The Development of an Internet Reverse Auction; an Alternative to e-Procurement

by

Nur Athira Md Isa

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(Business Information System)

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CERTIFICATION OF APPROVAL

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Approved by,

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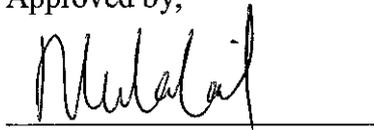
(Mr. Khairul Shafee Kalid)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
December 2005

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Nur Athira Md Isa

ABSTRACT

E-commerce is expected to growth tremendously as the economic shifted into global market. This has encouraged Small and Medium sized Enterprise (SME) to use the changes in the way they procured goods and services and should not miss the emergence of technology. The aim of this research is to understand and analyze the principles of online reverse auction, to design online reverse auction website and to develop a prototype called Web based Intermediary Reverse Auction (WIRA). The methodology that been adopted in order to develop this project are the planning phase, analysis phase, design and development phase, testing and debugging phase and implementation phase. The prototype of the online reverse auction is developed based on the research and analysis conducted by using several important tools. Tools that being used in this project are, Macromedia Dreamweaver, Adobe Photoshop, Macromedia Flash MX, Microsoft Access, ASP and IIS. By having this website, SMEs should realized that they can gained much profits as the product's price is much cheaper then they can get in e-procurement.

ACKNOWLEDGEMENT

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Worldwide electronic commerce (e-commerce) is expected to grow tremendously as the economic shifted into the global market. This has encouraged the growth of businesses in Malaysia especially for small and medium sized enterprise. The growth of the economic also has made the procurement activities as an extremely important business process that can be benefit from the e-marketplace. Before this, it is believed that the company has introduced with a few ways and techniques on how they can procured products and services in order to make sure the business run. The techniques might be from normal procurement to e-procurement and now companies and also a small and medium enterprise will be introduced to an online reverse auction as an alternative to e-procurement.

From business perspectives, procurement is an activity to acquire goods and services from either internal or external suppliers or vendor while auction is defined as a place that you can sell and buy (procure) goods. Reverse e-auction as the name implies are not like traditional auctions where with the reverse e-auction, first the buyers is the one that will start the auction by posting the advertisement and the certain criteria and description according to the business need. Later the seller (potential buyers) will compete among each others thus will reduce the price in order for the seller to be awarded with the tender. Basically the buyer will actually gets to select a winner form the available bids based on certain criteria listed out before the bidding started, for example price, qualifications, delivery time, vendor reputation, etc.

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1.2   Problem Statement

1.2.1   Problem Identification

Procuring activity is very important to every business especially to Small and Medium Enterprises (SMEs). A slight delay of getting the product or services on time will affect the business process and thus will make the SMEs facing a great loss i f t hey can n ot o vercome t he p roblem o f h aving t he p roduct o r s ervices o n time. Before this SMEs has been introduced with e-procurement as a tools to procure any product that they want. But e-procurement still has some problem that can be a burden for the SMEs to use it.

The main problem is with the transaction fee. An e-procurement application is rely on the fees from the suppliers. Suppliers have to pay for the operations and services facilities provided in the e-procurement. Normally, suppliers will pay annual fee to use the system and another fee for each transaction made. But many suppliers are unwilling to pay for this service. As a result, SMEs have to find or recruit suppliers to use their e-procurement system. By finding or identifying potential supplier that are willing to use for the e-procurement system is also a waste of time. In business time is money everything must be done on time without proper management of time and resources, this will affect the life of the business.

Besides that, e-procurement has an e-catalog that stored all the information about the product that is needed. Suppliers are forced to make an e-catalog. Sometimes the content of the catalog is insufficient. Moreover having insufficient contents of the e-catalog, suppliers also have to think and consider the platform, operating system, software and hardware needed for them and also for the buyer. This is because i t i s n o u se f or h aving s uch w onderful c atalog b ut i n t he e nd t he b uyer could not access it. Suppliers also have to make sure that all the information in the e-catalog is up-to-date. This task is easy if the suppliers only have fewer products

to maintain but what happen when he has to maintain and update more than thousand products.

The time taken for the buyer to procure any product from the e-procurement system is also a problem. This is because, there are more steps to follow in order for the buyer to procure the product that they interested with. The more steps ones take are the more time ones need. First a buyer need to identify what product or services they want to procure then they have to choose a supplier that willing to supply the product by sending request for quotation (RFQ). Then buyers have to wait for the feedback from the supplier. These steps will take sometimes and thus is not suitable for the businesses especially for SMEs that valued the time, costs and man power.

Therefore reverse auction is proposed. In reverse auction, neither the buyers nor the sellers have to create the catalog. Thus has eliminated the time taken for the user to create the catalog. Besides that, with reverse auction, a buyer can procure the product faster than the e-procurement can do. With reverse auction, the product offered are cheap and more profitable for the buyer where other auction or procurement tools can not offered. Steps taken to procure the product by using reverse auction are lesser compare to the e-procurement thus has made the reverse auction as the best alternatives to procure product especially to SMEs.

1.2.2 Significant of the Project

A prototype called web based intermediary reverse auction for SMEs will be developed based on the findings and analysis. With this prototype it will make the learning p rocess o n r everse e -auction w ill b ecome e asier and s mall a nd m edium sized enterprise can enjoy the benefits of having internet and be able to compete and enter the challenging global market.

1.3 Objectives

The objectives of this project are:

• To analyze the requirements needed which include the functional and non functional requirements in order to develop a reverse auction website prototype that will helps to reduce company expenses in term of time, costs and also man power especially to small and medium sized enterprise.

• To design the online reverse auction website prototype based on the requirement gather. The prototype of the website should be in corporate image and user friendly and easy to navigate.

• To develop an online reverse auction website prototype that will be called as Web Based Intermediary Reverse Auction for SMEs (WIRA) that can help those small and medium enterprises to gain benefits from the internet technologies.

1.4 Scope of Study

This project will focus only for small and medium enterprises (SMEs) in Malaysia. This project will focus only on the business process of online reverse auction and the prototype of this project will not includes some of the features for example the term of payment and the product deliveries. SMEs are also assumed, to accept the term of conditions in order for them to use the system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Forrester R esearch p redicts t hat t here will b e $ 1.5 t rillion i n goods a nd services transacted online among U.S business domestically by 2003 and $2.5 trillion internationally (Larso.P, 2000). Internet auctions have made rapid progress in recent years, and we can find many investigations of internet auctions (Turban.E et-al, 2000) and according to Ito.T, internet auctions have become a promising field to apply agent technologies (2001).

Nowadays, virtually every major industry has begun to use electronic sourcing (e-sourcing) and adopt online reverse auctions (Jap, 2002). More than 40 specialized solutions providers such as the FreeMarkets Inc, offer e-sourcing platforms, services and the technology for online reverse auctions (Minahan et-al, 2 002). I t has been estimated that t he annual throughput in online reverse auctions id over $40 billion (Jap, 2002).

2.2 History

According to Bichler and Werthner, multi-attribute auctions are a special kind of procurement auction (2000). Several authors have analyzed tenders and procurement auction (Vickrey.W, 1961; Dasgupta.S and Spulber.D, 1989)

Recently, there has been much promising research in the field of combinatorial auctions, where multiple heterogeneous goods are put up for sale and buyers supply bids on combination of goods (Forsythe.R and Isaak.R, 1982; Sandholm.T, 1999). However, this mechanism is not suitable for in a procurement setting, where a buyer has several preferences, but not clear picture of what suppliers are going to bid (Bichler et-al, 2000).

Price negotiation is one of the most time-intensive activities in the purchasing process (Emiliani.M, 2000). But, Laffont and Tirole describe many of the issues involved in procurement negotiations and also mention the need that auction theory must be generalized to so –called "multidimensional bidding" (1993).

According Bichler and Werthner previous models of procurement auctions have generally assumed that the qualitative attributes are fixed prior to competitive source selection, hence bidding competition is restricted to the price dimension.

Refer to article wrote by Teich et-al, they describe a system and the associated website for reverse auctions designed to increase efficiency of the selling of procurement process. In the paper also they did mention that the organizations in need of supplies often hold a reverse auction, possibly followed by negotiation with the winners of that auction. They introduced the NegotiAuction term which the word is a combination of negotiations and auction. They believe that NegotiAuction can create a uniquely efficient procurement mechanism (2000).

As stated by Matsuo and Ito in their article, currently there are two types of reverse auctions, defined in term of the way a buyer purchases goods. One involves

applying to an auction site for goods that a buyer hopes to purchase and the other types of auction involves showing goods that a buyer hopes to purchase and identifying potential sellers (2000). For an example that being highlighted in the article is a website that conducts reverse auction is priceline.com.

Raju et-al proposed, the concept of bundling has the potential of improving the efficiency of the procurement process but this can result in exploitation of complementary of products and in achieving logistic and lead time efficiencies. The allocation problems (the problem of selecting which vendors will supply which bundles) become hard in fact NP-hard (linear integer programming problem).

According to Menasce and Akula, 30% of the bids of an auction arrive in the last 5% of the auctions lifetime. This creates a surge in the load seen by auction sites as an auction's closing time approaches. The site's performance is degraded id the site is not able to cope with these load spike. With performance degradation comes frustrated customers and lost of business (2004).

2.3 Previous Work

According to Bandyopadhyay, Barron and Chaturvedi, analyzed the competition between sellers in reverse auctions in a game-theoretic frame work and established the Nash equilibrium in several scenarios. It was found that in an environment where sellers can collectively cater to the total demand, with the final seller catering to a residual, the sellers resort to a mixed strategy Nash equilibrium (2002). Analysis of Bandyopadhyay also establishes the nature of the equilibrium under various assumptions of the sellers' cost, capacities and the market demand (2002).

Bichler and Werthner studies that auction are mostly deployed in governmental or corporate procurement where a bid taker puts up an auction for goods or services she wants to purchase (2000). Bichler and Werthner also add that those studies have generally assumed that both qualitative attributes and the quantity are fixed prior to competitive source selection- hence the bidding competition is restricted to the price dimension (2000). While such approach may be appropriate for auctions of homogeneous goods, this precondition is rarely given in corporate procurement, where bidders often provide very different kinds of goods and services in their bid (Bichler et-al, 2000).

Previous workload characterization includes a detailed analysis of real data, obtained through automated agents, from online auctions to uncover patterns related to their major activities (Menasce.S and Akula.V, 2003). They also analyzed how the features of the workload change within price clusters determined by some specific rules. That work also yield several results regarding winner activity, unique bidders, price variation and closing tome activity (Menasce.S and Akula.V, 2003).

From the previous study done by Bichler, multi-attribute utility theory is a suitable and widely accepted methodology to elicit a buyer's preferences and model an appropriate utility function. In most cases and additive utility function is appropriate (1998).

Raju et-al also mentioned the problem of buyers who need to procure a bundle of items and they have solve the problem by formulated the problem as NP-hard. They also have formulated a relaxed version of this problem and show its connection to the iBundle algorithm of David Parkes (2001), which lead to iterative bundle procurement auction (IBPA). In iBundle introduced by David Parkes, the auctioneer solves the sequent of winner-determination problem to maintain a provisional allocation (2001). iBundle algorithm also is a variant of traditional

primal-dual algorithm to solve the linear programme formulation of Bickchandani and Ostroy's package assignment model.

Based on paper written by Raju et-al, Procurement Auction Using Actor-Critic Type Learning Algorithm, under section 3, used IBPA as proposed type for reverse auction. The objective function ensures to get every bundle form the bidder who has low private valuation than other bidders. From the research done, Bickchandani and Ostroy prove that the optimal feasible solution to the linear programme is integral and solve the Integer Programming formulation of combinatorial resource allocation problem.

Kaymak et-al proposed a clustered clustering- based approach for lottting in online reverse auction. The result of implementing this approaches are encouraging, indicating that the proposed algorithm, leads to 2 to 3% savings, while the procurement experts confirm that the lots determined by the proposed strategy are acceptable, given the procurement goals (2003).

In their proposed algorithm, lotting is needed, because it is not efficient to auction all the items separately. They also said that it is important to realize that lotting gives procurer the possibility to influence the attractiveness of the auctioned items for the suppliers, balancing 2 (possibly conflicting) goals.

2.4 Advantages

Some of the more prominent advantages business to business (B2B) exchanges are expected to bring include lower cost due to automating the procurement process, reverse auction, interoperability among users, collaborative planning and collaborative design (Helper and MacDuffie, forthcoming).

In the reverse auction multiple sellers compete on goods and the evaluation value shown by the buyer. A designated bidding system is required by the public works office of Japan and is one form of reverse auction (Matsuo and Ito, 2002). In their paper on A Designated Bid Reverse Auction For Agent-Based Electronic Commerce, did mention about the auctioneer nominates a bidder based on the quality o f w ork, t hus c an p revent p oor c ompanies f rom m aking a s uccessful b id prior to bidding. The result if an auctioneer's examination of the standard of technical requirements, the right bid is granted only to bidders accepted by aptitude.

As been stated by Kaymak et-al, in the article "A Heuristic Method for Electronic Reverse Auctions", Online reverse auctions can significantly speed up the pricing process (2003). Other than that (gains in the time spent on purchasing), it has been reported in the literature that online reverse auctions can produce cost savings from 5% to 40% (Tully.S, 2000). In the same articles also, Kaymak et-al add that online auctions have the potential to restructure the procurer's relation to its suppliers for example by allowing contact with more suppliers (2003).

Reverse auctions achieved fame when General Electric, the poster child for e-business, touted phenomenal savings from using the method. GE CIO Gary Reiner claimed the company saved approximately $600 million by using reverse auctions in 2001, which was a net savings of 8 percent (Mohanbir.S, 2003).

In the public sector, the U.S. General Services Administration reported that a pilot program in which the Defense Finance and Accounting Service, Air Force and Coast Guard used reverse auctions resulted in savings of 12 percent to 48 percent. And in its 2001 annual report, the leading auction software and services company FreeMarkets reported that it had saved its customers an estimated 20 percent on a total of $30 billion worth of purchases since 1995 (Mohanbir.S, 2003).

The National Probation Directorate has saved nearly a quarter of a million pounds by buying new IT kit in an online reverse-auction. The savings, £233,000 in total, represent a nine per cent reduction in price, according to the Office of Government Commerce (Sherriff.L, 2005).

One of the main advantages of sourcing through reverse auctions is that it saves time through the elimination of negotiation and hence negotiation should never become a substantial aspect of online auctions (Kaymak et-al, 2003).

2.5 Disadvantages

The disadvantage of reverse auction is the limitation of involvement, because the number of bid participant is restricted (McMillan.J, 1991; Saijo.T, 1994). Since the bidders are identified in advance, bidders are specifically nominated based on the quality of past performance. Therefore it is hard for companies from other areas and new companies to join the auction (Matsuo.T and Ito.T, 2002).

According to the online source obtained from yahoo.com on Reverse Auctions (2001), there are some drawbacks for procurement departments to use reverse auctions. Suppliers are forced to be so fast and offer low-cost products and services, so the quality of the product could suffer. In the articles also add that the buyers wont find its product by specified deadline because there is no guarantee that sellers will make offers within the timeframe the buyers specifies. A company or organizations might need a high-volume contracts in order to attract lots of competition from suppliers. Besides that, auction also can lengthen the front-end of the procurement process by setting clear product specifications and suppliers requirements.

According to Kaymak et-al who's proposed the lotting algorithm, they mentioned that less many online reverse auctions system did not allow negotiations. Which they believed that negotiation between suppliers and buyers is important.

One of the major problems with most of the existing auction or trading sites is that they match buyers and sellers just on price, not value (Teich et-al, 2001).

Mohanbir.S provides that, two of the most outspoken critics of reverse auctions are David Stec and M.L. (Bob) Emiliani from the Center for Lean Business Management at Rensselaer Polytechnic Institute. In a paper published last year, they argue that online reverse auctions rarely deliver savings that are as great as advertised by auction service providers. In addition, they contend that savings from reverse auctions are difficult to measure and that they do not teach buyers and sellers how to solve problems jointly. They conclude that reverse auctions are toxic for buyer-supplier relationships.

CHAPTER 3

METHODOLOGY

3.1 Procedure Identification
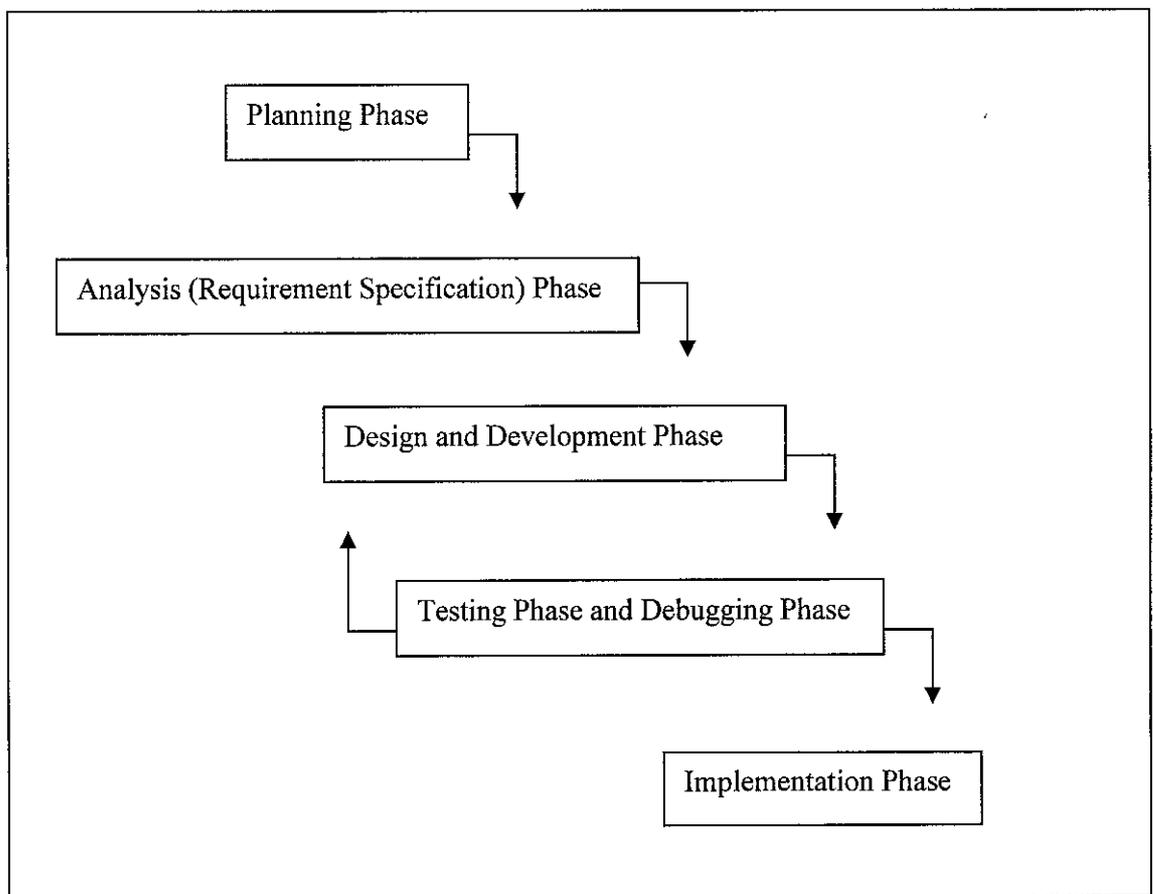
Figure 3.1: Project Methodology

Figure 3.1 showed the flow of procedures that are planned in this project. The project begins with planning and will end with the implementation phase.

3.1.1 Planning Phase

This is the first phase that will be executed in this project. Proper planning is needed in order to ensure project flow will run smoothly and efficiently. All data and information on online reverse auction is gathered first in order to get clear understanding on its. Planning on the data gathering is done in the early part of this project executes.

The data obtained must be related to the title of this project and all of the information about the reverse e-auction is obtained from journal, internet, books and magazines. After all information about reverse auction is gathered, analysis phase will take place and will follow with the development of the project prototype until the project is achieving its objectives. Besides that timeline also prepared, this project takes 1 semester or 5 months to be completed. Therefore it is essential to have the timeline to make sure that the all activity is done on time and meet all the requirements without delay.

3.1.2 Analysis (Requirement Specification) Phase

This is the phase where all the information and data gained from the previous phase will be analyzed and will be use to proceed with other phases. The data is gathered by accessing to the online database for example IEEE, springerlink.com to find journals that is related to the project title, accessing to some of the existing online auction website (for example; www.ebay.com, www.lelong.com.my) to learn how the auction website is working. Data also gathered by assessing the reverse auction website that provide online demo features which really help on the design and development of this prototype. This website can be access at this address www.usanetcreation.com. All the information is mainly obtained through the internet.

After all important information is gathered the analysis on the information from the online database and the existing website will be used in order to proceed to the next steps of the project which is the analysis phase. Some of the analysis done on the data gathered are; 1) how it really can help an organizations to reduce the costs, time and manpower, 2) how to encourage SMEs can used reverse auction to procure product, 3) what are the product that can use reverse auction, 4) who can benefits from using reverse auction.

Research on existing online reverse e-auction also been done in order to 1) get better understanding on the e-auction mechanism, 2) what are the products being auctioned in the market and 3) how does reverse auction works. Context diagram, use case diagram and also the business process of the project prototype is designed during this phase to help to get better understanding on reverse auction. Besides that all information that is essential is highlighted and it will be used in the design and development phase. This phase is essential in order to get better understanding before proceeding to the next phase.

3.1.3 Design and Development Phase

This phase has been divided into two sections and there are:

Prototype Design

There are 2 main components that being design under prototype design and there are the user interface design and database design. It is important to design both main components before the development take place. This is because, with proper design, errors can be minimizes and easily detect and also to ensure that the prototype meet all the requirements before can be implemented.

For user interface design, the first step is to design the story board by using tools like drawing canvas. This is to design each page of the website and how it can

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integrate with each page. All forms for example registration form, change password form also will be designed during this phase. This is to ensure that the design of the website is user friendly, formal and informative. Besides that flow of the website will also be drawn on the drawing board to show how the system works. in this system, well design database is important because, database will store all important information.

In order to develop good database, entity relationship diagram (ERD) for web based i ntermediary r everse a uction a nd a lso a c lass d iagram w ill b e d esign. T he purpose o f h aving E RD a nd c lass d iagram i s t o e nsure t hat t he d atabase i s w ell design for the development phase later on and to make sure that the maintenance of the database is easier.

Prototype Development

In this phase the prototype of the web based intermediary reverse auction will be develop according the design designed during prototype design phase. The prototype will be developed stage by stage starting from development of all the pages that is drawn in the drawing board.

The prototype will be developed by using Active Service Pages (ASP), Hypertext Markup Language (HTML) and others that will consider to be used later in the development of this prototype. After all the pages are developed and linked, development of the database will take place. The database will be develop accordingly so that problem can be eliminates. Microsoft Access will be used to develop the database for this project prototype.

3.1.4 Testing Phase and Debugging Phase

Testing on the prototype of the web based intermediary reverse auction will be conducted along the way on the development phase. This is to make sure the website is fully functioning and follow all the requirements. This testing phase is important because with testing it will help to finds flaws and errors of the prototype created. The major testing will be held when all the development of the web based intermediary reverse auction is completed. Full testing phase will be conducted by inviting a few students to 'play around' with the online system. This is to test whether the website is user friendly and capable to stores simultaneously bid post by the user.

3.2 Tools Required

For this project development, the tools that going to be used are as listed below:

- *Macromedia Dreamweaver MX*

It's a webpage or application authoring tools which used to design for the platforms page of the online reverse auction.

- *Adobe Photoshop*

Adobe Photoshop is the most popular program for creating and modifying images. this tools is used during the design phase of the prototype developed this is include the design on the interface of the website and also used to edit some graphics.

- *Microsoft Access*

The database of this website will be developed using Microsoft Access. This tool is chosen because not only it's easily understandable but also because it is reliable with the scripts choose to develop the prototype.

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- *Active Server Pages (ASP)*

ASP is a Microsoft technology for sending to the client dynamic web content, which also includes the HTML, XHTML, ActiveX Controls, and client-side scripts. ASP scripting is important as it will be used to develop the prototype.
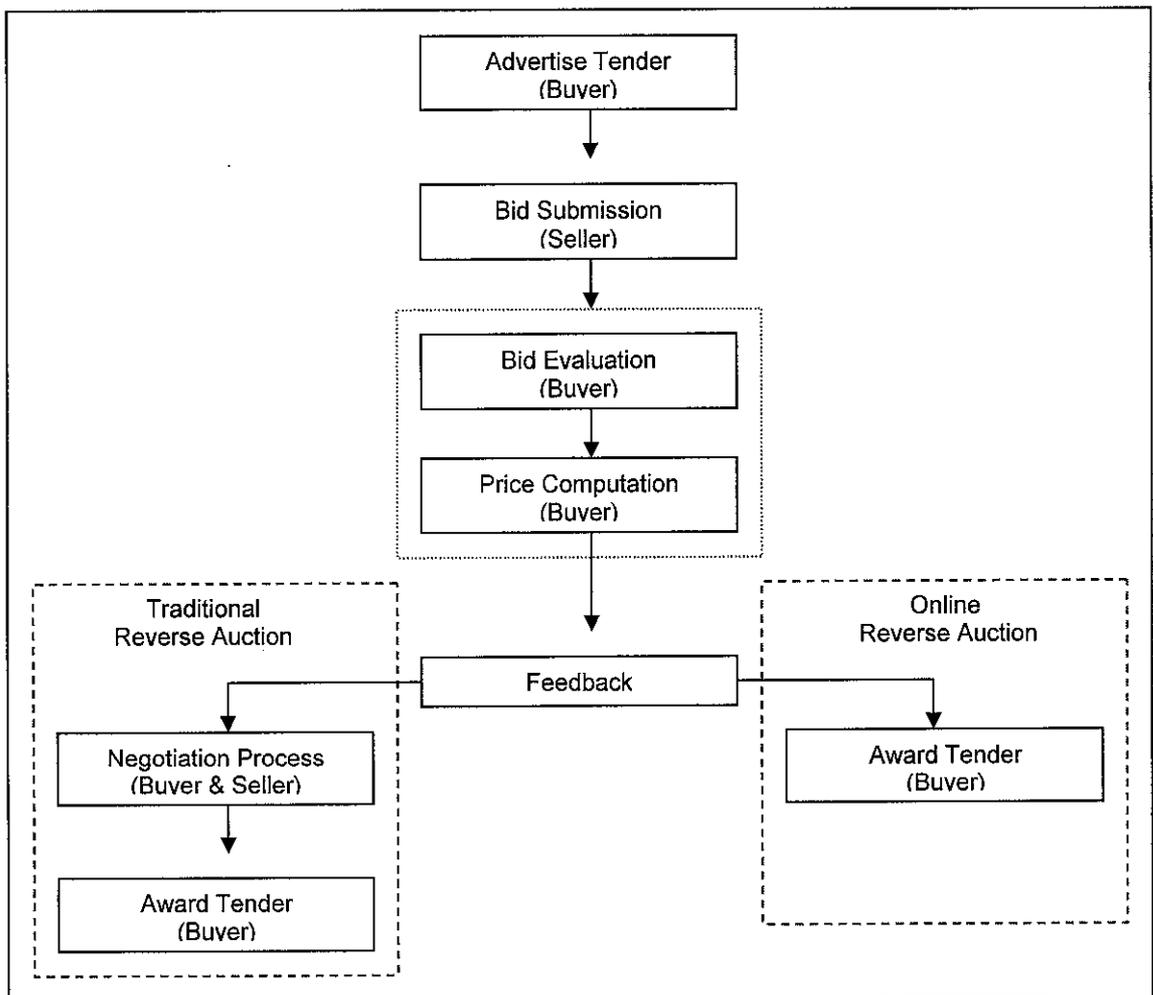
- *Internet Information Services (IIS)*

Microsoft Internet Information Services is a powerful web server that provides highly reliable, manageable and scalable web application infrastructure for Windows 2000.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Traditional Reverse Auction Vs Online Reverse Auction


Figure 4.1: Business Process of Reverse Auction for Traditional and Online Reverse Auction

Figure 4.1 shows the business process of a traditional reverse auction and online reverse auction. The bracket in each of the processes indicates the individual that involved with the process.

There are clear differences between traditional reverse auction and online reverse auction is that, traditional reverse auction have extra additional negotiation process. The purpose of this process is to drive the price offered by the winning suppliers (at the first phase) to be as low as possible. After some negotiations, then the tender will be awarded to the supplier. Where it is different from online reverse auction, the tender will be awarded immediately after the bidding process is closed and there will be no negotiation between supplier and buyer.

This is because, one from the main purpose of having online system is to eliminate the negotiation process and time. Besides that, traditional reverse auction is more to the best value ranking where the lowest price offered by the supplier will be ranked. In traditional reverse auction the supplier are anonymous where each suppliers don't even know who the competitors are and also how their bids is going on. Compare to online reverse auction, all potential supplier know who is the competitor and they know how their bids is going on. This has created the competitive bidding among suppliers thus the price can be push downward.

4.2 System Architecture
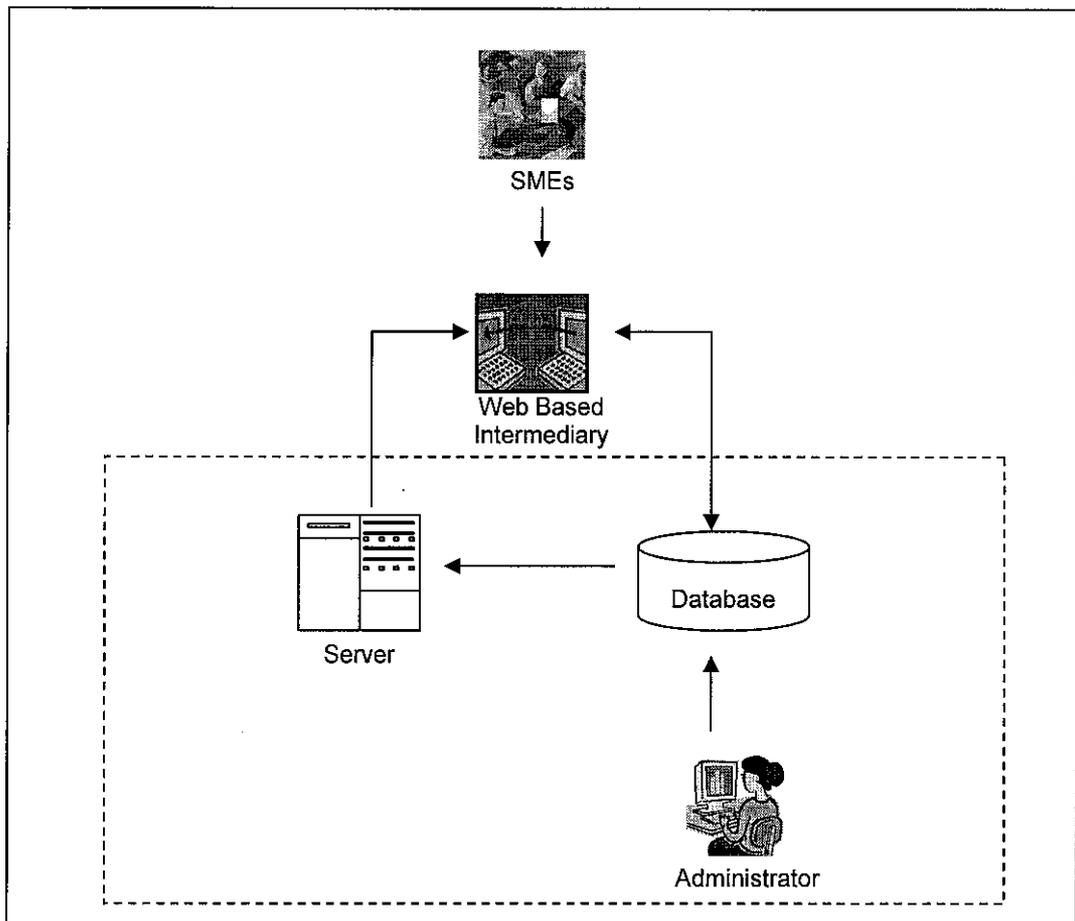
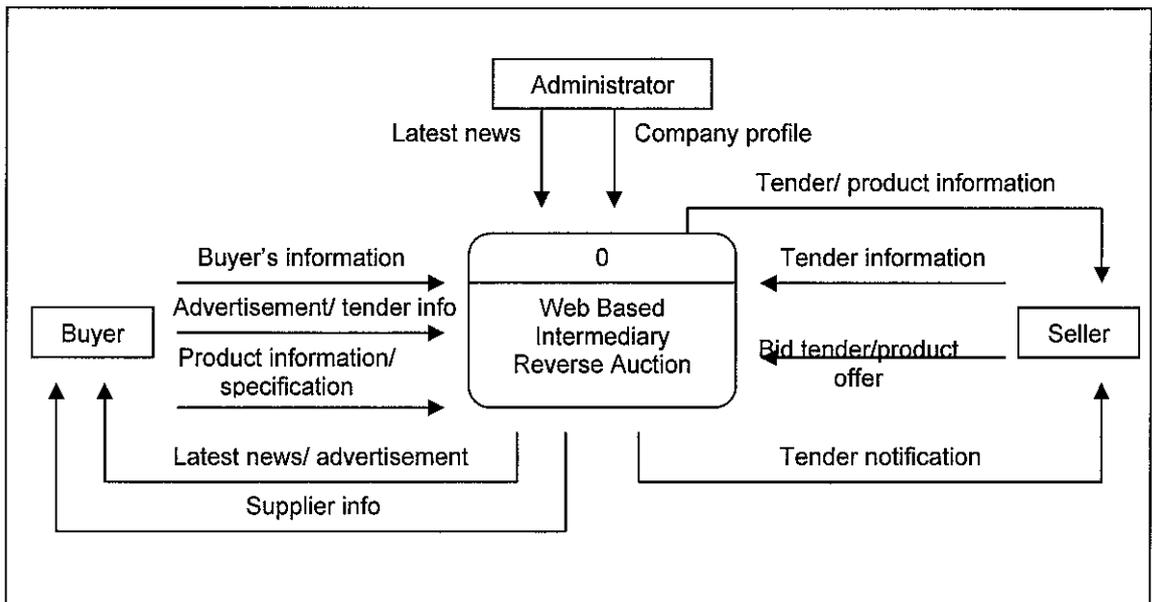**Figure 4.2:** Web Based Intermediary Reverse Auction Architecture

Figure 4.2 shows the architecture of the web based intermediary reverse auction system. As can be seen here, at the top of the architecture is the Small and Medium sized (SMEs) personnel. The SMEs personnel, is the main targeted group that going to use this website. SMEs personnel can be either a buyer or sellers or both. The SMEs can use the website's services once they have registered as a user and log on into the website. Each transaction made or any auction activities made will be stored in a database of the website. The maintenance of the website will be handled by the system administrator. The administrator is important person to make sure the website and auction activities is functioning and also to assist user id they has encounter any problem when using the system.

4.3 System Analysis for WIRA

All information gathered in the analysis phase will be used in order to move to the next steps in this project. For analysis part, context diagram, use case diagram and business process description are developed based on the information gathered. This is important in order to get better understanding on the flows and the process of the prototype that will be developed later.

Before each process begins, both buyer and seller need to be registered with WIRA. This website is meant for buyer therefore all bidding process will begin from the buyer side first. Registered buyer will advertise the product that they want to procure by fill in the user information and the item information. After the advertisement being announced in WIRA, a seller which also the SMEs can start to post their bid (bid submission) according the requirement listed by the buyer. When the bid time of each item reach the due date, the system will collect all bids sent by the seller and let the buyer choose the winner to be awarded with the tender.

4.3.1 Context Diagram

Figure 4.3: Context Diagram for Web Based Intermediary Reverse Auction

As shown in the Figure 4.3, is the flow of the information in and out of the system. WIRA have 3 main entities which are the buyer, seller and administrator. Buyer is the one who will start the process by posting the advertisement and seller that is interested to sell the product will respond to the advertisement. Buyer will post all necessary information in the advertisement and will wait for the latest news or advertisement and also the supplier information mailed to them. As for seller, they will get the product or tender information that post by the buyer and if the seller interested they will post the bid. In this system, buyer can perform a seller job, vice versa since this website is open for all SMEs in Malaysia. Administrator is a different agent that controls the flow and the activity of the website. Administrator also is responsible to update information that is related to all SMEs that using WIRA.

4.3.2 Use Case Diagram
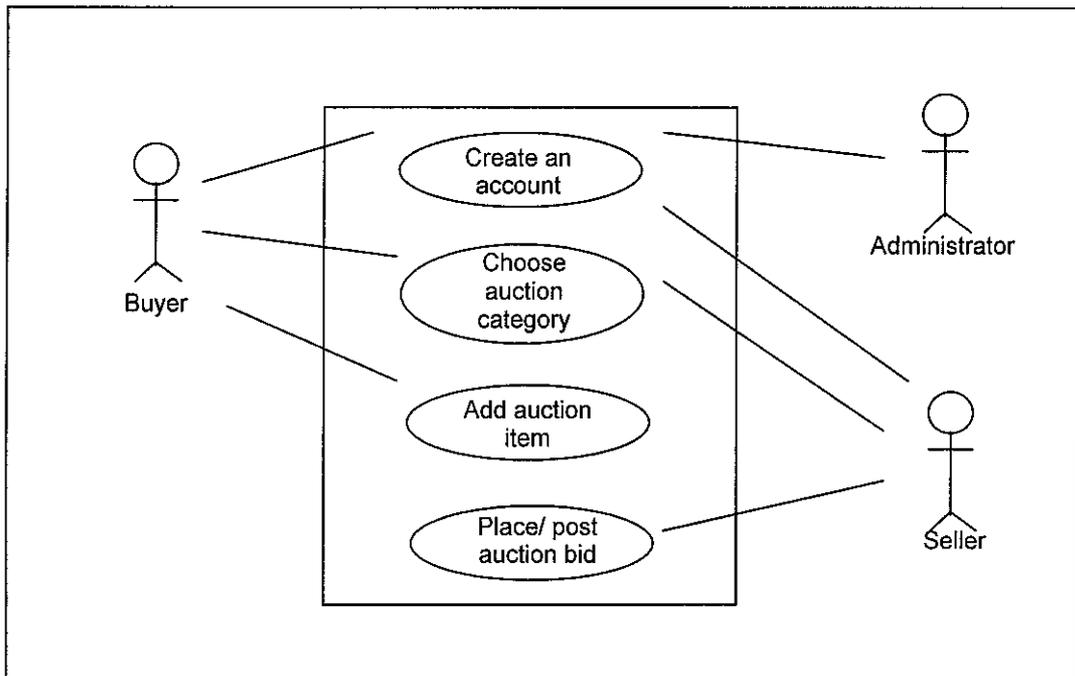
Figure 4.4: Use Case Diagram for Web Based Intermediary Reverse Auction

Figure 4.4 depict a use case diagram for Web Based Intermediary Reverse Auction (WIRA). There are 3 actors in the diagram which are the buyer, seller and administrator. In order for SMEs (buyer and seller) to be able to use the website, they need to register or have an account first. To register, SMEs can do it themselves or by requesting to administrator. A buyer that wants to place an advertisement must choose the auction category first to classify the type of the product. Then only they can post advertisement of the product or services or a tender by adding auction item. Same goes to a seller, a seller have to choose the category from auction category first before they can post bid to sell the product. After they have choose the category that they interested then can start placed the bid for the tender offered. Administrator is needed to control the process of the website and also to assist user that have encounter any problem using the website.

4.3.3 Business Process Description
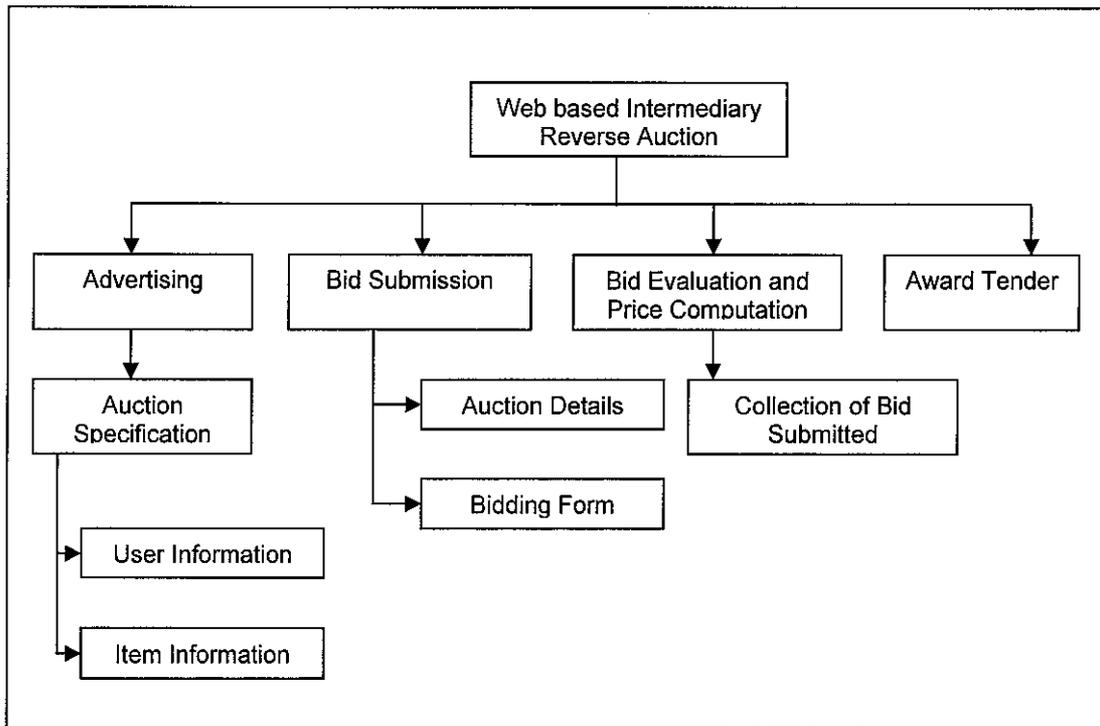
Figure 4.5: Web Based Intermediary Reverse Auction Business Process Diagram

This section will be discussed each phase of the business process of online reverse auction depicted in Figure 4.5. There are 4 main processes or module in WIRA and there are the advertising module, bid submission module, price evaluation module and award tender module. For advertising module, a buyer will key in or fill in the form consist of user information and item information. This information is essential in order for a buyer who wants to advertise the tender. Immediately after a buyer advertise the tender, a seller can start post the bid on the advertisement they interested with. Bid posted will consist of the auction details and the bidding form. Then if the auction for certain item has reach its due date, WIRA will collect all bid submitted by the seller and mailed it to the buyer so that buyer can start evaluate and do the price computation. This is important process where the buyer will do all the selection process to identify the winner for the tender they had advertised. Table 4.1 will describe the details of each task listed in Figure 4.5.

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Task		Description
Advertising	Auction specification	Consist of user information and item information form to be filled in by the buyer before they can advertise the tender.
	User information	User have to key in their username and password before can proceed with other process.
	Item information	Information of the item that a buyer have to key in. consist of the title of the product they want to procure, category of the product, number of days it will run, the description or requirement for the product and the maximum price a seller can bid.
Bid submission	Auction details	Is an advertisement posted by the buyers and consist of product details and item information.
	Bidding form	A bidding form that sellers have to fill in to post their bid.
Bid Evaluation and Price Computation	Collection of bid submitted	All bids submitted by the seller will be collected by the system when the auction has reached the due date. This list of bids will be forwarded to the buyers and the buyer will choose the winner to be awarded with the tender.
Award tender		Is the last process of awarded the seller with the tender by selecting the winner base on the requirements listed by the buyer.

Table 4.1: Detail Descriptions of WIRA Business Process

4.4 Web based Intermediary Reverse Auction Module

This section will explain in details the business process of Web based Intermediary Reverse Auction (WIRA). The business process of WIRA as showed in the Figure 4.5 is divided into 3 important modules and there are the Advertisement Module, Bid Submission Module and Bid Evaluation and Price Computation Module.

4.4.1 Advertisement Module
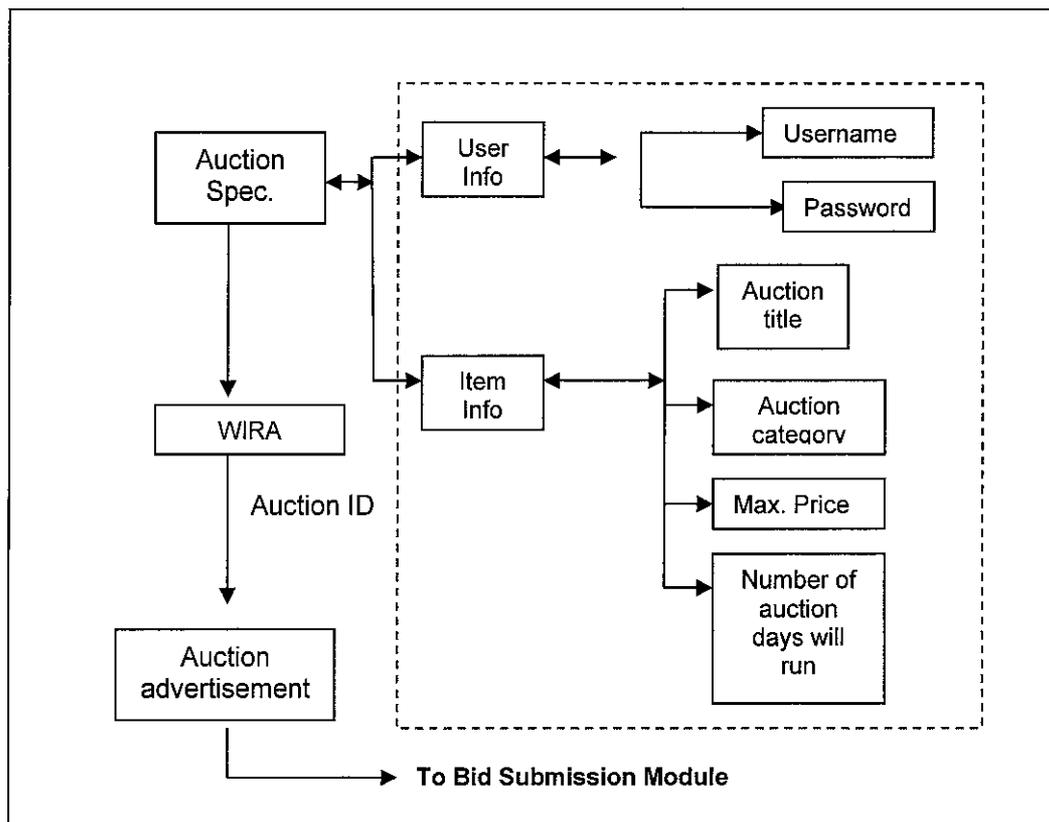
Figure 4.6: Advertisement Module

Auction process will begin when a buyer advertise the tender or products or services that they want to procure. The detail of the auction called auction specification. Auction specification is the important input for reverse auction website. As showed in Figure 4.6 the auction specification is from the form (user info and item info) that buyers have to fill in. After all the requirements are filled

and submitted, the system will generate an auction ID to the auction specification and advertise it in the website.

4.4.2 Bid Submission Module
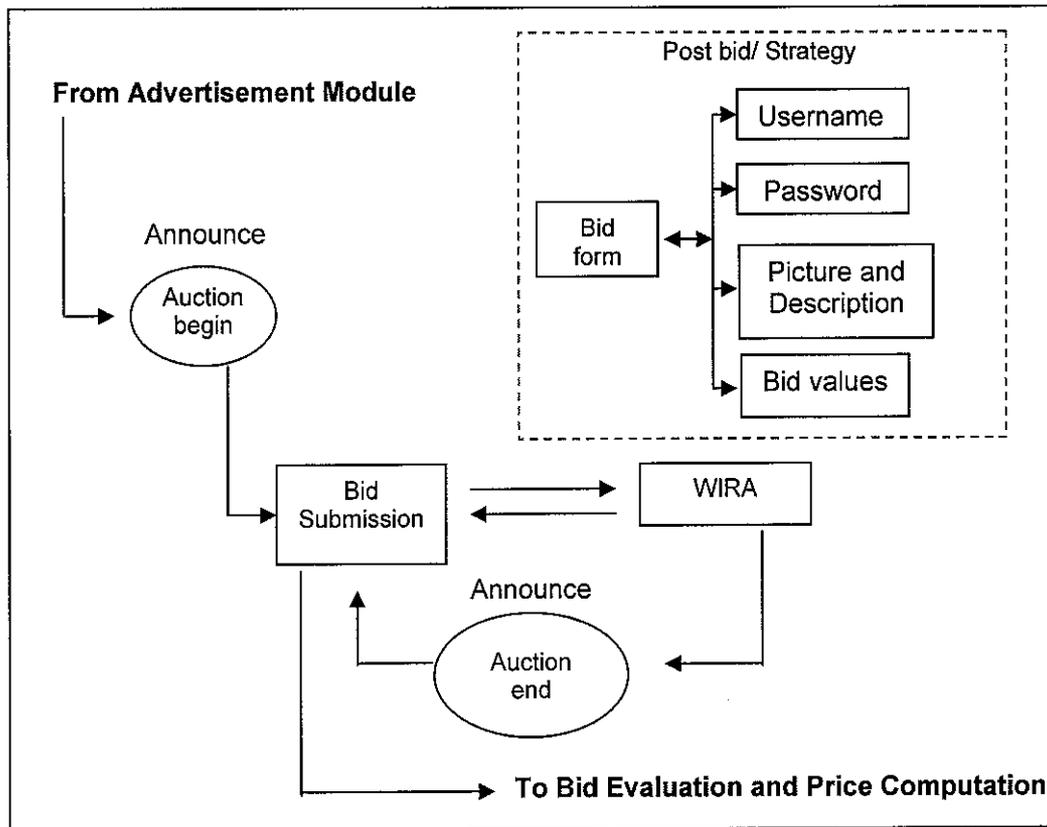
Figure 4.7: Bid Submission Module

Figure 4.7 shows a bid submission module. A seller can immediately post their bid on the products that they want to sell instantly after the buyers post the advertisement. In order for a seller to post the bid first, they must have an account with WIRA. Then sellers can fill in the bid form. Bid form consists of username, password, picture and description and also the bid values. A seller also can post as much as bid as they want until the time for that particular auction item is reached its due date.

4.4.3 Bid Evaluation and Price Computation Module

From Bid Submission Module

```
                    WIRA  ─────────────►  Buyer's evaluation
                                          and computation
                                                │
                                                ▼
                    Seller  ◄─────────────   Result
```
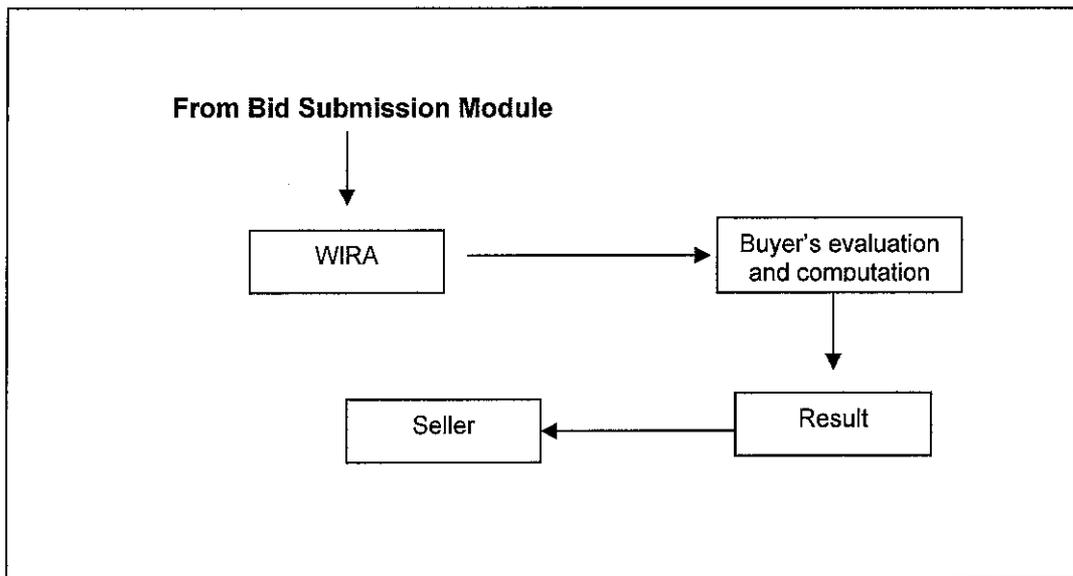
Figure 4.8: Bid Evaluation and Price Computation Module

Figure 4.8 shows the bid evaluation and price computation module. Each bid submitted by seller will be kept in the database. This is because, all the history will be used by the buyers to identify a seller that will be the winner, and the winner is selected base on certain criteria. For example, the criteria that a buyer look when selecting the winner is whether a seller can provide maintenance services for the product if a buyer choose them. So it is important for a seller to fill in the bid form especially on the picture and description section. This is because, a seller can be distinguished from the other seller that bid for the same item.

4.5 Logical Design of WIRA

This section will discuss on the logical design of Web based Intermediary Reverse Auction (WIRA). In order to develop the system, a dataflow diagram is created. The purpose of having the data flow diagram is to help to identify and understand the flow of the system. A story board of this system also has been drawn. This is to make sure the design of the website is formal and user friendly.
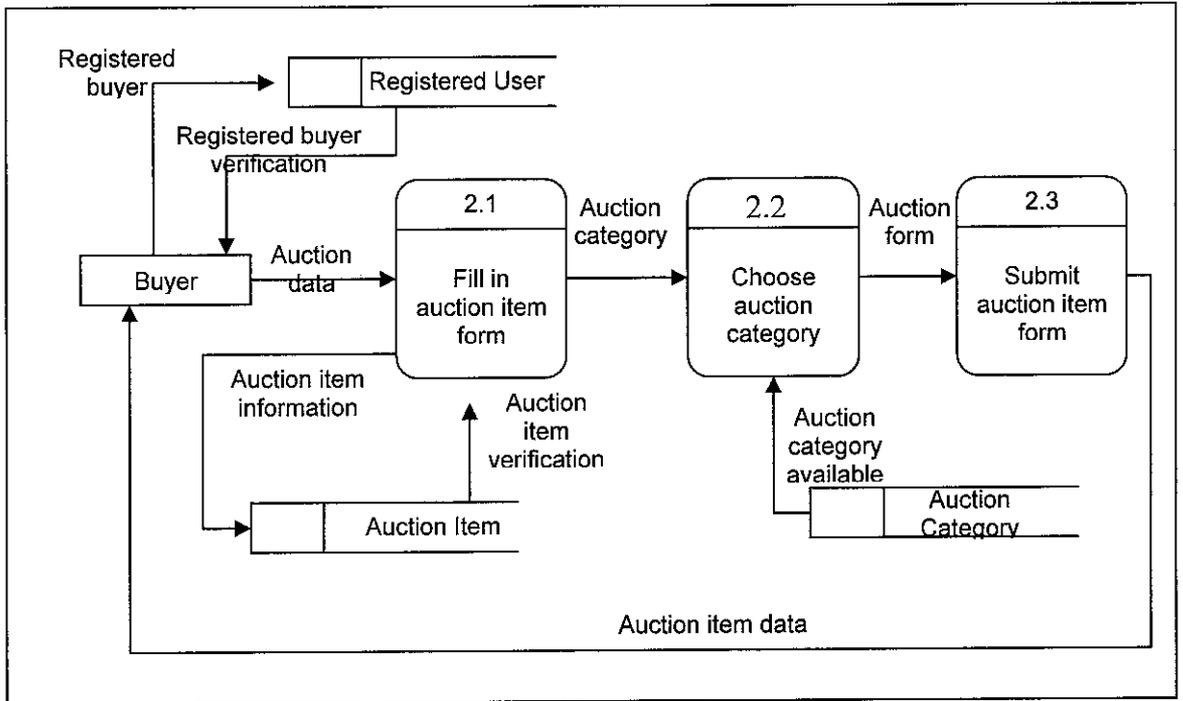
4.5.1 Concept

After completing analysis phase, the development of prototype will take place. The prototype is web based and user must have internet connection in order to access it. The prototype will be developed based on the requirement analysis done in the analysis phase. The website's design will be formal and user friendly for the SMEs personnel to use.

Web based intermediary reverse auction for SMEs is a web based auction website that can help SMEs to do business. In other words, this website is like a system that can help SMEs to get item or goods or services they want to procure because the system acts like a market place where the buyers will dominate the website.

This system requires SMEs to create an account with the reverse auction website. Upon the registration by the user, the user will be given a user name and password in order to place an advertisement and also to sell goods. There will be an administrator that will assist the SMEs personnel if they have encounter problems or they have inquires. Administrator is the responsible person that controls the website and also to make sure that the website is running properly.

4.5.2 Data Flow Diagram

Figure 4.9: Data Flow Diagram (level 1)

Figure 4.9 shows a data flow diagram for Web based Intermediary Reverse Auction (WIRA). As showed in the diagram there are 3 entities, the buyer, seller and admin. Both buyer and seller are from small and medium enterprises (SMEs) and they can be the same person that will perform either seller or buyer task. In order to be able to use WIRA, a buyer and seller need to create an account then only they can perform other function provided. As for buyer, they can post or advertise new auction item that they want to buy or procure, while seller can submit their bid for the goods that needed by the buyer.

Figure 4.10: Data Flow Diagram (level 2)

Figure 4.10 depicts the data flow diagram for "Post new auction item form". A registered user or buyer can post their advertisement of the product that they want to procure by fill in the auction item form. Then a buyer need to choose a category that best suited the goods that they want to procure. For example, a buyer wants to procure an A4 paper for 6 months tender, therefore the auction category should be under stationary category.
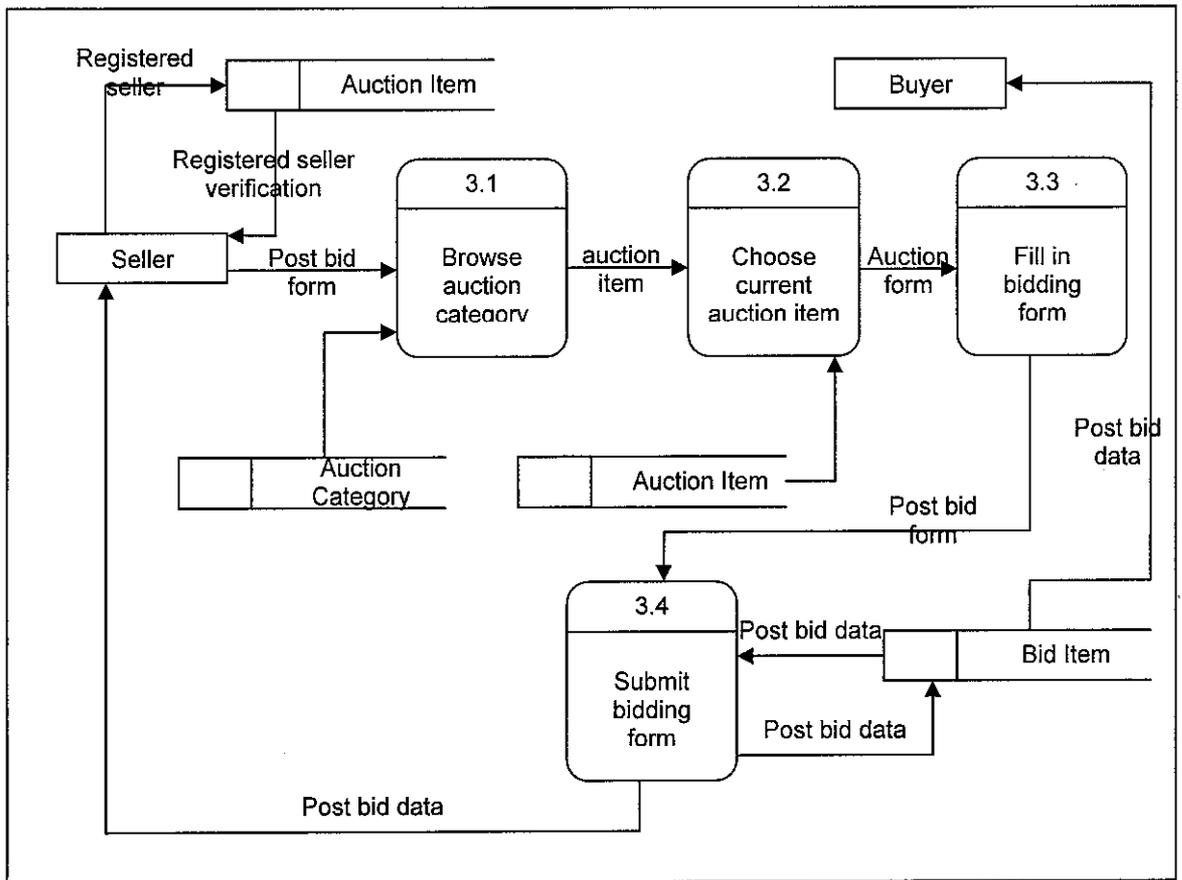
Figure 4.11: Data Flow Diagram (level 2)

Figure 4.11 depicts the data flow diagram level 2 for submit "Submit bid item form". Registered users are able to use all the features in the Web based Intermediary Reverse Auction (WIRA). To post a bid, a seller need to choose the auction category that they interested and then a seller will lead to the next page which list all the advertisement (auction item) that still running posted by the buyer. After a seller chose an item that they interested to sell they have to fill in and submit the bidding form.

4.5.3 User Interface

Front page of WIRA
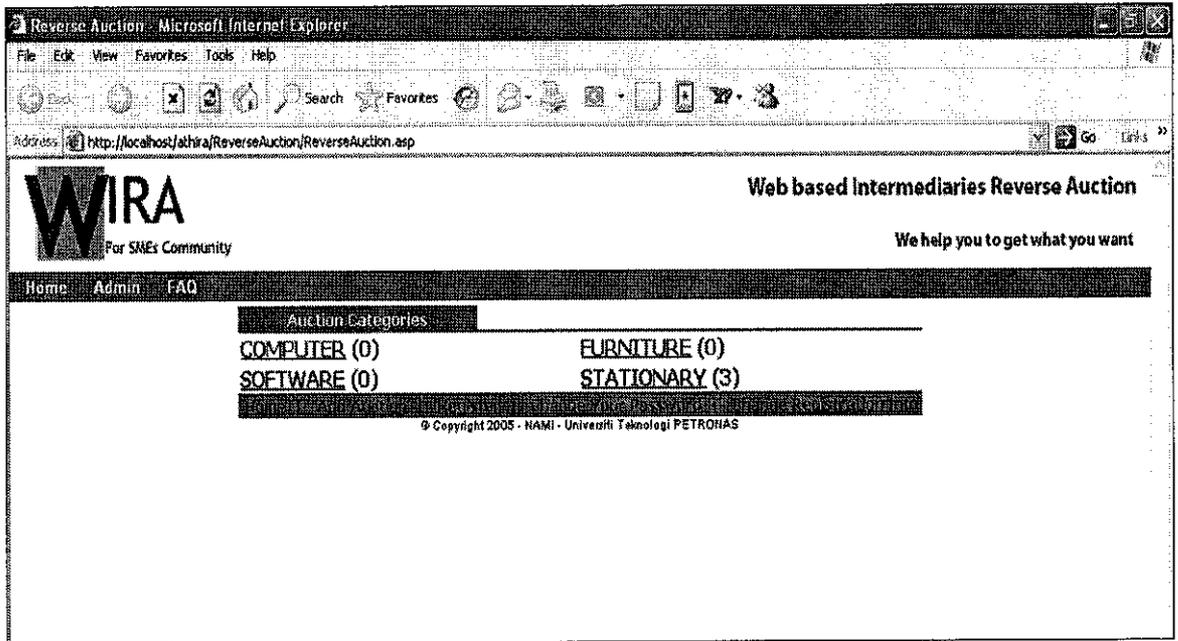
Figure 4.12: Front Page and the Auction Category

Figure 4.12 shows the front page and the auction category of WIRA. SMEs (buyer and seller) will see this page first before they can proceed with any auction activities. SMEs can choose any categories under auction categories listed in the front page.

Figure 4.13: Current Auction Page

After the buyer or seller has chosen the auction categories that they are interested, they will be lead to the next page that showed the current auction that still opened to bid. The current auction will be mark or labeled as hot when the bid post by the seller more then minimum bid post as showed in the Figure 4.13.
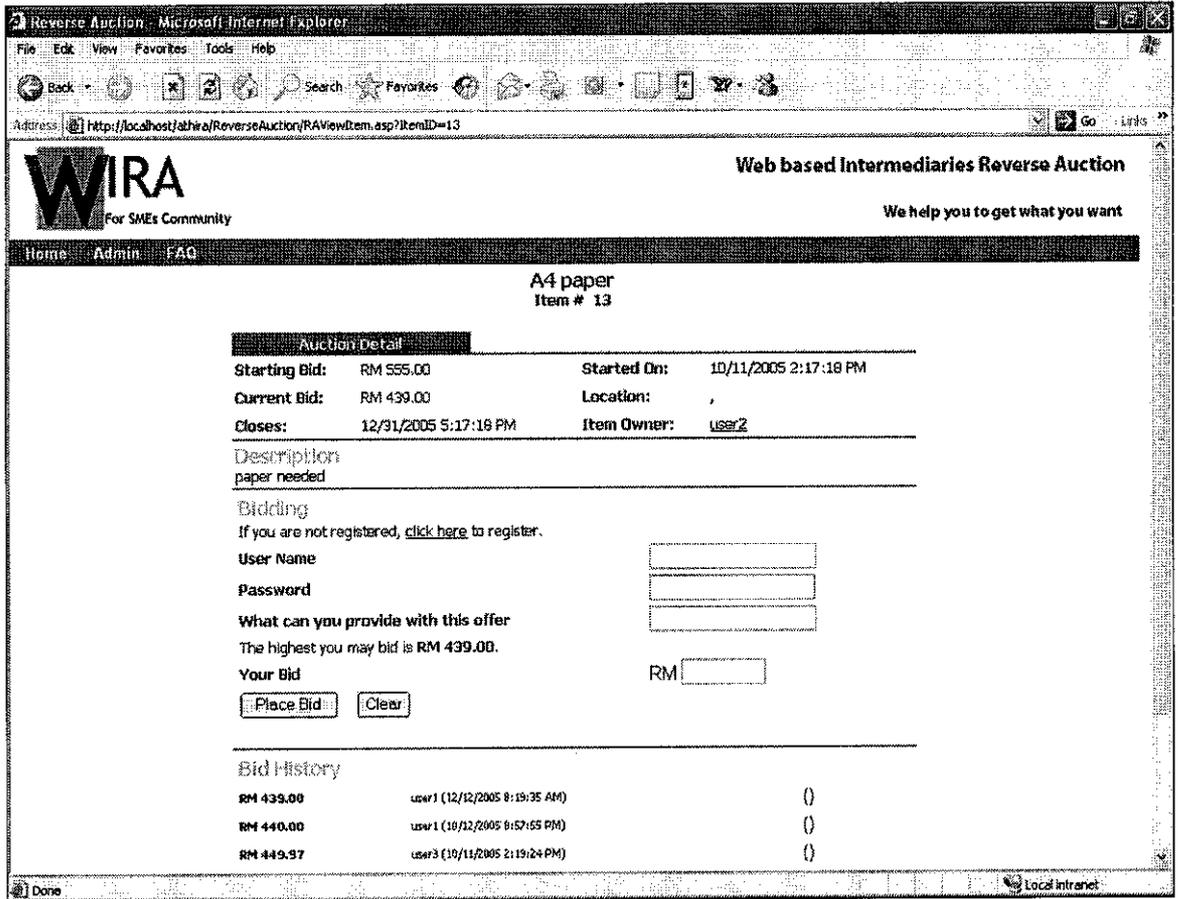
Figure 4.14: Post Bid Form

Figure 4.14 depicts the post bid form that sellers have to key in to place a bid. Seller will see this page after they have choose what item category that they want to sell showed in the Figure 4.12. In the figure showed a form that has been divided into 4 partitions and there are the auction details, description of the item that a buyer want to buy, bidding form where only registered user can post a bid and the last partition is the bid history that shows all the history of seller that has post their bid.

Figure 4.15: Advertisement/ Add Auction Page

Figure 4.15 shows the form for advertisement or add auction page. This page is meant for buyer to post or advertise the auction that they want to buy or procure. A buyer has to key in their user name and the password in order to submit the advertisement. In the form showed that the buyer also has to key in the bid information about goods or services that they want to procure or buy. Buyer can place an item to bid by clicking the Add Auction button.
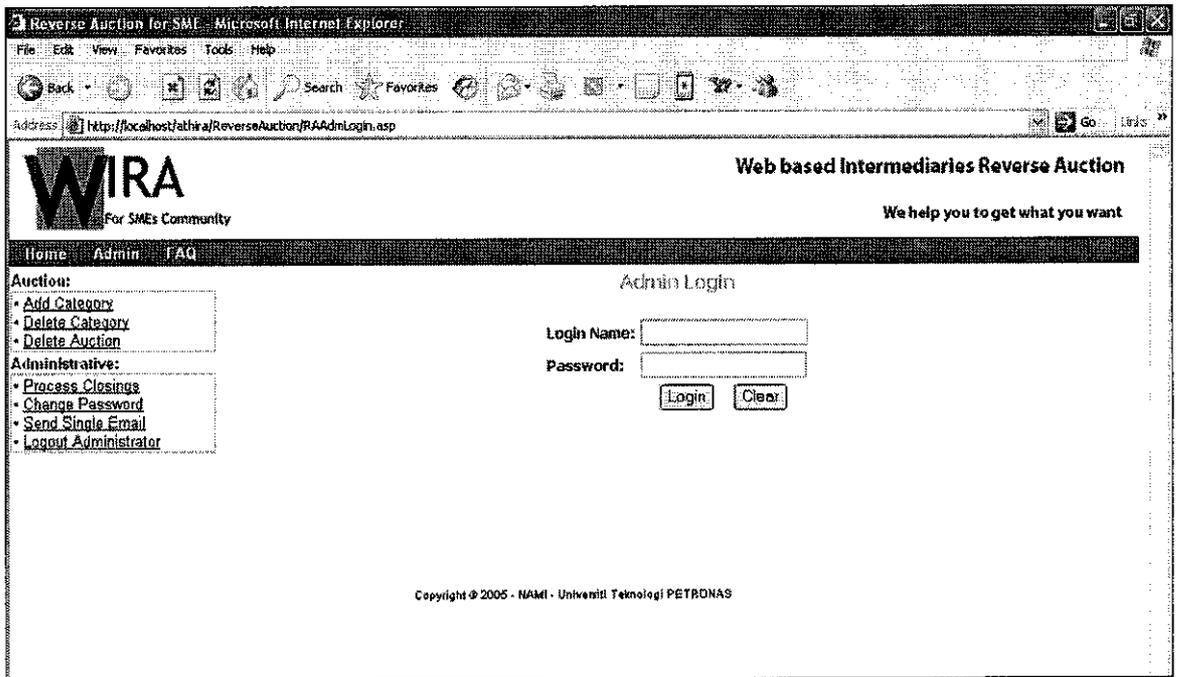
Figure 4.16: Admin Login Page

Figure 4.16 shows the admin login page. There are 2 types of main function that administrative of the website can do and there are the Auction and Administrative. For the Auction function, admin can add auction category, delete auction category and also can delete the category of the auction. Besides that, admin been equipped with the administrative function as showed in Figure 4.16. Other administrative functions are the process closing features where this features will indicate which auction has reached the date line, change password where admin can change his password and the user password if the user forgot the password and send single email where admin are able to send email by using WIRA to user.

CHAPTER 5
CONCLUSIONS

5.1 Conclusion

Research on procurement and reverse auction has been done and there are few articles and journals found which mentioned that online reverse auction can help to improve procurement activities. Online reverse auction can help most of the SMEs in Malaysia in term of procuring goods or services. The benefits of having online reverse auction are; SMEs can lowered the costs of procuring products because of the price SMEs have to pay on the procured goods or services is lower than any other offers, SMEs also can reduce the time taken to find all potential suppliers and can eliminates the negotiation process.

The limitation of having online reverse auction is that not all products can used this method and there is no guarantee that the product or services is as good as before since the suppliers are forced to be speedy and lower the price for products and services. Therefore clear understanding of the online reverse auction is needed in order SMEs can enjoy all the advantages of having this website as they have to move quickly and responsive to changing business conditions.

5.2 Recommendations

For this project, the most crucial part is the analysis part. It is important to understand the ground of the project before develop it. The requirement of the project is depending on the research done. This project only takes 1 semester to complete it which make research and analysis part to be completed quickly in order to proceed with other task. If there are more time given, more data will be able to collect for example distribute questionnaires to selected SMEs company. With more analysis done, it will create better understanding on the project title.

The scope of the project can be broadened by incorporate with payment system which will involve the third party such as the bank and finance institution. For future expansion of the project, it is recommended that a study and analysis of using an agent in the system can be done. The different concept of the prototype and ideas may help in rationalizing all the limitations of the prototype developed.

5.3 Future Enhancements

There are a lot of features and ideas can be generated for the future enhancements. Some of the features that can be included in the prototype of the website are:

• Forum and comments drop box.
Due to the time constraint and lack of skill, this requirement could not be implemented. It is advantageous if these requirements can be implemented in the web based intermediary reverse auction.

• Term of payment features.
This feature can be applied in the system in the future, to make the system capable in handling the payments method made by the users.

• Deliveries of product of service charge

This system does not have this feature included in the prototype. If possible in the future, this feature can be added up in the system so that this prototype can handle the deliveries of the product or service charge and become more functioning.

• Increased time to conduct research

If given an opportunity and more time to do the research on online reverse auction, the study of online reverse auction will be more valuable. Questionnaires can be distributed to selected small and medium sized enterprise so the analysis and the research part of this project will be more relevant.

• New programming languages

Other programming languages such as PHP, JSP or even XHTML can be considered to be used in the future. This programming language can be chosen based on best suited for the development of the website.

• Admin function

Admin function in this system is limited to a few simple tasks. It is advantageous for the website to have such good admin function for administrative staff to cater any problem faced by the user of this website.

5.4 System Limitations

The prototype of the system that has been developed is not fully functioning. This is because some of the features which are important are not included due to lack of time and skills. The features that are not included are the terms of payments and deliveries. Besides that, the admin function is limited with a few features such as the Add Auction, Add Category and Delete Auction or Delete Category. Admin should have more functions that will help him to do his task and help him to manage the system efficiently.

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APPENDICES

#	Task Name	Start	Finish
1	Selection of Proposed Topic	Fri 5/13/05	Fri 5/27/05
2	Propose Topic	Fri 5/13/05	Mon 5/16/05
3	Topic assigned to student	Fri 5/27/05	Fri 5/27/05
4	Self Learning and Research	Fri 5/27/05	Mon 10/31/05
5	Website Scripting	Fri 5/27/05	Mon 10/31/05
6	Research on Topic Assigned	Thu 6/9/05	Fri 9/9/05
7	Preliminary Research/ Design Work	Mon 8/1/05	Thu 8/11/05
8	Abstract	Thu 8/11/05	Thu 8/11/05
9	Introduction	Mon 8/1/05	Mon 8/1/05
10	Literature Review/ Theory	Mon 8/1/05	Mon 8/8/05
11	Methodology	Tue 8/9/05	Tue 8/9/05
12	Conclusion	Wed 8/10/05	Wed 8/10/05
13	Submission of Preliminary Report	Fri 8/19/05	Fri 8/19/05
14	Project Work and Project Development	Mon 8/1/05	Fri 9/30/05
15	List of Reference/ Literature/ Questionaires	Mon 8/1/05	Fri 9/9/05
16	Website Development	Mon 8/29/05	Fri 9/30/05
17	Progress Report/ Design Work	Mon 9/12/05	Wed 9/28/05
18	Abstract	Mon 9/12/05	Mon 9/12/05
19	Introduction	Tue 9/13/05	Tue 9/13/05
20	Literature Review/ Theory	Wed 9/14/05	Mon 9/19/05
21	Methodology	Fri 9/16/05	Tue 9/20/05
22	Result and Discussion	Mon 9/19/05	Mon 9/26/05
23	Conclusion	Wed 9/28/05	Wed 9/28/05
24	Submission of Progress Report	Fri 9/30/05	Fri 9/30/05
25	Project Work and Project Developement Continue	Mon 8/29/05	Fri 11/11/05
26	Website Development	Mon 8/29/05	Fri 11/11/05
27	Final Draft	Mon 10/10/06	Fri 10/28/05
28	Abstract	Mon 10/10/05	Mon 10/10/05
29	Introduction	Wed 10/12/05	Thu 10/13/05
30	Literature Review	Fri 10/14/05	Tue 10/18/05
31	Methodology	Tue 10/18/05	Wed 10/19/05
32	Result and Discussion	Thu 10/20/05	Wed 10/26/05
33	Conclusion and Recommendation	Thu 10/27/05	Fri 10/28/05
34	Submission of Dissertation Final Draft	Fri 10/28/05	Fri 10/28/05
35	Oral Presentation	Mon 11/14/05	Mon 11/14/05
36	Submission of Project Dissertation	Wed 11/23/05	Wed 11/23/05

Project: Gantt chart FYP
Date: Thu 12/22/05

Task		Milestone	◆	External Tasks	
Split		Summary		External Milestone	◆
Progress		Project Summary		Deadline	⇩

Page 1

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Project: Gantt chart FYP
Date: Thu 12/22/05

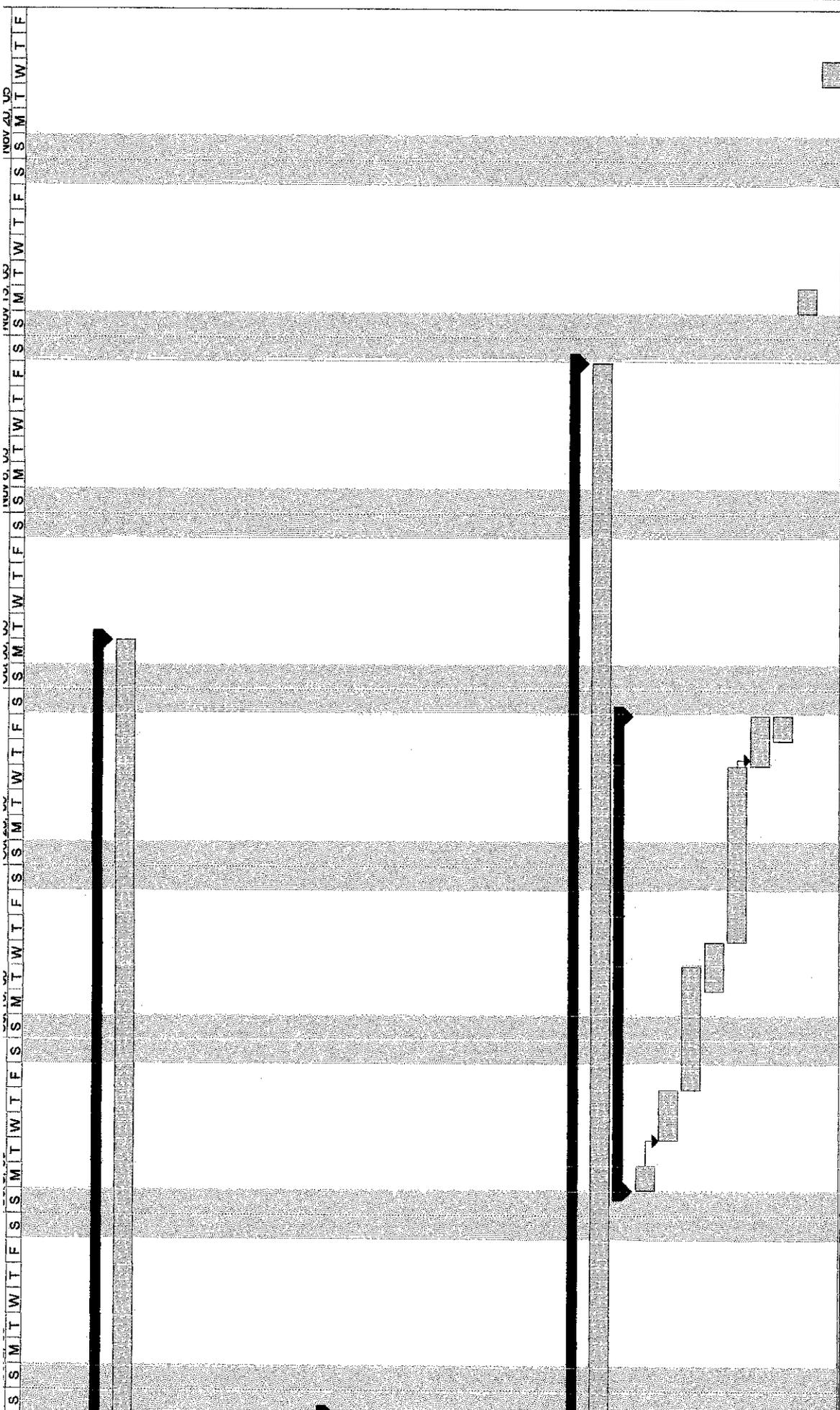| Task | | Milestone | ◆ | External Tasks | |
| Split | | Summary | | External Milestone | ◆ |
| Progress | | Project Summary | | Deadline | ⇨ |

Task

Split

Progress

Milestone

Summary

Project Summary

External Tasks

External Milestone

Deadline

Project: Gantt chart FYP
Date: Thu 12/22/05

Project: Gantt chart FYP
Date: Thu 12/22/05

Task	Milestone	External Tasks
Split	Summary	External Milestone
Progress	Project Summary	Deadline