DEVELOPING AGENT TOOLS AND DECISION SUPPORT SYSTEMS FOR E-COMMERCE

By

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Final draft submitted in partial fulfillment
of the requirements for the
Bachelor of Business Information Systems (Hons)

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Business Information System Programme
Universiti Teknologi PETRONAS
in partial fulfillment of the requirements for the
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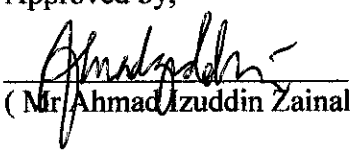
Approved by,

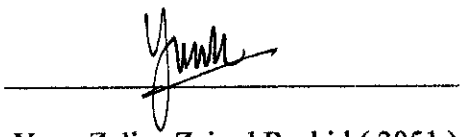


(Mr. Ahmad Izuddin Zainal Abidin)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
JUNE 2005

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 person.



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ABSTRACT

Despite the explosive growth of electronic commerce and the rapid increasing number of customer who use interactive multimedia, such as the World Wide Web for purchase information search and online shopping, very little is known about how customers make purchase decision in such settings. Thus, in the rush to open their website, e-commerce sites too often fail to support consumer decision making and search, resulting in a loss of sales and the loss of loyal customers. To overcome this weakness in the traditional e-commerce website, this project reviews the open problems that e-commerce website poses to the framework and to existing search engine technology for online shopping. Besides that, this research also involves design of the methodology for the development in supporting decision support making systems. Generally, the development of this e-commerce site showed that, the traditional e-commerce applications do need to be improving by integrating an appropriate decision making system by using an Intelligent Agent to aid the customers in their purchase decision-making process. Scope of study will focus into Business-to-Customer (B2C) models. In depth research will be conducted: survey, interviews, self-assessment, and online researches and from other written materials. The result can be determine when the developed e-commerce site used extensively on the Web, that perform tasks such as retrieving and delivering information and automating repetitive tasks by the developing Intelligent Agent software or services. It also used as tools to track Web behavior which they can even "watch" as user's surfing site and record how often they visit certain sites. Later, they can be used to automatically download the favorite sites, let them know when their favorite site has been updated, and even tailor specific pages to suit their tastes.

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BISMILLAHIRRAHMANIRRAHIM. ..
In the name of Allah, the Beneficent, the Merciful. ..

This final year project had been a struggle to the author. If it is not for most supporting people, this final project would not be complete.

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CHAPTER 1:

INTRODUCTION

1.1 BACKGROUND OF STUDY

" The title of the project is Intelligent Agent to support decision making on e-commerce". The anticipated outcome of this project is a methodology or process on Decision Making into e-commerce system development. Another outcome will be an e-commerce website being developed using a methodology with integration of the application Intelligent Agent.

The rapid expansion of the Internet is enable electronic commerce to become an important means for offering customers a simple way to select and purchase products. Over half of today's 80 million web uses shop for a product online and business to business purchasing is expected to rapidly eclipse that level. However, in the rush to provide online presence, many e-commerce sites have been built quickly, with little infrastructure and capabilities of its own features which needed to run such an e-business.

One important issue in electronic commerce online shopping, which encompasses the problem of examining the available products and comparing them in order to select those satisfying customers' needs. A major problem associated with electronic shopping is the cost and time spent to find some relevant information about products and services. In fact, a customer visiting an electronic store often

faces considerably difficulty in finding the product that he/she most desires also because of the fact that there is no assistance in this selection phase.

The users approaching the online shopping environment have different ways to access the big amount of available and, mostly unknown, information, which are related to the purpose of their search. The most immediate way is to navigate directly through the website by means of a chain links found in the pages; in this way, a formal expression of information needs is not necessary. However, when some specific information is searched, this point-and-click access paradigm is unpractical, and the effectiveness of the result strongly depends on the starting page.

For example, as we all know only too well, browsing, searching and buying via online web catalogs can be a time consuming, frustrating task. Boston Consulting Group Matrix (BCG), for example reports that over 80% if web shoppers have at some point left the e-commerce website findings what they want ad that 23% of al attempted e-shopping transaction end in failure.

To date, we know that the process of findings information via search functions provided is simply too complicated for internet-naïve people to use without very high levels if support. And some users who claim to surf on a regular basic are still having problem using search engine. For example, Neilson gave users the task:

> You have the following pets:
>
> - Cats
> - Dogs
>
> Find information about your pets.

Almost all users enter the query 'cats AND dogs'. They typically find nothing, since the site does not include pages that mentioned both animals. Upon encountering a "no hits found" message, the vest majority of users concluded that there was no information available about these and departed form the site. In short, it hinders the customer purchase decision making in the online shipping environment.

As a result, the definition of systems that help users to access information relevant to their needs is a very important research field. The activity of these systems is based on the solution of decision making problem: how to identify the items that corresponds to the user's information preferences?

Thus, the development of tools (interactive decision making aid agents/consumers decision support system) that assists customers in making their purchase decisions by customizing the electronic shopping environment to user's individual preferences is desirable for both customer and vendors. The availability of a customer preferences model allow both dynamically configure the website to make the customer's search easier and increase the probability of the customer in undertaking a commercial transaction.

1.2 PROBLEM STATEMENT

1.2.1 Problem Identification

The main problems that have been identified are as following:

- *Available search engine provided by current online shopping application is not effective enough to aid in customer purchase decisions.*

  Consumer behavior theory indicates that users will spend substantial time searching and comparing products. To facilitate this effort, just as good human sales representative, the search should culminate in what the user wants and not confounded by how they said it. However, current search technologies available are almost exclusively keyword matching, which means the given search will only match on exactly what is typed and not what was meant. Thus, results in ineffective search results, which might be further mislead the customer into a low quality purchase decision.

- *There are limited numbers of appropriate tools/functions in the current e-commerce website that help the customers in their purchase decision making process.*

  Findings results showed that current e-commerce website only provided the customers with the basic search technology and simple product comparison functions to them in their online shopping process. Current tools provided is not sufficient enough to help the customers to decide which products options that best suit their preferences, as there is no comparison and analysis have been done on those products that have been listed in the customer's search scope.

- *Increasing number online browser but not online consumer.*

  Online browser here refers to those customers who just browsing for products information through the online shopping website but buy the product offline. This decrease probability of the customers in undertaking a commercial transaction had also proven that the current online shopping

sites are not capable of supporting the customer's decision making process(although the security issue might contribute to the decreasing statistic too).

- *No any active agents to help the users while browsing the web.*

  User sometimes did not get the enough information when they serve the net because of the limitation of the site services. Some troublesome may occurred during the surfing when caused the user have to browse another site which related the current site that they currently serve. Some of them have to memorize the desired site for future use. They have to spend more time on this surfing because they have to open another of new window that link to original site. The sites also do not only contain information relevant to the users care, but also all the other activities of the agent, that is would be unwilling to make available to other parties, the actual management of community care has remained primarily outside the role of current systems (sites).

1.2.2 Significance of project

The incredible idea of exponential growth for things Internet seems almost like old hat these days, and according to the December, 11 Internet Daily, exponential growth is now spreading to e-commerce.

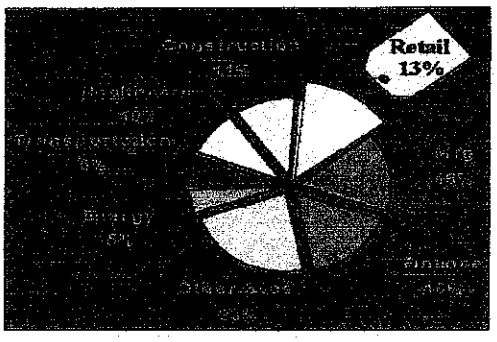


Figure 1.2.2.1 E-Commerce Trend in the Future

A survey done by IntelliQuest, cited in the November 2003. The study found of 10,000 Internet users surveyed, 81% intend to shop or buy online during the next year, 63% have already shopped online, and 22 percent have made purchase online within the past three months. And there will be more: "Overall there are three to five times more people intending to shop or buy than are currently shopping," e-Marketer says.

According to the surveys mentioned above, we can conclude that the traditional store-front business is going to be replaced by the online shopping business in the near future. Thus, the online shopping experienced and the customers online purchase behavior and decision becomes relatively important factors that will contribute to the success of one e-commerce business.

The following figure shows the result of a research done by XtraMSN on what customers seek for in online shopping environment.

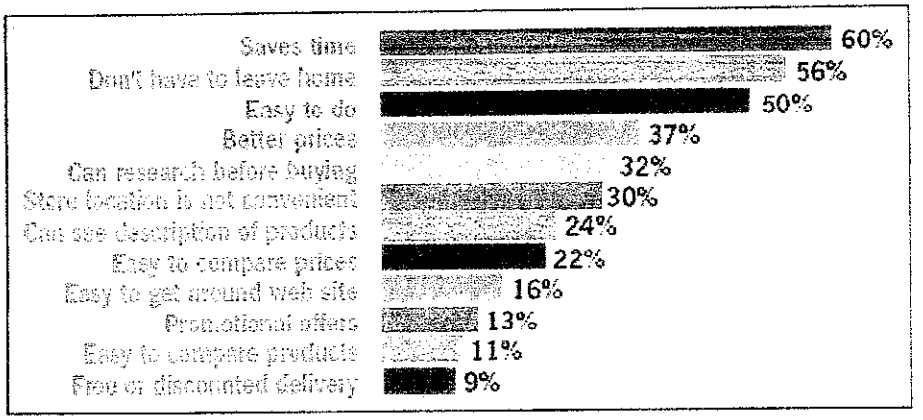


Figure 1.2.2.2 Statistic On What Customer Seeks For In Online Shopping Environment

Out of 12 attributes are the customer seeks for in online shopping environment, there are 4 attributes (can research before buying, can see description of products, easy to compare price, easy to compare product, prompt to another related website), which are related in contributing to customer's buying decision. This shows the importance of buying decision making in online shopping environment.

With the technology available, it is possible to improve the customer's decision-making process in online shopping environment. For this reason, this project focuses on the online decision making process and aim to produce an appropriate decision support system to be integrated into the current traditional online shopping website. This will help in improving customer's decision-making process, as well as reduce the frustrating and time-consuming product comparison process. As result, it will further improve the online shopping experience, which will further guarantee the success of the transformation of the traditional business into the electronic business.

1.3 OBJECTIVES AND SCOPE

1.3.1 Objectives

The main objectives of this project are as following:

- To develop a simulation of working prototype of online consumer's decision support system.
- To enhance the customer's online shopping experience by provide the customer a tool to improve the purchase decision-making quality.
- To develop the most important assistance on e-commerce which known as an Intelligent Agent.

1.3.2 Scope of Study

This project covers a research process that involves analysis and studies activities on the current online shopping website and the current available technology that aid in the customer's purchase decision making process.

The project is not focused entirely on the research area, but as well to design and develop a working prototype of a online decision support system for online shopping application based on the result of analysis.

There is no formal testing involved in this project, but there are a few informal testing by group of predefined users to ensure that the prototype functions as required. Besides that, there is also a simple user acceptance testing (UAT) to ensure the system meets one of its objective, which is to enhance the online shopping experience.

The detailed framework of the project will be further discussed in Chapter 5 Result and Discussion.

1.3.3 Relevancy of Project

To determine the relevancy of the proposed project, let's first review the role within the e-commerce. Basically, e-commerce transaction has two roles: seller and consumer. Each of these roles has its own agenda. This project is only to focus on the consumer's role.

Consumer expects three important features from a typical transaction: (1) they want to make the decision to purchase something, (2) they want to effect payment for their purchase and (3) they want to assume ownership of what they purchased. Anything that interferes with these three components is going to bother the consumer. Note that the consumer's decision to purchase something is our main concern in this project. Consumers request to find what they want, evaluate their budget, evaluate the product, etc.

As the proposed consumer's decision support system will provide with the product representation, the product comparison and analysis and finally the best recommendation of purchase, it is relevant in supporting the consumer's expectation of the e-commerce role to enable them to make the decision to purchase something.

Besides that, the reader may also refer to the result of the questionnaire attached in the appendix to determine the relevancy and the significant of this project (refer to Appendix I). The analysis on the questionnaire showed that the users are looking forward for a tool that is able to further aid their purchase decision making in the online shopping environment.

1.3.4 Feasibility of Project within Scope and Time Frame

1.3.4.1 Technical Feasibility

The decision to develop this consumer's decision support system is practical as the author is capable to design and build the solution. Besides that range of the project
technical complexity is reduced since the author will make use of the reusable components from her previous project for the construction of this proposed system.

1.3.4.2 Operational Feasibility

The proposed system aims at eliminate the problems face by the current online shopping application (refer to Section 1.2. 1). Besides that, the questionnaire results also showed that many users support the proposed system to be implemented in the current online shopping environment to further improve the customers' buying decision-making process.

1.3.4.3 Economic Feasibility

The proposed system is foreseen to help improve e-commerce transactions in long run. Besides that, as the proposed system is just a working prototype, the author and the university's available software and hardware is sufficient enough to support the development of the proposed system, thus no additional cost is involved in the development of this system.

1.3.4.4 Schedule Feasibility

The author is given fourteen weeks to complete this project. Due to the time constraint, only a prototype version of the proposed system will be developed and only informal testing activities will be carried out.

Anyhow, the prototype version of the system will still represents mostly of the basic function of decision support system as well as agents tools to assist the users in using this website.

CHAPTER 2

LITERATURE REVIEW AND/OR THEORY

2.1 E-COMMERCE CONCEPT

Electronic Commerce (e-commerce) in general refers to any form of business transaction or information exchange with the use of Internet; using information and communication technologies (ICTs). Laudon and Traver (2001) [4] are more definite; "More specifically, we focus on digitally enabled and commercial transaction between and among organizations and individuals."

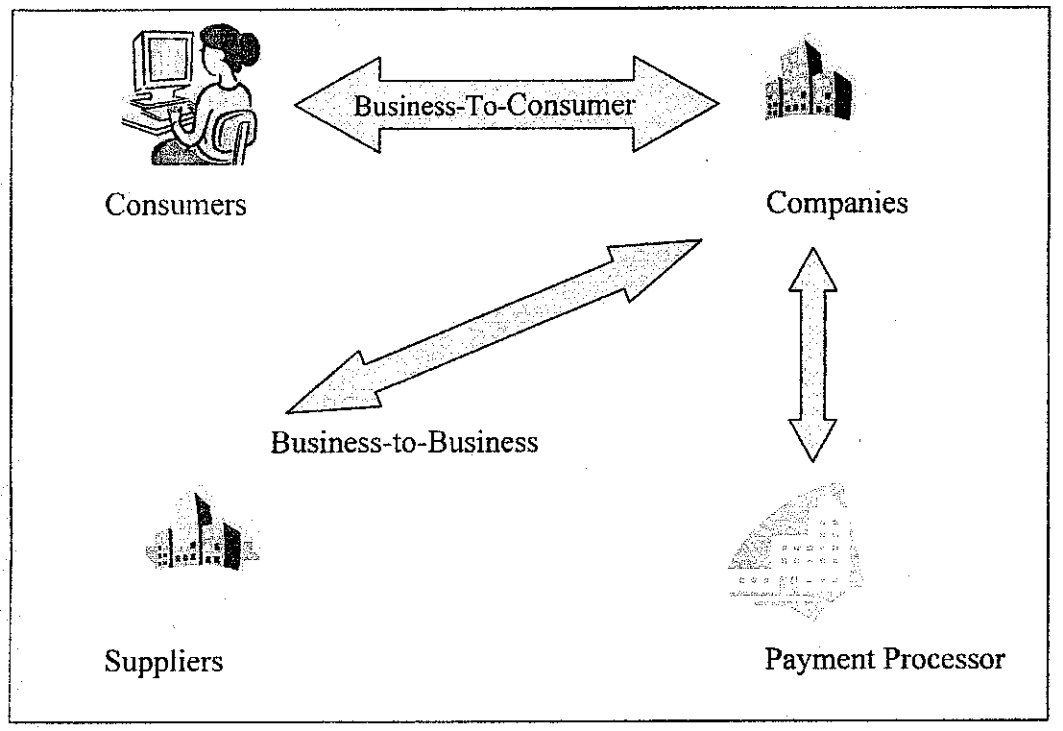


Figure 2.1 E-commerce illustrations.

Referring to the above statements, E-commerce is a subset of business, where products and services are advertised, bought and sold between customers and companies over the internet. Many businesses have become extremely profitable through online sales; Dell Computers is a prime example. Small companies and even individuals can also market their products or services on a worldwide basic through E-commerce. Large companies can reduce sales and stocking cost by selling online.

When implementing an E-business project, all the process and its structure are required to ensure the project will be successful. Later on, a failure project management case will be discussed to strengthen the needs to have a well-developed DSS methodology to maintain the project development integrity for any IT discipline.

Bhanu Prasad says that "E-commerce is the use of computing and communication technologies in commerce between some or all parts of a business and its customers. AI techniques are extensively used in the development of e-commerce systems also. The field of e-commerce can be classified as B2C e-commerce and B2B e-commerce, in terms of AI techniques involved in this field. In this paper, we present some important AI techniques that are useful in the design and development of e-commerce systems."

2.2 INTELLIGENT AGENTS

Intelligent Agent technology has evolved to become a promising technology used in aiding organizational decision making and information processing. Hence, a growing literature has appeared, although with limited focus on actual development for business applications.

An intelligent agent (IA) is a self-contained, autonomous software module that could perform certain tasks on behalf of its users. It could also interact with other intelligent

agents and or human in performing its task(s). There is now growing interest in using intelligent software agent for a variety of tasks in diverse range of applications: personal assistants, intelligent user interfaces, managing electronic mail, navigating and retrieving information from the Internet and databases, scheduling meetings and manufacturing operations, electronic business, online shopping, negotiating for resources, decision making, design and telecommunications. This paper gives a brief introduction to intelligent agents and their classification, outlines applications of intelligent agents on the Internet and Web and highlights their prospects.

San Murugesan, said that Intelligent agent (IA) is a self-contained, autonomous software module that could perform certain tasks on behalf of its users. It could also interact with other intelligent agents and/or human in performing its task(s). It is claimed as an important and exciting new paradigm in software to emerge in the 1990s and is currently a very popular area of investigation and development. The advent and widespread use of the Internet, Intranets and extranets and Web have opened vast opportunities for intelligent agents and, hence, industry academia and media are now showing great interest in development and applications of intelligent agents. Intelligent agents are currently used for a variety of tasks in diverse range of applications: personal assistants, intelligent user interfaces, managing electronic mail, navigating and retrieving information from the Internet and databases, scheduling meetings and manufacturing operations, electronic business, online shopping, negotiating for resources (p.97).

As Nwana (1996) notes software (intelligent) agent is now used as an umbrella term, meta-term or a class to represent a range of software with different characteristics and abilities. And hence, there are many definitions of an agent.

- Maes, (1995) points out "Autonomous Agents are computational systems that inhabit some complex dynamic environment sense and act autonomously in this

environment, and by doing so realize a ser of goals or tasks which they are designed." (p.1081).

- "Intelligent Agents are software entities that carry out some set of operation on behalf of a user or another program with some degree of independence or autonomy, and in so doing, employ some knowledge or representation of the user's goals and desires. It can describe, in terms of three dimensions of *agency* (degree of autonomy and authority), *intelligence* (degree of reasoning and learned behavior) and *mobility* (degree to which agent themselves travels through a network).

Another perception was by Prof. Jean-Michel SAHUT [9] which explained intelligent agent is the software, which differs from the traditional one as it is personalized, permanently running and semi-autonomous. Intelligent agent is personalized as it is able to adjust performance and range of services to user requirements. Intelligent agent runs permanently awaiting the orders given by users. It is sufficiently autonomous to carry out specified tasks with little or no human supervision. Nowadays, there are three basic types of agents existing on the e-commerce market: shopping, pricing, auctioning robots.

- Shopping Robot

  Software agent serving buyers. It is able to query multiple servers on the network (on behalf of the user) to gather information about prices and other service characteristics, like service quality and expected waiting time. Buyers delegate to agents the responsibility for searching, selecting on the basis of defined criteria and presenting available offer. In some cases agents can be empowered to purchase requested services and negotiate its price. As the question if an agent should be able to make final agreements or not is pertaining to certain security problems.

- Pricing Robot (pricebot)

  Software agent attached to a seller and having the ability to dynamically change the price of product or service to maximize the provider's expected profit. The main task of pricing robot is to browse permanently the websites of competing sellers and relevantly change prices of products. Thank to this software vendors can apply more sophisticated pricing strategies, such as dynamic pricing. The market example of a pricebot is Books.com. It queries the catalogues of three big online booksellers in the US: Amazon, Borders.com and BarnesandNoble.com and slightly undercuts the lowest of them.

- Auctioning Robot

  Software serving both, buyers or sellers. They participate in auctions on behalf of their users negotiating the most convenient price subject to a set user-specified constraints. The constraints relate to such parameters as: initial asking price, the lowest or highest acceptable price, a date by which to complete the transaction and how to change the price over time. Kasbah is a very popular auctioning bot. Here, the user creates an agent, gives it some directions and sends it off on the centralized marketplace. Another example is AuctionBot, which is more sophisticated as it enables users to create a new auction defining its type and specifying all parameters, such as number of sellers permitted or method for resolving bidding ties.

2.3 CURRENT AVAILABLE DECISION AIDING AGENT IN E-COMMERCE

In online shopping sites, consumers have decision to work out and tasks to perform that require the support of a DSS. The following table summarizes the

characteristics of current available DSS in online shopping environment, as well as a DSS modeled by the user preferences, which is an enhancement from the available DSS.

The current e-commerce applications tend to use the off-shelf general purpose software to set up the shopping pages and the simplest keyword-based search and browse technologies. These sites are "user-pull" based and cost very little to construct. Generally, they are executed to address web presence issues, and they offer little in the way of helping the consumer with anything but information access and the barest minimum of purchasing decisions functionality.

The next level is the DSS modeled by the user preferences, which is a series of effort that better understand consumer mental processes and steps during a transaction and to offer numerous default settings and templates to help with the better structured steps.

Table 2.3.1 Comparison of Available and User Preferred DSS that make take Supporting Consumer Decision Making at Shopping Sites

	DSS Characteristics
Currently Available in Online Shopping Sites (Accessed Focused).	Scope: ▪ All purpose web server & search tools useful for any domain (not just shopping) Prime Features: ▪ Linear Search & Browse ▪ Keywords Search ▪ Web Server Cost & Effort: ▪ Turn key solutions offered by many vendors but many shopping website functions and pages must be programmed.
User Preferred DSS (Transaction Focused)	Scope: ▪ Shopping focused toolset ▪ Mental model of consumer ▪ Guided choices Prime Features: ▪ Shopping site data structure and web server applications ▪ More intelligent keywords Search ▪ Products comparison and analysis (generated graph to assist comparison). Cost & Effort: ▪ Focus on catalog content integration and numerous GUI issues to aid interactive decision making.

CHAPTER 3

METHADOLOGY/PROJECT WORK

The process of developing this consumers decision support system for the online shopping website, involved the design and development for a few components. Due to the time constraints, the author has decided to design and construct the system's sub-components concurrently.

3.1 PROCEDURE IDENTIFICATION

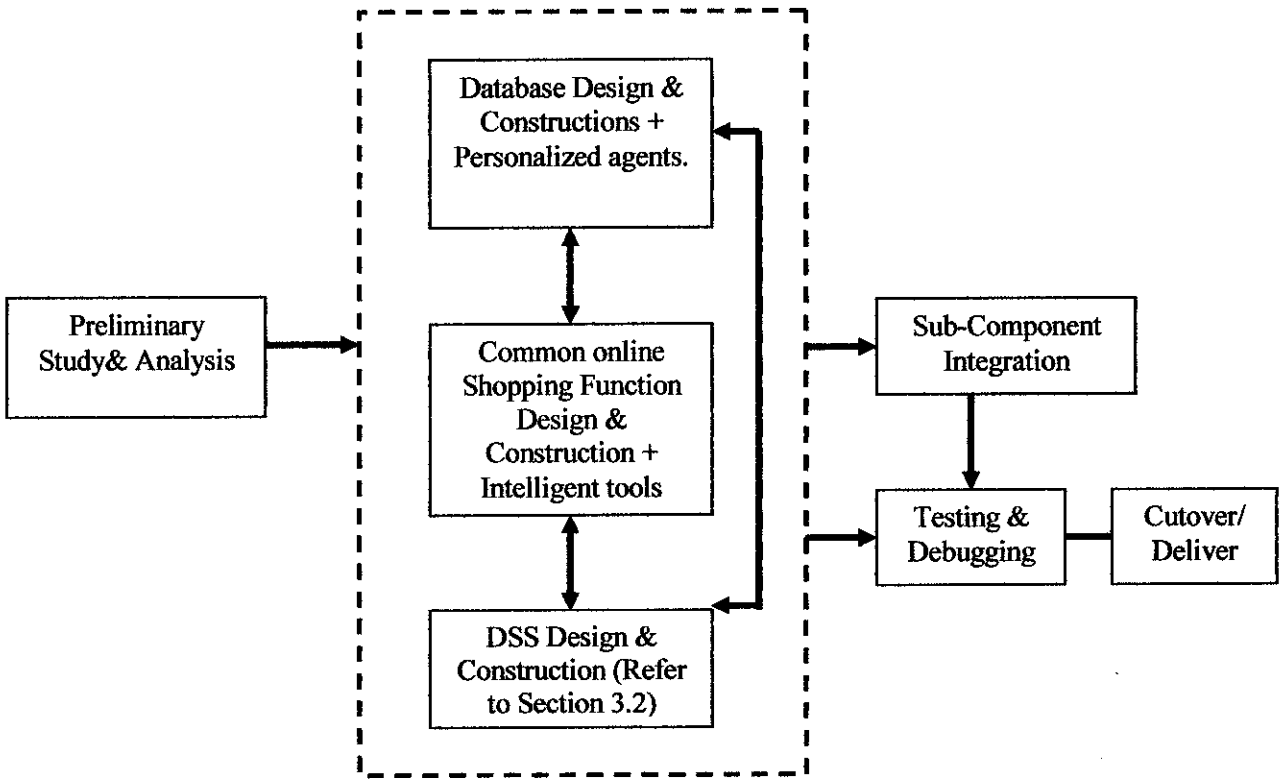


Figure 3.1.1 Development Model of Proposed System Prototype

1. Preliminary Study & Analysis

a) Tasks/Activities

- Determine the feasibility of the proposed project.
- Review samples of similar system and study the design of the system as guideline of the development of proposed system.
- Get consultation from university's supervisor and training host company's supervisor regarding to the project topic chosen.
- Gather information on decision support system.
- Define basic system flow, scope as well as objectives of project.

b) Methods

- Interview session with experiences personnel in the DSS field.
- Surfing internet for extra information.
- Readings on journal or references with related topics.
- Questionnaire analysis.

2. Database design & Construction

a) Tasks/Activities

- Review the functionality and capability of Microsoft SQL Server.
- Plan objects and attributes to be used in the system.
- Design basic database structure and relationship.
- Review on web data mining and data warehouse topic.
- Construction of database.

b) Methods

- Readings on references book about SQL and web data mining (XML on e-commerce application).
- Surfing internet
- Use of Microsoft SQL Server
- SQL queries.

3. Common Online Shopping Function Design & Construction

a) Tasks/Activities

- Review available online shopping website
- Design flow and available function for system.
- Design website interface
- Modification of existing components to best suit proposed system needs.
- Coding and construction of functional online shopping website.

b) Methods

- Collect useful code from previous project and internet.
- Internet surfing.
- Use Macromedia Dreamweaver.

4. DSS Design & Construction

a) Tasks/Activities

- Review available DSS structure
- Research on consumer's online decision-making process.

- Design decision-making process flow of the system.
- Integrate XML package to enable graph generation.
- Define and plan how information to be analyzed and how comparison to be made.

b) Methods

- Internet surfing.
- Readings on journals and references books.
- Macromedia Dreamweaver, XML, Microsoft SQL.

Refer to Figure 3.2.1 for further details on the used methodology to develop the decision support system.

5. Sub-Component Integration

a) Tasks/Activities

- Conduct initial functionality test on each sub-components.
- Conduct usability test on each sub-components.
- Prepare test cases and documents test result.
- Integrate sub-components to form the final system.

b) Methods

- Macromedia Dreamweaver, XML, Microsoft SQL server
- A few fellow students will be selected to participate in the testing activities and feedback will be documented.

6. Testing & Debugging

a) Tasks / Activities

- Prepare test cases and documents test result.
- Test the system as a whole.
- Conduct user acceptance testing (UAT).

If there is error found, modification and changes will be made and the system will be tested again.

b) Methods

- Macromedia Dreamweaver, XML, Microsoft SQL server.
- A few fellow students will be selected to participate in the testing activities and feedback will be documented.

7. Cutover/Deliver

a) Tasks/Activities

- Project completion.
- Prepare installation and migration document.
- Prepare user manual.

b) Methods

- Documentation.
- Project presentation.

3.2 METHODOLOGY FOR DSS DEVELOPMENT

The following figure shows the decision-making method that was developed by Charles Kepner and Benjamin Tregore. This model helps focus attention on critical issues and get to the crux of the matter without wasted effort. Besides that, its concept can help DSS developers in two ways: a) to see where computer can fit into the decision making process, and b) to outline a method computer can use to take over some of the decision making tasks. Thus, I have chosen the Kepner-Tregore decision-making method (K-T method to serve as the basic methodology blueprint for the design and development of the proposed DSS. However, a few phases from the original K-T method will be ignore in this case to suit the needs and condition of the proposed DSS.

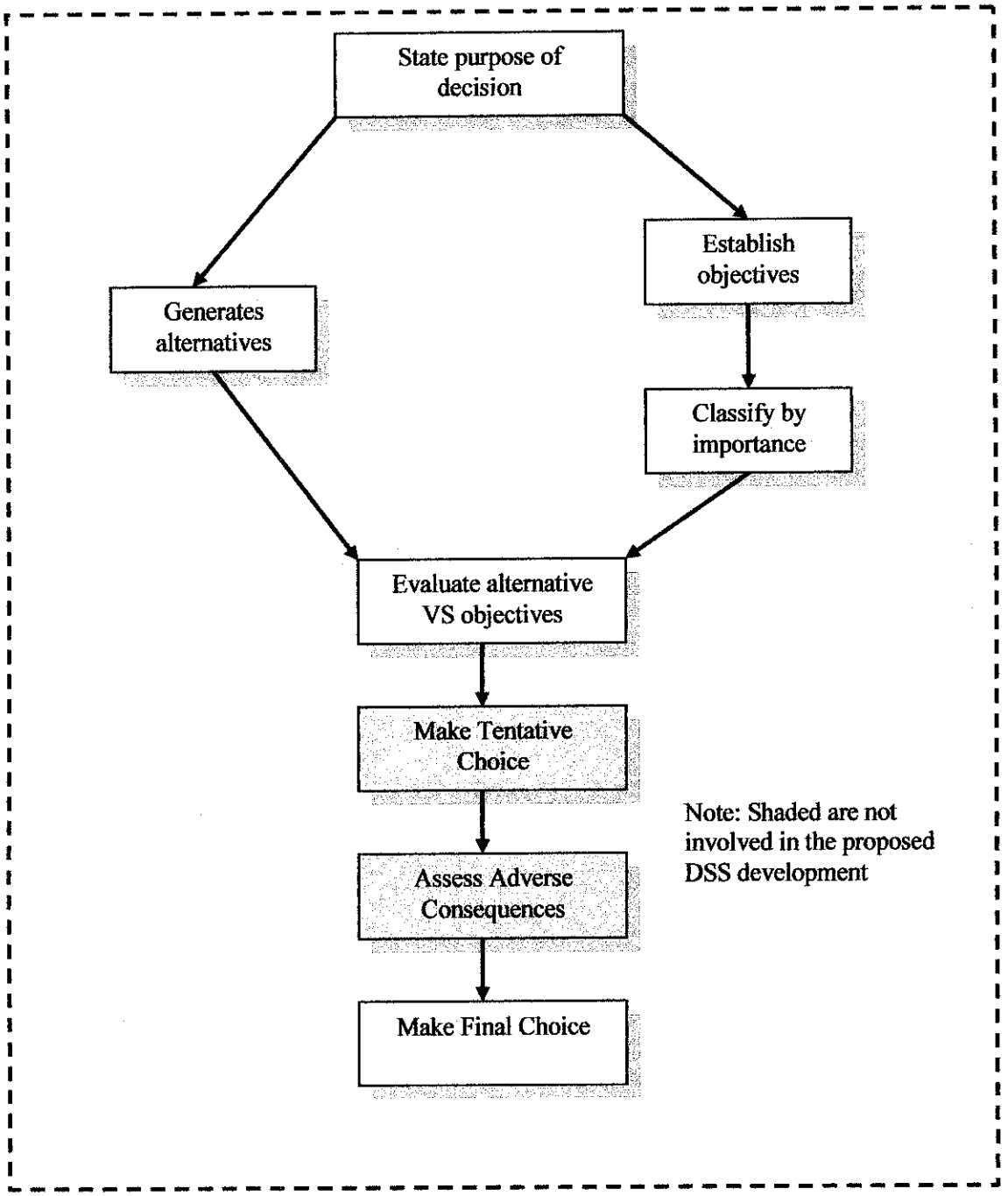


Figure 3.2.1 Graphical Reprentative of Kepner-Tregore Method

1. **State Purpose of Decision**

   In the online shopping environment, we assume that the users' purpose of decision is to search for appropriate product information to assist them in the purchasing activity.

2. **Establish Objectives**

   In this phase, the system will request the users to enter their purchase preferences. For example, product brand, product size, product capacity. Note that this is only apply to the DSS prototype that to be developed. As for the real system, the user preferences and buying pattern can be obtained through the data ware housing and data mining techniques.

3. **Classify by Important**

   In this phase, the user will be required to set their priority for their preferences.

4. **Generate Alternatives**

   The system will compare the users entered preferences or find another information that related to their current preferences which available in the product information database.

5. **Evaluate Alternatives vs. Objectives**

   Upon listing down search or related new prompt window, the system will help the user by giving extra information by new link page that related to their findings. The system will allows user to get to the new link if they wish to get more information and also some of the prompt window give best options and choices based on their searching products.

6. **Make Final Choice**

The system will recommend the user with the best option that was identified by the system. But the final choice is still in the users hand as the system will only act as recommendation agent in the online consumer decision-making process.

3.3 TOOLS

Below are the tools that are used through the development of the proposed system:

1) **Managerial / Documentation Purpose Tools**

- *Microsoft Project*

  Used for development schedule planning, resource allocation as well as tasks identification.

- *Microsoft Visio*

  Used to integrate professional system diagram, such as the data flow diagram, ERD Diagram, class diagram and etc.

- *Microsoft Word and Excel*

  Used for report, documentation and user manual editing and preparation.

- *Microsoft PowerPoint*

  Used for presentation purpose.

2) Development Tools

- *PHP Server*

  As the system is developing using XML/PHP/HTML, a server is needed to run the codes.

- *XML/PHP/HTML*

  The programming languages that is used to develop the proposed system.

- *Macromedia Dreamweaver*

  This is software is used to aid the programming activities as well as to design the use interface of the system.

- *Macromedia Fireworks*

  This software is used for pictures and image editing.

- *Microsoft SQL Server*

  This is the main database that is used to manage the system's data.

CHAPTER 4

RESULT AND DISCUSSION

4.1 INTRODUCTION

Basically, the progress of the project is quite smooth. Based on the information gathered during the analysis phase and guidance given by several experiences personnel, the author has come out with the blueprint of the proposed system. Besides that, the knowledge learned from the literature work has been incorporated into the design as well as the development of the system.

The following section will present the discussion as well as the result obtained from the project work as outlined in each major phase of the development model (refer to Figure 3.1.1).

4.2 PHASE 1 : PRELIMINARY STUDY AND ANALYSIS

There are literature reviews and white papers from various sources, which identify the importance of a proper decision support agent to aid the consumer's decision making decision making process in the online shopping environment.

In literature to further prove the feasibility of this project, the author has conducted a survey by having the University Teknologi Petronas's students and the member of Lowyat.net forum as the survey sample. Hardcopies of the questionnaire had been posted in the Lowyat.net online forum.

As the result, the author had received 50 replies on the questionnaire (both online and offline). The following are the results and analysis of the survey with sample size of 50 people.

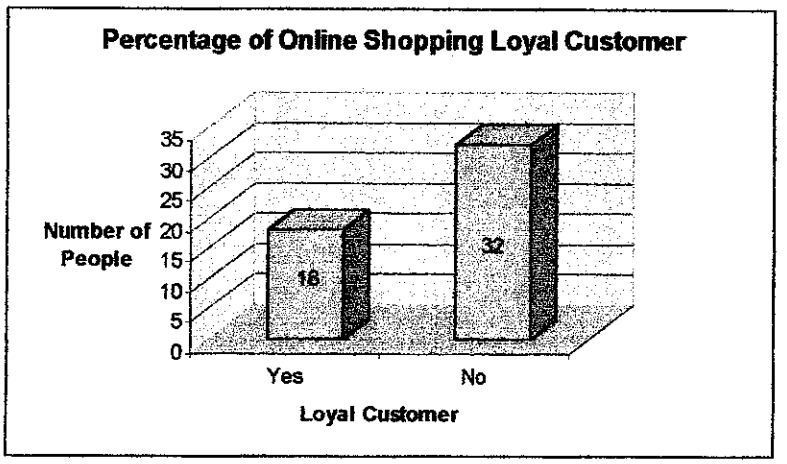


Figure 4.2.1Numbers of Online Shopping Customer

Figure 4.2.1 has supported the third problem statement (refer to section 2.1.1), which identifies the current online shopping condition where there is increasing number of online browser but not online consumer. According to the responses on the questionnaire, it was found that 80% of the users have tried to search for product information online before, but yet they are not loyal customer of online shopping site. The reasons given including online payment not secured, frustrating result process, insufficient product information, no purchase price available, security issues and so on. But most of the reasons are related to information needed by the consumers to enable them to make the purchase decision.

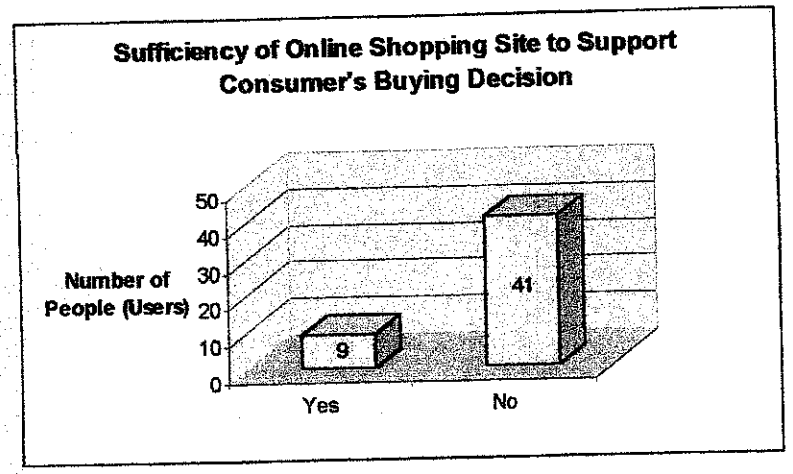
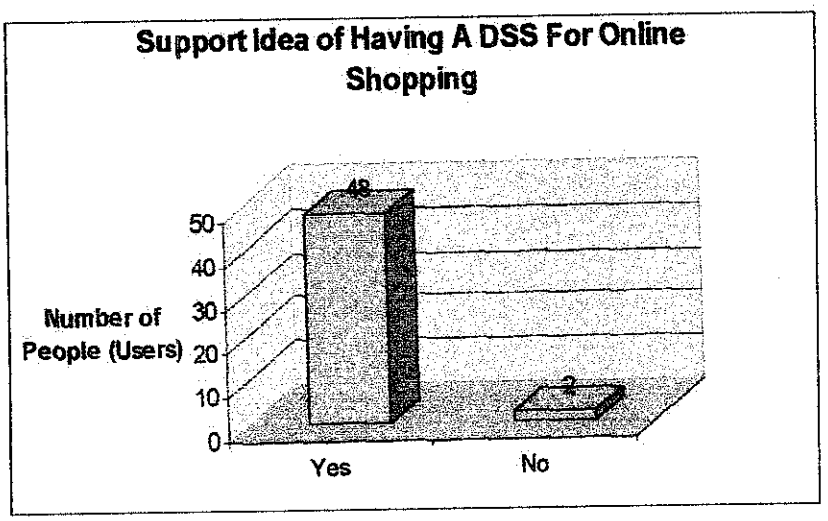


Figure 4.2.2 Sufficiency of Online Shopping Site to Support Consumer's Buying Decision

According to figure 4.2.2, 82% pf the surveyed users agree that the current online shopping websites are not sufficient enough to provide tools are able to support the consumer's buying decision-making process. They often found the search process tedious and frustrating, besides that the product information is not clear and incomplete. Thus, they face difficulties in making their purchase choices.



4.2.3 Percentage of Users that support Idea of Having a DSS for Online Shopping System

Due to that, 96% of the users support the idea of having on online DSS to serve as the recommendation agents to aid the customers in choosing a product that best suit their preferences.

As a conclusion, the author determines that this project is feasible enough to be carried on as it posses certain market value to the users needs.

4.3 PHASE 2 : SYSTEM DESIGN AND DEVELOPMENT

4.3.1 Database Design and Construction

The system for the storage and retrieval of information play the role of an automatic intermediary in the decision process; they work on a formal automatic intermediary of a set of information items and interpret and process users' request by estimating the relevant items. The main components of this system are a collection of information items, a query language that allows the expression of selection criteria specifying the users' need and preferences, and a matching mechanism that estimates the relevance information to queries.

a) Database and cookies

In order to define the input of users information and the result of Decision Support System, all the information will be keep on My SQL and cookies to detect the registered users.

b) Data Entry Requirements (Input/Output Design)

Due the time constraint, the author is not able to embed the data mining technology into the system to capture the consumer's preferences as well as their online buying pattern. Thus, a set of data entry requirements have been prepared to capture the users preferences to enable the system to aid them in the decision making process.

4.3.2 Common Online Shopping Function Design and Construction

As the DSS needs a basic online shopping site to serve as base for it to be integrated into, the author has taken a few popular online shopping website that contained some Intelligent Agent as references for the design of the web page layout. As the main focus of this project is on the DSS itself, thus this online shopping website will only consists of the most basic functions, such as register new user, upload new product (for creating dummy data purpose) and shopping cart function.

a) Screen Design

Screen Design is very important as it serves as the blueprint in developing the system. The author has planned the layout of the interface in the initial development stage. The screen design is useful to give a brief look and feel of the system structure as well it can set a boundary for the development work.

Refer to Appendix for the System's Interface.

b) Navigation

Since the proposed system is a web-based application, the navigation from the page to page is important in enabling the user to understand the whole of the system process. Therefore, the author has prepared a site map for the application.

Refer to Appendices for the System's Site Map.

4.3.3 DSS Design and Construction

In order to identify which user requirements are more crucial in the development of the DSS, the author has conducted another questionnaire survey.

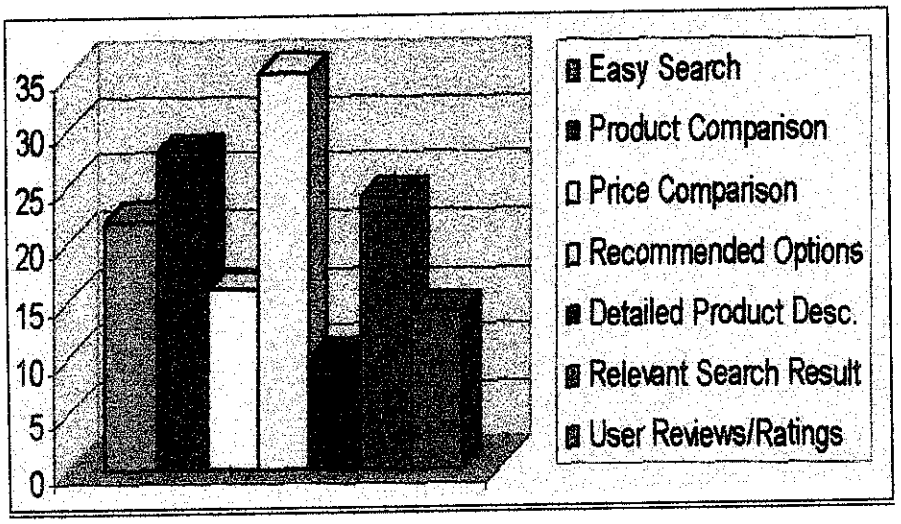


Figure 4.3.3.1 User Requirements for Online Shopping DSS

The result showed that most of the people preferred a recommendation agent to be included in the online shopping application in order to aid their

purchase decision making. Thus, the development of the system will focus more on the effectiveness and efficiency of the recommendation agent.

There are 2 common techniques that are used in the preferences prediction in the recommendation agent. They are collaborative filtering and constraints-based filtering. The collaborative filtering technique exploits the knowledge about the users with similar tastes to those of the active user, based on an analysis of the product that was already rated by the active user on the stored users' profile (user reviews /ratings). In the other hand, the constraint-based filtering offer customers an access to the products based on description of the product features; in a such way, the product that possibly reflect the customer preferences can be identified easily. For the time being, most of the online shopping site will only choose either one of these techniques to be implemented in their site. But in this project, the author has decided to apply both of this techniques concurrently into the system to further aid users in their decision making process.

Based on the user requirement and the discussed techniques, as well as the DSS methodology that was mentioned in the Section 3.2, the following DSS framework has been developed.

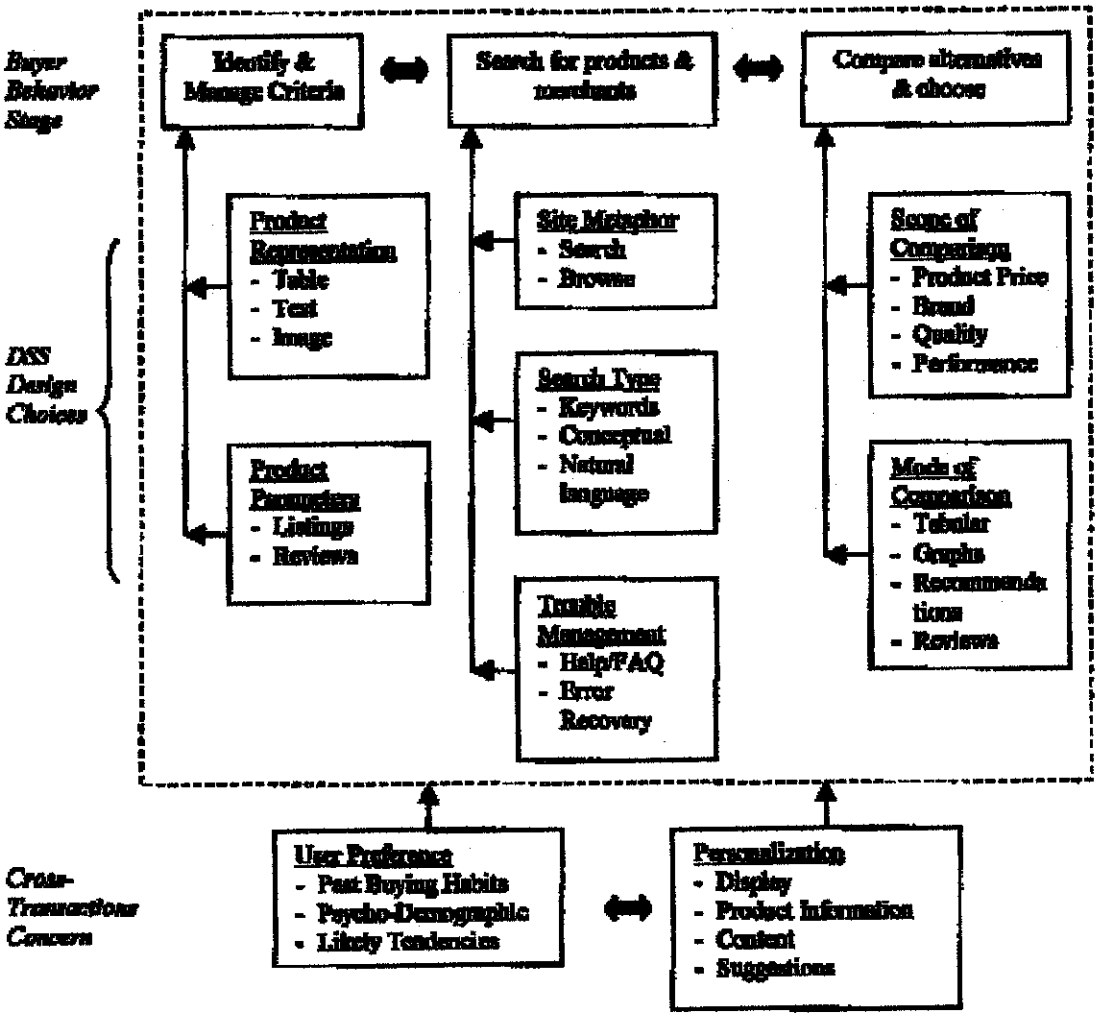


Figure 4.3.3.2 Framework for Online Buyer Decision Support System

Based on the figure 4.3.3.1, one can see the three stages of buyers' behavior across the top of the figure. Miles et al [4] surveyed the buyer behaviors literature and isolate an insightful three stage model of buyer behavior: (1) initial identification and subsequent management of search criteria that

happens as the search proceeds. (2) Search (via browsing, engine or other method) for a product based on the current criteria set – this is an information collection and intelligent building stage in which more is learned about the criteria, the product's attributes and the merchandise of those products, and (3) comparison of products leading to a choice, or to a decision to abandon the search.

The lower boxes express the range of DSS design options available to site development. Thus alternatives styles of products representations and form of parameters information presentation can be chosen to support the criteria management stage. Finally, in the comparison stage developers choose DSS alternatives in terms of the scope and mode of information the user can view.

Trouble Management, which is a vital a DSS Design feature given the frustration consumers are experiencing today on website, is added into the design framework as well.

How System Recommend The Best Solution To The Buyer?

A shopping recommendation agent can tell the buyer that "Product A is good, but you might like to try out Product B as well". When this situation comes into picture, where there are multiple satisfactory alternatives, a human expert can often provide a relative ranking of those alternatives.

The recommendation agent will handled this situation by using confidence associated and truth-value. The system will further use the switch case(if-else) method to determine the result based on their preferences.

4.4 PHASE 3 : TESTING

There are people had participated in the earlier questionnaire surveys as well did the system testing.

Due to the project development time constraint, the author was only able to provide three brand sets of dummy data (ipod, sony and zen creative) that are complete enough and available in current market to undergo the testing activities. Test cases were prepared in a way that real online purchase situation was created, and the tester was required to undergo the whole online purchase decision making process. The results of test cases showed that the system is functional properly and had passed the user acceptance testing as it has fulfilled the user's requirements and needs.

After the testing activities, questionnaire was distributed to the testers to further identify the user's satisfaction towards the system, as well as to determine whether the system meets the project's objectives or not.

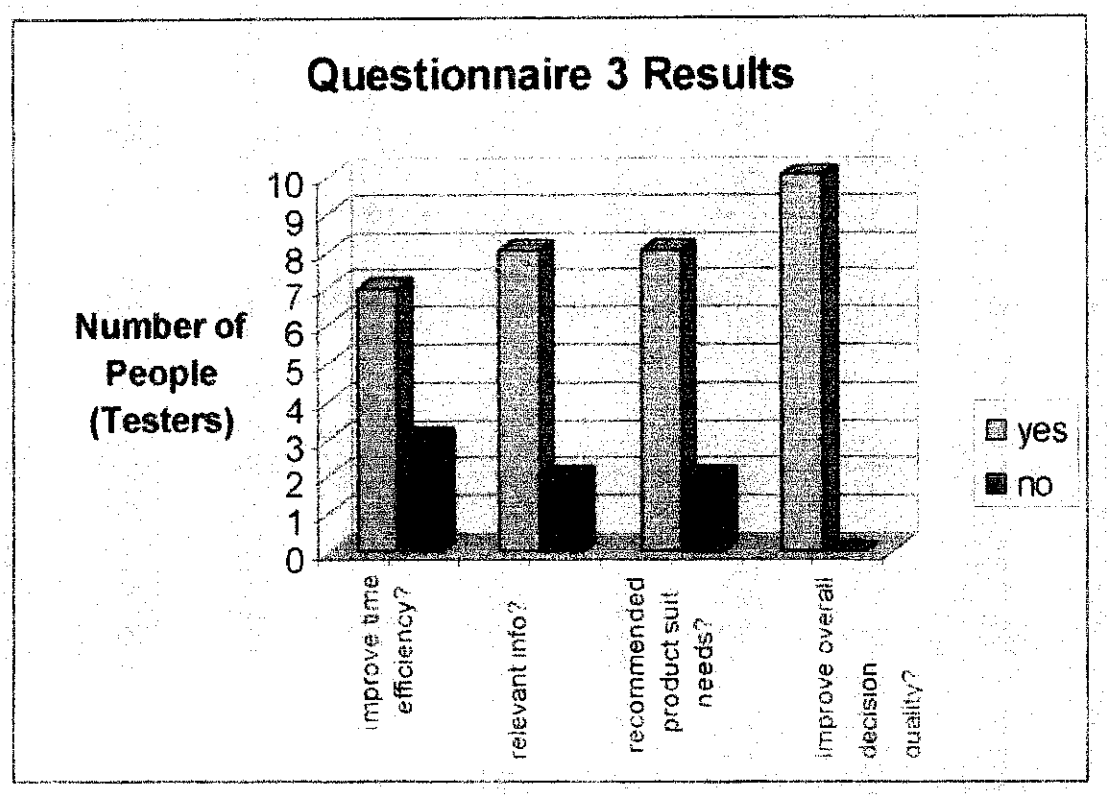


Figure 4.4.1 Results of Questionnaire 3

According to the above result, we can conclude that the system has actually met its objective, which is to enhance the customer's online shopping experience by provide the customers a tool to improve the purchase decision making quality.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 RELEVANCY TO THE OBJECTIVES

Objective 1: To develop an Agent application on working prototype of online consumer decision.

Status : Objective achieved.

Details : Based on the framework that has been proposed as well as the project methodology that has been planned in the earlier stage, a working prototype of the system has been created. Although the system contains only the most basic function of an online shopping website, which are the shopping cart function and login login function, but it provides a complete buyer's decision support system which aims at simplified the buyer's decision making process as well as to further aid the buyers in their purchase making.

Objective 2: To enhance the customer's online shopping experience by provide the customer a tool to improve the purchase decision making quality.

Status : Objective achieved.

Details : As stated in the Section 4.4, where the results of system testing were discussed, the system has passed the user acceptance testing. The users have gone through all the test cases and the test case document has been signed off by the user to approve the functionality as well as to agree that the system has met the user's requirements. Besides that, the questionnaire survey result also showed that 90%(refer to figure 4.4.1) of the users agree the system does improve the overall quality of Decision Making in their online shopping environment.

Objective 3: To develop personalized headlines based on the user gender.

Status : Objective achieved.

Details : Based on the surveying that has been done from few people, five out ten different interest choose to put on the headlines for every page. The headlines will automatically appear once the user open the web page. The headlines was done using cookies to detect the user interest for their first time to once they had register for the first time use.

5.2 FUTURE WORK FOR EXPANSION AND CONTINUATION

In Section 2.1, the author has presented the characteristic of current available DSS and a user preferred DSS (Refer to Table 2.1.1). In this section, the author is presenting the next level of DSS for future expansion. This level of DSS is the evolution of the user preferred DSS.

Table 5.2.1 Recommend DSS Future Expansion

Future Expansion (Relationship Focused)	Scope: ▪ Customized tuning to prospect and customer mental model. ▪ Knowledge-based prompting Prime Features: ▪ Trouble Management system (Human and Computerized customer relationship management). ▪ Cross session consumer preferences and personalization (Life cycle management) ▪ Reminding/Advertising/Extended supply chain (Client organization support of purchasing function). ▪ Natural language- "Do what I mean". Cost & Effects: ▪ Embellish vendor offerings, add warehouse, and integrate several vendor's application

Information in Table 5.2.1 shows a shift to support the long-term relationship that the prospect and consumers have with the site via knowledge based prompting within a transaction and across transactions.

Talking about knowledge based, the author has suggested automated learning to be integrated into the system for future expansion. Following the lead of companies such as Manna, it will important to incorporate automated learning into any personalization

technology. On the other hand, the structure of the rule sets and the availability of meaningful reports should provide important handles to the problem faces by the consumer and the decision making process.

Besides that, the use of natural languages search is going to become a hot discussion issue in the near future, thus the author also suggested the use of natural language search in the online shopping environment. Consumer's behavior theory indicates that users will spend substantial time searching and comparing products and makers. To further facilitate this effort, just as with a good human sales representative, the search should culminate in what the user wants and not be confounded by how they said it. However, current search technology us almost exclusively keyword matching, which means the given search will only match on exactly what was typed and not what was meant. Solving this dilemma implies use of natural language techniques including synonym zing, spell-checking and related capabilities to translate the terms from the language into the lexicon of the product catalogue.

5.3 CONCLUSION

The decision support framework pints out that consumer seek to refine search criteria as they uncover and compare products. Further, the framework also points out those online consumers need more than just product search, and when deciding on purchases they also perform comparative studies and availability of information.

Supported by the case study analysis, this project amply demonstrates that no application provides in this country currently support the range of features one needs to deploy to help manage the customers' decision making process. E-commerce websites currently must make up for this missing industrial capability by taking

responsibility for design, programming, integrating and rolling out of the needed consumers DSS on their own.

Yet few B2B e-commerce website executive currently seem to be aware of these differences and too often they attempt to use off-the-shelf web searching technology where it does not apply. Even in B2C shopping sites where they seem to understand the framework in general terms closer examination of the design points how these sites still suffer many of the same failure modes as B2B sites.

There is no intent here to suggest that "one sizes fits all" in terms of a solution to consumer decision support needs. It just attempts to point of the space of the functionality one must consider when assembling a decision support system that is at least capable of improve the customers online shopping experience.

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12) [website] http://www.nomadworld.com

13) [website] http://www.sony.com

14) [website] http://www.htmldoc.com

APPENDICES

Appendix I : Project Schedule

Appendix II : Questionnaire 1 [Preliminary Investigation]

Appendix III : Questionnaire 2 [User Requirements on Buyer's DSS]

Appendix IV : Questionnaire 3 [User 's Satisfaction on Final Product]

Appendix V : System Interface

Appendix VI : System's Site Map

Appendix VII : User Acceptance Testing (UAT) Test Cases

Appendices VIII : Surveying of Personalized Part on user

FINAL YEAR PROJECT : PROJECT SCHEDULE

Yang Zaliza Zainul Rashid (3051)
Project Title : Developing an Agent Tools and Decision Support System in e-commerce

Phases	Activities	Week															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Planning Phase	• Organize Milestones																
	• Identify and plan for activities that needed for each phases																
	• Plan on software and hardware required																
	• Submission of FYP Requisition Form to the Co-ordinator																
Analyze Phase	• Conduct Preliminary Research through reference materials																
	• Conducting surveys by distributing questionnaires																
	• Analyzing the information by drafting Literature Review																
	• Submission of Chapter 1 : Introduction																
	• Submission of Chapter 2 : Literature Review																
	• Submission of Logbook																
Design Phase	• Design the website interface based on data collected from surveys																
	• Construct the prototype using appropriate programming language																
	• Review the progress of the product by Supervisor																
Testing Phase	• Finalize the construction of the e-commerce Website																
	• Ensure the functionality of the website																
	• Test to users for acceptance testing																
	• Submission of Chapter 3, Chapter 4 and Chapter 5 to Supervisor																
Implementation Phase	• Document the reports as Final Draft and submit it to Supervisor																
	• Oral Presentation and Final Dissertation submission to Supervisor																

QUESTIONNAIRE 1 - PRELIMINARY INVESTIGATION

Survey on the Needs of DSS in Online Shopping System

I am a final year IS student from University Teknologi PETRONAS (UTP), doing my final year project. This questionnaire is to help me to gather responds from the general users towards the idea of an integrated decision support system (DSS) in the current online shopping system to further aid the consumer's online purchase decision. Please take a few moments to fill in the questionnaire. Thank you.

Please answer each question by checking only one box:

1. Do you have access to internet at home/workplace?

   ☐ Yes ☐ No

   If yes, average how many hours you online per day?

   1 = 3-5 hours 2 = 6-10 hours 3 = 11-15 hours 4 = more than 15 hours

   1 2 3 4

2. Do you visit online shopping website (e.g eBay.com, amazon.com) frequently?

   ☐ Yes ☐ No

3. Have you try to search for product information or make products comparison through online shopping website?

   ☐ Yes ☐ No

   If yes, do you find it helpful?

1 = very helpful 2 = helpful 3 = average 4 = not helpful
5=nonsense

1 2 3 4 5

4. Do you think current available online shopping system is sufficient enough to support your online buying decision?

☐ Yes ☐ No

5. Do you support the idea of implementing the decision support functions into online shopping system to aid the consumer's decision making process?

☐ Yes ☐ No

Please be specific and give examples if possible:

6. What kind of problem do you usually face when you use the online shopping system? (e.g frustrating search process, inaccurate product information, etc.)

_____

_____

_____

_____

_____

7. What are your suggestions to improve the current available online shopping system?

_____

_____

_____

QUESTIONNAIRE 2 - USER REQUIREMENTS ON DSS

Survey on the User Requirements for DSS in Online Shopping System

This questionnaire is the continual version of the questionnaire one. It aims at gathering user requirements for the development of the DSS for the online shopping system. Please take a few moments to fill in the questionnaire. Thank you.

1. Please check on the elements that you wish to be found/improve by the DSS for online shopping system.

   Note: You are only allowed to check maximum 3 choices.

1.	Easy Search	
2.	Product Comparison	
3.	Price Comparison	
4.	Recommended Options	
5.	Relevant Search Results	
6.	Detailed Description of Product	
7.	User's Reviews/Ratings on Product	

QUESTIONNAIRE 3 – USER'S SATISFACTION ON FINAL PRODUCT

Survey on the User Satisfaction on Final Product

This questionnaire aims at observing the users' satisfaction on the final product as well as to determine whether the final product meet the objectives of the project. Please take a few moments to fill in the questionnaire. Thank you.

Note: This is to be filled up only by the participants of system testing.

1. Does the final product improve your decision making process in terms of time taken to make a purchase decision compare to the normal online shopping website.

   ☐ Yes ☐ No

2. Did the system return you a relevant product searched result?

   ☐ Yes ☐ No

3. Does the system recommended product is the product that you have in your mind?

   ☐ Yes ☐ No

4. Finally, do you find that the final product do improve the overall online shopping purchase decision making process?

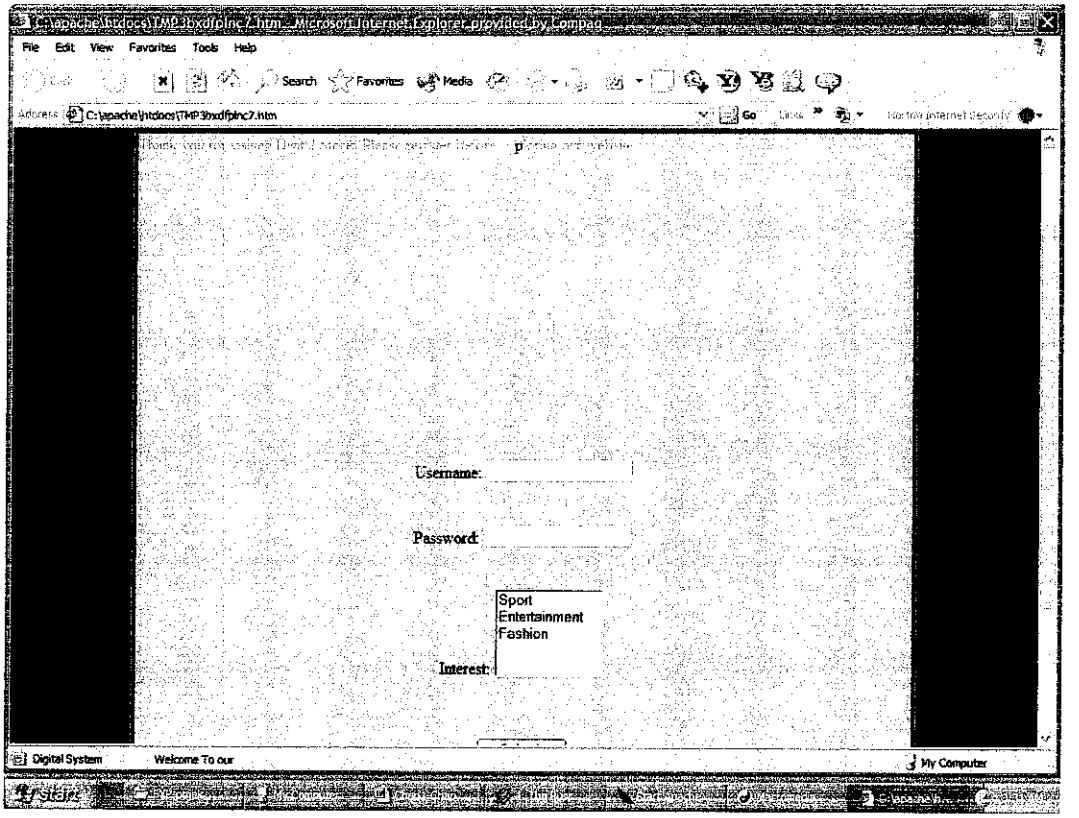
   ☐ Yes ☐ No

SYSTEM SITE MAP

- HOME
- PRODUCTS
    - Sony
    - iPod
    - Zen Creative
- INTERACTIVE DECISION MAKER
- MP3 GUIDE
    - What is MP3
    - 5 Tips to buy MP3
    - Technology Behind MP3
- SEARCH
- ABOUT US
- FAQ
- HOW TO USE DSS

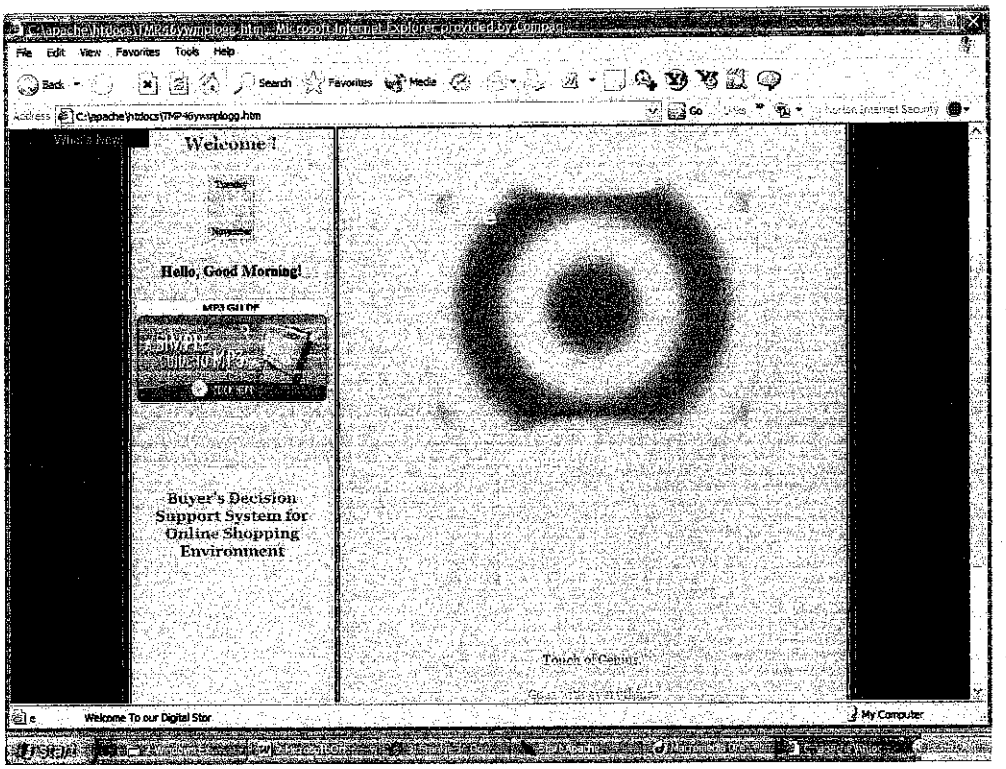
Note : The system involves less navigation compare to the real online shopping website. This is because the main focus of the project is to develop a prototype of the buyer's decision support system, which is able to improve the buyer's online shopping environment.

SYSTEM INTERFACE



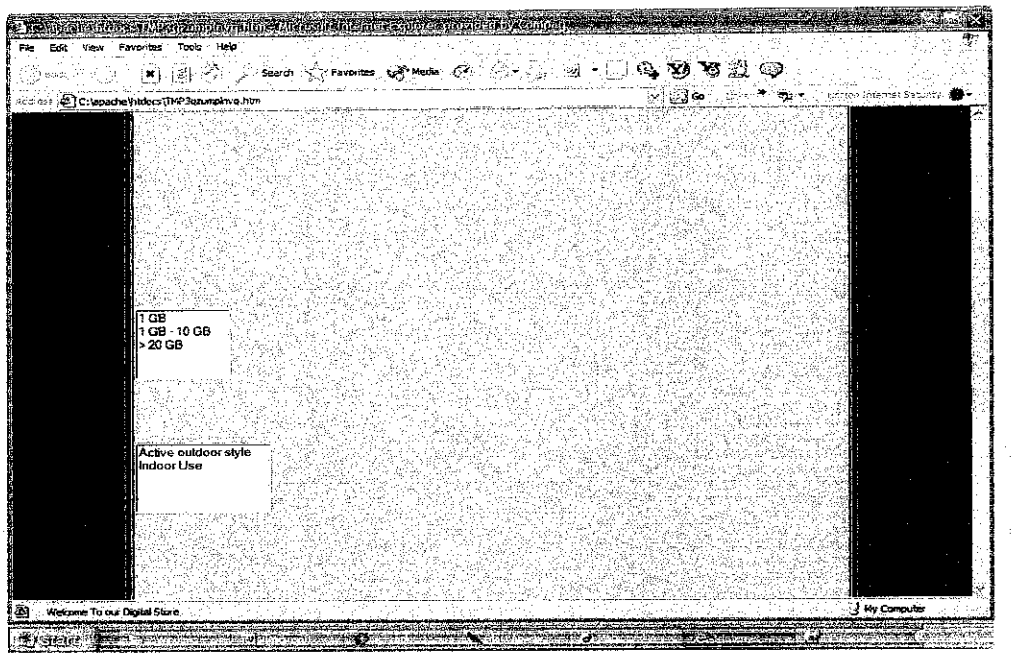
Appendix Figure 1 : Registration page for new user

Note: The colors that appear on this report for the system interface was not same as the real system because of the color cartridge that not functioning well during printing due to technical problem.



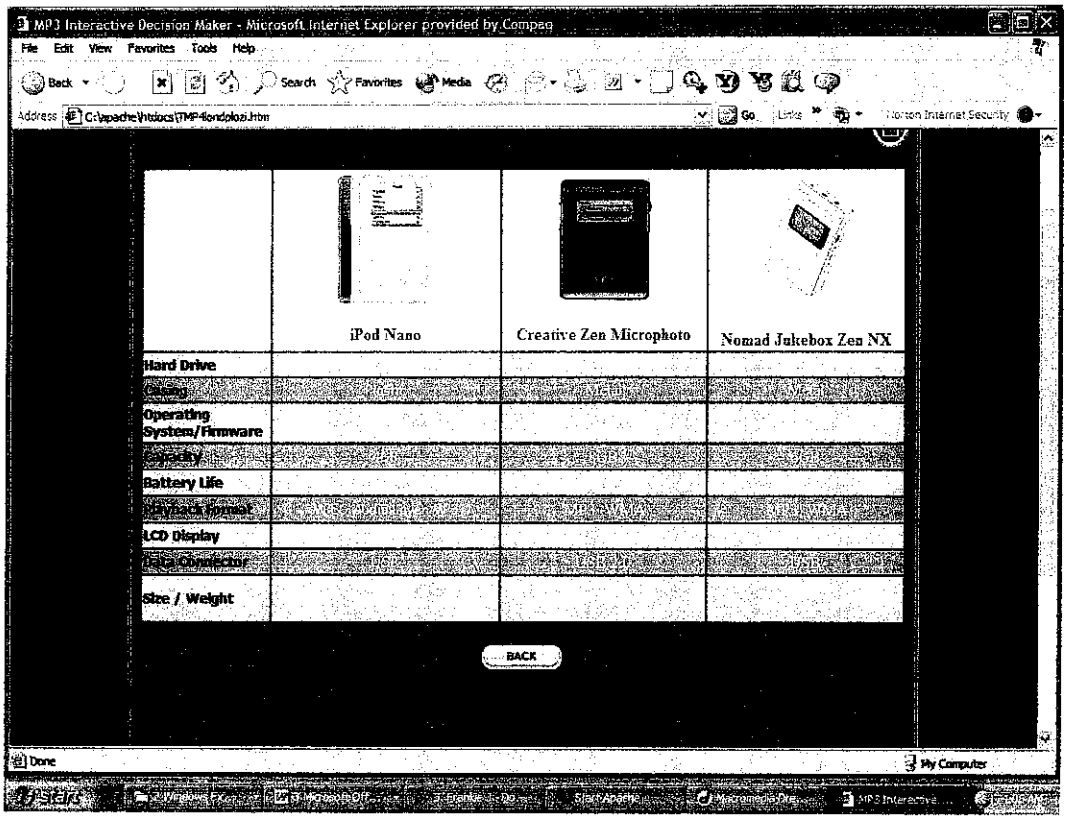
Appendix Figure 2: System Homepage

Note: The colors that appear on this report for the system interface was not same as the real system because of the color cartridge that not functioning well during printing due to technical problem.



Appendix Figure 3: DSS Part

Note: The colors that appear on this report for the system interface was not same as the real system because of the color cartridge that not functioning well during printing due to technical problem.



Appendix Figure 4: Page Result of DSS part

Note: The colors that appear on this report for the system interface was not same as the real system because of the color cartridge that not functioning well during printing due to technical problem.

Buyer's Decision Support System (e-DSS) Test Case

Date : 27th October 2005

Time : 2.00 – 3.30 pm

Tester : Hazrin Hanim Rani

Student ID : 3005

Process	Functional Requirements	Verified by User & Date	Accepted by user & Date
1. Search product	1.1 The user can search for product by typing in search keyword in the advanced search textbox.		
	1.2 The system will return the products that match the user entered keyword in the search result listing page.		
2. Compare product	2.1 The user can only select products to be compared when he/she is in the product listing page.		
	2.2 The user is allow to check on the product, which he/she wishes to compare and following by clicking the "Compare Selected" button to proceed with the comparing process.		
	2.3 The system will return the users a product comparison table, which shows the comparison on available attributes/characteristic of the selected product.		

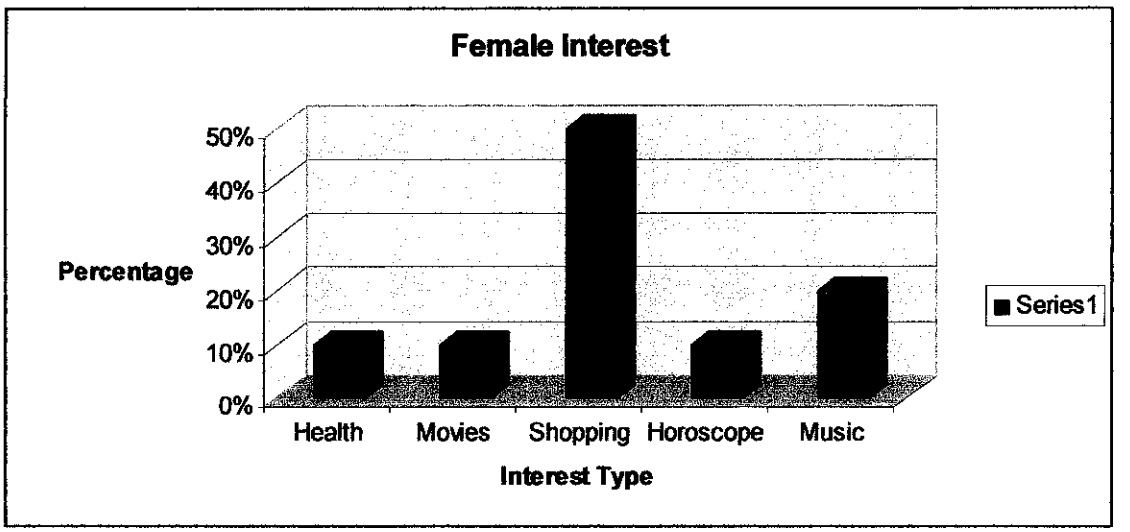
	the page.		
	3.2 The user will be requested to fill in their preferences on the product as well as fix a priority for each stated preference.		
	3.3 The system will recommend the users 3 best fit produots that fulfill the user preferences. The products will be ranked by best fit, second best and third best.		
	3.4 The user can check on any of the listed product and click on the 'Compare Selected' button to compare the selected product before he/she makes the purchase decision.		
	3.5 Once the user has confirmed the final decision, he/she can click 'Add to Cart' button to add the product to his/her shopping cart.		

Surveying of Personalized Part on Users

Interest type that used to gain the percentage of user's interest (among few peoples) :

- Health
- Movies
- Shopping
- Music
- Sports
- Travel
- Horoscope
- News
- Games
- Finance
- News
- Autos

Result of Female Interest :



Result of Male Interest :