WORKING PROTOTYPE OF WARRANTY MANAGEMENT SYSTEM (WMS) FOR COMPUTER SALES AND SERVICES SHOPS IN UNIVERSITI UTARA MALAYSIA (UUM).

HALIMAH BTE ADNAN

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A THESIS SUBMITTED TO GRADUATE DEPARTMENT OF COMPUTER SCIENCE, COLLEGE OF ARTS AND SCIENCES, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE MASTER OF SCIENCE IN INFORMATION TECHNOLOGY
UNIVERSITY UTARA MALAYSIA

HALIMAH BTE ADNAN

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ABSTRACT

Currently, there are rapid developments and improvements of technologies that we can see with our own eyes that change the way of people works and thinking. One of the fastest technology improvement and development can be categorized into computer technology including the hardware and software system. Therefore, the need of warranty for customer satisfaction and protection is increasing everyday. Serious action and concern need to be taken into account to ensure the effectiveness and value of the computer technology. Warranty Management System (WMS) belongs to a class of a system intended to assist customer to claim computer peripherals or products warranty in a more easiest and comfortable way. This research describes the working prototype of Warranty Management System (WMS) for the computer sales and services shops in University Utara Malaysia (UUM). The Warranty Management System (WMS) is a web based application system. The process of warranty record is available online and the record will be stored in secure database. Customer does not have to bring the receipt or warranty card to claim for computer peripherals or products warranty. More, customer can also check their computer products or peripherals through the system. The Warranty Management System (WMS) will keep all the customer records with unique ID assign for each customer. Only authorized person or staff can access to the system. These new methods must attain unprecedented levels of security, speed, privacy, decentralization, and internationalization.

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LIST OF ABBREAVIATION

ATM	Automated Teller Machine
HTTP	Hypertext Transport Protocol
UUM	Universiti Utara Malaysia
WMS	Warranty Management System
WWW	World Wide Web
UCD	User Centered Design
IT	Information Technology
MySQL	My Structured Query Language
ID	Identification
OEM	Original Electronic Manufacturer
HP	Hewlett Packard
HTML	Hypertext Markup Language

.

CHAPTER 1

INTRODUCTION

1.1Background

Warranties have been studied by researchers from many different disciplines and deal with a diverse range of issues. These include historical, legal, legislative, economic, behavioral, consumerist, engineering, statistical modeling and analysis, operations research, accounting, marketing, management and societal (Murth, Solem & Roren, 2003). Most products are sold with some form of warranty. The type of warranty offered depends on the product type. Warranties serve a somewhat different purpose for customer and seller. From the customer's point of view, the main role of a warranty is to protect them and the second role is informational (Jegan, 2008).

These roles of the warranty assure the buyer that a faulty item will either be repaired or replaced at no cost or at reduced cost. Many buyers infer that a product with a relatively long warranty period is a more reliable and long-lasting product than one with a shorter warranty period. In the side of seller, warranty also provide for protection and promotion. When the products are provided with warranty by the manufacturer or supplier, then the percentage of customer to buy the product is much higher than the product without any warranty cover. Leading companies realize that warranty data is an integral component of the voice of the customer. Not only is it strategic to the bottom line, it also affect customer satisfaction and brand reputation.

Brand reputation for safety and reliability takes years to create but much longer to recover even if consumer confident is undermined by only one issue (Pritchard, 2008). Creative deployment of information system technologies can lead to new ways to differentiate products and services through customer service, while simultaneously strengthening

customer ties (Gerald, Learmonth & Ives, 1987). New technologies and new competition require more responsiveness to customers and a better customer experience. Knowing who your customers are, and what they want is critical to surviving in the current communications market. One of the most common technologies that are well-known is called information system technology. One of the most well-known applications in information system technology is web based application.

Web based application also can be categorized in information system technology. Information system technology application in support of customer service may significantly affect the supplier, customer and other distribution channel. Besides, this technology also can create differentiation through customer service with direct future investments toward competitive oriented customer services application (Gerald *et al*., 1987). Future developments in Web applications will be driven by advances in browser technology, Web internet infrastructure, protocol standards, software engineering methods, and application trends (Javayeri, 2007*).* Web information system relies on the hypertext functionality and transfer mechanisms of the World Wide Web (Bauer & Schari, 1999). Figure 1.1 shows the web information system environment created by Bauer & Schari (1999).

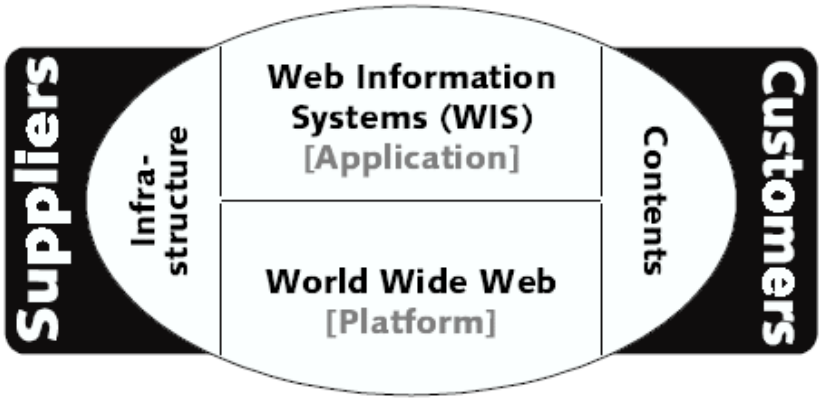


Figure 1.1: Web Information System Environment

Source: Bauer & Schari (1999).

1.2Problem Statement

According to my preliminary studies from certain researches through observation, Murthy, Solem & Roren (2002) found that currently computer sales and services shop in UUM used traditional method to record all the customer warranty information and computer hardware, peripherals and products that have warranty. Warranty management represents an area of huge untapped business potential and most companies are overlooking the potential of warranty management to boost their top lines (Accenture, 2005). Each product has different warranty period. If the computer hardware, peripherals and products is by coincidence damage or corrupt, customers can claim for the warranty as long as the warranty period is still valid.

Warranty validation process can be in various forms. First, computer sales and services used receipt as a proof of purchase and warranty. The computer sales and services shop only have this receipt paper as their warranty record. If anything happen to the receipt such as burn or lost, then the computer sales and services shop will not have any backup for the warranty records. Customers also been provided with the purchase and warranty receipt. If customer lost their receipt, the warranty process will be hard. Second, some computer hardware, peripherals and products were provided with warranty card for their customers. If customers lost this warranty card, they will not get any warranty anymore.

Fully one-third of company said their enabling IT systems for warranty management are inadequate, citing the systems' age and a lack of integration as the main problem areas (Accenture, 2005) Current system does not provide safety, convenience and quality for the business and customer themselves. As to increase performance, trust and profits in computer sales and services, they need to make sure the quality of services they had given to their customers especially in dealing with product warranty. In addition to the powerful warranty management solutions on the market today, emerging technologies hold great promise to revolutionize warranty management (Accenture, 2005) In the long run maximizing the customer warranty electronic record will lead to lasting and loyal relationship with customers (Bauer & Schari, 1999). Large and mid-size product manufacturers are looking for Information Technology based solutions to reduce the overall cost towards warranty and enable compliance to government regulations (Sureka, De. & Varma, 2008). Therefore, other alternative for current system or method are needed.

Based on the problem statement, the following research questions are formulated:

1. What is the current warranty process that had been implemented in computer sales and services shops in UUM?
2. How to automate current warranty process?

1.3 Objective

An alternative for current system is needed to overcome and reduce the problems that arise in as discussed in section 1.2. As such, the main objective of the project is to develop working prototype of Warranty Management System (WMS) for computer sales and services shops in UUM. In order to achieve this, the following sub objectives are proposed:

- To design the working prototype of a web-based Warranty Management System (WMS) for computer sales and services shop.
- To identify the essential functionality of web-based Warranty Management System (WMS)

1.4 Scope

The main scope for this project is local warranty records and focusing on computer sales and services shop in particular. The area covered for the implementation of the Warranty Management System (WMS) is only for computer sales and services shops in Universiti Utara Malaysia (UUM). The Warranty Management System (WMS) will be designed for computer hardware, peripherals and products that have warranty information. As for other computer products that do not have warranty information in about two weeks period of time and above will not be included in the WMS. This system will only focus and covers computer hardware, peripherals and products and not includes for any software or set of laptop or set of computer desktop warranty. The Warranty Management System (WMS) will be developed based on web application system by using PHP web programming with MySQL database and management system to store the warranty records. Target users for Warranty Management System (WMS) are students and personnel of computer services

and sales shops in UUM. The user for Warranty Management System (WMS) will be categorized in three types which are administrator, customer and staff. Specific ID will also provide for the authentication process depending on category.

1.5 Significance / Contribution

The significance of this study is to provide benefits to various parties involved in the Warranty Management System (WMS) environment, which includes the following:

1.5.1 Customer

- To provide convenience and easy way for the customer to claim for computer hardware, peripherals and products warranty according to the customer warranty record.
- The percentage of stealing or robbing computer hardware, peripherals and products in UUM can be decrease because only warranty records with match customer ID will be entertain.
- Customer does not have to worry if they lost their receipt or proof of purchase. They do not have to keep many receipt or proof of purchase with them.

1.5.2 Personnel of computer sales and services shop

- Provide fastest way for the personnel of computer sales and services in UUM to check warranty record and process the claim.
- Decreasing the use of paper. Personnel do not have to burden themselves with many papers.
- Personnel can add and search for products and warranty record in more efficient and effective way.

1.5.3 Organization or business

- As one of the alternative to improve current warranty system for computer sales and services.
- To decrease the percentage for computer sales and services shop to lose customer warranty records.
- To enhance the computer services, attract more customers and gain customers trust to buy and deal with the computer sales and services shop in UUM
- To increase business performance and profits by increasing the customer satisfaction and providing good after sales services.

1.6 Report Structure

This report consists of five main chapters. In Chapter Two presents a review on the literature of the current warranty system, discussion on the advantages and benefits of warranty management system and other works related to this research. Chapter Three discuss about the methodology process in developing the project. There is detail explanation that takes a structured approach to incorporating the methodology into the system design process which help project development and execute the appropriate user centered design tasks to ensure that system are easy to use and meet the needs of the users. Chapter Four discusses the findings of implementing the proposed system using the adapted methodology described in the previous chapter. Chapter Five describe the scenarios that were implemented to test the WMS. Chapter Six conclusion of the project and contain detail about project justification such as system limitation and some opinion on improving some functionality in order to maximize the usage of the system. Finally, discussion on the final product will end this project report. Other attachment also included in the appendices as a visual representation on topic that had been discussed.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Based on the fact that the proposed solution in this research of the warranty management system field, this study presented a brief review about warranty management system and process. The warranty management system challenges and achievements are illustrated in this phase. This chapter also describes the need of implementing the WMS as one of the ways in improving and enhancing computer sales and services shops in UUM. Finally, the study mentioned about the advantages in implementing warranty management system for organization or business and related works.

2.2 Warranty Management System Overview

The ability to manage change is probably the best competitive advantage any organization can build. Applying flexible Business Rules Management to warranty management systems can help organization to achieve ongoing advantage by building an agile platform for their business users to develop, maintain and simulate business decision making which drive to warranty process. Warranty management is a business process that includes warranty registration, claims submission, claims processing and settlement, fraud detection, returns management, supplier management, extended warranty marketing, replacement-parts logistics, and inventory management (Mandana & Mohammad, 2008). Many organizations are using multipoint solutions to manage their warranty processes.

According to TATA Consultancy Services (2008), to improve the bottom line and enhancing customer satisfaction, responsive warranty and after sale support need to be taken into consideration as to improved operational efficiency. An effective warranty and service implementation needs to address warranty reserve forecasting, supplier recovery,

fraudulent claim detection and product quality improvement. Figure 2.1 shows the warranty management services portfolio that applied in TATA Consultancy Services.

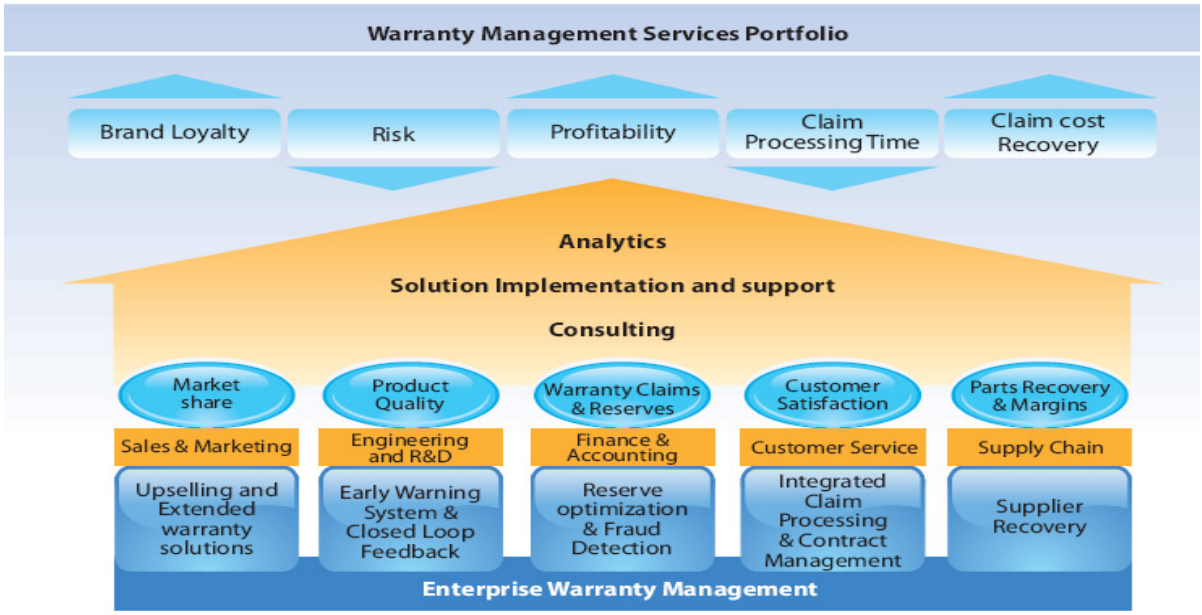


Figure 2.1: Warranty Management Services in TATA Consultancy Services

Source: TATA Consultancy Services (2008)

Warranty management system had given the impact on a company's manufacturing, quality, sales, and after-market customer-care processes. Nowadays, most organization or big companies are more consent about after sales services. An efficient and well designed warranty claim handling solution helps the company to actually go far beyond cost savings. Warranty improvements have been shown to boost revenues, enhance customer satisfaction and loyalty, and even drive up the quality of product (Siement PLM Software, 2007). For companies across all industries, warranty claims processing is believed to consume 2.5 percent to 4.5 percent of revenues (Byrne, 2004). With numbers like these, it shouldn't be surprising that many companies have started to rethink their approaches to warranty management.

There are several processes in Warranty Management System that can helps company or organization to successfully manage their warranty process. Defining the best warranty management process or method from end to start is one of the crucial aspects that need to be taken into account.

2.2.1 End to End Warranty Management Process

Effective warranty management requires the integration of leading practices across a number of major areas as shown in Figure 2.2: End to End Warranty Management Process.

Figure 2.2: End to End Warranty Management Process

Source: Sprague and B. M. (2005).

As illustrated in the Figure 2.2 above, the first phase of warranty management process involve the customer operation. Customer need to have valid product warranty contract or period by checking through the warranty system. Customers have to know which part of the product is covered by the warranty contract. Once the validation process for product warranty successful, then the next process is the claim processing in the supplier or manufacturer side.

Warranty claim that had been made by the customer will be submit through the system. Once again, the validation and processing claims are evaluated and pass directly to the

supplier or manufacturer for further action. If the product warranty expired, the customer is required to pay the amount of money in repairing the product cost. Else, the customer just needs to pay for service transportation fees. After all the payment settle, the claim report will be recorded and store in the particular database as for company record analysis and diagnosis.

Finally, the warranty record will be analyze and diagnose to check how much potential value exist in the warranty process. Besides, transformation of existing warranty management process needs to start with a diagnosis of the current state, to identify the key opportunity areas to reduce warranty costs and to get better control on the whole warranty process. It is important to think end to end when it comes to transforming warranty management capabilities. With a firm diagnosis in hand, the road to achieve high performance through a better warranty management can be a perfect one (Sprague & B. M, 2005).

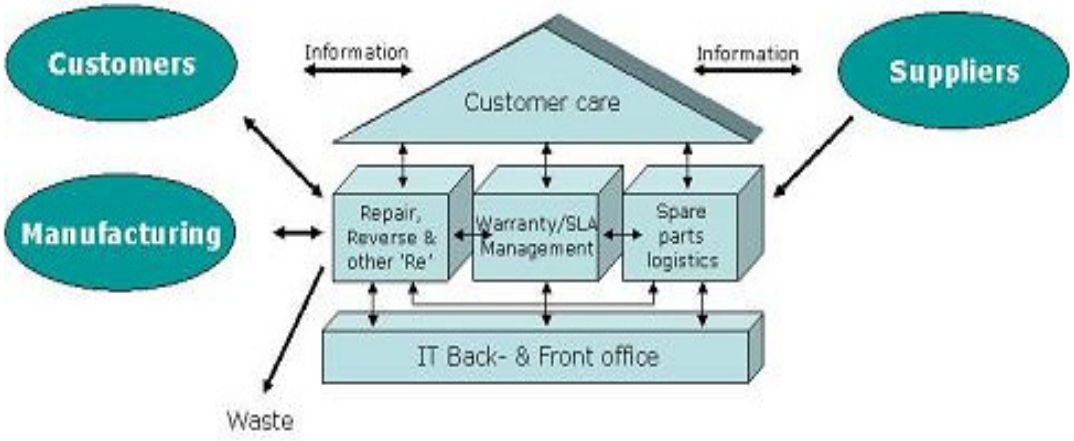


Figure 2.3: Deliver High Service Levels on Warranty Claims

Source: Warranty Management (2008)

Figure 2.3 shows the delivering process in high service levels on warranty claims. When it comes to claim handling processes, one of the most important things is to get all the information required from the customer. The required information can be retrieve by using product serial no from the system of "WMS" or any system that store information in secure databases. In practice however, end-users expect their claims to be handled quickly and

depending on the product type even immediately and on the spot (Warranty Management in "Service Level", 2008).

By implementing the right system, time waiting can be reduced. Customers do not have to queue or wait for their turn to claim for product warranty. They can just give a call or give their product serial no. Here is an obvious link to the repair and reverse logistics organization. But more importantly, this is a crucial point of contact where customer loyalty can be either built or destroyed.

2.3 Customer Satisfaction

Today, increasingly competitive service and support environment demands nothing less than full life-cycle service excellence. This service excellence is not just for initial need, but also through customer experience as to achieve maximum customer satisfaction. Figure 2.4 illustrated the warranty servicing process in achieving customer satisfaction.

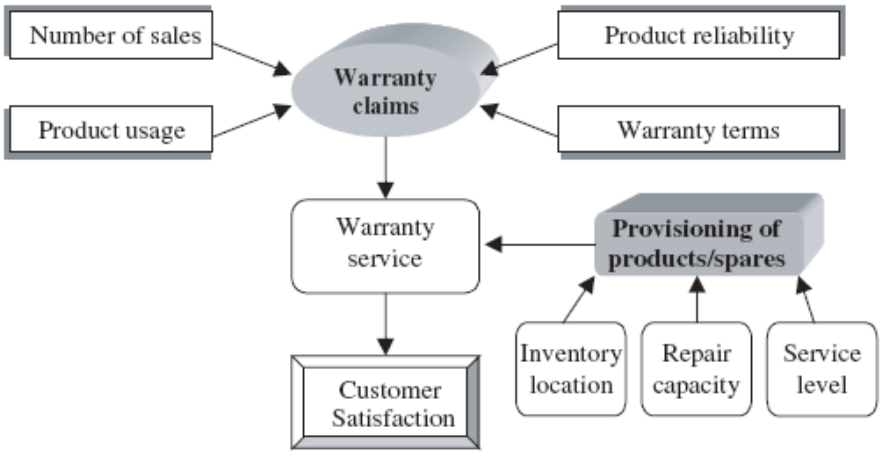


Figure 2.4: Warranty Servicing Process

Source: Murthy et al (2003)

Warranty claims depend on number of sales that the organization has achieved and comparing with the other factors like product usage, product reliability and warranty terms.

If one of these factors is not fulfill, the warranty claim process cannot be processed. After the evaluation and analysis done in warranty claim, the customer can get the warranty service. In this phase, the warranty services depending on the provisioning of products or spares. This means that, customer have to wait for a period of time for the warranty services to be processed.

The manufacturer or supplier will find the nearest inventory location to process the claim. Decisions with regards to warehouse location must include all product movements and associated costs as they take place from plant location through intermediate stocking points to customer locations, and finally back to the manufacturer for repair or replacement (Murthy et al., 2003). In the inventory location, repair capacity and service level factors affects the process of warranty servicing. If the repair capacity in the inventory location is high and service level is low, the time of warranty process will be much longer.

The time process in warranty process phase will affect customer satisfaction. If the warranty process finishes within the required time, then the warranty process is considered to have full customer satisfaction and vice versa. Furthermore, whenever a repairable item fails under warranty, the manufacturer has the option of either repairing the failed item or replacing it by a new item. In the case of repair, the manufacturer needs to choose between different repair actions and this impact on the customer satisfaction as well as the warranty servicing cost.

According to Long and Dutta (2008) from Aberdeen group research on IBM warranty management system, they found out that, IBM is trying to improve their warranty management process by using other software providers replacing their current warranty process. IBM current warranty process required multiple systems and interfaces for managing the warranty processes. IBM wants to integrate its multiple middleware system into a single platform so that their partners could easily gain access to IBM's database and functionality.

IBM embarked on a multi-faceted strategy to strengthen its warranty relationship with its business partners in order to drive growth and help partners develop more end to end relationship with customer. As for the solution IBM has chosen the web-based, hosted

system from the service bench that was cost effective and meets the company requirement (Long, 2008).

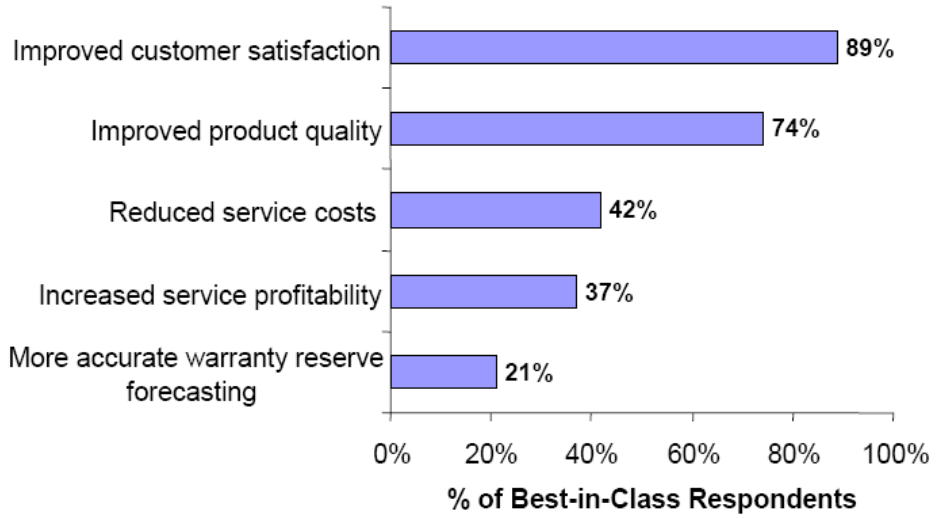


Figure 2.5: Result Statistic of IBM New System.

Source: Sprague, B. M. (2005).

As for the final result as illustrated in Figure 2.5, IBM had shown the highest improvement on customer satisfaction up to 89% by using single platform and worldwide implementation system. Moreover, IBM also achieved best improvement in product quality, reduced service cost, increased service profitability and warranty reserve forecasting. IBM recognizing opportunities for efficiency gains, streamlined processes and improved customer satisfaction within their warranty business, best in class companies are taking steps to gain greater control and visibility into their warranty processes and performance.

Customer dissatisfaction can arise due to poor performance of the purchased item or the quality of warranty service provided by the manufacturer. In either case, it results in a negative impact on the overall business performance (Derrick, 2004; Gecker, 2007). Figure 2.6 shows the key issues involved and their impact on the customer satisfaction. A proper contract between the manufacturer and service agents and the monitoring of the agents actions are very critical for ensuring high level customer satisfaction (Gecker, 2007).

Warranty management system provides a method for managing obligation and requirement for sales warranties. In turn, this adds value and automation to any organization as customer relationship (Vigoroso, 2006). Company or organization might increase customer value proposition and gain additional sales as a result.

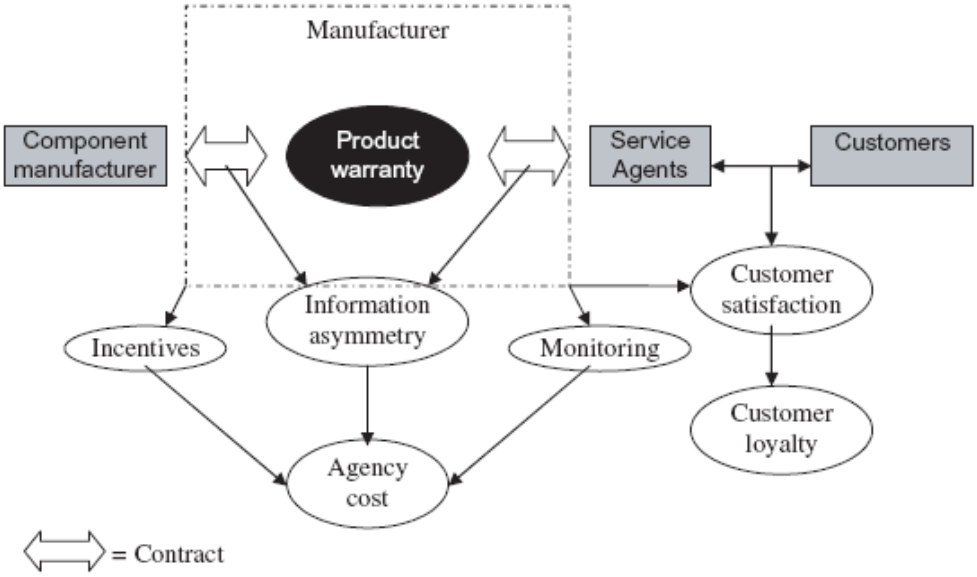


Figure 2.6: Key Issues and Impact in Customer Satisfaction

Source: Vigoroso (2006).

2.4 Claim Handling Costs

Although the claim process is electronically automated, human intervention is still need in handling large volume of products claim including mass data storage. In this situation, the transportation fees are not included or responsible by the organization as stated in the warranty rules. The claim cost can be reduced, by reducing the use of paperwork. The claim can be transfer directly to the supplier and supplier will automatically process the claim report (Warranty Management in "Selling More using…" 2008).

A study by Warranty Week (2008) estimated that the top 50 U.S.-based manufacturers spend more than $28 billion annually on warranty expense. For some of these manufacturers, warranty costs represent as much as 5% of total revenue. According to Mandana and Mohammad (2008), warranty cost is driven by three main factors which are

the warranty rules and regulation, product reliability and maintainability and service delivery as shown in Figure 2.7.

Figure 2.7: warranty cost drivers

Source: Mandana and Mohammad (2008)

In this Figure 2.7 illustrated the warranty cost drivers between three key factors in affecting the warranty cost management. The three key factors are depending on each other to provide efficient total warranty cost. In the warranty term and condition, basic warranty cost drivers is applied. Besides, in the service delivery and product reliability and maintainability apply the standard warranty and maintenances cost driver. Usually in the standard warranty and maintenance cost driver involve the extended warranty provided by the organization for the customer. There are differences between standard and extended warranty application. Table 2.1 illustrated the differences between these two warranties.

Table 2.1: comparison between standard and extended warranty

Source: Mandana and Mohammad (2008)

Standard warranty	Extended warranty
Warranty services are based on the standard rules and regulation	Warranty services based on the extended warranty that offered by the organization
Product with original price	Product with extra payment for the extended warranty value.

Less or equal to 90 days from product purchase date	More than 90 days. Up to 3 years from product purchase date.
Budgeted cost	Profit center

2.5 Generate Sales on Services

Offering better warranty terms convey greater assurance to buyers and can result in greater sales. However, this increases the cost of servicing the warranty (Murthy et al., 2003). The biggest and easiest opportunity is found in warranty itself. Once a company owns and uses an integrated warranty claim handling system, this will also support selling extended warranty programs, such as extra period of warranty, pick up and return instead of carry-in, faster service and temporary replacement

Another powerful way of using the Warranty Management System as a marketing tool is by using the available data, combined with the information provided by the customer to offer an alternative product or service at a discount (Unzicker & Harrity, 2006). For example, if a claim comes in just after the warranty expired, company or the organization will give a discount for repairing the claim product. This is a good way to bind the customer.

Moreover, computer products price is not stable in the market. The price depends on demand and outgoing products available in the market. If newest brand of the same product are produce with a discount, this could be a challenge for the company to gain profits from the claim product. Usually, one of the ways to handle and face this challenge is by offering an extended warranty, if product warranty is almost or just expired (Warranty Week in "Verizon's Extended Warranty" 2008).

Companies like Dell, Kodak and Saab are excellent examples. They generate a substantial part of their annual profits up to 50% from selling warranty due to the much higher margins on these services compared to product sales margins (Warranty Management in "Selling More using…" 2008). Besides increasing the percentage of sales, WMS also can improve products quality.

2.6 Product Quality

Warranty management system also do great job in improving product quality. This can be done by analyzing claims report made by the customer. By using sophisticated analytic solution, this can lead the organization or company to have more improvement in product quality at the same time gain more trust and satisfaction from user (Byrne, 2004). As for example, if the analysis result show the most claim product in the record was product type "A" from supplier "B", than the organization can stop buying the same product to avoid more lost and improve product quality. These solutions help provide business intelligence about product quality and performance by compiling data from warranty claims, production data, dealer information, and customer surveys.

Product quality can improve warranty management efficiency and not the control of warranty expenses (Kozyrkov, 2008) since warranty managers are not in control of the size of the legitimate warranty payouts, warranty expense occurs not because of poor warranty management but rather because of poor of product quality. The most important factor in warranty management is the product quality control and information about product failures. In the claim processing, customer will provide and submit detailed descriptions of the product failure.

Furthermore, with the record of product failure and solution taken in solving the problems occur will enhance the warranty management system and also improve product quality. With the product failure information, manufacturer will know their product weaknesses and try to fix the cause of product failure from happen again. Company or organization that do not have analytical techniques and predictive performance management will never know just how much they could have improved their performance and claim handling cost (SAS, 2008).

Thus, warranty management system is the repository of product problem information. The effectiveness and significance of warranty management system depends on how well and how quickly product problems could be identified and resolve. Otherwise, the product production might be stop or product design can be fixed up to meet the quality and significantly improve customer satisfaction and warranty process performance.

2.7 Computer products warranty

According to Warranty Week in "Computer and Peripherals…" (2007), warranty claim for U.S based computer OEMs, disk drive and data storage systems makers, telecom equipment manufacturers, semiconductor and printed circuit board makers, and associated peripherals in the half year of 2007 have been declined. Figure 2.8 shows the statistic on computer and peripherals products warranty on the year 2003 until 2007.

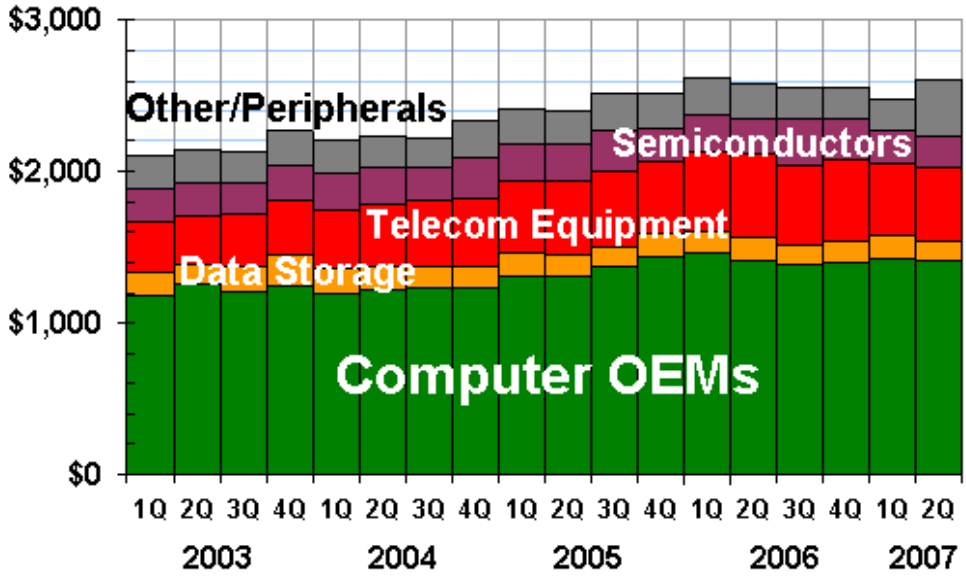


Figure 2.8: Computer & Peripheral Manufacturers: Quarterly Warranty Claims Paid, 2003 to 2007 (in $ millions)

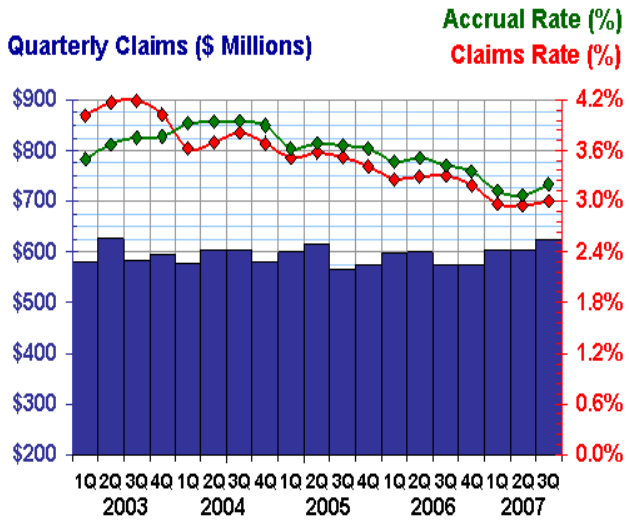
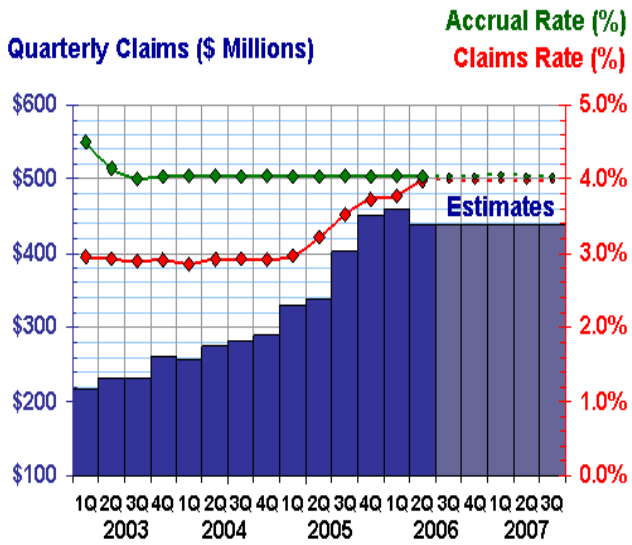
Sources: Warranty Week in "Computer and Peripherals…" (2007)

The Figure 2.8 illustrated the decreases in warranty claim and cost saving within the time period. The decline in warranty claim is up to more than 10% for the peripherals, semiconductors, telecom equipment, data storage and computer OEMs. Even though the decrease value is quite small, still it shows the decline in the claim processes which save quit money for organization or company. Furthermore, Table 2.2 provide more statistical and example of claim data analysis between HP and Dell company. The analysis shows increase in Dell warranty claim data because Dell still not have good warranty manageable compared to HP (Warranty Week in "Dell Warranty Accounting" (2007). As illustrated in

the Table 2.2, Dell began mixing extended warranty revenue in with its product warranty accruals, making it impossible for outsiders to tell the two apart.

Table 2.2: Comparison between Dell and HP warranty claims data

Source: Warranty Week in "Computer and Peripherals…" (2007) and Warranty Week in "Dell Warranty Accounting" (2007)

	
Hewlett-Packard Co. Quarterly Warranty Claims & Accruals, 2003 to 2007 (in $ millions and % of sales)	Dell Inc. Quarterly Warranty Claims & Accruals, 2003 to 2007 (in $ millions and % of sales)
Claims came in at 3% of sales and accruals 3.2%	Claim came in at 3% to 4% of sales and Accruals up to 4%. 1% highest than HP
$625 million quarterly claim in the past five years	$465 million quarterly claim in the past five years
HP warranty expenses is steadily downwards	Dell warranty expenses is increase with the claim data

2.7.1 Warranty and Claim Process as Service after Sales

In addition to customer loyalty, service after sales has also been shown to be essential in boosting revenue. According to studies made by Unzicker and Harrity (2006) in this area show that on average, the service after sales area contributes 24% of a firm's revenue, but as much as 45% of its gross profits. Service after sales is one of the important integral parts for organization to build customer satisfaction, profitability, performance and discovering new opportunity in global market.

Figure 2.9 (a): Key Measures for Service after Sales Benchmarking

Source: Unzicker and Harrity (2006)

Figure 2.9 (a) shows the suggested key measuring for service after sales in benchmarking for organization to measure their performance and improvement in terms of applying the warranty services after sales. The key measures also help organization to determine the right problem-solution in warranty process. By implementing the key measures, the

solution and statistic for value of returns, but also the percentage of units accepted for return for reasons other than product damage or failure and the percentage of repairs where no fault was found can be produced for organization references.

Furthermore, key measures for service after sales is important because with the right implementation of warranty services and the right approach of service after sales analysis can increase organization gross profits including the revenues. Figure 2.9 (b) illustrated the research result which has been done by the Unzicker and Harrity (2006) as a proof. Finally, Belingger (2006) mentions about cycle time measures are valuable tools for process assessment. In both the depot repair and end-user exchange environments, a certain level of expectation exists for average turnaround time performance.

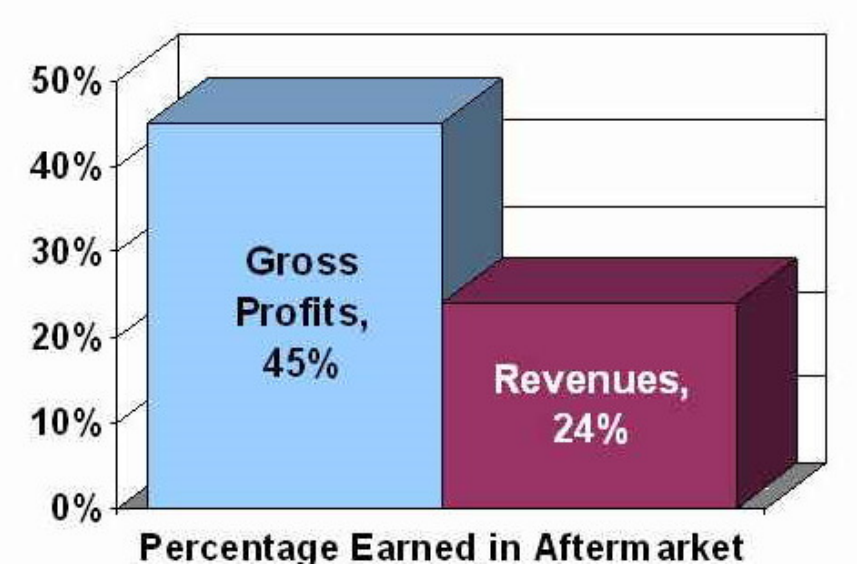


Figure 2.9 (b): Aftermarket Earning, 1999

Source: Unzicker and Harrity (2006)

2.7.2 Warranty Card

Warranty card is usually used for warranty validation for products that consumers buy. Most consumers do not know that instead of warranty validation, warranty card play other rolls in marketing strategy for some organization. According to Marks (1999), the warranty card is not necessary or important. Keeping the receipt or proof of purchase is much more important. Consumers need to take a good consideration on information requested in the warranty card. If the information is too much such as asking privacy questions, consumers should not let the information flow off. This is because they can put their personal information and themselves at great risk and unsecure environment.

2.7.3 Product registration VS warranty card

According to Harrison (2007) says product warranty cards that collect personal information are deceptive. He mention about Product warranty cards are information collected under the pretense of a benefit where the information goes straight to marketers. The purpose of a product warranty card is not to protect the consumers but it's to collect marketing information. There are big differences between warranty card and product registration card that most consumers are not consent about. Registration cards, at least in a perfect world, ask for just enough information so the company can notify you if the product is recalled.

Warranty cards have developed more of a reputation for asking a laundry list of questions about your personal habits. But that difference is getting blurred as many registration cards are data mining, too. According to Mark (1999) and Harrison (2007), they advised the consumer to include only name, serial number of the product. Address and a copy of the receipt to verify the date of purchase for the warranty card information. If the consumers are not care full enough in giving their privacy information, they might face the problem with telemarketing calls and junk mail or worst irresponsible people will use the data for their own benefit.

2.8 Implications of Literature Review on Research Project

According to the literature review discuss in this chapter, these days it is increasingly common for a company to be competitive among others as to survive and gain more profits. The answer to this dilemma lies in the adoption of a new approach to warranty management. While in many cases, to have good warranty management system for Computer Sales and Services Shop offers a number of significant benefits which can also create some challenges. One of the challenges is the ability for a company to identify the root cause of a problem in managing their warranty system. Understanding the term of warranty card, product registration card or other issues of warranty is one of the main aspects to create the best warranty management system.

Nowadays it is proven that to have good warranty management system is a crucial effort to computer sales and services shop. There are several processes in warranty management system that can be applied depending on time, money and complexity aspect. Defining the best warranty management process from start to end is one of the important aspect that need to be taken into account to ensure the effectiveness and best effects that can bring a lot of profits to the company or shop.

More over, better warranty management system can help the company or shop to gain more advantages and benefits such as improvement in customer relationship management. Result statistic of warranty management system by the IBM Company had shown the improvement on customer relationship up to 89% that can increase sales and customer royalty. Other than that, claim handling cost also can be reduced. More profits gain by applying extended warranty approach. With record of product failure and product warranty, will help the Computer Sales and Services Shop to improve their product quality but also ensure that these problems are not passed from one product design to another and generate service after sales.

Besides, exploiting warranty data can be a powerful weapon for the Computer Sales and Services Shop to analyze and identified their weaknesses. Finding and fixing the internal or external weaknesses of the Computer Sales and Services Shop not only improve their ability to detect and respond to problems, but also help the shop stronger and competitive. In addition to achieving higher quality products and minimizing service and warranty costs,

proper use of warranty data ensures organizations maintain an excellent reputation with their customer base.

2.9 Summary

Companies must focus on the best possible course of action as quickly as possible, process the ability to spot upcoming obstacles and be agile enough to change due to the technology and market competition. With the combined power of cost reduction, new revenue streams, superior product quality, and the elimination of fraudulent behavior, companies may transform warranty management from a curse to an asset. Simply put, better warranty management can generate improved marketplace performance by spurring greater differentiation, improving competitive advantage, and even enhancing revenues.

CHAPTER 3
METHODOLOGY

3.1 Introduction

Methodology is a sequence of process that describes step by step or flow of process for particular study. It is important to select the most suitable methodology as to accomplish this project with excellent understanding and outcome. Methodology used in this project is adapted from User Centered Design (UCD) methodology. This methodology contains five main important processes that need to be followed up as a guidance to successfully complete this study. User Centered-Design (UCD) is a philosophy and a process. It is a philosophy that places the person at the center and a process that focuses on cognitive factors such as perception, memory, learning, problem-solving, and many more. UCD can improve the usability and usefulness of everything to software to information systems to processes anything with which people interacts (Norman, 1998). The details are stated in the Gantt chart shown in the appendix C. Explanation on each stage is as followed in Figure 3.1

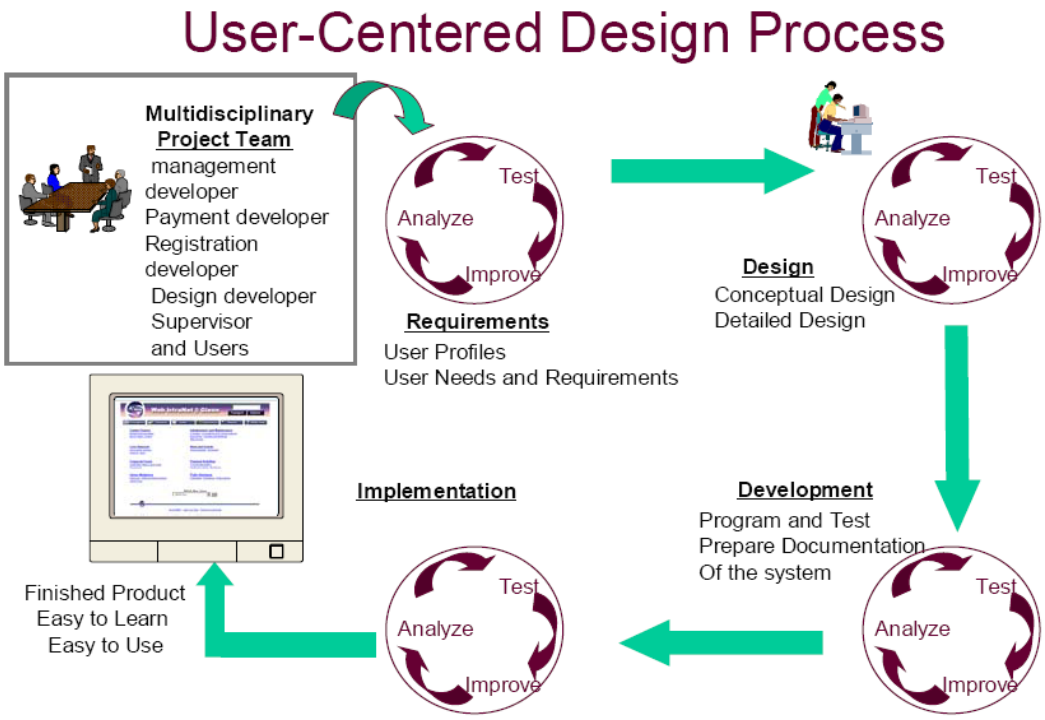


Figure 3.1: User Centered Design Methodology

Source: Retrieved From User Experienced Design Forum, 2002

3.2 Phase one: Requirements Phase Tasks

In this stage, user requirement and analysis is done to collect all the information to accomplish the study and find the solution of the current problem which had been discussed in the problem statement. This requirement phase task stage contains five main tasks such as:

- Task analysis
- User analysis
- Use-case scenario.
- Analysis usability goal
- Initial system documentation

3.2.1 Task Analysis

- The purpose of running the task analysis is to understand in detail what are suitable functionalities and user's need in developing Warranty Management System (WMS) and how to accomplish the WMS.
- Furthermore, in this phase technical information such as hardware and software requirement for designing and developing the WMS were determined. Table 3.1 and Table 3.2 show the detail about hardware and software requirement.

Table 3.1: Hardware Requirements

No	Item	Unit
1	Intel Pentium 4	1
2	256 MB DDRAM	1
3	16 Bit Monitor	1
4	Minimum 800*600 pixel screen resolution	1
5	40 GB Hardisk (Maxtor)	1
6	Server	1

Table 3.2: Software Requirements

No	Item	Functionalities
1	Macromedia Dreamweaver MX 2004	Design Template for the website in architecture and system design includes coding and testing.
2	Adobe Photoshop 7.0	Use to design the interface design of the Web-based Warranty Management System
3	Microsoft Office 2007	Write report and write the user analysis and task analysis requirement information as reference for web development.
4	Microsoft Project 2003	Design the work schedule according to the methodology.
5	Rational Rose 2000	Design the use-case diagram and sequence diagram for the system.
6	MySQL Database	Creating and structuring the database for the system for storing data.
7	Hypertext Preprocessor (PHP)	Template to write and run coding to make sure the system functionalities works well
8	Windows XP professional.	This is the operating system that had been used in the computer to make sure that all the software needs run perfectly.
9	Acrobat Reader 8.0	This software is used to write report of the system.

3.2.2 User Analysis

The purpose of a user analysis is to understand, at a high level of who will use the Warranty Management System (WMS) and how they will use it. User analysis is conducted before this project planning begun or in other words in the early stages of a project. Before the formal project of WMS has been established, a user analysis was conducted before project planning to provide system management with an understanding of the workplace that can help to determine the need of systems development. The workplace evaluations were used to define the project scope and determine the project approach and problem statement. In this phase, there are some processes that need to be done to fulfill this user analysis which are uses:

i. User profiling

Define and knowing the need of customer and computer sales and services shop personnel on the system, the purposes of the system and how they will use the system. Identify level of computer experience, web experience, domain knowledge and application specific experience. More over, all the information were used to design an effective user interface and functionalities. Table 3.3 shows the user profiling detail gathered from interview in result analysis.

ii. Interviews

Interview is one of the approaches that had been taken in fact finding techniques. With limited time, money and location, interview is much more suitable approach than questionnaire or observation based approach. Besides, by doing the interview, researcher can get close and get more information depending on the interviewee time and the outcome is much more reliable or clear.

a. Goal and objective of the interview

The main goal and objective of the interview is to collect user requirements and understand user needs and environment. Second, is to define the problem statement of the system and business requirement.

b. Location, Duration and Participants of interview

Collect more information from the manager and personnel of computer sales and services shop such as from the Megabase Enterprise, Qlife enterprise and Zcom enterprise in the varsity mall UUM. Moreover, collect information from the JMC supplier at Jitra and Alor Setar. The time taken for the interview to finish is about a month because of location distance, transport, money and finding the suitable time.

c. Type of interview

The type of the interview is semi-structured and in informal condition to put both parties in more comfortable and open situation. The interview done in mostly open-ended question designed for the interview that varied to suit context and ranged from general to particular issues.

c. Result Analysis

All the information gathered from the interview process was analyze and documented in category by using table form. Computer experience described how long the intended users been using a computer and typical activities involve. Besides, it is use to measure user skill level. Web experience described how long the users been using the web system and how much do the intended users understand about internet jargon and concepts such as Java, Active X, Hypertext markup Languages (HTML) and more.

Therefore, some experience with Web browsers also will be helpful. Domain knowledge described whether the intended users familiar with the subject matter associated with the application. Application specific Experience discuss about how well the users know about the purpose and capabilities of the propose system

because of past experience. Table 3.3 is the result analysis from the interview information.

Table 3.3: Result analysis

Experiencing Grades	
None= 0 Low= 1 Medium= 2 High= 3	
Attribute	**Minimum Experience**
Computer Experience	2 to 3
Web Experience	2 to 3
Domain Knowledge	1 to 3
Application Experience	0 to 1

3.2.3 Use-case Scenario

Visual representation of WMS is important to provide greater understanding and clear picture of the system. The use-case diagram was created by using the program of Rational Rose 2000. With the application of use-case diagram, it is easy to detect or define error in the system as well as to ensure the usability of the system. The flow of the Warranty Management System (WMS) had been refined and had been structured as use-case diagram in Chapter 4.

3.2.4 Analyze usability goal

Usability goals provide target to indicate when design is done to help achieved this project objective. Goals of the system were determined based on measurable performance of time to complete the system, errors made while performing task, improved performance over time, how much training or help was needed and subjective satisfaction of users. In

appendix C shows the Gantt chart Schedule for this research study that explain in detail about the process of completing this study as to achieve the usability goal of the system.

3.2.5 Initial system documentation

Initial system documentation or report after defining the scopes, objectives and problem statement of the system**.** System documentation for the WMS is very important as for reference and record of analysis that had been done in the early phase. System documentation on early phase helps the developer to be on the right track.

3.3 Design phase task

The WMS is designed based on information gathered in the previous stage. The design was referred to the requirement specification from the supplier and computer sales and services shop in UUM. In this stage, three main tasks had been discussed to make sure the functionalities of the system which are:

- User Interface design
- Architectural design
- Database design

3.3.1 Architecture design

In many ways, the correct design of the information architecture had been a key to a successful create user interface, as it provides a strong foundation on which to build the detailed user interface screens**.** The Information Architecture had been high-level map of how information will be organized in a user interface. The system architecture for the Warranty Management System (WMS) is three-tier application model which will be described more detail in the Findings chapter 4.

3.3.2 User interface Design

Once the information architecture has been completed, detailed screens were designed. The screen designs start as rough mockups, and were transferred into PHP and HTML renderings as it were refined. The user interface screens of the system were design consistently between screens to provide ease of use of the whole system. The system use of hypertext buttons. The rules of the hypertext were defined to let the user know which ones get chosen as hypertext. The rules is the blue color were made as to code to the text has link. Moreover, multiple search mechanisms also provided. Moreover, other criteria need to be looked up such as:

- This information architecture for the system is the pages of the website are interesting yet simple and uncluttered.
- Related elements had been group close to each other so users can associate the elements just by looking at the placement.
- Color for the system was used conservatively. Although color can engage users, it can distract them unnecessarily or be misinterpreted.
- Size of the button or banner need to be in the right and necessary size.

3.3.3 Database design

A database management system (DBMS) provides mechanism for storing and organizing data in a manner that is consistent with the database's format. In this database design, user can access and store data without worrying about the internal representation of database. The database use for the Warranty Management System (WMS) is relational database management system (RDBMS). All the information that had been inserted from users is stored in the database. The database is called 'alimz' database. This database contains six main tables which are adminlogin, customer, product, supplier, warranty and staff. The detail description of the database design will be presented in the chapter 4 in findings.

3.4 Development phase task

The development process had already been started in the design stage after collecting all the information related with the system and also organization and users requirements. Development process continued in this phase. The system functionalities will be tested to detect any error and fix the error immediately. This stage consists of:

- Testing
- System documentation

3.4.1 Testing

The system was tested using the gray-box testing method to make sure no error and to detect any malfunction of the system before implementing the system. The system was tested using http://localhost to make sure the system runs smoothly, in order and consistent. During the testing, all mistakes have been corrected and now the system completely functioning well. Brief explanations are discussed in chapter 5 of Testing.

3.4.2 System documentation

System documentation or draft report finish after done with testing. The documentation is important as the documentation contains everything about the system from start to end.

3.5 Implementation

This phase had several processes such as remove the entire file into the specific server, insert data in database, and present the finish system to supervisor of UUM and evaluator to evaluate the system. If the system fulfill the entire requirement and get the satisfaction from evaluator and supervisor, this system will be implemented in the computer sales and services shop in UUM. The specific captured screens and user manual also provided for proper guide in using the system as shown in appendix A.

3.6 Summary

This chapter discussed brief idea about the methodology used for developing the system from start to end. Methodology used in this project is User Centered Design (UCD) methodology. This methodology contains four main important processes that need to be followed up as a guidance to successfully complete this study.

1. Requirement phase task
2. Design phase task
3. Development phase task
4. Implementation phase task

In Requirement phase task, user requirement and analysis is done to collect all the information to accomplish the study and find the solution of the current problem by designing and developing Warranty Management System (WMS). This stage contains five main tasks which are Task Analysis, User Analysis, Use-Case Diagram, Usability Goal Analysis and Initial System Documentation. In Design phase task, the WMS is designed based on information gathered in the previous stage. Three main tasks had been discussed to make sure the functionalities of the system which are Architectural Design, User Interface Design and Database Design.

In Development phase task, development process continued in this phase. The system functionalities will be tested to detect any error and fix the error immediately. This stage consists of testing and System documentation. In Implementation phase task, had several processes such as remove the entire file into the specific server, insert data in database, and present the finish system to supervisor of UUM and evaluator to evaluate the system.

CHAPTER 4

FINDINGS

4.1 Introduction

This chapter will go through the methodology phase task that was done to the Warranty Management System (WMS) in UUM. It will start with Requirement phase task to review the cornerstones of the designed WMS. This includes the finding of task analysis, user analysis, and goal analysis and use case diagram. Then, system user and system functionality will be described and briefly demonstrated. The Design phase will illustrate the architecture design, user interface design and database design of the WMS.

4.2 Requirement Phase Task

The requirement of the designing and developing Warranty Management System had been successfully collected from the customer and the computer sales and services shop in Universiti Utara Malaysia (UUM). The requirement for the system is collected from three different computer sales and services shop in UUM from five to come out with the right solution to problem statement which had been discussed in the early stage of this report.

4.2.1 List of the requirements

Listed below are the functional and non-functional requirements of the system. In the priority column, the following short hands are used:

1. M-Mandatory requirements (Something the system must do)
2. S- desirable requirements (something the system preferably should do)
3. O- Optional requirements (something the system may do)

Table 4.1: Functional Requirements

No.	Requirement ID	Requirement Description	Priority
	WMS_01	**Log in**	
1	**WMS_01-01**	Administrator or Staff can key in User ID and password	**M**
2	**WMS_01_02**	System shall detect invalid password and user ID	**D**
3	**WMS_01_03**	Administrator or Staff can reset the log in	**O**
	WMS_02	**Check Warranty**	
4	**WMS_02_01**	Customer can check their product warranty validation period	**M**
5	**WMS_02_02**	Administrator or staff can check product warranty record	**M**
6	**WMS_02_03**	System shall detect invalid input or incomplete form	**D**
7	**WMS_02_04**	Administrator, staff or customer may reset the product ID form	**O**
	WMS_03	**Add New Warranty**	
8	**WMS_03_01**	Administrator or Staff can add new warranty information in the database	**M**
9.	**WMS_03_02**	Administrator or Staff shall reset all the warranty if he/she wants to clear the information at the product form.	**O**
10.	**WMS_03_03**	Administrator or Staff may cancel the add new warranty activity	**O**
11.	**WMS_03_04**	System shall detect error of not complete the form or invalid input	**D**
12	**WMS_03_05**	System shall detect error of redundant data	**D**
	WMS_04	**Manage Warranty**	
13	**WMS_04_01**	Administrator or Staff can view product warranty information	**M**
14.	**WMS_04_02**	Administrator or Staff can update product warranty	**M.**

		information	
15.	**WMS_04_03**	Administrator or Staff can delete product warranty information	**M**
16.	**WMS_04_04**	Administrator or staff can search particular product warranty information	**D**
17.	**WMS_04_05**	Administrator or staff can cancel the warranty activity / process anytime	**O**
18.	**WMS_04_06**	System is able to detect invalid input and incomplete form	**D**
	WMS_05	**Add New Claim**	
19.	**WMS_05_01**	Administrator or Staff can add new claim information in the database	**M**
20.	**WMS_05_02**	Administrator or Staff shall reset the claim if he/she wants to clear the information at the product form.	**O**
21.	**WMS_05_03**	Administrator or Staff may cancel the add new claim activity	**O**
22.	**WMS_05_04**	System shall detect error of not complete the form or invalid input	**D**
23.	**WMS_05_05**	System shall detect error of redundant data	**D**
	WMS_06	**Manage Claim**	
24.	**WMS_06_01**	Administrator or Staff can view product claim information	**M**
25.	**WMS_06_02**	Administrator or Staff can update product claim information	**M.**
26.	**WMS_06_03**	Administrator or staff can search for particular claim information	**D**
27.	**WMS_06_04**	Administrator or staff can cancel the warranty activity / process anytime	**O**
28.	**WMS_06_05**	System is able to detect invalid input and incomplete form	**D**
	WMS_07	**Add New Product**	
29.	**WMS_07_01**	Administrator or Staff can add new product information in the database	**M**

30.	**WMS_07_02**	Administrator or Staff shall reset all the information if he/she wants to clear the information at the product form.	**O**
31.	**WMS_07_03**	Administrator or Staff may cancel the add new product activity	**O**
32.	**WMS_07_04**	System shall detect error of not complete the form or invalid input	**D**
33.	**WMS_07_05**	System shall detect error of redundant data	**D**
	WMS_08	**Manage Product**	
34.	**WMS_08_01**	Administrator or Staff can view product information	**M**
35.	**WMS_08_02**	Administrator or Staff can update product information	**M**
36.	**WMS_08_03**	Administrator or Staff can delete product information	**M**
37.	**WMS_08_04**	Administrator or staff can search particular product information	**D**
38.	**WMS_08_05**	Administrator or staff can cancel the activity / process anytime	**O**
39.	**WMS_08_06**	System is able to detect invalid input and incomplete form	**D**
	WMS_09	**Add New Customer**	
40.	**WMS_09_01**	Staff can add new customer information in the database	**M**
41.	**WMS_09_02**	Staff shall reset all the information if he/she wants to clear the information at the customer form.	**O**
42.	**WMS_09_03**	Staff may cancel the add new customer activity	**O**
43.	**WMS_09_04**	System shall detect error of not complete the form or invalid input	**D**
44.	**WMS_09_05**	System shall detect error of redundant data	**D**
	WMS_10	**Manage Customer**	
45.	**WMS_10_01**	Administrator or Staff can view customer information	**M**
46.	**WMS_10_02**	Administrator or Staff can update customer information	**M**

47.	**WMS_10_03**	Administrator or Staff can delete customer information	**M**
48	**WMS_10_04**	Administrator or staff can search particular customer information	**D**
49.	**WMS_10_05**	Administrator or staff can cancel the activity / process anytime	**O**
50.	**WMS_10_06**	System is able to detect invalid input and incomplete form	**D**
	WMS_11	**Add New Supplier**	
51.	**WMS_11_01**	Staff can add new supplier information in the database	**M**
52.	**WMS_11_02**	Staff shall reset all the information if he/she wants to clear the information at the supplier form.	**O**
53.	**WMS_11_03**	Staff may cancel the add new supplier activity	**O**
54.	**WMS_11_04**	System shall detect error of not complete the form or invalid input	**D**
55.	**WMS_11_05**	System shall detect error of redundant data	**D**
	WMS_12	**Manage Supplier**	
56.	**WMS_12_01**	Administrator or Staff can view supplier information	**M**
57.	**WMS_12_02**	Administrator or Staff can update supplier information	**M**
58.	**WMS_12_03**	Administrator or Staff can delete supplier information	**M**
59.	**WMS_12_04**	Administrator or staff can search particular supplier information	**D**
60.	**WMS_12_05**	Administrator or staff can cancel the activity / process anytime	**O**
61.	**WMS_12_06**	System is able to detect invalid input and incomplete form	**D**
	WMS_13	**Add New Staff**	
62.	**WMS_13_01**	Administrator can add new staff information in the database	**M**
63.	**WMS_13_02**	Administrator shall reset all the information if he/she wants to clear the information at the staff form.	**O**

64.	**WMS_13_03**	Administrator may cancel the add new staff activity	**O**
65.	**WMS_13_04**	System shall detect error of not complete the form or invalid input	**D**
66.	**WMS_13_05**	System shall detect error of redundant data	**D**
	WMS_14	**Manage Staff**	
67.	**WMS_14_01**	Administrator or Staff can view staff information	**M**
68.	**WMS_14_02**	Administrator can update staff information	**M**
69.	**WMS_14_03**	Administrator can delete staff information	**M**
70.	**WMS_14_04**	Administrator or staff can search particular staff information	**D**
71.	**WMS_14_05**	Administrator or staff can cancel the activity / process anytime	**O**
72.	**WMS_14_06**	System is able to detect invalid input and incomplete form	**D**

Table 4.2: Non-Functional Requirements

No.	Requirement ID	Requirement Description	Priority
73.	**WMS_15**	**Reliability Issues**	
74.	**WMS_15-01**	If the system crash, it should behave perfectly normal when reloaded again	**M**
75.	**WMS_15_02**	The system should crash not more than once per 5 hours	**M**
	WMS_16	**Usability Issues**	
76.	**WMS_16-01**	Administrator or Staff should be able to add any new record within 2 minutes	**M**
77.	**WMS_16_02**	Administrator or Staff should be able to update any record within 3 minutes	**M**

78.	**WMS_16_03**	Administrator or Staff should be able to delete any record within 1 minutes	**M**
79.	**WMS_16_04**	Administrator or Staff should be able to search any record within 2 minutes	**M**

4.2.2 System's Functionalities

There are thirteen main functionalities in the system including the search, adding, update, delete, view and more.

i. Login and logout

- Registered users need to login to go to their homepage. This system provide login for staff and administrator.
- This type of users needs to enter correct username and password to go to their homepage. If the information incorrect, the error page will be displayed.
- Further more, each homepage provide logout. Users need to logout the homepages after they had finished for security purposes.

ii. Change password

- Staff or administrator can change their account login information.

iii. Change password session

- The system prompts the staff or administrator to verify their email for security purposes before the user change the login information.

iv. Forgot password

- This system also provides forgot password for staff or administrator that had forgotten their password or username.
- They must pass forgot password session to get back their login information

v. Forgot password session

- To get back login information, users need to enter their email correctly. If the information incorrect, error page will be displayed.
- Besides, if the user also forgot their email, they can seek more help by click the hypertext 'click here' in error page.
- When users click the hypertext, email manager together with administrator email address. So, the users can send their problem directly to administrator box mail.
- As for administrator, system will prompt the administrator to verify their email also.

vi. Check product warranty

- User can check the availability of product warranty in the system.
- The system will prompt the user to input the product ID for the evaluation process.
- After the evaluation process done, the result will be displayed if the input is correct or valid. Otherwise, the result will return error.
- For this function, no authentication is needed. The user like customer can access directly to the system and used this function without any restriction on user level.

vii. Manage Warranty record

- The user needs to log in to the system first. Staff and administrator only can access and use this function.
- The system provide form element that need user input on customer ID, warranty date sale, warranty date end and product ID for new warranty record.
- The system will validate the form and insert the data in the warranty table in the local database.
- More, the system allows the staff or administrator to update, view and delete the warranty record.
- User can search for particular warranty record by using the customer ID.

viii. Manage Claim record

- To make claim record, the customer must have warranty record in the system. If no warranty record, then the system cannot allow the user to make claim record.

- Only authorized user can use this function in the system.
- The claim record consists of five main fields that need to be fulfilled in. These five fields are replacement product ID, replacement date, replacement status, replacement type and description on claim.
- System allows the staff or administrator to view and update the claim record.
- Search function also provided for claim record. User can search particular claim record by using the customer ID.

ix. Manage Product Record

- To add new product Record, the authorized user must fill in the form required by the system. The main details that need to be recorded about product are product ID or serial No., product name, date purchase, date sale, price sale, and price purchase, and discount and warranty period.
- User need to log in to the system to use this function. This function only available to staff and administrator.
- User can update, delete and view list of product warranty.
- More over, the user can search for particular product record by using the product ID or category.

x. Manage Customer record

- Only authorized user like staff and administrator can access and use this function in the system.
- The system allow the user to add new customer record by prompting few important information of the customer such as customer ID, name, email, address and contact No.
- Staff or administrator can update, delete and view list of customer.
- Search function for customer record also provided by the system. User can search for particular customer by using the customer ID.

xi. Manage supplier Record

- Supplier record contains information about the supplier. New supplier information or record can be added by the staff or administrator. The information required are the supplier name, address, email, fax no and contact no.
- Besides, only authorized user like staff and administrator can used this function. User need to log in to the system to use this function because it deals with the record in the database.
- User also can update, view and delete the supplier record.
- Search function also provided in this function. User can search the specific supplier record by using the supplier ID or address.

xii. Manage Staff Record

- This function can only be accessed by the administrator of the system. Administrator can manipulate and manage the staff information in the system.
- Administrator can view list of staff in the system and update, delete the staff record.
- Specific staff record can be search by using the staff ID
- More, the administrator can add new staff record by inserting the staff name, email, address, date start and date end.

xiii. View report

- Only authorize user like staff or administrator can view the report. The system allow the user to view five record which are warranty record, claim record, product record, supplier record and customer record.
- The report cannot be update or delete.

4.2.3 System User

This task provide the detailed of system user with particular task in the system application. The system has limitation depends on the level of users. Each user can use certain application in the system only as to provide security and business privacy. The main

customer of computer sales and services in UUM is the students in UUM. Students have many responsibilities to take care of and students also need to use computer products for study purposes. So, with WMS, students can have more advantages and convenient in buying computer products in UUM. There are three users for the WMS which are:

i. Customer

a. View the main page of WMS in index.php
b. Check product warranty validation by using product ID.

ii. Staff

a. Add new warranty record, product record, customer record, supplier record and claim record
b. Manage warranty record
    - update, delete, view and search for warranty record in the WMS
c. Manage product record
    - Update, delete, view and search for product record
d. Manage customer record
    - Update, delete, view and search for customer record
e. Manage supplier record
    - Update, delete, view and search for supplier record
f. Manage claim record
    - Update, view and search for claim record.
g. Able to view report of customer, product, supplier, warranty and claim
h. Able to sign in and sign out as a staff
i. Able to change password.

iii. Administrator

a. Add new warranty record, product record, customer record, supplier record and claim record
b. Manage warranty record

- update, delete, view and search for warranty record in the WMS

c. Manage product record
    - Update, delete, view and search for product record

d. Manage customer record
    - Update, delete, view and search for customer record

e. Manage supplier record
    - Update, delete, view and search for supplier record

f. Manage claim record
    - Update, view and search for claim record.

g. Manage staff record
    - Update, delete, view and search for staff record

h. Able to view report of customer, product, supplier, warranty and claim

i. Able to sign in and sign out as a administrator

j. Able to change password.

4.2.4 use-case scenario

The system users for the Warranty Management System (WMS) are customer, administrator and staff or personnel of computer sales and services shop in UUM. Each of the users has different level of authority in using the system. Only administrator has full authority in the system. The authentication process in the system validates and differentiates the user accessibility through the system for security and confidential purposes. Figure 4.1 illustrate use case diagram for system's user.

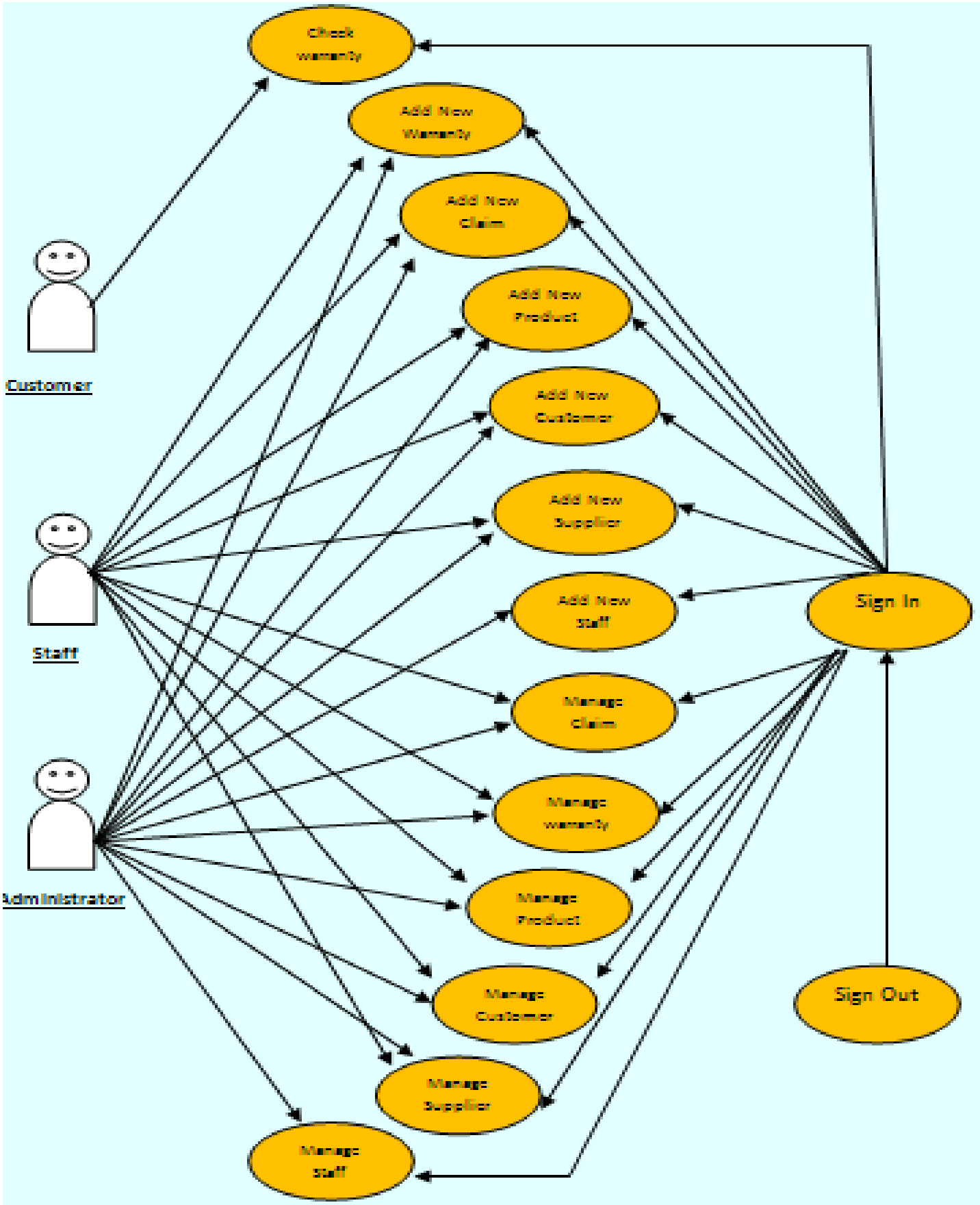


Figure 4.1: Use Case Diagram for System User

4.3 Design phase task

The WMS is designed based on information gathered in the previous stage. Three main tasks had been discussed to make sure the functionalities of the system which are Architectural Design, User Interface Design and Database Design.

4.3.1 Architectural Design

The combination of HTML and PHP with scripting provides a powerful means for expressing documents. In this architectural design, it is important to know where the documents are actually processed and what kind of processing takes place.

4.3.1.1 three-tier application model

The warranty management system (WMS) is design based on the three-tier application model. The three-tier application model architecture consists of three different functionality which are the client-tier represent the user interface level, middle-tier represent the processing level and information tier represent the data level. The architecture design use to determine the process and usability of WMS as well as the security concerns. Figure 4.2 presents the basic structure of the three-tier application.

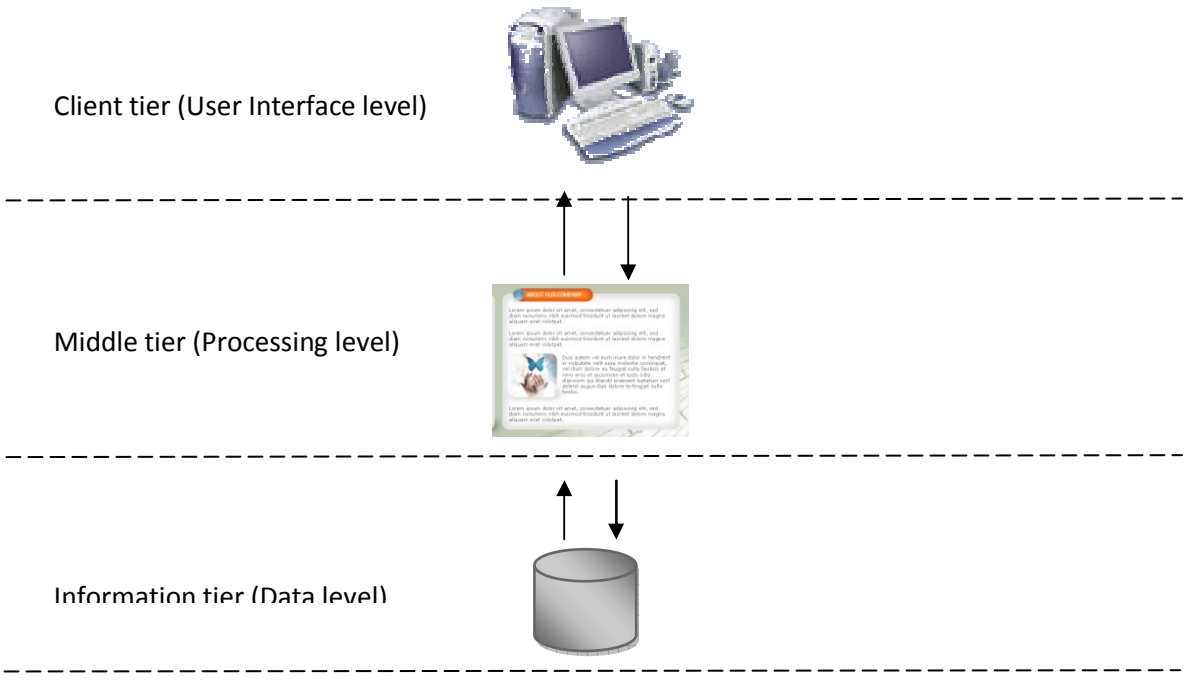


Figure 4.2: Three Tier Application Model.

The information tier which is also called the data tier maintains data for the application. This tier stores data in a relational database management system (RDBMS) of the WMS. The RDBMS of WMS is called "alimz" database. This information tier contains all the WMS records in particular table design. The "alimz" database will be discussed further in the database design part.

The middle tier implements the business logic and presentation logic to control interaction between application clients and application data. Besides, the middle tier also acts as an intermediary between data in the information tier and the application clients. Clients can request data such as warranty record or claim record from the top tier and the process will be done in the application tier to verify the client request and retrieve the data from the 'warranty table' in the "alimz" database. The validation process will be done in the warranty.php application.

Moreover, business logic in the application level ensures the data is reliable before updating or presenting the database to a user. In this level, it defines and determines how user can and cannot access application data by using the authentication process to differentiate between customer and staff and how the application process and evaluate the process data. The WMS present the information to the user as HTML and PHP documents.

The client tier or top tier is the application's user interface. Users of WMS can interact directly with the application through the client tier. The client tier can be in the form of web browser, keyboard and mouse. The client interacts with middle tier to make requests and to retrieve data from the information tier. The client then displays the data retrieve from the middle tier to the user. The client tier never directly interacts with the information tier. The client tier will be described more in the user interface design part. Figure 4.3 shows the General organization of WMS in three different layers.

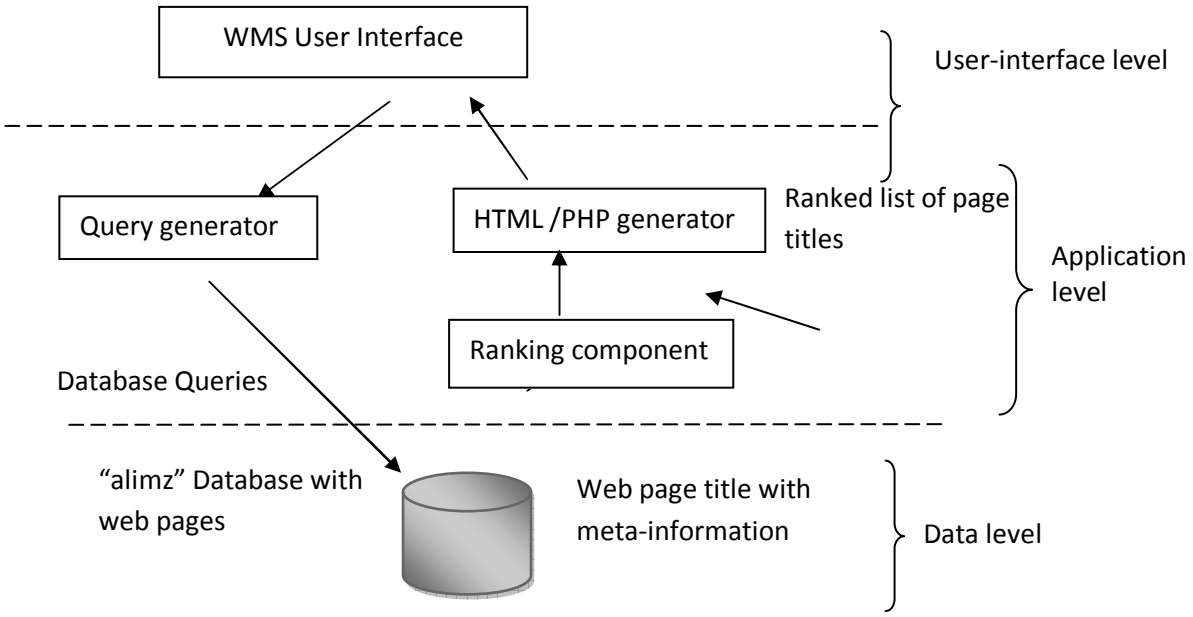


Figure 4.3: General organization of WMS in three different layers.

4.3.1.2 Client-Server Model System

The World Wide Web (WWW) is essentially a huge client-server system with millions of servers distributed worldwide. In the Warranty Management System (WMS), the server maintains a collection of documents. Each document is stored as a file although documents can also be generated on request. The server accepts request for fetching a document and transfer it to the user or client. Besides, it can also accept request for storing new documents such as new warranty record, new claim record, customer record and more. Figure 4.4 shows the WMS organization of the web.

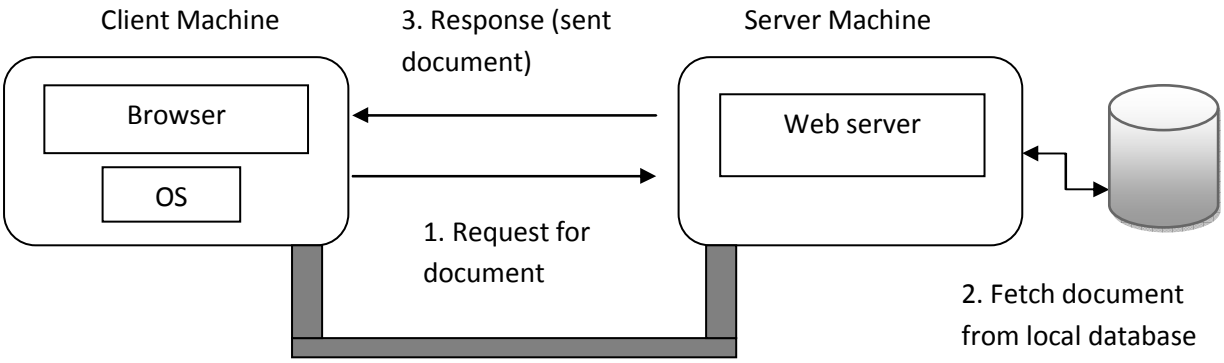


Figure 4.4: WMS organization of the web

4.3.2 User Interface Design

WMS implement the user interface level. This level consists of the program that allows end users to interact with the application of WMS. Specific button, form and functionalities design depends on the level of user experiences in computer application program. In the WMS, simple and easy user interface design is implemented to provide user-friendly environment and ease of use. Figure 4.5 is the example of user interface design for view customer.

- The main menu buttons for the WMS have specific links that connects the user to several function and application. This can avoid the user from lost in the system.
- More, the main color for WMS is blue. Blue is soft and gentle color that can avoid the user to get easily bored and good for the eyes.
- Else, the functionality such as delete, update and search is provided in the application layout. The user can manipulate the document directly from the interface page provided.

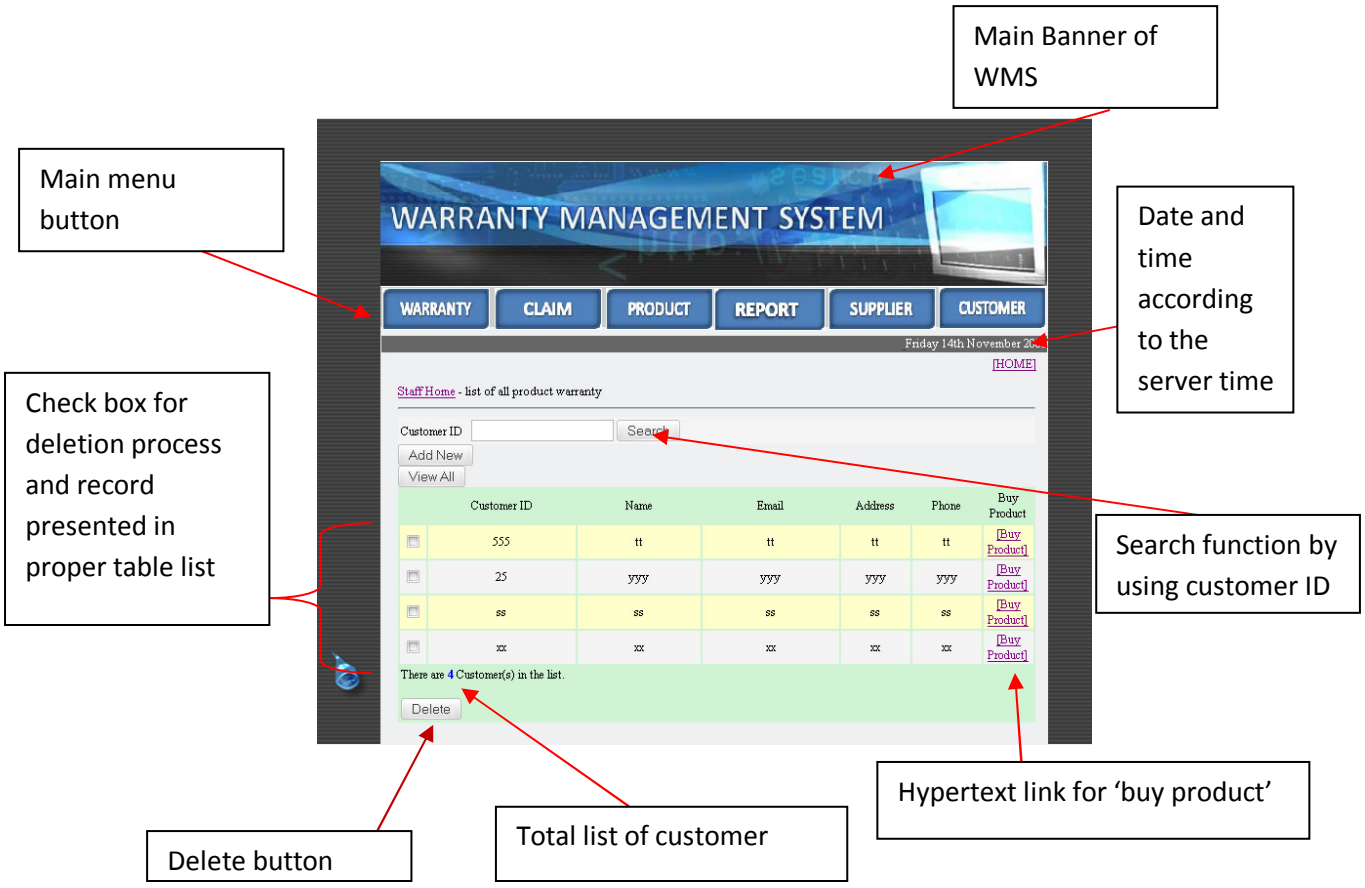


Figure 4.5: User Interface Design for View_Customer.php

4.3.3 Database Design

WMS use the relational database management system for database design. In other words, the data or record is organized as a relational database. Data in the database is independence. The data are organized independent of the application in such a way that changes in the organization not affect application and neither do the applications affect the data organization. Using the relational databases helps separate the processing level from the data level, as processing and data are considered independent. The WMS relational database is created by using the PHP MySQL server software. Table 4.3 shows the relational database structure for the 'customer' table. Screen shots for complete table in the database can be view in appendix B.

Table 4.3: Relational Database Structure for the 'Customer' Table.

Customer ID (PK)	Name	Email	Address	Phone No.
84045488	Halimah Adnan	geng@yahoo.com	Jln 4, kg baru sintok, 06010 sintok, kedah	0124565440
84145589	Abu Bakar Ali	bakar@gmail.com	Lot 5665, kg hulu hilir, 94000 Ulu Langat, Selangor	0198877890

4.3.3.1 Conceptual Database Design

The first step in building the conceptual data model for WMS is to define the main objects that the users are interested in. identifying the entity type is to examine user requirement and needs in the system. For WMS, the main important entity that must exist in the system is warranty attributes. In figure 4.6 shows the entity relationship diagram for WMS database. This figure represents the entities and how they relate to each other.

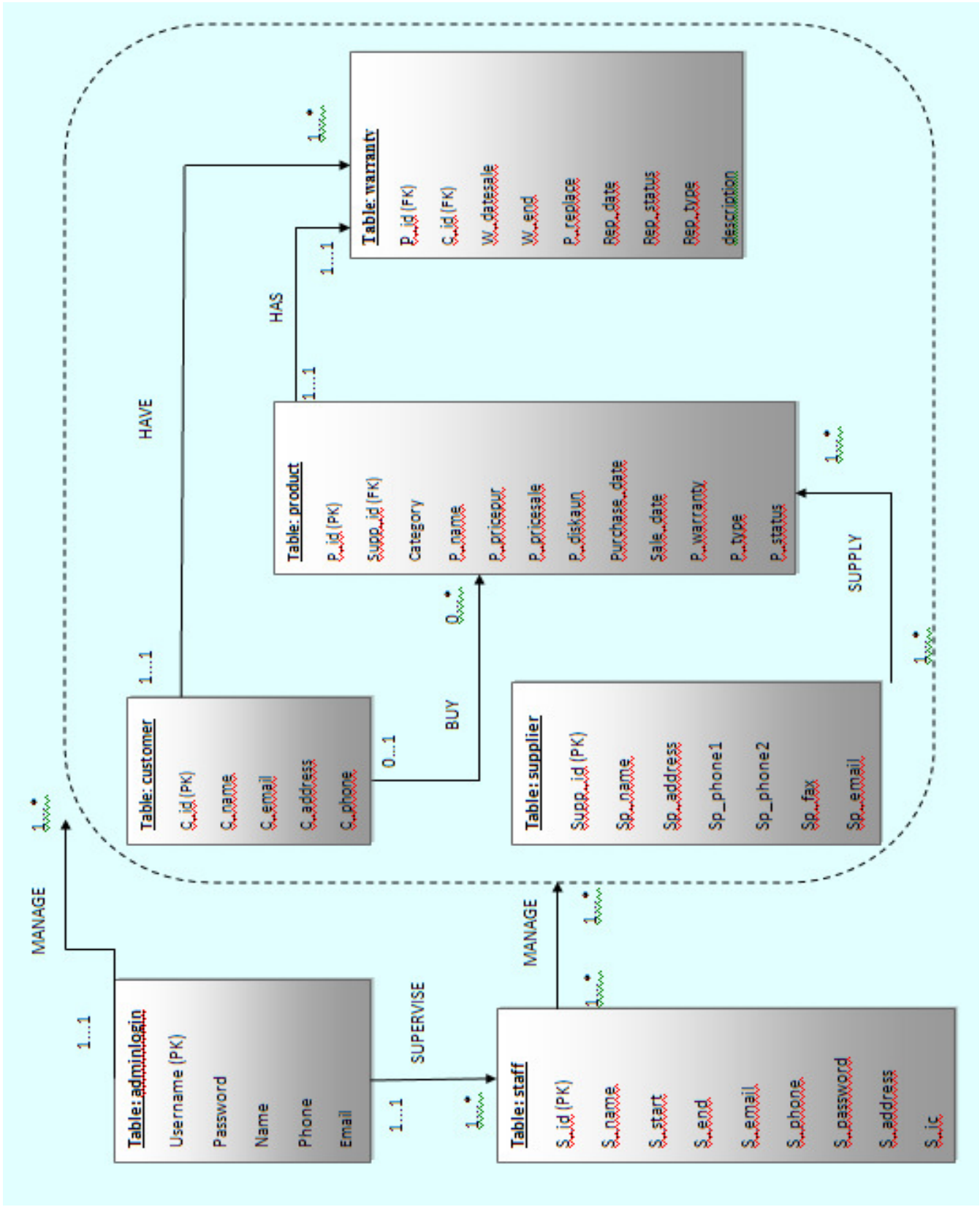


Figure 4.6: Entity Relationship Diagram for WMS Database

There are six entities in Warranty Management System (WMS) to provide usable functionality in the system for the user. The six entities are the adminlogin, staff, supplier, product, customer and warranty. In the adminlogin entity contains brief information about the administrator such as admin password and username for the authentication process. Other than that, the supplier, customer and staff entities contain personal information such as email, phone no, address, name and more. The warranty entity contains important data for the warranty and claim process in the system.

The warranty entity store product warranty record such as the warranty date start and warranty date end to determine the product warranty validation. Administrator in the WMS has the full authority in the system including manipulating the data in the database. Administrator can supervise one to more staff in computer sales and services shop in UUM. One to more Administrator and staff can manage more than one customer, supplier, product and warranty. Customer can buy more than one product and have more than one warranty record.

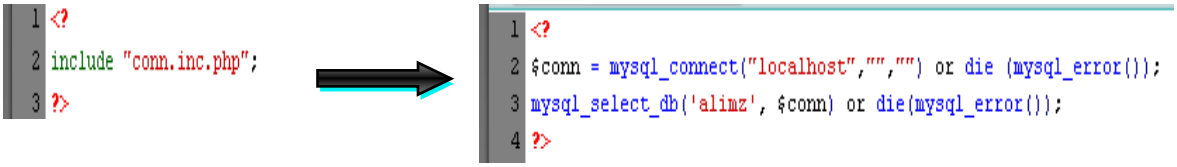
Further more, supplier can supply many products and products might have more than one supplier. Nevertheless, one product can only have one warranty record. No redundant data acceptable in the database. Certain rules and requirements are specified to avoid redundant data by assigning the primary key (PK) and foreign key (FK) in each entity. To retrieve the data in the database, users face a session that prompts users to enter specific data correctly for security purposes. It is important to ensure the entire database had no error and function well.

In Warranty Management system (WMS), administrator and staff have the authority to manipulate the database. Only administrator has full access to the database. Staff have limited accessibility depends on functionality of the system. The WMS allow the assign user to delete, update and insert data into the database. Figure 4.7 shows the attributes assign to make connection with the database in the local machine. The hostname assign is ‘localhost’. The database name is ‘alimz’ with the username ‘root’.

```php
<?php
# FileName="Connection_php_mysql.htm"
# Type="MYSQL"
# HTTP="true"
$hostname_imz = "localhost";
$database_imz = "alimz";
$username_imz = "root";
$password_imz = "";
$imz = mysql_pconnect($hostname_imz, $username_imz, $password_imz) or trigger_error(mysql_error(),E_USER_ERR
?>
```

Figure 4.7: Database Connection

Every PHP page in the WMS needs the same piece of code to connect with the database. As to save from having to write the same code over and over again, 'includes' file code is implemented in the php script. Figure 4.8 illustrates how include files can help to simplify the connection in each php page. Instead of repeating the code fragment in every file that needs it, write it just once in a separate file, known as an include file. The file can then be included in any other php files that need to use it.



Page.php **Conn.inc.php**

Figure 4.8: Include Code in PHP File

4.3.3.2 Database Security Issues

Data in the WMS is very valuable that must be strictly controlled and managed. Therefore, it is important to make sure organization data is secure and confidential. The terms security refers to the protection of the database against unauthorized access, either intentionally or accidental. There are several ways and security application that had been implemented in the WMS. One of the function and services include the authorization process. The database must verify a mechanism to ensure only authorized users can access the database. The other ways is by using firewall to secure database from unsecured network. Figure 4.9 represent the security structured for the WMS.

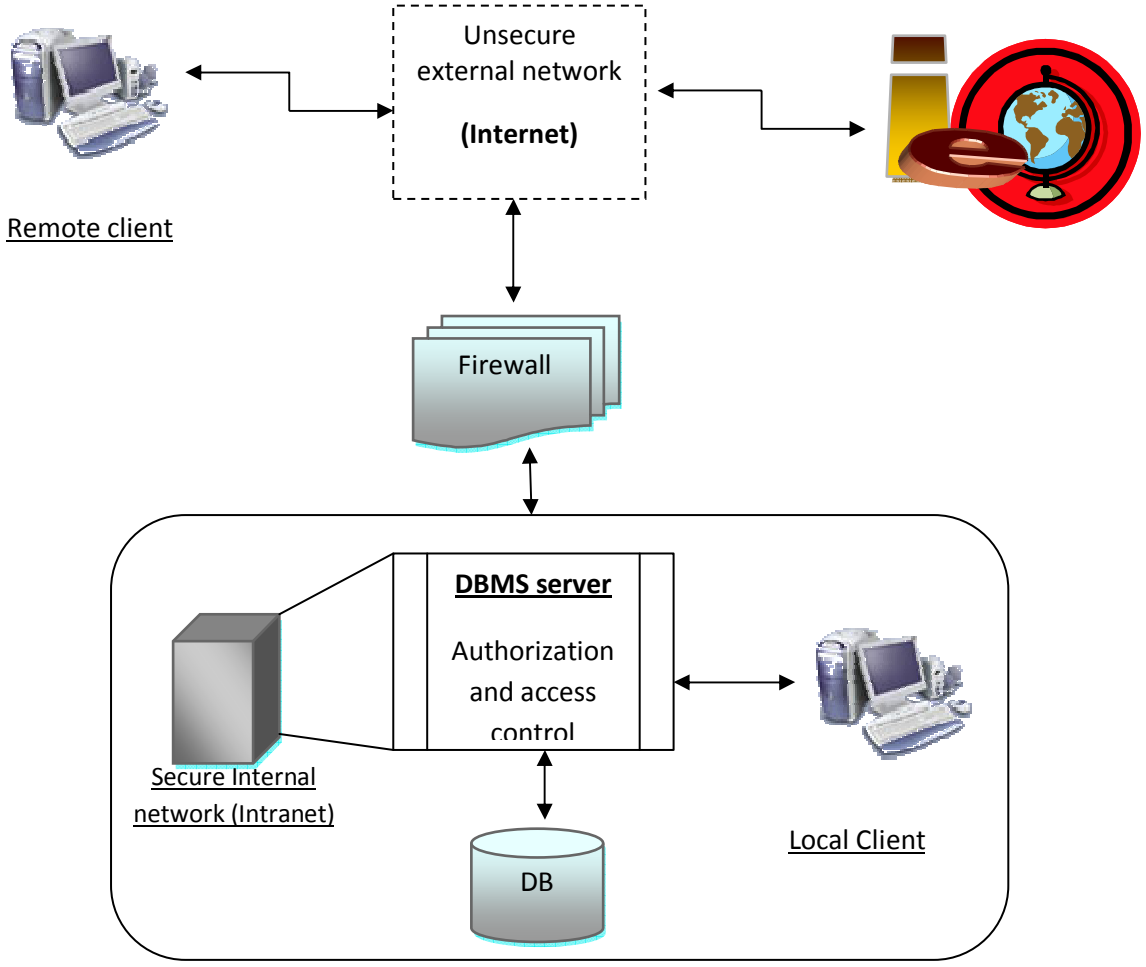


Figure 4.9: Security Structure for WMS Database

i. Authorization and Access Control

The process of authorization involves authentication of user requesting to access through the database. System administrator is responsible for allowing the users to have access to WMS by creating and assign individual user account. Each user level is given particular user ID and password which is used by the operating system to determine and verify who the user. In this WMS only staff and administrator have the authorization to access the database.

Unfortunately, staff cannot access staff entity or table in the database because only administrator can manipulate staff record. Only the programmer or administrator gets all the privileges to object in the database. Figure 4.10 shows the staff authentication function in the WMS.

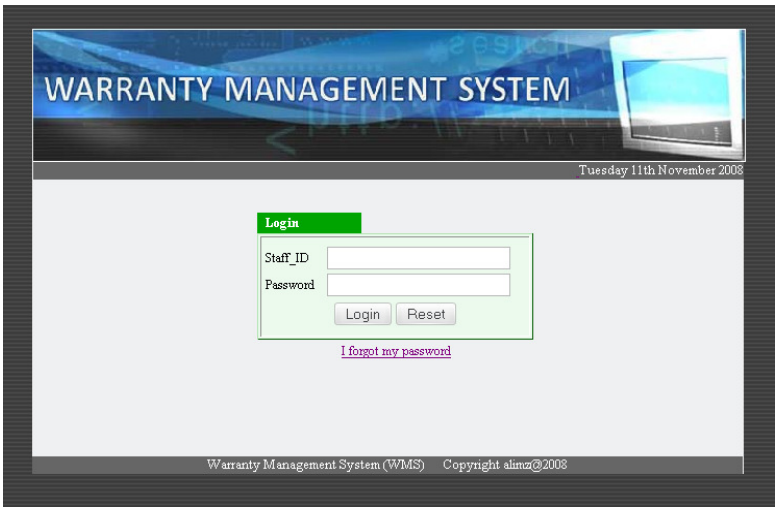


Figure 4.10: Staff Authentication Function

ii. Firewall

Currently, every operating system such as windows XP professional service pack 2 is automatically provided with the firewall security. Firewall can prevent unauthorized access from private network or internet users from accessing the database online. All messages entering or leaving the intranet pass through the firewall, which examines each message and blocks unwanted message that can harm the system.

4.4 Implementation

This is the last phase in completing the research study and achieves the objectives of this study. User manual for user guidelines is provided in appendix A. The user manual explains flow of process of how to use the Warranty Management System (WMS).

4.5 Summary

In this chapter finding, complete explanation had been discussed by following the step in methodology chosen. The WMS is design and develop by using the PHP server side script page and MySQL programming for database. Brief explanation and detail view of user requirements, system user and functionality had been discussed. Visual representation of system user presented in use-case diagram. Security aspect for the WMS also discussed. Several screen capture of the system also included in the user interface design, database design and architecture design in the system to provide visual representation for the user.

CHAPTER 5

TESTING

5.1 Introduction

All projects have a beginning and an end and many activities in between. As the complexities of system development have evolved over the years, the demands placed on software testing have grown and taken on greater relevance. There are many types, techniques, method and approaches to web application testing. Choosing the best testing plan is important for effective and quality of the web testing plan. There are always limits to the amount of time and money that can be invested into testing. There are scheduling and budgetary constraints on development project that severely restrict testing.

For this reason, it is important that cost justification, including potential technical support and outsourcing be factored in this testing process. One of the suitable testing types that had been defined for this project is by using the gray-box testing. According to Nguyen H.Q, Johnson B, Hackett M. (2003), Gray-box testing incorporates elements of both black-box and white box testing. It considers the outcome on the user end, system-specific technical knowledge, and operating environment. The gray-box testing approach is integral to the effective testing of web application because web application comprise numerous components, both software and hardware. In the gray-box testing for this project, there are two main tests performed which are the End-to End Test and Functional Test

5.2 End to End Test

This test is usually similar to system testing, but involves a clear user scenario that is being followed to test a user's complete interaction with the system (Ash L., 2003). There are two main processes in WMS that is best tested by using this testing method which are the warranty process and claim process. This testing process is presented by using the scenario-based testing to give brief and clear explanation to the user. Figure 5.1 describe the warranty process scenario and figure 5.2 describe the claim process scenario.

The process is tested from start until end. According to Ash L. (2003), scenario-based testing is excellent for end-to-end testing. Having a full scenario ensures that the full user interaction with the software is seamless and that the components on a development level are not seen from the perspective of the user. Error messages in the testing process are also explained in detail. There are two common types of message-based feedback available which are the client-based error message and server-based error message.

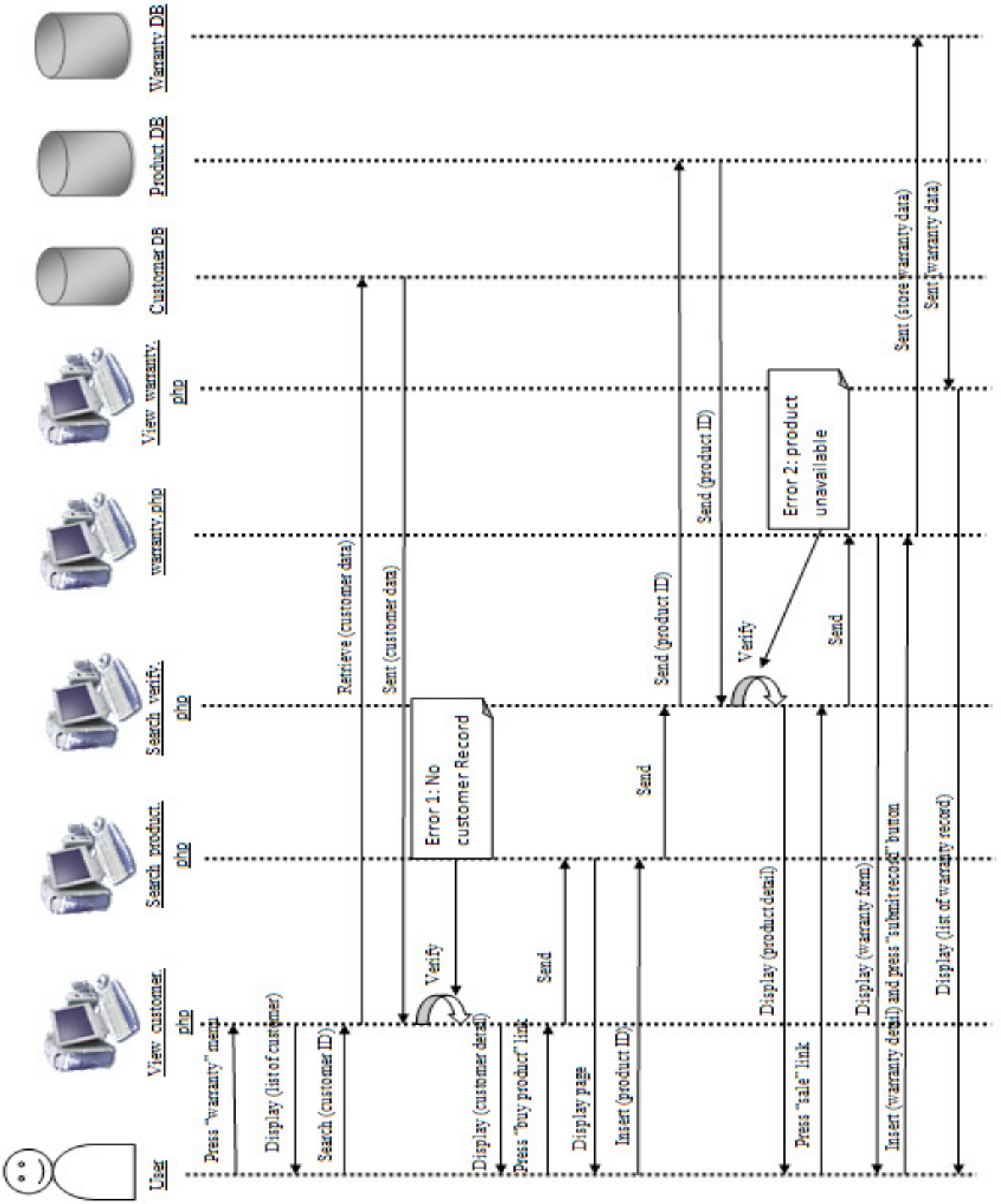


Figure 5.1: Warranty Process Scenario-Based Testing

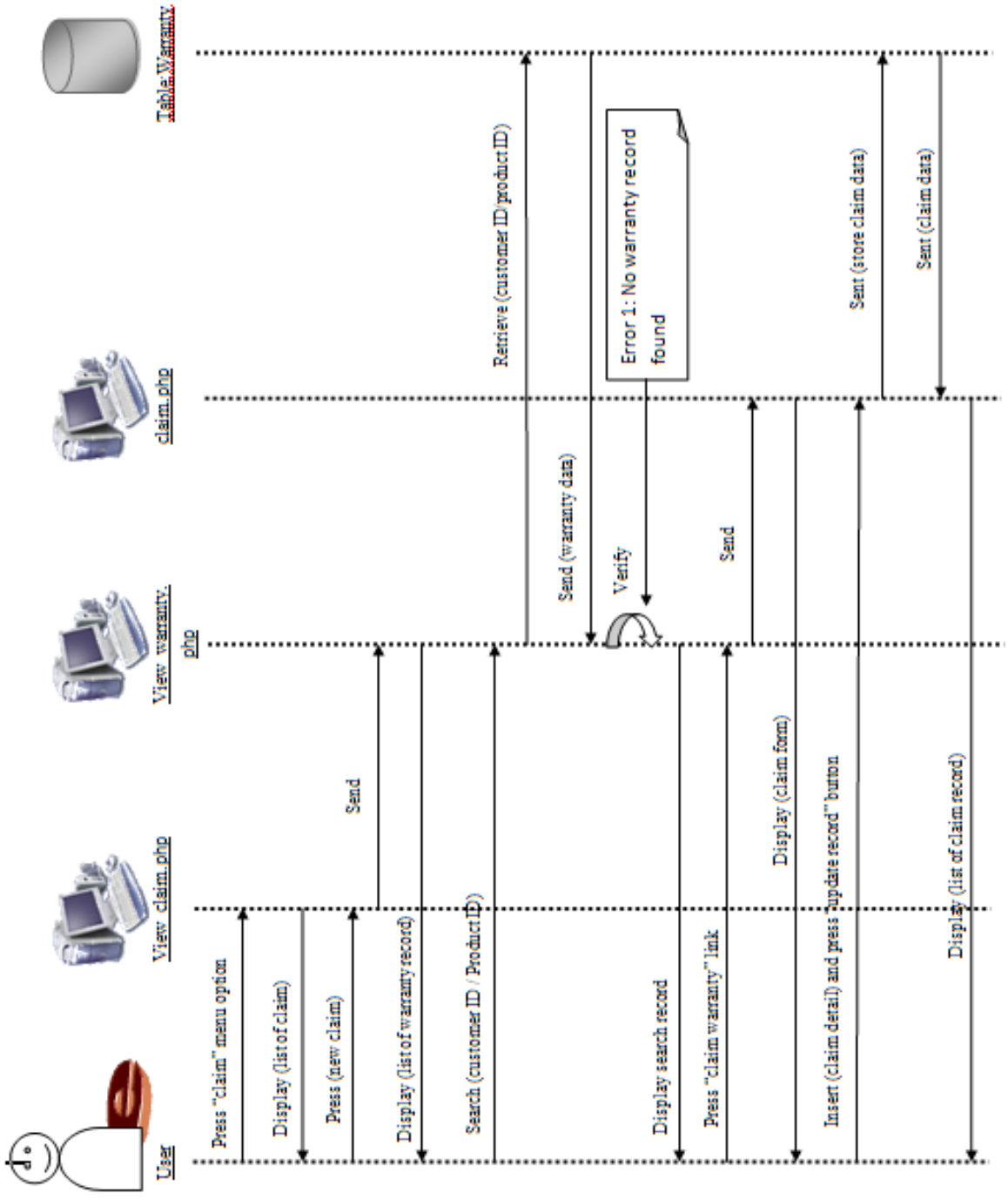


Figure 5.2: Claim Process Scenario-Based Testing

5.2.1 Warranty and Claim Scenario-Based Testing

By now, this simple architecture has been extended with numerous components to support the advanced type of documents shown in Figure 5.1. First of all, the user or staff need to check whether the customer record already exist or not to avoid redundant and error data. The user or client side request to view customer record from the web server. The view_customer.php page verifies the request and sent the output data to the user through the web browser. Then, the user requested for specific customer ID in the customer list record. The web server get the input parameter of the customer ID and try to translate the parameter value and retrieve the document requested from the customer table in the local database. The document requested is sent to the web server and displayed in the view_customer.php page.

After verifying the customer record in the local database, the staff needs to insert the product ID to start warranty record. The search_product.php page waiting for the staff input. By using the HTML form, the HTML form specifies the program that is to be executed at the server side, along with the product ID values that are filled by the staff. When the server sees the request, it starts the program of search_product.php in the request and passes it the parameter values. The data is retrieve from the product table in local database. At that point, the program simply does its work and generally returns the results in the form of document that is sent back to the staff's browser in the search_verify.php to be displayed.

Once the product detail was displayed, the staff can select the 'sale' hypertext link to open the warranty.php page. The warranty.php page sent the HTML form that needs the staff to fill in required field. The server processed the document before store the data to the warranty table in the local database. After successfully stored the record in the warranty table, the result is sent back to the web server and displayed to the client or staff in the view_warranty.php page. Further more, the staff can manipulate the document and data in the local database by updating, deleting and editing the record.

One of the most important functions is that the server can also process a fetched document before passing it to the user. In particular, the document contains the server-side script

which is executed by the server when the document has been fetching locally. When the user want to update or delete the document or record, the server-side script embedded in the PHP document will be executed and sent back to the user. The script itself is not sent to the client or user. By processing the script, the original document is modified.

5.2.2 Error Message Feedback

In this project, the error message-based feedback is using the client-based error message instead of server-based error message. Client-based error message are generally more efficient and cause less strain on servers than server-based error message. Server-based error message require that data first be sent from client to the server and then returned from server back to the client where the error message is displayed to the user. Client-based error message in the other hand is using the script embedded in the html page which can prevent such excessive network traffic by identifying errors and displaying error messages locally without requiring contact with the server. Simple errors such as invalid inputs should be detected and handled at the client side.

The user or client side request to view customer record from the web server. The view_customer.php page verifies the request and sent the output data to the user through the web browser. Then, the user requested for specific customer ID in the customer list record. The web server get the input parameter of the customer ID and try to translate the parameter value and retrieve the document requested from the customer table in the local database. Unfortunately, the parameter value or customer ID input is not valid or exist in the customer table. The error page is sent to the web server and displayed in the view_customer.php page. The staff need to record customer information before proceed to warranty process.

More, if the staff input invalid product ID or the product has been sold or unavailable, the input will be verified by the server and the server will return the error page errorpc.php document. The same evaluation process happened in the claim scenario. The server cannot found the warranty record in the warranty table and displayed error result in the

view_warranty.php. Then, the staff cannot precede the claim if no warranty record found. The product might not come from the computer sales and services shop in UUM.

5.3 Functional Test

Functional testing is a broad category of testing. It includes a variety of testing methods such as FAST, TOFT, boundary, FET and other techniques. While in this project, functional testing method that had been chosen is the task-Oriented Functional Tests (TOFT). The TOFT checks whether the application can do useful task correctly. There are test check program functions by comparing the results of performed task with the product specification and requirement documents. In this TOFT test, use case is design to develop functional test cases and describe the functional behavior of the system according to the user functional requirements. Use cases do not capture the non-functional requirements or the system design.

The WMS functional testing done by using the apache web servers through the local hosts address http://localhost/public/wms. Figure 5.3 shows that the apache service had been started to start the functional testing. The HTML and PHP document must be stored in the particular location in order to test the system. The directory must be in the C:\phpdev\www\public\wms. As for the functional test of this project, the main process for the functional testing is taken from the warranty process. The functions tested are the insert, update and search.

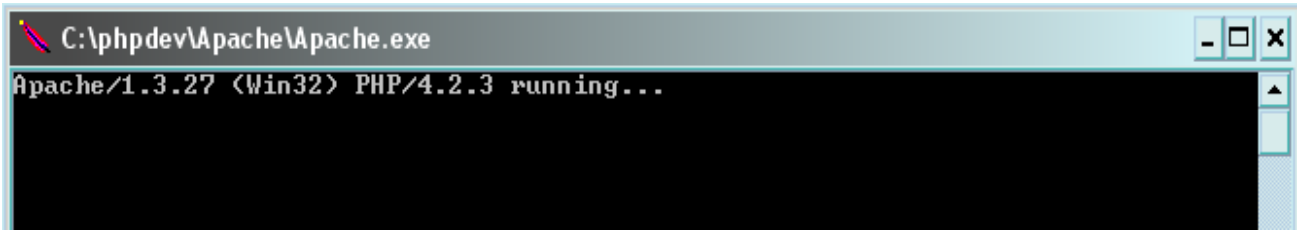


Figure 5.3: Apache Services Running

5.3.1 Search Test Case

Staff or administrator can search the availability of customer record in the WMS database by input the parameter value of customer ID in the form given. After inserting the parameter value, the form data will be posted for processing. Table 5.1 illustrates the use case for search function by using the customer ID. Meanwhile, from the preceding use cases, the following test case for the search customer function is developed (see Table 5.2).

Table 5.1: Use Case for Search Customer

Use Case ID: 1.1 **Use Case Name: Search by Customer ID**	
Actor:	Administrator or Staff
Description-Purpose of Case:	Describes the process of searching by customer ID
Preconditions:	The user is in the search page of customer database site
Post conditions:	The search result page had been displayed
Normal course of events:	1. The user clicks on the customer menu. The system will display the customer page. 2. The user enters the customer ID in the search text field, and then clicks the search button. 3. System will verify and validate the input 4. The system displays the search result page with the customer detail that match with the customer ID

Secondary Scenarios:	1. In step 2, the user enters the customer ID that is not in the customer database. 2. The system displays the search results page with a message indicating that the customer specified does not exist in the customer database
Exceptions:	1. In step 2, the user does not enter any text in the search text field. 2. The system displays all list of customer

Table 5.2: Test Case for Search Function

Use Case ID:	1.1					
Use Case Name:	Search by Customer ID					
Scenario:	Search Function testing					
Test Case No.	1	2	3	4	5	6
Initial Condition (Preconditions)	Customer site page with search function available	Customer site page with search function available	Customer site page with search function available	Customer site page with search function available	Customer site page with search function available	Customer site page with search function available
Actor	Administrator/Staff	Administrator/Staff	Administrator/Staff	Administrator/Staff	Administrator/Staff	Administrator /Staff
Action	Enter a Customer ID that exist in the customer database	Enter a nonexistent customer ID	Enter extended characters in Customer ID text field	Leave search text field blank	Enter uncompleted customer ID	Enter maximum 1 character in search
Expected Results (Post conditions)	Correct search result display	No customer record found	No customer record found	Error message- cannot leave text field blank	No customer record found	No customer record found
Notes	Test data: 84100204548	Test Data: 831002045488	Test Data:84100204548s Extended character: s	No input	Test Data: 84100204548 Forgotten number:8	Test Data:8

The user input of customer ID is posted to the web server and process the requested data. The client side page will determines whether the customer ID input by the user is valid. The system will search for the requested customer ID from customer table in the local database. If the value is valid, the result will be return. The server shall view requested customer detail according to the customer ID (Figure 5.4). In the other side, if the customer do not post any input, the server will display all the customer record. In this case, if the user enter incorrect customer ID, the server will sent error message to the user (Figure 5.5).

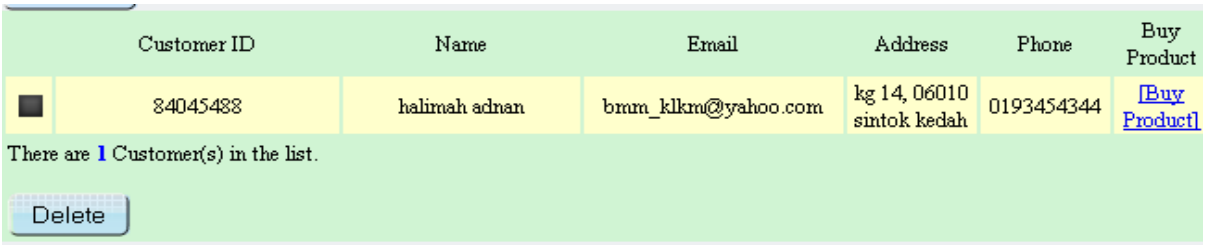


Figure 5.4 Requested Customer's ID

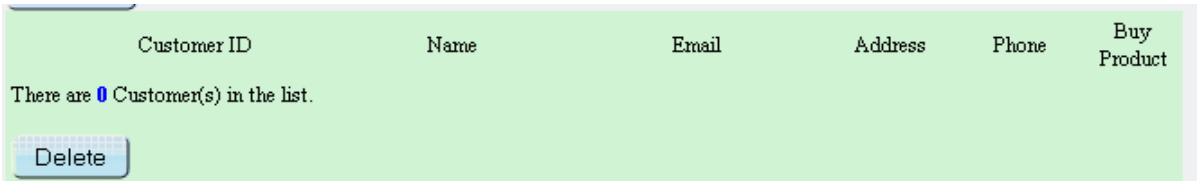


Figure 5.5: Error. No Customer Record

5.3.2 Insert Test case

In the warranty page, the page will send the form element that requires user input. The form requests the user to input the customer ID, warranty date sale and warranty date end. Then, the product status need to change to 'SOLD'. This status is important to avoid redundant data in the warranty record and let the user know the product is already sold. User need to fill in all the fields with correct parameter. If the user left the form blank, the page will evaluate the form and prompt the user to input or fill in the blank field. Table 5.3 illustrates the use case for insert function for warranty record process. Meanwhile, from the preceding use cases, the following test case for the insert warranty function is developed (see Table 5.4).

Table 5.3: Use Case for Insert Warranty Record

Use Case ID: 2.1 **Use Case Name: Insert Warranty Record**	
Actor:	Administrator or Staff
Description-Purpose of Case:	Describes the process of inserting new warranty record
Preconditions:	The user is in the content editing interface of warranty site
Post conditions:	The new warranty record has been added to the warranty database. The system will display the new warranty record in the list of warranty page
Normal course of events:	1. The user clicks the Add new warranty button. The system will display the warranty form page. 2. The user enters the customer ID, warranty date sale and warranty date end. Then, the user need to change the product status to 'SOLD'. 3. The user need to clicks the submit button. 4. The system saves the warranty information, and then displays the warranty record in the list of warranty page.
Secondary Scenarios:	1. The user enters the warranty record that already exists in the database.
Exceptions:	1. In step 2, the user leaves one of the text fields blank. The system displays an alert message telling the user to enter text in the appropriate fields. 2. In step 2, the user enters existing warranty record. The system displays a message indicating that the warranty specified already exist in warranty database

Table 5.4: Test Case for Insert Warranty Record

Use Case ID: 2.1 Use Case Name: Insert Warranty Record Scenario: Insert Function Testing					
Test Case No.	1	2	3	4	5
Initial Condition (Preconditions)	User is in content of insert form warranty information page	User is in content of insert form warranty information page	User is in content of insert form warranty information page	User is in content of insert form warranty information page	User is in content of insert form warranty information page
Actor	Administrator/Staff	Administrator/Staff	Administrator/Staff	Administrator/Staff	Administrator/Staff
Action	1. Enters the customer ID, warranty date sale and warranty date end. 2. Change the product status to 'SOLD'. 3.click submit button	1. Enters the customer ID, No warranty date sale and warranty date end. 2. Change the product status to 'SOLD'. 3.click submit button	1. Enters the customer ID, warranty date sale and warranty date end 2. Never change the product status to 'SOLD'. 3.click submit button	1. Leave the customer ID, warranty date sale and warranty date end field blank 2. Change the product status to 'SOLD'. 3.click submit button	1. leave all information required blank 3.click submit button
Expected Results (Post conditions)	Warranty information added in warranty database. Warranty list page will be displayed	Error message: the form is uncompleted. Warranty date sale and date end is required	Error message: the form is uncompleted. The product status need to change to "SOLD"	Error message: the form is uncompleted. Customer ID, Warranty date sale and date end is required	Error message: the form is uncompleted. User need to insert all the required information
Notes	Test data: 841002045488, 1/4/2009, 1/4/2010,SOLD	Test Data: no warranty date sale and warranty date end	Test Data: product status is "Available"	Test Data: No customer ID, warranty date sale and warranty date end	Test Data: No input

After the user input all the required fields, the server will evaluate the input. The server sent the product ID, the next script is executed. The server will try to connect to the database. By using the product ID as unique ID, specific warranty field will be selected. Then, the input values will be stored in the warranty table with product ID as reference. The result will be sent to the server in the view warranty page. Figure 5.6 shows Screen Capture of the End to End Process of Warranty Record

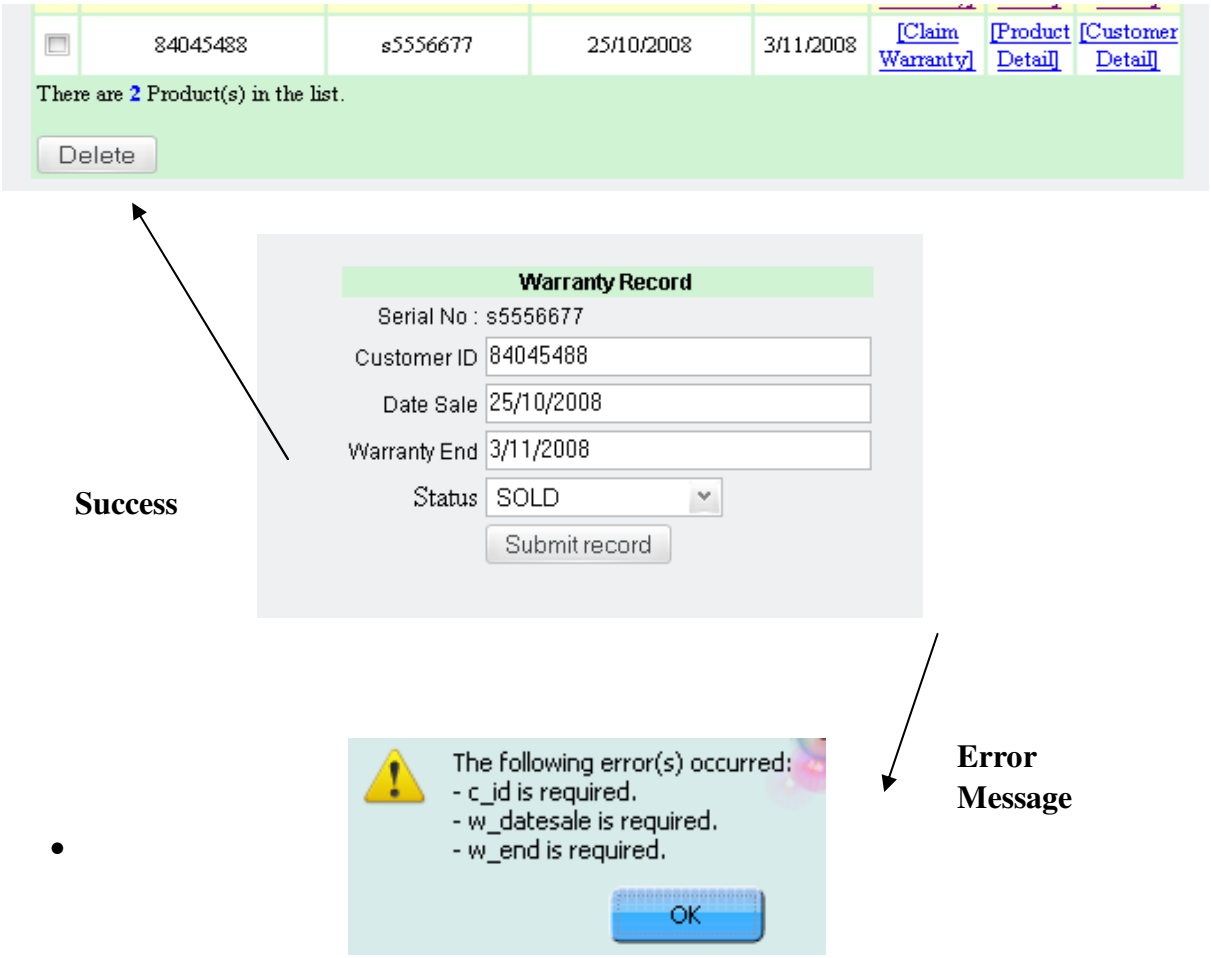


Figure 5.6: End to End of Inserting Warranty Record Process

5.3.3 Update Test Case

The database can be updated online by the authorized user. User can update warranty record, update product record, update customer record, update supplier record and update their user account information. In this task, the process of update product record will be presented in detail. In the product information record database, the update function is available to allow the staff or administrator to update product record. If any changes happen to the product information, the staff and administrator can log in to the system and go directly to product page. In the product page, the administrator and staff can search for specific product record that wants to be updated. Once the product record found, the administrator and staff can click on the update button to open the edited update page of requested product.

In the edited update product page, the page will send the form element that requires user input. The form requests the user to input the product category, product name, product purchase price, product sale price, warranty period, discount, product status, and brand and supplier name. This status is important to avoid redundant data in the warranty record and let the user know the product is already sold. User need to fill in all the fields with correct parameter. If the user left the form blank, the page will evaluate the form and prompt the user to input or fill in the blank field. Table 5.5 illustrates the use case for update function for product record process. Meanwhile, from the preceding use cases, the following test case for the update product function is developed (see Table 5.6).

Table 5.5: Use Case for Update Product Record

Use Case ID: 3.1 **Use Case Name: Update Product Record**	
Actor:	Administrator or Staff
Description-Purpose of Case:	Describes the process of updating the product record
Preconditions:	The user is in the content editing interface of update product page
Post conditions:	The new warranty record has been added to the warranty database. The system will display the new warranty record in the list of warranty page
Normal course of events:	1. The user clicks the update button. The system will display the update product form page. 2. The user enters the product category, product name, product purchase price, product sale price, warranty period, discount, product status, and brand and supplier name The user need to clicks the update button. 3. The system saves the product information, and then displays the updated product record in the list of product page.
Secondary Scenarios:	1. The user enters the invalid parameter of product information
Exceptions:	2. In step 2, the user leaves one of the text fields blank. The system displays an alert message telling the user to enter text in the appropriate fields. 3. In step 2, the user enters invalid input. The system displays a message indicating that the input is invalid

Use Case ID:	3.1			
Use Case Name:	Update Product Record			
Scenario:	Update Function Testing			
Test Case No.	1	2	3	4
Initial Condition (Preconditions)	User is in content of update form product information page	User is in content of update form product information page	User is in content of update form product information page	User is in content of update form product information page
Actor	Administrator/Staff	Administrator/Staff	Administrator/Staff	Administrator/Staff
Action	1. The user enters valid value of product information in all required field. product category, product name, product purchase price, product sale price, warranty period, discount, product status, and brand and supplier name 2.click update button	1. Enter the required field product category, product purchase price, product sale price, warranty period, discount, product status, and brand without product name and supplier name 3.click update button	1. Enter the required field of purchased date with incorrect parameter 2. click update button	1. Leave all the required field blank 2.click update button
Expected Results (Post conditions)	Product information successfully updated in product database. Updated product list page will be displayed	Error message: the form is uncompleted. Product name and supplier name is required	Error message: The input is invalid. Input valid parameters	Error message: the form is uncompleted. The required field cannot be blank
Notes	Test data: WMAATD2807, hardisk, WD400Maxter, 150,120, 3/01/2009, 1 year, Available	Test Data: leave the product name and supplier name blank	Test Data: insert purchase date as "2ert@#$%"	Test Data: No input

Table 5.6: Use Case for Update Product Record

5.4 Testing Consideration

There are other several way of testing methods or approaches that is needed to perform in this project to ensure the performance and effectiveness of the system. These testing include the performance testing, usability testing, coding testing, database testing and other testing that is seen relevant for this project. Unfortunately, these testing cannot be done because of few other reasons. The testing stops because a project deadline has been met. There is not enough time to perform the other testing because of the limitation of time. Besides, the main test cases of this project have been run.

5.5 Summary

This chapter is one of the steps involve from the development phase task. This chapter discusses specific issues on testing. There are many types, techniques, method and approaches to web application testing. Choosing the best testing plan is important for effective and quality of the WMS. The main type of testing taken for this project is called the gray-box testing. Gray-box testing is the combination of both black box testing and white box testing. As for this project, there are two main testing which is the End to End testing and Functional Testing.

End to End testing is illustrated and brief explained by using the scenario-based testing approach which provides visual representation to make the process more clear and understandable. Functional testing approach taken is using the task-oriented Functional testing (TOFT). More over, the TOFT is performed by using the use case to develop the functional test case. Several testing application that relevant for this project cannot be performed because of time limitation as discussed in the testing consideration.

CHAPTER 6

CONCLUSION

6.1 Introductions

The WMS is build mainly to provide online warranty management system for computer sales and services shop in UUM. However, the system does have some limitation. Improvement on some functionality can be done in order to maximize the usage of the functionalities. Additional function also can be added in to the web site to make the system can be widely use. The conclusion chapter will review the project's overall progression. Finally, this chapter will be ended with possible directions for future work related to the project.

6.2 Problems and Limitations

The system has some limitation such as:

i. The system only can be implemented in UUM, Malaysia because the system analysis and design is limited and based on UUM environment only. The architecture and interface design is not universal as the design does not use any icon graphics and not suitable to for global use.

ii. The system also does not have automated email to confirm the warranty record made by staff is successfully received by the customer.

iii. All the list of information in the system does not have alternative printing button. So, the users need to use their menu toolbar in the computer to print out anything.

iv. More function like contact us or FAQ might be useful for the customer. With this function, customer can easily contact the personnel of computer sales and service and check FAQ for inquiry.

6.3 Project Recommendation

In the future, the system need to be maintained and updated to make sure that the system is not out of date. So, the administrator needs to take responsibilities on doing the maintenance. Besides, this system can be improved in many ways to follow up with the growth of technology such as:

- Design and develop WMS with the ability to scan the product ID by using the bar code scanner without need to input the code manually. With this ability, the warranty process can become more efficient and save time.

- Develop automated analysis tools that can be used to analyze claim data automatically.

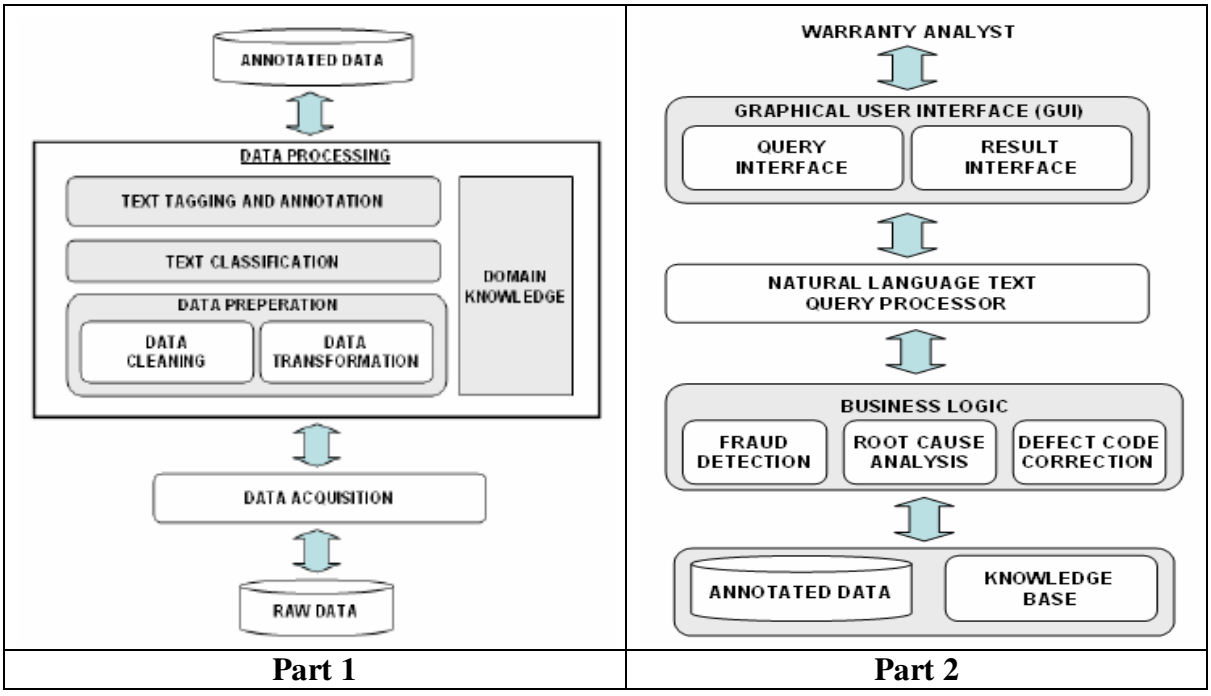
- Create printing button , as one of the alternative for the administrator to print out the list with the right margin and properly

- Otherwise, the system can be improved by adding discussion forum, contact us column or FAQ. So the customer and personnel of computer sales and services can share their opinion together with the help of administrator.

6.4 Related Work

As mention previously, warranty management system (WMS) is develop for the computer sales and services in UUM only. This system can be enhance and work widely by improving some functionality that provide more support and category for computer products worldwide. One of the functions that are very useful for big organization or company like IBM, Dell, HP and more is the analysis tool for claim data processing. With the function of analysis tools, company can generate the statistics and analysis on warranty claim cost, customer satisfaction, product quality and business growth performance.

According to Sureka.A., De.S., Varma.K. (2008), they implementing the text processing system for analyzing the warranty claims data. The researchers, created an application of text analytics applied on textual data recorded in warranty claim forms for the purpose of efficient defect discovery. They propose a generic architecture of a text analytics based system for gaining intelligence from the textual data stored in warranty claim forms. Figure 5.1 illustrated the system architecture that proposes by the Sureka A et. Al (2008).



Part 1 | **Part 2**

Figure 6.1: Proposed Architecture

Source: Sureka.A. et. al (2008).

As illustrated in figure above, there are two different architectures in providing the efficient analysis system which are part 1 and part 2. The claims data will go through the part 1 architecture before continue the result in architecture part 2. The relevant claims data will be extracted from the relational database management and sent it to the data processing level. In the data processing level, the unstructured and structured data will be clean and transform into meaningful data. It is normally observed that real-world data is never perfect and can consists of missing information, incorrect values and inconsistent values. The quality of analysis done on a data depends on the quality of the data itself (Sureka.A. et al., 2008)

There has been a growing interest in unstructured data analysis and one application of unstructured data analysis which has received significant interest recently is of analyzing textual data recorded in warranty claim forms data for gaining useful insights and patterns from it. Current analysis system for warranty claims data is not impractical and time consuming. To gain more efficient data analytics, the natural language data stored in the claims forms need to be process automatically. This analysis function in the system purposes is to extracts information out of structured data and also leverages unstructured data which is currently not exploited to its full extent.

6.4 Conclusion

Warranty Management System (WMS) is one of the solution to problem that occurred in computer sales and services shop in Universiti Utara Malaysia (UUM). Implementing the system in World Wide Web can give more option to the users to access in any location at anytime necessary. At a high level, research found that companies with centralized warranty management processes and teams, either globally or regionally, tend to have far better insight and visibility into their warranty programs. Moreover, this pervasive mindset makes it difficult for companies to emulate warranty management leaders, which have

achieved tight integration between warranty management and their broader after-sale parts and services function which commonly known as service management.

In the prevailing circumstances of millions of warranty claims being filed per year, it becomes practically difficult for any computer sales and services shop to manage the warranty record manually. As a result most of the information reported goes unnoticed and undecipherable. The Warranty Management System (WMS) presented in this paper will help integrate and automate this current warranty process. This will help the organization to improve and manage the warranty record properly. Furthermore, security aspect is highly focused to make this system be more reliable and effective. Besides, this will help computer sales and services to map and classify the customer's behavior, to predict future trends, and to advertise more effectively. In the future maximizing the customer warranty electronic record will lead to lasting and loyal relationship with customers.

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APPENDIX A

USER MANUAL

USER MANUAL

1. CUSTOMER WARRANTY CHECK

Figure 1.0: Insert product serial No.

This figure is the main home with the address index.html. Customer can access this page online without need to have authentication process. Customer can check their computer products warranty by entering the right product serial number as shown in the figure above to search for the product warranty.

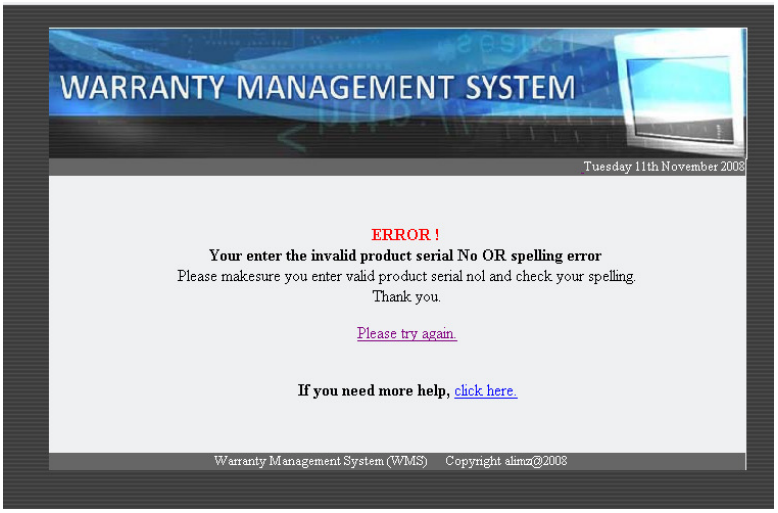


Figure 1.1 Error Product Serial No.

This page will be displayed if customer entered wrong product serial No. or the product do not exist in the system record.

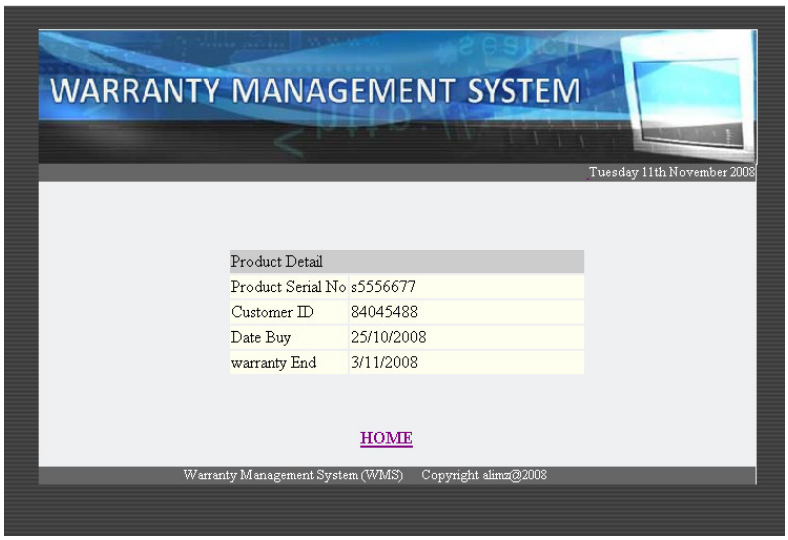


Figure 1.2 Success Product Serial No.

This page will be displayed if the customer entered the right Product Serial No. This page shows the product warranty detail, so that customer can check their warranty validity to claim for warranty under specific term and condition applied.

2. AUTHENTICATION PROCESS

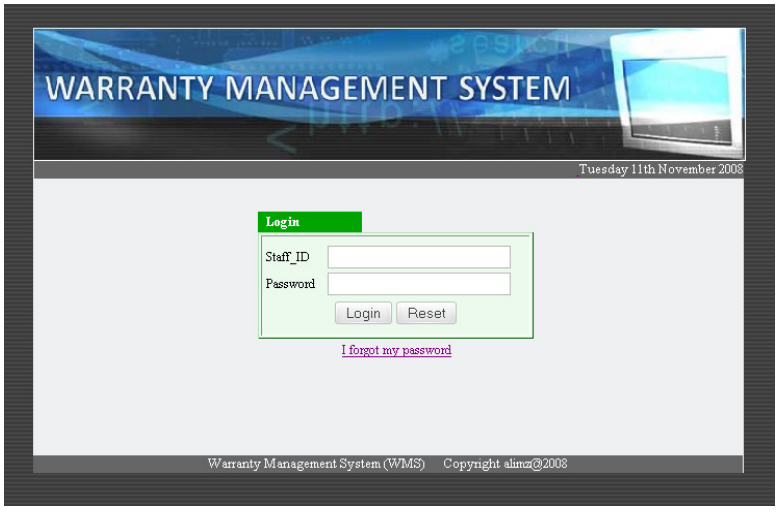


Figure 2.0 Authentication Process for Staff / Personnel

Figure 2.0 show the authentication process for staff. To record for product warranty, add or view supplier, product, customer and other functions than '*Customer Warranty Check'* need to have the access key to the system. Staff or administrator need to log in to the system.

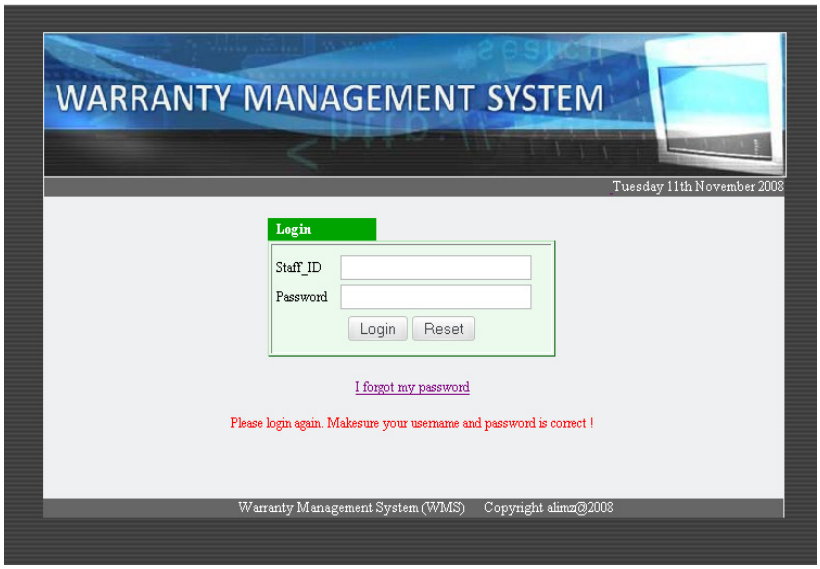


Figure 2.1 Errors. Username or Password is invalid.

This figure shows error page when staff enters wrong ID or password. If the staff forgot their password, the staff can select the *'I forgot my password'* hypertext link.

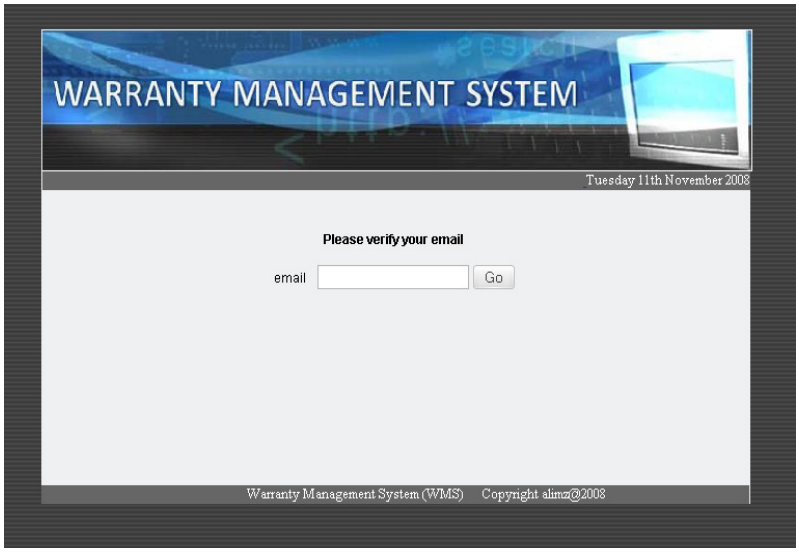


Figure 2.2 Forgot Password

This page will require the staff to enter invalid email. The staff need to type full email address without typing error.

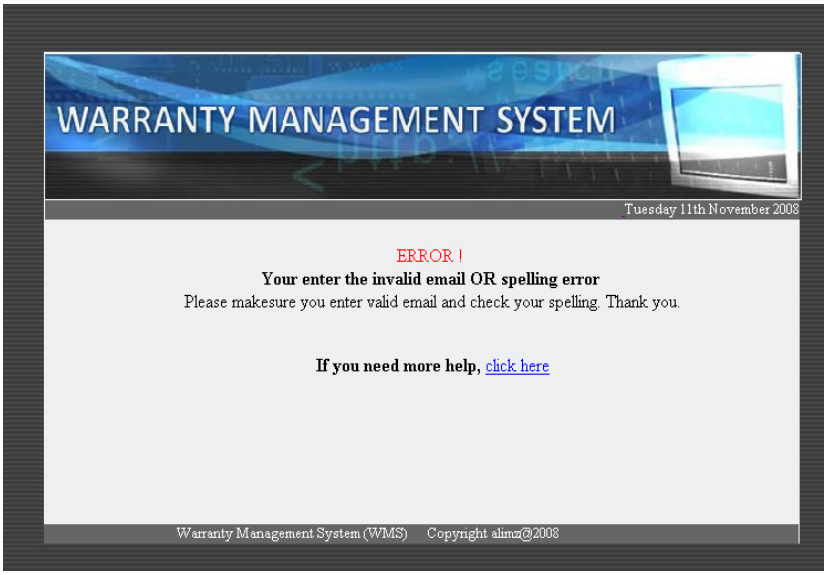


Figure 2.3 Error Email Address

This page will be displayed if the staff enters the wrong email address. The staff is required to check the spelling and try to insert the email again.

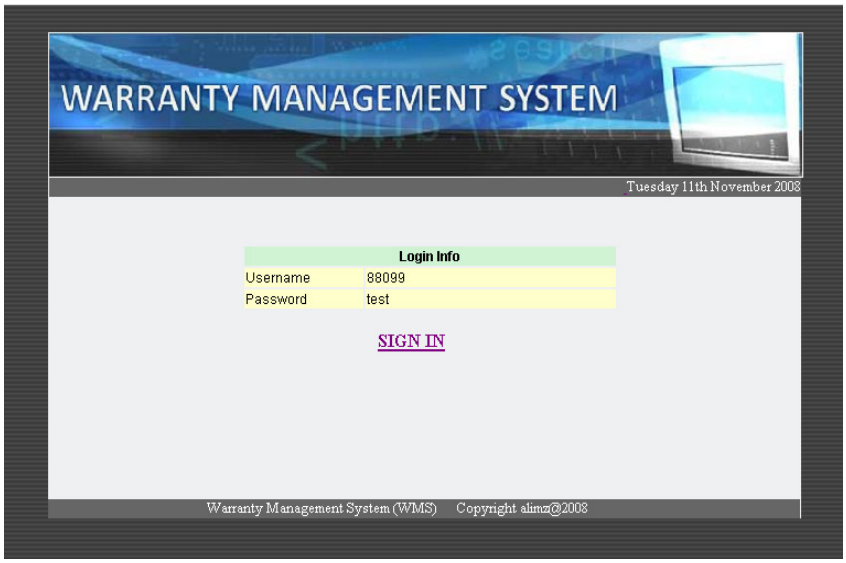


Figure 2.4: Success Email Address

When the staff inserts the right email address, the login information will be displayed as shown in the figure 2.4 above. The staff needs to sign in again to access through the system.

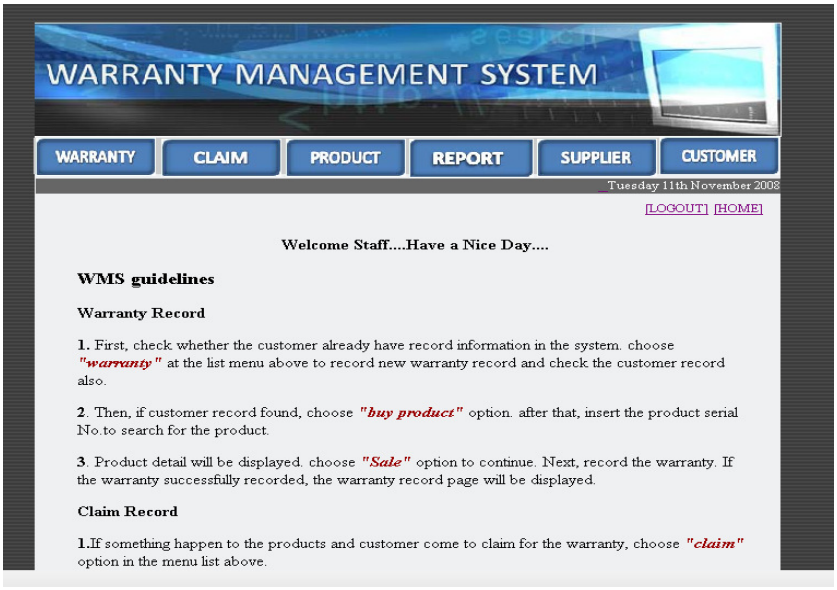


Figure 2.5 Home Pages for Staff

After the authentication process success, the staff can start to manage the system. In this page, a WMS simple guideline was provided for staff understandings.

3. WARRANTY RECORD PROCESS

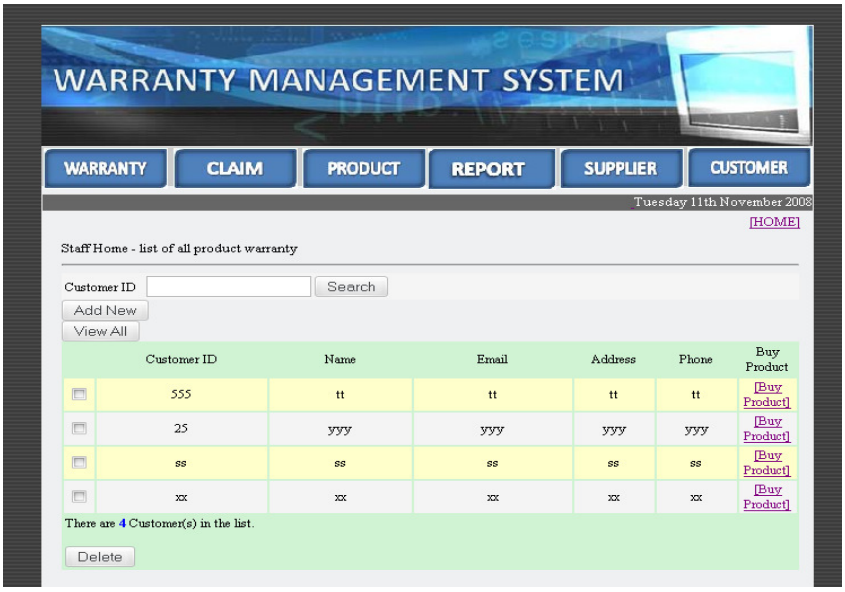


Figure 3.0: List of Customer in the Product Warranty

First, staff need to check whether the customer already have record information in the system. If the customer already exists, then the staff can choose 'Buy Product' hypertext link to proceed. If no customer record found, staff need to add new customer record.

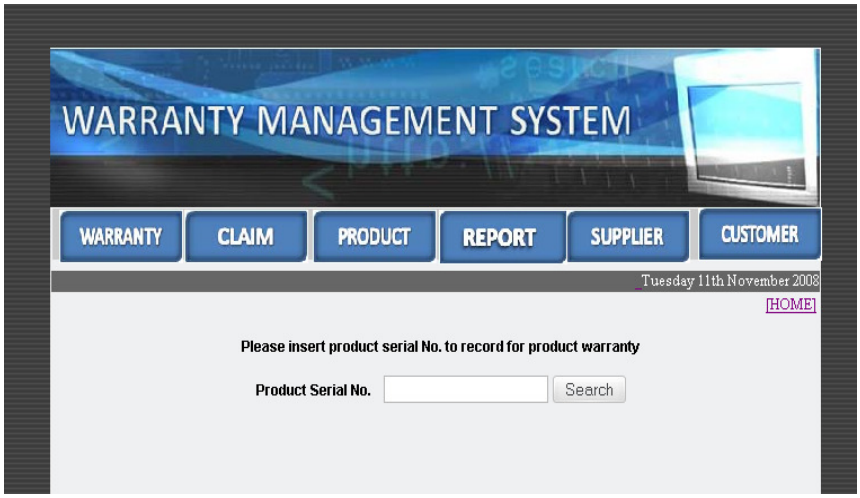


Figure 3.1: Product Serial No.

After selecting 'Buy Product' link, staff need to insert the product serial No. that the customer buy. This page will verify the product whether the product record exist or not.

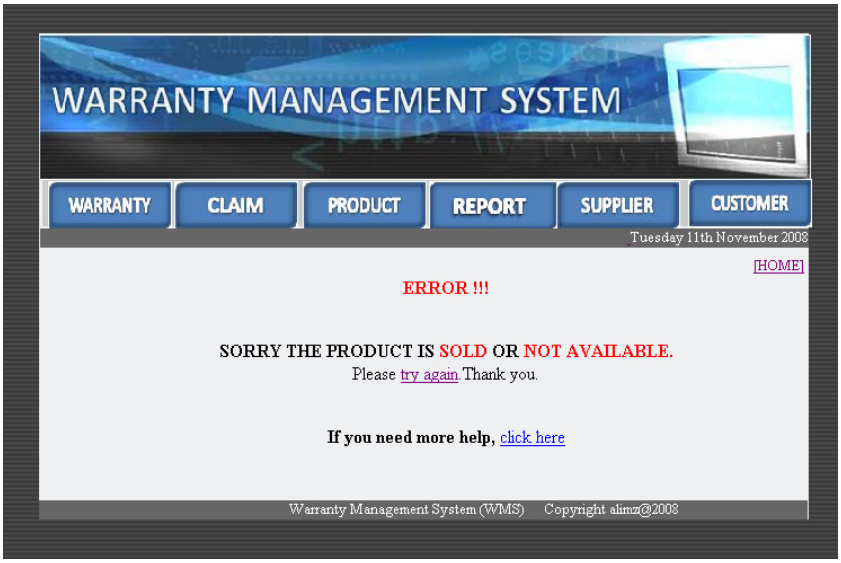


Figure 3.2 Errors Product.

This page will be displayed if the product is not available or sold. Staff needs to make sure the product serial no is type in correctly.

Figure 3.3: Product Detail

If success, the product detail will be displayed. The staff can click on the 'sale' hypertext link to continue. The staff needs to inform the customer about the warranty validity period for customer information.

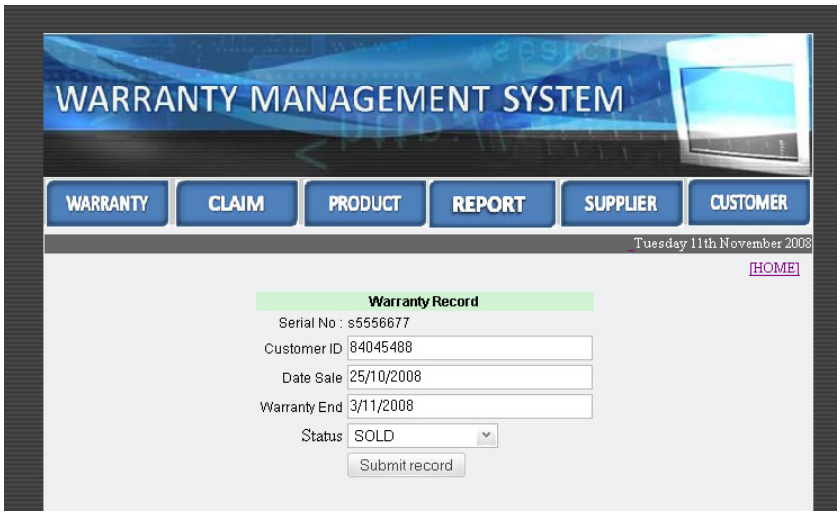


Figure 3.4: Warranty Record

The 'sale' link will open this page. The staff can start to record for product warranty by fulfilling all the required fields and press submit record button.

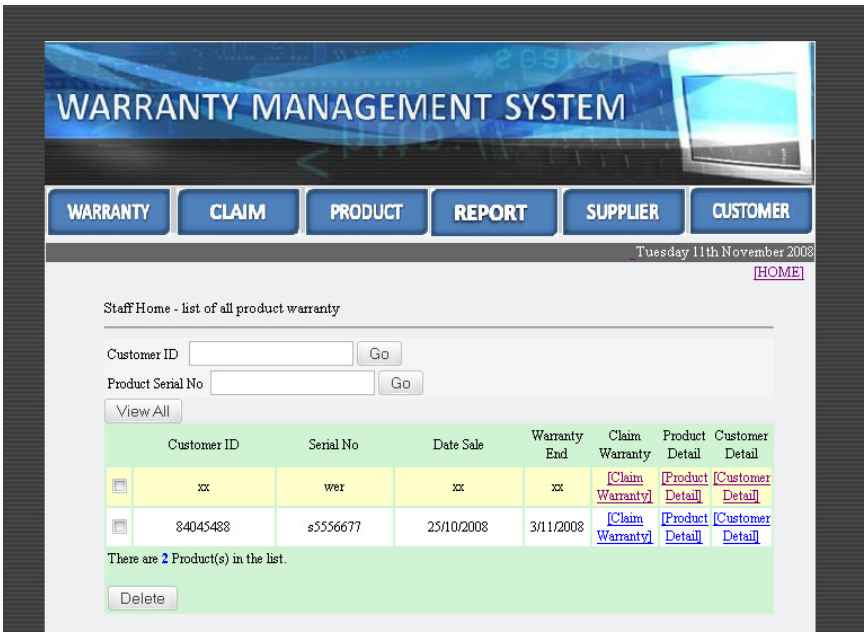


Figure 3.5 List of Product Warranty Record

Finally, this page of warranty product record list will be displayed. The new record inserted can be seen in the list. The staff can delete or search for specific customer or product in the list.

4. CLAIM WARRANTY PROCESS

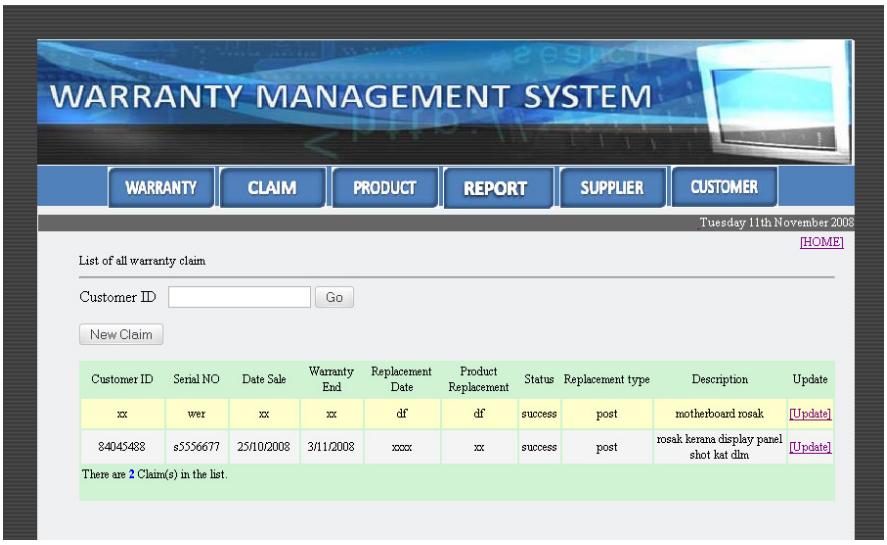


Figure 4.0: List of Warranty Claim

Staff must choose the 'claim' option menu for the claim warranty process. This page is specially created for customer that wants to claim the product warranty within the warranty time period under terms and regulation applied. In this page, staff can update claim record, search for particular customer claim record and add new claim record.

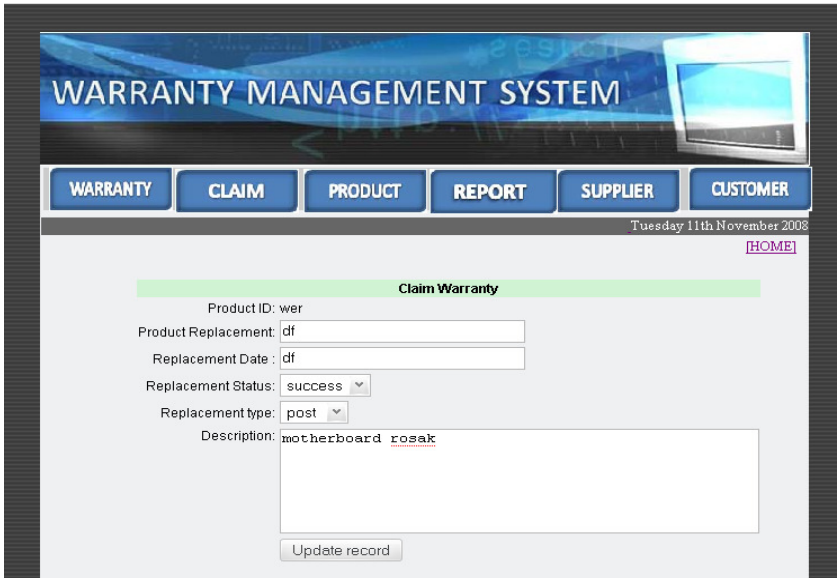


Figure 4.1: Update Claim Warranty Record

This page allows the staff to update the claim record. The entire required field cannot be left empty. After inserting the value in the field required, press 'update record' button to continue. The figure 4.0 will be displayed again after successfully update the claim record. Staff can directly see the changes made.

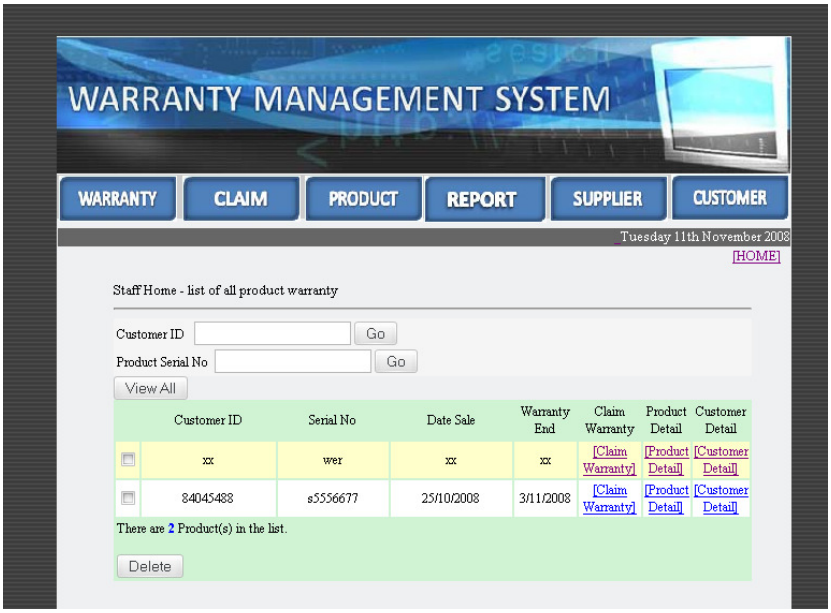


Figure 4.2: Claim Warranty

This page will be displayed for the staff to record new claim warranty according to customer ID and product serial number. Staff can insert the product serial number or customer ID to get the customer warranty record. Then, press 'claim warranty' hypertext link' to continue. Staff can view product detail and customer detail.

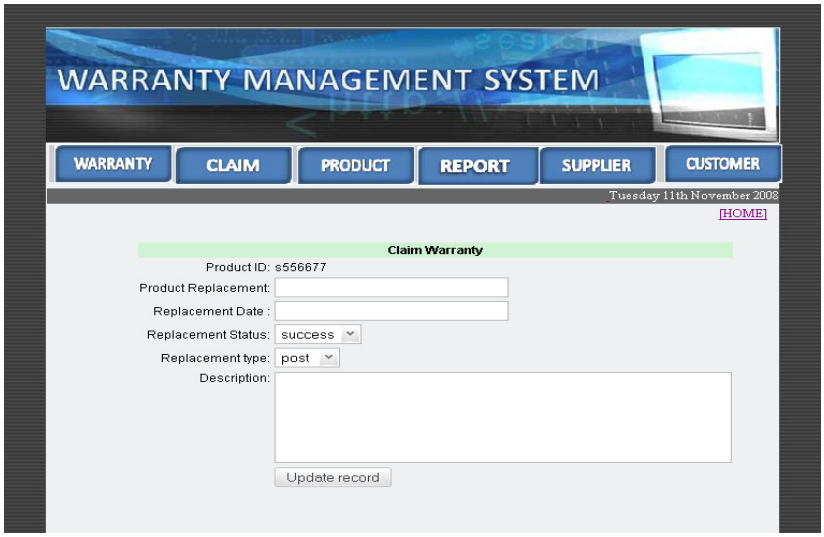


Figure 4.3: New claim Warranty Record

This page will be displayed when the staff clicks the 'claim warranty' hypertext link. After successfully insert new claim warranty page in figure 4.0 will be displayed.

5. VIEW, UPDATE AND ADD PRODUCT, SUPPLIER AND CUSTOMER

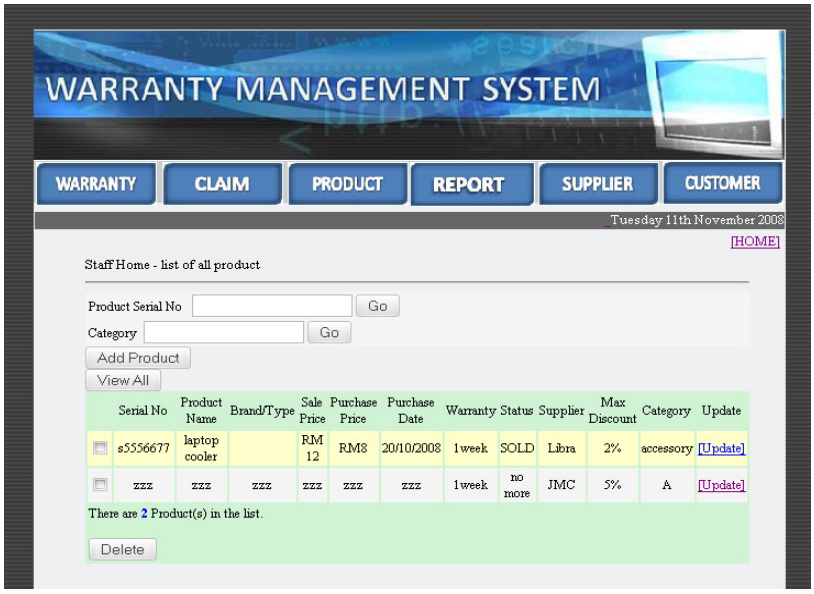


Figure 5.0: List of Product

This page shows all the products in the record. Staff can update, search product by serial no or category and delete product in the list.

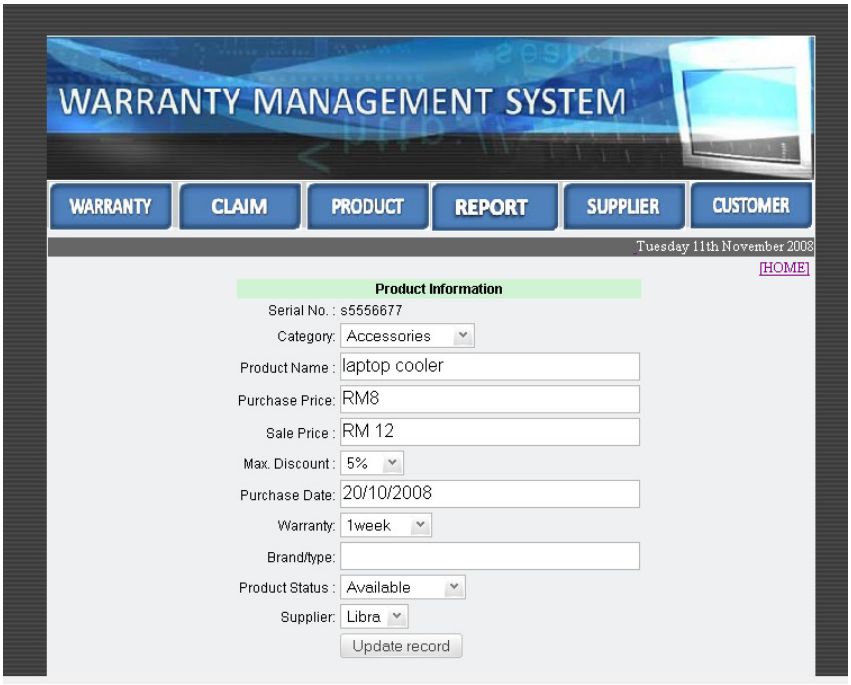


Figure 5.1: Update Product Information

This page allows staff to update the product information. After successfully update the product, the figure 5.0 will be displayed again.

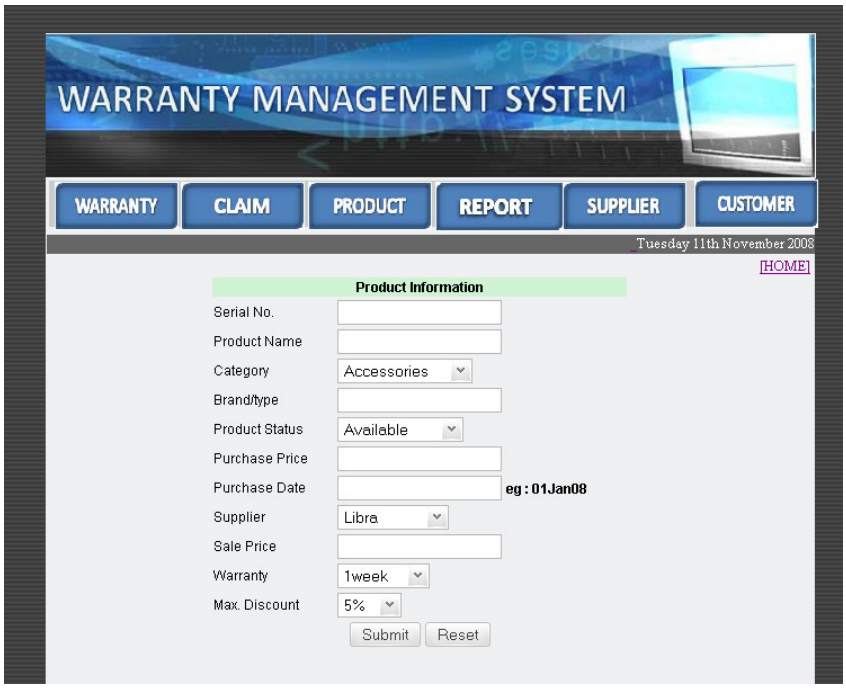


Figure 5.2 Add New Product

In this page, staff can add new product information after press the 'new product' button. There are two option submit and reset. When submit, the page will go to figure 5.0 to display the new product record that successfully inserted.

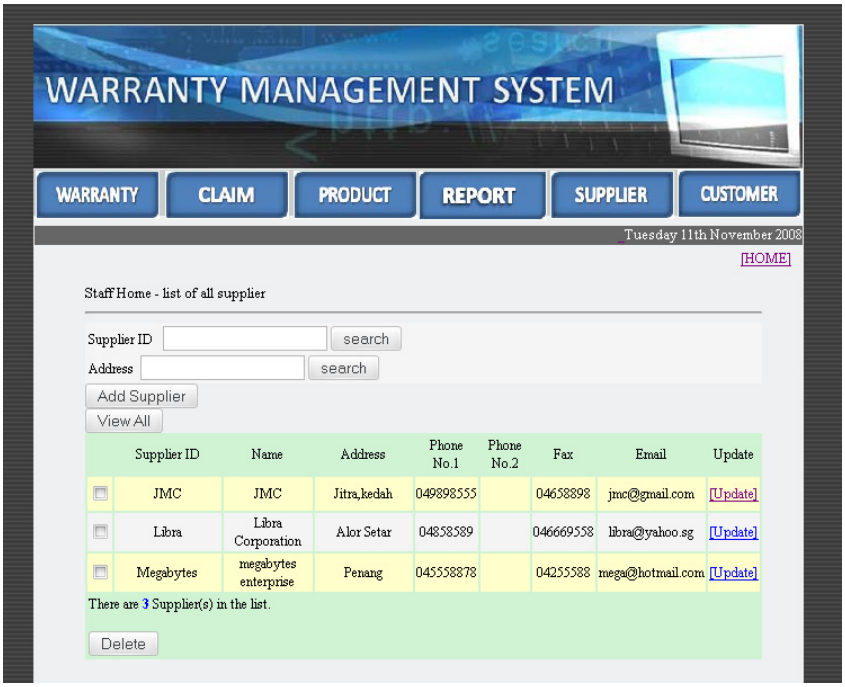


Figure 5.3: List of Supplier

This page shows all the suppliers in the record. Staff can update, search supplier by supplier ID or address and delete supplier in the list.

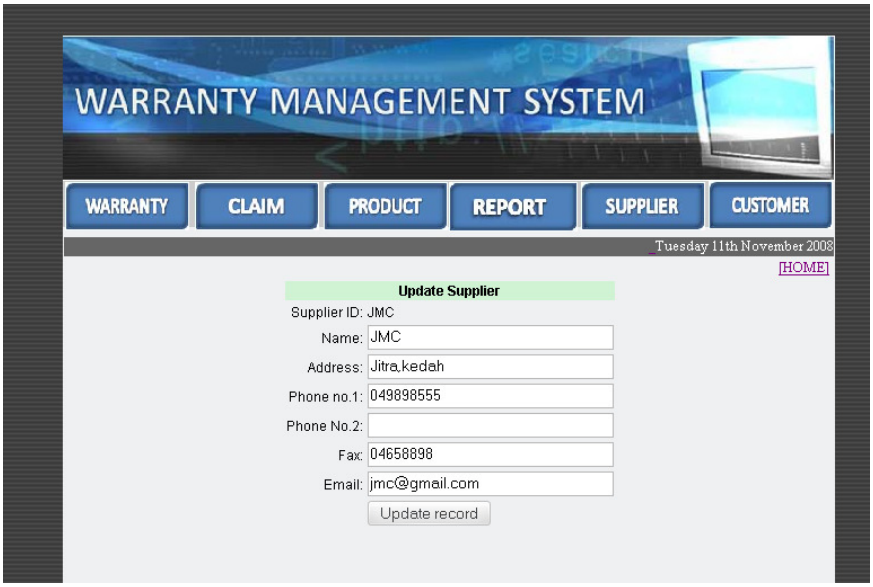


Figure 5.4: Update Supplier

This page allows staff to update the supplier information. After successfully update the supplier, the figure 5.3 will be displayed again.

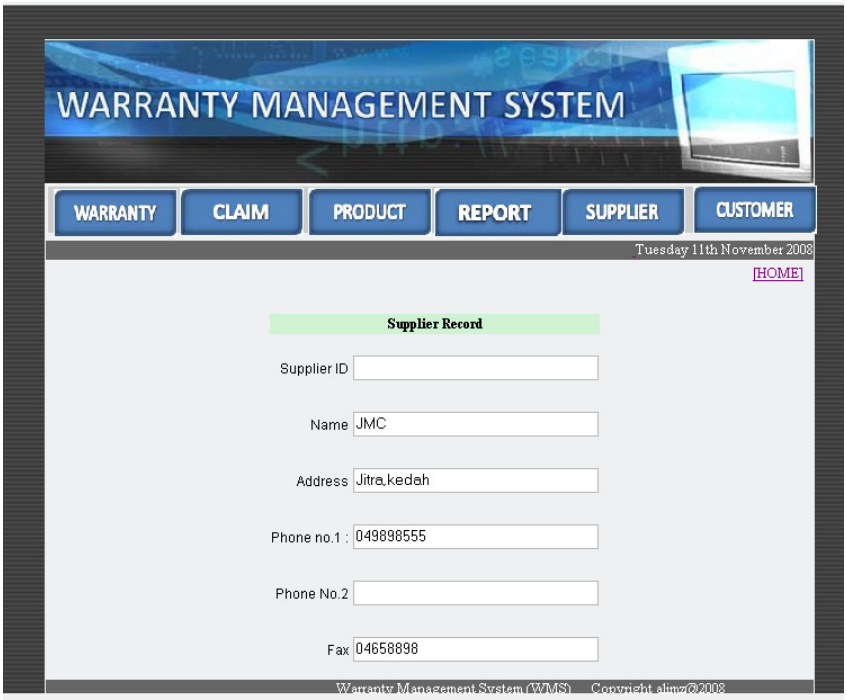


Figure 5.5: Add New Supplier

In this page, staff can add new supplier information after press the 'add suppliers' button. There are two option submit and reset. When submit, the page will go to figure 5.3 to display the new supplier record that successfully inserted.

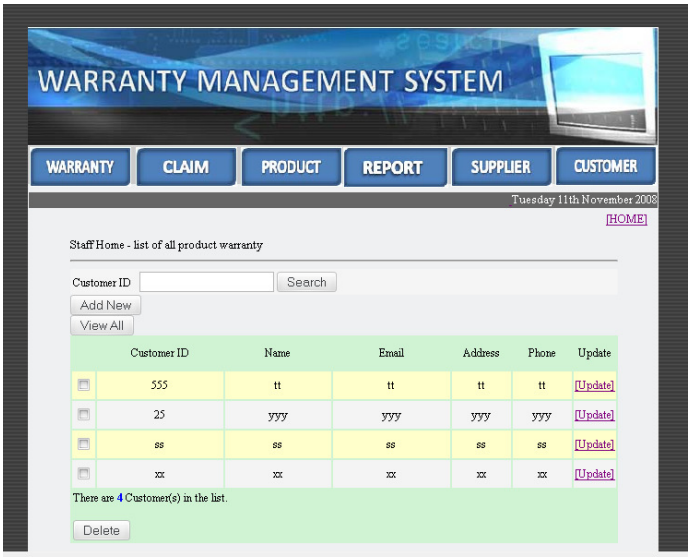


Figure 5.6: List of Customer

This page shows all the customers in the record. Staff can update, search customer by customer ID and delete customer in the list.

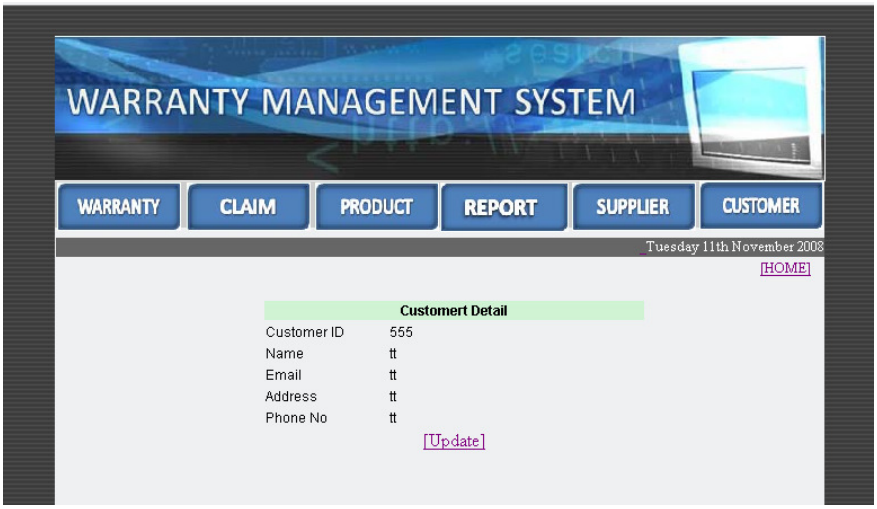


Figure 5.7 Update Customer

This page allows staff to update the customer information. After successfully update the customer information, the figure 5.6 will be displayed again.

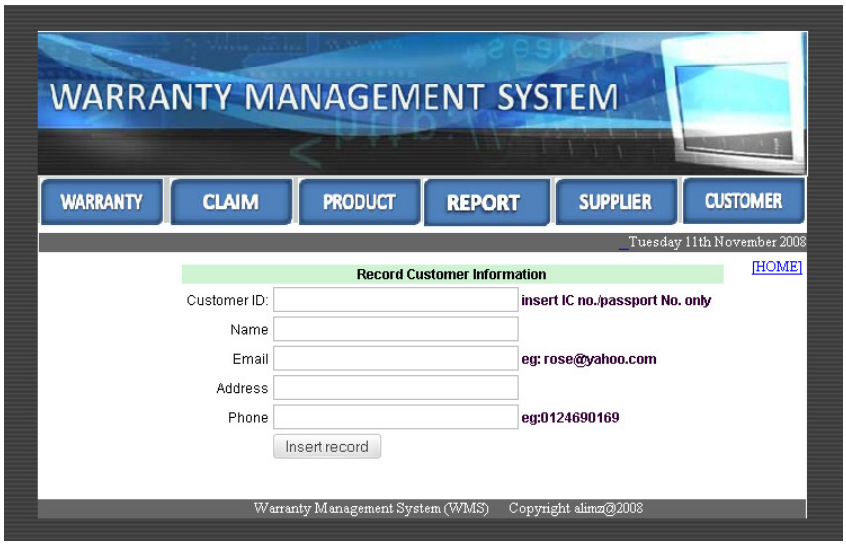


Figure 5.8 Add New Customer

In this page, staff can add new customer information after press the ‘add new’ button. There are two option submit and reset. When submit, the page will go to figure 5.6 to display the new customer record that successfully inserted.

6. VIEW REPORT PROCESS

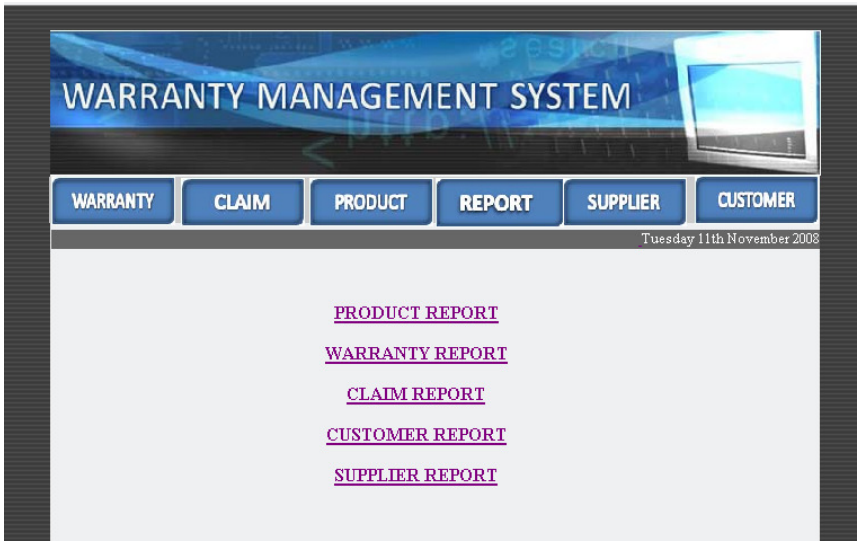


Figure 6.0 Report

This page displays the links to all product, warranty, claim, and customer and supplier report.

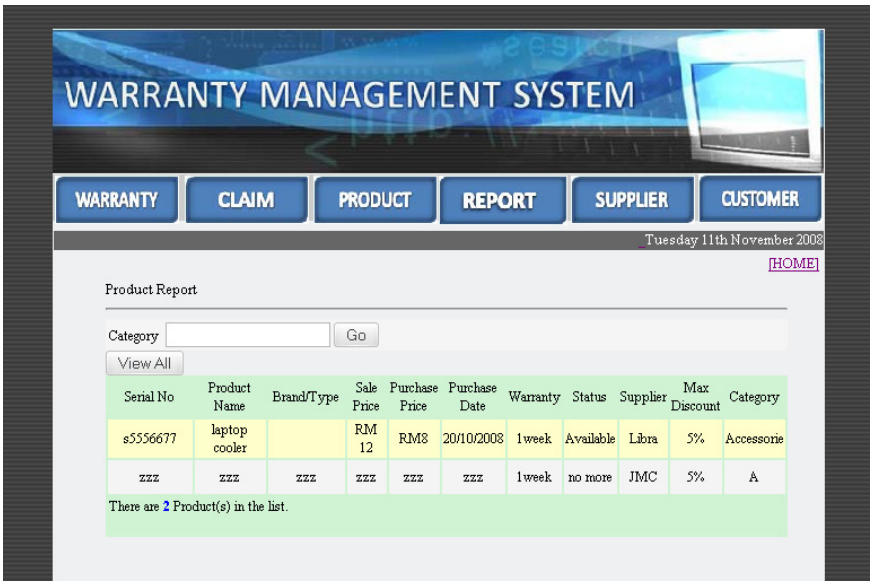


Figure 6.1 Product Report

This page will display the product report. This report gives the option to the staff or manager to search the product by category.

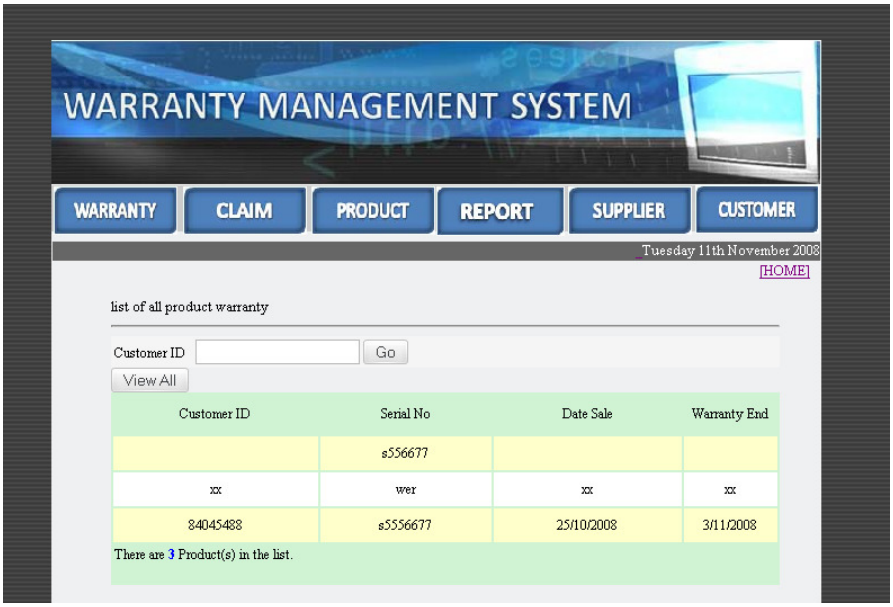


Figure 6.2 Warranty Report

This page will display the warranty report. This report gives the option to the staff or manager to search the warranty by customer ID.

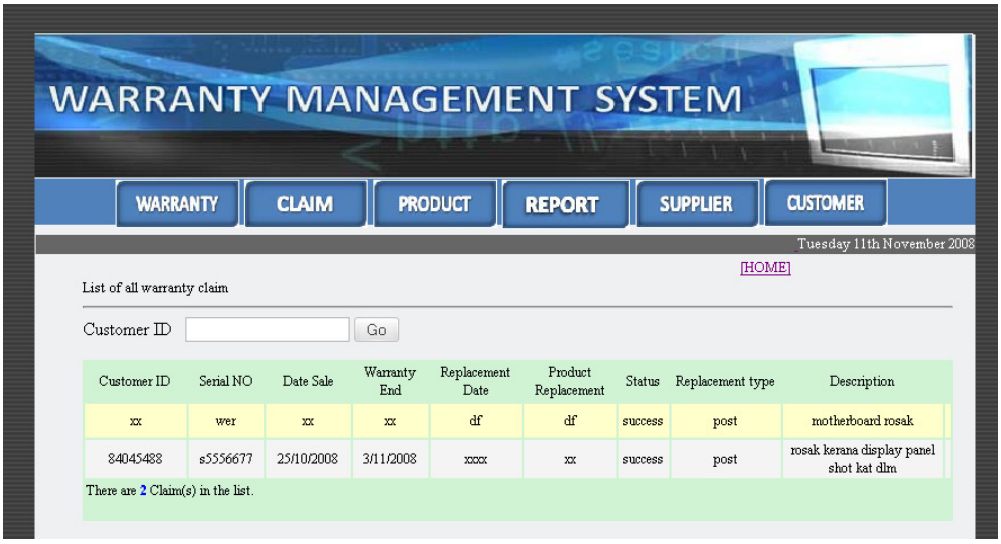


Figure 6.3 Claim Report

This page will display the claim report. This report gives the option to the staff or manager to search the claim by customer ID.

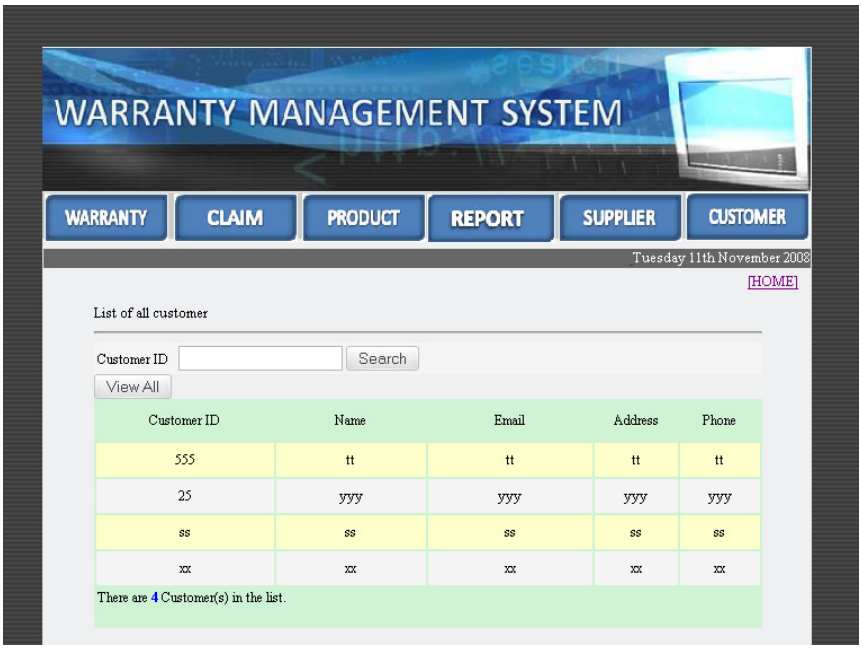


Figure 6.4 Customer Report

This page will display the customer report. This report gives the option to the staff or manager to search the customer by customer ID.

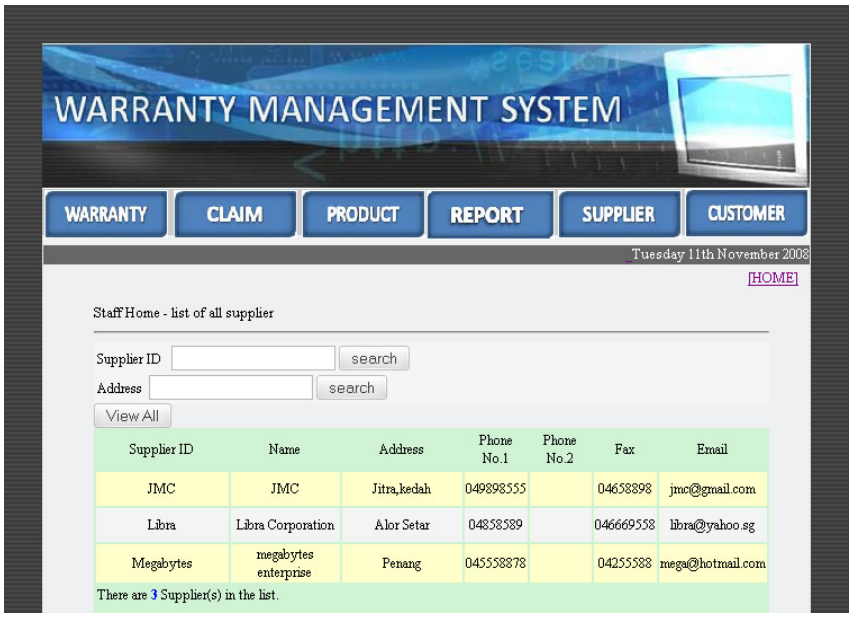
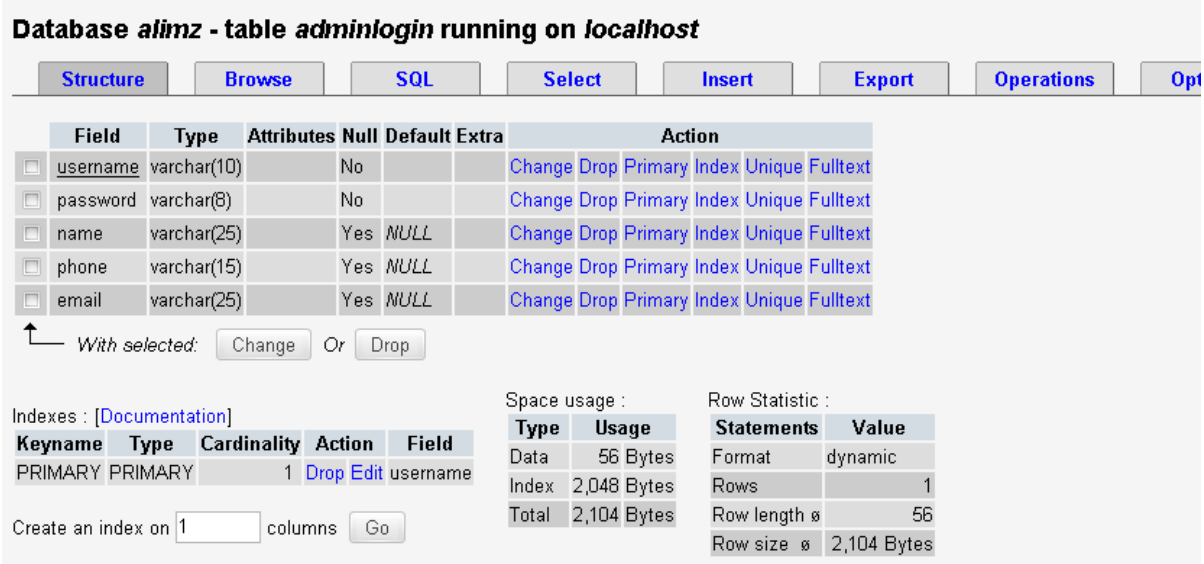


Figure 6.5: Supplier Report

This page will display the supplier report. This report gives the option to the staff or manager to search the supplier by supplier ID or address.

APPENDIX B

DATABASE DESIGN



Database *alimz* - table *adminlogin* running on *localhost*

Structure | Browse | SQL | Select | Insert | Export | Operations | Opt

	Field	Type	Attributes	Null	Default	Extra	Action
☐	username	varchar(10)		No			Change Drop Primary Index Unique Fulltext
☐	password	varchar(8)		No			Change Drop Primary Index Unique Fulltext
☐	name	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	phone	varchar(15)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	email	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext

With selected: Change *Or* Drop

Indexes : [Documentation]

Keyname	Type	Cardinality	Action	Field
PRIMARY	PRIMARY	1	Drop Edit	username

Create an index on 1 columns Go

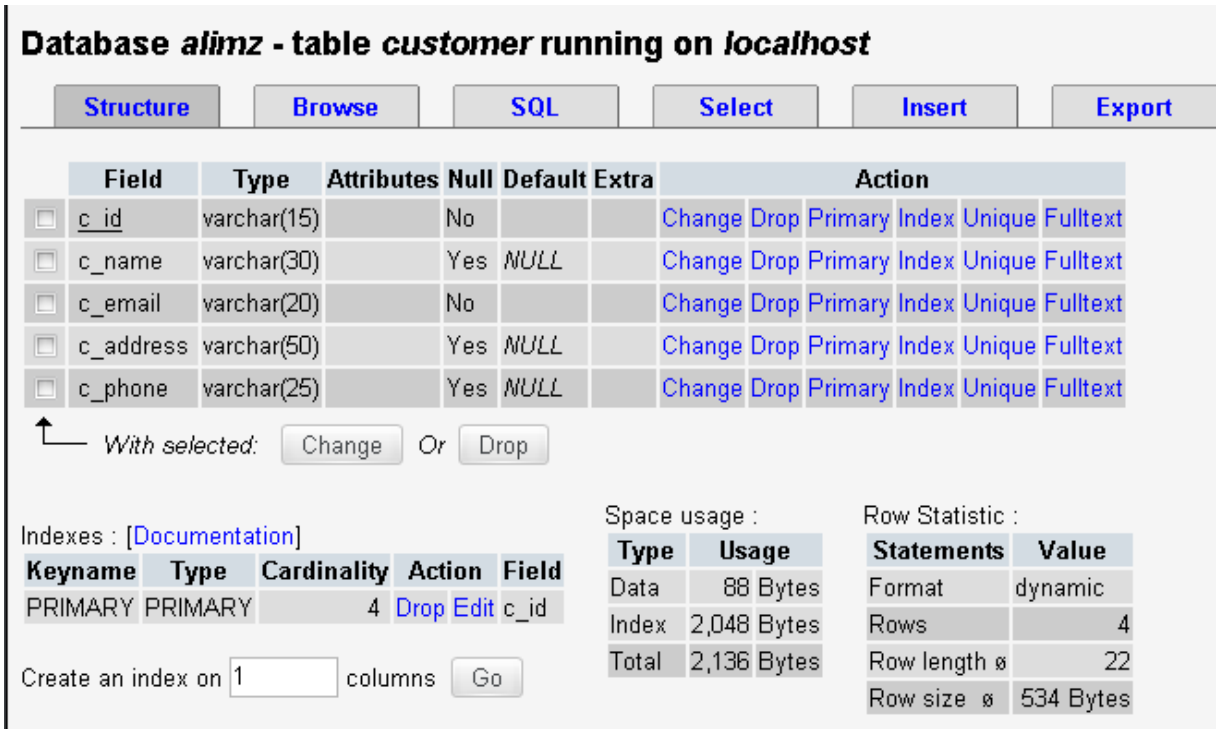
Space usage :

Type	Usage
Data	56 Bytes
Index	2,048 Bytes
Total	2,104 Bytes

Row Statistic :

Statements	Value
Format	dynamic
Rows	1
Row length ø	56
Row size ø	2,104 Bytes

Figure 1.0: Adminlogin Table



Database *alimz* - table *customer* running on *localhost*

Structure | Browse | SQL | Select | Insert | Export

	Field	Type	Attributes	Null	Default	Extra	Action
☐	c_id	varchar(15)		No			Change Drop Primary Index Unique Fulltext
☐	c_name	varchar(30)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	c_email	varchar(20)		No			Change Drop Primary Index Unique Fulltext
☐	c_address	varchar(50)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	c_phone	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext

With selected: Change *Or* Drop

Indexes : [Documentation]

Keyname	Type	Cardinality	Action	Field
PRIMARY	PRIMARY	4	Drop Edit	c_id

Create an index on 1 columns Go

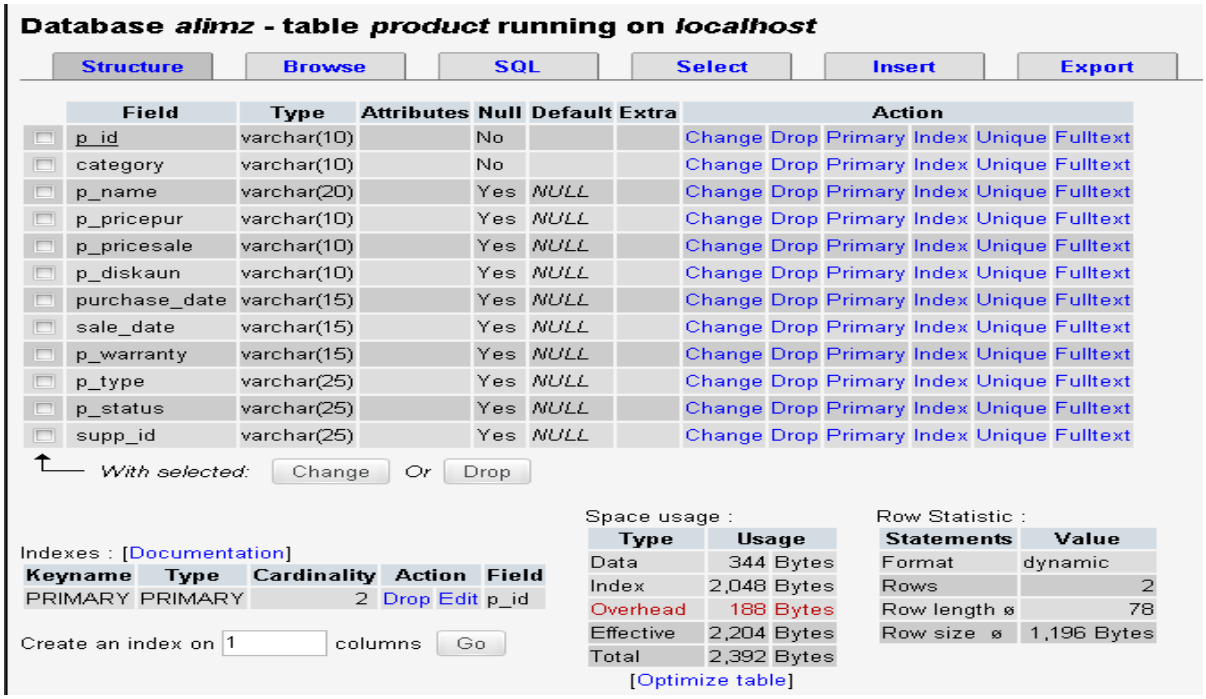
Space usage :

Type	Usage
Data	88 Bytes
Index	2,048 Bytes
Total	2,136 Bytes

Row Statistic :

Statements	Value
Format	dynamic
Rows	4
Row length ø	22
Row size ø	534 Bytes

Figure 1.1: Customer Table



Database *alimz* - table *product* running on *localhost*

Structure | Browse | SQL | Select | Insert | Export

	Field	Type	Attributes	Null	Default	Extra	Action
	p_id	varchar(10)		No			Change Drop Primary Index Unique Fulltext
	category	varchar(10)		No			Change Drop Primary Index Unique Fulltext
	p_name	varchar(20)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	p_pricepur	varchar(10)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	p_pricesale	varchar(10)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	p_diskaun	varchar(10)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	purchase_date	varchar(15)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	sale_date	varchar(15)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	p_warranty	varchar(15)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	p_type	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	p_status	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	supp_id	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext

With selected: Change *Or* Drop

Indexes : [Documentation]

Keyname	Type	Cardinality	Action	Field
PRIMARY	PRIMARY	2	Drop Edit	p_id

Create an index on 1 columns Go

Space usage :

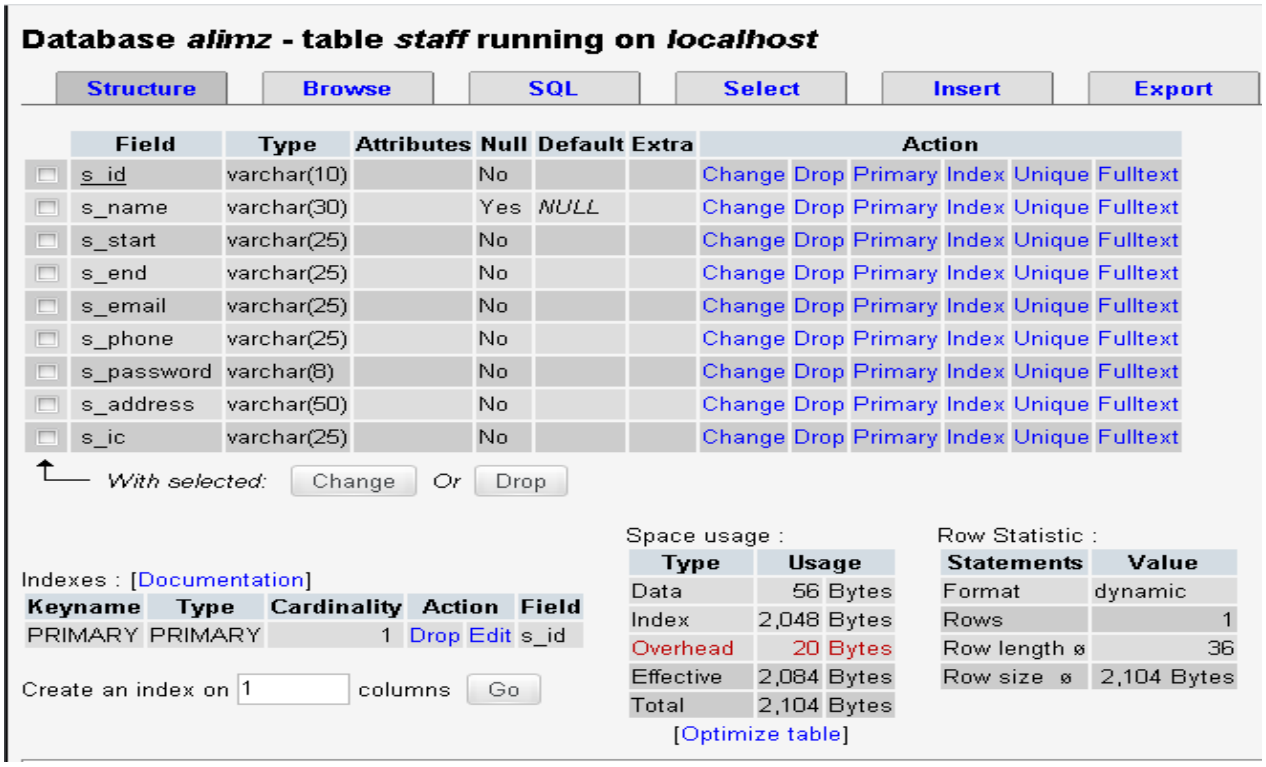
Type	Usage
Data	344 Bytes
Index	2,048 Bytes
Overhead	188 Bytes
Effective	2,204 Bytes
Total	2,392 Bytes

[Optimize table]

Row Statistic :

Statements	Value
Format	dynamic
Rows	2
Row length ø	78
Row size ø	1,196 Bytes

Figure 1.2: Product Table



Database *alimz* - table *staff* running on *localhost*

Structure | Browse | SQL | Select | Insert | Export

	Field	Type	Attributes	Null	Default	Extra	Action
	s_id	varchar(10)		No			Change Drop Primary Index Unique Fulltext
	s_name	varchar(30)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
	s_start	varchar(25)		No			Change Drop Primary Index Unique Fulltext
	s_end	varchar(25)		No			Change Drop Primary Index Unique Fulltext
	s_email	varchar(25)		No			Change Drop Primary Index Unique Fulltext
	s_phone	varchar(25)		No			Change Drop Primary Index Unique Fulltext
	s_password	varchar(8)		No			Change Drop Primary Index Unique Fulltext
	s_address	varchar(50)		No			Change Drop Primary Index Unique Fulltext
	s_ic	varchar(25)		No			Change Drop Primary Index Unique Fulltext

With selected: Change *Or* Drop

Indexes : [Documentation]

Keyname	Type	Cardinality	Action	Field
PRIMARY	PRIMARY	1	Drop Edit	s_id

Create an index on 1 columns Go

Space usage :

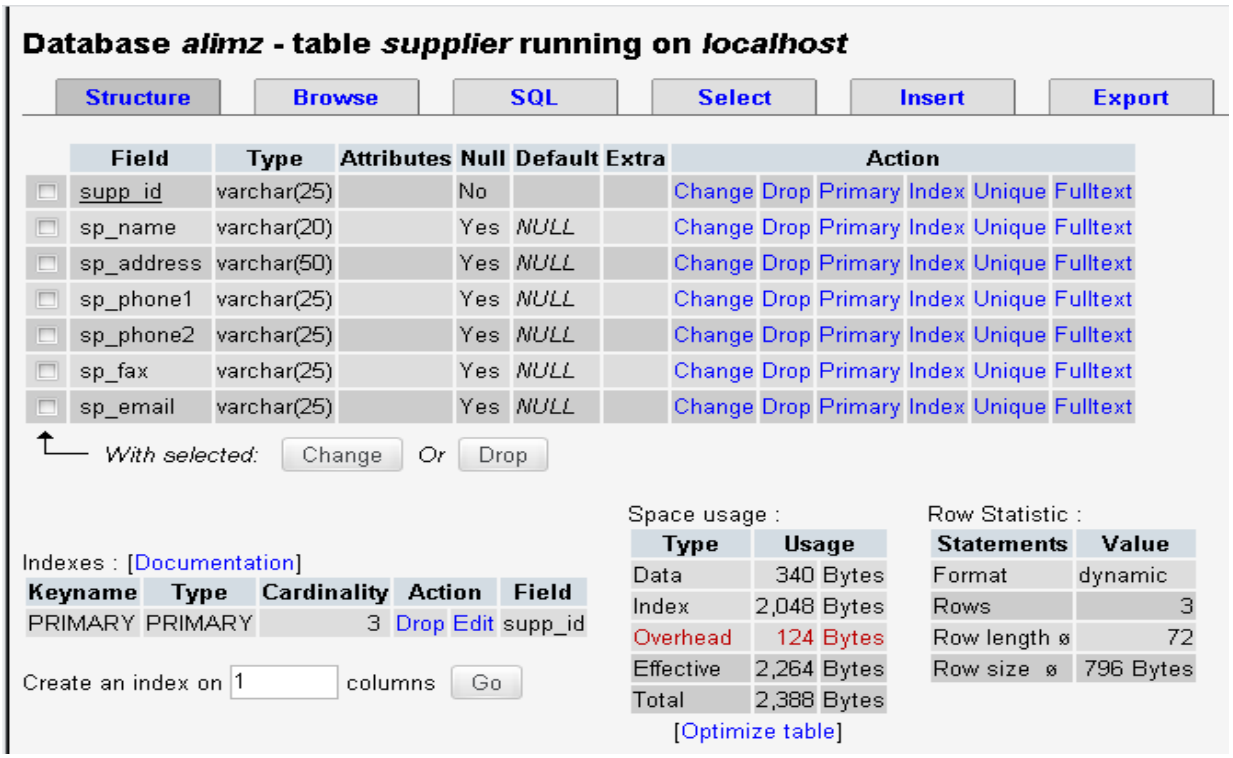
Type	Usage
Data	56 Bytes
Index	2,048 Bytes
Overhead	20 Bytes
Effective	2,084 Bytes
Total	2,104 Bytes

[Optimize table]

Row Statistic :

Statements	Value
Format	dynamic
Rows	1
Row length ø	36
Row size ø	2,104 Bytes

Figure 1.3: Staff Table



Database *alimz* - table *supplier* running on *localhost*

Structure | Browse | SQL | Select | Insert | Export

	Field	Type	Attributes	Null	Default	Extra	Action
☐	supp_id	varchar(25)		No			Change Drop Primary Index Unique Fulltext
☐	sp_name	varchar(20)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	sp_address	varchar(50)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	sp_phone1	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	sp_phone2	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	sp_fax	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	sp_email	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext

With selected: Change *Or* Drop

Indexes : [Documentation]

Keyname	Type	Cardinality	Action	Field
PRIMARY	PRIMARY	3	Drop Edit	supp_id

Create an index on 1 columns Go

Space usage :

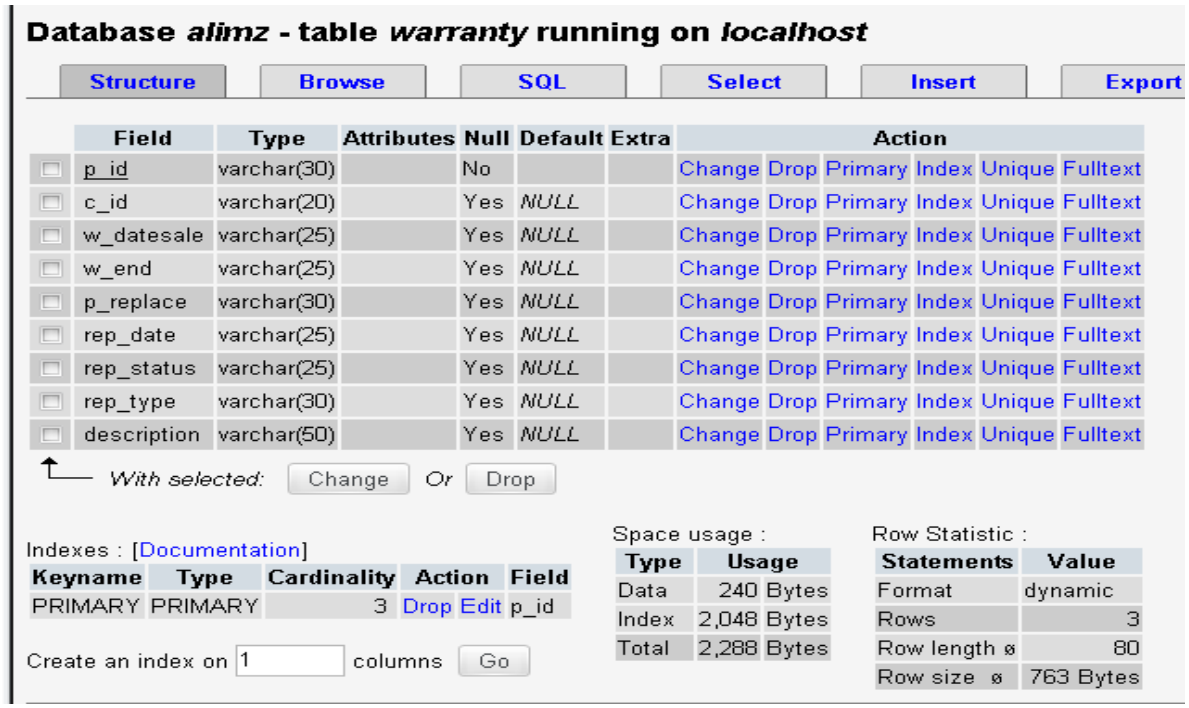
Type	Usage
Data	340 Bytes
Index	2,048 Bytes
Overhead	124 Bytes
Effective	2,264 Bytes
Total	2,388 Bytes

[Optimize table]

Row Statistic :

Statements	Value
Format	dynamic
Rows	3
Row length ø	72
Row size ø	796 Bytes

Figure 1.4: Supplier Table



Database *alimz* - table *warranty* running on *localhost*

Structure | Browse | SQL | Select | Insert | Export

	Field	Type	Attributes	Null	Default	Extra	Action
☐	p_id	varchar(30)		No			Change Drop Primary Index Unique Fulltext
☐	c_id	varchar(20)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	w_datesale	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	w_end	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	p_replace	varchar(30)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	rep_date	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	rep_status	varchar(25)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	rep_type	varchar(30)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext
☐	description	varchar(50)		Yes	*NULL*		Change Drop Primary Index Unique Fulltext

With selected: Change *Or* Drop

Indexes : [Documentation]

Keyname	Type	Cardinality	Action	Field
PRIMARY	PRIMARY	3	Drop Edit	p_id

Create an index on 1 columns Go

Space usage :

Type	Usage
Data	240 Bytes
Index	2,048 Bytes
Total	2,288 Bytes

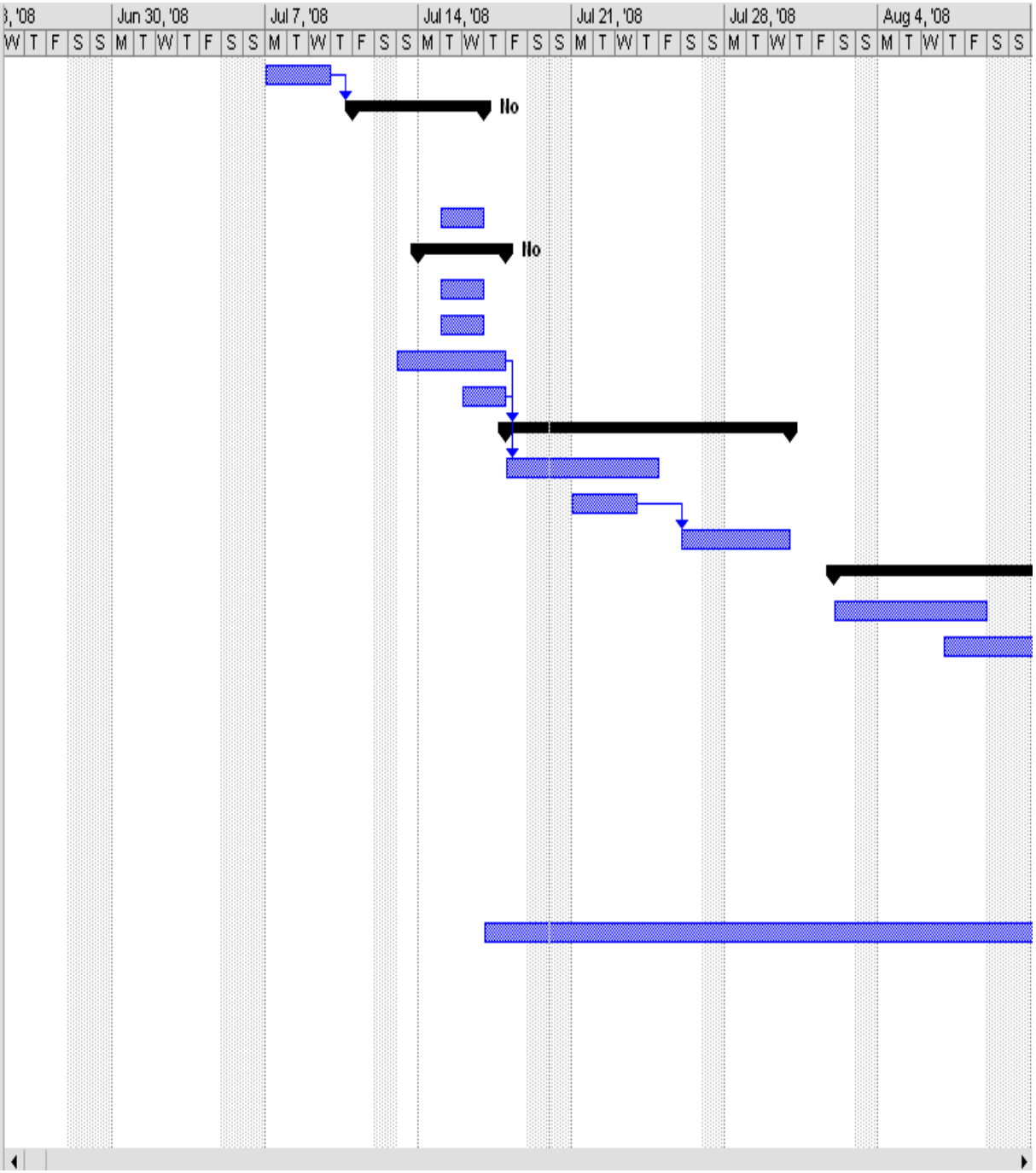
Row Statistic :

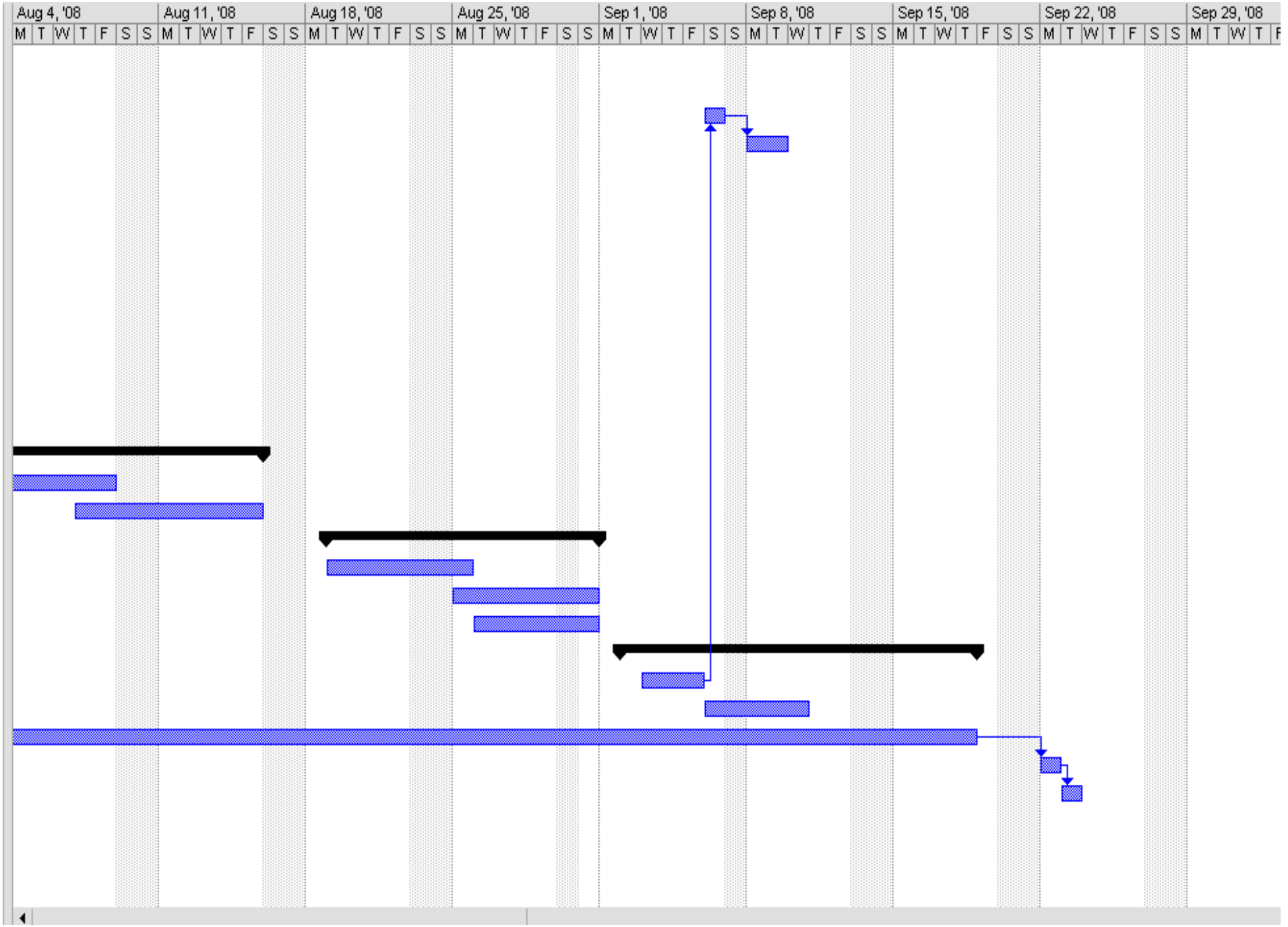
Statements	Value
Format	dynamic
Rows	3
Row length ø	80
Row size ø	763 Bytes

Figure 1.5: warranty Table

APPENDIX C
GANTT CHART

	Task Name	Duration	Start	Finish
1	Project title selection	3 days	Mon 7/7/08	Wed 7/9/08
2	Project proposal	5 days	Fri 7/11/08	Wed 7/16/08
3	Executive summary	1 day	Sat 9/6/08	Sat 9/6/08
4	Introduction	2 days	Mon 9/8/08	Tue 9/9/08
5	Project Shedule	2 days	Tue 7/15/08	Wed 7/16/08
6	Project Planning Phase	4 days	Mon 7/14/08	Thu 7/17/08
7	Project Specification	2 days	Tue 7/15/08	Wed 7/16/08
8	Project Scope	2 days	Tue 7/15/08	Wed 7/16/08
9	Project Methodology	5 days	Sun 7/13/08	Thu 7/17/08
10	Tool Development Selection	2 days	Wed 7/16/08	Thu 7/17/08
11	Project Analysis Phase	10 days	Fri 7/18/08	Wed 7/30/08
12	Requirement Analysis	5 days	Fri 7/18/08	Thu 7/24/08
13	Disadvantages of Current System	3 days	Mon 7/21/08	Wed 7/23/08
14	Requirement Selection	4 days	Sat 7/26/08	Wed 7/30/08
15	Project Design Phase	11 days	Sat 8/2/08	Fri 8/15/08
16	Interface Design	6 days	Sat 8/2/08	Fri 8/8/08
17	Database Design	7 days	Thu 8/7/08	Fri 8/15/08
18	Project Development	10 days	Tue 8/19/08	Sun 8/31/08
19	Interface Development	5 days	Tue 8/19/08	Mon 8/25/08
20	Database Development	6 days	Mon 8/25/08	Sun 8/31/08
21	PHP and HTML Coding	5 days	Tue 8/26/08	Sun 8/31/08
22	testing Phase	14 days	Tue 9/2/08	Thu 9/18/08
23	MySQL Testing	3 days	Wed 9/3/08	Fri 9/5/08
24	Publish The System	4 days	Sat 9/6/08	Wed 9/10/08
25	Project Documentation	50 days	Thu 7/17/08	Thu 9/18/08
26	Project Finish	1 day	Mon 9/22/08	Mon 9/22/08
27	Project Presentation	1 day	Tue 9/23/08	Tue 9/23/08




Aug 4, '08
Aug 11, '08
Aug 18, '08
Aug 25, '08
Sep 1, '08
Sep 8, '08
Sep 15, '08
Sep 22, '08
Sep 29, '08
M T W T F S S