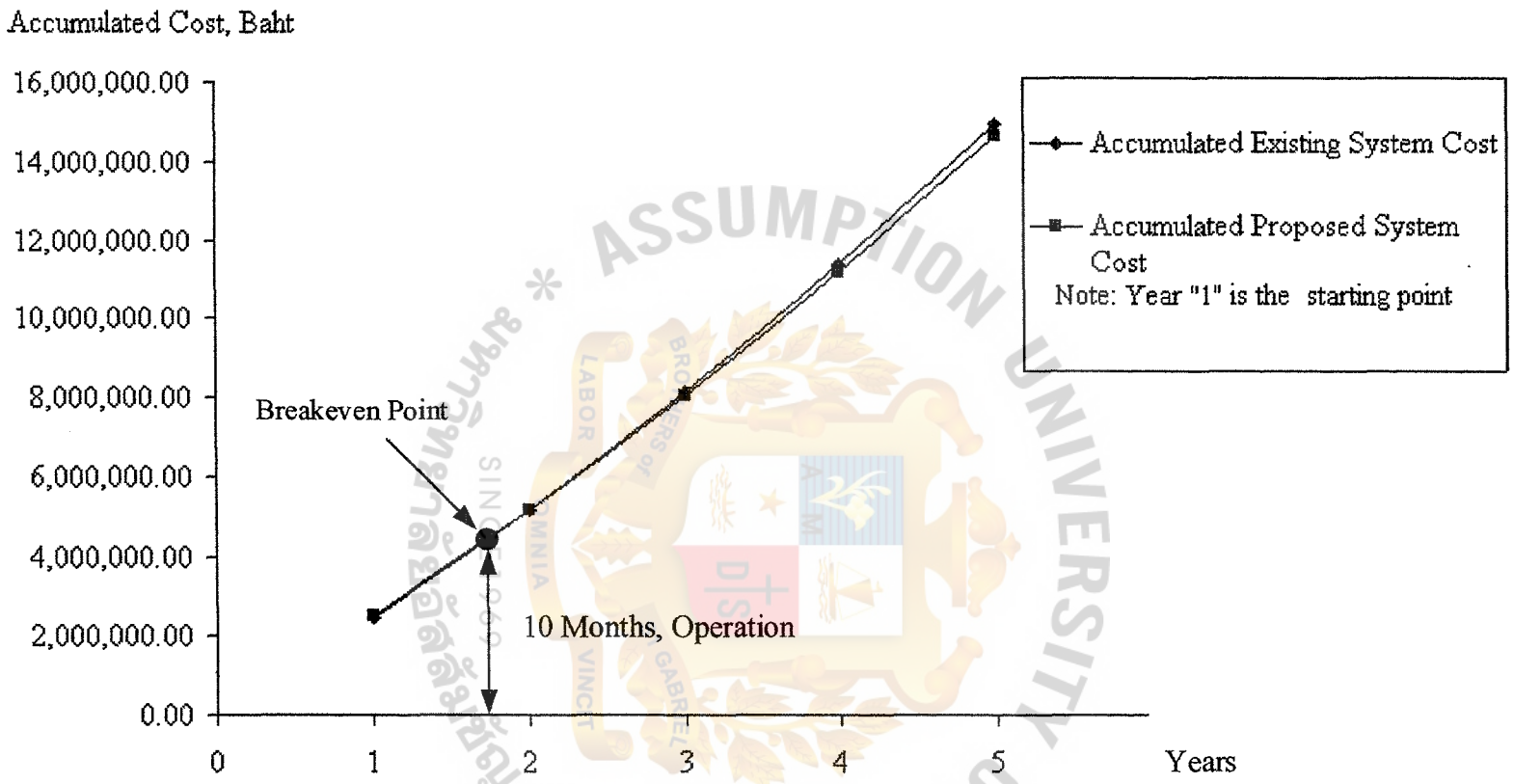

Figure 3.3. Cost Comparison between the Existing and the Proposed Systems

Benefit Analysis

(1) Tangible Benefits

Cost reduction is the major benefit of the proposed system. The resource utilization will operate efficiently. Salary cost, office supplies and miscellaneous cost, and utility cost are saved as shown below:

Benefit for the 1st year = (1,764,000.00 - 1,392,000.00) + (120,000.00 - 62,400.00) + (792,000.00 – 786,000.00)

= 435,000.00 Baht/year

Benefit for the 2nd year = (1,940,400.00 - 1,531,200.00) + (132,000.00 - 68,640.00) + (871,200.00 – 864,600.00)

= 479,160.00 Baht/year

Benefit for the 3rd year = (2,134,440.00 - 1,684,320.00) + (145,200.00 - 75,504.00) + (958,320.00 – 951,060.00)

= 527,076.00 Baht/year

Benefit for the 4th year = (2,347,884.00 - 1,852,752.00) + (159,720.00 - 83,054.40) + (1,054,152.00 – 1,046,166.00)

= 579,783.60 Baht/year

Benefit for the 5th year = (2,582,672.40 - 2,038,027.20) + (175,692.00 - 91,359.84) + (1,159,567.20 – 1,150,782.60)

= 637,761.96 Baht/year

(2) Intangible Benefits

(a) Provide more accurate data information than the existing system.

(b) Increase efficiency and accuracy in work process because it is designed to be easier.

(c) Reduce work process time and improve efficiency of all operations.

(d) Reduce human errors in workforce and documentation.

(e) Provide accelerated work and efficient service to customers.

(f) Provide up-to-date information and reports to support the management section for decision making, including flexibility in providing ad-hoc reports.

(g) Make the system user friendly in searching information and make it faster to search the required information.

(h) Make it easier to produce report summaries.

Payback Analysis

The calculation for payback analysis is shown in Table 3.10.

(2) Intangible Benefit

(a) Provide more accurate data information than the existing system.

(b) Increase efficiency and accuracy in work process because it is designed to be easier.

(c) Reduce work process time and improve efficiency of all operations.

(d) Reduce human errors in workforce and documentation.

(e) Provide accelerated work and efficient service to customers.

(f) Provide up-to-date information and reports to support the management section for decision making, including flexibility in providing ad-hoc reports.

(g) Make the system user friendly in searching information and make it faster to search the required information.

(h) Make it easier to produce report summaries.

Payback Analysis

The calculation for payback analysis is shown in Table 3.10.

Table 3.11. Payback Analysis for the Proposed System, in Baht.

Cost items	Years					
	0	1	2	3	4	5
Depreciation cost	-818,000.00	--	-	-	-	-
Operation & Maintenance cost	-	-39,000.00	-42,900.00	-47,190.00	-51,909.00	-57,099.00
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621
Time – adjusted costs (adjusted to present value)	-818,000.00	-35,451.00	-35,345.00	-35,439.69	-35,453.00	-35,458.00
Cumulative time-adjusted costs over lifetime	-818,000.00	-853,451.00	-888,886.40	-924,326.00	-959,779.00	-995,238.30
Benefit derived from operation of new system	-	435,000.00	479,160.00	527,076.00	579,783.60	637,761.96
Discount factor for 10%	1.000	0.909	0.826	0.751	0.683	0.621
Time – adjusted costs (adjusted to present value)	-	395,415.00	395,786.00	395,834.00	395,992	396,050
Cumulative time-adjusted benefits over lifetime	-	395,415.00	791,201.00	1,187,035	1,583,027	1,979,078
Cumulative lifetime time-adjusted cost + benefit	-818,000.00	-458,036.00	-97,685.40	262,709.00	623,247.30	983,839.80

The payback period can be calculated by the formula as follows:

$$P = \text{Last year of negative cash flow difference} + \frac{\text{Cumulative Difference of last negative year}}{\text{Absolute value of cumulative difference (last negative plus first positive year)}}$$

Where P = Payback Period

$$P = 2 + \frac{97{,}675.4}{(97{,}675.4+262{,}709)}$$

$$= 2.22 \text{ years or } 2 \text{ years } 3 \text{ months}$$

Therefore, the payback period is about 2 years 3 months.

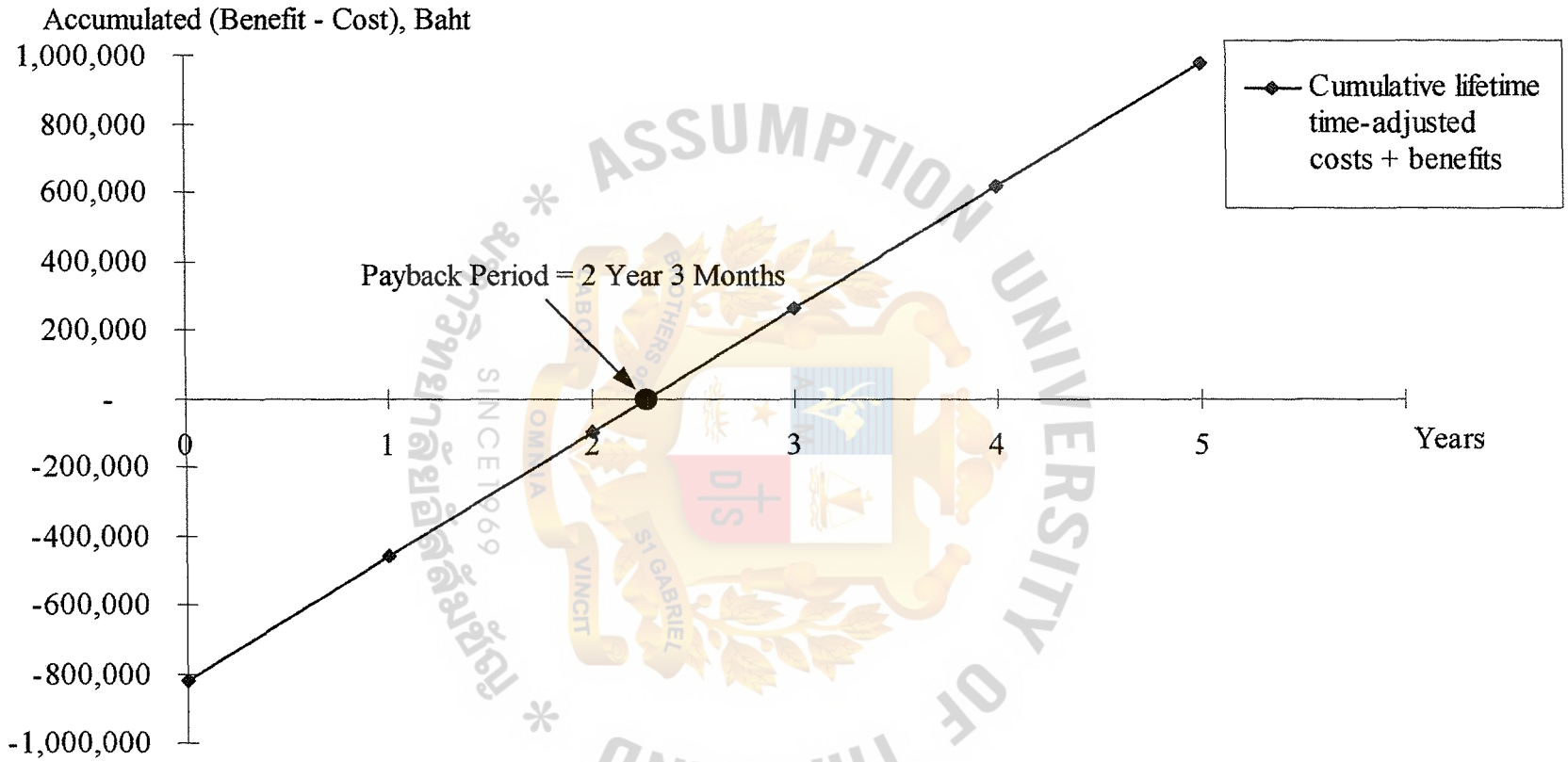

Figure 3.4. Payback Chart for the Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

The analysis and design of the proposed system as applied in this system is implemented to replace the existing operation. The initial processes are presented in brief details as follows:

(1) Hardware and Software Acquisition and Installation

The existing hardware and software resources utilize additional maintenance cost and license fee except for database server newly purchased and installed in the proposed system.

(2) Personnel Training

Training is provided to the end-user and system administrator. The purpose of the training is for a particular understanding of the new system relevant to end-users operation and system administrator. User training describes how to use the proposed system in the particular workplace and user uses basic configurations to control operations. System administration is based on technical aspects of the proposed system configuration.

(3) Site and Data Preparation

Information Technology is responsible for preparing new system network cabling with other facilities set up before the new system is implemented. In Loading Car Rental Service, it is the system owner who prepares the data to input into the computerized system.

(4) System Testing

Testing was conducted to make sure the proposed system works properly for the new system with satisfactory performance, before the system is converted from the existing system.

(5) Conversion Plan

The conversion plan is prepared as a development team guideline for converting the existing into the proposed system. The task is clearly identified in the new function.

4.2 Test Plan

System testing plan is a critical process for testing of programs, sub systems, and the entire system that is essential to the quality assurance of software and to find out if there are any problems before the system is used. The significant development understands the testing process of executing a program with the explicit intention of finding the error if the program fails. The successful test finds out error in the program.

The following tests are recommended:

(1) The testing program is a stand-alone program that fixes the bug without error effects.

(2) System testing is an entire application, in which modified program is a part.

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

(4) Security and recovery testing is secure enough to prevent unauthorized users and access failure is on database that system recovers the data.

The effective testing program does not guarantee all systems reliability. System reliability is designed in the proposed system. The test is one condition to be tested in the new system. The test case should include the following:

(1) Input Validation.

(2) Functionality

  (a) Input

  (b) Process

  (c) Output

(3) Access Control

The tester created cases as the test script in the program. Test script is the data test to be keyed in to the new system according to the test case condition. The data that is written in the test script are created with the express intention of determining whether the system will process them correctly. Each module will be tested separately with the test case. After having finished testing all the modules, a new test case will be prepared for the testing of the whole program. If any errors are found at this stage, all of them have to be fixed until no error is found after performing the final test by using another test case.

4.3 Conversion

Data conversion is implemented for the new system. The developer makes sure that data conversions from the existing to the new system are properly complete and correctly done. The developer will check correctness and completeness of the system by using parallel run working on both the existing and the new proposed system. The entire data and output from calculation of both systems are the same with the existing system and then provide additional requirements are provided. The system developer will provide the data conversion only on the first time of implementing the new system. So

the testing of data conversion occurs only on the first time of implementing a new system. After the system developer assures the completeness and correctness of data conversion, they give the new system to the users to test the new system.

V. CONCLUSIONS AND RECOMMENDATOINS

5.1 Conclusions

The new computerized system of Loading Car Rental service is developed to analyze, design and implement for facilitating the routine operational employees, and eliminate complexity of passing all documents and report in providing customers service for improving the transaction process. In part, the existing manual system makes the company face many problems in handling of excessive transaction paper, tracing of previous record and information for customers collection and incurring cost of communication.

The proposed system is designed to support the user's requirement and management in providing Loading Car rental service to the customers, by which assistant staff can do their routine job effectively. Furthermore, the computerized system uses only two employees to operate the entire system. The proposed system satisfies several parties. The system owner uses computer information system to organize the budget for this system.

Table 5.1 shows the time spent on each process of the Existing System compared to the Proposed System. It shows that each process of the Proposed System uses less time to operate, explaining that the Proposed System is more efficient and effective than the Existing System.

Table 5.1. Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System
Enquiry Process	15 Minutes	2 Minutes
Rental Process	15 Minutes	5 Minutes
Reservation Process	15 Minutes	5 Minutes
Payment Process	15 Minutes	2 Minutes
Report Generation Process	1 hour	5 Minutes

The details of this operation time improvement can be summarized as follows:

(1) Enquiry Process

At present, rental service staff takes about 15 minutes to respond to each incoming inquiry. But the proposed system will decrease the response time to only 2 minutes as required records are searched electronically with faster access.

(2) Rental Process

The proposed system can reduce rental data entry by 15 minutes with the aid of graphical user interface. It is easier for entering data with correctness and accuracy of data. Proposed system can reduce operating time to only 5 minutes, because the data are verified and updated automatically.

(3) Reservation Process

This process takes a long time to search rental record to be canceled and change the reservation status with up to date information on availability of rental reservation. Proposed system can reduce operating time to only 5 minutes, because the data are verified and updated automatically.

(4) Payment Process

This process is also a time-consuming task to accomplish in the existing system. Time is taken to search the rental charges information and calculate the payment for issuing receipts to customer with total amount paid, due date, amount due, etc. The proposed system will provide the calculation function to facilitate this process.

(5) Report Generation Process

The existing system uses Excel to generate the reports by searching, reformatting data and printing reports for distribution to all relevant units. It takes about one hour to produce reports. The proposed system will automate the process and reduce the processing time to only 5 minutes.

5.2 Recommendations

The new computerized system is designed to meet user requirements of the owner and administrative staff of the Loading Car Rental Service. The management team runs an important role in developing the new system. Users are involved in participating all in activities of the proposed system. Feedback from users will require valuable information for the evaluation of the new system after implementation. The evaluation should be conducted three months after implementation. The new proposed system

tends to use easy program for users and operation is designed to be Client/Server architecture used to interact with outside the company. The proposed system is tested with the feedbacks received from the users before it is launched for the real use.

The new system would be implemented using parallel conversion method to ensure the system works correctly and efficiently. After the system proves itself to be capable of replacing the existing system, using the existing system can be terminated. User training sessions should be held during the first stage of the new system operations to see whether they perform the procedures efficiently by using improved aspects of the system. System administrators must also study the proposed system in order to troubleshoot the difficulties that may occur with the proposed system. In the future, the system will be integrated with accounting system and management information system. When three systems work together, the front office will make a big step of improvement in its efficiency.

In addition, the developed system may be expanded to support EDI (Electronic Data Interchange) or XML Web Method for Loading Car Rental Service in the future. EDI is the direct computer-to-computer exchange between two organizations of standard business transaction documents. EDI lowers transaction costs automatically transmitted from one information system to another through a telecommunications network, eliminating the printing and handling of paper at one end and the inputting of data at the other. Loading Car Rental Service can fully benefit from EDI when they integrate the data supplied by EDI with other applications in respect to EAI (Enterprise Application Integration).

APPENDIX A

SCREEN DESIGN

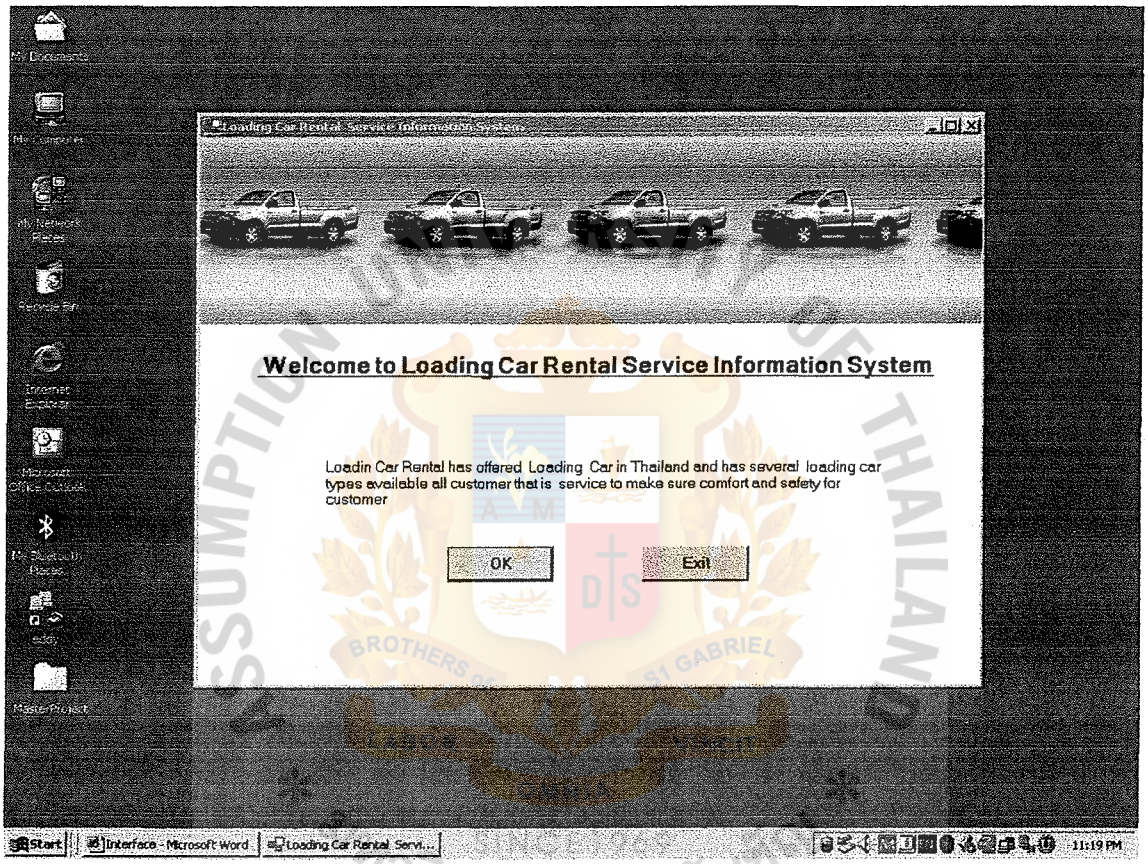

Figure A.1. Access to the System Form.

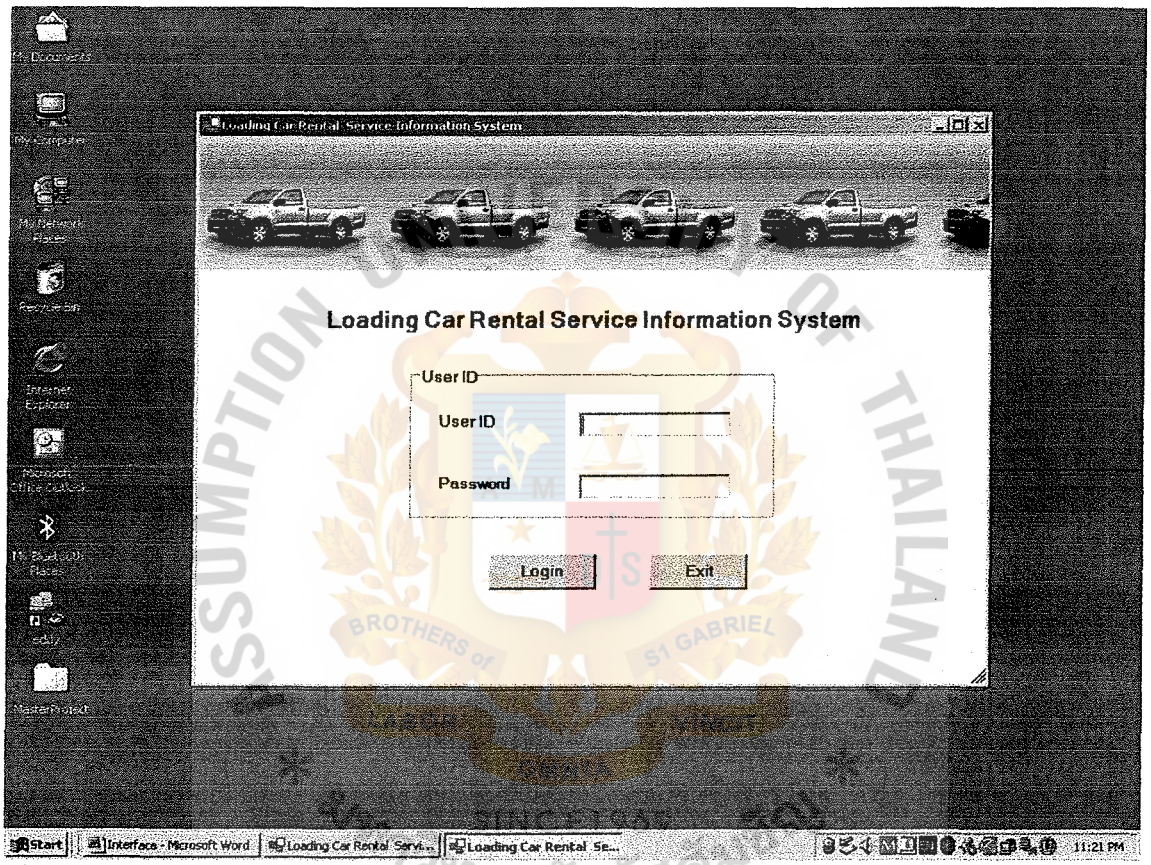

Figure A.2. Login to the System Form.

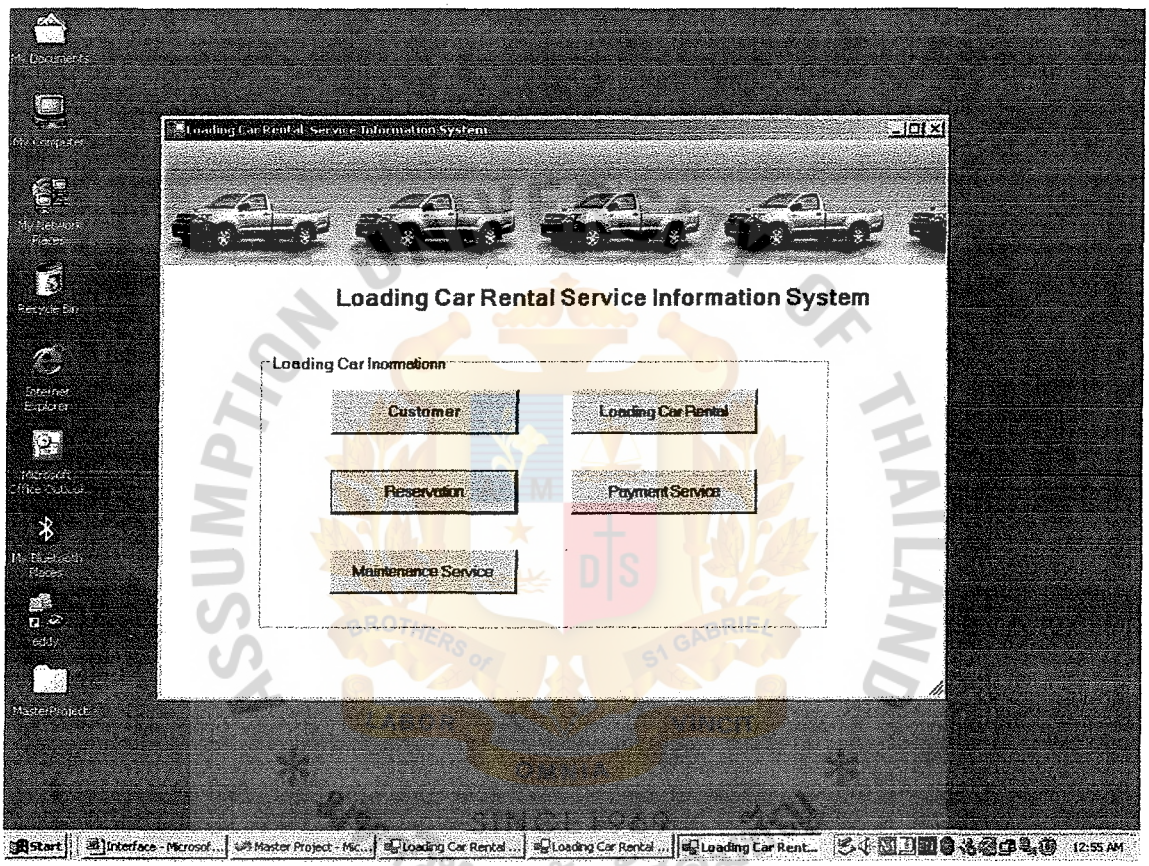

Figure A.3. Main Menu for Loading Car Rental Service System Form.

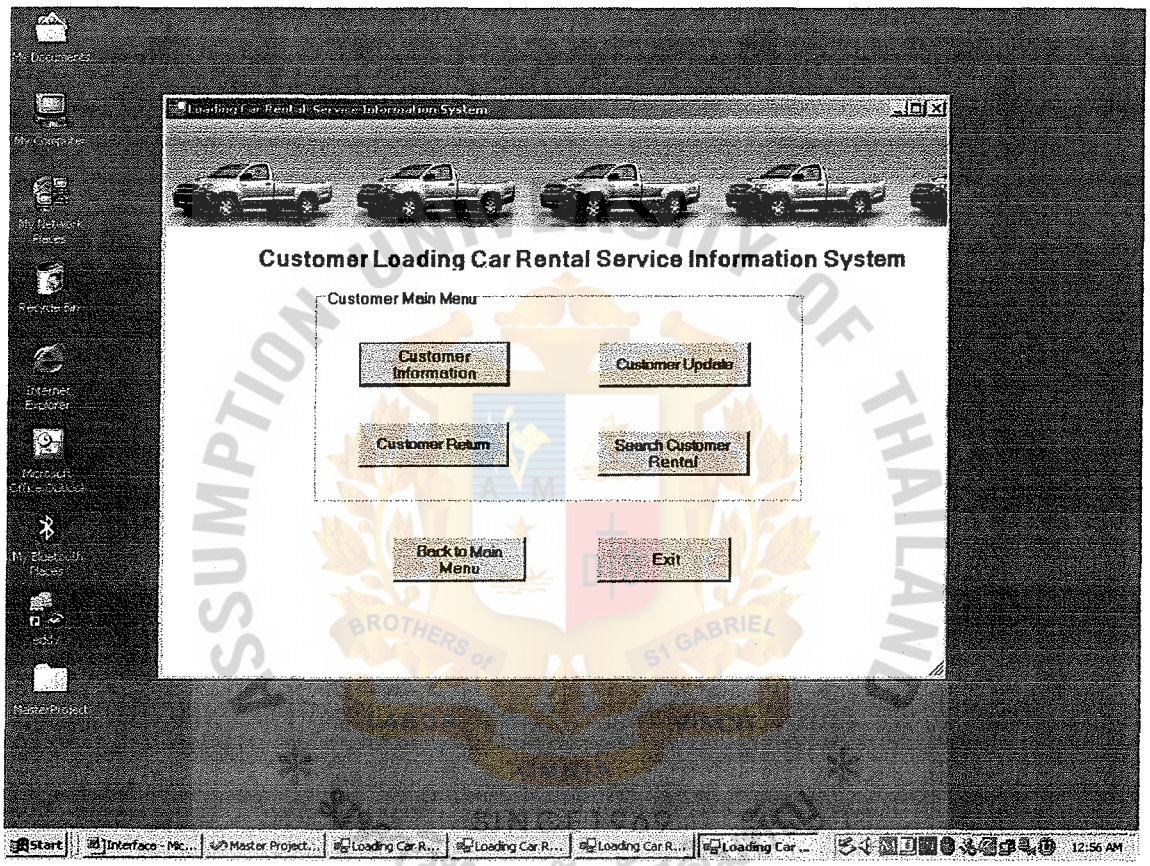

Figure A.4. Main Menu for Customer Information System Form.

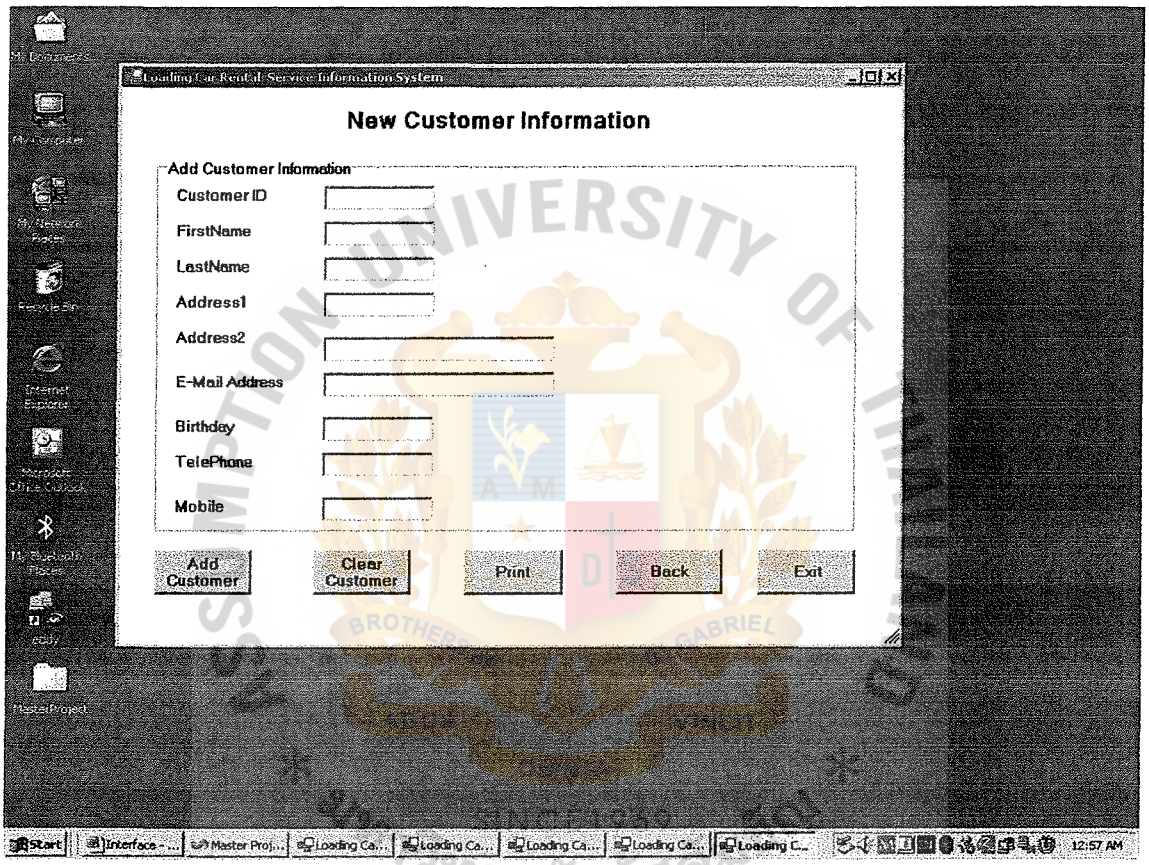

Figure A.5. New Customer Information Form.

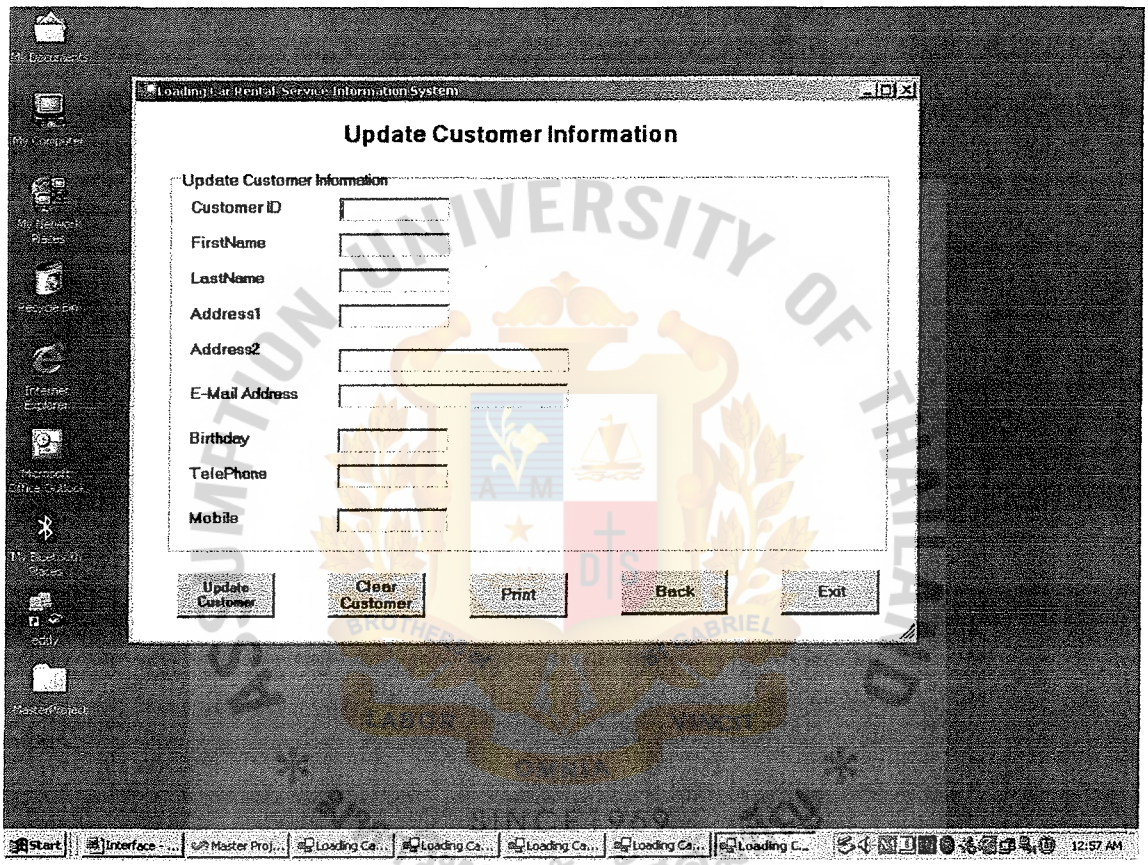

Figure A.6. Update Customer Information Form.

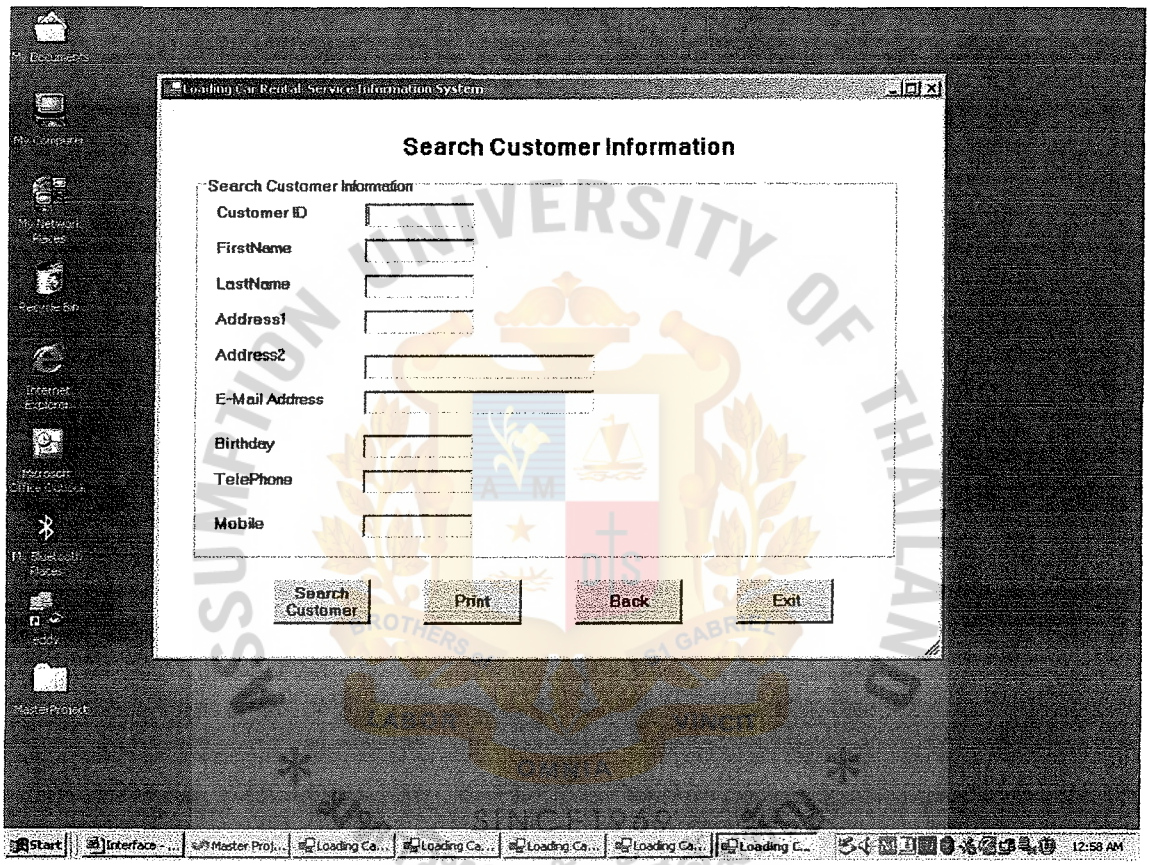

Figure A.7. Search Customer Information Form.

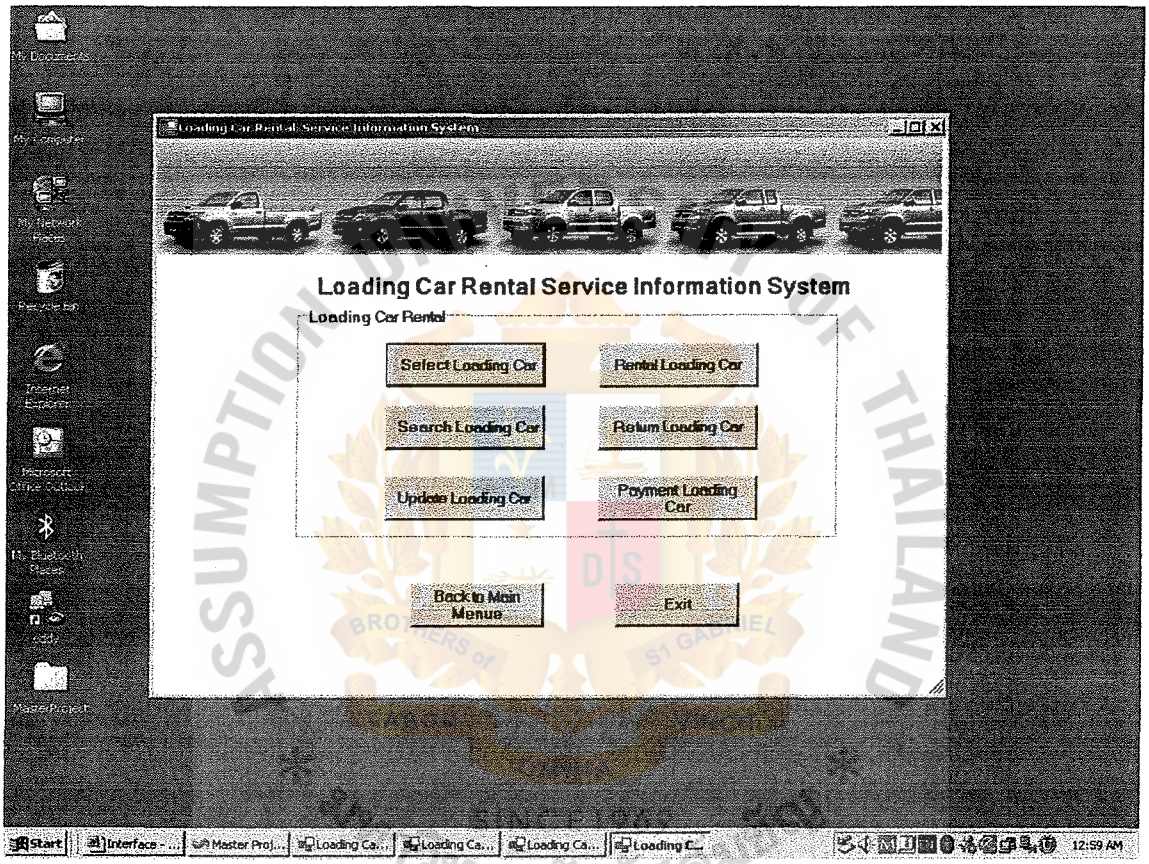

Figure A.8. Main Menu for Loading Car Rental Service Information Form.

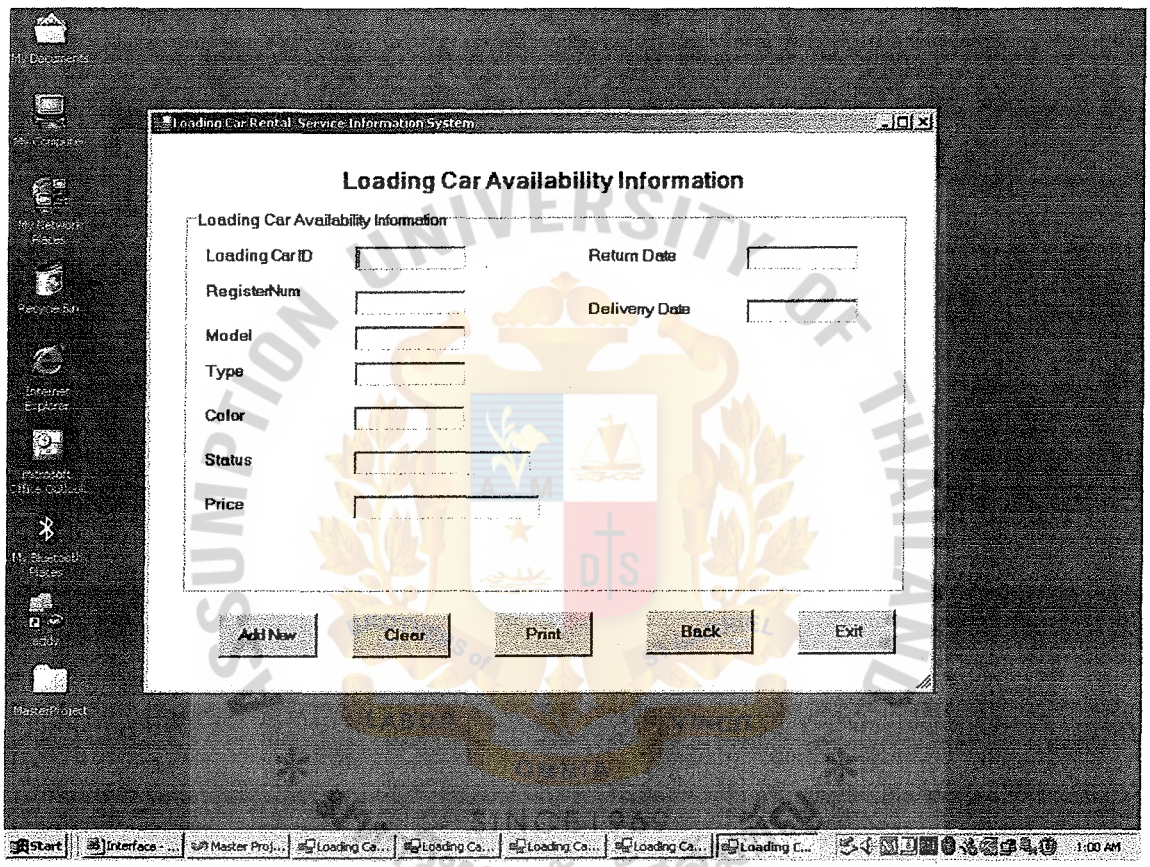

Figure A.9. Loading Car Availability Information Form.

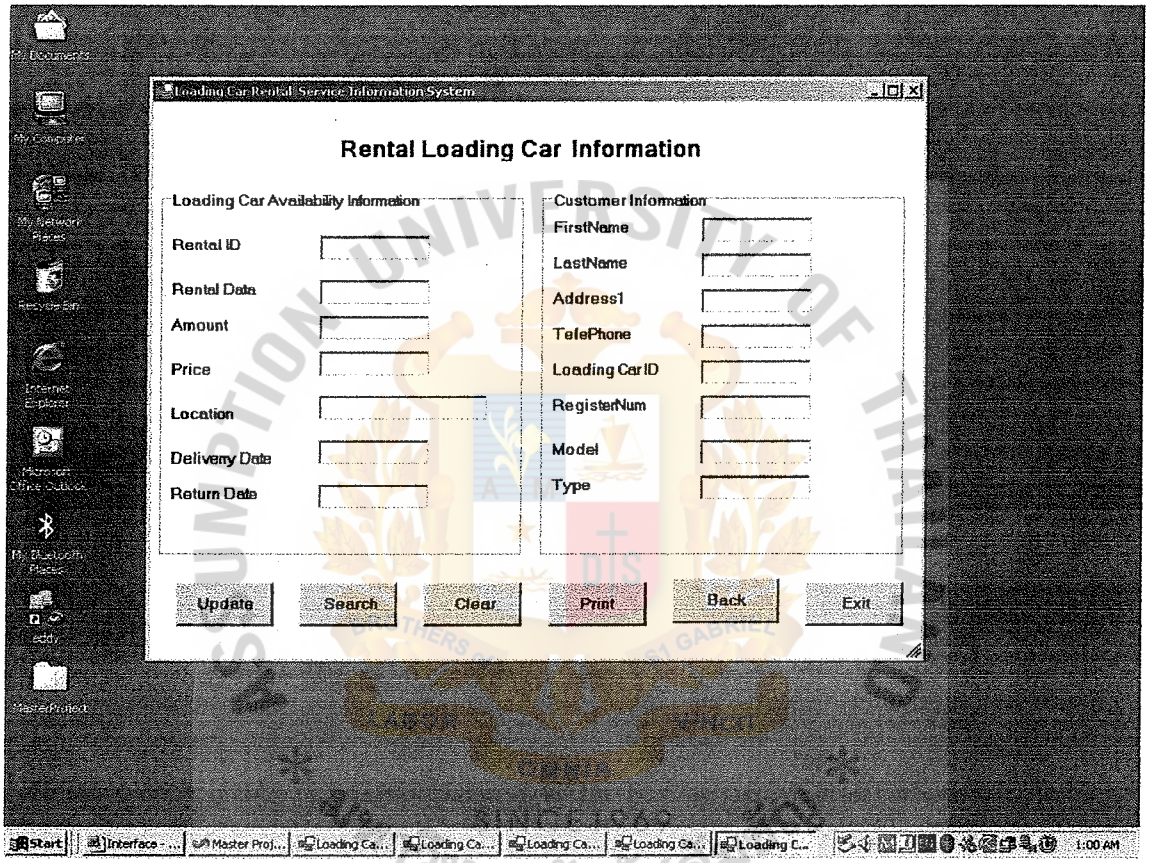

Figure A.10. Rental Loading Car Information Form.

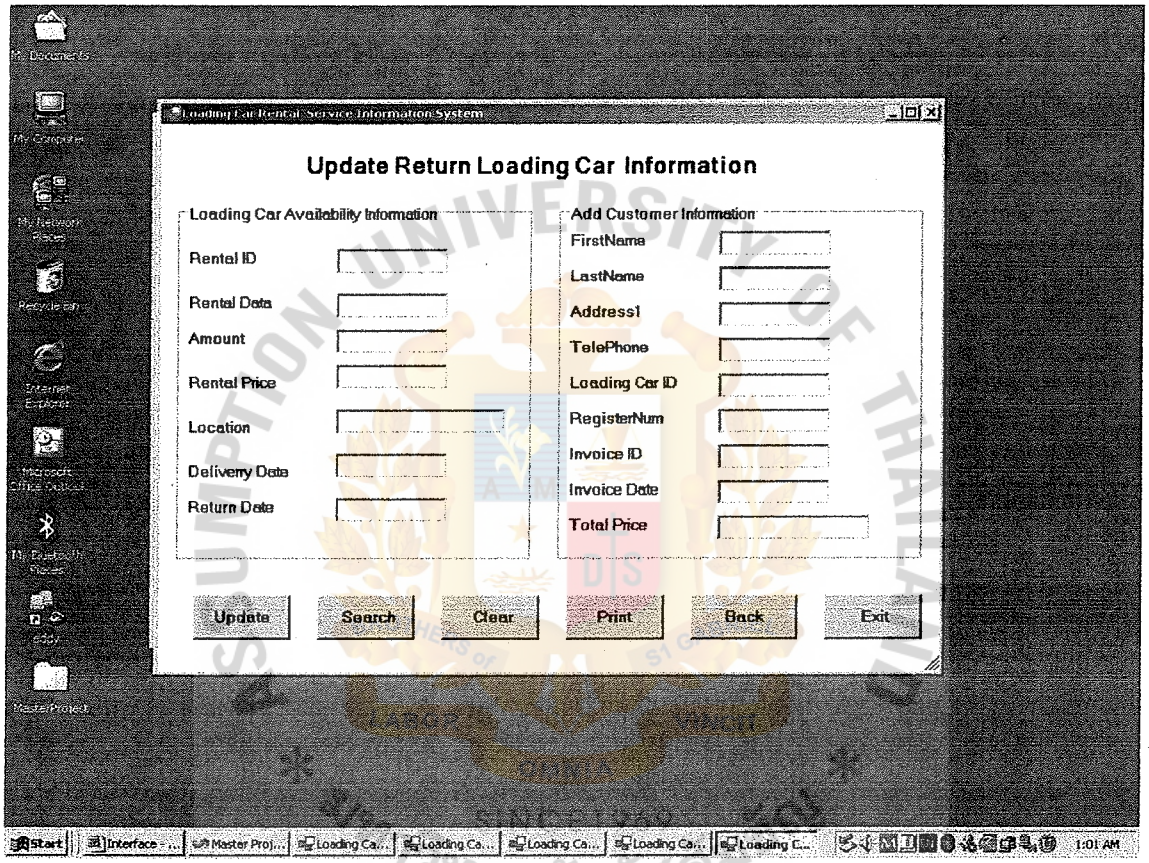

Figure A.11. Update Return Loading Car Information Form.

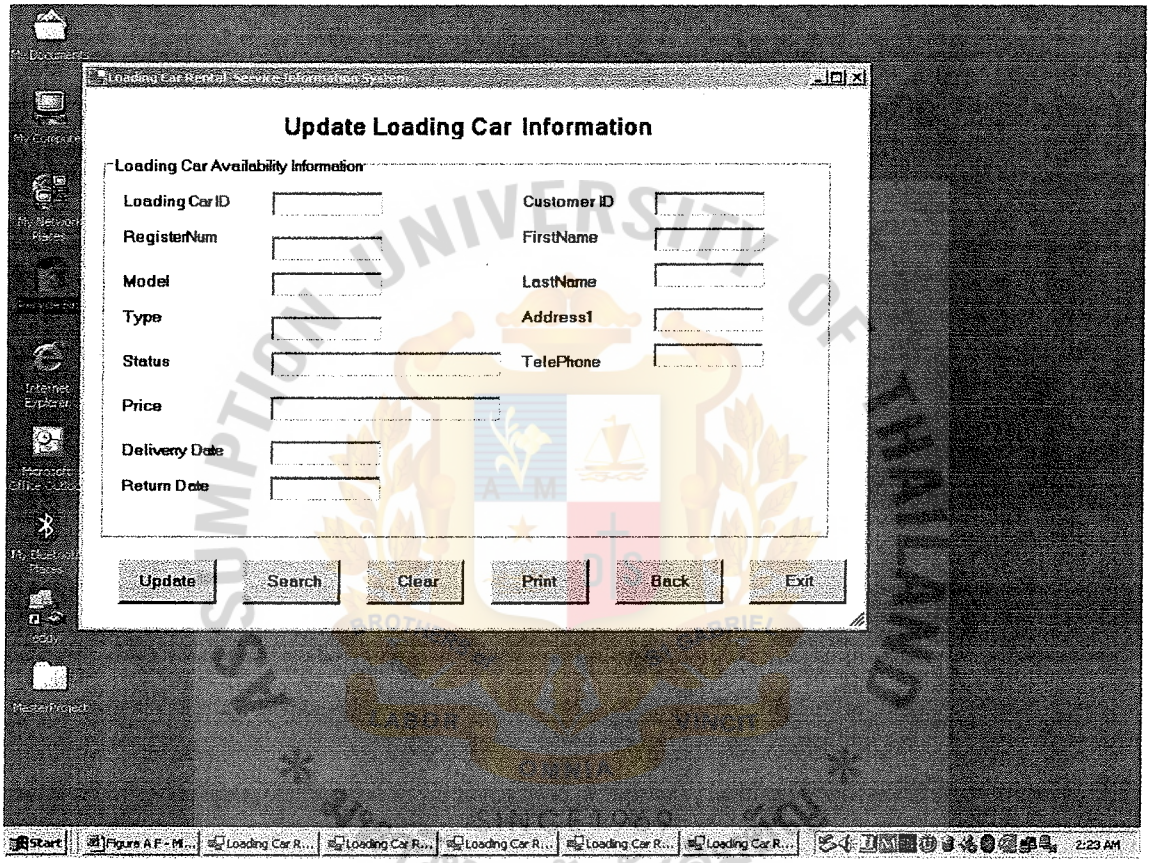

Figure A.12. Update Loading Car Information Form.

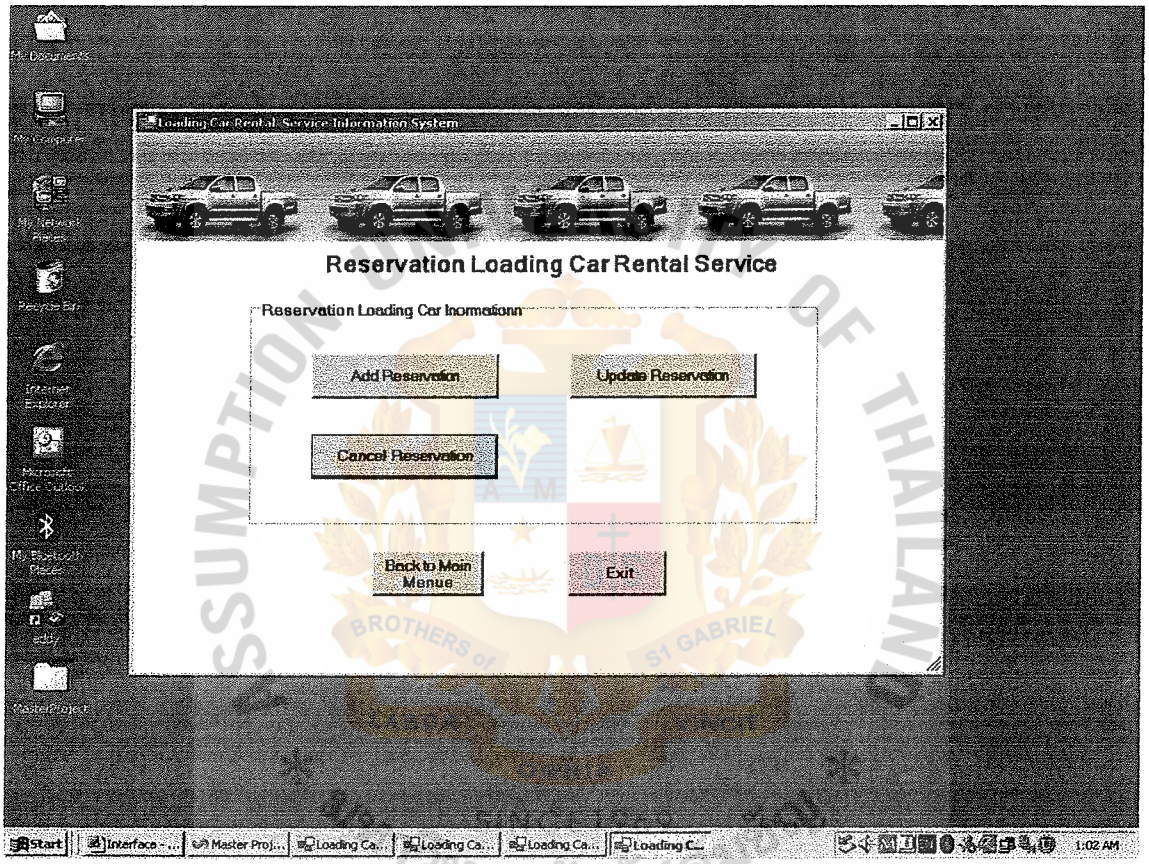

Figure A.13. Main Menu for Reservation Loading Car Rental Service Form.

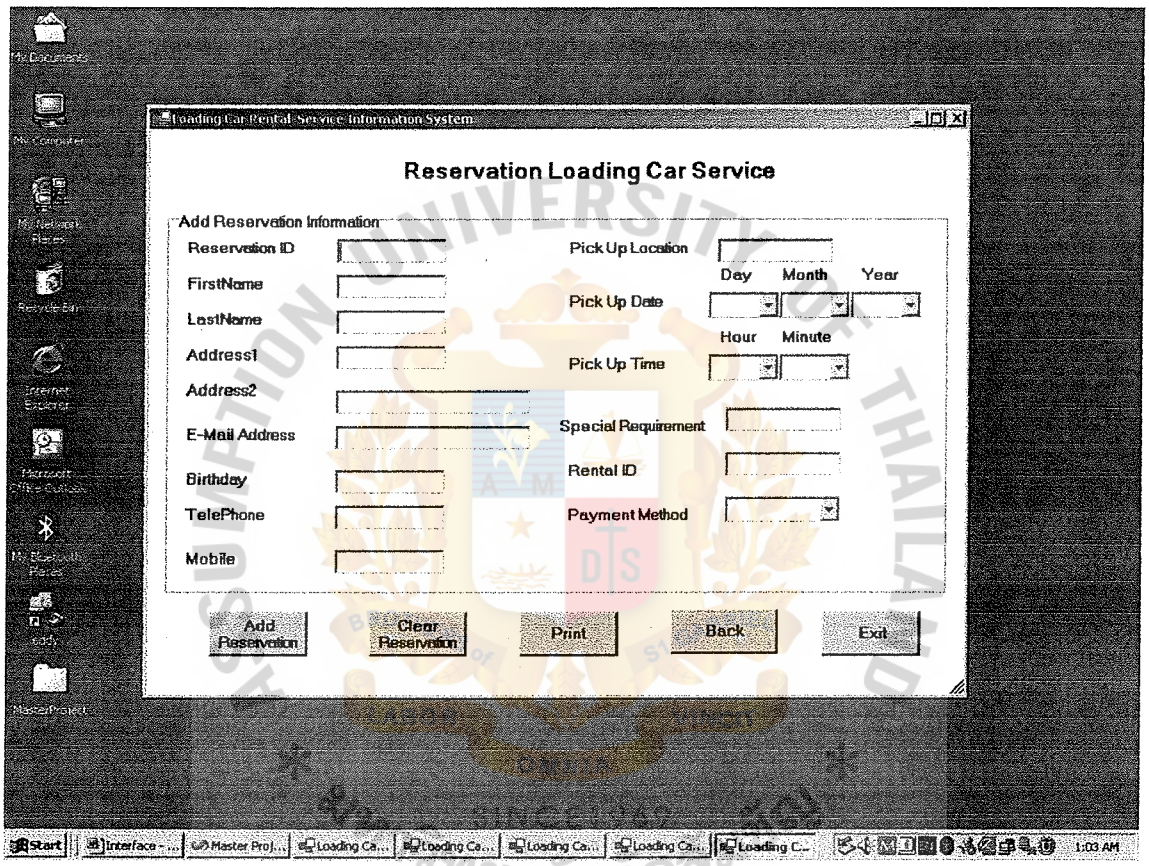

Figure A.14. Reservation Loading Car Service Form.

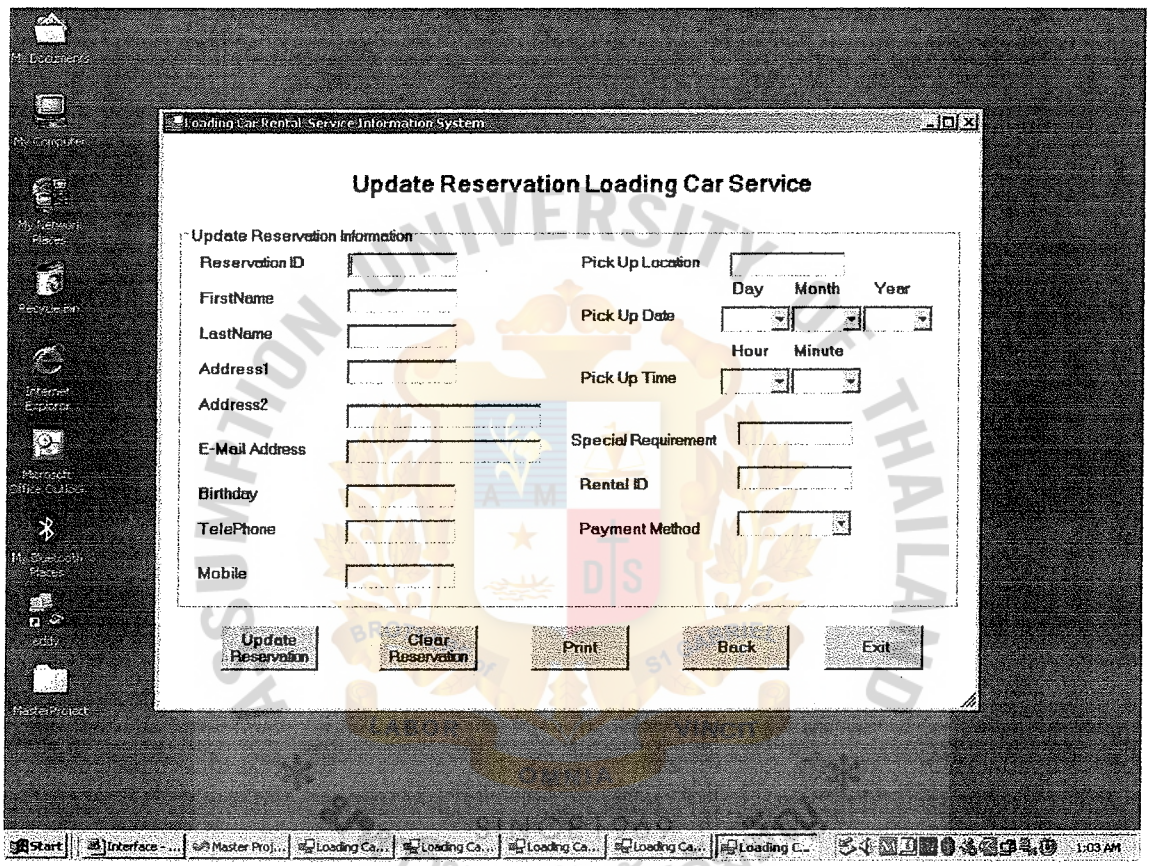

Figure A.15. Update Reservation Loading Car Service Form.

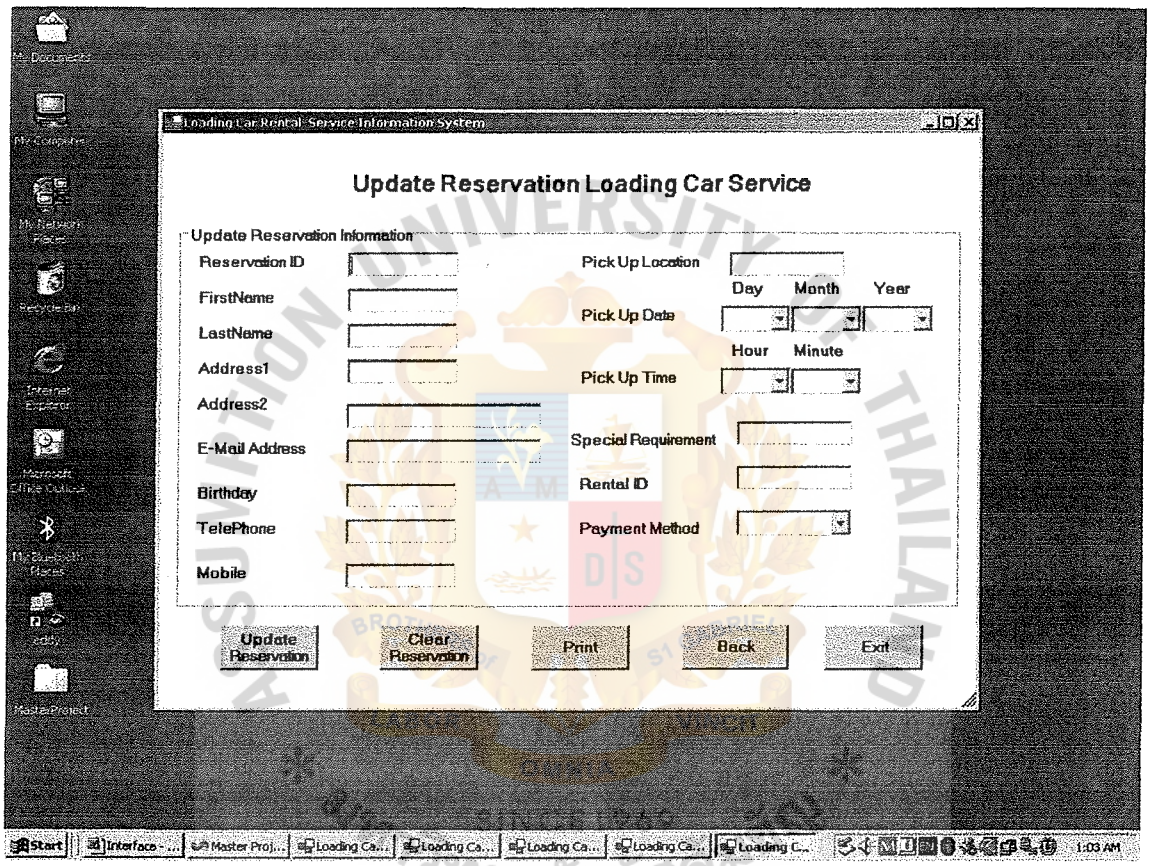

Figure A.16. Update Reservation Loading Car Service Form.

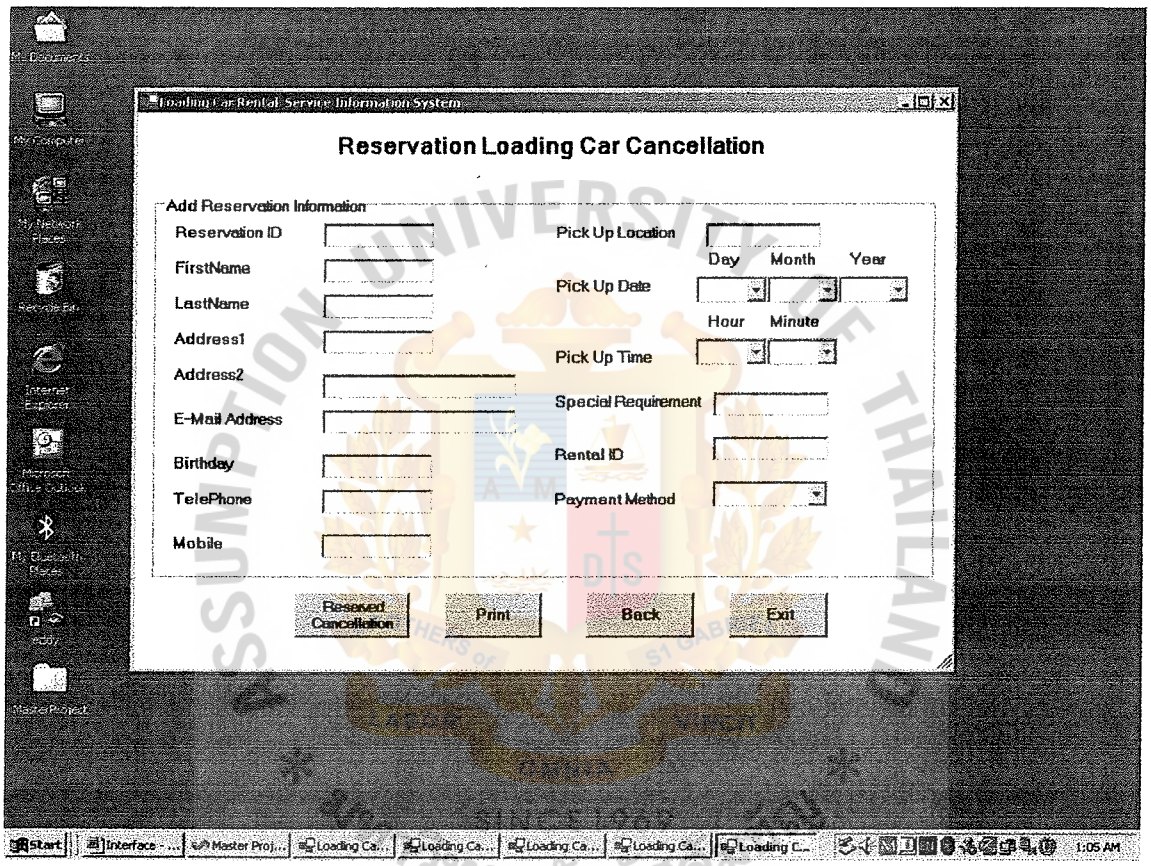

Figure A.17. Reservation Loading Car Cancellation Form.

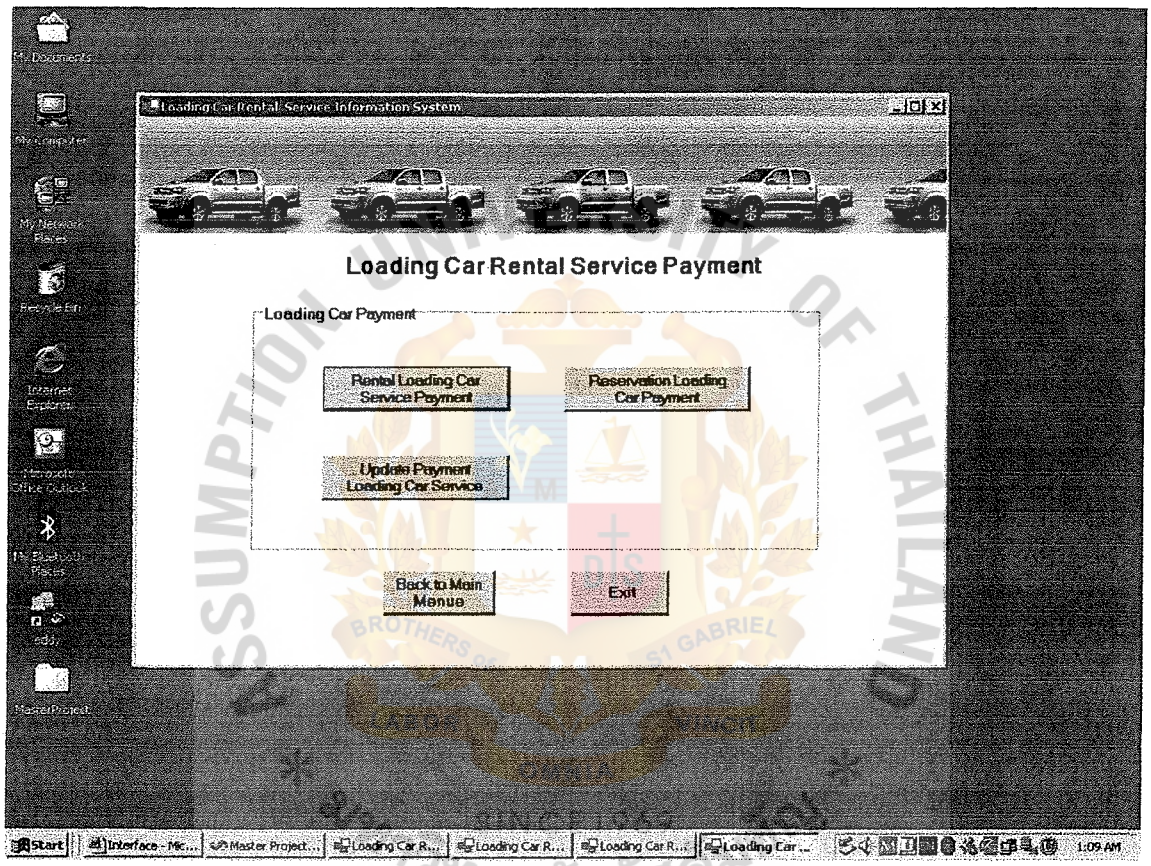

Figure A.18. Main Menu for Loading Car Rental Service Payment Form.

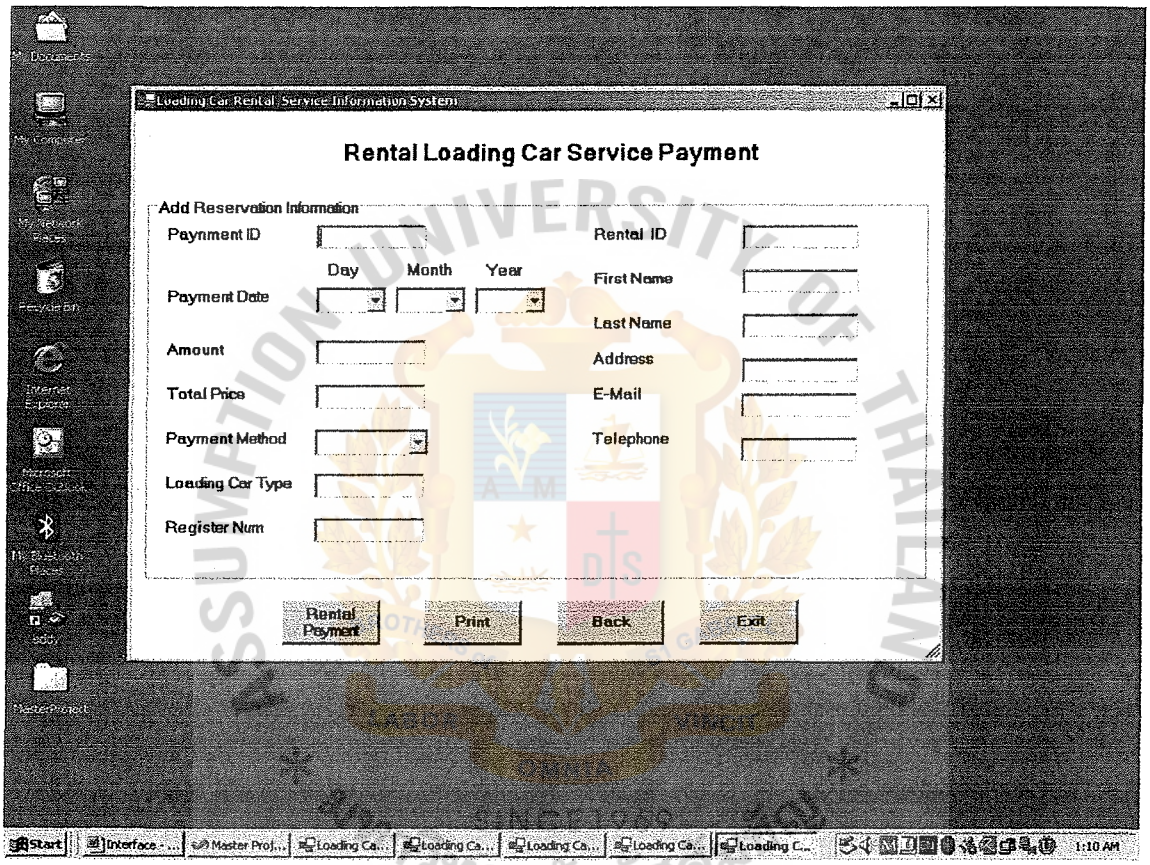

Figure A.19. Loading Car Rental Service Payment Form.

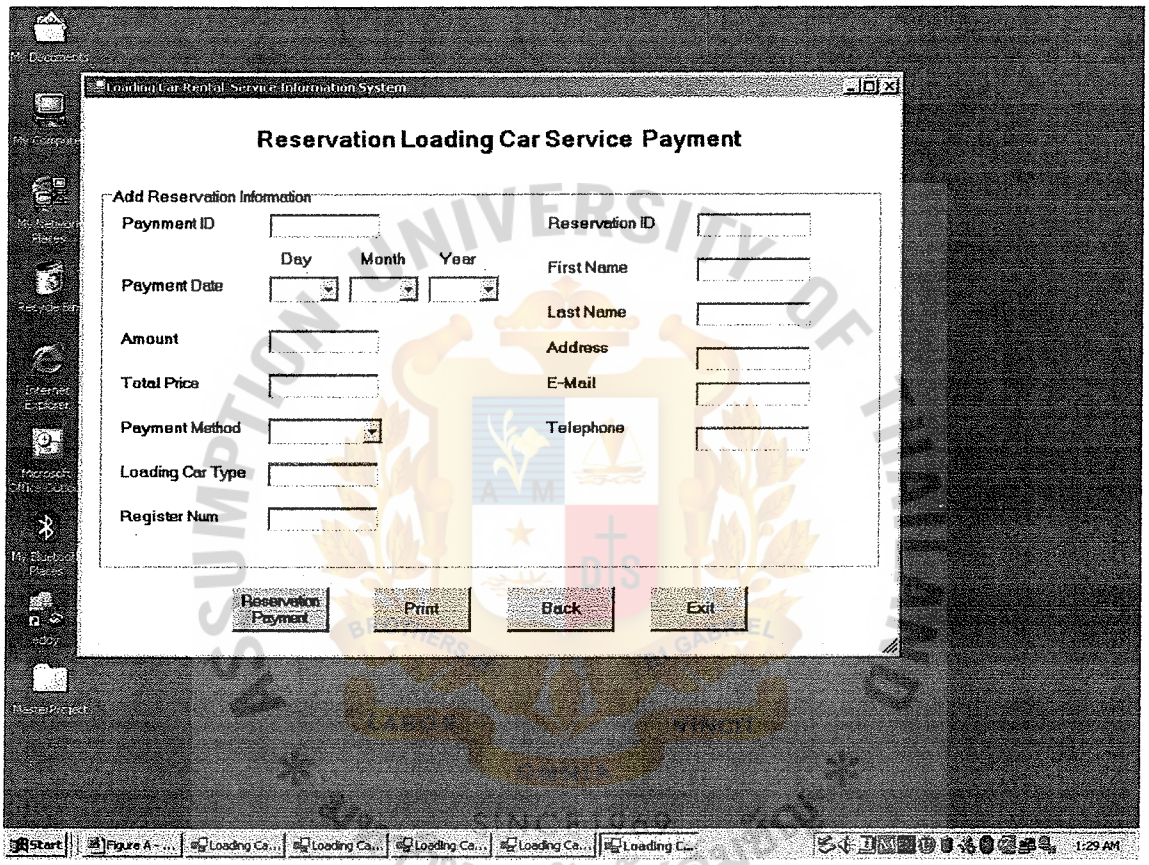

Figure A.20 Reservation Loading Car Service Payment Form.

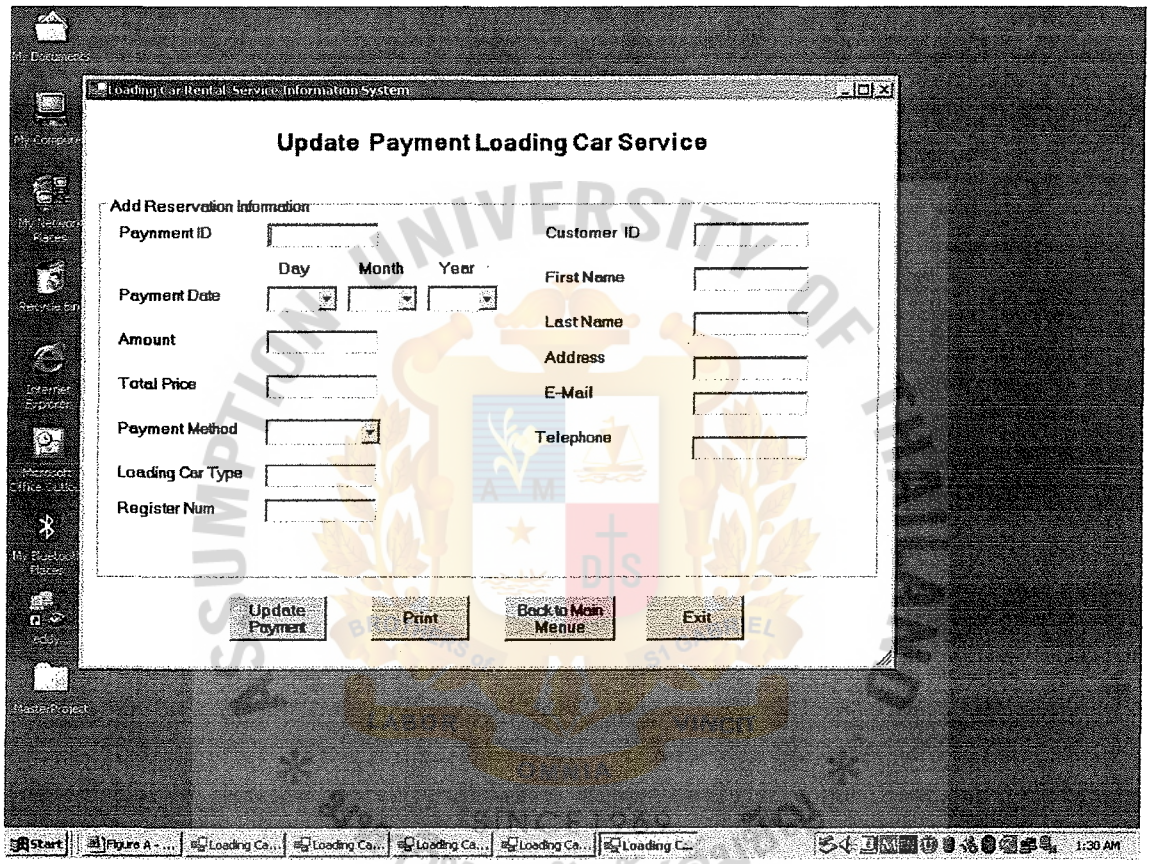

Figure A.21. Update Payment Loading Car Service Form.

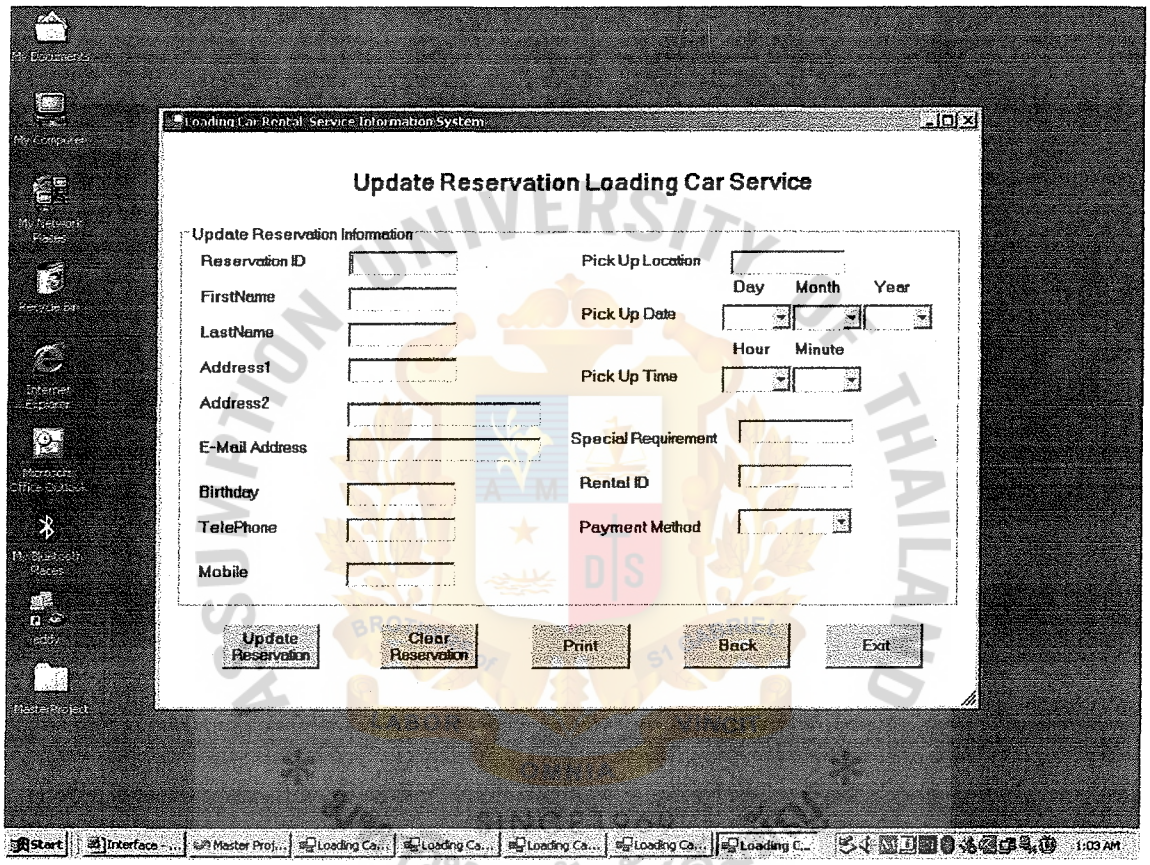

Figure A.22. Update Reservation Loading Car Service Form.

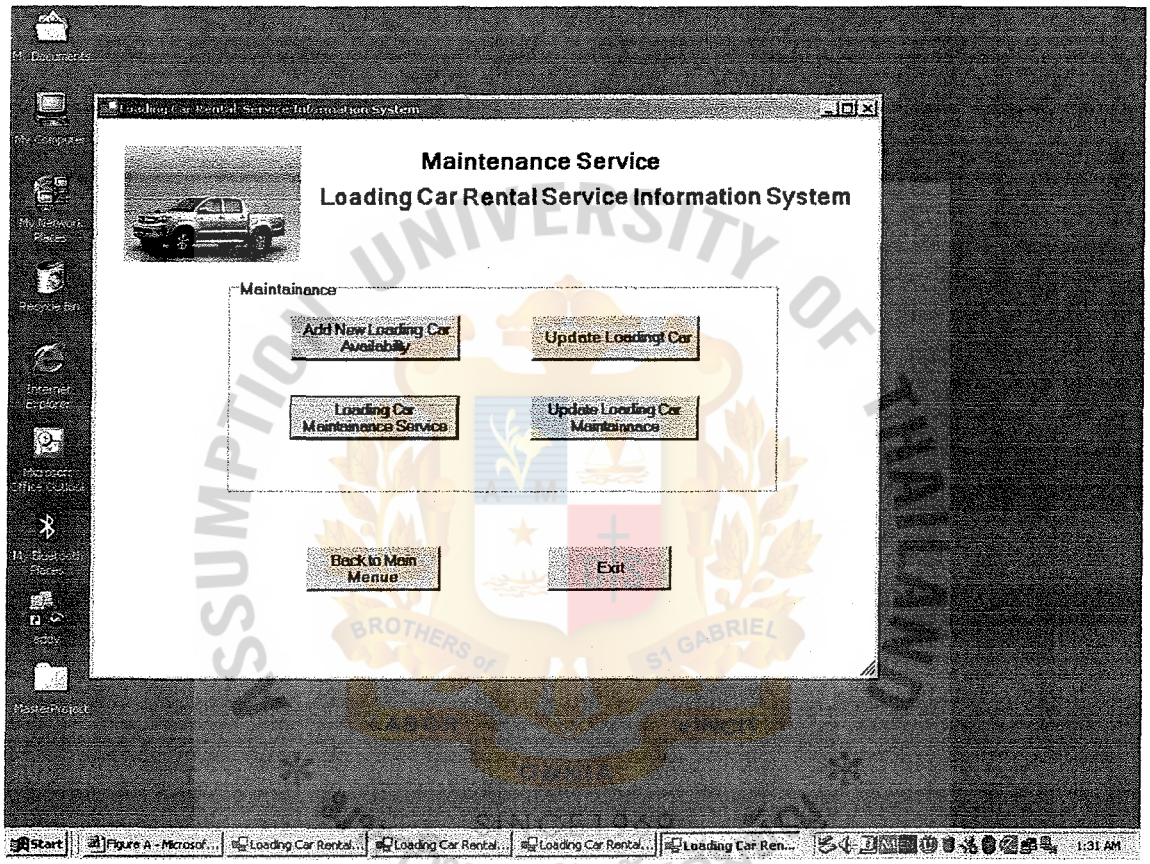

Figure A.23. Main Menu for Maintenance Service Form.

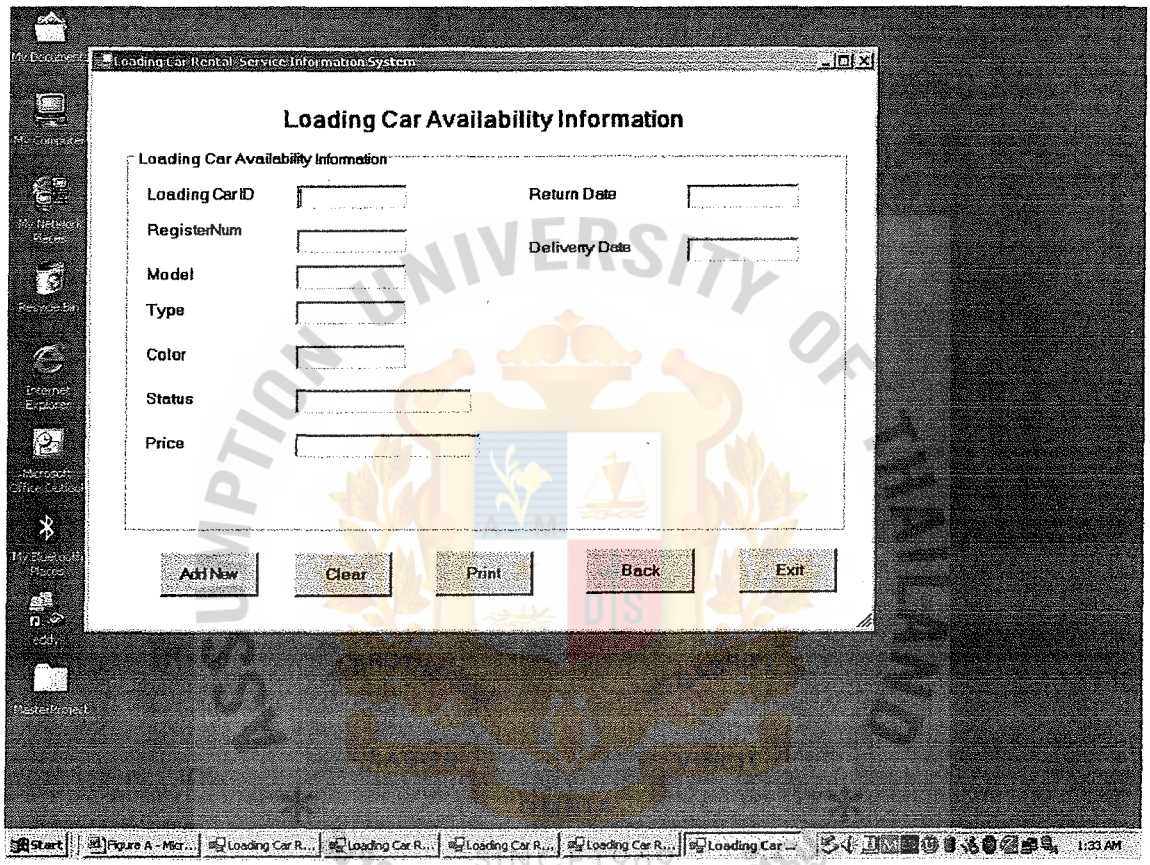

Figure A.24. Loading Car Availability for Maintenance Service Form.

APPENDIX B

REPORT DESIGN

Loading Car Rental Service Information system

Weekly New Customer Report

Date:20/01/05

MemberID	First Name	Last Name	E-mail	Address
C4001	Peter	Jackson	peter@yahoo.com	2/965 Plangnam Rd
C4002	Yosap	Ju	yosap@hotmail.com	268/74 Bangkhunsri
C4003	Joe	Mike	joe@yahoo.com	456/445 Silom
C4004	Jilly	Yu	Yu@yahoo.com	709 Petchburi Rd
C4005	Somsark	Jarart	jarat@yahoo.com	12 Soi 3 Seri4
C4006	Thana	Wantanasin	thana@yahoo.com	877/74 Paholyothin
C4007	Sujika	Tanettawornkul	Sujika@hotmail.com	963 Happylang
C4008	Sirirat	Wiwattanakij	sirirat@hotmail.com	78/4 Paknam
C4009	Wipa	Rattanasombat	wipa@hotmail.com	456 Ekachai Road
C4010	Paiboon	Lertchaichana	paiborn@yahoo.com	36/44 On-nuch
			Total Customer	10

Figure B.1. Weekly Customer Report

Loading Car Rental Service Information system

Weekly Loading Car Rental Report

Date:20/01/05

LoadingCar ID	RegisterNum	Type	Model	Color
L5001	Mk 4546	Van	Toyota Custom	White
L5002	Mk 4569	Loading Car	Toyota Tiger	White
L5003	Mk 4568	4WD	Toyota Tiger	White
L5004	Mk 4563	6 Wheel	Toyota	White
			Grand Total	5

Figure B.2. Weekly Loading Car Rental Report.

Loading Car Rental Service Information system

Weekly Loading Car Report

Date:20/01/05

MaintenanceID	RegisterNum	Type	Model	Maintenance Date
M6001	Mk 4540	Van	Toyota Custom	10/01/05
M6002	Mk 4541	Loading Car	Toyota Tiger	8/01/05
M6003	Mk 4539	4WD	Toyota Tiger	2/01/05
M6004	Mk 4538	6 Wheel	Toyota	1/01/05
			Grand Total	5

Figure B.3. Weekly Loading Car Report Maintenance.

Loading Car Rental Service Information system

Weekly Return Loading Car Report

Date:02/11/04

Rental ID	Loading Car ID	Pick up Date	Return Date	Locations
R3001	L5009	9/01/05	10/01/05	Phahonyothin
R3003	L5011	8/01/05	9/01/05	Bangna
R3006	L5015	3/01/05	4/01/05	Silom
R3009	L5020	9/01/05	10/01/05	Silom
			Grand Total	4

Figure: B.4. Weekly Return Loading Car Report.

Loading Car Rental Service Information system

Weekly Return Loading Car Report

Date:02/11/04

Rental ID	Loading Car ID	Type	Time Quantity	Price : Baht
R3006	L5016	Van	1 Day	800
R3009	L5019	Van	2 Day	800
R3010	L5023	Loading Car	1 Day	800
R3011	L5021	Loading Car	1 Day	800
		Grand Total		3200

Figure: B.5. Weekly Rental Loading Car Report.

Loading Car Rental Service Information system

Weekly Reservation Report

Date:20/01/05

Reservation ID	Customer ID	First Name	Last Name	Address
R8001	C4001	Peter	Jackson	2/965 Plangnam Road
R8002	C4002	Yosap	Ju	268/74 Bangkhunsri
R8003	C4003	Joe	Mike	456/445 Silom
R8004	C4004	Jilly	Yu	709 Petchburi Road
R8005	C4005	Somsark	Jarart	12 Soi 3 Seri4
R8006	C4006	Thana	Wantanasin	877/74 Paholyothin
R8007	C4007	Sujika	Tanettawornkul	963 Happylang
R8008	C4008	Sirirat	Wiwattanakij	78/4 Paknam
R8009	C4009	Wipa	Rattanasombat	456 Ekachai Road
R8010	C4010	Paiboon	Lertchaichana	36/44 On-nuch
			GrandTotal	10

Figure B.6. Weekly Reservation Loading Car Report.

Loading Car Rental Service Information system

Reservation Slip

Personal Details:

Rental Name:	Yanpol Dumkum
E-Mail:	yapol2000@hotmail.com
Address:	64/56 Soi Phahonyothin 57
Street:	Phahonyothin
Post Code:	10220
Country:	Thailand

Rental Detail

Type Loading Car	Loading Car
RegisterNum	RM 4689
Model	TOYOTA Tiger
Pick Up Location	Phahonyothin Rd
Pick Up Date	23/01/05
Pick Up Time	10:00 AM
Drop Location	Phahonyothin Rd
Drop Date	14/01/05
Drop Time	4:00 PM

Figure B.7. Reservation Slip.

Loading Car Rental Service Information system

Rental Loading Car Slip

Personal Details:

Rental Name:	Yanpol Dumkum
E-Mail:	yapol2000@hotmail.com
Address:	64/56 Soi Phahonyothin 57
Street:	Phahonyothin
Post Code:	10220
Country:	Thailand

Rental Detail

Type Loading Car	Loading Car
RegisterNum	RM 4689
Model	TOYOTA Tiger
Pick Up Location	Phahonyothin Rd
Pick Up Date	23/01/05
Pick Up Time	10:00 AM

Rental Detail

Rental Quantity	1 Day
Rental Payment	800 Baht
Insurance	50 Baht
Grand Total	850 Baht

Figure B.8. Rental Slip.

Loading Car Rental Service Information system

Rental Loading Car Slip

Personal Details:

Rental Name:	Yanpol Dumkum
E-Mail:	yapol2000@hotmail.com
Address:	64/56 Soi Phahonyothin 57
Street:	Phahonyothin
Post Code:	10220
Country:	Thailand

Rental Detail

Type Loading Car	Loading Car
RegisterNum	RM 4689
Model	TOYOTA Tiger
Pick Up Location	Phahonyothin Rd
Pick Up Date	23/01/05
Pick Up Time	10:00 AM
Drop Location	Phahonyothin Rd
Drop Date	14/01/05
Drop Time	4:00 PM

Rental Detail

Rental Quantity	1	Day
Rental Payment	800	Baht
Insurance	50	Baht
Charge	200	Baht
Total Payback	200	Baht

Figure B.9. Rental Invoice.

Loading Car Rental Service Information system

Daily Payment Detail Report

Date:14/01/05

MemberID	RentalID	PickupDate	Method	Drop Date	Price
C4009	1001	9/01/2005	Cash	10/01/2005	850 Baht
C4006	1003	4/01/2005	Cash	5/01/2005	850 Baht
C4020	1011	1/01/2005	Cash	2/012005	950 Baht
				Total Payment:	1350 Baht

Figure: B.10. Daily Payment Detail Report.

Loading Car Rental Service Information system

Loading Car Available Report

Date:20/01/05

LoadingCar ID	RegisterNum	Type	Model	Color
L5011	Mk 4556	Van	Toyota Custom	White
L5021	Mk 4567	Van	Toyota Custom	White
L5041	Mk 4582	Loading Car	Toyota Tiger	White
L5042	Mk 4592	Van	Toyota Custom	White
			Grand Total	5

Figure B.11. Daily Loading Car Report for Management.

Loading Car Rental Service Information system

Loading Car Price Report

Date:20/01/05

Type	Model	Color	Price Hour	Price Day
Loading Car	Toyota	White	200	700
Loading Car Extra Cab	Toyota	White	250	750
Loading Car 4 Doors	Toyota	White	300	800
4 WD	Toyota	White	350	900
4 WD4 Doors	Toyota	White	400	1000
4 WD5 Doors	Toyota	White	450	1050
Transit Van	Toyota	White	500	1100
Loading Van	Toyota	White	450	1150
Loading 6 Wheels	Toyota	White	600	1200

Figure B.12. Daily Loading Car Price Report.

Loading Car Rental Service Information system

Monthly New Customer Report

Date:30/01/05

Member ID	First Name	Last Name	E-mail	Address
C4001	Peter	Jackson	peter@yahoo.com	2/965 Plangnam Road
C4002	Yosap	Ju	yosap@hotmail.com	268/74 Bangkhunsri
C4003	Joe	Mike	joe@yahoo.com	456/445 Silom
C4004	Jilly	Yu	Yu@yahoo.com	709 Petchburi Road
C4005	Somsark	Jarart	jarat@yahoo.com	12 Soi 3 Seri4
C4006	Thana	Wantanasin	thana@yahoo.com	877/74 Paholyothin
C4007	Sujika	Tanettawornkul	Sujika@hotmail.com	963 Happylang
C4008	Sirirat	Wiwattanakij	sirirat@hotmail.com	78/4 Paknam
C4009	Wipa	Rattanasombat	wipa@hotmail.com	456 Ekachai Road
C4010	Paiboon	Lertchaichana	paiborn@yahoo.com	36/44 On-nuch
			Total Customer	10

Figure B.13. Summary Customer Report.

Loading Car Rental Service Information system

Weekly Return Loading Car Report

Date:02/11/04

Request ID	Rental ID	Loading Car ID	Type	Time Quantity
Q2001	R3006	L5016	Van	1 Day
Q2002	R3009	L5019	Van	2 Day
Q2003	R3010	L5023	Loading Car	1 Day
Q2004	R3011	L5021	Loading Car	1 Day
		Grand Total		4

Figure: 14. Daily Request Loading Car Rental Report.

Loading Car Rental Service Information system

Weekly Loading Car Maintenance Report

Date:20/01/05

MaintenID	RegisterNum	Type	Model	MaintenDate
D9001	Mk 4540	Van	Toyota Custom	10/01/05
D9002	Mk 4541	Loading Car	Toyota Tiger	8/01/05
D9003	Mk 4539	4WD	Toyota Tiger	2/01/05
D9004	Mk 4538	6 Wheel	Toyota	1/01/05
			Grand Total	5

Figure B.15. Weekly Loading Car Maintenance Report.

APPENDIX C

DATABASE DESIGN

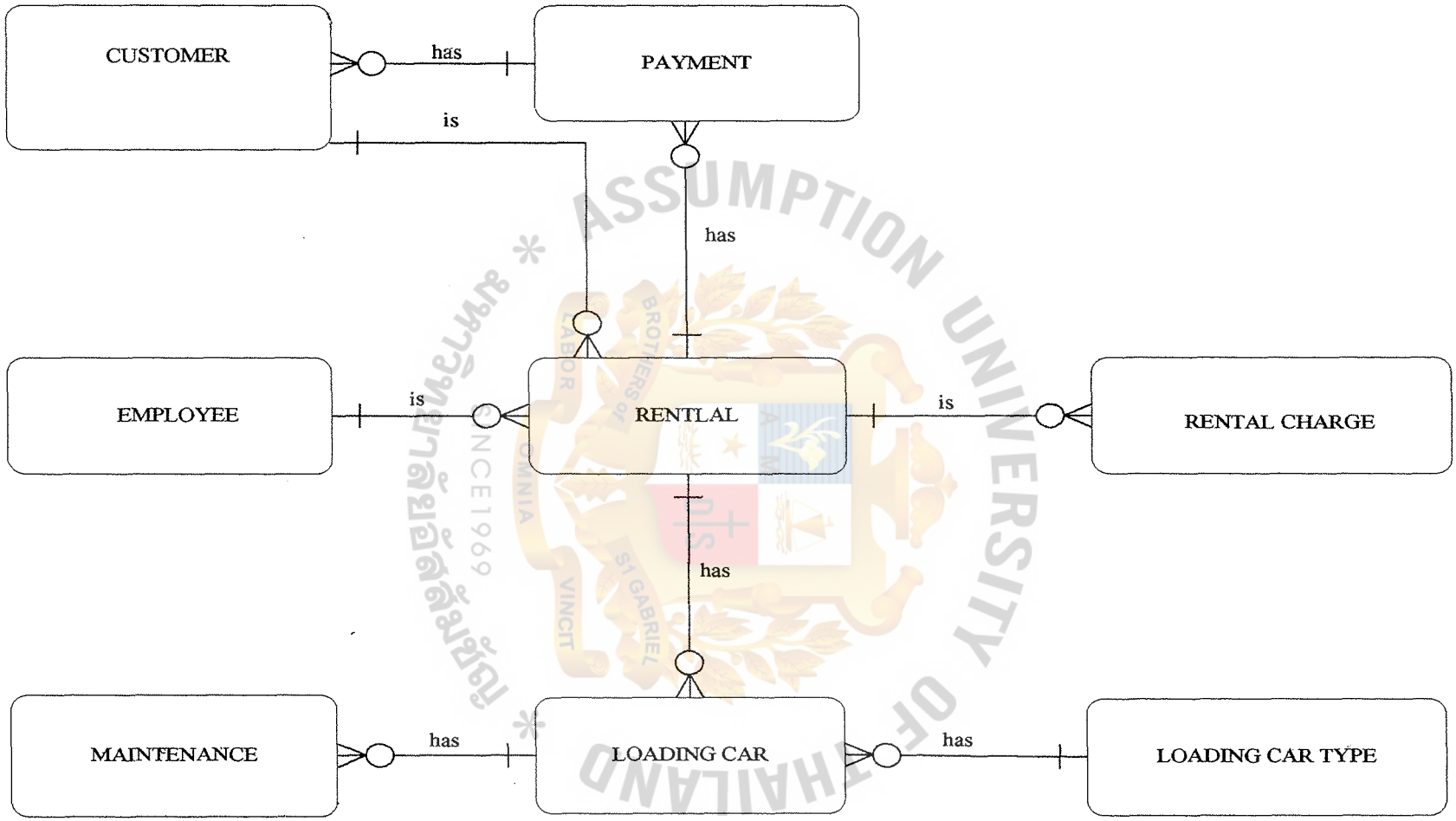

Figure C.1. Context Diagram of Entity Relationship Diagram.

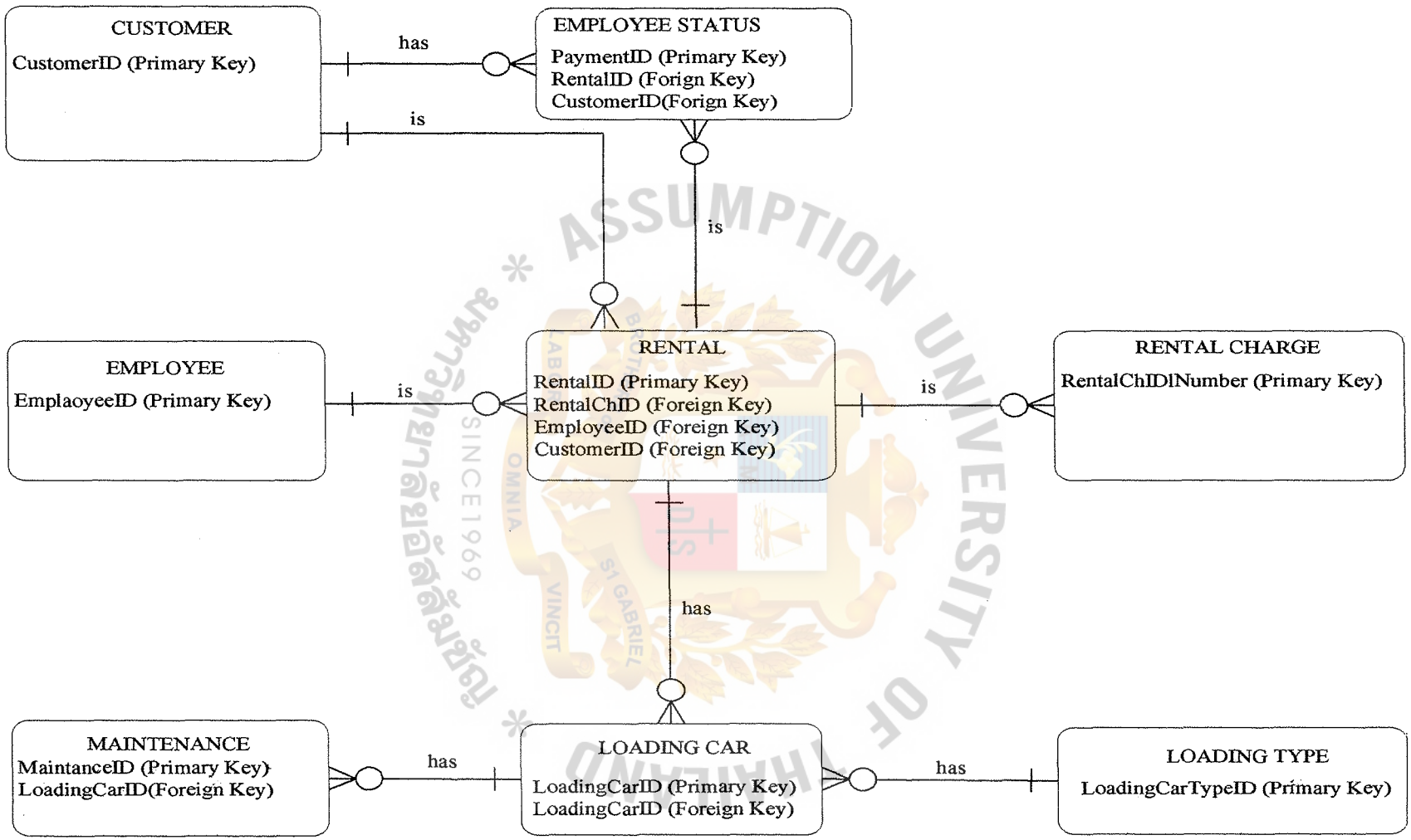

Figure C.2. Key-based Diagram of Entity Relationship Diagram.

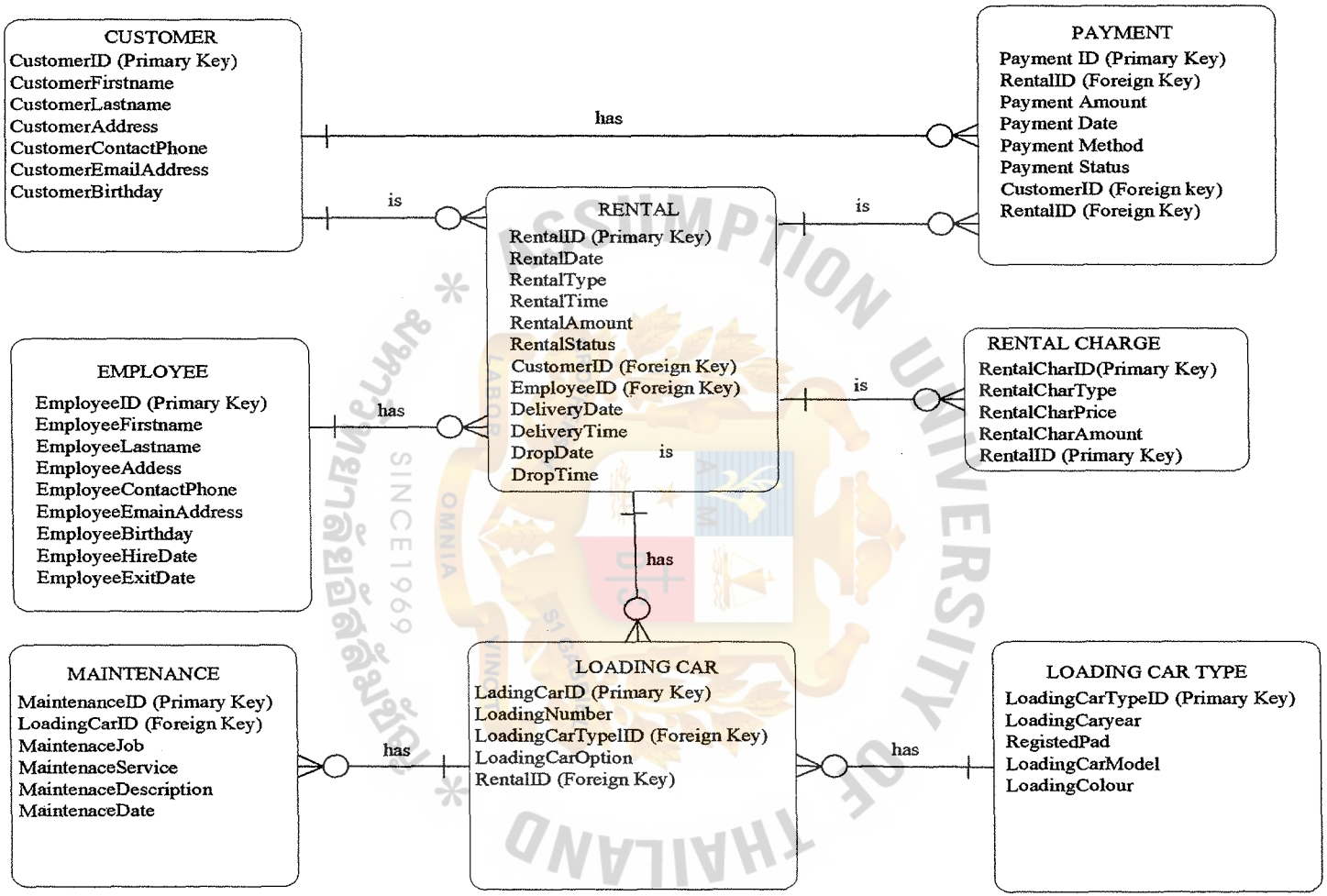

Figure C.3. Fully Attribute Diagram of Entity Relationship Diagram.

Customer Database

Table C.1. Structure of Customer Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	CustomerID	Integer	Y	Y				Primary Key
2	CustomerFirstname	Text (30)	Y					Attribute
3	CustomerLastname	Text (50)	Y					Attribute
4	CustomerAddress	Text (200)						Attribute
5	CustomerContactPhone	Text (10)			Y			Attribute
6	CustomerEmailAddress	Text (30)			Y			Attribute
7	CustomerBirthday	Date/Time	Y					Attribute

Payment Database

Table C.2. Structure of Payment Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	Payment ID	Integer	Y	Y				Primary Key
2	PaymenDate	Date/Time						Attribute
3	PaymentMethod	Text (20)			Y			Attribute
4	PaymentStatus	Text (10)			Y			Attribute
5	PaymentAmount	Text (10)			y			Attribute
6	RentalID	Integer			Y	Rental		Attribute
7	CustomerID	Integer			Y	Customer		Attribute

Loading Car Database

Table C.3. Structure of Loading Car Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	LoadignCarID	Integer	Y	Y				Primary Key
2	LoadingCarNumber	Text (10)	Y					Attribute
3	LoadingCarTypelID	Integer				Loading Car type		Attribute
4	LoadinCarOption	Text (20)			Y			Attribute
5	RentalID	Integer				Rental		Attribute

Loading Car Type Database

Table C.4. Structure of Loading Car Type Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	LoadingCarTypeID	Integer	Y	Y				Primary Key
2	LoadigCaTypeYear	Date/Time						Attribute
3	RegistedPad	Text (20)			Y			Attribute
4	LoadingCarModel	Text (20)			Y			Attribute
5	LoadingCarModel	Text (20)			Y			Attribute
6	LoadingCarTypeID	Integer			Y	Loading Car		Attribute

Problem Request Database

Table C.5. Structure of Rental Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	RentalID	Integer	Y	Y				Primary Key
2	RentalDate	Date/Time						Attribute
3	RentalType	Text (10)	Y					Attribute
4	EmployeeID	Integer	Y			Employee		Attribute
5	CustomerID	Integer	Y		Y	Customer		Attribute
6	RentalDescription	Text (20)			y			Attribute
7	DeliveryTime	Date/Time			Y			Attribute
8	DeliveryDate	Date/Time			y			Attribute
9	DropDate	Date/Time			Y			Attribute
10	DropTime	Data/Time			Y			Attribute
11	RentalStatus	Text (20)			Y			Attribute
12	RentalAmount	Text (20)			Y			Attribute

RentalCharge Database

Table C.6. Structure of Status Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	RentalCahrID	Integer	Y	Y				Primary Key
2	RentalCharType	Text (30)						Attribute
3	RentalCharPrice	Text(10)			Y			Attribute
4	RentalCharAmount	Text(20)			Y			Attribute
5	RentalID	Integer			Y	Rental		Attribute

Employee Database

Table C.7. Structure of Employee Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	EmployeeID	Integer	Y	Y				Primary Key
2	EmployeeFirstname	Text (30)	Y					Attribute
3	EmployeeLastname	Text (50)	Y					Attribute
4	EmployeeAddress	Text (200)						Attribute
5	EmployeeContactPhone	Text (10)						Attribute
6	EmployeeEmailAddress	Text (30)			Y			Attribute
7	EmployeeBirthday	Date/Time			Y			Attribute
8	EmployeeHireDate	Date/Time			Y			Attribute
9	EmployeeExitDate	Date/Time			Y			Attribute

Maintenance Database

Table C.8. Structure of Maintenance Table.

No.	Field Name	Field Type	Index	Unique	Nullable	Foreign Key to Table	Check	Key Type
1	MaintenanceID		Y	Y				Primary Key
2	MaintenanceDate	Date/Time	Y					Attribute
3	MaintenanceTime	Date/Time						Attribute
4	MaintenanceService	Integer			Y			Attribute
5	MaintanceJob	Text (200)			Y			Attribute
6	LoadingCarID	Integer	Y			Loading Car		Attribute
7	MaintenanceDescription	Text(200)	Y					Attribute

APPENDIX D

PROCESS SPECIFICATION

PROCESS SPECIFICATION

Table D.1. Process Specification of Process 1.1 Complete the Customer Information.

Item	Description
Process Name:	Complete the Customer Information
Data In:	(1) New Customer Information
Data Out:	(1) New Customer Information
Process:	(1) Get necessary customer data, customer name, address, phone number, etc. and assign new Customer ID from the Customer Request Form
Attachment:	(1) Customer Service Staff

Table D.2. Process Specification of Process 1.2 Check the Required Information For Completeness and Customer Existence.

Item	Description
Process Name:	Check the Required Information For Completeness and Customer Existence
Data In:	(1) New Customer Information (2) Database Conditions
Data Out:	(1) New Customer Information
Process:	(1) Check the Required Information for Completeness and Customer Existence
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.3. Process Specification of Process 1.3 Verify and Confirm Customer Information.

Item	Description
Process Name:	Verify and Confirm Customer Information
Data In:	(1) New Customer Information
Data Out:	(1) Verified Customer Information
Process:	(1) Verify Customer Information (2) Confirm Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.4. Process Specification of Process 1.4 Record New Customer Information.

Item	Description
Process Name:	Record New Customer Information
Data In:	(1) Verified Customer Information
Data Out:	(1) Verified Customer Information (2) New Customer Information
Process:	(1) Record New Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.5. Process Specification of Process 1.5 Notify the Result of Recording.

Item	Description
Process Name:	Notify the Result of Recording
Data In:	(1) Verified Customer Information
Data Out:	(2) Adding Result
Process:	(1) Notify the Result of Recording
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.6. Process Specification of Process 2.1 Search Customer Information.

Item	Description
Process Name:	Search Customer Information
Data In:	(1) Customer Serach
Data Out:	(1) Customer Detail
Process:	(1) Search Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.7. Process Specification of Process 2.2 Show Required Customer Information.

Item	Description
Process Name:	Show Required Customer Information
Data In:	(1) Required Customer Information
Data Out:	(1) Required Customer Information
Process:	(1) Show Required Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.8. Process Specification of Process 2.3 Update Customer Information.

Item	Description
Process Name:	Update Customer Information
Data In:	(1) Updated Customer Information
Data Out:	(1) Updated Customer Detail
Process:	(1) Update Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.9. Process Specification of Process 2.4 Verify and Confirm Customer.

Item	Description
Process Name:	Verify and Confirm Customer
Data In:	(1) Updated Customer Information
Data Out:	(1) Verified Customer Information
Process:	(1) Verify Customer (2) Confirm Customer
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.10. Process Specification of Process 2.5 Record Customer Information.

Item	Description
Process Name:	Record Customer Information
Data In:	(1) Verified Customer Information
Data Out:	(1) Updated Customer Information
Process:	(1) Record Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.11. Process Specification of Process 2.6 Notify the Result of Updating.

Item	Description
Process Name:	Notify the Result of Updating
Data In:	(1) Updated Customer Information
Data Out:	(1) Updating Result
Process:	(1) Notify the Result of Updating
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.12. Process Specification of Process 3.1 Search Customer Information.

Item	Description
Process Name:	Search Customer Information
Data In:	(1) Customer Information
Data Out:	(1) Customer Information
Process:	(1) Search Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.13. Process Specification of Process 3.2 Show Required Customer information.

Item	Description
Process Name:	Show Required Customer information
Data In:	(1) Required Customer Information
Data Out:	(1) Required Customer Information
Process:	(1) Show Required Customer Information
Attachment:	(1) Customer Service Staff (2) Customer Database

Table D.14. Process Specification of Process 4.1 Search Loading Car Information.

Item	Description
Process Name:	Search Loading Car Information
Data In:	(1) Customer Information (2) New Customer Information. (3) Loading Car List
Data Out:	(1) Customer Information
Process:	(1) Complete the Car information
Attachment:	(1) Dealership Customer Relationship Department (2) Customer Database (3) Loading Car Database

Table D.15. Process Specification of Process 4.2 Check Loading Car Available Information

Item	Description
Process Name:	Checks Loading Car Available information
Data In:	(1) Database Conditions
Data Out:	(1) Database Conditions
Process:	(1) Check the Loading Car Available Information
Attachment:	(1) Loading Car Database

Table D.16. Process Specification of Process 4.3 Verify and Confirm Loading Car Information.

Item	Description
Process Name:	Verify and Confirm Car Information
Data In:	(1) Customer Account Balance (2) Data Store D1 (Account)
Data Out:	(1) Car information
Process:	(1) Verify Car Information (2) Confirm Car Information
Attachment:	(1) Customer (2) Loading Car Database

Table D.17. Process Specification of Process 4.4 Record Loading Car Information.

Item	Description
Process Name:	Record New Car Information
Data In:	(1) Verified Car Information
Data Out:	(1) New Car Information
Process:	(1) Record New Car Information
Attachment:	(1) Customer (2) Car Database

Table D.18. Process Specification of Process 4.5 Notify the Result of Recording.

Item	Description
Process Name:	Notify the Result of Recording
Data In:	(1) Verified Car Information
Data Out:	(1) Adding Result
Process:	(1) Notify the Result of Recording
Attachment:	(1) Customer (2) Loading Car Database

Table D.19. Process Specification of Process 5.1 Search Loading Car Reservation Information .

Item	Description
Process Name:	Search Loading Car Reservation Information
Data In:	(1) Adding New Reservation
Data Out:	(1) Loading Car Information
Process:	(1) Search Loading Car Reservation
Attachment:	(1) Customer (2) Loading Car Database

Table D.20. Process Specification of Process 5.2 Selected Loading Car Reservation

Item	Description
Process Name:	Selected Lading Car Reservation
Data In:	(1) Required Loading Car Information
Data Out:	(1) Required Loading Car Information
Process:	(1) Selected Loading Car Reservation
Attachment:	(1) Customer (2) Loading Car Database

Table D.21. Process Specification of Process 5.3 Update Loading Car Available Reservation.

Item	Description
Process Name:	Update Loading Car Available Reservation
Data In:	(1) Updated Loading Car Information
Data Out:	(1) Updated Loading Car Information
Process:	(1) Update Loading Car Information
Attachment:	(1) Customer (2) Car Database

Table D.22. Process Specification of Process 5.4 Verify and Confirm Loading Car Reservation.

Item	Description
Process Name:	Verify and Confirm Loading Car Reservation
Data In:	(1) Updated Loading Car Information
Data Out0:	(1) Verified Loading Car Information
Process:	(1) Verify Loading Car Information (2) Confirm Loading Car Information
Attachment:	(1) Customer (2) Car Database

Table D.23. Process Specification of Process 5.5 Record Loading Car Reservation.

Item	Description
Process Name:	Record Loading Car Reservation
Data In:	(1) Verified Reservation Car Information
Data Out:	(1) Updated Reservation Car Information
Process:	(1) Record Loading Car Information
Attachment:	(1) Customer (2) Car Database

Table D.24. Process Specification of Process 5.6 Notify the Result of Updating Reservation.

Item	Description
Process Name:	Notify the Result of Updating Reservation
Data In:	(1) Updated Loading Car Information
Data Out:	(1) Updating Loading Car Information
Process:	(1) Notify the Result of Updating
Attachment:	(1) Customer (2) Car Database

Table D.25. Process Specification of Process 6.1 Delivery Loading Car

Item	Description
Process Name:	Delivery Loading Car
Data In:	(1) Customer Detail
Data Out:	(1) Update Loading Car
Process:	(1) Delivery Loading Car
Attachment:	(1) Customer Service Staff (2) Customer (3) Loading Car Database

Table D.26. Process Specification of Process 6.2 Return Loading Car Information.

Item	Description
Process Name:	Return Loading Car Information
Data In:	(1) Required Car Information
Data Out:	(1) Required Car Information
Process:	(1) Return Loading Car Information
Attachment:	(1) Customer (3) Customer Service Staff (2) Loading Car Database

Table D.27. Process Specification of Process 7.1 Loading Car Rental Price Information.

Item	Description
Process Name:	Loading Car Rental Price Information
Data In:	(1) Adding New Rental
Data Out:	(1) Rental Detail
Process:	(1) Loading Car Rental Price
Attachment:	(1) Customer (2) Employee Database 3) Rental Database

Table D.28. Process Specification of Process 7.2 Show Loading Car Price Information.

Item	Description
Process Name:	Show Loading Car Price Information
Data In:	(1) Customer Rental Information
Data Out:	(1) Customer Rental Information
Process:	(1) Show Loading Car Price Information
Attachment:	(1) Customer (2) Rental Database

Table D.29. Process Specification of Process 7.3 Complete Loading Car Rental

Item	Description
Process Name:	Complete Loading Car Rental
Data In:	(1) Customer Rental Information
Data Out:	(1) Customer Rental Information
Process:	(1) Complete Loading Car Rental
Attachment:	(1) Customer (2) Customer Database (3) Rental Database

Table D.30. Process Specification of Process 7.4 Verify and Confirm Loading Car Rental Information.

Item	Description
Process Name:	Verify and Confirm Loading Rental Information.
Data In:	(1) Customer Rental Information
Data Out:	(1) Customer Rental Information
Process:	(1) Verify and Confirm Loading Rental Information.
Attachment:	(1) Customer (2) Customer Database

Table D.31. Process Specification of Process 7.5 Record Loading Car Information.

Item	Description
Process Name:	Record Loading Car Information.
Data In:	(1) Customer Rental Information
Data Out:	(1) Customer Rental Information
Process:	(1) Record Loading Car Information.
Attachment:	(1) Customer (2) Customer Database

Table D.32. Process Specification of Process 7.6 Notify and Result of Update .

Item	Description
Process Name:	Notify and Result of Update
Data In:	(1) Customer Rental Information
Data Out:	(1) Customer Rental Information
Process:	(1) Notify and Result of Update
Attachment:	(1) Customer (2) Customer Database

Table D.33. Process Specification of Process 8.1 Rental Payment Request

Item	Description
Process Name:	Rental Payment Request
Data In:	(1) Rental Payment
Data Out:	(1) Payment Detail
Process:	(1) Rental Payment Request
Attachment:	(1) Customer (2) Payment Database

Table D.34. Process Specification of Process 8.2 Retrieve Rental Payment.

Item	Description
Process Name:	Retrieve Rental Payment
Data In:	(1) Rental Payment
Data Out:	(1) Required Job Information
Process:	(1) Retrieve Rental Payment
Attachment:	(1) Payment Database

Table D.35. Process Specification of Process 8.3 Completed Loading Car Payment Service .

Item	Description
Process Name:	Completed Loading Car Rental
Data In:	(1) Rental Information
Data Out:	(1) Customer Update information
Process:	Completed Loading Car Rental
Attachment:	(1) Customer (2) Customer Database (3) Payment Database

Table D.36. Process Specification of Process 8.3 Completed Loading Car Payment Service .

Item	Description
Process Name:	Completed Loading Car Rental
Data In:	(1) Rental Information
Data Out:	(1) Customer Update information
Process:	Completed Loading Car Rental
Attachment:	(1) Customer (2) Customer Database (3) Payment Database

Table D.37. Process Specification of Process 8.4 Verify and Confirm Payment Information

Item	Description
Process Name:	Verify and Confirm Payment Information
Data In:	(1) Customer Payment Information
Data Out:	(2) Verified Customer Payment Information
Process:	(1) Verify Payment Information (2) Confirm Payment Information
Attachment:	(1) Customer (2) Customer Database (3) Payment Database

Table D.38. Process Specification of Process 8.5 Record Payment Information.

Item	Description
Process Name:	Record Payment Information
Data In:	(1) Verified Payment Information
Data Out:	(1) Updated Payment Information
Process:	(1) Record Payment Information
Attachment:	(1) Customer (2) Payment Database

Table D.39. Process Specification of Process 9.1 Loading Car Service Maintenance .

Item	Description
Process Name:	Loading Car Service Maintenance
Data In:	(2) Service Number (3) Loading Car
Data Out:	(2) Service Number (3) Loading Car
Process:	(2) Search for Job Information
Attachment:	(3) Dealership Customer Relationship Department (4) Job Database

Table D.40. Process Specification of Process 9.2 Complete Loading Car Maintenance Service.

Item	Description
Process Name:	Show Required Job Information
Data In:	(2) Required Job Information
Data Out:	(2) Required Job Information
Process:	(2) Show Required Job Information
Attachment:	(2) Job Database

APPENDIX E

DATA DICTIONARY

DATA DICTIONARY

Table E.1. Data Dictionary of Customer Database.

Field Name	Meaning
CustomerID	Customer ID that is unique. Each customer has only one customer ID. This ID is auto generated by the computer.
CustomerFirstname	First name of the customer
CustomerLastname	Surname of the customer
CusotmerAddress	Address of the customer
CustomerContactPhone	Phone number of a contact person of the customer
CustomerEmailAddress	E-mail address of the customer
CustomerBirthday	Birthday of the customer

Table E.2. Data Dictionary of Payment Database.

Field Name	Meaning
PaymentID	PaymentID that is unique. Each PaymentID has only one ID. This ID is auto generated by the computer. PaymentID is the Payment that the customers for pay for the Loading Car Rental.
PaymentAmount	Name of the PaymentAmount.
PaymentDate	Date of payment
PaymentMethod	Method of Payment that customer uses for Rental payment
PaymentStatus	Status of payment

Table E.3. Data Dictionary of Loading Car Database.

Field Name	Meaning
LoadingCarID	LoadingCarID that is unique. Each car has only one LoadingCarID
LoadingCarNumber	LoadingCarNumber that is also unique. Each car has only one number.
LoadingCarTypeID	Model of the car. There are 8 car models in the existing system. - '1' for Toyoto Hilux Vigo Standard - '2' for Toyota Hilux Vigo D cab 4x2 - '3' for Toyota Hilux Vigo D cab 4x4 - '4' for Toyata Hilux Extra cab 4x2 - '5' for Toyata Hilux Extra cab 4x4 - '6' for Toyota Hiace Van - '7' for Toyota Commuter Van - '8' for Toyota 6 wheel Dina
LoadingCarOption	External option of the Loading car

Table E.4. Data Dictionary of Loading Car Model Database.

Field Name	Meaning
LoadingCarTypeID	Loading CarType ID that is unique. Each car model has only one ID. This ID is auto generated by the computer. There are 6 car models in the existing system. - '1' for Toyoto Hilux Vigo Standard - '2' for Toyota Hilux Vigo D cab 4x2 - '3' for Toyota Hilux Vigo D cab 4x4 - '4' for Toyata Hilux Extra cab 4x2 - '5' for Toyata Hilux Extra cab 4x4 - '6' for Toyota Hiace Van - '7' for Toyota Commuter Van - '8' for Toyota 6 wheel Dina
LoadingCarYear	Description of the Loading Car Year used
RegisteredPad	Description of the Loading Car Register Number pad
LoadingCarModel	Description about the Loading Car model
LoadingColour	Description about the Loading Car Colour

Table E.5. Data Dictionary of Rental Database.

Field Name	Meaning
RentalID	RentalID of the Loading car Rental information that the customer requests for.
RentalDate	Status of the rental date.
RentalType	Type of Rental who requests the Rental a whole day or per hour.
RentalTime	Rental time that indicates requested rental who requests rental.
RentalAmount	Description of Loading amount for rental. This date is promised with the requester.
RentalStatus	Rental status of identified rental
CustomerID	Customer ID that is unique. Each customer has only one customer ID. This ID is auto generated by the computer.
EmployeeID	Employee ID that is unique. Each employee has only one employee ID. This ID is auto generated by the computer.
DeliveryDate	Date that customer picks up loading car
DeliveryTime	Time that customer picks up loading car
DropDate	Date that customer drops loading car
DropTime	Date that customer drops loading car

Table E.6 Data Dictionary of Rental Database.

Field Name	Meaning
RentalID	RentalID of the Loading car Rental information that the customer requests for.
RentalDate	Status of the rental date.
RentalType	Type of Rental who requests the Rental a whole day or per hour.
RentalTime	Rental time that indicates requested rental who requests rental.
RentalAmount	Description of Loading amount for rental. This date is promised with the requester.
RentalStatus	Rental status of identified rental
CustomerID	Customer ID that is unique. Each customer has only one customer ID. This ID is auto generated by the computer.
EmployeeID	Employee ID that is unique. Each employee has only one employee ID. This ID is auto generated by the computer.
DeliveryDate	Date that customer picks up loading car
DeliveryTime	Time that customer picks up loading car
DropDate	Date that customer drops loading car
DropTime	Date that customer drops loading car

Table E.7. Data Dictionary of Rental Charge Database.

Field Name	Meaning
RentalCharID	Rentalcharge ID that is unique. Each status has only one ID. This ID is auto generated by the computer used each loading car type.
RentalCharType	RentalChargeType that indicates price of loading car
RentalID	RentalID of the Loading car Rental information that the customer requests for.

Table E.8. Data Dictionary of Employee Database.

Field Name	Meaning
EmployeeID	Employee ID that is unique. Each employee has only one employee ID. This ID is auto generated by the computer.
EmployeeFirstname	First name of the employee
EmployeeLastname	Surname of the employee
EmployeeAddress	Address of the employee
EmployeeContactPhone	Phone number of the employee
EmployeeEmailAddress	E-mail address of the employee
EmployeeBirthday	Birthday of the employee
EmployeeHireDate	Hired date of the employee
EmployeeExitDate	Quitted date of the employee

Table E.9. Data Dictionary of Maintenance Database.

Field Name	Meaning
MaintenanceID	Maintenance ID that is unique. Each MaintenanceID has several services. One car can have many services.
LoadingCarID	LoadingCarID that is unique. Each car has only one LoadingCarID
MaintenaceService	Maintenance service identified for the Loading Car
MaintenaceDate	Date the customer takes the car for the maintenance services
MaintenaceDescription	Detailed description of maintenance service

APPENDIX F

DATA FLOW DRIAGRAM

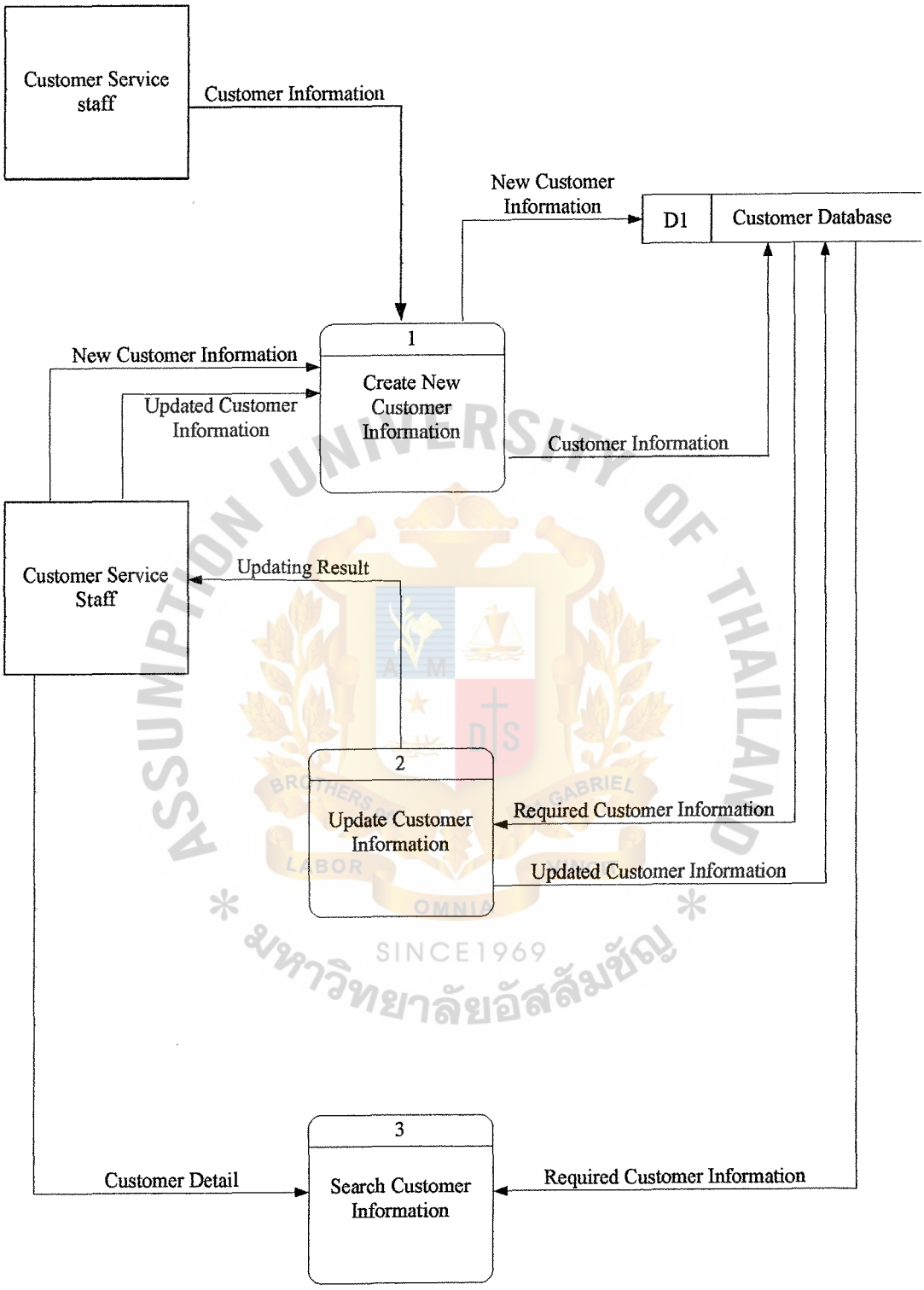

Figure F.1. Level 0 Data Flow Diagram of Loading Car Rental Service.

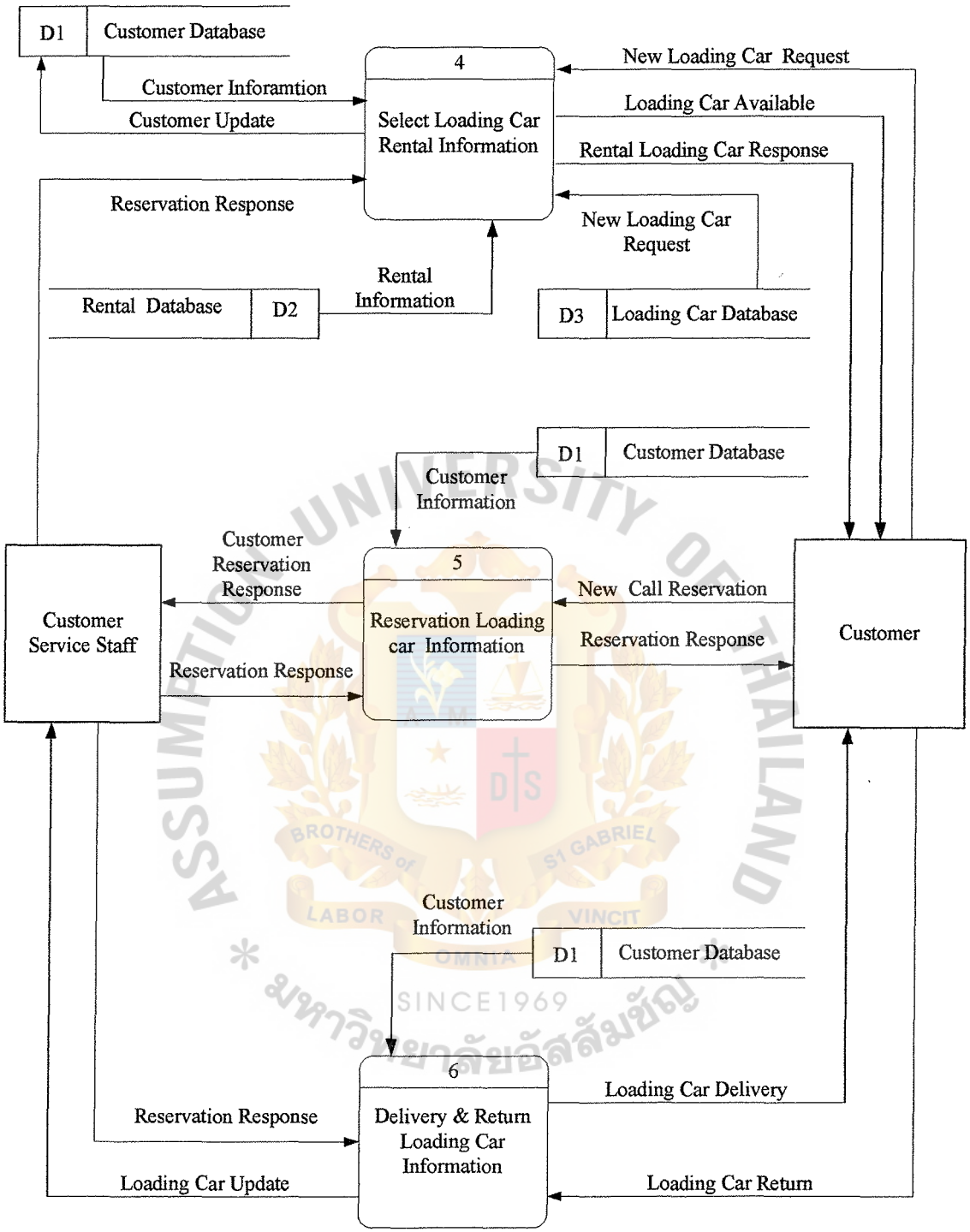

Figure F.2. Level 0 Data Flow Diagram of Loading Car Rental Service (Continued).

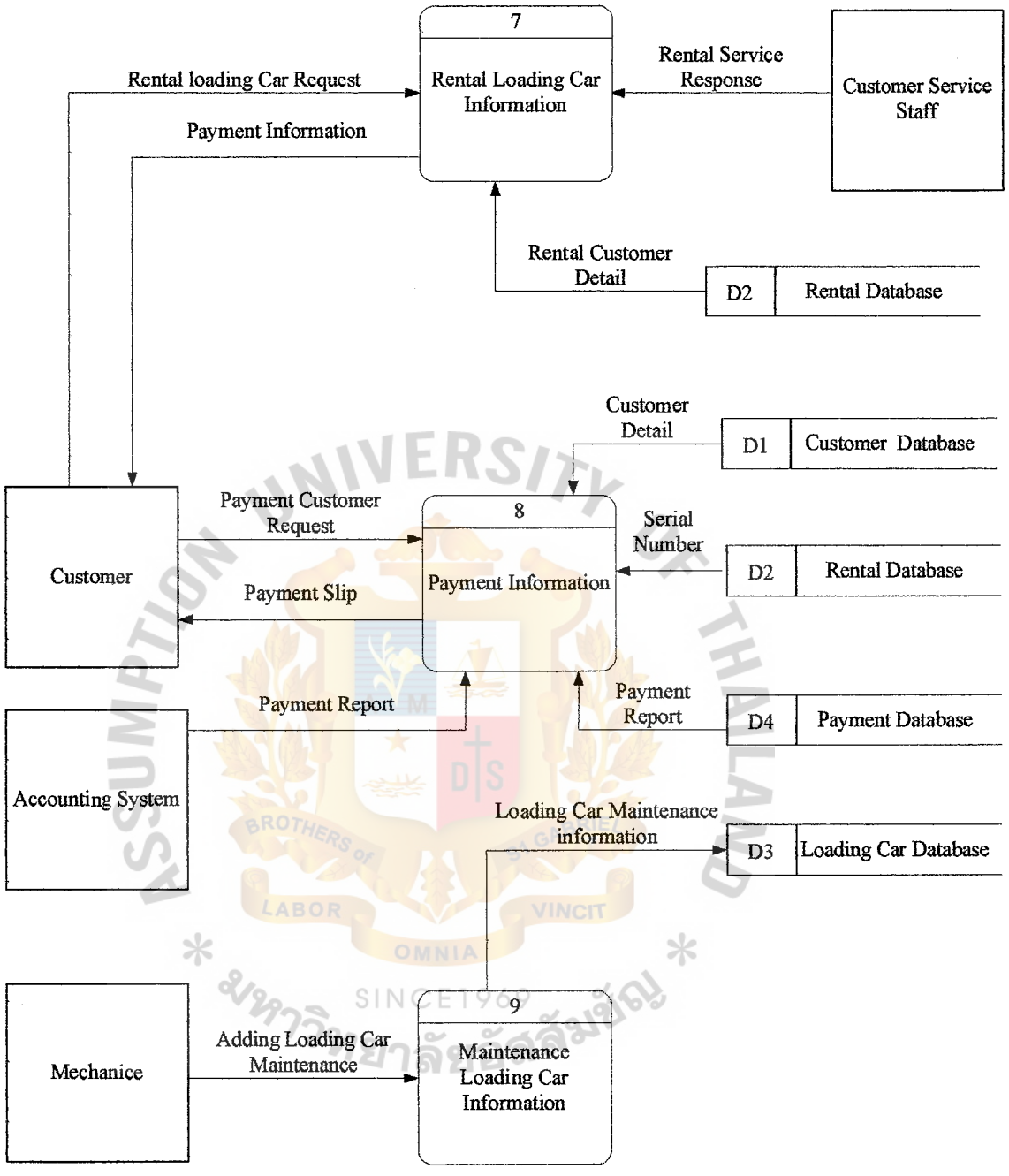

Figure F.3. Level 0 Data Flow Diagram of Loading Car Rental Service (Continued).

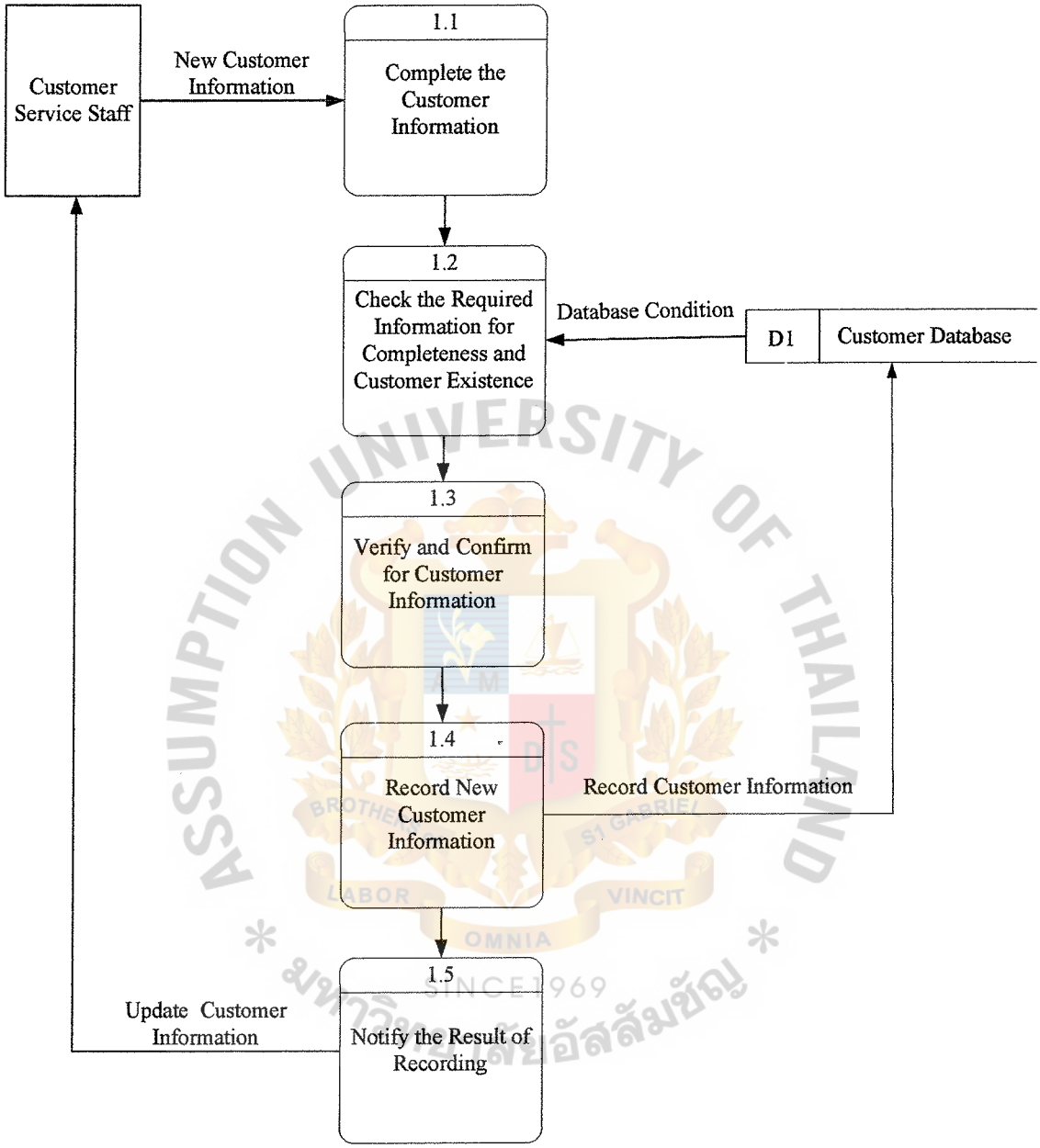

Figure F.4. Level 1 Data Flow Diagram of Create New Customer Information.

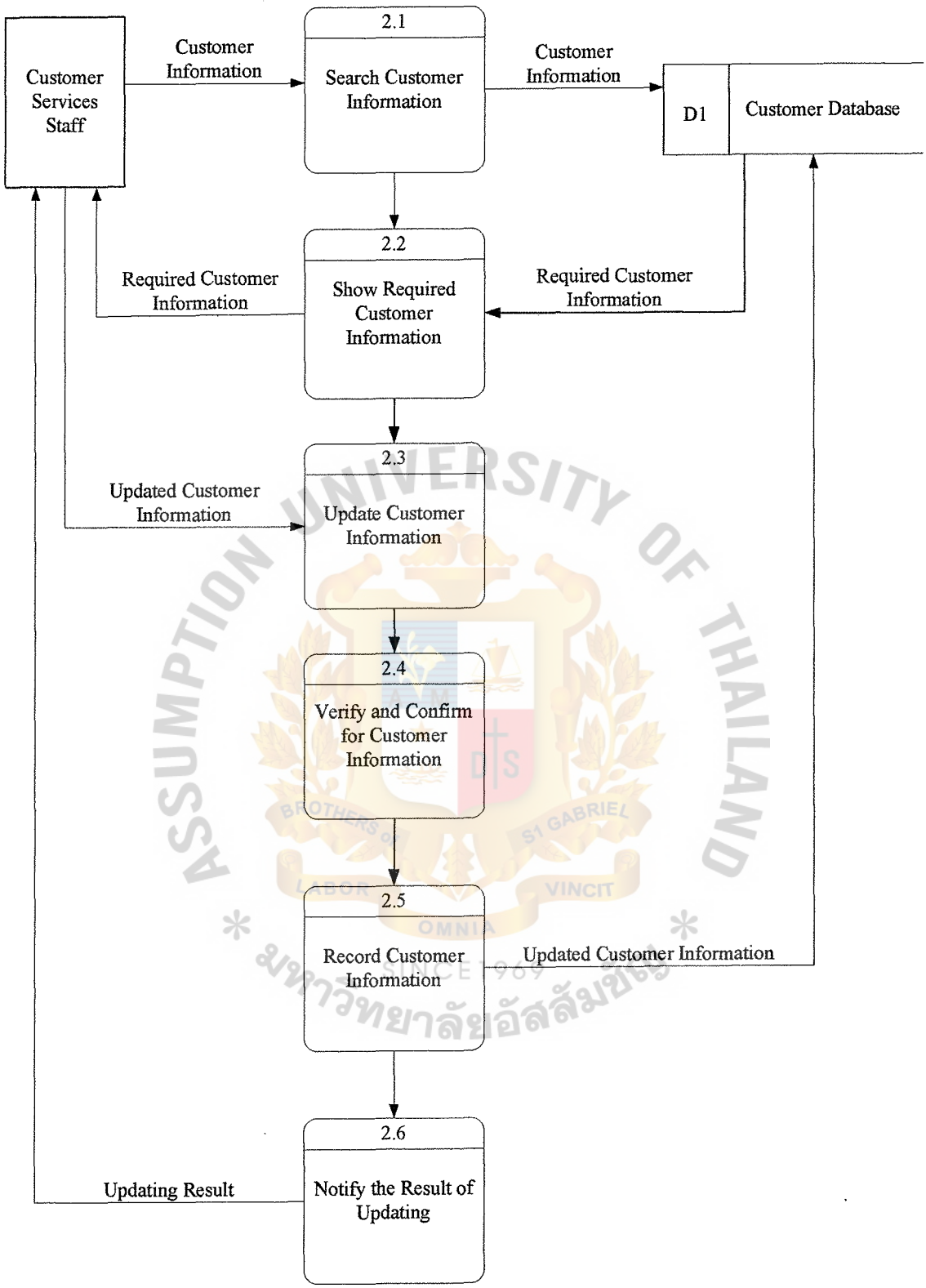

Figure F.5. Level 1 Data Flow Diagram of Update Customer Information.

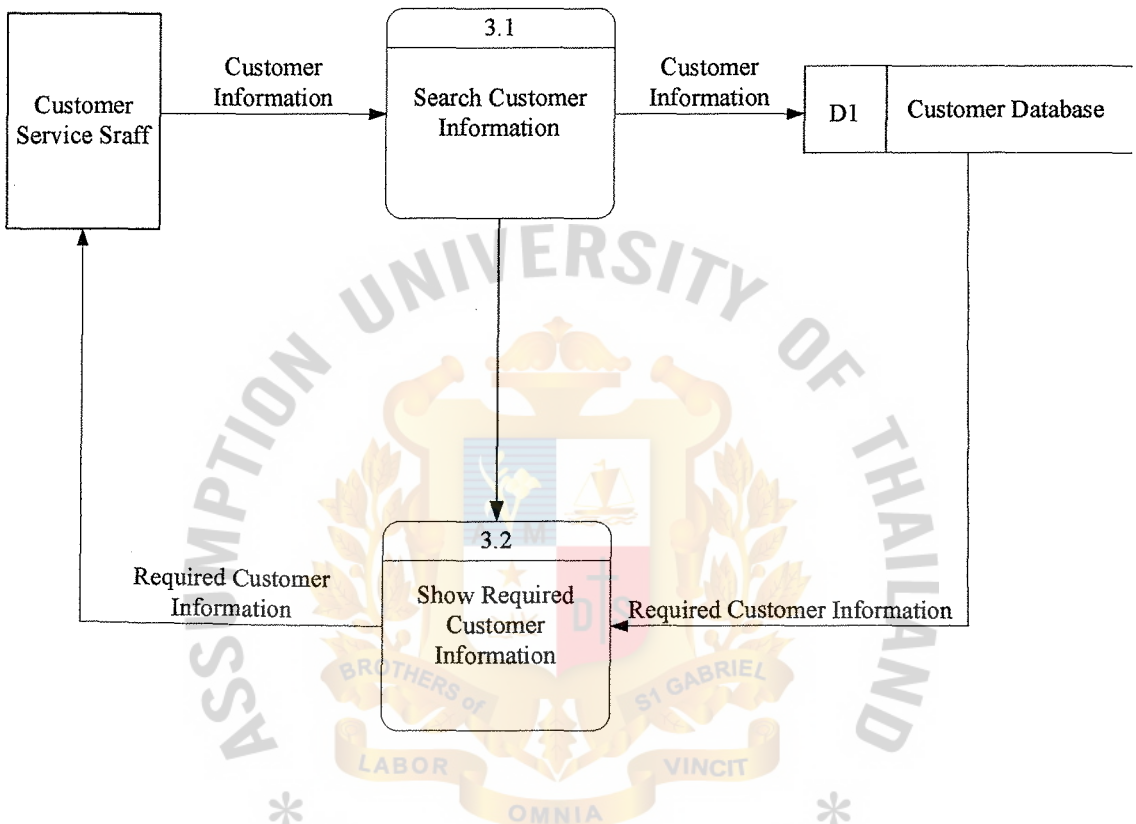

Figure F.6. Level 1 Data Flow Diagram Search Customer Information.

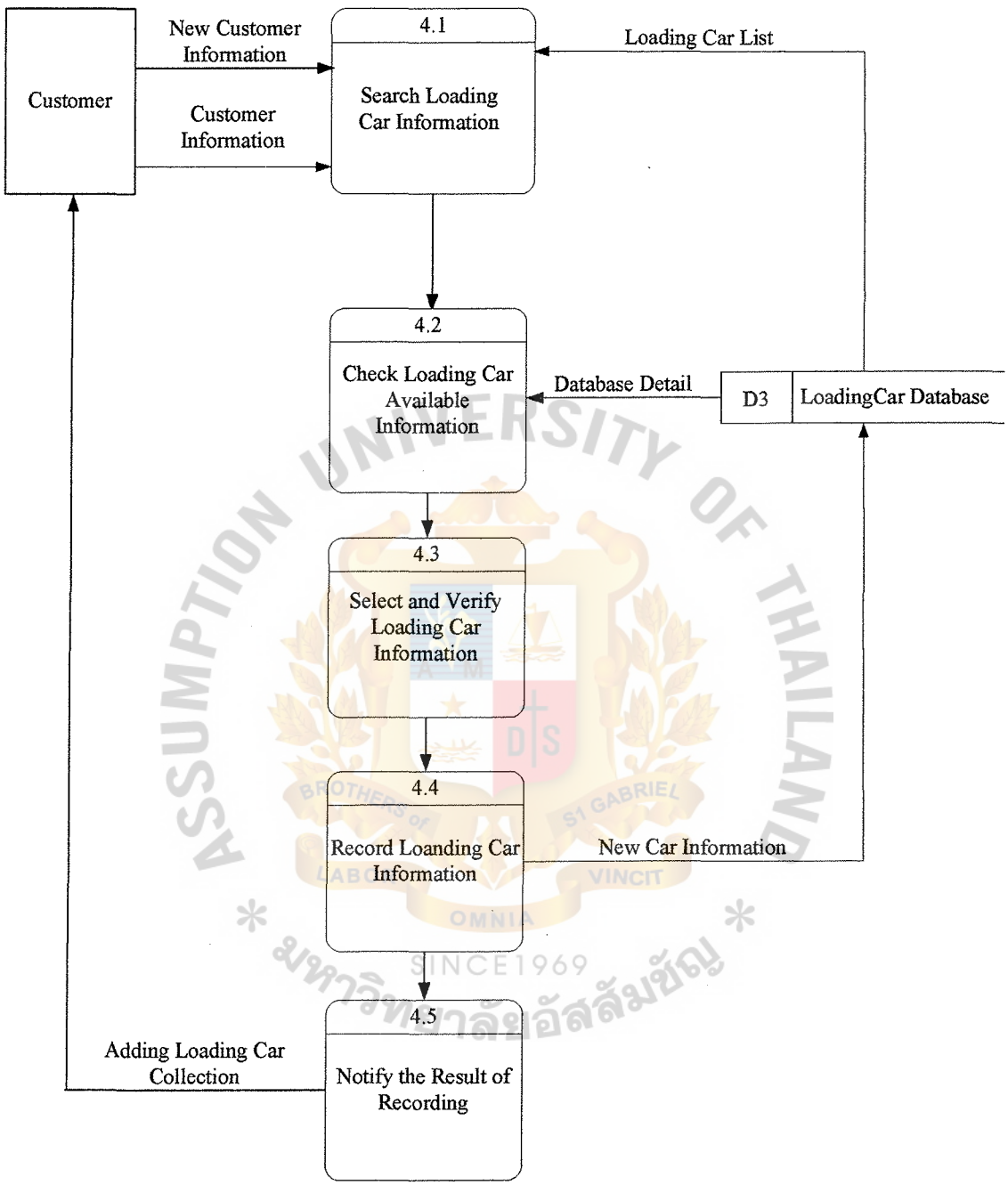

Figure F.7. Level 1 Data Flow Diagram of Search Loading Car Information.

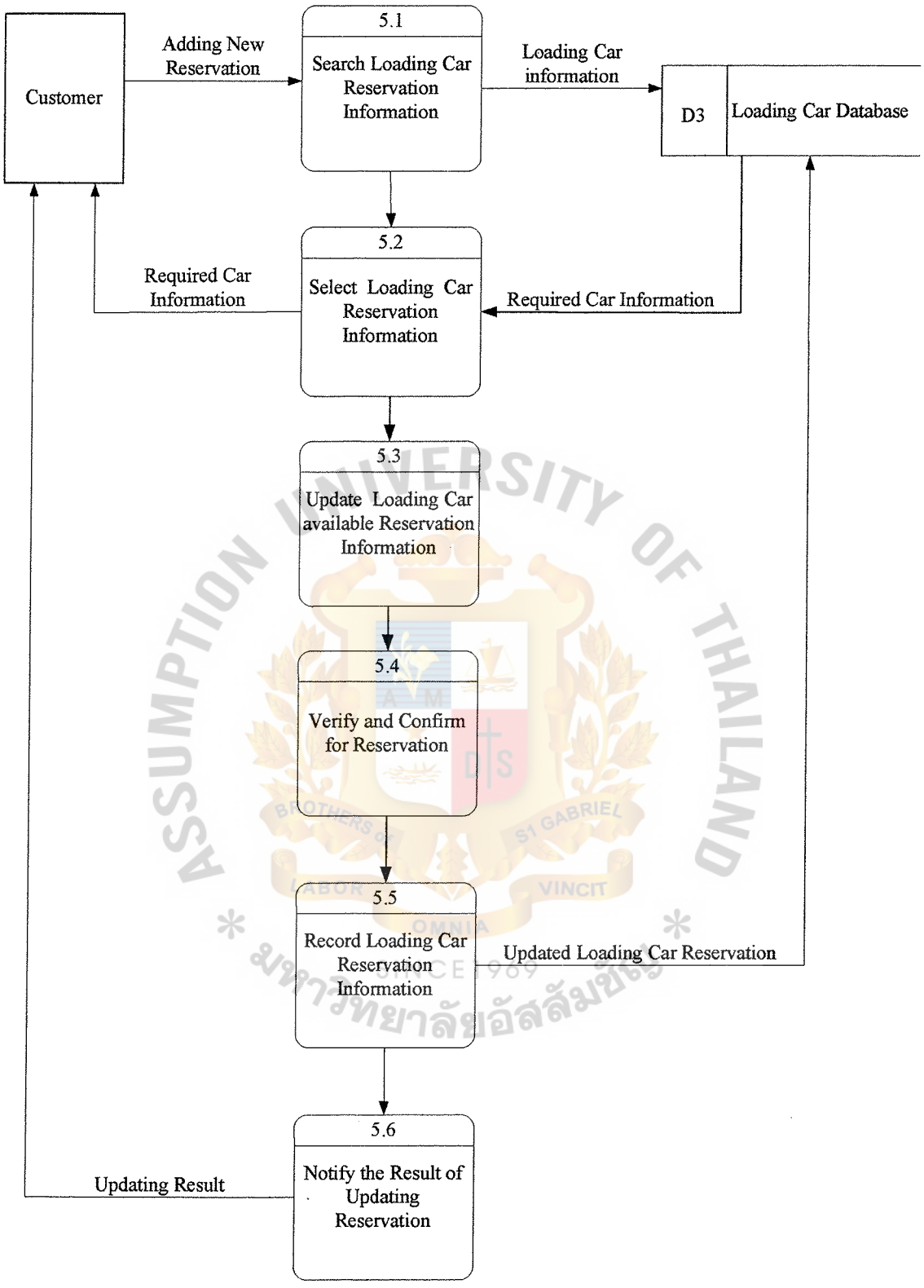

Figure F.8. Level 1 Data Flow Diagram Loading Car Reservation Information.

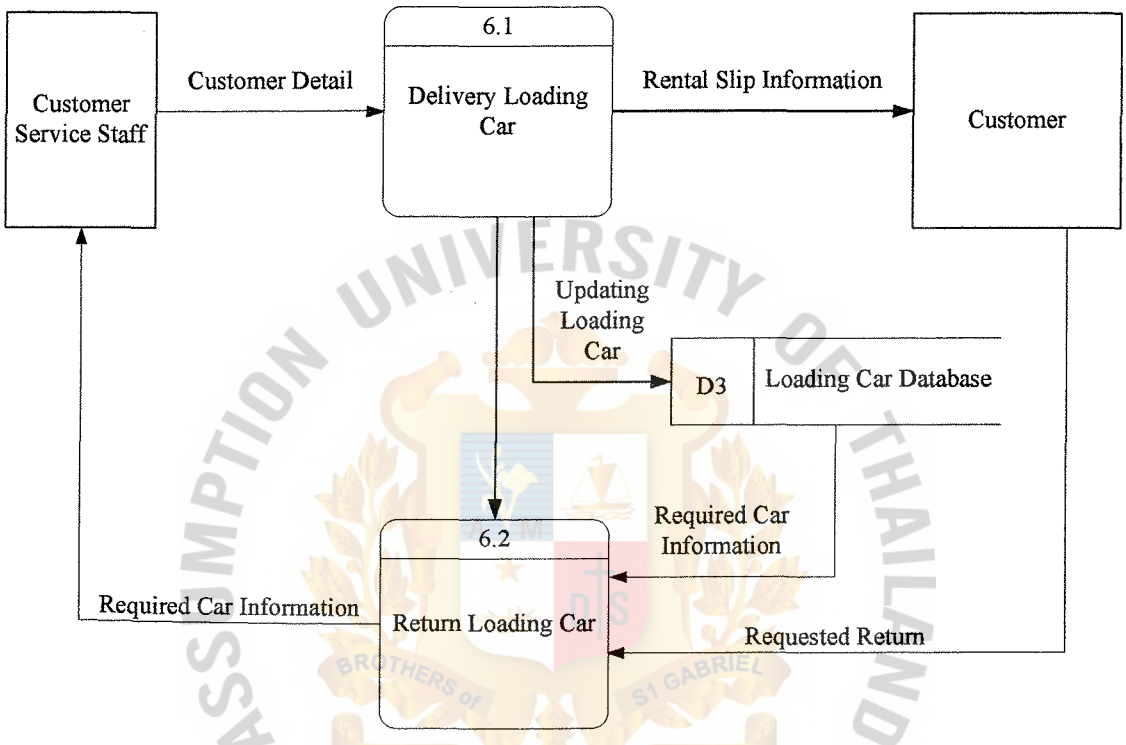

Figure F.9. Level 1 Data Flow Diagram of Delivery and Return Loading Car.

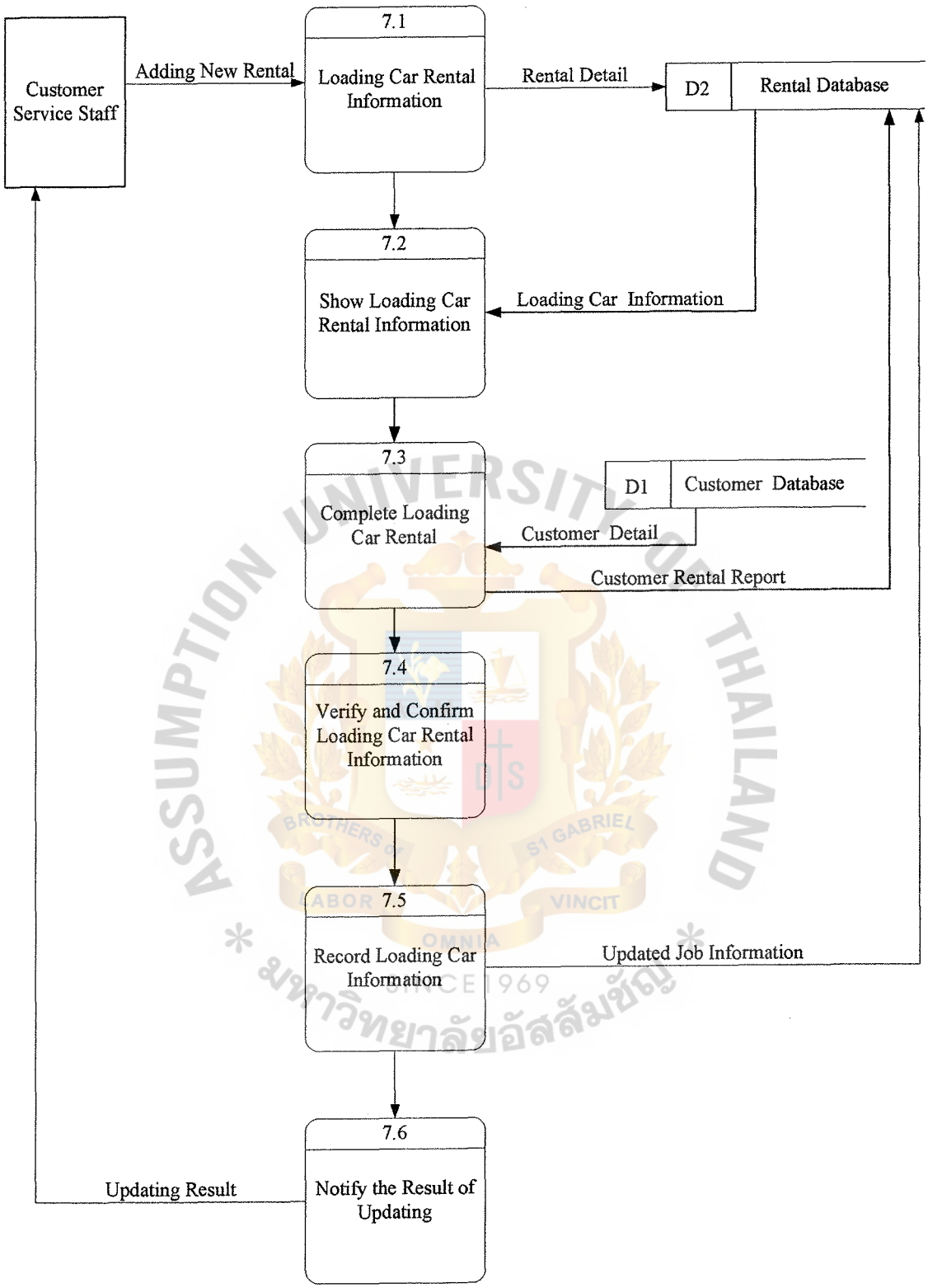

Figure F.10. Level 1 Data Flow Diagram of Loading Car Rental Information.

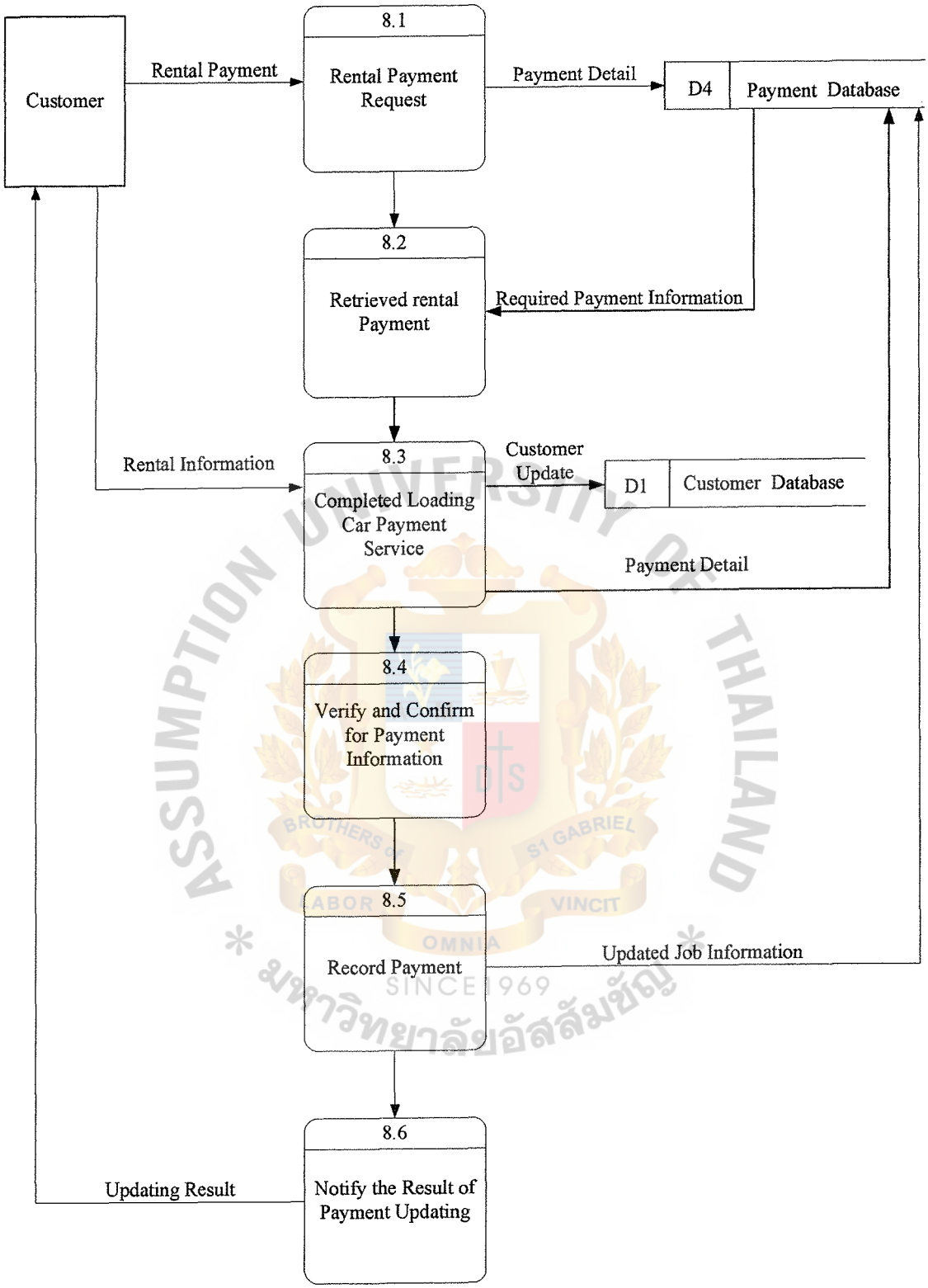

Figure F.11. Level 1 Data Flow Diagram of Payment Loading Car Information.

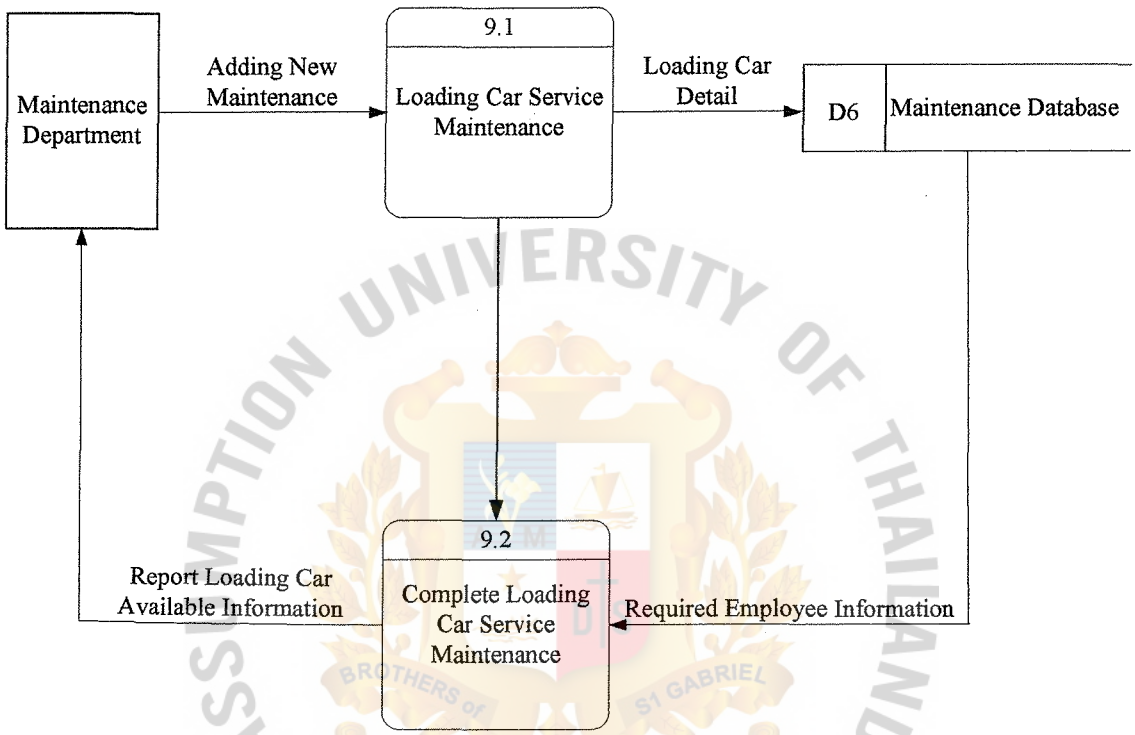

Figure F.12. Level 1 Data Flow Diagram of Loading Car Maintenance information.

BIBLIOGRAPHY

1. Alvin A. Arens. Auditing.. Prentice Hall International, Inc., 2000.

2. Banfield, Paul, jt. and Joy-Matthews, Jennifer, jt. Human Resource Development. Second Edition. London : Kogan Page, 2000.

3. Bull, Malcolm. Systems Development Using Structured Techniques. First Edition. Chapman and Hall., 1989.

4. Judith W. Kincaid. Customer Relationship Management. First Edition. Hewlett-Packard Company, 2003.

5. Korth, F. Henry and Abraham Slberschatz. Database System Concepts. First Edition. McGraw-Hill, 1991.

6. Mueller, John Paul. Visual Studio 6 : the Complete Reference. First Edition. McGraw-Hill, 1999.

7. O'Brien, James A. Management Information Systems. Third Edition. McGraw-Hill, 1996.

8. Ozkarahan, Esen. Database Management : Concepts, Design and Practice. First Edition. Prentice Hall, 1990.

9. Papazoglou, M. Valder. Relational Database Management : A Systems Programming Approach. First Edition. Prentice Hall, 1989.

10. Post, Gerald V. Database Management Systems : Desinging and Building Business Applications. First Edition. McGraw-Hill, 1999.

11. Pressman, Roger S. Software Engineering. A Practitioner's Approach. First Edition. McGraw-Hill, 1998.

12. Ron Weber. Informaiton Systems Control and Audit. First Edition. Prentice Hall International, Inc., 1999.

13. Tillmann, G. A Practical Guide to Logical Data Modeling. Second Edition. McGraw-Hill, 1993.

14. Vasta, Joseh A. Understanding Database Management Systems. Second Edition. Wadsworth, 1989.

15. Whitten, Jeffery L., Lonnie D. Dentley and Kevin C. Dittman. System Analysis and Design Methods. Sixth Edition. McGraw-Hill, 2004.