



Automobile Service Information System for  
Autotire Limited Partnership

by

Ms. Nampetch Gadetragoon

A Final Report of the Six-Credits Course  
CS 6998 - CS 6999 System Development Project

Submitted in Partial Fulfillment  
of the Requirements for the Degree of  
Master of Science  
In Computer Information Systems  
Assumption University

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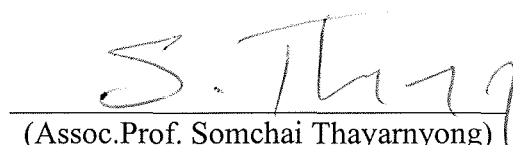
March 2002

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## ABSTRACT

Nowadays, the society has greatly changed as a result of changing lifestyle of human beings. Time is a very important factor, which affects human life. People have to work against time and have to complete more jobs in shorter time with higher efficiency. Human beings have always been trying to invent something to make their life more comfortable. One of such inventions is computer technology.

Service business of today has to focus on maximizing customers' satisfaction in shorter period of time. Not only expert mechanics are required to have good skills, the management also requires a well-organized flow of information to support decision-making. Information technology can be used to gain the competitive advantage in the global market. The existing Automobile Service Information System of Autotire Limited Partnership uses the combination of manual and computerized operations. Miscommunication and misunderstanding among personnels do occur frequently. In addition, data redundancy is one of the major concerns to the company since it is hard to keep track of existing customers information. Data redundancy often occurs when data is updated, deleted, or inserted by each individual department. Many administrative staffs are required to maintain the existing system, which are error-prone and requires a high maintenance cost.

In an attempt to improve Automobile Service Information System, database management system together with friendly user interfaces are incorporated into the proposed computerized system. As a result the number of staffs, operating costs, and office supply costs are reduced dramatically.

## ACKNOWLEDGEMENTS

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## **I. INTRODUCTION**

### **1.1 Background of the Project**

The combination of manual and computer system on the service operation of Autotire Limited Partnership has created the difficulties and complicated in the communication among the personnel in the shop. For example, when the mechanics receive order lists from the officers, they may wrongfully be misleading and misunderstanding in the items because the order lists are prepared in handwriting format. The mechanics may replace another item, which part number or part name is likely similar. Moreover, they may even replace the spare parts to another customer's car, which is not corresponded to the one who is ordered because the license plate of that car is very similar to one another. These examples are odd, but it is really happened if the mechanics have to serve many customers at a time, and do not carefully check the information that they receive from the personnel before they perform the services.

Next, the database of the customers, and spare parts are not well designed, managed and controlled, therefore the data redundancy is occurred in the system. The management of Autotire Limited Partnership often has a hard time to keep track on the customers, and it is quite complicated to explore the historical of the customers. In addition, prices of the spare part are varies and are subject to be changed corresponding to the demand on the market, and suppliers at the period of time. The system that Autotire Limited Partnership uses to support this function is not able to fulfill this activity. As a result, when customers request for the quotation, the personnel cannot respond at once since the price is fluctuated, and set by the management according to the market price. Therefore, Autotire Limited Partnership is required a good system to support daily activities. Likewise, the database of the new system must allow the

management to control, and manage the database effectively. Otherwise, the management, and customers would spend more time during the services. It is time-consuming.

According to the partial computer system, the problem would be defined in term of the followings:

- (1) The difficulties of checking whether the customer's record is already existed or not. Data redundancy is possibly occurred, and tracing the customers is difficult if new promotion is launched.
- (2) The price of spare parts is varied, and the current system cannot support the management in order to determine the prices of the spare parts. So, it leads to profit loss for Autotire Limited Partnership.
- (3) For the manual system, the mechanic may misunderstand which part is required to repair. It would consume time and inconvenience for them.
- (4) Not enough information for the management to make the right decision, and issue new policy in order to invest and to expand the business.
- (5) High operation cost because it requires operation to check and confirm repair.

## **1.2 Objectives of the Project**

The Automobile Service Information System is developed to generate all historical information of serviced customers, insert, update and delete customers' record. The records are automatically stored and retrieved in the database by the officers for further activities. Meanwhile, new system should be able to calculate the quotation for customers, and it must support decision-making for the management.

The objectives of developing the Automobile Service Information System for Autotire Limited Partnership are as follows:

- (1) To reduce data redundancy by developing a good database schema that can support current and future changes.
- (2) To improve the processing time with accuracy information for mechanic to serve customers.
- (3) To reduce the operation costs with computerized system by sharing the resources with other sections of the shop; therefore, Autotier Limited Partnership can reduce the cost of hard copy and less time-consuming to check availability of the spare parts.
- (4) To give the accurate information for management to make the right decision.
- (5) To increase the number of service rate per day while maintaining high quality services.

We attempt to design the data file system that is very useful and practical in the business. The design that we have created can improve the performance easily. However, the basic design of the system is very significant to lead to the next level of the development.

### **1.3 Scope of the Project**

The project is covered with major parts of the facilities and repair information, which can be described as follows:

- (1) Customer Information should be accurate and unique for each customer, to provide the facilities for officer to search by categories of customer's information and service information.
- (2) Repair information should be passed to the mechanic in order to estimate the real situation for reparation. Furthermore, the mechanic must be able to correct the repaired items if necessary. If changing the items are more

suitable, and fits to the customers' requirements, the mechanic must change the items in the order list and place it back to the officer to determine the quotation for customers.

- (3) Spare part should have unique code, and description for Automobile Service Information System to retrieve information, and to check part's availability and part's price.

#### **1.4 Deliverables**

The deliverables of the project can be identified as follows:

- (1) Data Modeling (ER Diagram)
- (2) Process Modeling (Context Diagram, Data Flow Diagram)
- (3) System Specification (Hardware and software specification)
- (4) Cost Benefit Analysis (Payback Period, Net Present Value)
- (5) Input Design (Input Screen of proposed system)
- (6) Output Design (Report from proposed system)
- (7) Structured Design (Structured Chart)
- (8) Process Specification (Detail of each process of proposed system)
- (9) Data Dictionary

#### **1.5 Project Plan**

A project plan of the Automobile Service Information System is given in Figure

1.1.

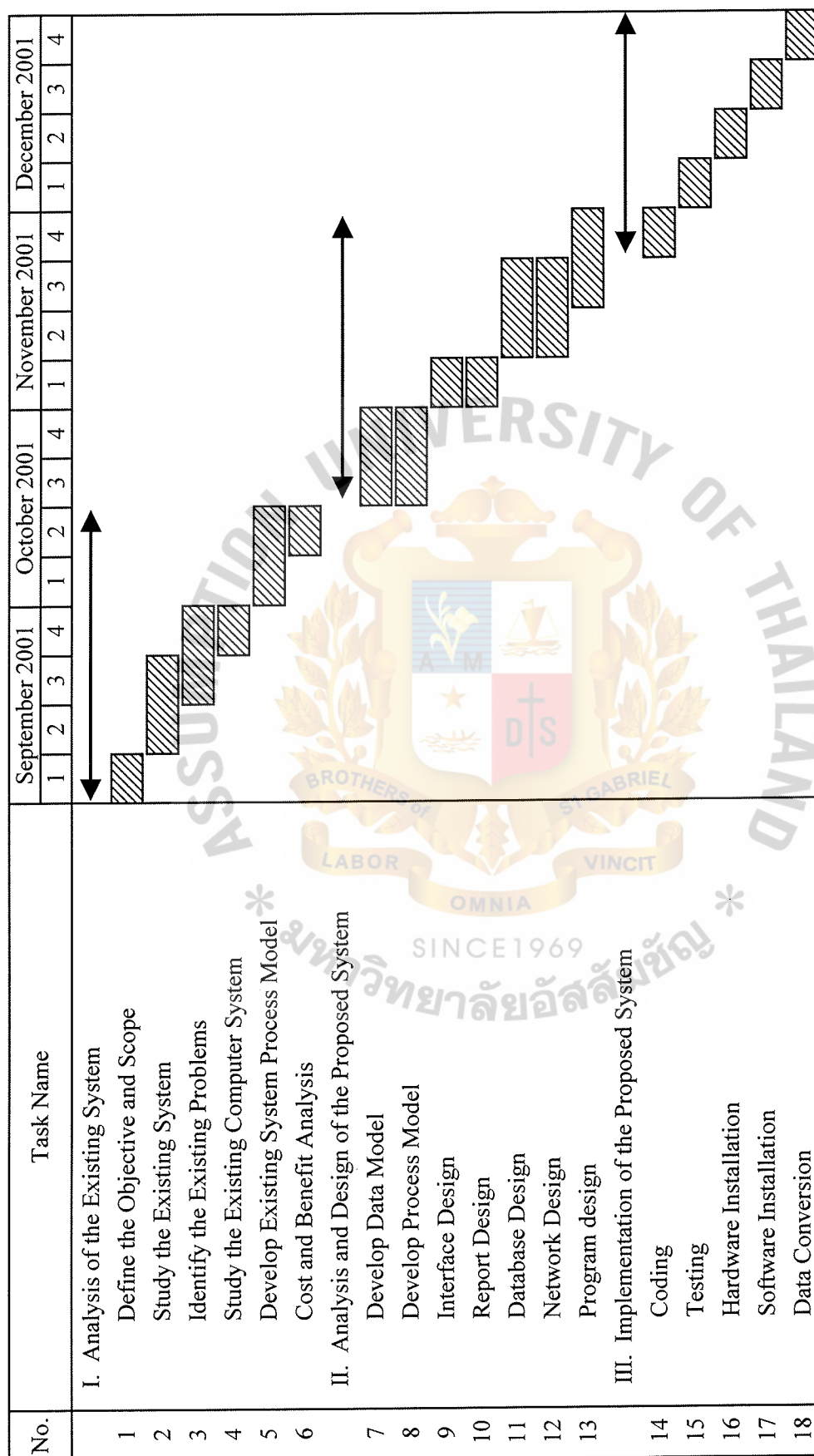


Figure 1.1. Project Plan for Automobile Service Information System.

## II. THE EXISTING SYSTEM

### 2.1 Background of the Organization

Autotire Limited Partnership is an auto parts service garage. Besides, the body shop, Autotire Limited Partnership is providing the services in examining and repairing such as wheels, engine repair, shock absorber, accessories, and suspension to customers. Mr. Kowit Limratanasaran has founded the company in 1998.

At present the shop has four departments, which are Account and Finance, Mechanic, Warehouse, and Management. Accounting and Finance is responsible for accepting customer requests, issuing the bills, preparing reports, claim services, and managing the account of the shop. As a mechanic, he is person who responsible to check and repair the customers' cars, there are eleven mechanics in the shop at this moment. Next, stock of the spare parts and other accessories are controlled, and managed by two storekeepers. Finally, management controls the shop, quotes the prices of all parts and accessories that are available in the shop. Management is also responsible for approving the order and purchasing of the parts and accessories whenever the safety stock is met.

However, the obstacles of the shop are lacking of proper communication between departments, manual system is applied such as filing, recording, and sending repaired item lists. Moreover, the data redundancy of the spare part records in the warehouse is also the major problem. For example, part number or code must be assigned to each part by storekeepers. New code will be generated to every single part category and type. Nonetheless, it is possible that one single part category may be assigned the code twice, which is double count if all the records are kept in hardcopy, and manual system is applied. Consequently, data redundancy and error are unintentionally occurred.

Thus, new system is required to eliminate the errors that may occur in the business, haste the processes, and originate accuracy. Figure 2.1 illustrates the basic structural organization of Autotire Limited Partnership. There are four major departments within this partnership.

(1) Management

The manager of Autotire Limited Partnership, Mr. Kowit Limratanasaran, is responsible for the management, which takes care of planning, managing and organizing the shop. Enormous amounts of related data is needed to support the decision-making.

(2) Warehouse

This department provides the auto parts to the specialist or mechanic whenever it is requested. Its function is keeping auto parts in a safe place, issuing purchasing orders, receiving bills of purchase, and accepting purchased auto parts and accessories from the supplier.

(3) Account/Finance

Account/Finance is mainly deal with paper work such as receipts, invoice, car records, customer records, and all major reports to the management.

(4) Mechanic

Mechanics mostly coordinate with storekeepers in the Warehouse, and the officers in Account/Finance department. Mechanic must receive the order lists from the officer before they can request for available spare parts from Warehouse in order to replace non-functional devices. After the repair service is done, the list of spare parts, and units used for replacement will be forwarded to Account/Finance as a turnaround document.

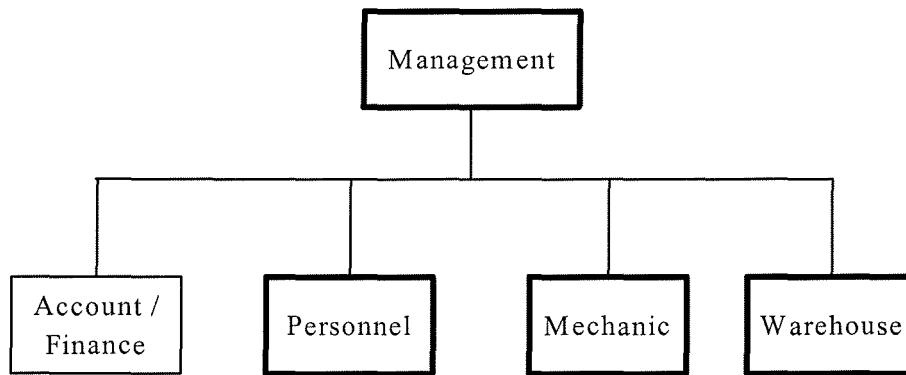


Figure 2.1. Organization Chart of Autotire Limited Partnership.

## 2.2 The Existing Problems and Areas for Improvement

The existing problems of the legacy system of Autotire Limited Partnership are as follows:

### (1) Loss of Important Data

Difficulty of checking the customer's record whether it has already existed or not. Data redundancy may occur, and it also difficult to trace off customer if new promotion is launched.

### (2) Instability of Price

Prices of the spare parts are fluctuated, and inconsistent because the demand in the market during the period of time. Therefore, the management is the one who responsible to quote the prices of all parts and accessories.

### (3) Time Consuming

For the manual system, the mechanic may misunderstand which part is needed to repair because the order lists are prepared in handwriting format. Mechanic may waste their time finding the corrected order lists with the officers. It is time consuming and inconvenience for them.

(4) Inefficient Data

Inaccuracy and lack of information to support the management in decision making in order to launch new policy, promotion to support the sales, and investment on new shop.

**Areas for Improvement**

The areas for improvement of the systems can be defined as changes that will result in incremental yet worthwhile benefits. The computerized system must be implemented to three major departments (Account/Finance, Warehouse, and Management in order to improve the system, and increase the benefits for Autotire Limited Partnership according to the missions, and strategic planning. The followings are the areas that must be improved.

- (1) Reducing errors in data input to improve the accuracy of information and data integrity.
- (2) Speeding up the processes to reduce time and documentation.
- (3) Not only reducing workload of the officers, and mechanics by using a computerized system, but it also reduces misunderstanding and miscommunication among them.
- (4) Improving the quality of services, service rate, and response time serving the customers. Quotation is estimated more precisely, improving the quality of services creates good will to the customers.
- (5) Increasing the profits from the efficient used of data, and reduce the costs by cutting unnecessary activities.

## 2.3 The Existing Computer System

Before we start designing new system, first we have to understand clearly about the perception of the existing system as a whole. Then, studying in the details of the existing system from the documentation. This is one of the examples of the requirement discovery processes. Requirement discovery of the existing system would provide us what the inputs are, what the processes do, what the throughputs and outputs are, and where the outputs go. In addition, we may need to learn more about the network of the existing system. After gathering all the information needed, analyzing the existing system is the next major concerns. We are able to identify the problems and find the solution from this phase. To solve the problems that we have learnt from the analysis phase, we must apply new technology and redesigning the control flow of the data and processes according to the functional and nonfunctional requirements from the users that would bring us to the proposed system. During the requirement analysis, we may need to perform the feasibility analysis of the proposed system whether the proposed system is worth enough to invest or continue. These are the advantages of revising the existing system. Therefore, in this section the existing system of Autotire Limited Partnership would be examined and decomposed into details. The following diagrams will be performed to help us understanding the existing system clearly. Context Data Flow Diagram, Functional Decomposition Diagram, and Data Flow Diagram. However, we may not be able to study the existing system if we develop new system from scratch. Therefore, using other fact-finding techniques to gather the functional requirement is necessary, and it is depended on the requirement of the stakeholders.

### 2.3.1 The Process Modeling

The process modeling is created to show how the data is captured and used (data in motion) represented by using data flow diagrams. The context diagram is constructed

to establish the initial project scope. It depicts the system as a whole in correlation with its environment that are the “external agents” involved. The context diagram of the current system is shown in Figure 2.2.

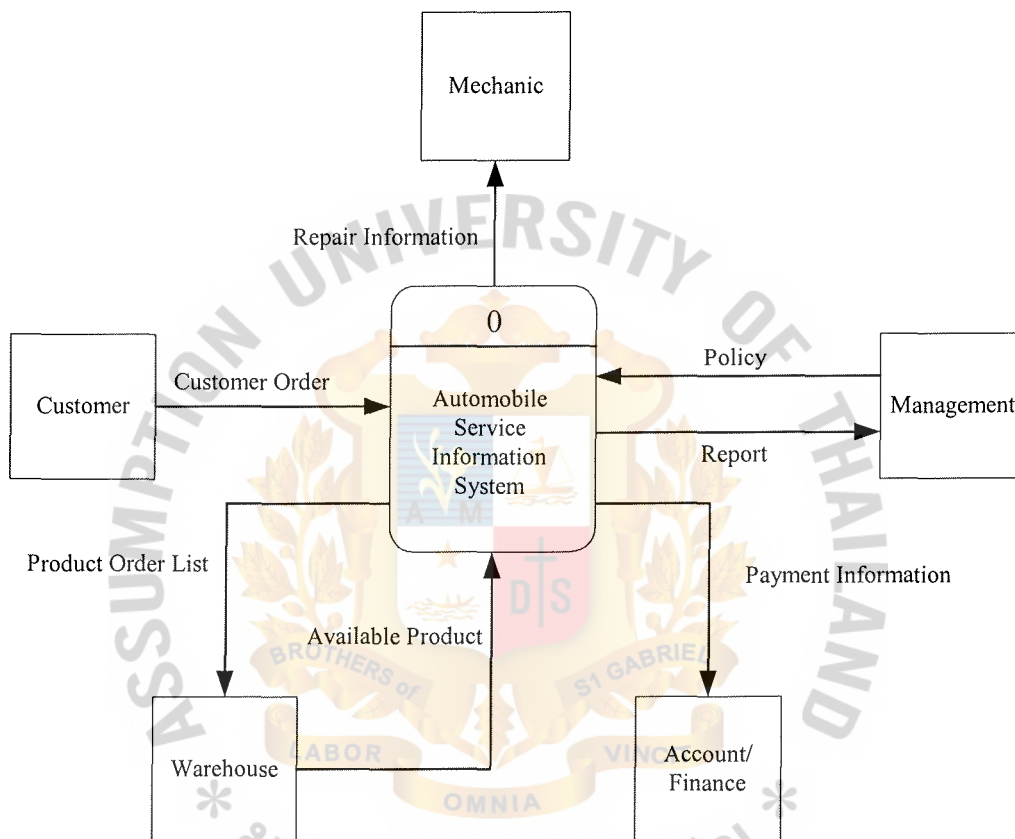


Figure 2.2. The Context Diagram of the Existing System.

The existing system is composed of five major external agents. Whenever a customer walks in, an officer would be given the problems, which are occurred to the customer's car. Customer is required to give the information in details to the officer in order to inform the management, and assigned the mechanic. Mechanic will check the car for the customer and what is needed to repair. Then, report back to the officer to quote the prices for the customer. If the officer has already informed the price of that

part by the management, the estimation is started right away. If price of some parts and accessories are not informed to the officer, he or she needs to ask the management to quote the price. Price quoting is approximately calculated, and forwarded to the customer. The reason why the officer needs to ask for price quotation from the management is that price of some parts and accessories are fluctuated through the year. Management is responsible to order parts and accessories needed to fill up the stock with First-In First-Out (FIFO) technique to control the inventory. It means that prices of the units per order are different upon the suppliers. If the management does not control the parts sold in the shop by comparing the purchasing prices with the parts in the inventory, they may lose more money since holding the part in the inventory also creates holding costs in the perspective of management.

If the customer approves to repair, the mechanic would start the repair process by getting the spare part from the warehouse. Next, before the officer issues the total charged in the bill with the management's approval, the officer needs to update the final repaired details from the mechanics in order to issue the bill. However, there is one exceptional issue in the existing system, some parts and accessories have a specific lifetime guaranteed such as 20,000 kilometers/tire, 3 months/shock absorber, customer may claim the defected part without any extra charge. Since the existing system is not computerized system, error is mostly found in this process because the records of parts are not well managed and designed. Consequently, the repaired part records, which the officer has and files in the computer, may not correspond to the part, which the mechanic has actually replaced to the customer. Sometimes they cannot even find the records of the claimed item, lost records.

The existing system of Autotire Limited Partnership uses less computerized system. There are only two machines and one printer, which are operated in the system,

and they are all standalone. Only the officer and management use the computer. Officer general keys in the parts information, calculate and issuing bills, transactions, and keeps the records of the customers. Management uses Microsoft Excel to record all major expenses, incomes, personnel, and print out as a report. Functional Decomposition Diagram and Data Flow Diagram of the existing system are shown in Figures 2.3 and 2.4 respectively.



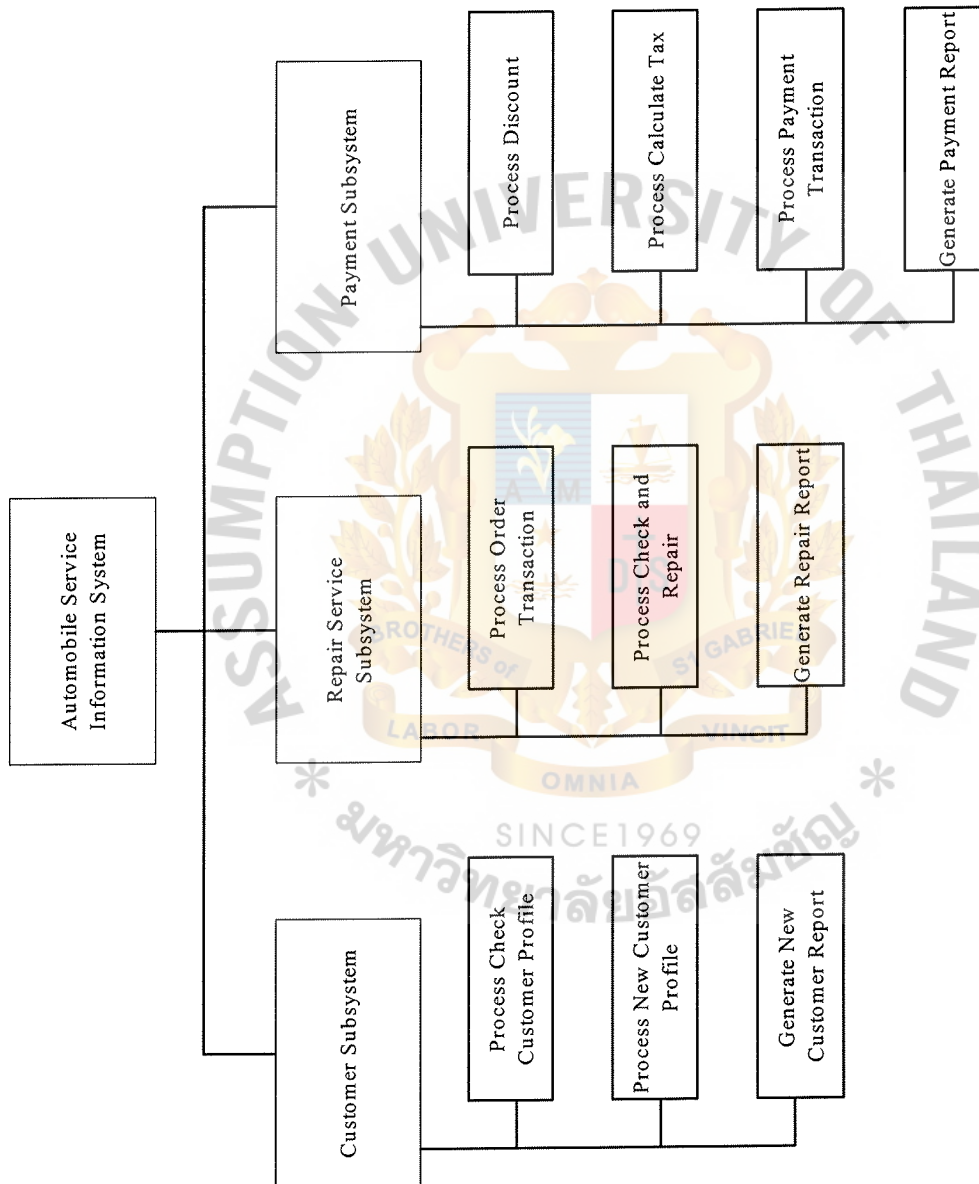


Figure 2.3. The Functional Decomposition Diagram of Automobile Service Information System.



### III. THE PROPOSED SYSTEM

#### 3.1 System Specification

According to the previous section, Autotire Limited Partnership is now requires an effective Automobile Service Information System, which can facilitate the various processes of spare part service, manage the customers' record, calculate and issue the bills in order to solve the issuing problems from the existing system. To achieve the specified objectives, the proposed Automobile Service Information System should have the following components:

- (1) The database applications for the new system can be easily obtained and there are varieties of choices to select from. The applications such as Microsoft Access and MS Window 2000 Server will lead to lower application expense than propriety application.
- (2) All the functions are displayed by GUI, which is ease of use and nice graphic display. The system user and system owner will be highly satisfied.
- (3) The DBMS at server supports and allows multi-user to retrieve information from database simultaneously. While the DBMS located at client site does not support multi users, there will be traffic jam at one terminal. And the work of DBMS will be more sophisticated to distribute the requested information from various users.

### 3.2 Requirement Analysis

The study of the existing system reveals many problems, such as high operating cost and human errors, which lead to the new requirement that is computerized system to handle the work more efficiently. After all problems are identified and evaluated, the business requirement for the new system can be summarized as follows:

- (1) The proposed system should facilitate the user in searching customers and car information, and should result in decreasing the response time to access information.
- (2) Users require input screen that allows direct manipulation of the graphical representation on screen, which can be accomplished with keyboard input and mouse. New users, who are unfamiliar with the computer environment can use new system easily.
- (3) To calculate the quotation for customer, the new system should provide the embedded arithmetic function within the system to generate calculation result automatically.
- (4) To encourage the paperless office, the proposed system should provide the requested report or document to the user by introducing real time information display screen.
- (5) The developed system should enhance the existing data entry process, and eliminate human data entry errors, through the use of electronic form by providing the verification mechanism for the input data from user.

To gain a better understanding of the new system requirement, the logical model is drawn to depict the system independent of any technical implementation. In this project, data modeling and process modeling techniques are used to document business

requirement, and serve as the logical design of the proposed system. The detail of each technique can be explained as follows:

### **Data Modeling**

It is a technique for organizing and documenting a system's data. The complete data model is usually implemented as a database. Typically, the data model is called an entity relationship diagram (ERD). There are three levels of entity relationship diagram: context data model, key-based data model and fully attributed data model.

The context data model includes only entities and relationships, but the attributes are excluded. The intent is to refine the understanding of scope, not get in to detail about the entities and business rules.

The key-based data model will eliminate nonspecific relationships, add associative entities, and include primary and foreign keys. This model will also include precise cardinalities and any generalization hierarchies.

The final data model, fully attributed data model includes all the remaining descriptive attributes and subsetting criteria. To identify all attributes, it requires the understanding of the data attributes for the system. These facts can be discovered through the study of the existing reports and documents to be the naming standard for attribution.

The complete entity relationship diagram of the proposed system is shown in Appendix A.

### **Process Modeling**

Process modeling is a technique for organizing and documenting the structure and the flow of data through the system's process and/or the logic, policies, and procedures to be implemented by a system's process. To construct the process model, the context diagram is firstly drawn to establish the initial project scope, which defines how the

developed system interacts with other systems and the business as a whole. Figure 3.1 illustrates the context diagram of the proposed system. Five external entities, which are Customer, Management, Supplier, Mechanic, and Warehouse, interact with the developed system.

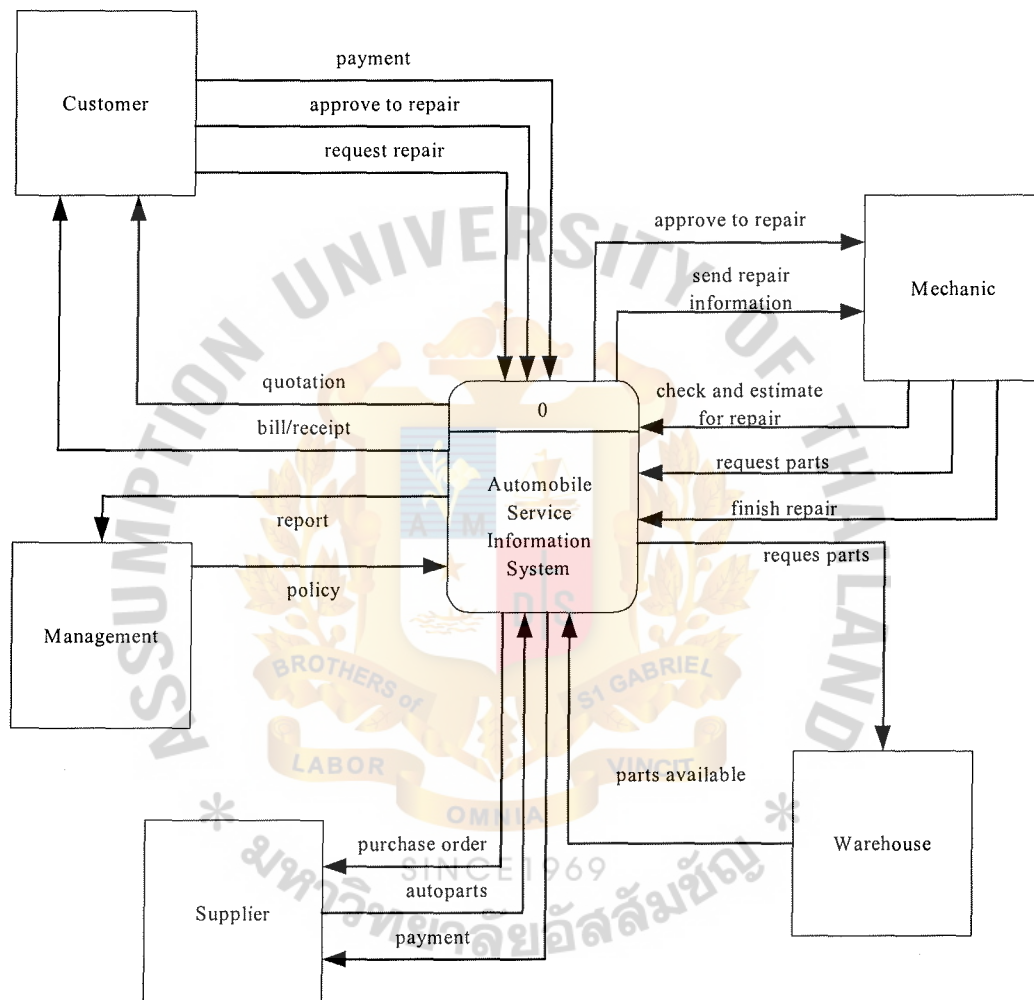


Figure 3.1. Context Data Flow Diagram of the Proposed System.

Next, the functional decomposition diagram is created to show the top-down structure of the system. This diagram also serves as an outline for drawing the data flow diagram. The functional decomposition diagram of the proposed system is shown in Figure 3.2, which compose five main subsystems. The higher-level data flow diagrams

(DFDs), which map the subsystems, sub-functions, and primitive events, are constructed the FDD.

The Automobile Service Information System consists of five major subsystems. They are customer subsystem, check and repair subsystem, payment subsystem, purchase subsystem, and report subsystem. Each subsystem comprises many sub-processes with distinct functionality. The brief description of each subsystem is explained as follows:

(1) Customer Subsystem

This subsystem performs inputting customer and car information into the system by ensuring that all required customer and car information will be stored into the system. If the record is already existed, the system will retrieve the information from the database. Otherwise, the system must generate new record, and report to the management level to support decision-making.

(2) Check and Repair Subsystem

This subsystem performs checking and reparation process, and generates quotation for customer. After receiving customer's approval, mechanic would start the reparation process. The parts are provided by warehouse.

(3) Payment Subsystem

This subsystem performs price calculation for customers that will include discount, tax and generates all required bills or receipts. Discount comes from the promotion of the shop that is automatically activated by the time trigger in the system.

(4) Purchase Subsystem

This subsystem performs ordering or purchasing from the supplier when the safety stock is met. The purchase order will send to supplier and the record will be kept in the database. After the order is delivered and received by the storekeepers, the information of the spare part in the database will be updated. Account and Finance department will make payment after receiving the invoice from the supplier.

(5) Report Subsystem

Account and Finance acts as an actor who initiate this subsystem. Issuing bills and receipt for customers after calculating the total charges, and generate detail or monthly report to the management.

The complete Data Flow Diagram of the proposed system is shown in Appendix B.

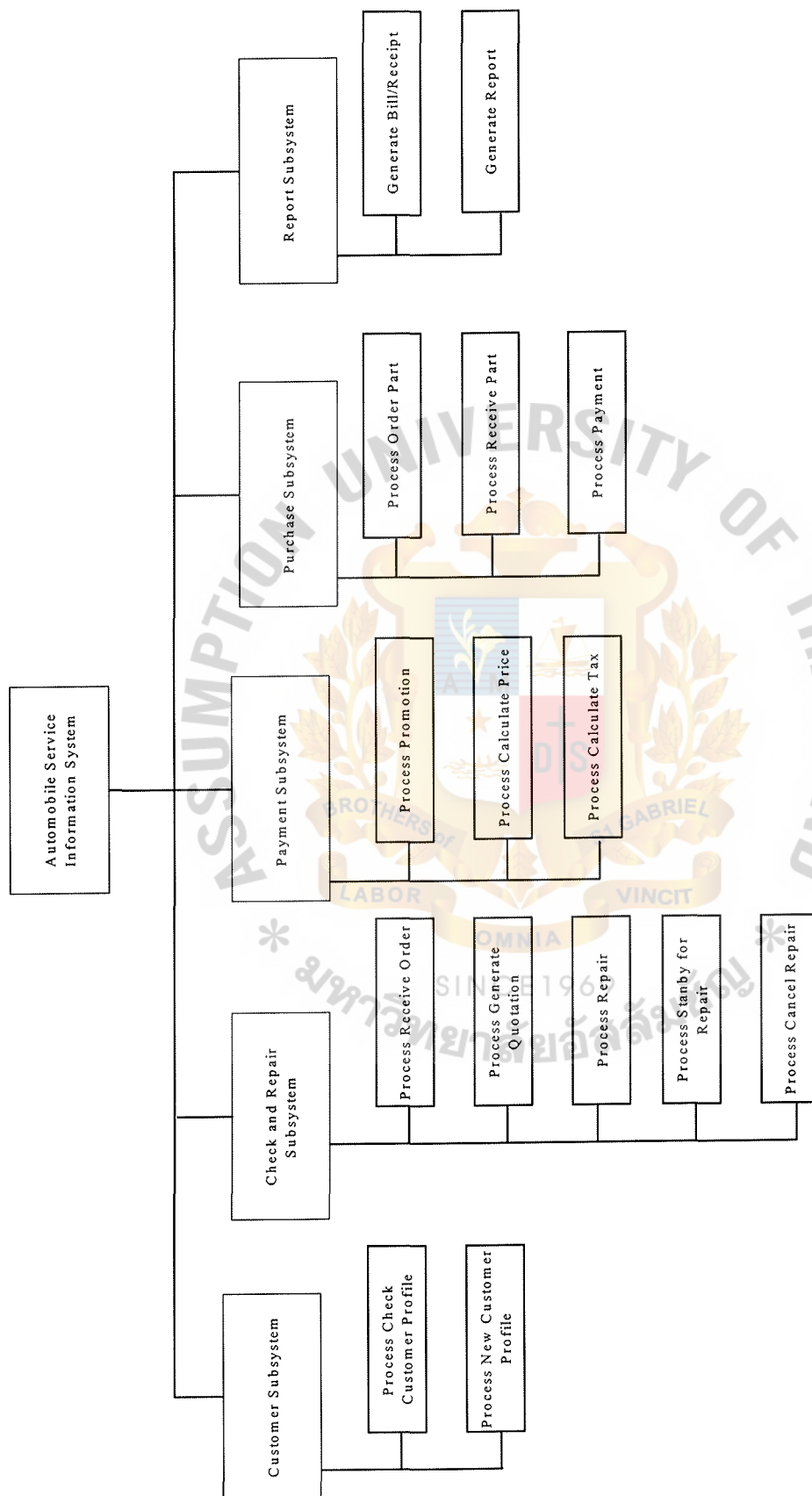


Figure 3.2. Functional Decomposition of the Proposed System.

### 3.3 System Design

The previous requirement analysis section primarily focuses on the logical aspects of a system, whereas system design deals with the physical implementation aspects of a system. Various design techniques are applied to construct the system to accomplish the objectives of the project. The details of each design technique can be explained as follows:

#### Candidate Solutions

Given the business requirement established in the previous section, the alternative candidate solutions can be identified from the idea and opinion of the development team and user. Along with reviewing the system specification, the three candidate solutions can be defined for the proposed system.

- (1) Candidate 1: Two-tier Client/Server Computing – Window 2000 Server and MS Access 2000 are used as Development Tool and Database Software respectively. This solution supports the multi-user environment and relational database technology. Database Server is used to follow the concept of two-tier Client/Server Computing. This candidate provides the best way of developing the new system by introducing the effective development tool and database software.
- (2) Candidate 2: Two-tier Client/Server Computing – MS Visual Basic 6.0 & MS SQL Server 7.0 MS Visual Basic 6.0 is used for application development, because of its rapid application development (RAD) environment. With its visual style, it makes application development easier. For DBMS, MS SQL Server 7.0 is chosen, because it is a standard DBMS for Windows platform.

- (3) Candidate 3: Two-Tier Client/Server Computing – This solution uses COT package Service Information from INETASIA Co., LTD. According to the COT package, there are some customs required to satisfy this solution. Window 2000 Server and MS Access 2000 are used in this candidate. The network architecture for this solution is the same as Candidate 1, which is Two Tier Client/Server Computing. This candidate can be implemented very quickly and easy application development.

In order to achieve the target, the alternative candidate solutions of the business requirements defined during systems analysis are identified. The amount of information describing the characteristics of any candidate solution may become overwhelming. A matrix is a useful tool for effectively capturing, organizing, and communicating the characteristics for candidate solutions. Three candidate solutions of the Automobile Service Information System are demonstrated by using a completed candidate matrix as shown in Table 3.1.

Table 3.1. Completed Candidate Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Portion of system computerized Brief description of that portion of the system that would be computerized in this candidate.	Fully supports all relevant units that are involved in rewards catalogue	Same as candidate 1.	COTS package Service Information from INETASIA Co., LTD. would be purchased and customized to satisfy customer service required functionality.
Benefits Brief description of the business benefits that would be realized for this candidate.	Application development is easy with fast learning time.	Powerful DBMS and application that perform tasks more efficiently.	Quickly implemented on client PC and easy application development.

Table 3.1. Completed Candidate Matrix (Continued).

Characteristics	Candidate 1	Candidate 2	Candidate 3
<b>Servers and Workstations</b> A description of the servers and workstations needed to support this candidate.	Server: Pentium III 800 MHz Client: Pentium II 500 MHz	Same as candidate 1.	Same as candidate 1.
<b>Software Tools Needed</b> Software tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages, etc). Not generally applicable if applications software packages are to be purchased.	Windows 2000 Server Windows ME MS Access 2000	Windows ME MS Visual Basic 6 MS SQL Server 7.0	Windows 2000 Server Windows 98 SE MS Access 2000
<b>Application Software</b> A description of the software to be purchased, built, accessed, or some combination of these techniques.	Custom Solution	Custom Solution	Package + Custom Solution
<b>Method of Data Processing</b> Generally some combination of: on-line, batch, deferred batch, remote batch, and real-time.	Database stored on server and processed on workstation	Database stored on server and processed on workstation	Database stored on server and processed on workstation
<b>Output Devices and Implications</b> A description of output devices that would be used, special output requirements (e.g., network, preprinted forms, etc.), and output considerations (e.g., timing constraints).	Laser and Dot Matrix Printer (Network Printer)	Same as candidate 1.	Same as candidate 1.
<b>Input devices and Implications</b> A description of input methods to be used, input devices (e.g., keyboard, mouse, etc), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs).	Keyboard & Mouse	Keyboard & Mouse	Keyboard & Mouse
<b>Storage Devices and Implications</b> Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used, how much storage capacity would be needed, and how data would be organized.	MS Access with 40 GB storage capacity	MS SQL Server DBMS with 40 GB storage capacity	Same as candidate 1.

After alternative candidate design solutions have been identified, each candidate must be analyzed for feasibility. It should not be limited to costs and benefits, but follow to these four sets of criteria.

- (1) Technical feasibility: Is the solution technically practical?
- (2) Operational feasibility: Will the solution fulfill the user's requirement?
- (3) Economic feasibility: Is the solution cost-effective?
- (4) Schedule feasibility: Can the solution be designed and implemented within an acceptance time period?

The feasibility analysis is performed on each individual candidate regardless to the feasibility of other candidates in order to evaluate the alternative candidate solutions according to their economic, operational, technical, and schedule feasibility as shown in Table 3.2 below. The full details of cost-benefit calculations (Economic Feasibility) are shown in Appendix C, which are all Candidate Cost tables, Payback table and graph, and Net Present Value (NPV) table.

Table 3.2. Completed Feasibility Matrix.

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
<u>Operational Feasibility</u> Functionality. A description of to what degree the candidate would benefit the organization and how well the system would work. Political. A description of how well received this solution would be from both user management, user, and organization perspective.	30%	Fully support user requirements in term of both functionality and business process.  Score : 95	Same as candidate 1  score : 95	This software package is not fully support all the requirement. It require technical people who has an expertise on creating a custom report.  score : 80
<u>Technical Feasibility</u> Technology. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate. Expertise. An assessment of the technical expertise needed to develop, operate and maintain the candidate system.	30%	Programmer is familiar with Microsoft products therefore this reduces development process.  MS Access 2000 for both Client and Server This solution is using MS-access, which has been understood by current system so it decreases software and training cost. Changing integrity rules of store application will be increase maintenance cost score : 90	Programmer is familiar with Microsoft products therefore this reduces development process.  Microsoft Visual Basic 6.0 and MS SQL Server 7.0 is a company standard for application development.  score : 75	The software can be modified to add custom report using Microsoft products, therefore this reduces development process. Require expertise on Crystal Report programming  score : 80
<u>Economic Feasibility</u> Cost to develop: Payback period (discounted): Net present value:  Detailed calculations:	35%	Approximately 161,080 baht Approximately 2.2 years Approximately 1,341,601.22 baht See Appendix D.  score : 90	Approximately 171,080 baht Approximately 2.3 years Approximately 1,329,950.68 baht See Appendix D.  score : 85	Approximately 196,080 baht Approximately 2.4 years Approximately 1,182,699.45 baht See Appendix D.  score : 80
<u>Schedule Feasibility</u> An assessment of how long the solution will take to design and implement.	5%	4 - 6 months  Score : 85	5 - 7 months  score : 80	3 months  score : 95
Ranking	100 %	92	85	81

Candidate 1 is selected as a target system. The main purpose of this target system is to fully support the user required functionality and system owner satisfaction. The best candidate will be selected base on the cost, benefits, payback period, return on investment, and net present value. The selected system should provide the benefits to the present Automobile Service Information System as following:

- (1) The applications for the new system can be easily obtain and there are varieties of choices to select from. The applications such as Microsoft Access will lead to lower application expense than propriety application.
- (2) All the functions are displayed by GUI, which is ease of use and nice graphic display. The system user and system owner will be highly satisfied.
- (3) No training is needed for the new system because all the information and system guide can be easily obtain or search for. In addition, the new system can be learn and understand by the users themselves. Thus, the suggested system will not have any additional training cost incurred.
- (4) The new DBMS is located at the server. It is capable to calculate and select the best way to draw information from database. Therefore, all data are retrieve very quickly from the database without any traffic problem.
- (5) The DBMS at server supports and allows multi-user to retrieve information from database simultaneously. While the DBMS located at client does not support multi user, there will be traffic jam at one terminal. And the work of DBMS will be more sophisticates to distribute the requested information from various users.

### Structure Design

Structure charts are used to graphically depict a modular design of a program. A structure diagram is a hierarchical, modular breakdown of a program. Between levels on the tree, there are links, with symbols to indicate the sort of information that is being passed back and forth. The structure chart is usually the end result of the activity known as structured analysis, in which the functions of a system are partitioned in a top-down manner.

Specifically, they show how the program has been partitioned into smaller more manageable modules, the hierarchy and organization of those modules, and the communication interfaces between modules. Structure charts; however, do not show the internal procedures performed by the module or the internal data used by the module. The output of structure design is partitioned data flow diagram and structure chart, which is illustrated in Appendix D.

#### Process Specification

The purpose of a process specification is to define what the system does to transform inputs into outputs. It provides the details of system processes in table format, which is easier to look at all related input, output, and relevant process than in a diagram. All specified tables, which are the process from the logical data flow diagram, are shown on Appendix E.

#### Data Dictionary

To support system design, data dictionary provides a list of terms and definition for all data items and data stores within the developed system. The data dictionary for both entity relationship diagram and data flow diagram is shown on Appendix F.

#### Database Design

Referring to the data model (ERD) in the previous section, it requires some additional processes, called data analysis, to convert the designed logical data model into implemented database. In data analysis, a normalization technique is used to transform all data in ERD into applicable database. The result of database design is database structure in table format, which is shown on Appendix G.

### 3.4 Hardware and Software Requirement

Microsoft has provided a lot of software, which can transform a normal Intel-based PC server, application server, and database server. The software is designed to integrate with Microsoft Windows 2000 Server, and is also packed together as Microsoft Back Office suite.

We have decided to use the Microsoft Back Office suite as the major software for our proposed MS Window 2000 based client/server system. Therefore the servers must have the hardware specification, which can run both Microsoft Windows 2000 Server and the other software in the suit. Hardware and software specifications for the proposed MS Access based server are shown in Tables 3.3 and 3.4 respectively.

Table 3.3. The Hardware Specification for the MS Window 2000 Based Server.

Hardware	Specification
CPU	Intel Pentium III processor
Cache Memory	256 KB or higher
Main Memory (RAM)	256 MB or higher
Hard Disk	40 GB or higher
CD-ROM Drive	48X or higher
Floppy Drive	1.44 MB
Network Adapter	Ethernet 10 Base-T
Display Adapter	SVGA card
Display	15" Monitor
Printer	Dot Matrix and Laser
UPS	1 KVA

Table 3.4. The Software Specification for the MS Window 2000 Based Server.

Software	Specification
Operating System	Microsoft Window 2000 Server
Database Server	Microsoft Window 2000 Server & MS Access 2000
Application Server	Microsoft Access 2000

In the MS Window 2000 based client/server system, the client machines will only have capacity, which are high enough to execute Microsoft Access. Therefore, in general standard, client machines should have higher hardware specification enough to run Microsoft Windows ME and Microsoft Office 2000 Professional. The hardware and software specifications for each client machine are shown in the Tables 3.5 and 3.6 respectively.

Table 3.5. The Hardware Specification for Each Client Machine.

Hardware	Specification
CPU	Intel Pentium II or higher
Cache Memory	256 KB or higher
Main Memory ( RAM )	128 MB or higher
Hard Disk	40 GB or higher
CD-ROM Drive	48X or higher
Floppy Drive	1.44 MB
Network Adapter	Ethernet 10 Base-T

Table 3.5. The Hardware Specification for Each Client Machine (Continued).

Hardware	Specification
Display Adapter	SVGA card
Display	15" Monitor

Table 3.6. The Software Specification for Each Client Machine.

Software	Specification
Operating System	Microsoft Windows ME
Application Software	Microsoft Office 2000 Professional Edition

Other than server and client machines, the connection cannot be established if we do not have network peripherals. The MS Window 2000 based client/server system, however, does not use any net work peripherals, which differs from any other general Local Area Network (LAN).

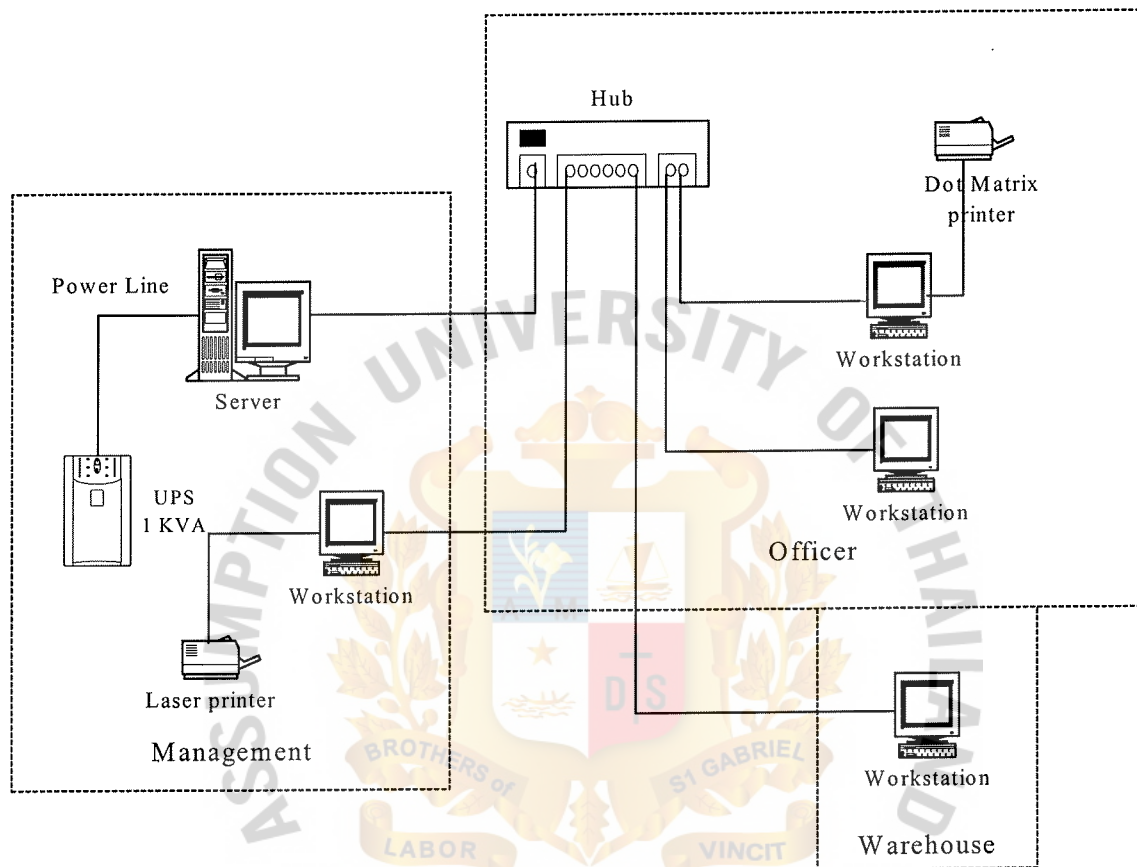


Figure 3.3. Network Configuration of the Proposed System.

### 3.5 System Cost Analysis

#### (1) Cost of Manual System

Table 3.7. Manual System Cost Analysis, Baht.

Cost Items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Desktop computer	2units@20,000	2,000	2,000	2,000	2,000	2,000
Dot Matrix Printer	1units@8,200	1,640	1,640	1,640	1,640	1,640
Total Fixed Cost		3,640	3,640	3,640	3,640	3,640
<u>Operating Cost</u>						
Shop manager	1person@25,000	25,000	27,500	30,250	33,275	36,603
Store keeper	2person@9,000	18,000	19,800	21,780	23,958	26,354
Front officer	3person@10,000	30,000	33,000	36,300	39,930	43,923
Mechanic (Trainee)	4person@8,000	32,000	35,200	38,720	42,592	46,851
Mechanic (Assistant)	4person@10,000	40,000	44,000	48,400	53,240	58,564
Mechanic (Supervisor)	3person@12,000	36,000	39,600	43,560	47,916	52,708
Total monthly salary Cost		181,000	199,100	219,010	240,911	265,002
Total annual salary Cost		2,172,000	2,389,200	2,628,120	2,890,932	3,180,025
<u>Office Supplies &amp; Miscellaneous Cost</u>						
Stationary	Per Annual	28,000	30,800	33,880	37,268	40,995
Office Supplier	Per Annual	16,300	17,930	20,620	23,712	27,269
Utility	Per Annual	84,000	92,400	106,260	116,886	128,575
Miscellaneous	Per Annual	24,000	26,400	29,040	31,944	35,138
Total Annual Office Supplies & Miscellaneous Cost		152,300	167,530	189,800	209,810	231,977
Total Annual Operating Cost		2,324,300	2,556,730	2,817,920	3,100,742	3,412,002
Total Manual System Cost		2,327,940	2,560,370	2,821,560	3,104,382	3,415,642

Table 3.8. Five Years Accumulated Manual System Cost, Baht.

Year	Total Manual Cost	Accumulated Cost
1	2,327,940	2,327,940
2	2,560,370	4,888,310
3	2,821,560	7,709,870
4	3,104,382	10,814,252
5	3,415,642	14,229,894
Total	14,229,894	-

(2) Cost of Computerized system

Table 3.9. Computerized System Cost Analysis, Baht.

Cost Items		Years				
		1	2	3	4	5
<b>Fixed Cost</b>						
Hardware Cost:						
Computer Server Cost	1set@125,000	25,000	25,000	25,000	25,000	25,000
Workstation Cost	4units@39,000	31,200	31,200	31,200	31,200	31,200
Laser Printer	1 Unit@11,800	2,360	2,360	2,360	2,360	2,360
Dot Matrix Printer	1 Unit@5,600	1,120	1,120	1,120	1,120	1,120
Hub (10/100 Mbps)	1Unit@5,500	1,100	1,100	1,100	1,100	1,100
UPS 1 KVA	1 Unit@11,500	2,300	2,300	2,300	2,300	2,300
Total Hardware Cost		63,080	63,080	63,080	63,080	63,080
Maintenance Cost:						
Total Maintenance Cost		-	-	18,000	16,200	14,580
Software Cost:						
Software Cost		20,000	20,000	20,000	20,000	20,000
Network Cost		18,000	18,000	18,000	18,000	18,000
Total Software Cost		38,000	38,000	38,000	38,000	38,000
Implementation Cost:						
Basic Training Cost		32,000	-	-	-	-
Set up Cost		28,000	-	-	-	-
Total Implementation Cost		60,000	-	-	-	-
Total Fixed Cost		161,080	101,080	119,080	117,280	115,660
<b>Operating Cost</b>						
People Ware Cost:						
System Analyst	6 months@25,000	150,000	-	-	-	-
Programmer	4 months@25,000	100,000	-	-	-	-
Network Specialist	1month@20,000	20,000	-	-	-	-
Shop manager	1person@25,000	25,000	27,500	30,250	33,275	36,603
Store keeper	1person@9,000	9,000	9,900	10,890	11,979	13,177
Front officer	1person@10,000	20,000	22,000	24,200	26,620	29,282
Mechanic (Trainee)	2person@10,000	24,000	26,400	29,040	31,944	35,138
Mechanic (Assistant)	3person@8,000	40,000	44,000	48,400	53,240	58,564
Mechanic (Supervisor)	4person@10,000	36,000	39,600	43,560	47,916	52,708
Total Monthly Salary Cost		154,000	169,400	186,340	204,974	225,471
Total Annual Salary Cost		2,118,000	2,032,800	2,236,080	2,459,688	2,705,657
Miscellaneous Cost:						
Stationary	Per Annual	21,000	23,100	25,410	27,951	30,746
Office Supplier	Per Annual	12,000	13,200	14,520	15,972	17,569
Utility	Per Annual	84,000	92,400	101,640	111,804	122,984
Miscellaneous	Per Annual	22,000	24,200	26,620	29,282	32,210
Total Miscellaneous Cost		139,000	152,900	168,190	185,009	203,510

Table 3.9. Computerized System Cost Analysis, Baht (Continued).

Cost Items	Years				
	1	2	3	4	5
Total Operating Cost	2,257,000	2,185,700	2,404,270	2,644,697	2,909,167
Total Computerized System Cost	2,418,080	2,286,780	2,523,350	2,761,977	3,024,827

Table 3.10. Five Years Accumulated Computerized Cost, Baht.

Year	Total Computerized Cost	Accumulated Cost
1	2,418,080	2,418,080
2	2,286,780	4,704,860
3	2,523,350	7,228,210
4	2,761,977	9,990,187
5	3,024,827	13,015,014
Total	13,015,014	-

(3) The comparison between computerized system cost and manual system cost.

Table 3.11. The Comparison of System Cost, Baht.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	2,327,940	2,418,080
2	4,888,310	4,704,860
3	7,709,870	7,228,210
4	10,814,252	9,990,187
5	14,229,894	13,015,014

Accumulated Cost, Baht

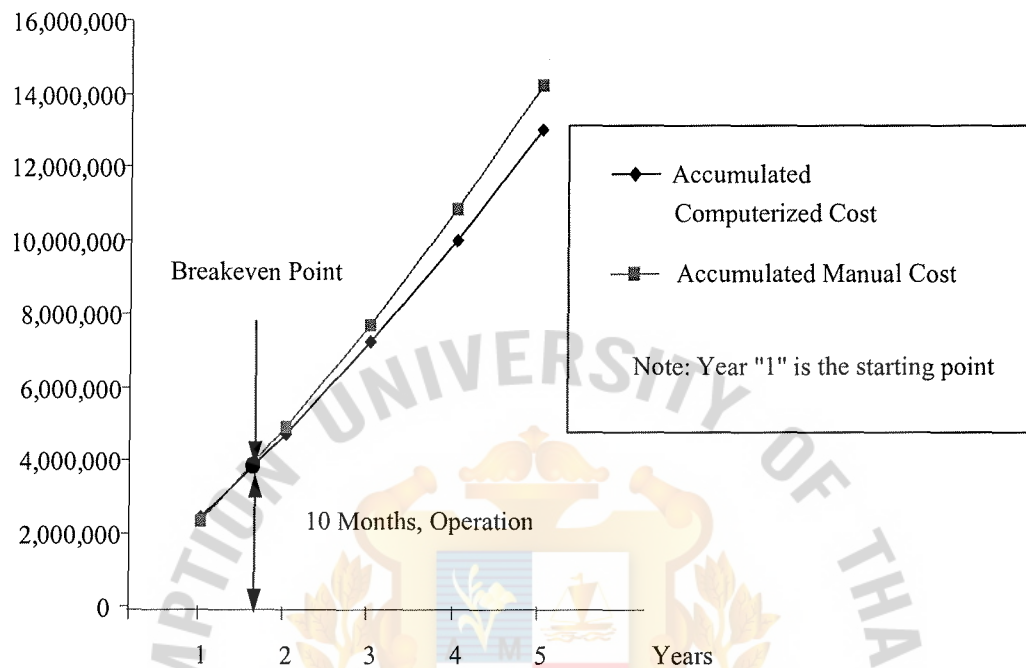


Figure 3.4. Cost Comparison between Manual and Proposed System.

## **IV. PROJECT IMPLEMENTATION**

### **4.1 Overview of Project Implementation**

System Implementation is the conversion process from a current manual system to the new computerized information system. The final design should be evaluated first by the users and management teams to guarantee that the new computerized system can meet the requirements and objectives, and then the other remaining processes will be performed. It is expected that the system implementation would take approximately six weeks. The duration may vary depending on the readiness of the staffs to use the new system. The processes of System Implementation are:

- (1) Software development
- (2) Hardware installation
- (3) Personnel training
- (4) Test Plan
- (5) Conversion
- (6) Documentation

### **4.2 Software Development**

Using Microsoft Access as DBMS develops the Automobile Service Information System. The computerized system is developed based on user friendly and the capability in making report. The system allows user to add, edit and delete the data and also search for desired data. In order to generate reports, the system will join tables in database file and make the calculation in the required field based on user and management requirements.

### **4.3 Hardware Installation**

In order to establish the computerized system, the company requires new File Server as shown in the Cost/ Benefit Analysis section in previous section. Four clients and one server need to be installed with LAN card so they can work in the network system in the proposed system.

### **4.4 Personnel Training**

User training course is an important process in the system implementation phase. The objective of training course is to make users understand, be familiar and able to use the program correctly. Training course should include computer concepts, functions of hardware and software, functions of the proposed system and how to use the system properly and efficiently. Users should be given the system manual, class lecture about the procedure and hands on experience on using new equipment. Furthermore, the programmer or system analyst when initially using the system also should supervise the users.

### **4.5 Test Plan**

After the program has been designed and installed, module testing, program testing and system testing are required to ensure that the new system are free from errors and can work well with the other systems in the company.

Module testing would help to check errors in program module. It can detect errors in coding and errors in logic. After finishing all module testing, program testing is used to check the program to verify the way the system works and to check whether each module can work together or not. System testing checks whether the proposed system can share data or work with the other manual systems properly, and whether the proposed system can work well on the operating system or not. When finishing all testing, the testing document plans and testing results should be filed as a benchmark.

Therefore, whenever the company does the testing again in the future, programmers can use benchmark as a reference. Moreover, security and recovery testing is tested to ensure that the system can protect unauthorized users from access into the system. If failure happens to the database, the system should be able to recover those data.

The effective testing of the program does not guarantee system reliability. Therefore, the test case should include the Input Validation, Functionality, and Access Control.

#### **4.6 Conversion**

Conversion is the process of changing from existing system to a new proposed system. The conversion process is set up based on the replacing concept. Since the existing system is the combination of manual and computer system. Users have to key in the data to create the database because the records from the existing system are not convertible.

#### **4.7 Documentation**

Documentation of the proposed system is separated into 2 documents. Firstly, user's guide or manual, which describes how to access and use the program, how to correct the problems and how to use interface screens. Secondly, is the flow of the system and data dictionary. Both documents can help the users whenever they need or get the problem when using the program and also can help programmer to develop and maintain the system.

## V. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

After the proposed system is implemented, and all the data is input in the database server, which is proved that there is no data redundant and consistent anymore, all reports can automatically be generated by the system. The number of unavailable spare parts is immensely reduced by querying the data from the database, and the storekeeper can order the spare parts at the moment when the system gives the user safety stock warning. Moreover, the alternate spare part information is also easily retrieved from the system. Hence, time that a mechanic spends for a service is reduced. Therefore, the rate of reparation services increase up to seven services per mechanic a day. Service orders that are recorded by the officers, and it can be automatically retrieved from the database without manual processing; therefore, the wrong input problem, which occurs by manual processing is eliminated. In addition, the customers' records are well organized and stored. It is easily to retrieve the records by the officers upon the demand of the customers and the management. Not only the data redundancy problems such as insert, delete, and update anomaly are minimized, but the flow of the data and the direction of the processes are also redesign to utilize the productivity (number of service hour per mechanic). Last but not least, time that each customer spends during the process is deteriorated. The overall performance and productivity of Autotire Limited Partnership are increased due to the implementation of the proposed system.

The following table is time spending comparison between the existing system and the proposed system.

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

Process	Existing System	Proposed System
Check Customer Profile	5 Minutes	1 Minute
Check and Repair	1 Hour 20 Minutes	40 Minutes
Payment Transaction	10 Minutes	4 Minutes
Generate Report	7 Minutes	1 Minute
Order Transaction	1 Hour 30 Minutes	10 Minutes
Total	3 Hours 12 Minutes	56 Minutes

The details of the operation time improvement can be summarized as the followings:

- (1) Check Customer Profile: The existing system spends 5 minutes average in checking the customers' profile. With the existing system, semi-computerized system, if the officer cannot find customer' record in the computer, he or she must look through the entire records of the customers in the hardcopies to ensure that customer' record does exist or not, which will take more than 5 minutes. Unless the officer can find the records, new record would be created, which will take another 5 minutes at least. The proposed system uses Client-Server approach as a solution to eliminate such problem. With one server, all the information of the customers is filed in the main memory. If the records are not found, then new record is created. It will take 1 minute to input new data through the graphical user interface form.
- (2) Check and Repair: This process in the existing system takes a lot of times since the mechanic needs to perform checking to find the cause of all non-

functional devices after a short brief from the customers. Moreover, after the mechanic find out the causes of the problems, and propose the solution, the officer must quote the price to the customers in order to start the reparation process. However, not all the prices of the spare parts and accessories in the shop are fixed, some of them are fluctuated. If the management discloses the price of the required spare parts, then the officer must be the one who must get the prices quoted. Hence, it would take more time. With the new system, all the prices of the spare part are saved on the server side, it is an on-line. The officer can easily retrieve the information and price quoted by the management, it would take less and less time in the operations.

- (3) Payment Transaction: The proposed system offers a better way to shortcut this process using GUI form for the officers to retrieve the information of the customers and replaced spare parts in order to speed up the process. It is shortened the time from 10 minutes with the existing system to 4 minutes with the new system.
- (4) Generate Report: Rather than spending 10 minutes to generate a report by the existing system, the officers can now spend just a minute to retrieve the information and generate a report for the management. With powerful feature and GUI embedded in the new system, it allows the officers to generate a report within three clicks.
- (5) Order Transaction: Existing system is not well design to support Autotire Limited Partnership to store the information of the inventory. Therefore, the officers have to count the number of the available parts and accessories every morning in order to check the stock. Any spare parts or accessories

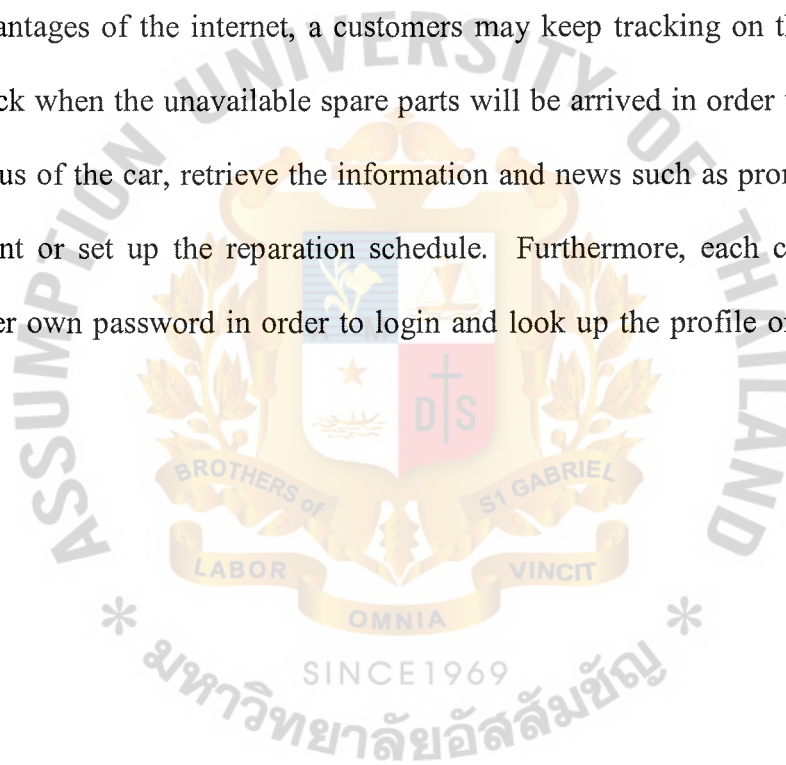
that are below the safety stock will be ordered from the suppliers. Consequently, Autotire Limited Partnership wastes 1 hour and 30 minutes approximately each morning. Applying the safety stock approach in proposed system making Autotire Limited Partnership easily keeps track on the inventory and make an order in advance before they are in low inventory.

## **5.2 Recommendations**

The proposed system is emphasized on the database management in order to minimize the redundancy, increase the speed of the service, utilize the workforce, and maximize the profits. With the computerized system, Autotire Limited Partnership must put more investment, and the balance sheet may turn out to be negative in the first couple years. Nevertheless, the return on investment would yield them more benefits in the long run after the payback period. Computerized system is also reduced the cost of Autotire Limited Partnership in the future.

However, the new system is not yet a completed system for Autotire Limited Partnership since it does not support purchasing, inventory, accounting, and levy. Therefore, after the new system is implemented, Autotire Limited Partnership should develop the new system that can support and cover all of the above functions. Furthermore, the future system should assist the accounting of the company to calculate the cash inflow, cash outflow, expenses, net income, and all other documents needed by the management. Giving the management a full report would help them in decision-making. Another function that the system should perform for accounting is calculating the levy or income tax by converting the data from the database in order to generate the report, which is submitted to the Revenue Department.

Finally, another way to increase the business core competency for Autotire Limited Partnership is using the internet. Nowadays, the internet is a powerful tool, which interconnect thousand of thousand networks together. It opens twenty four hours a day, seven days a week. Autotire Limited Partnership can promote their business on the internet, they can save a lot of money spending in mailing in order to keep in touch with the customers using an e-mail, and webboard. Meanwhile, they can use the internet as a gateway to gain more and more customers using the web-based application. With the advantages of the internet, a customers may keep tracking on the fixing car. They can check when the unavailable spare parts will be arrived in order to fix the car, check the status of the car, retrieve the information and news such as promotion, make an appointment or set up the reparation schedule. Furthermore, each customer may have his or her own password in order to login and look up the profile or history, and credit.





**APPENDIX A**  
**ENTITY RELATIONSHIP DIAGRAM**

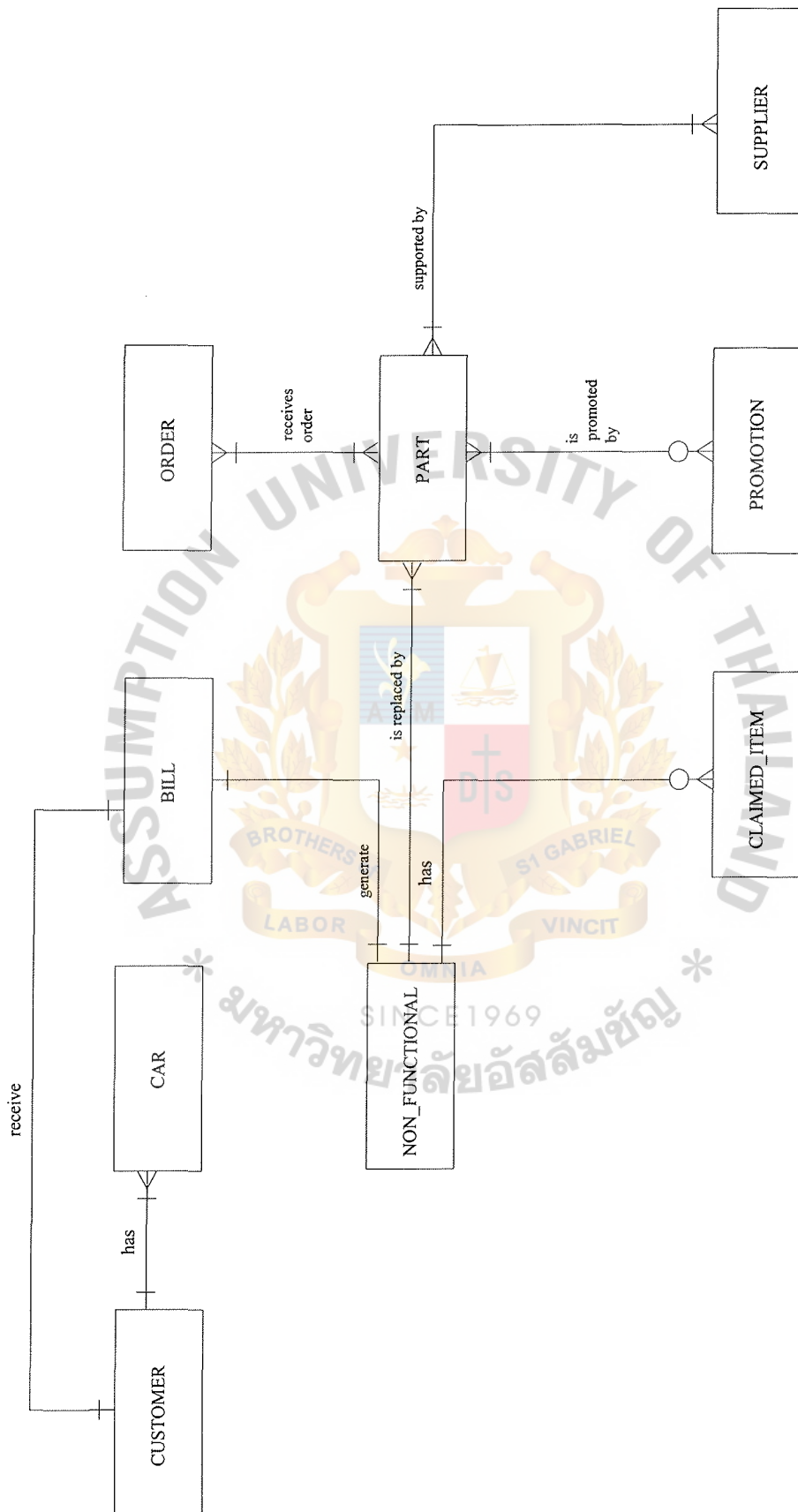


Figure A.1. Context Data Model of the Proposed System.

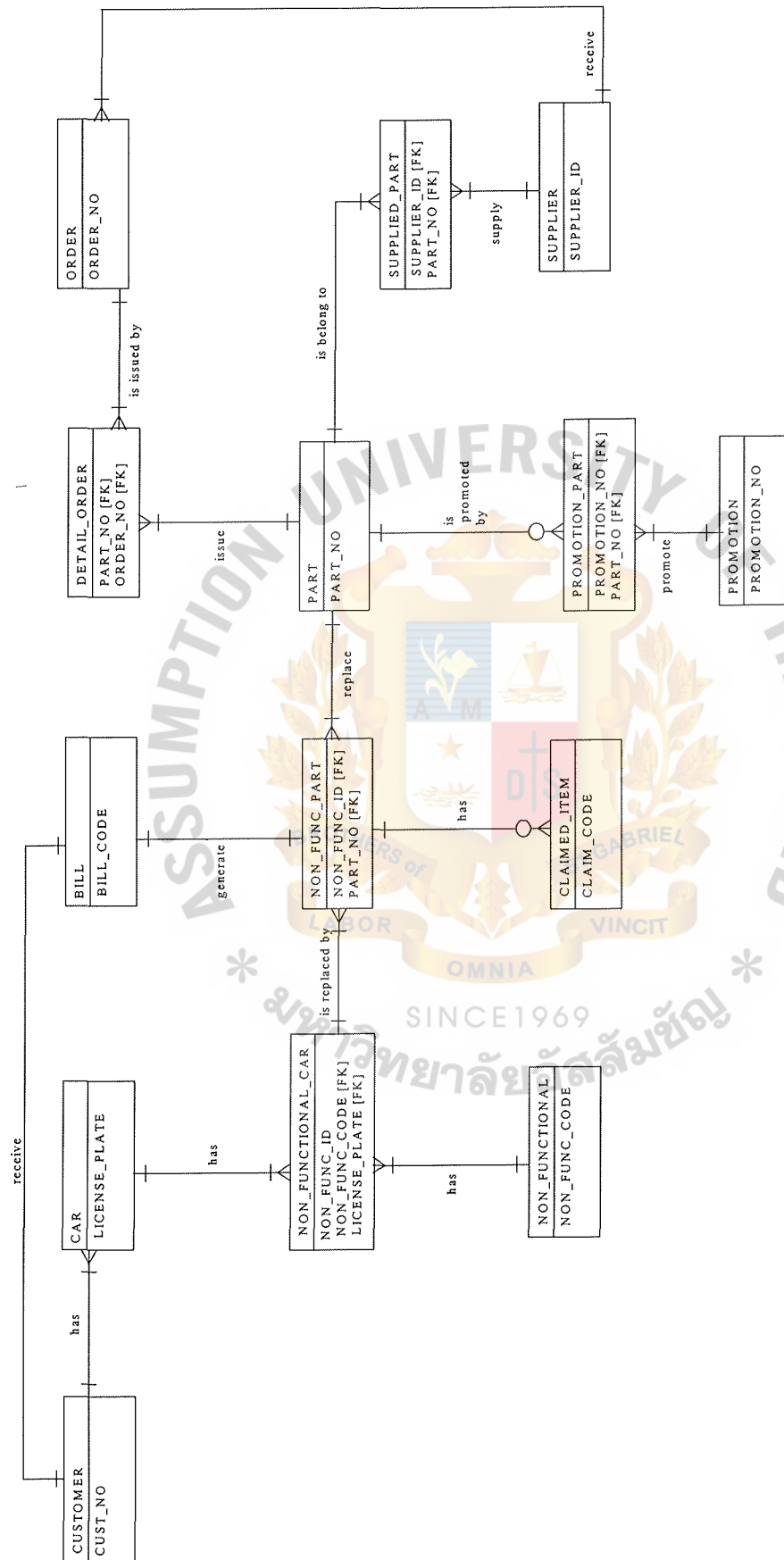


Figure A.2. Key-based Data Model of the Proposed System.

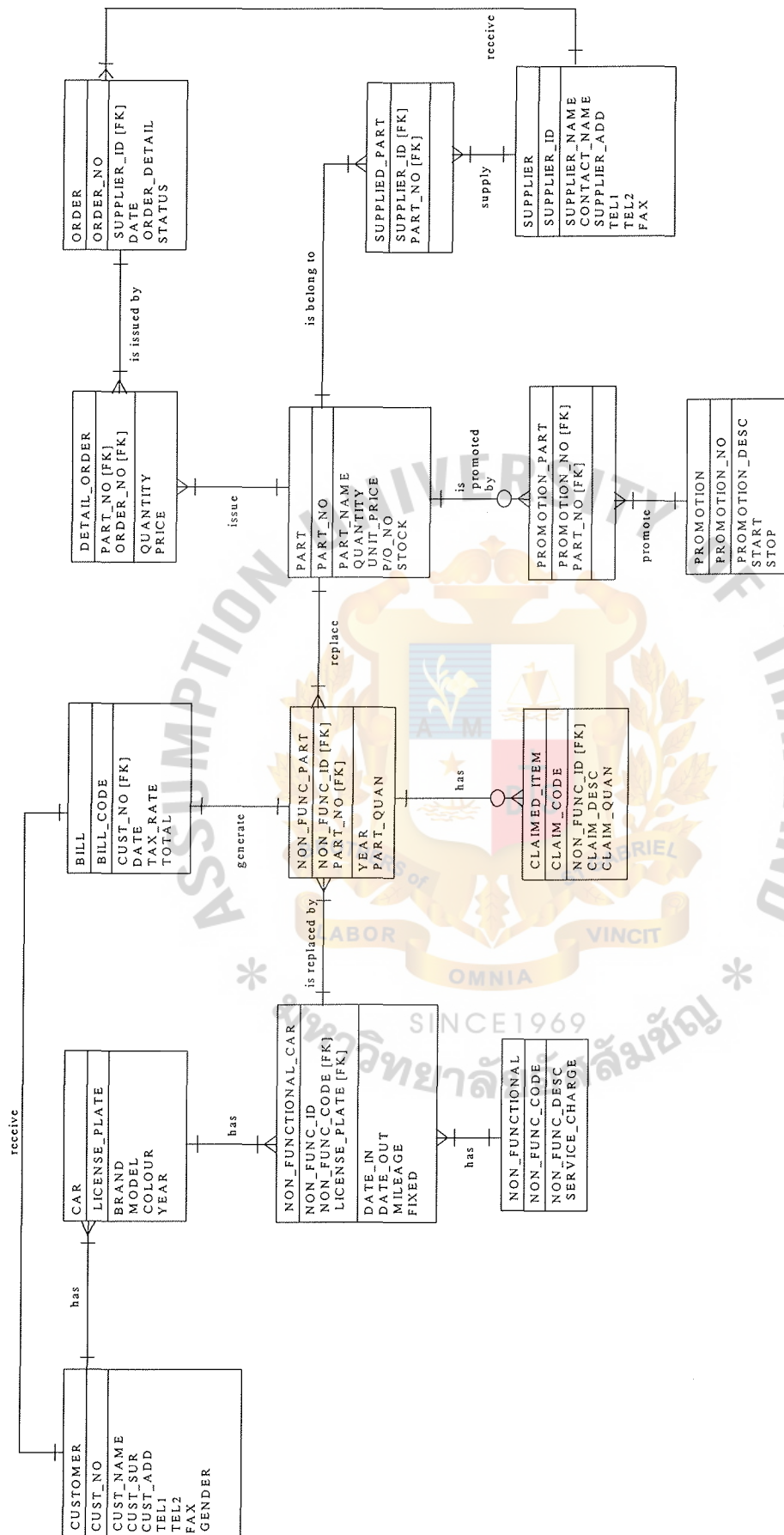


Figure A.3. Fully Attributed Data Model of the Proposed System.



## APPENDIX B

### DATA FLOW DIAGRAM

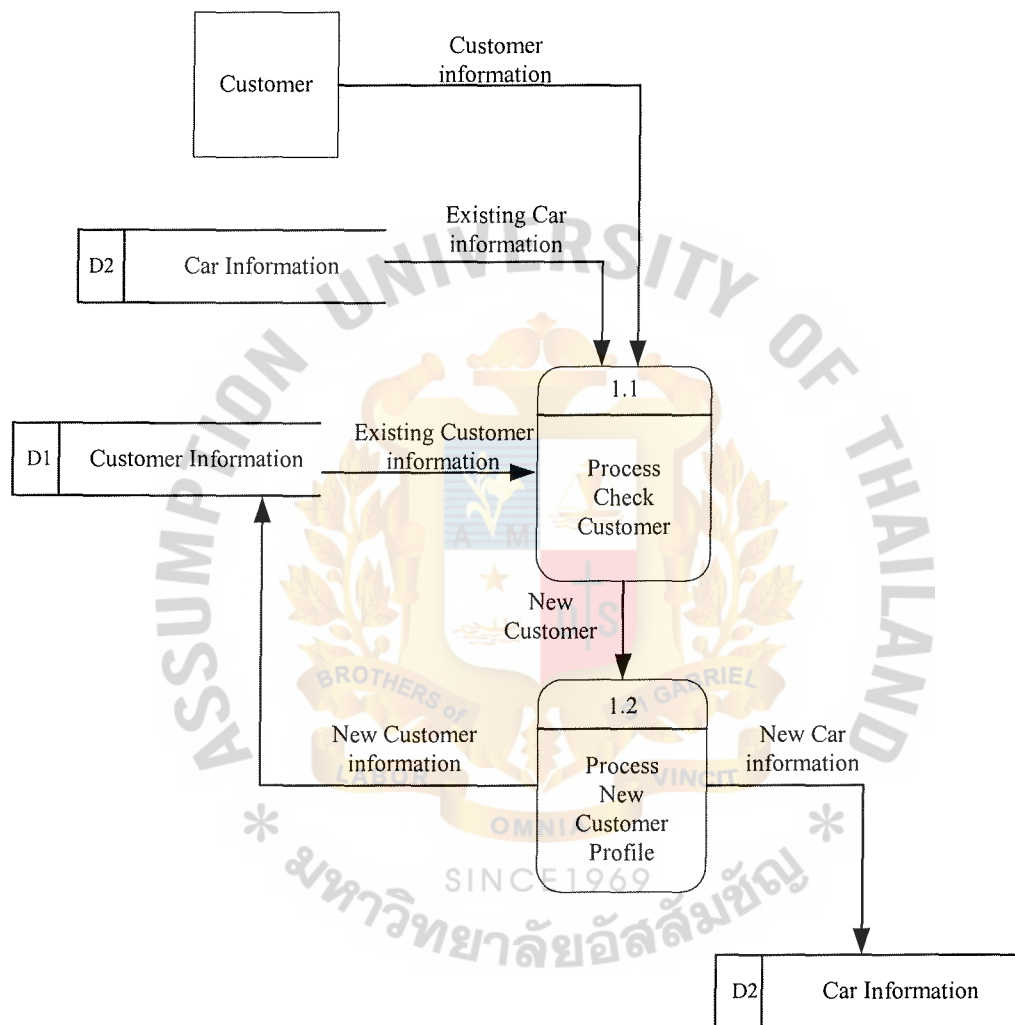


Figure B.1. Data Flow Diagram of Check Customer Profile Process.

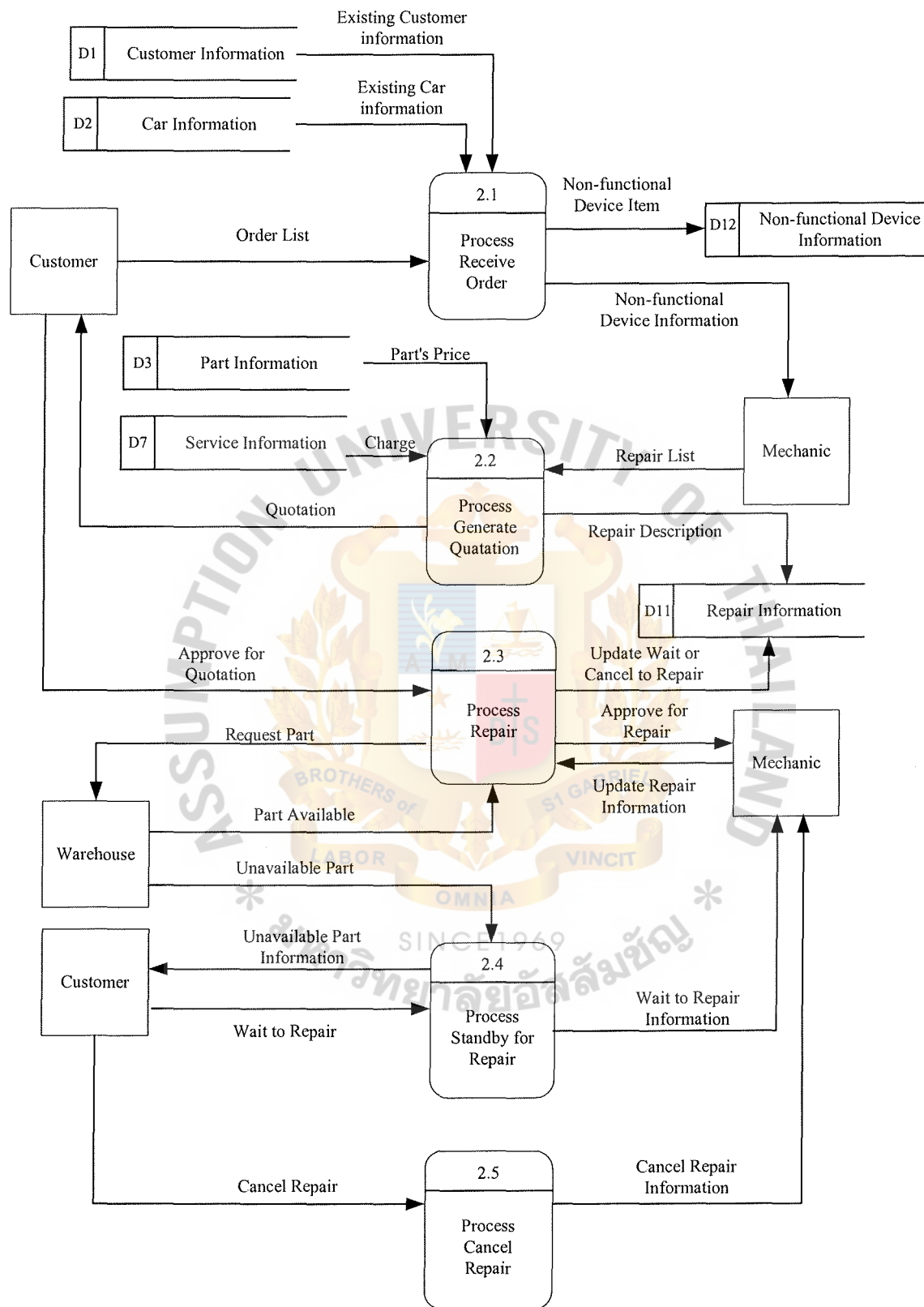


Figure B.2. Data Flow Diagram of Check and Repair Process.

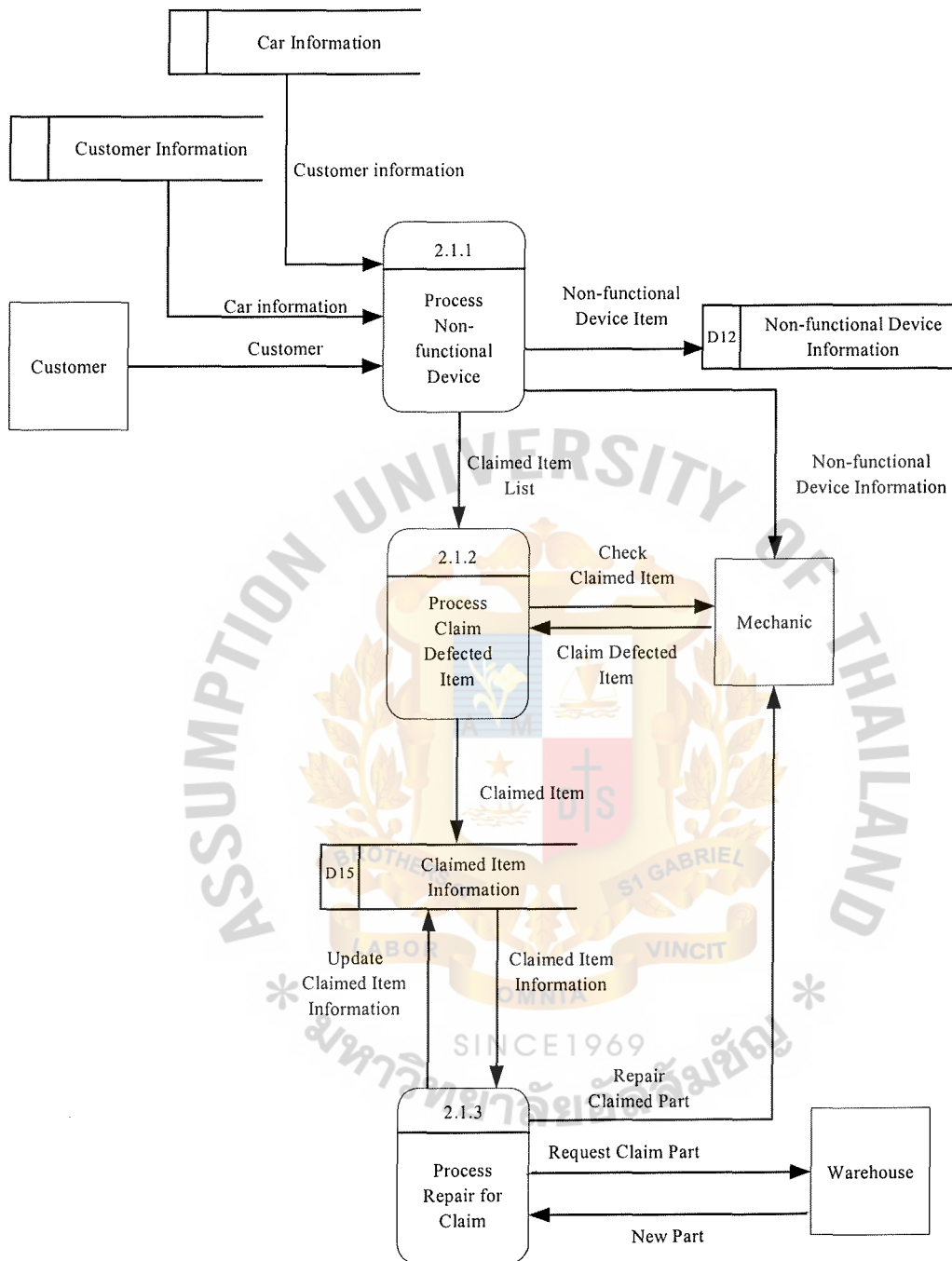


Figure B.3. Data Flow Diagram Level 2 of Check and Repair Process.

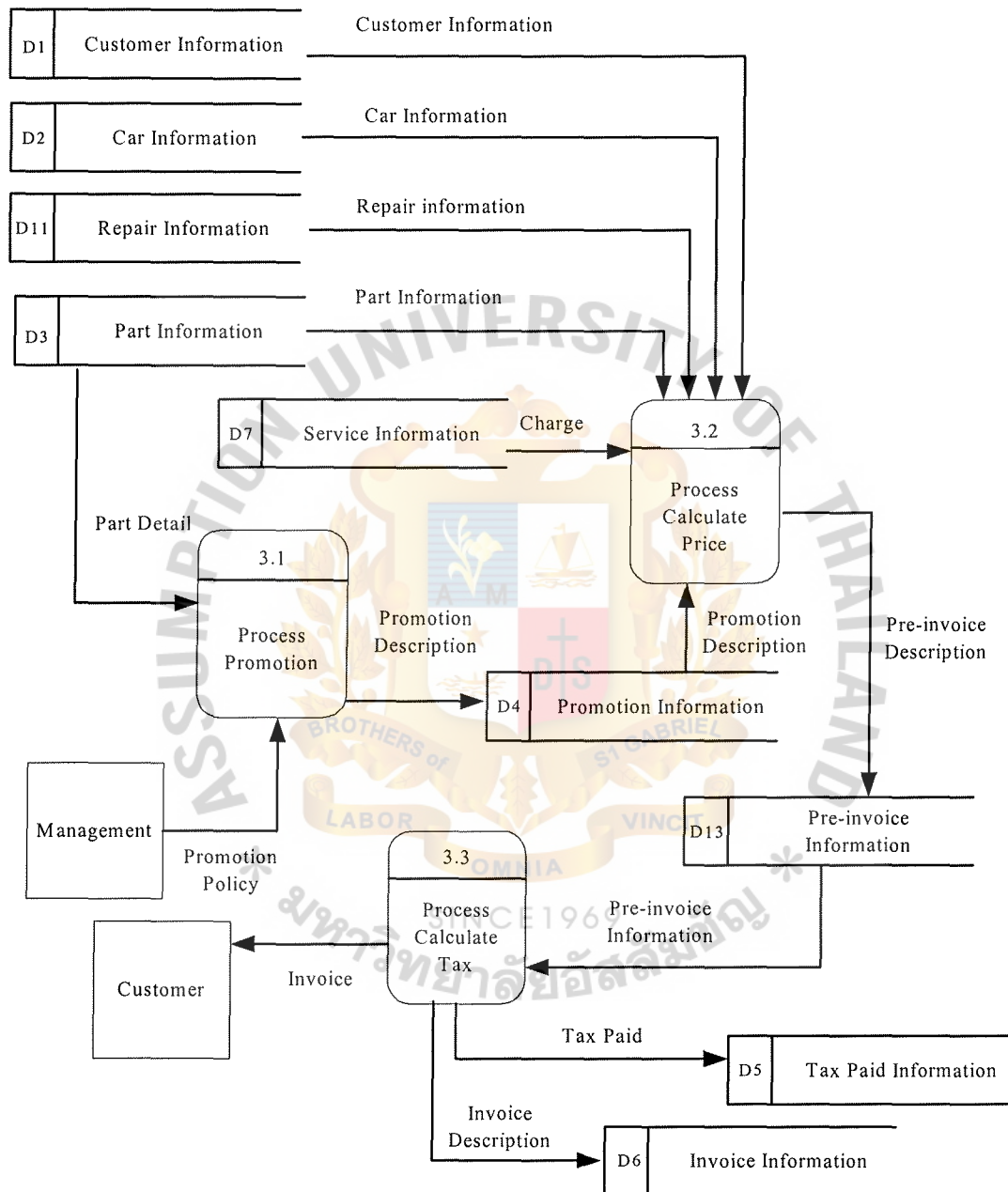


Figure B.4. Data Flow Diagram of Payment Transaction Process.

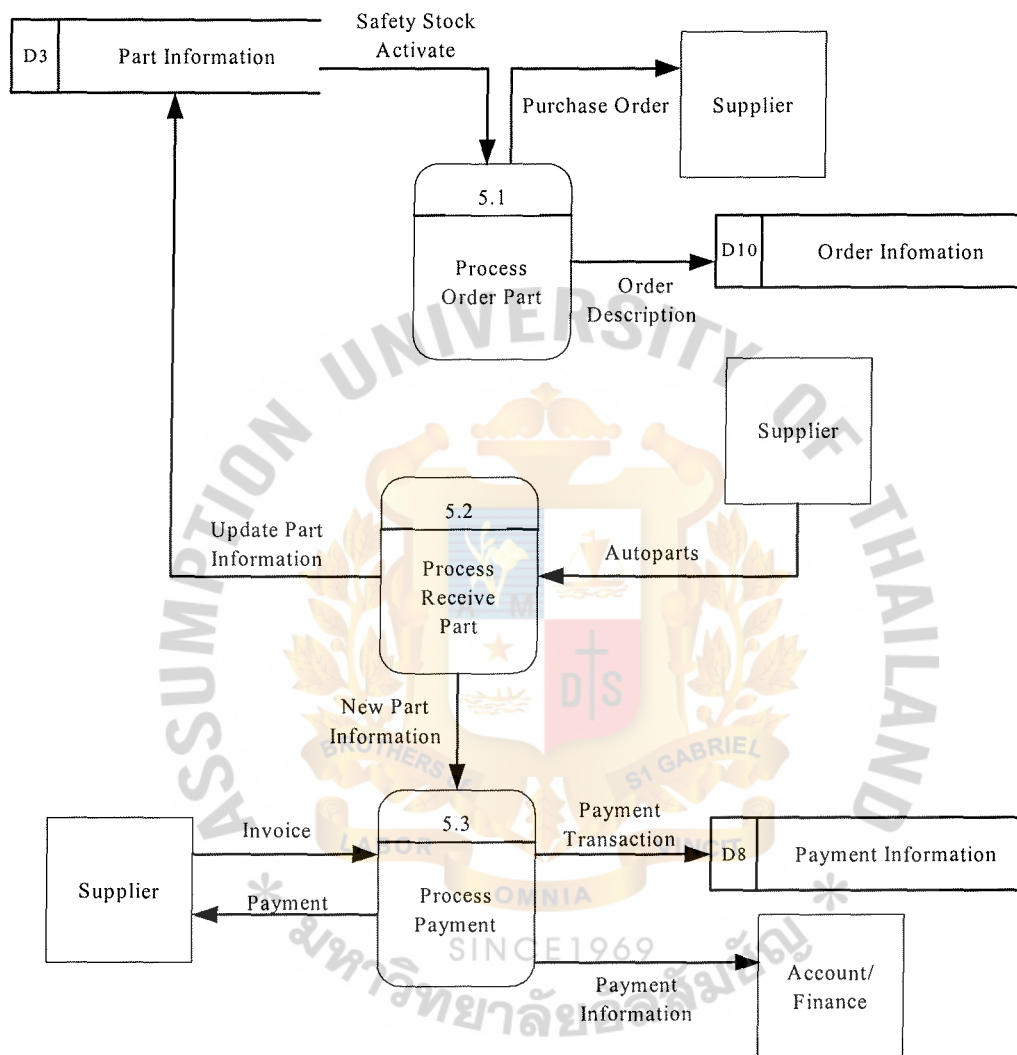


Figure B.6. Data Flow Diagram of Purchase Order Process.

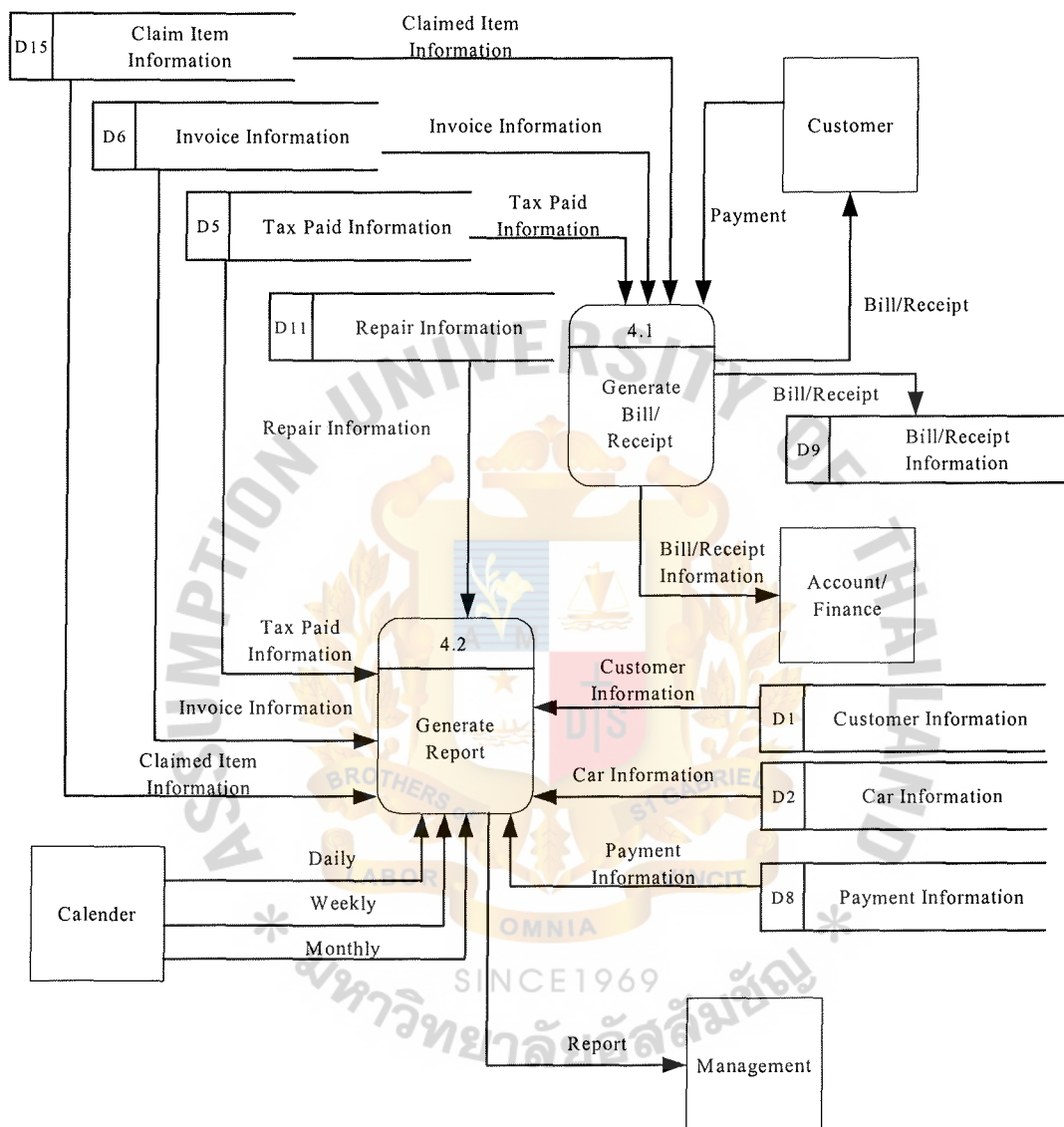


Figure B.5. Data Flow Diagram of Generate Report Process.



## APPENDIX C

### FEASIBILITY ANALYSIS

Table C.1. The Cost of the Candidate 1, Baht.

Cost Items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Hardware Cost:						
Computer Server Cost	1set@125,000	25,000	25,000	25,000	25,000	25,000
Workstation Cost	4units@39,000	31,200	31,200	31,200	31,200	31,200
Laser Printer	1 Unit@11,800	2,360	2,360	2,360	2,360	2,360
Dot Matrix Printer	1 Unit@5,600	1,120	1,120	1,120	1,120	1,120
Hub (10/100 Mbps)	1Unit@5,500	1,100	1,100	1,100	1,100	1,100
UPS 1000 VA	1 Unit@11,500	2,300	2,300	2,300	2,300	2,300
Total Hardware Cost		63,080	63,080	63,080	63,080	63,080
Maintenance Cost:						
Total Maintenance Cost		-	-	18,000	16,200	14,580
Software Cost		20,000	20,000	20,000	20,000	20,000
Network Cost		18,000	18,000	18,000	18,000	18,000
Total Software Cost		38,000	38,000	38,000	38,000	38,000
Implementation Cost:						
Basic Training Cost		32,000	-	-	-	-
Set up Cost		28,000	-	-	-	-
Total Implementation Cost		60,000	-	-	-	-
Total Fixed Cost		161,080	101,080	119,080	117,280	115,660
<u>Operating Cost</u>						
People Ware Cost:						
System Analyst	6 months@25,000	150,000	-	-	-	-
Programmer	4 months@25,000	100,000	-	-	-	-
Network Specialist	1month@20,000	20,000	-	-	-	-
Shop manager	1person@25,000	25,000	27,500	30,250	33,275	36,603
Store keeper	1person@9,000	9,000	9,900	10,890	11,979	13,177
Front officer	2person@10,000	20,000	22,000	24,200	26,620	29,282
Mechanic (Trainee)	3person@8,000	24,000	26,400	29,040	31,944	35,138
Mechanic (Assistant)	4person@10,000	40,000	44,000	48,400	53,240	58,564
Mechanic (Supervisor)	3person@12,000	36,000	39,600	43,560	47,916	52,708
Total monthly salary Cost		154,000	169,400	186,340	204,974	225,471
Total annual salary Cost		2,118,000	2,032,800	2,236,080	2,459,688	2,705,657
Miscellaneous Cost:						
Stationary	Per Annual	21,000	23,100	25,410	27,951	30,746
Office Supplier	Per Annual	12,000	13,200	14,520	15,972	17,569
Utility	Per Annual	84,000	92,400	101,640	111,804	122,984
Miscellaneous	Per Annual	22,000	24,200	26,620	29,282	32,210
Total Miscellaneous Cost		139,000	152,900	168,190	185,009	203,510
Total Operating Cost		2,257,000	2,185,700	2,404,270	2,644,697	2,909,167
Total Computerized System Cost		2,418,080	2,286,780	2,523,350	2,761,977	3,024,827

Table C.2. The Cost of the Candidate 2, Baht.

Cost Items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Hardware Cost:						
Computer Server Cost	1set@135,000	27,000	27,000	27,000	27,000	27,000
Workstation Cost	4units@39,000	31,200	31,200	31,200	31,200	31,200
Laser Printer	1 Unit@11,800	2,360	2,360	2,360	2,360	2,360
Dot Matrix Printer	1 Unit@5,600	1,120	1,120	1,120	1,120	1,120
Hub (10/100 Mbps)	1Unit@5,500	1,100	1,100	1,100	1,100	1,100
UPS 1000 VA	1 Unit@11,500	2,300	2,300	2,300	2,300	2,300
Total Hardware Cost		65,080	58,200	58,200	58,200	58,200
Maintenance Cost:						
Total Maintenance Cost		-	-	20,000	18,000	16,200
Software Cost		22,000	22,000	22,000	22,000	22,000
Network Cost		20,000	20,000	20,000	20,000	20,000
Total Software Cost		42,000	42,000	42,000	42,000	42,000
Implementation Cost:						
Basic Training Cost		34,000	-	-	-	-
Set up Cost		30,000	-	-	-	-
Total Implementation Cost		64,000	-	-	-	-
Total Fixed Cost		171,080	100,200	120,200	118,200	116,400
<u>Operating Cost</u>						
People Ware Cost:						
System Analyst	6 months@25,000	150,000	-	-	-	-
Programmer	4 months@25,000	100,000	-	-	-	-
Network Specialist	1month@20,000	20,000	-	-	-	-
Shop manager	1person@25,000	25,000	27,500	30,250	33,275	36,603
Store keeper	1person@9,000	9,000	9,900	10,890	11,979	13,177
Front officer	2person@10,000	20,000	22,000	24,200	26,620	29,282
Mechanic (Trainee)	3person@8,000	24,000	26,400	29,040	31,944	35,138
Mechanic (Assistant)	4person@10,000	40,000	44,000	48,400	53,240	58,564
Mechanic (Supervisor)	3person@12,000	36,000	39,600	43,560	47,916	52,708
Total monthly salary Cost		154,000	169,400	186,340	204,974	225,471
Total annual salary Cost		2,118,000	2,032,800	2,236,080	2,459,688	2,705,657
Miscellaneous Cost:						
Stationary	Per Annual	21,000	23,100	25,410	27,951	30,746
Office Supplier	Per Annual	12,000	13,200	14,520	15,972	17,569
Utility	Per Annual	84,000	92,400	101,640	111,804	122,984
Miscellaneous	Per Annual	22,000	24,200	26,620	29,282	32,210
Total Miscellaneous Cost		139,000	152,900	168,190	185,009	203,510
Total Operating Cost		2,257,000	2,185,700	2,404,270	2,644,697	2,909,167
Total Computerized System Cost		2,428,080	2,285,900	2,524,470	2,762,897	3,025,567

Table C.3. The Cost of the Candidate 3, Baht.

Cost Items		Years				
		1	2	3	4	5
<u>Fixed Cost</u>						
Hardware Cost:						
Computer Server Cost	1set@130,000	26,000	26,000	26,000	26,000	26,000
Workstation Cost	4units@39,000	31,200	31,200	31,200	31,200	31,200
Laser Printer	1 Unit@11,800	2,360	2,360	2,360	2,360	2,360
Dot Matrix Printer	1 Unit@5,600	1,120	1,120	1,120	1,120	1,120
Hub (10/100 Mbps)	1Unit@5,500	1,100	1,100	1,100	1,100	1,100
UPS 1000 VA	1 Unit@11,500	2,300	2,300	2,300	2,300	2,300
Total Hardware Cost		64,080	64,080	64,080	64,080	64,080
Maintenance Cost:						
Total Maintenance Cost		-	-	17,000	15,300	13,770
Software Cost		50,000	50,000	50,000	50,000	50,000
Network Cost		22,000	22,000	22,000	22,000	22,000
Total Software Cost		72,000	72,000	72,000	72,000	72,000
Implementation Cost:						
Basic Training Cost		32,000	-	-	-	-
Set up Cost		28,000	-	-	-	-
Total Implementation Cost		60,000	-	-	-	-
Total Fixed Cost		196,080	136,080	153,080	151,380	149,850
<u>Operating Cost</u>						
People Ware Cost:						
System Analyst	6 months@25,000	150,000	-	-	-	-
Programmer	4 months@25,000	100,000	-	-	-	-
Network Specialist	1month@20,000	20,000	-	-	-	-
Shop manager	1person@25,000	25,000	27,500	30,250	33,275	36,603
Store keeper	1person@9,000	9,000	9,900	10,890	11,979	13,177
Front officer	2person@10,000	20,000	22,000	24,200	26,620	29,282
Mechanic (Trainee)	3person@8,000	24,000	26,400	29,040	31,944	35,138
Mechanic (Assistant)	4person@10,000	40,000	44,000	48,400	53,240	58,564
Mechanic (Supervisor)	3person@12,000	36,000	39,600	43,560	47,916	52,708
Total monthly salary Cost		154,000	169,400	186,340	204,974	225,471
Total annual salary Cost		2,118,000	2,032,800	2,236,080	2,459,688	2,705,657
Miscellaneous Cost:						
Stationary	Per Annual	21,000	23,100	25,410	27,951	30,746
Office Supplier	Per Annual	12,000	13,200	14,520	15,972	17,569
Utility	Per Annual	84,000	92,400	101,640	111,804	122,984
Miscellaneous	Per Annual	22,000	24,200	26,620	29,282	32,210
Total Miscellaneous Cost		139,000	152,900	168,190	185,009	203,510
Total Operating Cost		2,257,000	2,185,700	2,404,270	2,644,697	2,909,167
Total Computerized System Cost		2,453,080	2,321,780	2,557,350	2,796,077	3,059,017

Table C.4. The Benefits of the Proposed System, Baht.

Benefit items	Year1	Year2	Year3	Year4	Year5
Presonnel Reduction :					
Store keeper            1person@9,000	108,000	118,800	130,680	143,748	158,123
Front officer            1person@10,000	120,000	132,000	145,200	159,720	175,692
Mechanic (Trainee)   1person@8,000	96,000	105,600	116,160	127,776	140,554
Total Annual Personnel Reduction Benefit	324,000	356,400	392,040	431,244	474,368
Operating Time Saving :					
Shop manager            1person@2 hours/ day	66,000	72,600	79,860	87,846	96,631
Store keeper            1person@2 hours/ day	24,000	26,400	29,040	31,944	35,138
Mechanic (Supervisor) 3person@2 hours/ day	96,480	106,128	116,741	128,415	141,256
Expected Productivity Increased 20%:					
13 Persons @ 2 Hour/Day	1,854,000	2,039,400	2,243,340	2,467,674	2,714,441
Annual Operating time Saving:	186,480	205,128	225,641	248,205	273,025
Net Annual Operating time Saving:	2,040,480	2,244,528	2,468,981	2,715,879	2,987,467
Office Supplies & Miscellaneous Cost Reduction:					
Stationary            Per Annual	7,000	7,700	8,470	9,317	10,249
Office Supplier       Per Annual	4,300	4,730	5,203	5,723	6,296
Miscellaneous       Per Annual	2,000	2,200	2,420	2,662	2,928
Total Miscellaneous Cost Saving	13,300	14,630	16,093	17,702	19,473
Total Benefit from implementing Computerized System	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308

Table C.5. Payback Period for the Candidate 1, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	-161,080					
Annual Operating Cost:		-2,257,000	-2,286,780	-2,523,350	-2,761,977	-3,024,827
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	-161,080	-2,191,547.00	-2,156,433.54	-2,308,865.25	-2,452,635.58	-2,610,425.70
Cumulative time-adjusted costed over life time:	-161,080	-2,352,627.00	-4,509,060.54	-6,817,925.79	-9,270,561.37	-11,880,987.07
Benefits derived from operation of the new system	0	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	0	2,308,824.38	2,466,471.19	2,632,559.31	2,810,364.60	3,004,368.80
Cumulative time-adjusted benefits over life time:	0	2,308,824.38	4,775,295.57	7,407,854.88	10,218,219.48	13,222,588.29
Cumulative Life Time Time-Adjusted Costed + Benefit	-161,080	-43,802.62	266,235.03	589,929.09	947,658.12	1,341,601.22

Table C.6. Payback Period for the Candidate 2, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	-171,080					
Annual Operating Cost:		-2,257,000	-2,285,900	-2,524,470	-2,762,897	-3,025,567
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	-171,080	-2,191,547.00	-2,155,603.70	-2,309,890.05	-2,453,452.54	-2,611,064.32
Cumulative time-adjusted costed over life time:	-171,080	-2,362,627.00	-4,518,230.70	-6,828,120.75	-9,281,573.29	-11,892,637.61
Benefits derived from operation of the new system	0	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	0	2,308,824.38	2,466,471.19	2,632,559.31	2,810,364.60	3,004,368.80
Cumulative time-adjusted benefits over life time:	0	2,308,824.38	4,775,295.57	7,407,854.88	10,218,219.48	13,222,588.29
Cumulative Life Time Time-Adjusted Costed + Benefit	-171,080	-53,802.62	257,064.87	579,734.13	936,646.20	1,329,950.68

Table C.7. Payback Period for the Candidate 3, Baht.

Cost Items	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	-196,080					
Annual Operating Cost:		-2,257,000	-2,321,780	-2,557,350	-2,796,077	-3,059,017
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	-196,080	-2,191,547.00	-2,189,438.54	-2,339,975.25	-2,482,916.38	-2,639,931.67
Cumulative time-adjusted costed over life time:	-196,080	-2,387,627.00	-4,577,065.54	-6,917,040.79	-9,399,957.17	-12,039,888.84
Benefits derived from operation of the new system	0	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	0	2,308,824.38	2,466,471.19	2,632,559.31	2,810,364.60	3,004,368.80
Cumulative time-adjusted benefits over life time:	0	2,308,824.38	4,775,295.57	7,407,854.88	10,218,219.48	13,222,588.29
Cumulative Life Time Time-Adjusted Costed + Benefit	-196,080	-78,802.62	-198,230.03	490,814.09	818,262.32	1,182,699.45

Table C.8. Net Present Value for the Candidate 1, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	-161,080					
Annual Operating Cost:		-2,257,000	-2,286,780	-2,523,350	-2,761,977	-3,024,827
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	-161,080	-2,191,547.00	-2,156,433.54	-2,308,865.25	-2,452,635.58	-2,610,425.70
Cumulative time-adjusted costed over life time:	-161,080	-2,352,627.00	-4,509,060.54	-6,817,925.79	-9,270,561.37	-11,880,987.07
Benefits derived from operation of the new system	0	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308
Discount factor for 3%	1.00	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	0	2,308,824.38	2,466,471.19	2,632,559.31	2,810,364.60	3,004,368.80
Cumulative time-adjusted benefits over life time:	0	2,308,824.38	4,775,295.57	7,407,854.88	10,218,219.48	13,222,588.29
Cumulative Life Time Time-Adjusted Costed + Benefit	-161,080	-43,802.62	266,235.03	589,929.09	947,658.12	1,341,601.22

Table C.9. Net Present Value for the Candidate 2, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	-171,080					
Annual Operating Cost:		-2,257,000	-2,285,900	-2,524,470	-2,762,897	-3,025,567
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	-171,080	-2,191,547.00	-2,155,603.70	-2,309,890.05	-2,453,452.54	-2,611,064.32
Cumulative time-adjusted costed over life time:	-171,080	-2,362,627.00	-4,518,230.70	-6,828,120.75	-9,281,573.29	-11,892,637.61
Benefits derived from operation of the new system	0	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308
Discount factor for 3%	1.00	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	0	2,308,824.38	2,466,471.19	2,632,559.31	2,810,364.60	3,004,368.80
Cumulative time-adjusted benefits over life time:	0	2,308,824.38	4,775,295.57	7,407,854.88	10,218,219.48	13,222,588.29
Cumulative Life Time Time-Adjusted Costed + Benefit	-171,080	-53,802.62	257,064.87	579,734.13	936,646.20	1,329,950.68

Table C.10. Net Present Value for the Candidate 3, Baht.

Cash Flow Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
System Development Cost:	-196,080					
Annual Operating Cost:		-2,257,000	-2,321,780	-2,557,350	-2,796,077	-3,059,017
Discount factor for 3%	1.000	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	-196,080	-2,191,547.00	-2,189,438.54	-2,339,975.25	-2,482,916.38	-2,639,931.67
Cumulative time-adjusted costed over life time:	-196,080	-2,387,627.00	-4,577,065.54	-6,917,040.79	-9,399,957.17	-12,039,888.84
Benefits derived from operation of the new system	0	2,377,780	2,615,558	2,877,114	3,164,825	3,481,308
Discount factor for 3%	1.00	0.971	0.943	0.915	0.888	0.863
Time-Adjusted Costs (Adjusted to Present Value)	0	2,308,824.38	2,466,471.19	2,632,559.31	2,810,364.60	3,004,368.80
Cumulative time-adjusted benefits over life time:	0	2,308,824.38	4,775,295.57	7,407,854.88	10,218,219.48	13,222,588.29
Cumulative Life Time Time-Adjusted Costed + Benefit	-196,080	-78,802.62	198,230.03	490,814.09	818,262.32	1,182,699.45

Cumulative Cost, Baht

Candidate Solution 1

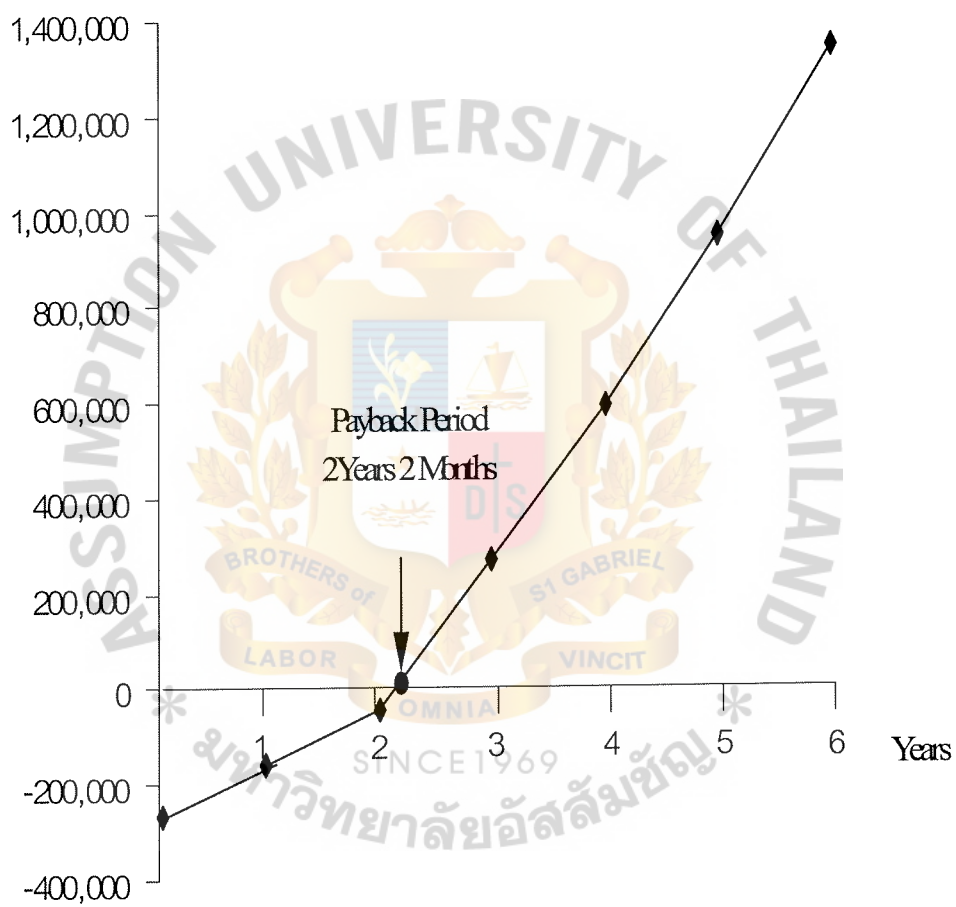


Figure C.1. Payback Period for Candidate 1.

Cumulative Cost, Baht

Candidate Solution 2

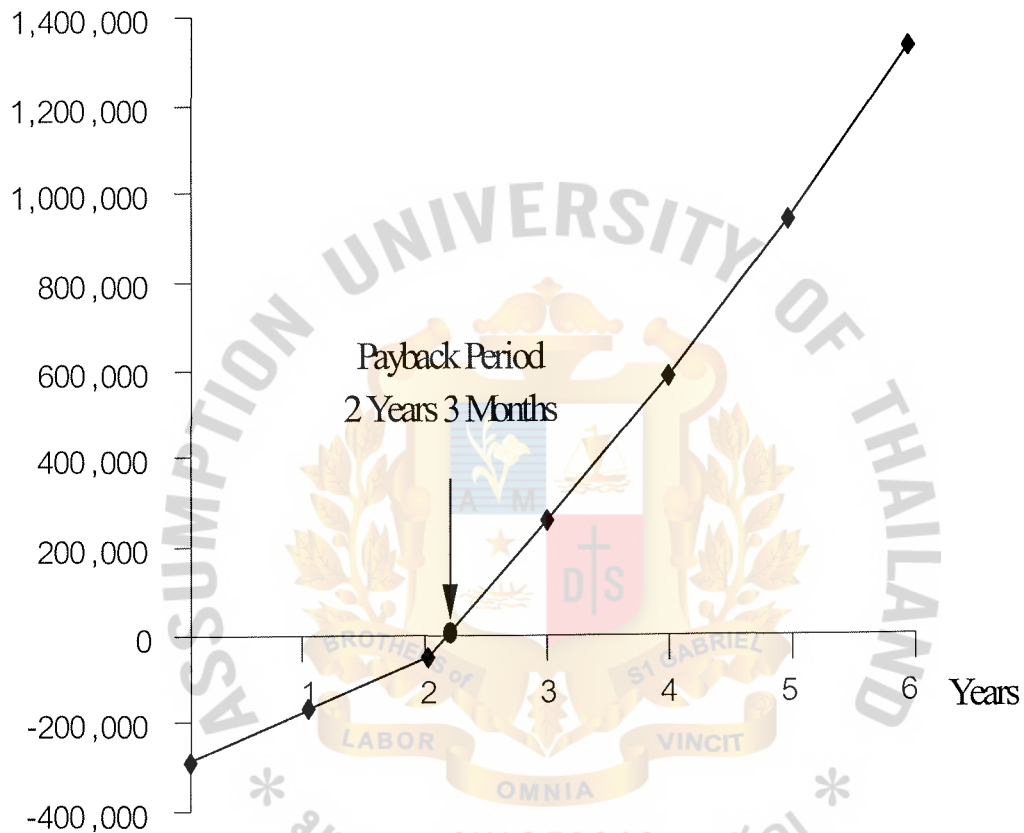


Figure C.2. Payback Period for Candidate 2.

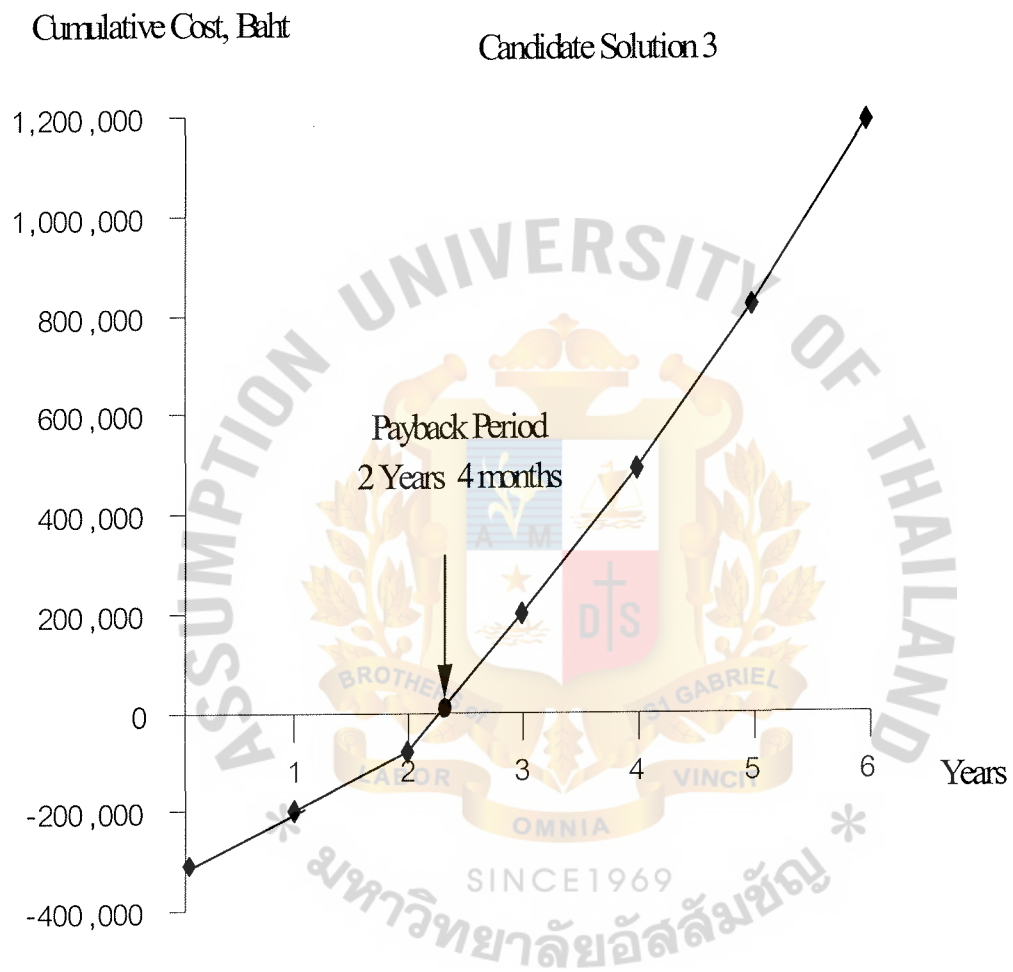


Figure C.3. Payback Period for Candidate 3.



## APPENDIX D

### STRUCTURE DESIGN

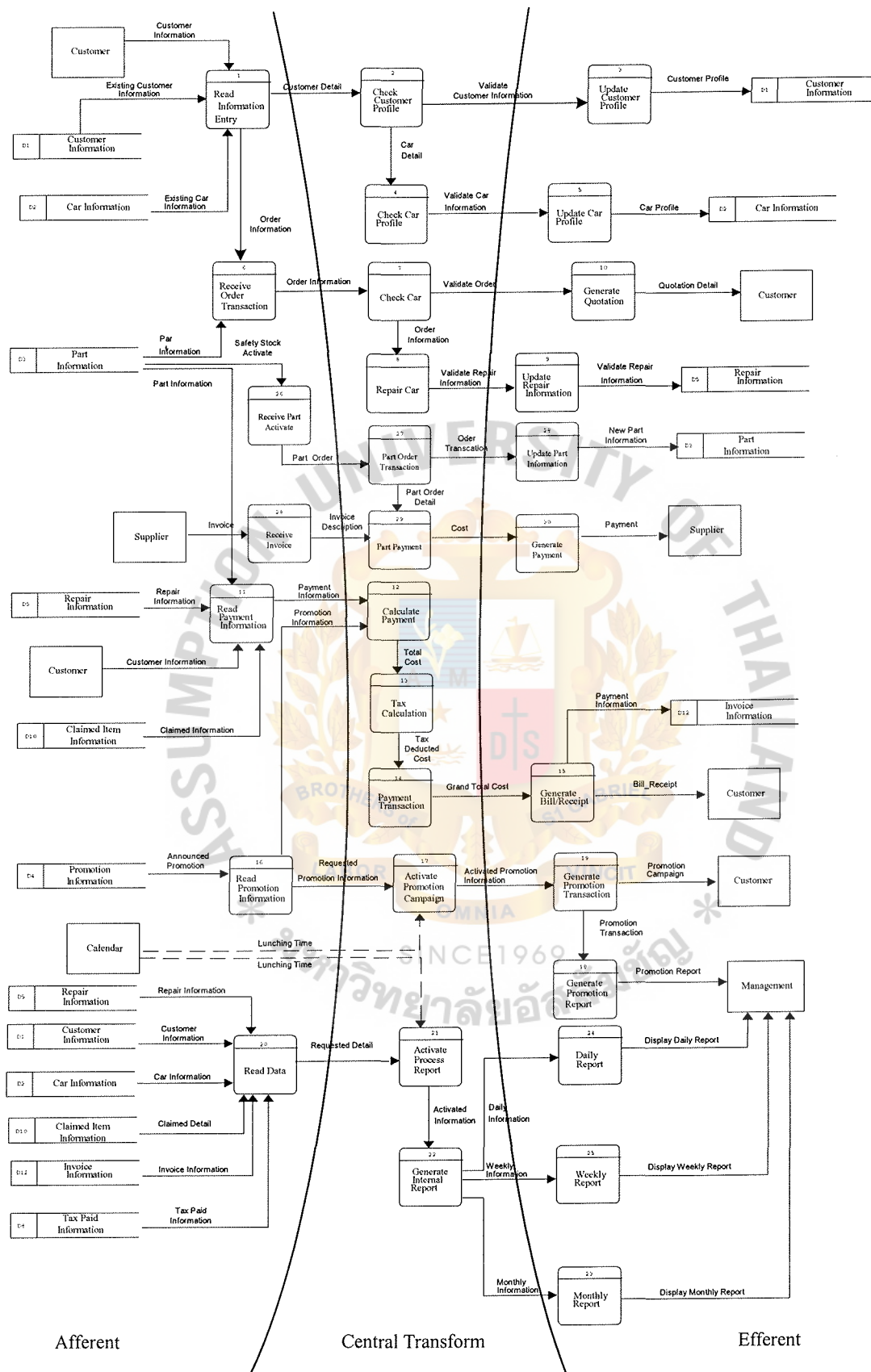


Figure D.1. Partitioned Data Flow Diagram of The Automobile Service Information System.

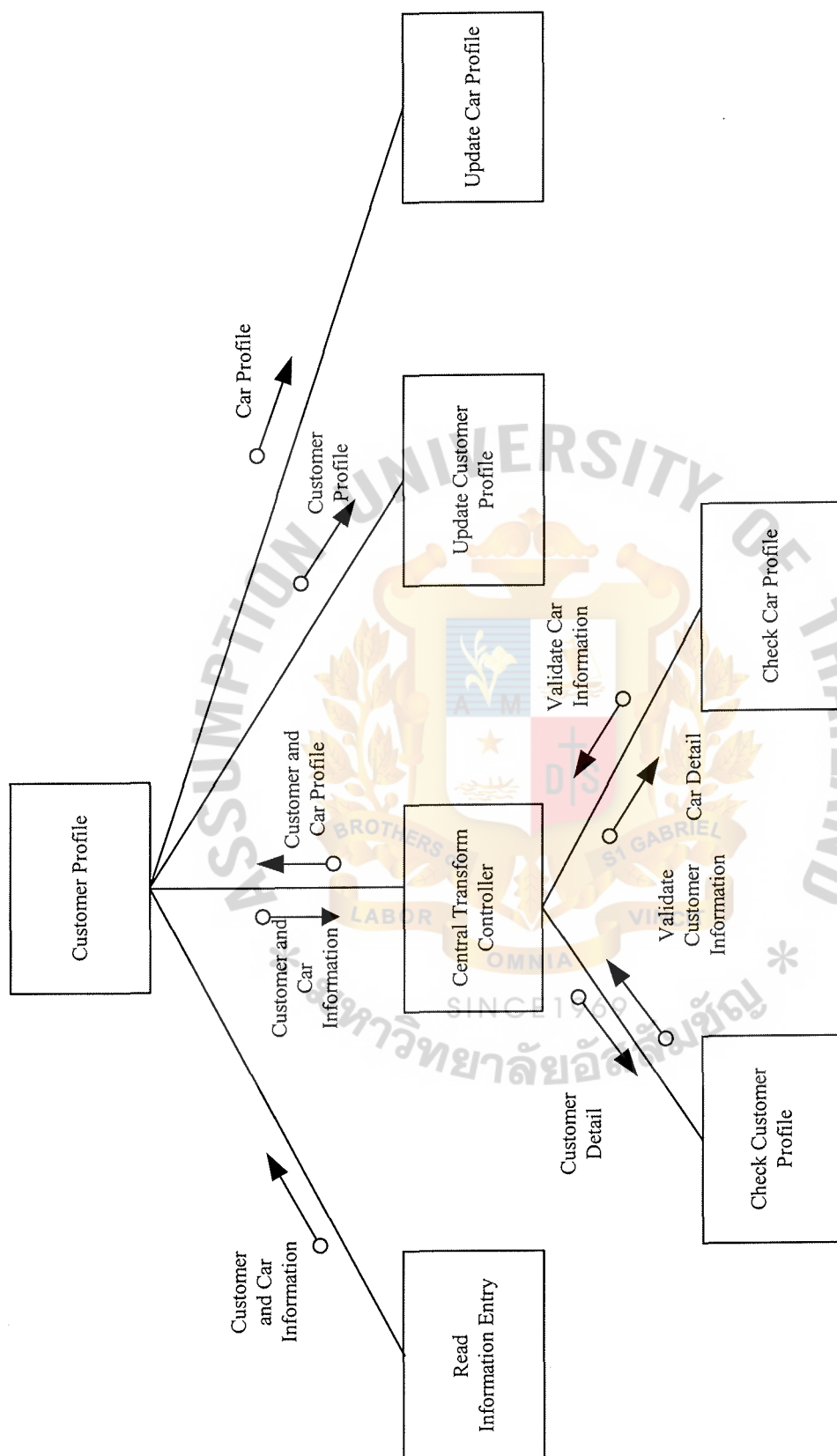


Figure D.2. Structure Chart of Check Customer Profile.

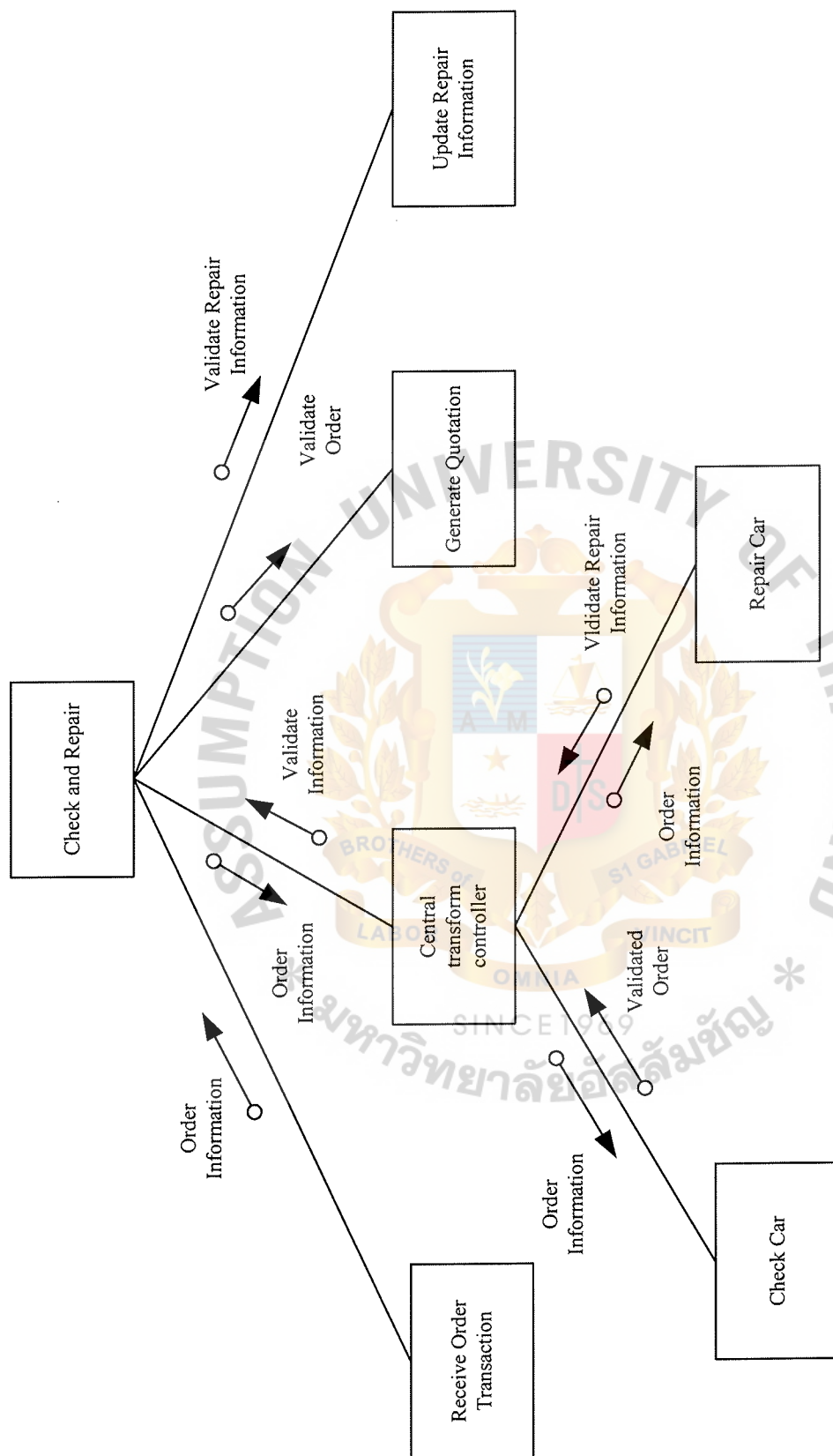


Figure D.3. Structure Chart of Check and Repair.

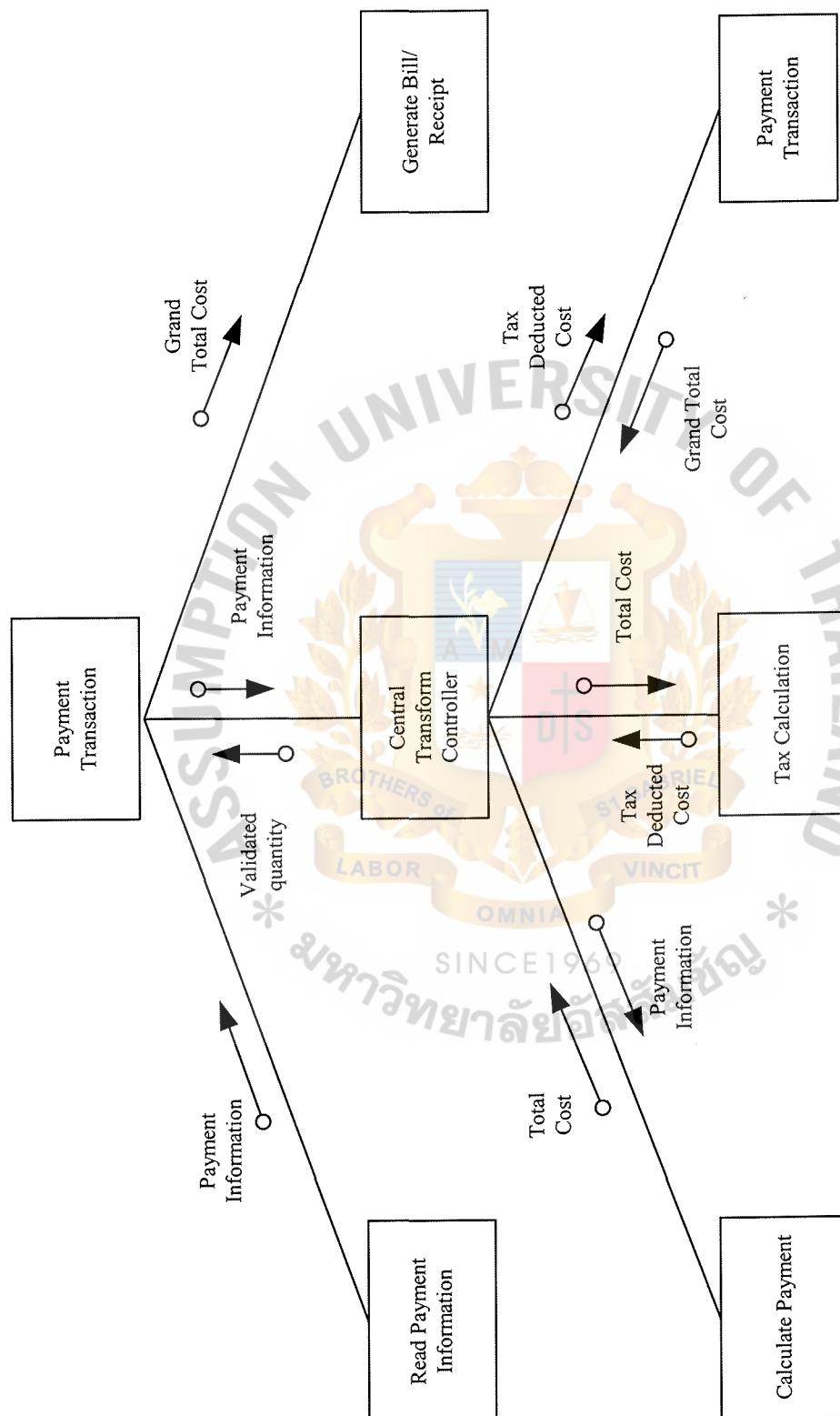


Figure D.4. Structure Chart of Payment Transaction.

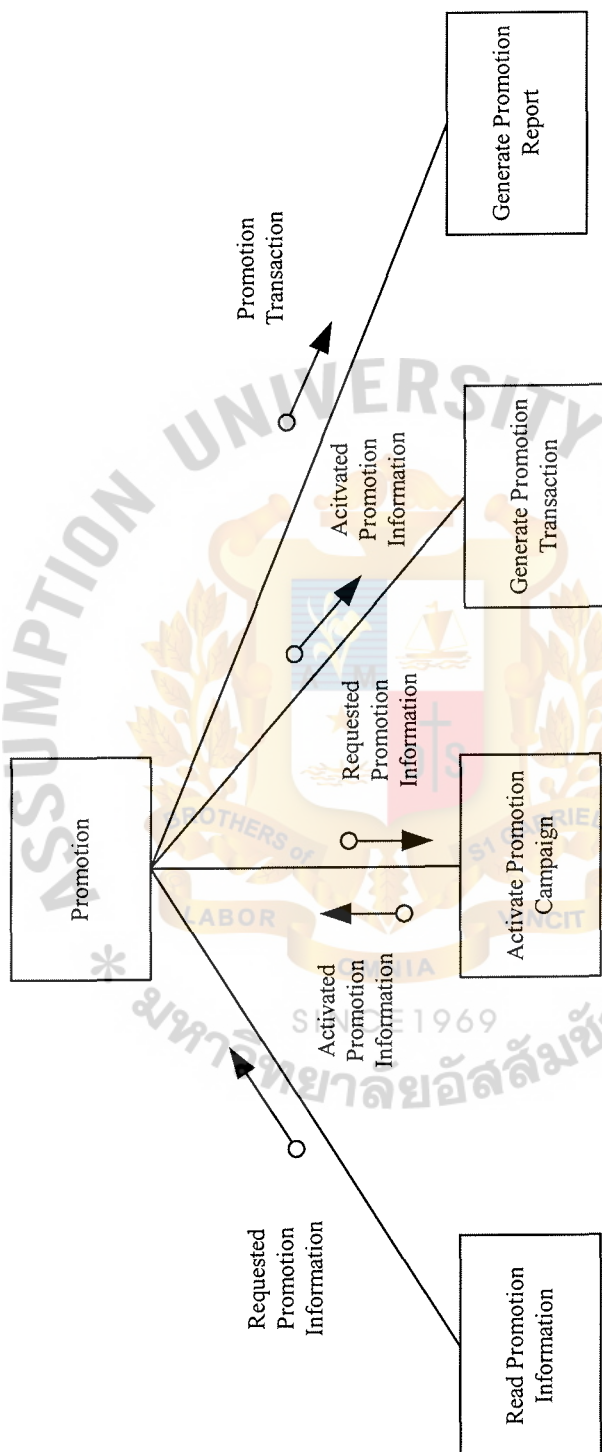


Figure D.5. Structure Chart of Promotion.

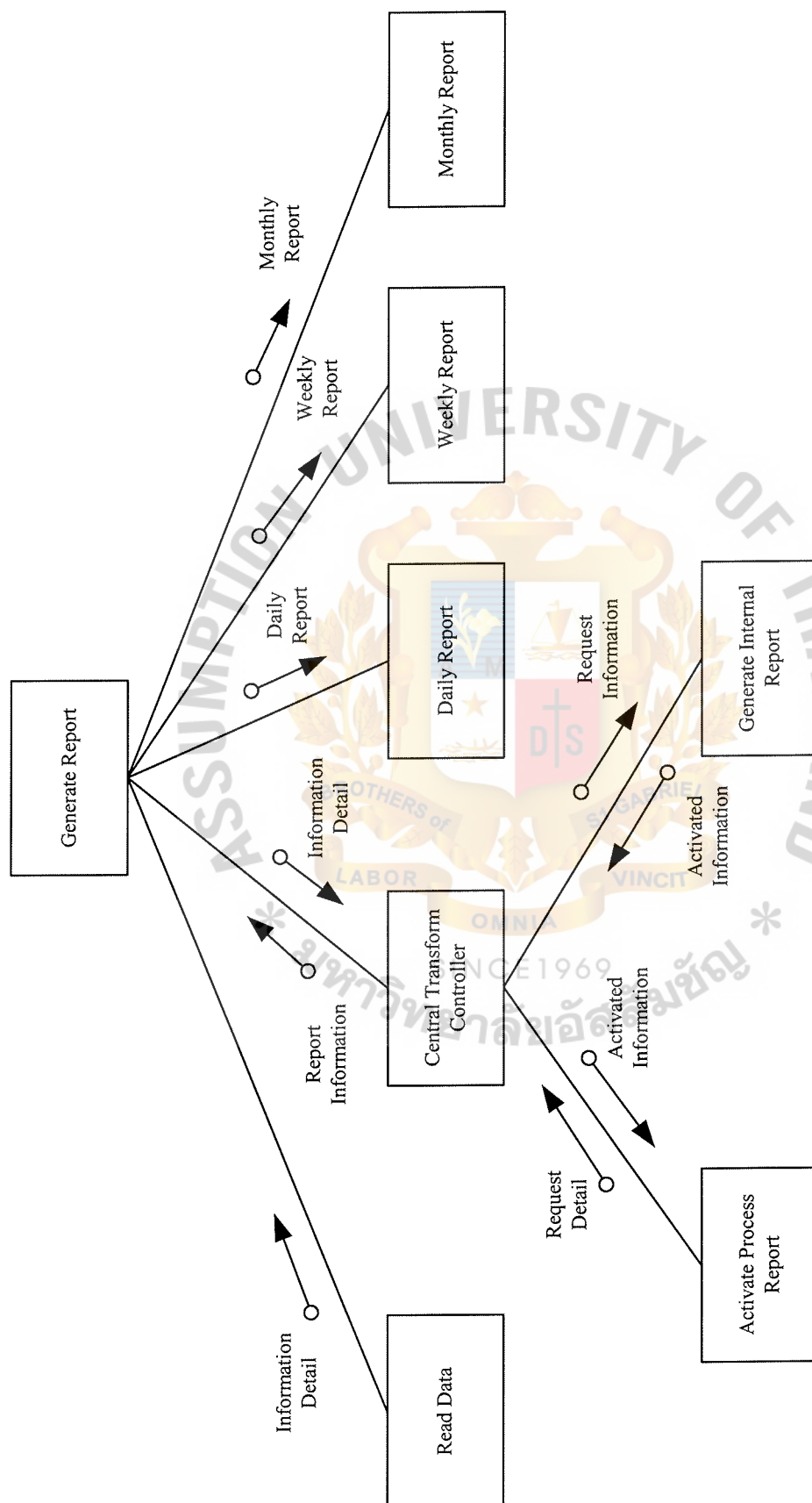


Figure D.6. Structure Chart of Generate Report.

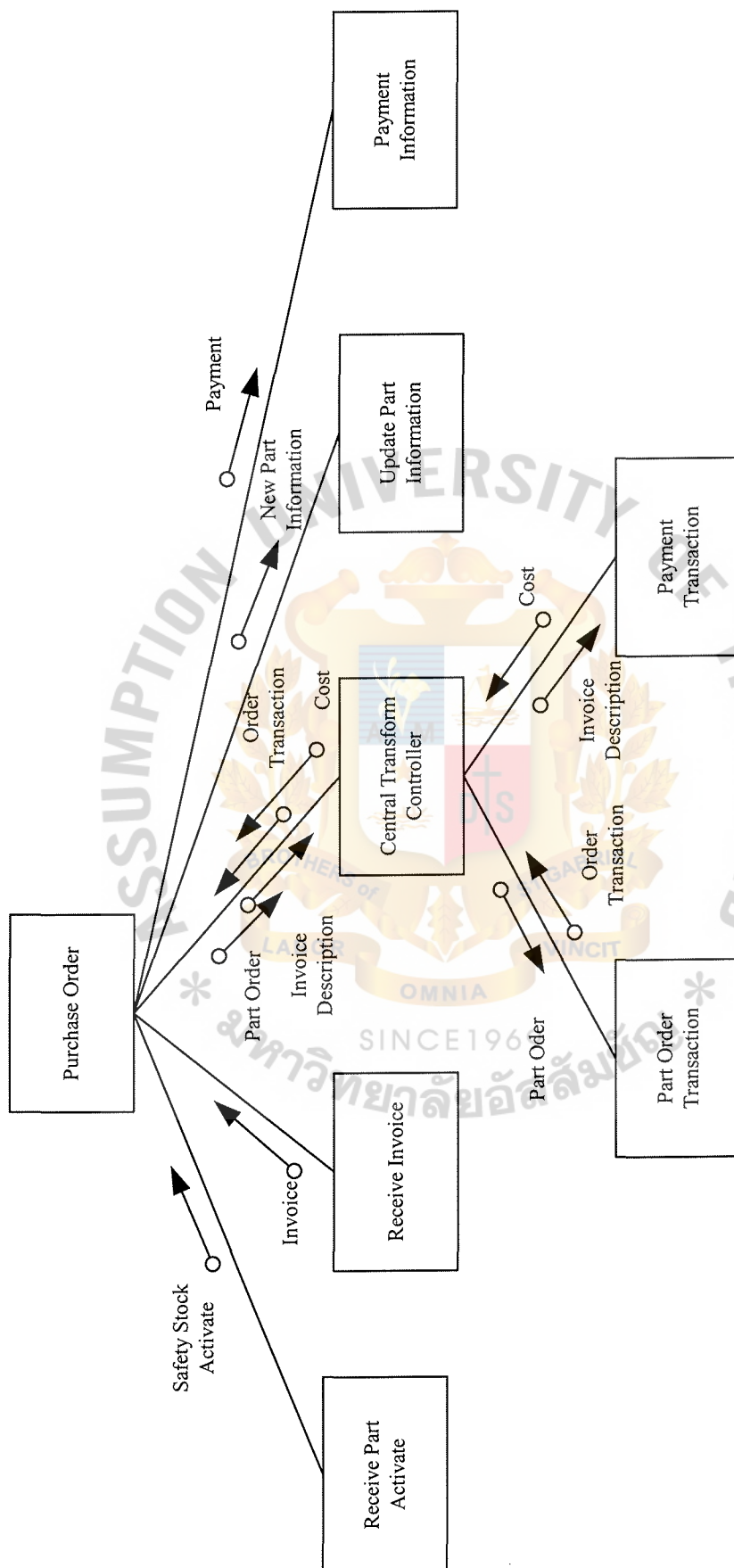


Figure D.7. Structure Chart of Purchase Order.



Table E.1. Process Specification of Process 1.1.

Items	Description
Process Name:	Check Customer
Data In:	Customer data from customer Car data from customer Car Information Database Customer Information Database
Data Out:	New customer data is sent to process 1.2 New car data is sent to process 1.2
Process:	(1) Officer receives data from customer to verify with the existing customer records and existing car records
Attachment:	Customer Information database Car Information database

Table E.2. Process Specification of Process 1.2.

Items	Description
Process Name:	New Customer Profile
Data In:	New customer information from process 1.1 New car information from process 1.1
Data Out:	New customer record in database New car record in database
Process:	(1) Classify customer information and car information, then add new record in database
Attachment:	Customer Information database Car Information database

Table E.3. Process Specification of Process 2.1.

Items	Description
Process Name:	Receive Order
Data In:	Order list from customer Customer Information Car Information
Data Out:	Non-functional Device Information Repair list from Mechanic send to process 2.2
Process:	(1) Receive Order list from customer (2) Keep description to Non-functional Device Item file (3) Send description to assigned Mechanic who will check the car in order to repair
Attachment:	Customer Non-Functional Device Information database

Table E.4. Process Specification of Process 2.1.1.

Items	Description
Process Name:	Non-Functional Device
Data In:	Order list from customer Customer Information Car Information
Data Out:	Non-functional Device database Claimed Item list sent to process 2.1.2
Process:	(1) Receive Order list from customer (2) Classify normal item and claimed item
Attachment:	Customer Customer Information database Care Information database Non-Functional Device Information database

Table E.5. Process Specification of Process 2.1.2.

Items	Description
Process Name:	Claim Defected Item
Data In:	Claimed Item List from process 2.1.1 Claimed Defected Item from Mechanic
Data Out:	Claimed Item Information after checked by Mechanic
Process:	(1) Receive claimed item and send to Mechanic who will check whether the item is valid to claim or not
Attachment:	Mechanic Claimed Item Information database

Table E.6. Process Specification of Process 2.1.3.

Items	Description
Process Name:	Repair for Claim
Data In:	Claimed Item Information
Data Out:	Update Claimed Item Information
Process:	(1) Retrieve claimed item from Claimed Item Information file (2) Request claim part from Warehouse (3) Receive part from Warehouse (4) Send Repair Claimed Part to Mechanic
Attachment:	Claimed Item Information database Warehouse Mechanic

Table E.7. Process Specification of Process 2.2.

Items	Description
Process Name:	Generate Quotation
Data In:	Repair list from Mechanic Part's price and Service Charge Rate from database
Data Out:	Quotation for customer Repair Description
Process:	(1) Receive repair list from Mechanic (2) Retrieve part's price and Service Charge Rate from database (3) Generate quotation to customer
Attachment:	Customer Mechanic Part Information database Service Information database Repair Information database

Table E.8. Process Specification of Process 2.3.

Items	Description
Process Name:	Repair
Data In:	Approve quotation from customer Part available from Warehouse
Data Out:	Approve to repair to Mechanic
Process:	(1) Receive approved quotation from customer (2) Request part from Warehouse (3) Receive available part from Warehouse (4) Send repair approval to Mechanic
Attachment:	Repair Information database Customer Mechanic Warehouse

Table E.9. Process Specification of Process 2.4.

Items	Description
Process Name:	Standby for Repair
Data In:	Unavailable part number from Warehouse Wait-to-Repair from customer
Data Out:	Inform Wait-to-Repair information to Mechanic Update repair information
Process:	(1) Receive unavailable part number from Warehouse (2) Inform unavailable part to customer (3) Acceptance of Wait-to-Repair from customer (4) Update repair information from Mechanic to process 2.3
Attachment:	Customer Mechanic Warehouse

Table E.10. Process Specification of Process 2.5.

Items	Description
Process Name:	Cancel Repair
Data In:	Cancel repair from customer
Data Out:	Inform repair cancellation to Mechanic Update repair information (cancel)
Process:	(1) Receive Cancel repair from customer (2) Update repair information (cancel)
Attachment:	Customer Mechanic

Table E.11. Process Specification of Process 3.1.

Items	Description
Process Name:	Promotion
Data In:	Part's detail from Part Information database Promotion policy from Management
Data Out:	Restore promotion description into promotion information database and send to process 3.2
Process:	(1) Retrieve part's detail from Part Information database (2) Retrieve promotion policy from Management (3) Keep promotion description into Promotion Information database
Attachment:	Part Information database Promotion Information database Management

Table E.12. Process Specification of Process 3.2.

Items	Description
Process Name:	Calculate Price
Data In:	Customer information Car information Repair information Part Information Service charge Promotion description from Promotion Information
Data Out:	Pre-invoice description send to process 3.3
Process:	(1) Retrieve customer information, car information, repair information, part information and service charge from database (2) Receive promotion description from Promotion Information database (3) Calculate price and store into Pre-invoice Information database
Attachment:	Customer Information database Car Information database Repair Information database Part Information database Promotion Information database Service Information database Pre-invoice Information database

Table E.13. Process Specification of Process 3.3.

Items	Description
Process Name:	Calculate Tax
Data In:	Pre-invoice information
Data Out:	Tax Paid Information store into database Invoice is sent to customer
Process:	(1) Retrieve pre-invoice information from Pre-invoice Information database (2) Calculate tax and store into Tax Paid Information file (3) Generate Invoice and send to customer
Attachment:	Pre-invoice Information database Tax Paid Information database Invoice Information database Customer

Table E.14. Process Specification of Process 4.1.

Items	Description
Process Name:	Generate Bill/Receipt
Data In:	Claimed Item Information Invoice Information Tax Paid information Payment from customer
Data Out:	Bill/Receipt to Customer and Account/Finance
Process:	(1) Retrieve Claimed Item Information, Invoice Information and Tax Paid Information to generate Bill/Receipt to customer (2) Store Bill/Receipt Information into database and forward information to Account/Finance
Attachment:	Customer Account/Finance Claimed Item Information database Tax paid Information database Invoice Information database Bill/Receipt Information database

Table E.15. Process Specification of Process 4.2.

Items	Description
Process Name:	Generate Report
Data In:	Claimed Item Information Invoice Information Tax Paid Information Repair Information, Customer Information, Car Information and Calendar (daily, weekly and monthly)
Data Out:	Bill/Receipt Report
Process:	(1) Retrieve Claimed Item Information, Invoice Information, Tax Paid Information, Repair Information, Customer Information and Car information to generate report that activated by time to management
Attachment:	Customer Information database Car Information database Repair Information database Claimed Item Information database Invoice Information database Tax paid Information database Calendar Management

Table E.16. Process Specification of Process 5.1.

Items	Description
Process Name:	Order Part
Data In:	Part Information
Data Out:	Purchase Order Order Description
Process:	(1) Retrieve Safety Stock Activate from Part Information Database then generate purchase order and send to supplier.
Attachment:	Part Information Database Order Information Supplier

Table E.17. Process Specification of Process 5.2.

Items	Description
Process Name:	Receive Part
Data In:	Auto parts
Data Out:	Update Part Information
Process:	(1) Receive auto parts from supplier and update part information in database
Attachment:	Part Information Database Supplier

Table E.18. Process Specification of Process 5.3.

Items	Description
Process Name:	Payment
Data In:	New Part Information Invoice
Data Out:	Payment Transaction
Process:	(1) Receive invoice from supplier then generate payment transaction to supplier and send payment information to Account/Finance
Attachment:	Payment Information database Supplier Account/Finance



**APPENDIX F**

**DATA DICTIONARY**

## DATA DICTIONARY

Project: AUTOMOBILE SERVICE INFORMATION SYSTEM

Detailed Listing -- Alphabetically  
All Entries -- Data Flow Diagrams

Account/Finance	External Entity
Location:	
DFD_Level0 ( 0 )	
Input Flows:	
Bill_Receipt	
Input Flows:	
Payment Information	
Date Last Altered:24/2/02	Date Created:24/2/02
-----	
Approve to repair	Data Flow
Location:	
DFD_Level0 ( 0 )	
Source: Customer ( External Entity )	
Dest: Process Check and Repair ( Process )	
Date Last Altered:24/2/02	Date Created:24/2/02
-----	
Autoparts	Data Flow
Location:	
DFD_Level0 ( 0 )	
Source: Supplier ( External Entity )	
Dest: Process Order Transaction ( Process )	
Date Last Altered:24/2/02	Date Created:24/2/02
-----	
BILL_CODE	Data Element
Data element attributes	
Storage Type: Char	
Null Type: NotNull	
Location:	
Entity --> BILL	
Date Last Altered:22/2/02	Date Created:22/2/02
-----	
Bill_Receipt	Data Flow
Location:	
DFD_Level0 ( 0 )	
Source: Generate Report ( Process )	
Dest: Bill_Receipt Information ( Data Store )	
Source: Generate Report ( Process )	
Dest: Customer ( External Entity )	
Source: Generate Report ( Process )	
Dest: Account/Finance ( External Entity )	
Date Last Altered:24/2/02	Date Created:24/2/02

---

Bill\_Receipt Information                      Data Store  
Data Store #:D5  
Location:  
    DFD\_Level0 ( 0 )  
    Input Flows:  
        Bill\_Receipt  
Date Last Altered:24/2/02              Date Created:24/2/02

---

BRAND                                      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: NotNull  
Location:  
Entity --> CAR  
Date Last Altered:22/2/02              Date Created:22/2/02

---

Calendar                                      External Entity  
Location:  
    DFD\_Level0 ( 0 )  
    Output Flows:  
        Weekly  
        Daily  
        Monthly  
Date Last Altered:24/2/02              Date Created:24/2/02  
Car Information                              Data Store

---

Data Store #:D2  
Location:  
    DFD\_Level0 ( 0 )  
    Output Flows:  
        Existing Car Information  
    Input Flows:  
        New Car Information  
    Output Flows:  
        Car Information  
    Output Flows:  
        Car Information  
Date Last Altered:24/2/02              Date Created:24/2/02

---

Car Information                              Data Flow  
Location:  
    DFD\_Level0 ( 0 )  
        Source: Car Information ( Data Store )  
        Dest: Process Payment Transaction ( Process )  
        Source: Car Information ( Data Store )  
        Dest: Generate Report ( Process )  
Date Last Altered:24/2/02              Date Created:24/2/02

---

Charge                                      Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Service ( Data Store )

Dest: Process Check and Repair ( Process )

Source: Service ( Data Store )

Dest: Process Payment Transaction ( Process )

Source: Service Information ( Data Store )

Dest: Generate Report ( Process )

Date Last Altered:24/2/02

Date Created:24/2/02

---

CLAIM\_CODE

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CLAIMED\_ITEM

Date Last Altered:22/2/02

Date Created:22/2/02

---

CLAIM\_DESC

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CLAIMED\_ITEM

Date Last Altered:22/2/02

Date Created:22/2/02

---

CLAIM\_QUAN

Data Element

Data element attributes

Storage Type: Interval

Null Type: NotNull

Location:

Entity --> CLAIMED\_ITEM

Date Last Altered:24/2/02

Date Created:24/2/02

---

COLOUR

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CAR

Date Last Altered:22/2/02

Date Created:22/2/02

---

CONTACT\_NAME

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> SUPPLIER

Date Last Altered:22/2/02

Date Created:22/2/02



Customer Information

Data Store

Data Store #:D1

Location:

DFD\_Level0 ( 0 )

Output Flows:

Existing Customer Information

Input Flows:

New Customer Information

Output Flows:

Customer Information

Output Flows:

Customer Information

Date Last Altered:24/2/02

Date Created:24/2/02

Customer Information

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Customer ( External Entity )

Dest: Process Check Customer Profile ( Process )

Source: Customer Information ( Data Store )

Dest: Process Payment Transaction ( Process )

Source: Customer Information ( Data Store )

Dest: Generate Report ( Process )

Date Last Altered:24/2/02

Date Created:24/2/02

Daily

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Calendar ( External Entity )

Dest: Generate Report ( Process )

Date Last Altered:24/2/02

Date Created:24/2/02

DATE

Data Element

Data element attributes

Storage Type: Date

Null Type: Null

Location:

Entity --> ORDER

Entity --> BILL

Date Last Altered:22/2/02

Date Created:22/2/02

DATE\_IN

Data Element

Data element attributes

Storage Type: DateTime

Null Type: Null

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

DATE\_OUT

Data Element

Data element attributes

Storage Type: DateTime

Null Type: Null

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02 Date Created:22/2/02

---

Estimate for repair

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Mechanic ( External Entity )

Dest: Process Check and Repair ( Process )

Date Last Altered:24/2/02 Date Created:24/2/02

---

Existing Car Information

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Car Information ( Data Store )

Dest: Process Check Customer Profile ( Process )

Date Last Altered:24/2/02 Date Created:24/2/02

---

Existing Customer Information

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Customer Information ( Data Store )

Dest: Process Check Customer Profile ( Process )

Date Last Altered:24/2/02 Date Created:24/2/02

---

FAX

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CUSTOMER

Entity --> SUPPLIER

Date Last Altered:22/2/02 Date Created:22/2/02

---

FIXED

Data Element

Data element attributes

Storage Type: Bit

Null Type: Null

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02 Date Created:22/2/02

---

GENDER

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CUSTOMER

Date Last Altered:22/2/02

Date Created:22/2/02

---

Generate Report

Process

Process #: 4

Location:

DFD\_Level0 ( 0 )

Input Flows:

Weekly

Daily

Monthly

Repair Information

Customer Information

Car Information

Charge

Output Flows:

Bill\_ Receipt

Bill\_ Receipt

Bill\_ Receipt

Report

Date Last Altered:24/2/02

Date Created:24/2/02

Invoice

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Process Payment Transaction ( Process )

Dest: Invoice Information ( Data Store )

Date Last Altered:24/2/02

Date Created:24/2/02

---

Invoice Information

Data Store

Data Store #:D13

Location:

DFD\_Level0 ( 0 )

Input Flows:

Invoice

Date Last Altered:24/2/02

Date Created:24/2/02

---

LICENSE\_PLATE

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CAR

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

---

Management

External Entity

Location:

DFD\_Level0 ( 0 )

Input Flows:

Report

Date Last Altered:24/2/02

Date Created:24/2/02

---

Mechanic

External Entity

Location:

DFD\_Level0 ( 0 )

Input Flows:

Repair Order Description

Output Flows:

Estimate for repair

Date Last Altered:24/2/02

Date Created:24/2/02

---

MILEAGE

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

---

MODEL

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CAR

Date Last Altered:22/2/02

Date Created:22/2/02

---

Monthly

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Calendar ( External Entity )

Dest: Generate Report ( Process )

Date Last Altered:24/2/02

Date Created:24/2/02

---

New Car Information

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Process Check Customer Profile ( Process )

Dest: Car Information ( Data Store )

Date Last Altered:24/2/02

Date Created:24/2/02

---

New Customer Information

Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Process Check Customer Profile ( Process )

Dest: Customer Information ( Data Store )

Date Last Altered:24/2/02

Date Created:24/2/02



Date Last Altered:22/2/02      Date Created:22/2/02

ORDER\_NO      Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity -->      DETAIL\_ORDER

Entity -->      ORDER

Date Last Altered:22/2/02      Date Created:22/2/02

P/O\_NO      Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity -->      PART

Date Last Altered:22/2/02      Date Created:22/2/02

Part Information      Data Store

Data Store #:D10

Location:

DFD\_Level0 ( 0 )

Output Flows:

Part Price

Input Flows:

Update Part Information

Output Flows:

Safety Stock Activate

Date Last Altered:24/2/02      Date Created:24/2/02

Part Price      Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Part Information ( Data Store )

Dest: Process Payment Transaction ( Process )

Date Last Altered:24/2/02      Date Created:24/2/02

PART\_NAME      Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity -->      PART

Date Last Altered:22/2/02      Date Created:22/2/02

PART\_NO      Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART  
Entity --> NON\_FUNC\_PART  
Entity --> PROMOTION\_PART  
Entity --> SUPPLIED\_PART  
Entity --> DETAIL\_ORDER

Date Last Altered:22/2/02 Date Created:22/2/02

---

PART\_QUAN Data Element

Data element attributes

Storage Type: Interval

Null Type: Null

Location:

Entity --> NON\_FUNC\_PART

Date Last Altered:22/2/02 Date Created:22/2/02

---

Payment Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Customer ( External Entity )

Dest: Process Payment Transaction ( Process )

Source: Process Order Transaction ( Process )

Dest: Supplier ( External Entity )

Source: Process Order Transaction ( Process )

Dest: Payment Information ( Data Store )

Date Last Altered:24/2/02 Date Created:24/2/02

---

Payment Information Data Store

Data Store #:D15

Location:

DFD\_Level0 ( 0 )

Input Flows:

Payment

Date Last Altered:24/2/02 Date Created:24/2/02

---

Payment Information Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Process Order Transaction ( Process )

Dest: Account/Finance ( External Entity )

Date Last Altered:24/2/02 Date Created:24/2/02

---

PRICE Data Element

Data element attributes

Storage Type: Money

Null Type: NotNull

Location:

Entity --> DETAIL\_ORDER

Date Last Altered:22/2/02 Date Created:22/2/02

---

Process Check and Repair                      Process  
Process #: 2  
Location:  
    DFD\_Level0 ( 0 )  
    Input Flows:  
        Repair Order Description  
        Approve to repair  
        Charge  
        Estimate for repair  
    Output Flows:  
        Quotation  
        Repair Order Description  
        Repair Information  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Process Check Customer Profile              Process  
Process #: 1  
Location:  
    DFD\_Level0 ( 0 )  
    Input Flows:  
        Existing Customer Information  
        Existing Car Information  
        Customer Information  
    Output Flows:  
        New Customer Information  
        New Car Information  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Process Order Transaction                      Process  
Process #: 5  
Location:  
    DFD\_Level0 ( 0 )  
    Input Flows:  
        Safety Stock Activate  
        Autoparts  
    Output Flows:  
        Update Part Information  
        Purchase Order  
        Payment  
        Payment  
        Order Information  
        Payment Information  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Process Payment Transaction                  Process  
Process #: 3  
Location:  
    DFD\_Level0 ( 0 )

Input Flows:  
Car Information  
Customer Information  
Promotion Description  
Part Price  
Payment  
Charge  
Repair Information

Output Flows:  
Tax Paid  
Invoice

Date Last Altered:24/2/02      Date Created:24/2/02

---

Promotion Description      Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Promotion Information ( Data Store )  
Dest: Process Payment Transaction ( Process )  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Promotion Information      Data Store  
Data Store #:D11  
Location:  
DFD\_Level0 ( 0 )  
Output Flows:  
Promotion Description  
Date Last Altered:24/2/02      Date Created:24/2/02

---

PROMOTION\_DESC      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: NotNull  
Location:  
Entity --> PROMOTION  
Date Last Altered:22/2/02      Date Created:22/2/02

---

PROMOTION\_NO      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: NotNull  
Location:  
Entity --> PROMOTION  
Entity --> PROMOTION\_PART  
Date Last Altered:22/2/02      Date Created:22/2/02

---

Purchase Order      Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Process Order Transaction ( Process )

Dest: Supplier ( External Entity )  
Date Last Altered:24/2/02      Date Created:24/2/02

---

QUANTITY      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: NotNull  
Location:  
Entity --> PART  
Entity --> DETAIL\_ORDER  
Date Last Altered:22/2/02      Date Created:22/2/02

---

Quotation      Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Process Check and Repair ( Process )  
Dest: Customer ( External Entity )  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Repair Information      Data Store  
Data Store #:D9  
Location:  
DFD\_Level0 ( 0 )  
Input Flows:  
Repair Information  
Output Flows:  
Repair Information  
Repair Information  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Repair Information      Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Process Check and Repair ( Process )  
Dest: Repair Information ( Data Store )  
Source: Repair Information ( Data Store )  
Dest: Process Payment Transaction ( Process )  
Source: Repair Information ( Data Store )  
Dest: Generate Report ( Process )  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Repair Order Description      Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Customer ( External Entity )  
Dest: Process Check and Repair ( Process )  
Source: Process Check and Repair ( Process )  
Dest: Mechanic ( External Entity )  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Report Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Generate Report ( Process )  
Dest: Management ( External Entity )  
Date Last Altered:24/2/02 Date Created:24/2/02

---

Safety Stock Activate Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Part Information ( Data Store )  
Dest: Process Order Transaction ( Process )  
Date Last Altered:24/2/02 Date Created:24/2/02

---

Service Data Store  
Data Store #:D6  
Location:  
DFD\_Level0 ( 0 )  
Output Flows:  
Charge  
Charge  
Date Last Altered:24/2/02 Date Created:24/2/02

---

Service Information Data Store  
Data Store #:D14  
Location:  
DFD\_Level0 ( 0 )  
Output Flows:  
Charge  
Date Last Altered:24/2/02 Date Created:24/2/02

---

SERVICE\_CHARGE Data Element  
Data element attributes  
Storage Type: Money  
Null Type: NotNull  
Location:  
Entity --> NON\_FUNCTIONAL  
Date Last Altered:22/2/02 Date Created:22/2/02

---

START Data Element  
Data element attributes  
Storage Type: Date  
Null Type: Null  
Location:  
Entity --> PROMOTION  
Date Last Altered:22/2/02 Date Created:22/2/02

---

STATUS Data Element

Data element attributes

Storage Type: Bit

Null Type: Null

Location:

Entity --> ORDER

Date Last Altered:22/2/02

Date Created:22/2/02

STOCK

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART

Date Last Altered:22/2/02

Date Created:22/2/02

STOP

Data Element

Data element attributes

Storage Type: Date

Null Type: Null

Location:

Entity --> PROMOTION

Date Last Altered:22/2/02

Date Created:22/2/02

Supplier

External Entity

Location:

DFD\_Level0 ( 0 )

Input Flows:

Purchase Order

Payment

Output Flows:

Autoparts

Date Last Altered:24/2/02

Date Created:24/2/02

SUPPLIER\_ADD

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> SUPPLIER

Date Last Altered:22/2/02

Date Created:22/2/02

SUPPLIER\_ID

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> SUPPLIER

Entity --> SUPPLIED\_PART

Entity --> ORDER

Date Last Altered:22/2/02      Date Created:22/2/02

---

SUPPLIER\_NAME      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: NotNull  
Location:  
Entity -->      SUPPLIER  
Date Last Altered:22/2/02      Date Created:22/2/02

---

Tax Paid      Data Flow  
Location:  
DFD\_Level0 ( 0 )  
Source: Process Payment Transaction ( Process )  
Dest: Tax Paid Information ( Data Store )  
Date Last Altered:24/2/02      Date Created:24/2/02

---

Tax Paid Information      Data Store  
Data Store #:D12  
Location:  
DFD\_Level0 ( 0 )  
Input Flows:  
Tax Paid  
Date Last Altered:24/2/02      Date Created:24/2/02

---

TAX\_RATE      Data Element  
Data element attributes  
Storage Type: Integer 4  
Null Type: Null  
Location:  
Entity --> \* BILL  
Date Last Altered:22/2/02      Date Created:22/2/02

---

TEL1      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: NotNull  
Location:  
Entity -->      CUSTOMER  
Entity -->      SUPPLIER  
Date Last Altered:22/2/02      Date Created:22/2/02

---

TEL2      Data Element  
Data element attributes  
Storage Type: Char  
Null Type: Null  
Location:  
Entity -->      CUSTOMER  
Entity -->      SUPPLIER

Date Last Altered:22/2/02      Date Created:22/2/02

---

TOTAL      Data Element

Data element attributes

Storage Type: Money

Null Type: Null

Location:

Entity --> BILL

Date Last Altered:22/2/02      Date Created:22/2/02

---

UNIT\_PRICE      Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART

Date Last Altered:22/2/02      Date Created:22/2/02

---

Update Part Information      Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Process Order Transaction ( Process )

Dest: Part Information ( Data Store )

Date Last Altered:24/2/02      Date Created:24/2/02

---

Weekly      Data Flow

Location:

DFD\_Level0 ( 0 )

Source: Calendar ( External Entity )

Dest: Generate Report ( Process )

Date Last Altered:24/2/02      Date Created:24/2/02

---

YEAR      Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CAR

Entity --> NON\_FUNC\_PART

Date Last Altered:22/2/02      Date Created:22/2/02

---

## DATA DICTIONARY

Project: AUTOMOBILE SERVICE INFORMATION SYSTEM

Detailed Listing -- Alphabetically  
All Entries -- Entity Relationship

<b>BILL</b>	<b>Entity</b>
Composition: CUST_NO : Char BILL_CODE : Char DATE : Date TAX_RATE : Integer 4 TOTAL : Money	
Primary Key: Index Name: Generated by VAW Column(s): BILL_CODE [ ASC ]	
Foreign Key(s): CUSTOMER 'receive' BILL CUST_NO -> CUST_NO On Delete Restrict On Update Restrict On Insert of Child Row Restrict	
Location: Attribute Level Attached relationships on Attribute Level: [ receive ] MIN: 1 MAX: 1 CUSTOMER generate MIN: 1 MAX: 1 NON_FUNC_PART	
Context ERD Attached relationships on Context ERD: generate MIN: 1 MAX: 1 NON_FUNC_PART [ receive ] MIN: 1 MAX: 1 CUSTOMER	
Date Last Altered:24/2/02      Date Created:22/2/02	
-----	
<b>BILL_CODE</b>	<b>Data Element</b>
Data element attributes Storage Type: Char Null Type: NotNull	
Location: Entity --> BILL	
Date Last Altered:22/2/02      Date Created:22/2/02	
-----	
<b>BRAND</b>	<b>Data Element</b>
Data element attributes	

Storage Type: Char  
Null Type: NotNull  
Location:  
Entity --> CAR  
Date Last Altered:22/2/02 Date Created:22/2/02

---

CAR Entity

Composition:  
LICENSE\_PLATE : Char  
BRAND : Char  
MODEL : Char  
COLOUR : Char  
YEAR : Char  
Primary Key:  
Index Name: Generated by VAW  
Column(s): LICENSE\_PLATE [ ASC ]

Foreign Key(s):  
CUSTOMER 'has' CAR  
On Delete Restrict  
On Update Restrict  
On Insert of Child Row Restrict

Location:  
Attribute Level  
Attached relationships on Attribute Level:  
[ has ] MIN: 1 MAX: 1  
CUSTOMER  
has MIN: 1 MAX: many  
NON\_FUNCTIONAL\_CAR

Context ERD  
Attached relationships on Context ERD:  
[ has ] MIN: 1 MAX: 1  
CUSTOMER  
has MIN: 1 MAX: many  
NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02 Date Created:22/2/02

---

CLAIM\_CODE Data Element

Data element attributes  
Storage Type: Char  
Null Type: NotNull

Location:  
Entity --> CLAIMED\_ITEM  
Date Last Altered:22/2/02 Date Created:22/2/02

---

CLAIM\_DESC Data Element

Data element attributes  
Storage Type: Char  
Null Type: Null

Location:

Entity --> CLAIMED\_ITEM  
Date Last Altered:22/2/02 Date Created:22/2/02

---

CLAIM\_QUAN Data Element

Data element attributes

Storage Type: Interval

Null Type: NotNull

Location:

Entity --> CLAIMED\_ITEM

Date Last Altered:24/2/02 Date Created:24/2/02

---

CLAIMED\_ITEM Entity

Composition:

NON\_FUNC\_ID : Char

CLAIM\_CODE : Char

CLAIM\_DESC : Char

CLAIM\_QUAN : Interval

Primary Key:

Index Name: Generated by VAW

Column(s): CLAIM\_CODE [ ASC ]

Foreign Key(s):

NON\_FUNC\_PART 'has' CLAIMED\_ITEM

NON\_FUNC\_ID -> NON\_FUNC\_ID

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

[ has ] MIN: 1 MAX: 1

NON\_FUNC\_PART

Context ERD

Attached relationships on Context ERD:

[ has ] MIN: 1 MAX: 1

NON\_FUNC\_PART

Date Last Altered:24/2/02 Date Created:22/2/02

---

COLOUR Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CAR

Date Last Altered:22/2/02 Date Created:22/2/02

---

CONTACT\_NAME Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> SUPPLIER

Date Last Altered:22/2/02

Date Created:22/2/02

---

CUST\_ADD

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CUSTOMER

Date Last Altered:22/2/02

Date Created:22/2/02

---

CUST\_NAME

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CUSTOMER

Date Last Altered:22/2/02

Date Created:22/2/02

---

CUST\_NO

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CUSTOMER

Entity --> BILL

Date Last Altered:22/2/02

Date Created:22/2/02

---

CUST\_SUR

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CUSTOMER

Date Last Altered:22/2/02

Date Created:22/2/02

---

CUSTOMER

Entity

Composition:

CUST\_NO : Char

CUST\_NAME : Char

CUST\_SUR : Char

CUST\_ADD : Char

TEL1 : Char

TEL2 : Char

FAX : Char

GENDER : Char

Primary Key:

Index Name: Generated by VAW

Column(s): CUST\_NO [ ASC ]  
 Location:  
 Attribute Level  
 Attached relationships on Attribute Level:  
     has                      MIN: 1    MAX: many  
     CAR  
     receive                 MIN: 1    MAX: 1  
     BILL  
 Context ERD  
 Attached relationships on Context ERD:  
     has                      MIN: 1    MAX: many  
     CAR  
     receive                 MIN: 1    MAX: 1  
     BILL  
 Date Last Altered:22/2/02    Date Created:22/2/02

---

DATE                      Data Element  
 Data element attributes  
     Storage Type: Date  
     Null Type: Null  
 Location:  
     Entity -->        ORDER  
     Entity -->        BILL  
 Date Last Altered:22/2/02    Date Created:22/2/02

---

DATE\_IN                      Data Element  
 Data element attributes  
     Storage Type: DateTime  
     Null Type: Null  
 Location:  
     Entity -->        \* NON\_FUNCTIONAL\_CAR \*  
 Date Last Altered:22/2/02    Date Created:22/2/02

---

DATE\_OUT                      Data Element  
 Data element attributes  
     Storage Type: DateTime  
     Null Type: Null  
 Location:  
     Entity -->        NON\_FUNCTIONAL\_CAR  
 Date Last Altered:22/2/02    Date Created:22/2/02

---

DETAIL\_ORDER                      Entity  
 Composition:  
     PART\_NO : Char  
     ORDER\_NO : Char  
     QUANTITY : Char  
     PRICE : Money  
 Primary Key:  
     Index Name:    Generated by VAW

Column(s): PART\_NO [ ASC ]  
ORDER\_NO [ ASC ]  
Foreign Key(s):  
PART 'issue' DETAIL\_ORDER  
PART\_NO -> PART\_NO  
On Delete Restrict  
On Update Restrict  
On Insert of Child Row Restrict  
ORDER 'is issued by' DETAIL\_ORDER  
ORDER\_NO -> ORDER\_NO  
On Delete Restrict  
On Update Restrict  
On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

[ is issued by ] MIN: 1 MAX: 1

ORDER

[ issue ] MIN: 1 MAX: 1

PART

Date Last Altered:22/2/02

Date Created:22/2/02

FAX

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CUSTOMER

Entity --> SUPPLIER

Date Last Altered:22/2/02

Date Created:22/2/02

FIXED

Data Element

Data element attributes

Storage Type: Bit

Null Type: Null

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

GENDER

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CUSTOMER

Date Last Altered:22/2/02

Date Created:22/2/02

generate

Relationship

Attached Objects:

BILL  
 generate MIN: 1 MAX: 1  
 NON\_FUNC\_PART  
 [ generate ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 BILL 'generate' NON\_FUNC\_PART  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Context ERD  
 Attribute Level  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

has Relationship  
 Attached Objects:  
 CUSTOMER  
 has MIN: 1 MAX: many  
 CAR  
 [ has ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 CUSTOMER 'has' CAR  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Context ERD  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

has Relationship  
 Attached Objects:  
 CAR  
 has MIN: 1 MAX: many  
 NON\_FUNCTIONAL\_CAR  
 [ has ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 CAR 'has' NON\_FUNCTIONAL\_CAR  
 LICENSE\_PLATE -> LICENSE\_PLATE  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

has Relationship  
 Attached Objects:  
 NON\_FUNCTIONAL

has MIN: 1 MAX: many  
 NON\_FUNCTIONAL\_CAR  
 [ has ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 NON\_FUNCTIONAL 'has' NON\_FUNCTIONAL\_CAR  
 NON\_FUNC\_CODE -> NON\_FUNC\_CODE  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

has Relationship  
 Attached Objects:  
 NON\_FUNC\_PART  
 has MIN: 0 MAX: many  
 CLAIMED\_ITEM  
 [ has ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 NON\_FUNC\_PART 'has' CLAIMED\_ITEM  
 NON\_FUNC\_ID -> NON\_FUNC\_ID  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Context ERD  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

has Relationship  
 Attached Objects:  
 CAR  
 has MIN: 1 MAX: many  
 NON\_FUNCTIONAL  
 [ has ] MIN: 1 MAX: many  
 Foreign Key(s):  
 CAR 'has' NON\_FUNCTIONAL  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Context ERD  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

is belong to Relationship  
 Attached Objects:  
 PART  
 is belong to MIN: 1 MAX: many

SUPPLIED\_PART  
 [ is belong to ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 PART 'is belong to' SUPPLIED\_PART  
 PART\_NO -> PART\_NO  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Date Last Altered:25/2/02 Date Created:22/2/02

---

is fixed by Relationship  
 Attached Objects:  
 NON\_FUNCTIONAL  
 is fixed by MIN: 1 MAX: many  
 NON\_FUNC\_PART  
 [ is fixed by ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 NON\_FUNCTIONAL 'is fixed by' NON\_FUNC\_PART  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Context ERD  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

is issued by Relationship  
 Attached Objects:  
 ORDER  
 is issued by \* MIN: 1 MAX: many \*  
 DETAIL\_ORDER  
 [ is issued by ] MIN: 1 MAX: 1  
 Foreign Key(s):  
 ORDER 'is issued by' DETAIL\_ORDER  
 ORDER\_NO -> ORDER\_NO  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Date Last Altered:25/2/02 Date Created:22/2/02

---

is promoted by Relationship  
 Attached Objects:  
 PART  
 is promoted by MIN: 0 MAX: many  
 PROMOTION\_PART  
 [ is promoted by ] MIN: 1 MAX: 1

Foreign Key(s):

PART 'is promoted by' PROMOTION\_PART

PART\_NO -> PART\_NO

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Date Last Altered:22/2/02

Date Created:22/2/02

is promoted by

Relationship

Attached Objects:

PART

is promoted by

MIN: 0 MAX: many

PROMOTION

[ is promoted by ]

MIN: 1 MAX: many

Foreign Key(s):

PART 'is promoted by' PROMOTION

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Context ERD

Date Last Altered:22/2/02

Date Created:22/2/02

is replaced by

Relationship

Attached Objects:

NON\_FUNCTIONAL\_CAR

is replaced by

MIN: 1 MAX: many

NON\_FUNC\_PART

[ is replaced by ]

MIN: 1 MAX: 1

Foreign Key(s):

NON\_FUNCTIONAL\_CAR 'is replaced by' NON\_FUNC\_PART

NON\_FUNC\_ID -> NON\_FUNC\_ID

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Date Last Altered:25/2/02

Date Created:22/2/02

issue

Relationship

Attached Objects:

PART

issue

MIN: 1 MAX: many

DETAIL\_ORDER

[ issue ]

MIN: 1 MAX: 1

Foreign Key(s):

PART 'issue' DETAIL\_ORDER

PART\_NO -> PART\_NO  
On Delete Restrict  
On Update Restrict  
On Insert of Child Row Restrict

Location:

Attribute Level

Date Last Altered:25/2/02

Date Created:22/2/02

LICENSE\_PLATE

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> CAR

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

MILEAGE

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

MODEL

Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> CAR

Date Last Altered:22/2/02

Date Created:22/2/02

NON\_FUNC\_CODE

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> NON\_FUNCTIONAL

Entity --> NON\_FUNCTIONAL\_CAR

Date Last Altered:22/2/02

Date Created:22/2/02

NON\_FUNC\_DESC

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> NON\_FUNCTIONAL

Date Last Altered:22/2/02

Date Created:22/2/02

-----

NON_FUNC_ID	Data Element
-------------	--------------

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> NON\_FUNCTIONAL\_CAR

Entity --> NON\_FUNC\_PART

Entity --> CLAIMED\_ITEM

Date Last Altered:24/2/02      Date Created:22/2/02

-----

NON_FUNC_PART	Entity
---------------	--------

Composition:

NON\_FUNC\_ID : Char

PART\_NO : Char

YEAR : Char

PART\_QUAN : Interval

Primary Key:

Index Name: Generated by VAW

Column(s): NON\_FUNC\_ID [ ASC ]

PART\_NO [ ASC ]

Foreign Key(s):

NON\_FUNCTIONAL 'is fixed by' NON\_FUNC\_PART

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

NON\_FUNCTIONAL\_CAR 'is replaced by' NON\_FUNC\_PART

NON\_FUNC\_ID -> NON\_FUNC\_ID

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

PART 'replace' NON\_FUNC\_PART

PART\_NO -> PART\_NO

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

BILL 'generate' NON\_FUNC\_PART

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

[ replace ]      MIN: 1    MAX: 1

PART

[ is replaced by ]      MIN: 1    MAX: 1

NON\_FUNCTIONAL\_CAR

has      MIN: 0    MAX: many

CLAIMED\_ITEM

[ generate ]                      MIN: 1   MAX: 1  
 BILL  
 Context ERD  
 Attached relationships on Context ERD:  
 [ replace ]                      MIN: 1   MAX: 1  
 PART  
 [ generate ]                      MIN: 1   MAX: 1  
 BILL  
 has                                  MIN: 0   MAX: many  
 CLAIMED\_ITEM  
 [ is fixed by ]                      MIN: 1   MAX: 1  
 NON\_FUNCTIONAL  
 Date Last Altered:24/2/02              Date Created:22/2/02

---

NON\_FUNCTIONAL                      Entity  
 Composition:  
   NON\_FUNC\_CODE : Char  
   NON\_FUNC\_DESC : Char  
   SERVICE\_CHARGE : Money  
 Primary Key:  
   Index Name:   Generated by VAW  
   Column(s):   NON\_FUNC\_CODE [ ASC ]  
 Foreign Key(s):  
   CAR 'has' NON\_FUNCTIONAL  
   On Delete Restrict  
   On Update Restrict  
   On Insert of Child Row Restrict  
 Location:  
   Attribute Level  
     Attached relationships on Attribute Level:  
       has                                  MIN: 1   MAX: many  
       NON\_FUNCTIONAL\_CAR  
   Context ERD  
     Attached relationships on Context ERD:  
       [ has ]                              MIN: 1   MAX: many  
       CAR  
       is fixed by                          MIN: 1   MAX: many  
       NON\_FUNC\_PART  
 Date Last Altered:22/2/02              Date Created:22/2/02

---

NON\_FUNCTIONAL\_CAR                      Entity  
 Composition:  
   NON\_FUNC\_ID : Char  
   NON\_FUNC\_CODE : Char  
   LICENSE\_PLATE : Char  
   DATE\_IN : DateTime  
   DATE\_OUT : DateTime  
   MILEAGE : Char  
   FIXED : Bit

Primary Key:

Index Name: Generated by VAW  
Column(s): NON\_FUNC\_ID [ ASC ]  
LICENSE\_PLATE [ ASC ]  
NON\_FUNC\_CODE [ ASC ]

Foreign Key(s):

CAR 'has' NON\_FUNCTIONAL\_CAR  
LICENSE\_PLATE -> LICENSE\_PLATE  
On Delete Restrict  
On Update Restrict  
On Insert of Child Row Restrict  
NON\_FUNCTIONAL 'has' NON\_FUNCTIONAL\_CAR  
NON\_FUNC\_CODE -> NON\_FUNC\_CODE  
On Delete Restrict  
On Update Restrict  
On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

[ has ] MIN: 1 MAX: 1

CAR

[ has ] MIN: 1 MAX: 1

NON\_FUNCTIONAL

is replaced by

MIN: 1 MAX: many

NON\_FUNC\_PART

Date Last Altered:22/2/02

Date Created:22/2/02

ORDER

Entity

Composition:

SUPPLIER\_ID : Char

ORDER\_NO : Char

DATE : Date

ORDER\_DETAIL : Char

STATUS : Bit

Primary Key:

Index Name: Generated by VAW  
Column(s): ORDER\_NO [ ASC ]

Foreign Key(s):

SUPPLIER 'receive' ORDER

SUPPLIER\_ID -> SUPPLIER\_ID

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

is issued by

MIN: 1 MAX: many

DETAIL\_ORDER

[ receive ]

MIN: 1 MAX: 1

## SUPPLIER

### Context ERD

Attached relationships on Context ERD:

[ receive ]

MIN: 1 MAX: 1

SUPPLIER

receives order

MIN: 1 MAX: many

PART

Date Last Altered:22/2/02

Date Created:22/2/02

---

## ORDER\_DETAIL

### Data Element

Data element attributes

Storage Type: Char

Null Type: Null

Location:

Entity --> ORDER

Date Last Altered:22/2/02

Date Created:22/2/02

---

## ORDER\_NO

### Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> DETAIL\_ORDER

Entity --> ORDER

Date Last Altered:22/2/02

Date Created:22/2/02

---

## P/O\_NO

### Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART

Date Last Altered:22/2/02

Date Created:22/2/02

---

## PART

### Entity

Composition:

PART\_NO : Char

PART\_NAME : Char

QUANTITY : Char

UNIT\_PRICE : Char

P/O\_NO : Char

STOCK : Char

Primary Key:

Index Name: Generated by VAW

Column(s): PART\_NO [ ASC ]

Foreign Key(s):

ORDER 'receives order' PART

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

replace	MIN: 1 MAX: many
NON_FUNC_PART	
is promoted by	MIN: 0 MAX: many
PROMOTION_PART	
is belong to	MIN: 1 MAX: many
SUPPLIED_PART	
issue	MIN: 1 MAX: many
DETAIL_ORDER	

Context ERD

Attached relationships on Context ERD:

replace	MIN: 1 MAX: many
NON_FUNC_PART	
[ receives order ]	MIN: 1 MAX: many
ORDER	
is promoted by	MIN: 0 MAX: many
PROMOTION	
supported by	MIN: 1 MAX: many
SUPPLIER	

Date Last Altered:22/2/02

Date Created:22/2/02

PART\_NAME

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART

Date Last Altered:22/2/02

Date Created:22/2/02

PART\_NO

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART

Entity --> NON\_FUNC\_PART

Entity --> PROMOTION\_PART

Entity --> SUPPLIED\_PART

Entity --> DETAIL\_ORDER

Date Last Altered:22/2/02

Date Created:22/2/02

PART\_QUAN

Data Element

Data element attributes

Storage Type: Interval

Null Type: Null

Location:

Entity --> NON\_FUNC\_PART  
Date Last Altered:22/2/02 Date Created:22/2/02

---

PRICE Data Element

Data element attributes

Storage Type: Money

Null Type: NotNull

Location:

Entity --> DETAIL\_ORDER

Date Last Altered:22/2/02 Date Created:22/2/02

---

promote Relationship

Attached Objects:

PROMOTION

promote MIN: 1 MAX: many

PROMOTION\_PART

[ promote ] MIN: 1 MAX: 1

Foreign Key(s):

PROMOTION 'promote' PROMOTION\_PART

PROMOTION\_NO -> PROMOTION\_NO

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Date Last Altered:25/2/02 Date Created:22/2/02

---

PROMOTION Entity

Composition:

PROMOTION\_NO : Char

PROMOTION\_DESC : Char

START : Date

STOP : Date

Primary Key:

Index Name: Generated by VAW

Column(s): PROMOTION\_NO [ ASC ]

Foreign Key(s):

PART 'is promoted by' PROMOTION

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

promote MIN: 1 MAX: many

PROMOTION\_PART

Context ERD

Attached relationships on Context ERD:

[ is promoted by ] MIN: 1 MAX: many

## PART

Date Last Altered:22/2/02

Date Created:22/2/02

### PROMOTION\_DESC

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PROMOTION

Date Last Altered:22/2/02

Date Created:22/2/02

### PROMOTION\_NO

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PROMOTION

Entity --> PROMOTION\_PART

Date Last Altered:22/2/02

Date Created:22/2/02

### PROMOTION\_PART

Entity

Composition:

PROMOTION\_NO : Char

PART\_NO : Char

Primary Key:

Index Name: Generated by VAW

Column(s): PROMOTION\_NO [ ASC ]

PART\_NO [ ASC ]

Foreign Key(s):

PROMOTION 'promote' PROMOTION\_PART

PROMOTION\_NO -> PROMOTION\_NO

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

PART 'is promoted by' PROMOTION\_PART

PART\_NO -> PART\_NO

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Attached relationships on Attribute Level:

[ is promoted by ] MIN: 1 MAX: 1

PART

[ promote ] MIN: 1 MAX: 1

PROMOTION

Date Last Altered:22/2/02

Date Created:22/2/02

### QUANTITY

Data Element

Data element attributes

Storage Type: Char

Null Type: NotNull

Location:

Entity --> PART

Entity --> DETAIL\_ORDER

Date Last Altered:22/2/02 Date Created:22/2/02

---

receive

Relationship

Attached Objects:

SUPPLIER

receive

MIN: 1 MAX: many

ORDER

[ receive ]

MIN: 1 MAX: 1

Foreign Key(s):

SUPPLIER 'receive' ORDER

SUPPLIER\_ID -> SUPPLIER\_ID

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Context ERD

Date Last Altered:25/2/02 Date Created:22/2/02

---

receive

Relationship

Attached Objects:

CUSTOMER

receive

MIN: 1 MAX: 1

BILL

[ receive ]

MIN: 1 MAX: 1

Foreign Key(s):

CUSTOMER 'receive' BILL

CUST\_NO -> CUST\_NO

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

Attribute Level

Context ERD

Date Last Altered:25/2/02 Date Created:22/2/02

---

receives order

Relationship

Attached Objects:

ORDER

receives order

MIN: 1 MAX: many

PART

[ receives order ]

MIN: 1 MAX: many

Foreign Key(s):

ORDER 'receives order' PART  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Context ERD  
 Date Last Altered:22/2/02      Date Created:22/2/02

---

replace      Relationship  
 Attached Objects:  
 PART  
 replace      MIN: 1    MAX: many  
 NON\_FUNC\_PART  
 [ replace ]      MIN: 1    MAX: 1  
 Foreign Key(s):  
 PART 'replace' NON\_FUNC\_PART  
 PART\_NO -> PART\_NO  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 Location:  
 Attribute Level  
 Context ERD  
 Date Last Altered:25/2/02      Date Created:22/2/02

---

SERVICE\_CHARGE      Data Element  
 Data element attributes  
 Storage Type: Money  
 Null Type:    NotNull  
 Location:  
 Entity -->    \*    NON\_FUNCTIONAL    \*  
 Date Last Altered:22/2/02      Date Created:22/2/02

---

START      Data Element  
 Data element attributes  
 Storage Type: Date  
 Null Type:    Null  
 Location:  
 Entity -->    PROMOTION  
 Date Last Altered:22/2/02      Date Created:22/2/02

---

STATUS      Data Element  
 Data element attributes  
 Storage Type: Bit  
 Null Type:    Null  
 Location:  
 Entity -->    ORDER  
 Date Last Altered:22/2/02      Date Created:22/2/02

---

STOCK Data Element  
 Data element attributes  
 Storage Type: Char  
 Null Type: NotNull  
 Location:  
 Entity --> PART  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

STOP Data Element  
 Data element attributes  
 Storage Type: Date  
 Null Type: Null  
 Location:  
 Entity --> PROMOTION  
 Date Last Altered:22/2/02 Date Created:22/2/02

SUPPLIED\_PART Entity  
 Composition:  
 SUPPLIER\_ID : Char  
 PART\_NO : Char  
 Primary Key:  
 Index Name: Generated by VAW  
 Column(s): SUPPLIER\_ID [ ASC ]  
 PART\_NO [ ASC ]  
 Foreign Key(s):  
 SUPPLIER 'supply' SUPPLIED\_PART  
 SUPPLIER\_ID -> SUPPLIER\_ID  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict  
 PART 'is belong to' SUPPLIED\_PART  
 PART\_NO -> PART\_NO  
 On Delete Restrict  
 On Update Restrict  
 On Insert of Child Row Restrict

Location:  
 Attribute Level  
 Attached relationships on Attribute Level:  
 [ is belong to ] MIN: 1 MAX: 1  
 PART  
 [ supply ] MIN: 1 MAX: 1  
 SUPPLIER  
 Date Last Altered:22/2/02 Date Created:22/2/02

---

SUPPLIER Entity  
 Composition:  
 SUPPLIER\_ID : Char  
 SUPPLIER\_NAME : Char  
 CONTACT\_NAME : Char  
 SUPPLIER\_ADD : Char

TEL1 : Char  
TEL2 : Char  
FAX : Char  
Primary Key:  
Index Name:   Generated by VAW

---





Table G.1. Structure of Customer Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Cust_no	Text	6	Primary Key	Car Table	-
Cust_name	Text	30	Attribute	-	-
Cust_sur	Text	30	Attribute	-	-
Cust_add	Text	50	Attribute	-	-
Tel1	Number	9	Attribute	-	9 Digits
Tel2	Number	9	Attribute	-	9 Digits
Fax	Number	9	Attribute	-	9 Digits
Gender	Boolean	2	Attribute	-	-

Table G.2. Structure of Car Table.

Name	Type	Length	Key Type	Foreign Key to	Check
License_plate	Text	6	Primary Key	Non_functional_car Table	-
Brand	Text	30	Attribute	-	-
Model	Text	30	Attribute	-	-
Colour	Text	20	Attribute	-	-
Year	Date/Time	4	Attribute	-	4 Digits

Table G.3. Structure of Non\_Functional\_Car Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Non_Func_Code	Text	6	Primary Key	Non_Func_Part Table	-
License_Plate	Text	6	Primary Key	Claimed_Item Table	-
Date_In	Date/Time	10	Attribute	-	-
Date_Out	Date/Time	10	Attribute	-	-
Mileage	Number	10	Attribute	-	-
Fixed	Boolean	1	Attribute	-	-

Table G.4. Structure of Non\_Functional Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Non_Func_Code	Text	6	Primary Key	Non_Functional_Car Table	-
Non_Func_Desc	Text	30	Attribute	-	-
Service_Charge	Money	20	Attribute	-	-

Table G.5. Structure of Part Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Part_No	Text	8	Primary Key	Non_Func_Part Table Promotion_Part Table Supplier_Part Table	-
Part_Name	Text	30	Attribute	-	-
Quantity	Number	20	Attribute	-	-
Unit_Price	Money	20	Attribute	-	-
P/O_No	Text	10	Attribute	-	-

Table G.6. Structure of Non\_Func\_Part Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Non_Func_Code	Text	6	Primary Key	Claimed_Item Table	-
Part_No	Text	8	Primary Key	-	-
Part_Quan	Number	20	Attribute	-	-

Table G.7. Structure of Promotion\_Part Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Promotion_No	Text	6	Primary Key	-	-
Part_No	Text	8	Primary Key	-	-

Table G.8. Structure of Promotion Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Promotion_No	Text	6	Primary Key	Promotion_Part Table	-
Promotion_Desc	Text	50	Attribute	-	-
Start	Date/Time	10	Attribute	-	-
Stop	Date/Time	10	Attribute	-	-

Table G.9. Structure of Claimed\_Item Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Claim_Code	Text	6	Primary Key	Promotion_Part Table	-
Non_Func_Code	Text	6	Primary Key	-	-
License_Plate	Text	6	Primary Key	Claimed_Item Table	-
Claim_Desc	Text	50	Attribute	-	-

Table G.10. Structure of Bill Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Bill_Code	Text	6	Primary Key	-	-
Cust_No	Text	6	Foreign Key	-	-
Date	Date/Time	10	Attribute	-	-
Tax_Rate	Number	10	Attribute	-	-
Total	Money	10	Attribute	-	-

Table G.11. Structure of Supplier Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Supplier_ID	Text	6	Primary Key	Supplier_Part Table Order Table	-
Supplier_Name	Text	30	Attribute	-	-
Contact_Name	Text	30	Attribute	-	-
Supplier_Add	Text	50	Attribute	-	-
Tel1	Number	9	Attribute	-	9 Digits
Tel2	Number	9	Attribute	-	9 Digits
Fax	Number	9	Attribute	-	9 Digits

Table G.12. Structure of Supplier\_Part Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Supplier_ID	Text	6	Foreign Key	-	-
Part_No	Text	8	Foreign Key	-	-

Table G.13. Structure of Order Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Order_NO	Text	6	Primary Key	-	-
Supplier_ID	Text	6	Foreign Key	-	-
Date	Date/Time	10	Attribute	-	-
Order_Detail	Text	30	Attribute	-	-
Status	Boolean	1	Attribute	-	-

Table G.14. Structure of Detail\_Order Table.

Name	Type	Length	Key Type	Foreign Key to	Check
Order_NO	Text	6	Foreign Key	-	-
Part_No	Text	8	Foreign Key	-	-
Quantity	Number	20	Attribute	-	-
Price	Money	20	Attribute	-	-



## APPENDIX H

### USER INTERFACE DESIGN

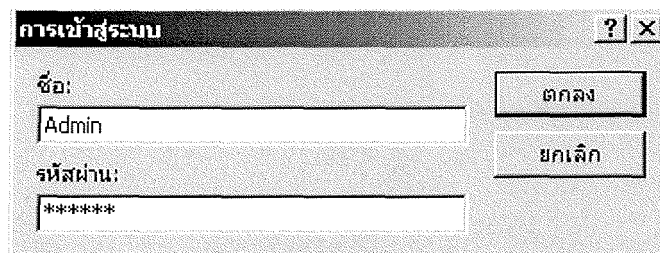


Figure H.1. Interface Design of Login Screen.



Figure H.2. Interface Design of Invalid User Login.

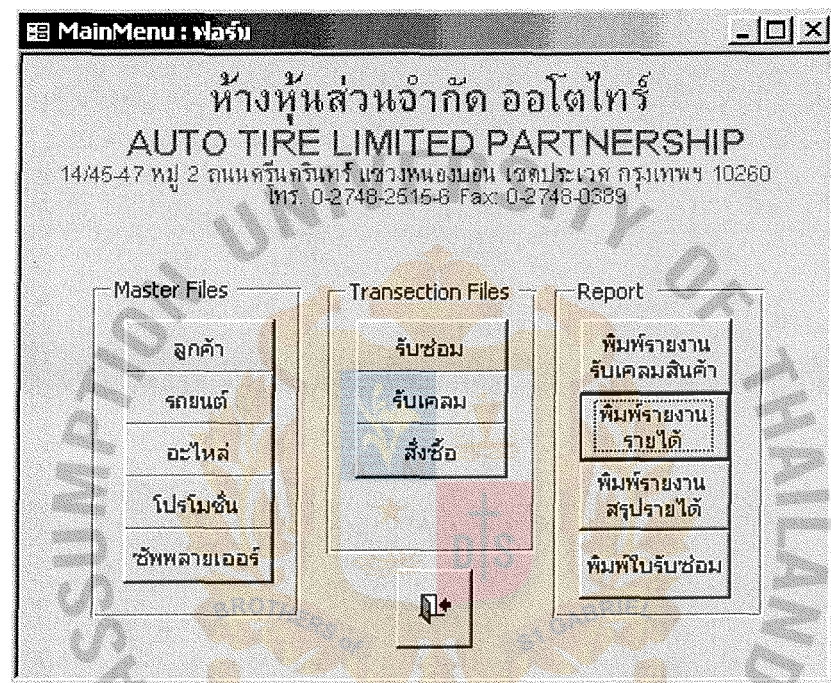


Figure H.3. Interface Design of Main Menu.

Fix

ID

000001

วันที่

22/02/2002

ลักษณะรถ

ทะเบียนรถ

1ก-5654

ยี่ห้อ

Audy

รุ่น

A4

สี

บรอนซ์

รายละเอียด

รายละเอียด	จำนวน	หมายเหตุ
▶ เปลี่ยนพวงมาลัย	1	
เปลี่ยนล้อ	4	
*	0	

ระเบียบ:

1

ลาก 3

Figure H.4. Interface Design of Order List Screen.

**AUTO TIRE LIMITED PARTNERSHIP - [Customer : ฟอรัม]**

เพิ่ม แก้ไข ลบ เบิก หน้าต่าง วิธีใช้    พิมพ์คำถามเพื่อขอความช่วยเหลือ

### ลูกค้า

ข้อมูลลูกค้า

ชื่อย่อ	อ	
ชื่อ-นามสกุล	nuntanit	watcharakarn
ที่อยู่	15/157 ซ.นวลจันทร์ ถ.สุขาภิบาล1 เขตบึงกุ่ม กรุงเทพฯ 10230	
โทรศัพท์ 1	02-8618058	
โทรศัพท์ 2	01-7328222	
แฟกซ์	02-9445471	
เพศ	Female	

มุมมองฟอร์ม    NUM

Figure H.5. Interface Design of Customer Screen.

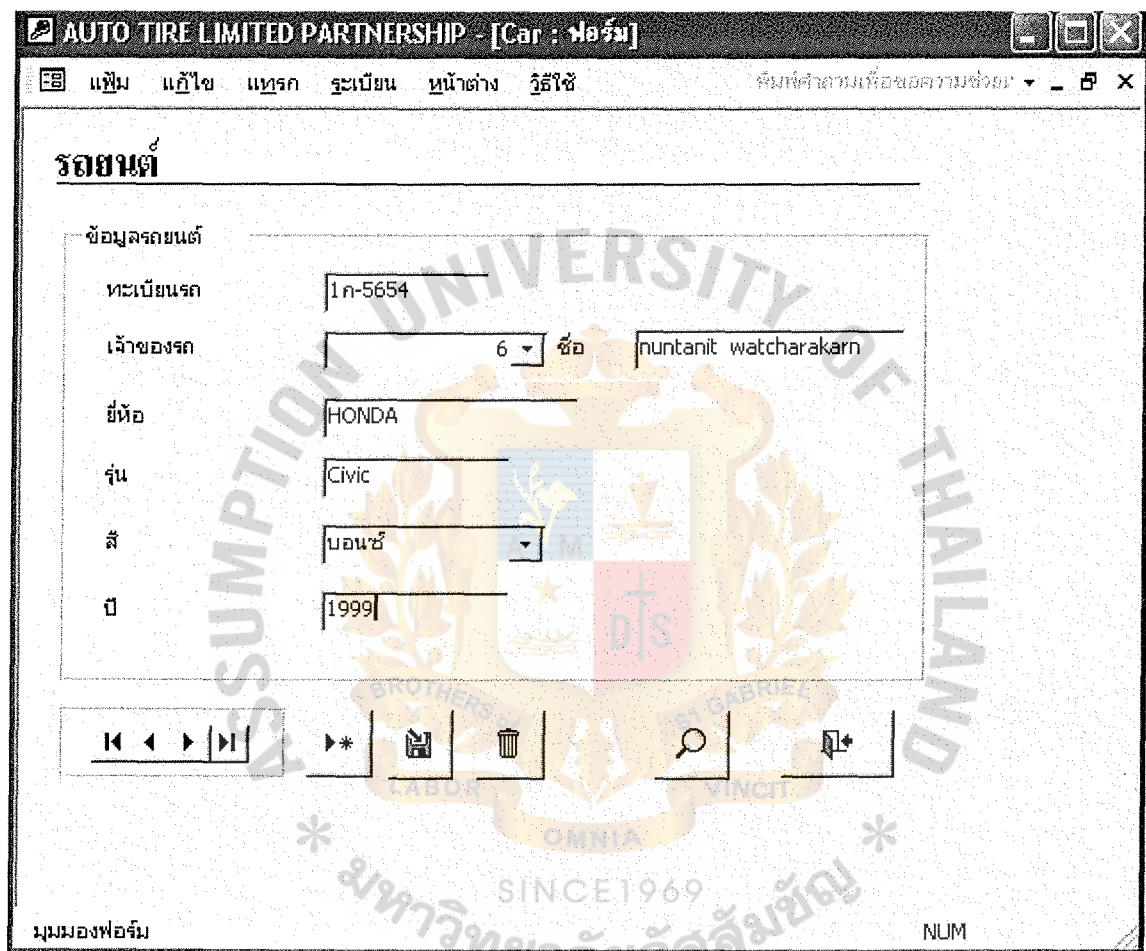


Figure H.6. Interface Design of Car Screen.

Figure H.7. Interface Design of Part Screen.

**Promotion : ฟาร์ม**

## อะไหล่โปรโมชั่น

ข้อมูลโปรโมชั่น

รหัส	3
รายละเอียด	เปลี่ยนน้ำมันเครื่องไม่คิดค่าบริการ
วันเริ่มโปรโมชั่น	01/01/2544
วันสิ้นสุดโปรโมชั่น	31/12/2546

Navigation buttons: Previous, Next, Home, Delete, Search, Print

Figure H.8. Interface Design of Promotion Screen.

Cliemed

ห้างหุ้นส่วนจำกัด ออโต้ไทร์  
 AUTO TIRE LIMITED PARTNERSHIP  
 14/45-47 หมู่ 2 ถนนพหลโยธิน แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0388

क्रमनल

क्रमनलनल  
 क्रमनलनलनल

क्रम	क्रमनल	क्रमनलनल	क्रमनलनलनल	क्रमनलनलनल	क्रमनल	क्रमनलनलनलनलनल	क्रमनल
11	00000001	P0002	क्रमनलनल	क्रमनलनल	क्रमनल	1	21/02/2002
3	00000001	P0003	क्रमनल	क्रमनलनल	क्रमनल	4	15/02/2002
4	00000001	P0004	क्रमनलनल	क्रमनलनल	क्रमनल	1	15/02/2002
5	00000001	P0005	क्रमनलनल	क्रमनलनल	क्रमनल	1	15/02/2002
	00000001	P0006	क्रमनलनल	क्रमनलनल	क्रमनल		
6	00000001	P0007	क्रमनल	क्रमनलनल	क्रमनल	1	16/02/2002
10	00000002	P0003	क्रमनल	क्रमनलनल	क्रमनल	1	16/02/2002
	00000002	P0005	क्रमनलनल	क्रमनलनल	क्रमनल		
	00000002	P0006	क्रमनलनल	क्रमनलनल	क्रमनल		
	00000002	P0007	क्रमनल	क्रमनलनल	क्रमनल		
8	00000003	P0002	क्रमनलनल	क्रमनलनल	क्रमनल	1	16/02/2002
	00000003	P0004	क्रमनलनल	क्रमनलनल	क्रमनल		

Figure H.9. Interface Design of Claimed Item Screen.

Clientmed

ห้างหุ้นส่วนจำกัด ออโตไทร์  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/45-47 หมู่ 2 ถนนพหลโยธิน แขวงถนนทองหล่อ เขตปทุมวัน กรุงเทพฯ 10260  
 โทร. 0-2748-2615-6 Fax: 0-2748-0389

**क्रमशः**

กรณเลขที่ใบ  
 กรณเลขที่ใบ 00000001

รหัส	เลขที่ใบ	รหัสสินค้า	รายการอะไหล่	จำนวนที่ซื้อไป	รายการ	จำนวนอะไหล่ที่เคลม	วันที่
11	00000001	P0002	อะไหล่รถ	4	พัง	1	21/02/2002
3	00000001	P0003	ยางล้อ	3	หลุดขาด	4	15/02/2002
4	00000001	P0004	พวงมาลัย	1	มีรอยขีดข่วน	1	15/02/2002
5	00000001	P0005	ไฟหน้า	2	หัก	1	15/02/2002
	00000001	P0006	อะไหล่ไฟส่องสว่าง	5			
6	00000001	P0007	ยาง	1	มีรอยจั่ว	1	16/02/2002
Auto							25/02/2002

Figure H.10. Interface Design of Searching Claimed Item by Bill No.

ClaimedReportForm : ฟลอร์

รายงานการเคลมสินค้า

ระหว่างวันที่ 01/02/2002 ถึง 28/02/2002

รูปแบบการกรอก : วัน/เดือน/ปี ค.ศ.

พิมพ์รายงาน

Figure H.11. Interface Design of Claimed Item Report Menu.

**AUTO TIRE LIMITED PARTNERSHIP - [Non\_functional\_car1]**

เพิ่ม แก้ไข แทรก ลบ ย้อน หน้าต่าง วัสดุ

**ห้างหุ้นส่วนจำกัด ออโต้ไทร์**  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/45-47 หมู่ 2 ถนนศรีนครินทร์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0389

**ออกบิล**

เลขที่บิล

00000015

ซ่อมเรียบร้อย (ลอกใบเสร็จ) ☒

**รถยนต์**

ทะเบียนรถ: กท-5854  
 ยี่ห้อ: HONDA Civic  
 สี: บรอนซ์  
 ปี: 1999

**ลูกค้า**

รหัส: 6  
 ชื่อ: nuntanit watcharakarn  
 ที่อยู่: 15/157 ซ.หลวงจันทร์ ต.สุขาภิบาล1 เขตบึงกุ่ม  
กรุงเทพฯ 10230  
 โทร: 02-8618058 01-7328222

**ค่าบริการ**

รหัส: 1  
 รายละเอียด: เปลี่ยนยาง  
 ค่าบริการ: 1,000.00

**รายละเอียด**

วันที่เข้า: 14/3/3088  
 วันที่ออก: 14/3/2545  
 เลขไมล์: 300,586

รหัสสินค้า	รายการ	คงเหลือ	ราคา/หน่วย	จำนวน	เป็นเงิน	โปรโมชั่น	ส่วนลด %	ส่วนลด	จำนวนเงิน
P0003	น้ำมัน	3	500.00	2	1,000.00	5 No Promotion	0	0.00	1,000.00
P0007	ยาง	4	1,000.00	4	4,000.00	1 เปลี่ยนยาง 4 เส้น	0	0.00	4,000.00
				5					
รวม									5,580.00
ภาษีมูลค่าเพิ่ม 7%									420.00
เป็นเงิน (รวมค่าบริการแล้ว)									6,000.00

Figure H.12. Interface Design of Bill Screen.

**Supplier**

**ข้าพพลายเออร์**

รหัส  โทร

ชื่อผู้ติดต่อ  โทร

ชื่อบริษัท  แฟกซ์

ที่อยู่

รายการสินค้าที่ขาย

รหัสสินค้า	รายการ	จำนวน	เลขที่ P/O
P0002	กระดาษ	11	8
P0004	พวงมาลัย	62	8
P0007	ยาง	15	8
*			

Navigation buttons: Previous, Next, Add, Delete, Search, Print

Figure H.13. Interface Design of Supplier Screen.

OrderForm : ฟารีน

ห้างหุ้นส่วนจำกัด ออโตไทร์  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/45-47 หมู่ 2 ถนนศรีนครินทร์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0389

ใบสั่งซื้อ

เลขที่ใบสั่งซื้อ: 00000004 วันที่: 21/02/2002

รหัสผู้ค้าปลีก: 00001 สินค้ามาส่งหรือไม่ ☒

ชื่อ: สมบูรณ์ วิทยา

บริษัท: หจก. อะไหล่ยนต์

ที่อยู่: 15/2 หมู่ ถนนหลานหลวง

โทรศัพท์: 0-2225-4856 0-1896-5235

แฟกซ์: 0-2225-6584

รายการสั่งซื้อ

รหัสสินค้า	รายการ	จำนวน	ราคาต่อหน่วย	เป็นเงิน
P0002	กระบอกหน้า	200	300.00	60,000.00
P0004	พวงมาลัย	300	250.00	75,000.00
P0007	ยาง	400	700.00	280,000.00
*				

Navigation buttons: Back, Forward, Home, Search, Print, Exit

Figure H.14. Interface Design of Purchase Order Screen.

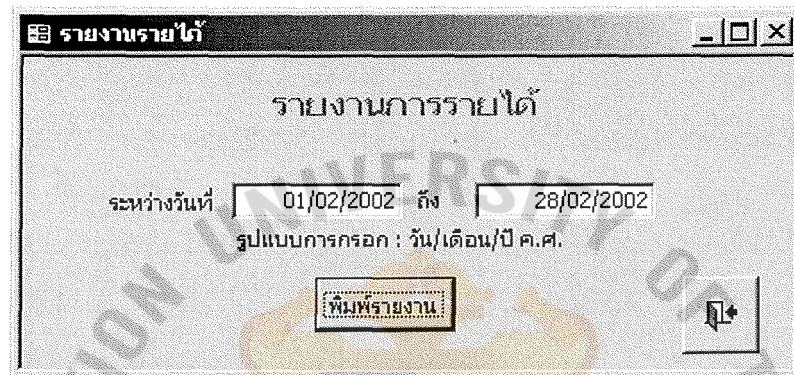


Figure H.15. Interface Design of Report Menu.



**APPENDIX I**  
**REPORT DESIGN**

ห้างหุ้นส่วนจำกัด ออโตไทร์  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/45-47 หมู่ 2 ถนนศรีจันทร์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0388

**ใบรับซ่อม**

ทะเบียนรถ..... วันที่ .....

อาการ.....

ลำดับ	รหัสสินค้า	รายการ	ซ่อม	หมายเหตุ
1	P0002	กะลกลหน้า	<input type="checkbox"/>	
2	P0003	ไฟท้าย	<input type="checkbox"/>	
3	P0004	พวงมาลัย	<input type="checkbox"/>	
4	P0005	ใบปัดน้ำฝน	<input type="checkbox"/>	
5	P0006	หลอดไฟห้องผู้โดยสาร	<input type="checkbox"/>	
6	P0007	ยาง	<input type="checkbox"/>	
7	P0008	น้ำมันเครื่อง	<input type="checkbox"/>	
8	P0009	เพลาน้ำ	<input type="checkbox"/>	
9	P0010	เพลาลัง	<input type="checkbox"/>	
			ผู้ตรวจสอนรถ	

Figure I.1. Order List Report.

<p>ห้างหุ้นส่วนจำกัด ออโต้ไทร์</p> <p>AUTO TIRE LIMITED PARTNERSHIP</p> <p>14/45-47 หมู่ 2 ถนนสุวินทรินทร์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10360</p> <p>โทร. 0-2748-2515-6 Fax: 0-2748-0369</p> <p>รายงานผลมสสินค้า ตั้งแต่ 1 กุมภาพันธ์ 2002 ถึง 28 กุมภาพันธ์ 2002</p>					
รหัส	เลขที่บิล	อะไหล่	จำนวน	อาการ	จำนวนที่เคลม
00003	00000001	ไฟท้าย	3	หลอดขาด	4
00004	00000001	พวงมาลัย	1	มีรอยขีดข่วน	1
00005	00000001	ใบปัดน้ำฝน	2	หัก	1
00006	00000001	ยาง	1	มีรอยรั่ว	1
00008	00000003	กะจกหน้า	2	มีรอยขีดข่วน	1
00009	00000011	หลอดไฟห้องผู้โดยสาร	10	ขาด	2
00010	00000002	ไฟท้าย	2	มีรอยร้าว	1
00011	00000001	กะจกหน้า	4	พัง	1
รวมจำนวนที่เคลม					12

Figure I.2. Claimed Item Report.

ห้างหุ้นส่วนจำกัด ออโต้ไทร์  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/45-47 หมู่ 2 ถนนศรีนครินทร์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0389

**ใบสั่งซื้อ**

เลขที่ 0000004  
 วันที่ 21 กุมภาพันธ์ 2002

บริษัท สมบูรณ์ วิทยา  
 ที่อยู่ 15/2 หมู่ ถนนหลานหลวง

โทร 0-2225-4856 0-1896-5235  
 แฟกซ์ 0-2225-6584

ลำดับ	รหัสสินค้า	รายการ	จำนวน	ราคา/หน่วย	เป็นเงิน
1	P0002	กระบอกน้ำ	200	300.00	60,000.00
2	P0004	พวงมาลัย	300	250.00	75,000.00
3	P0007	ยาง	400	700.00	280,000.00
				<b>รวม</b>	<b>415,000.00</b>

ผู้พิมพ์ \_\_\_\_\_ ผู้อนุมัติ \_\_\_\_\_

Figure I.3. Purchase Order Report.

ห้างหุ้นส่วนจำกัด ออโตไทร์  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/46-47 หมู่ 2 ถนนศรีนครินทร์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0388

รายงานรายได้ ตั้งแต่ **1 กุมภาพันธ์ 2002** ถึง **28 กุมภาพันธ์ 2002**

เลขที่บิล	ลูกค้า	วันที่	ภาษีมูลค่าเพิ่ม	จำนวนเงิน
00000429	Jason Young	01/02/2002	฿158.20	฿2,260.00
00000430	nuntanit watcharakarn	01/02/2002	฿132.30	฿1,890.00
00000431	สมคิด แก้วกระช่วง	01/02/2002	฿253.40	฿3,620.00
00000432	Jason Young	01/02/2002	฿685.30	฿9,790.00
00000433	สมชาย ชาติทหาร	01/02/2002	฿368.20	฿5,260.00
00000434	Aungsuchot Hongyon	01/02/2002	฿628.60	฿8,980.00
00000435	Aungsuchot Hongyon	01/02/2002	฿554.40	฿7,920.00
00000436	สมหญิง กล้าหาร	01/02/2002	฿170.80	฿2,440.00
00000437	nuntanit watcharakarn	01/02/2002	฿326.20	฿4,660.00
00000438	สมคิด แก้วกระช่วง	02/02/2002	฿161.70	฿2,310.00
00000439	สมชาย ชาติทหาร	02/02/2002	฿385.70	฿5,510.00
00000440	สมคิด แก้วกระช่วง	02/02/2002	฿454.30	฿6,490.00
00000441	สมหญิง กล้าหาร	02/02/2002	฿45.50	฿650.00
.	.	.	.	.
00000639	Jason Young	28/02/2002	฿471.80	฿6,740.00
00000640	nuntanit watcharakarn	28/02/2002	฿265.30	฿3,790.00
00000641	สมคิด แก้วกระช่วง	28/02/2002	฿319.90	฿4,570.00
รวม			฿78,725.50	฿1,124,650.00
				<b>฿1,045,924.50</b>

Figure I.4. Revenue Report.

ห้างหุ้นส่วนจำกัด ออโตไทร์  
**AUTO TIRE LIMITED PARTNERSHIP**  
 14/45-47 หมู่ 2 ถนนสุรินทรรักษ์ แขวงหนองบอน เขตประเวศ กรุงเทพฯ 10260  
 โทร. 0-2748-2515-6 Fax: 0-2748-0389

รายงานสรุปรายได้ ตั้งแต่ **1 กุมภาพันธ์ 2002** ถึง **28 กุมภาพันธ์ 2002**

วันที่	รวมภาษีมูลค่าเพิ่ม	รวมรายได้
01/02/2002	3,277.40	46,820.00
02/02/2002	2,279.90	32,570.00
03/02/2002	3,149.30	44,990.00
04/02/2002	3,062.60	43,760.00
05/02/2002	3,427.20	48,960.00
06/02/2002	3,656.80	52,240.00
07/02/2002	3,417.40	48,820.00
08/02/2002	2,485.70	35,510.00
09/02/2002	4,111.10	58,730.00
10/02/2002	1,269.10	18,130.00
11/02/2002	1,719.20	24,560.00
12/02/2002	2,760.80	39,440.00
13/02/2002	1,955.80	27,940.00
14/02/2002	3,695.30	52,790.00
15/02/2002	2,432.60	34,760.00
16/02/2002	2,558.40	57,210.50
17/02/2002	3,617.60	51,680.00
18/02/2002	2,899.40	41,420.00
19/02/2002	2,699.20	38,560.00
20/02/2002	4,149.60	59,280.00
21/02/2002	2,743.30	39,190.00
22/02/2002	2,594.90	37,070.00
23/02/2002	1,670.20	23,860.00
24/02/2002	3,558.10	50,830.00
25/02/2002	2,390.80	34,160.00
26/02/2002	1,843.80	26,340.00
27/02/2002	2,671.90	38,170.00
28/02/2002	2,672.60	38,180.00
<b>รวม</b>	<b>78,769.50</b>	<b>1,145,940.50</b>

Figure I.5. Summary Revenue Report.

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