GENERIC WEB-BASED SURVEY SYSTEM GENERATOR

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ABSTRACT

Survey is one of the important research methods and is popularly used by the researchers. The increased usage of the Internet and the World Wide Web technologies has provided opportunities for web-based surveys. The purpose of this dissertation is to study the current usage of the web-based survey as the selected survey method and to produce a generic web-based survey generator to help the researchers improve the process of constructing web-based surveys. The main idea of web-based survey generator is to simplify the process of constructing the web-based surveys where the web-based survey forms can be generated automatically. With the web-based survey generator, the researchers are able to produce and deploy web-based surveys more efficiently. Feedback from the survey can be stored in a database and basic reports are generated automatically. Data can be easily imported into web page or report file for more comprehensive reporting. Hence, to achieve the purpose of this dissertation, a prototype of web-based survey generator had been developed through this study.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, web-based surveys are everywhere on the Internet. The increasing use of the Internet and the World Wide Web technologies has provided opportunities for Web-based surveys. Broadband access to the internet improves the speed of downloads, which enhances the scope and richness of web-based surveys. By making comparison to the traditional surveys, web-based surveys have the advantage of low cost and quick distribution. Data that was previously collected by other survey modes is now being collected with Web-based surveys (Dillman & Bowker, 2001).

1.2 Problem Statement

Web-based surveys are having a deep influence on survey methodology. The skills required to produce a web-based survey are different from those required to construct other types of surveys (Gunn, 2002). The focuses of Web-based survey design are more on programming ability and web page design rather than traditional survey methodology. Problems associated with web page design and programming play a significant role in web-based surveys. Web-based survey design is more complex because it must be developed in HTML and supports scripting and database languages. Creating long or complex web-based survey forms will increase development overhead and has become a tedious process to web developers or survey designers. Thus, there is a need to have a

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generic web-based survey generator to simplify the process of constructing web-based surveys.

A generic web-based survey generator is a flexible tool that provides common features required for everyone when building a general type of web-based survey. By having a generic web-based survey generator, the web-based survey developer does not require to understand programming language or HTML when developing a web-based survey. The generic web-based survey generator is an easy-to-use tool that simplifies the process of constructing a web-based survey.

1.3 Dissertation Objectives

The objectives of the dissertation are to:

1. Study the structure of web-based survey in order to understand the general requirement when developing a web-based survey. Identify the strengths and potential weaknesses of web-based surveys.
2. Analyse and define the shortcoming of current web-based survey systems in the market. Identify the common features required by a generic web-based survey generator.
3. Design a generic web-based survey system generator that is capable to simplify and improve the process of developing web-based survey. Determine the appropriate tools and technique to develop generic web-based survey generator.

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4. Develop a generic web-based survey generator based on the proposed design that is capable to automate and simplify the development process of web-based survey. The generator will be user-friendly for all levels of system users. The name of this proposed generic web-based survey system is My-WEBQ.

1.4 Research Questions

It is important to address the research question of this study to ensure the study meet the objectives. Research question is a statement that identifies the phenomenon to be studied. Three research questions are addressed to meet the objectives of this dissertation. The research questions are:

i. Is web-based survey a right tool for conducting a survey?

ii. What are the common features of a generic web-based survey generator?

iii. Would the expected benefit realized by implementing My-WEBQ?

1.4.1 Hypothesis

The hypothesis section of a thesis or dissertation identifies the problem to be explored and gives insight into the research questions. This dissertation investigates the following hypothesises:

Ha: Web-based survey is a preferred tool for conducting a survey in local study.

Hb: The process of constructing a web-based survey can be simplified by implementing My-WEBQ.

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1.5 Significance of Study

The investigation of this dissertation focused on the common features and the design of the web-based survey. This study examines the effectiveness of the response format and the user preferable features via a questionnaire. If web-based survey generator only focuses on the advancement of the design features but overlook the effect on the user, there will be a gap between design feature and user-capability. Hence, the design of My-WEBQ is aims to meet user needs rather than focus on the advancement of design features. This study also aims to develop a generic web-based survey generator to simplify and improve the process of constructing a web-based survey. The target users are the surveyors from public sector and commercial industries. The type of surveys supported by My-WEBQ is common survey conducted by these sectors such as customer satisfaction survey, market research, employee satisfaction survey and etc.

1.6 Scope of Study

The study scope includes study the use of web-based survey and the implementation of a prototype of generic generator which able to generate a customizable web-based survey, with the intention to improve the process of constructing web-based surveys. This is a prototype of a web-based survey generator. The main research tools of the study are documents reviews and questionnaire. The intent of the questionnaire is to collect the user preferences on features of a generic web-based survey system generator and their opinion on the usage of the web-based survey. The analysis of the prototype is performed on its functionalities, features, and character of the application with regards to the technologies used to develop it and the design concept involved. The scope of the

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dissertation also involves the testing of the generator. The types of testing are focused on Functional Testing, Structural Testing and Interface testing.

1.7 Dissertation Organization

This dissertation organized into seven chapters. The following is a brief description of each chapter:

Chapter 1 - Introduction

An overview describes the overall background of the dissertation, including problem statement, dissertation objectives and scope of the dissertation.

Chapter 2 - Literature Review

This chapter presents literature review on dissertation topic. The chapter provides review on the current trend of Internet survey and the issues of using web-based survey as survey method. A comparison of some selected existing web-based survey applications is described in the chapter.

Chapter 3 - Methodology

This chapter describes the methodologies adopted in this study and the development of the prototype of My-WEBQ. As a questionnaire is used to investigate the users' habits and user preferences when constructing web-based surveys, this chapter also discusses the design of the questionnaire.

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Chapter 4 - System Analysis

System analysis involves the analysis activities. This chapter presents the result of the questionnaire analysis and requirement analysis, both functional and non-functional requirement of My-WEBQ are described.

Chapter 5- System Design

This chapter presents the system design of My-WEBQ that focuses on architectural design, system architecture and functionality design.

Chapter 6 - System Implementation and Testing

This chapter explains the implementation of My-WEBQ and describes the testing activities and its results in detail.

Chapter 7 - Conclusion and Future Work

This chapter draws a conclusion of the dissertation. The suggestions for future works are discussed in this chapter.

1.8 Conclusion

This introductory chapter presents the overview of this dissertation, which briefly described the objective and scope of this research. A short description of each chapter in this dissertation is included here for the benefit of the reader.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents literature review and study related to the research problem. It provides review on the current trend of web-based survey and the issues of using web-based survey as survey method. This chapter also outlines the types of web-based survey and factors need to be considered when constructing a web-based survey. This study is important, as it serves as an input for developing a questionnaire which is used to collect the user requirements of a desired web-based survey system. A comparison of some selected existing web-based survey applications is described in this chapter together with some common features of a generic web-based survey generator identified thru this study. At the end of the chapter, the proposed framework of My-WEBQ will be presented. The framework provides a conceptual design of the system and its major components are discussed here.

2.2 What is survey?

A survey is a type of research strategy. Survey involves an overall decision- a strategic decision – about the way to set about gathering and analyzing data. The strategy involved in a survey is that the researchers collect the same information about all the cases in sample. Like other research method such as case study and experiment, survey research is one method of collecting, organizing and analyzing data (Figure 2.1). Case study is the documented history of noteworthy events that have taken place in a given institution

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(Sekaran, 2003). Experiment is a type of research methods to conduct a controlled test or investigation. The distinguishing features of survey are the form of data collection and the method of analysis.

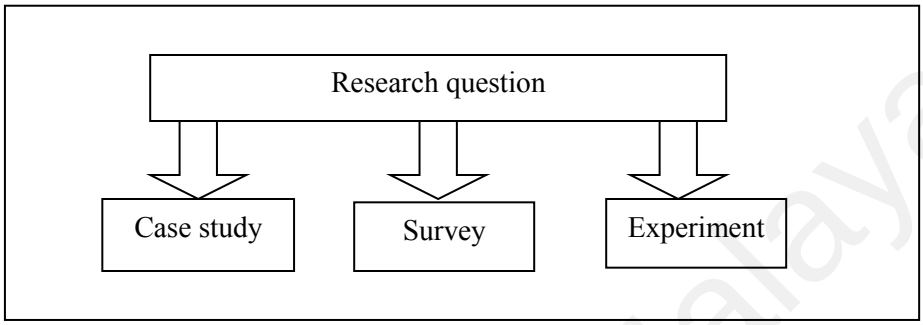

Figure 2.1: A range of method of research

Marsh Catherine (2002), defines a survey as any enquiry which collects pieces of information, by whatever method, over a range of different cases, and arranges the information about those cases as variables. According to her, the survey is a method of testing hypotheses about social processes.

Surveys have been a tool of social investigation since the early days of empirical social science (De Vaus, 2002). There are probably as many different reasons for conducting surveys as there are surveys. Surveys are frequently conducted for the purpose of making descriptive assertions about some population: discovering the distribution of certain traits or attributes (Babbie, 1973).

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2.3 Survey on the Internet

The growth of the Internet has impact on virtually every aspect of society including social survey research. Beginning in the late 1980s and early 1990s, prior to the widespread use of the internet technology, e-mail was first explored as survey mode (Fricker & Schonlau, 2002). In an e-mail survey, a questionnaire is sent out to a respondent via email as an attachment or within the email message. In the early stage, e-mail were primarily simple text-based with static format and document with rudimentary formatting. Therefore, the early e-mail surveys are simple to compose and sent. However, it provides fewer options for dealing with complex structural features of questionnaires and tends to limit the length and scope of the surveys.

With the rapid growth of Internet technology, the World Wide Web (WWW) has grown in popularity in 1990s. The use of Hypertext Markup Language (HTML) form has provided a new method of gathering survey data. The web-based survey started to become widely in used as data collection method in the mid-1990s and quickly supplanted e-mail as the Internet survey medium of choice (Fricker & Schonlau, 2002). The web-based surveys provide survey capabilities far beyond those available for any other type of self-administered questionnaire. With the programmable HTML form, the web-based surveys can be designed so to provide a more dynamic interaction between the respondent and the questionnaire compared with e-mail or traditional paper survey. The use of web-based surveys has been validated by researchers and the web-based surveys are now used for many different kinds of surveys.

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2.4 Web-based surveys

The rapid development of survey on the World Wide Web (WWW) is leading some to argue that soon Internet (and, in particular Web) survey will replace traditional methods of survey data collection (Couper, 2002). The interest in web-based surveying is not surprising as it offers a number of distinct advantages over more traditional paper surveys. Web-based surveys are having a profound influence on survey methodology (Gunn, 2002). The programmability of HTML form, Java or VB scripting and support of database as data repository provide web-based survey, the ability to create an attractive, interactive, and compelling survey that is inviting to the respondents. During web-based survey, the data provided by the respondents is stored to the database repository directly via data access component.

Although the principles of paper survey design also apply to web-based survey, we can find that the distinction between the design of paper and web-based survey. Dillman (2000) in his paper describes that in the paper questionnaire, designer produces a questionnaire that gives the same visual appearance to the designer as to the respondent. However, in the case of web-surveys the intention of the designer for the creation, sending, and receipt of the questionnaire are mediated through the hardware, software and user preferences. The final design as seen by the creator is sent to the respondent's computer, which displays the questionnaire for viewing by the respondent (Figure 2.2). It may be possible that the questionnaire seen by the respondent may not be exactly the same as that intended by the creator, for several reasons such as color setting is different

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at respondents' computer; text becomes misaligned due to different operating system or Internet browser.

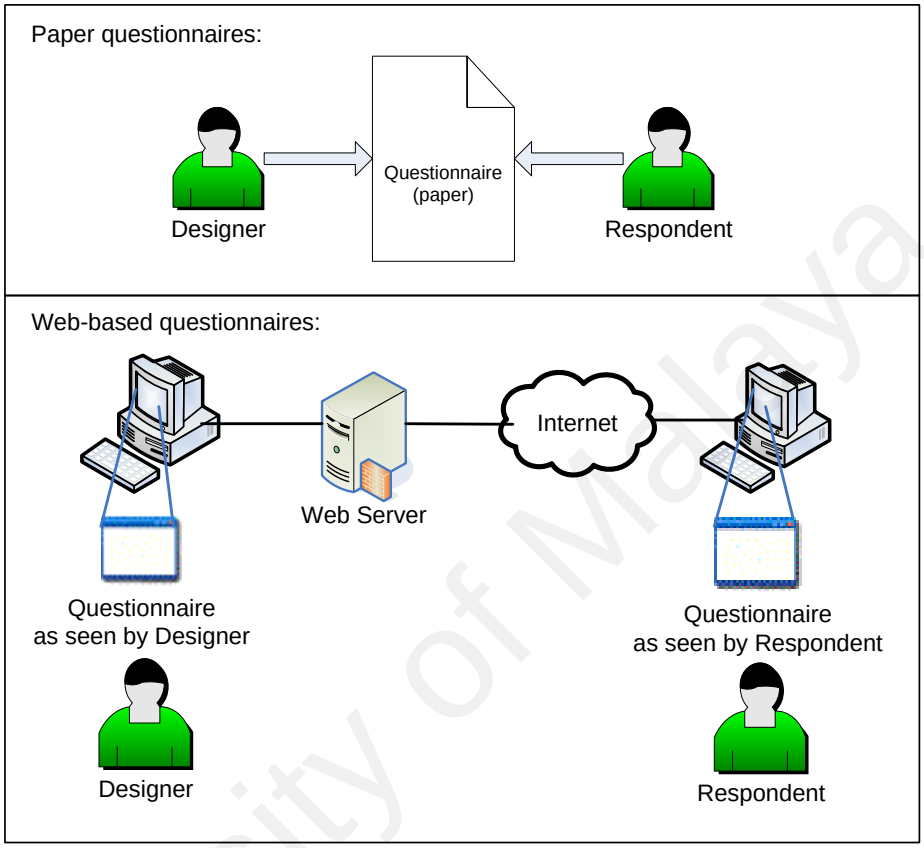

Figure 2.2: The fundamental different between paper surveys and web-based surveys. Adopted from Dillman (2000), John Wiley & Sons, Inc., A. Mail and Internet Surveys: The Tailored Design Method.

2.4.1 Type of Web-based surveys

It is important for researchers to distinguish the different types of web surveys before they decide to use which type to utilize as data collection method. Couper (2002), in his paper describes a variety of web survey types and discusses the source of errors that affect the quality of web survey types. According to Couper, there are varous types of web survey that are available on the Internet, but the web survey types can be basically

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summarized into two main categories, non-probability approaches and probability-based methods as shown in Table 2.1.

Table 2.1: Types of web surveys

Non-probability Methods	Probability-Based Methods
Poll as entertainment Unrestricted self-selected surveys Volunteer opt-in panel	Intercept surveys List-based samples Web-option in mixed-mode surveys Pre-recruited panels of Internet users Pre-recruited panel of full population

2.4.1.1 Non-probability Approaches

Web-based survey as entertainment

These surveys, usual polls posted on web sites are mainly for entertainment purposes and normally with no statistical validity. Controls over the questions to be posed and who the respondents should be are not a concern for this survey type. Couper (2002) explains this type of survey may not be considered a survey in scientific sense of world, but because of their popularity and the possibility that these may be confused with real survey in the mind of some people. These types of surveys are commonly used in forum for exchanging of opinion.

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Self-selected Web-surveys

Coupler (2002) in his paper describes this approach as web surveys which use open invitations on portals, frequently visited web site, or dedicated survey sites. This type of survey is common today and has no access restrictions and no control over multiple completions and hence might not provide valid statistics to the researchers.

Volunteer panel of Internet users

This approach creates a volunteer panel by wide appeals on well traveled site and Internet portals. Basic demographic information is collected from these volunteers when they register. This basic demographic information is collected to build a huge database of potential respondents for future surveys usage. Typically, these are volunteer, opt-in panel members who have provided their e-mail addresses on different occasions such as while e-shopping, during certain other Web interaction, in exchange for on-line information, etc..

2.4.1.2 Probability-Based Methods

Intercept surveys

This intercept-based approaches target visitors to a Web site. In a fashion similar to that of exit polls, these approaches generally used systematic sampling to invite every nth visitor to a site to participate in a survey.

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List-based samples of high-coverage populations

This approach argues that web-based surveys are useful for a subset of the population with very high or complete coverage. The basic approach to this type of Web survey is to begin with a frame or list of those with Web access. Email invitations will be sent to participants, and this type of web survey has access control to prevent multiple completions by the same respondent. These restricted populations typically have no coverage problem. Usually, these types of surveys are intra-organizational or private business surveys.

Mixed-mode design with choice of completion method

This approach uses the web as an alternative among many that might be offered to a respondent in mixed-mode design such as paper surveys. This approach is popular in panel surveys of establishments such as firms, business, schools and etc, where repeated contacts with respondents over a long period of time are likely. The main concern of this approach is to minimize respondent burden and cost.

Pre-recruited panel of Internet users

This approach is similar to the non-probability approach in web-panel creation. The main difference is that the earlier type is based on a panel of volunteers, whereas this type of survey recruits panel members using probability sampling methods such as telephone surveys. The background information is collected via telephone interviews, identify those with Internet access, and recruit eligible persons into Internet panel. Access is controlled

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via IDs, personal identification numbers or passwords as well to ensure that only those who are invited to do so complete the survey and do so only once.

Probability samples of full population.

Couper (2002) describes this type of web-based survey is unique in that it is the only method with the potential to obtain a probability sample of the full population, not just those who currently have Web access. This approach provides the necessary equipment and tools to potential respondents in exchange for their participation in subsequent Web surveys. This approach allows generalization beyond the current population of Internet users. Due to the high cost of recruitment, this approach invariably employs a panel design.

2.4.2 Type of Web-based Surveys Developments

In implementing a web-based survey project, there are few methods to develop a web-based survey form. Basically, there are four types of methods to develop a web-based survey that a researcher can choose from. The first method is self development where the researcher or the designer is computer literate programmer who can build and administer a survey without the help from an outside programmer. The researchers required to have a web server or web site to launch the survey themselves.

The second method is to purchase the program package and install it to the researchers or designers' workstation. These program tools allow the researchers or survey designers to

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build a survey themselves. Similar to the first method, a web server is required to launch the survey.

The third method is to outsource the web survey development to web survey development or service companies. These companies can be commissioned to create and prepare the survey on the intended web site. The benefit in outsourcing the development includes reducing computing hassle and having professional display survey format.

The final method is to use the online services provided by the Internet based companies. These Internet based companies provide online software to the researchers or designers to build and administer a survey on their secure web site. These programs require some computer and Internet knowledge in order to create a web-based survey but offer a cost effective option to develop a web-based survey.

2.5 Advantages and Disadvantages of Web-based surveys

The current research was motivated by the growing trend towards the realization of web-based technology. Since the mid 1990's researchers have been testing the practicality of using the WWW as a data collection format in research. Burkey and Kuechler (2003) have reported that the web-based surveys are an information-gathering technique that is used increasingly both within and across organizations and group. The web-based survey has potential for bringing efficiencies of comparable importance to the design and administration of self-administered questionnaires. The web-based survey does have

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considerable potential for surveying specific population where internet access is high (De Vaus, 2002).

The technology for web-based survey is considered young and evolving. In the existing literature on the topic of web-Based Surveys, many authors devote a great deal of their attention to discuss the advantages and disadvantages of this methodology as compared to the traditional "paper and-pencil" format (Fricker & Schonlau, 2002; Evans, 2005; Gunn, 2002; Sheehan & Hoy, 2002). The following section will discuss the advantages and disadvantages of conducting a web-based survey.

2.5.1 Advantages of Web-based Surveys

Researchers appear to agree on a particular set of advantages of web-based data collection methodology as compared to the traditional surveys: cost benefits, time efficiency, access to a large population in different geographic areas and quality of responses.

2.5.1.1 Cost Benefits

Web-based survey is considered as less expensive research methodology. The costs of both data collection and analysis can be minimized by the use of web-based surveys (Sheehan & Hoy, 2002). The web-based surveys eliminate the cost of paper, envelops or postage. For a given sample size, web-based surveys can be executed for less cost than any traditional forms of research. The traditional surveys such as paper surveys and telephone surveys tend to be costly with the increase of the sample size. As the web-

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based surveys are self-administered, interviewers are not required. Therefore, the costs of conducting the web-based survey can be kept down.

In terms of survey administration, the web-based surveys' responses are automatically stored into an electronic repository such as database. Data analysis can be simplified by a direct transfer from the database to analysis software, where limited data cleaning would be necessary. Additionally, transcription costs can be avoided since the online responses are automatically documented.

There is an argument that the preparation cost of web-based survey might not be less expensive as compared to others traditional survey format due to the preparation of web-based surveys involves the cost of various types of labor, including: survey design and programming, and other such items (Fricker & Schonlau, 2002; Evans & Mathur, 2005). However, with the availability of advanced survey software and specialized online questionnaire development firms, preparation costs are much lower (Evans & Mathur, 2005). Roztocki and Lahri's (2003) paper describes that Web-based surveys can result in estimated cost reduction of as much as one-third. In general, web-based surveys have cost saving benefit.

2.5.1.2 Time efficiency

In today's fast-paced world, time efficiency becomes an important factor in conducting a social survey or survey research. One of the advantages of web-based surveys is time saving and efficiency. Roztocki and Lahri (2003) reported that on average, the response

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time for web-based survey is much shorter than traditional means of data collection. The researchers can save time with web-based surveys, where by the web-based survey allow researchers to reach thousands of people with common characteristics in a short period of time, regardless the respondents are being separated by great geographic distances (Wright, 2005). In the face-to-face research environment, it would take considerably longer-if it were possible at all-to find an equivalent number of people with specific attributes, interests, and attitudes in one location (Wright, 2005). Sheehan and Hoy's paper (2002) states that the high volume of responses can be collected very quickly and studies have shown that several hundred responses can be generated over the course of a single weekend.

As the web-based surveys are self-administered, the researches can save their time while collecting data and able to use their time efficiently. The responses to the web-based surveys can be stored to the database automatically. This allows the researchers to conduct preliminary analyses on the collected data while waiting for the desired number of responses to accumulate (Wright, 2005). This time factor suggests huge benefit over traditional surveying techniques in term of being able to collect and analyze data quickly, and implement decisions based on the findings (Sheehan & Hoy, 2002).

2.5.1.3 Access to Larger Population in Different Geographic Areas

Web-based surveys have the potential to reach a high number of participants in the most remote geographic area. De Vaus (2002) described web-based surveys do have considerable potential for surveying specific populations where internet access rate is

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high. From the example given by Sheehan and Hoy (2002), web paged-based poll have been noted for their ability to generate a high number of responses. One illustrative example given is the GVU polls at Georgia Institute of Technology which generate more than 10,000 responses per poll (Feinberg, 1998; Sheehan & Hoy, 2002).

2.5.1.4 Quality of Responses and Human-Error Reduction

Since respondents type in their answers directly to a form on a web page, there is no need for an interviewer to have contact with respondents. Therefore, survey responses will be free from errors caused by interviewers, resulting in cleaner data. Roztocki and Lahri (2003) reported that comparative studies show that the responses to web-based survey, show fewer missing and fewer completion mistakes than traditional "paper-and-pencil" counterparts. Web-based surveys have dynamic error checking capability that improves the quality of responses. Human error during data entry is also eliminated because the responses are already in the digital format.

2.5.1.5 Design Flexibility

Web-based survey has advantage of design flexibility compare to email survey and traditional survey (Gunn, 2002; Sheehan & Hoy, 2002). The web-based survey can be designed so as to provide a more dynamic interaction between respondent and questionnaire than can be achieved in e-mail or paper survey (Dillman, 2000). Web-based surveys with Interactive features are now made possible by Java applets, JavaScript, VBScript and ActiveX technologies. By using CGI script, PHP or ASP programming languages in web-based survey allows adaptive questions to be constructed based on

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responses on previous questions. This allows for follow-up question that can enrich responses as well as for easier navigation for respondents (Sheehan & Hoy, 2002).

2.5.2 Disadvantages of Web-based Surveys

Every survey methodology has its weaknesses and disadvantages, thus web-based survey also come with disadvantages that should be considered by researchers.

2.5.2.1 Sampling Issues

The sampling issues are considered as primary issues and main concern in web-based survey. Sampling error is result of collecting data from only a subset, rather than all of the members of the sample frame (Dillman, 2000). The most questionable aspect of web-based survey data is whether a representative sample of the target population will have the opportunity to respond. For example, the web-based surveys may provide high-quality samples for researchers who are interested in population who are likely to frequent the Internet, such as college student or people who likes to surf the Internet. For those interested in older populations who are not likely to frequent Internet, however, the Internet may not provide a representative sample of that population of interest.

The other primary concern is the issue of data quality. When conducting web-based survey, researchers face problem to verify the identity of a respondent. Some web-survey programs using participants' email address to control the data quality (Andrews *et al.*, 2003). Before starting web-survey, participants are required to submit their email address in order to complete the survey. The survey program will store the email address and

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does not allow anyone using that email address access to the survey. However, problem such as multiple email addresses for same person, multiple responses from participants, and invalid addresses could potentially happen.

2.5.2.2 Respondent lack of online experience/expertise.

Respondents may have different levels of computer expertise. This lack of computer expertise can be a source of error or non-response (Gunn, 2002). The respondents must be computer literate or know how to use web browser in order to complete the web-based survey. Even people who are fairly computer savvy are not always willing to spend time learning or trying to figure out a new application that they will not use again (Boyer *et al.*, 2001). The researchers could not determine in advance the number of potential respondents who may have problems with the Web-based surveys. This will result in non-response or the respondents not able to complete the survey due to lack of computer knowledge.

2.5.2.3 Access Issues

A web-based survey should be accessible to all the individuals in the sample group. However, the occasional problem with web-based surveys is some respondents may not have Internet access (Freeman, 2002). Barriers to Internet accessibility issues will lead to poor response rates.

Another issue occurs when researchers extend the survey invitation to the potential participants to join a web-based survey. Some researchers reach potential participants by

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posting invitations to participate in a survey community bulletin board or discussion group chat rooms. However, the receiver may consider this type of posting to be "spam" and may delete the unwanted post (Wright, 2005). Researchers using email invitations for participation in a survey may face similar rejection.

2.5.2.4 Implementation Issues

The implementation of web-based surveys is technically more involved than mail or phone surveys. Technical ability is required to format the survey and related database. Survey designers need to specify many factors related to the technical control of web-based surveys such as input validation, passwords, answering optional and etc.

Problems associated with web page design computer programming can play a significant role in web-based surveys, and the coding of the questionnaire can be a source of error with web-based surveys (Gunn, 2002). Time and extra resources are needed to program a web-based survey so that it meets the acceptable standards of functionality. During the programming stage, if the developer overlook a programming error in the web-based survey program, this error may be triggered when a respondent fill up the questionnaire. This might results the display of a confusing error message and might stop the respondent to continue to complete the questionnaire.

2.5.2.5 Technical and Software issues

Some web browsers do not fully support web-page scripting like JayaScript. Some participants are using older version of web-browsers such as Netscape Navigator 3.0 and

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lower or Microsoft Internet Explorer version older than 4.0. There might be program or scripting error if the participants' web-browser is not working properly with the latest scripting or programming languages. There is no guarantees that today functioning code will continue to function properly in future browser version.

Another disadvantage is related to hardware or system failure such as server crash, network outage and etc. The respondent may be unable to complete the survey due to server failure or network failure. This will lead to missing data as a respondent's answers are submitted at the end of each page.

Among the above-mentioned disadvantages, sampling and access issues are the common issues among other survey methods such as paper survey, telephone survey and etc. To overcome the sampling issue in conducting a web-based survey, Wright (2005) recommends researchers generate sample from online community and conduct multiple web-based surveys with the same or similar type of Internet communities to gain a more reliable picture of the characteristics of web-based survey participants.

In this dissertation, the scope of study is focus on the weaknesses related to the implementation and technical issues. After identified the issues faced when constructing a web-based surveys, it is clear that there is a need to have a tool to automate and simplify the process of constructing a web-based survey. The outcome of the study is a web-based survey generator system (named My-WEBQ) that able to provide the solution to overcome the implementation and technical issues of constructing a web-based survey.

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My-WEBQ provides graphic user interface to the researchers or survey developers to construct a web-based survey without the need to have any knowledge on any programming language or scripts syntax.

2.6 Web-based Questionnaires

Web-based survey questionnaire design is not web design. It is important to understand the goal of writing a survey question. According to Dillman (2000), the goal of writing a self-administrated survey question is to develop a query that every potential respondent will interpret it in the same way and respond to the query accurately. Designing questions is a difficult challenge mainly due to simultaneously influence of many factors that decides a proposed question's ability to obtain accurate answers.

To design a good web-based questionnaire, the researchers face a number of decision including which question structure is most appropriate to formulate the question, what are the response format suitable for web-based questionnaires and questionnaire layout design.

2.6.1 Type of Questions

Survey questions vary according to what type of information the researches are trying to collect from the respondents and how this information will achieve to the goals of the survey. Generally, questions can be divided into two broad types: open-ended question and closed-ended question. Dillman (2000) in his paper describes, basically there are only three different ways a survey question can be structured. One way is to pose a query as an

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open-ended question, an item for which no answer choices are provided. The others provided answer choices which can, in turn, be structured as closed-ended in either of two ways – as ordered or unordered response categories.

Researchers first will need to decide which question type that they would like to ask in their questionnaire: open-ended or closed-ended questions. The choice between open and closed questions depends on the general research problem, the types of data researchers seek, and where the researchers want to place the burden of interpretation.

2.6.1.1 Open-Ended Questions

Open-ended questions allow respondents to have freedom to answer in their own words and give any answer. The response is free-form and could be one word or several hundred words, depending on the individual. In traditional survey, open-ended questions may be a good way to break the ice with respondents by giving respondents an opportunity to answer in their own words.

Example:

Why did you buy a new hand phone?

I bought a new hand phone because _____

Open-ended questions provide primarily qualitative data, and are frequently used in exploratory research. The drawback to open-ended questions is that the responses are more difficult to catalogue and interpret.

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2.6.1.2 Closed-Ended Question

In closed-ended questions the possible responses are listed for the respondents. Closed-ended questions restrict respondents to selecting from the provided answers. There are 5 basic types of closed-ended questions: Multiple-choice, Categorical; Likert-scale, Numerical, and Ordinal (Rank Order Scaling).

2.6.1.3 Multiple-choice

A multiple-choice question is used when the researchers want the respondents to choose the best possible answer among all possible options presented. Multiple-choice questions are easy to put up in a written survey. This includes specific directions about how many answers to select directly after the question.

Example:

How did you first hear about our web site?

☐ Television

☐ Radio

☐ Newspaper

☐ Magazine

☐ Internet

☐ Word-of-mouth

☐ Other: Please Specify _____

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2.6.1.4 Categorical

A categorical question is used when the possible answers are categories, and the respondent must belong in exactly one of categories.

Example:

What is your gender?

☐ Male

☐ Female

A categorical question is useful when the researcher is interested on the response given by a particular category. If the researchers want information only about female users, they may want to ask this type of question to "screen out" those male users of their products or services.

2.6.1.5 Likert-scale

A Likert-scale question is used when the researchers are trying to determine respondents' attitudes or feelings about something. The respondents must indicate how closely their feelings match the question or statement on a rating scale.

Example:

What was your overall impression of the Facilitator Service?

Poor 1 2 3 4 5 Excellent

Likert-scale questions are commonly used for collecting quantitative data. A typical question using a Likert Scale might pose a statement and ask the user whether they Strongly Agree, Agree, Undecided, Disagree or Strongly Disagree. The number at one

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end of the scale represents least agreement, or "Strongly Disagree," and the number at the other end of the scale represents most agreement, or "Strongly Agree". Likert-scale is a great way to measure and compare sets of variables

2.6.1.6 Numerical

A numeric question is a question that expects a number for the answer. A numerical question is asked when the answer must be a number like age, number of months, etc. Numerical question has the added flexibility to accept a range of answers.

Example:

> What is your current age? (Select one)
> ☐ Less than 18
> ☐ 18 to 29
> ☐ 30 to 39
> ☐ 40 to 49
> ☐ 50 or older

2.6.1.7 Ordinal

Sometimes the researchers may want their respondents to rank the order of their responses. An ordinal question is asked when the researchers need all possible answers to be rank ordered. A ranking indicates the importance assigned by a participant to an attitudinal object.

Example:

> Based upon what you have seen, heard, and experienced, please rank the following operating system according to their reliability. Place a "1" next to the

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operating system that is most reliable, a "2" next to the operating system that is next most reliable, and so on. Remember, no two operating systems can have the same ranking.

__ MS Windows NT
__ MS Windows 98
__ MS Windows 2000
__ MS windows XP

Ordinal questions allow a certain set of brands or products to be ranked based upon a specific attribute or characteristic.

Closed-ended questions are much easier to quantify and analyze than open-ended questions and place fewer demands on respondents, and therefore they are emphasized by most scientific surveys. The potential drawback in closed-ended question is the researchers must be able to anticipate the great majority of the possible different answers to the question from an often diverse set of respondents. When this is not possible, open-ended questions are preferred, and most surveys will include one or few such questions to make sure respondents have some chance to convey information not revealed by the closed-ended questions.

2.6.2 Response Format

The response format is how the researchers collect the answer from the respondents. Different types of questions require different types of answers leads the researcher to different decisions on choosing the response format or the option on the presentation of the answer. It is the researchers' responsibility to decide which response format best suits

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the question. Choosing a right response format is very important in designing a web-based questionnaire to ensure the efficiency and data quality of a survey. From the studies carried out by researchers (Couper *et al.* 2001; Heerwegh & Loosveldt, 2002) it showed that different response formats used for a question in web-based survey can affect the survey result.

Web-based survey together with HTML programming ability has the advantage of design flexibility compare to traditional paper survey. In web-based survey, the ways in which response formats are presented are more interactive than traditional survey method. There is a wide array of response options for web-based surveys such as radio boxes, check boxes, drop-down menus, as well as the inclusion of graphics and etc. The researchers may ask the respondents to illustrate their answer by checking the relevant check box in a multiple choice question. In either open or partially closed questions, a text entry box may be provided for respondent to enter their answer.

Radio buttons are similar to tick boxes in traditional paper questionnaires where all answer options are visible to the respondent. This response type requires precision in clicking and appropriate for "choose one only" from mutually exclusive item. The respondents would take less time to complete the questionnaire than the entry box. There is a potential drawback of radio buttons that once an option is clicked upon, a respondent is committed to provide an answer. Once an option is click, the respondent can only change the answer but can't erase the answer although there is no answer from the

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respondent. However, there is a solution to overcome this problem by offering a 'no answer' option in the answers list.

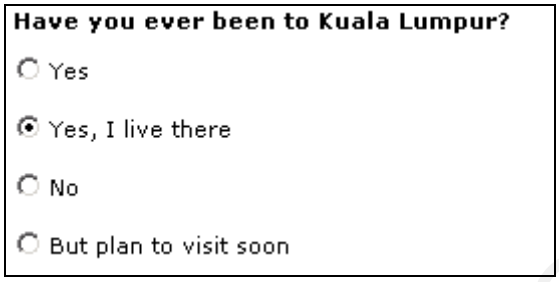

Figure 2.3: Radio button as response format.

Drop-down boxes are best used when the answer option is a very long list such as country list. The advantage of using drop-down boxes is that the questionnaire appears to be substantially shorter than those using radio buttons. Some researcher reported that the advantageous over radio buttons is that the drop-down boxes have a faster download time (Couper *et al*., 2001). A drawback of the drop-down boxes is the respondents require two mouse click actions to select their answer whereas radio buttons require only one. Thus, this response format may increase the respondent's burden (Couper *et al*., 2001).

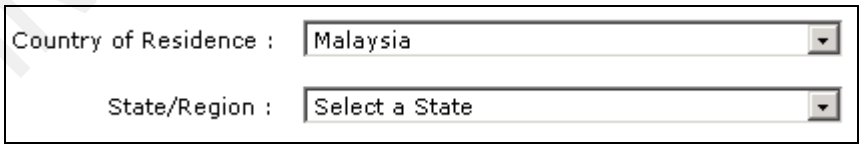

Figure 2.4: Drop-down box as response format.

Check boxes are one of the response formats to allow the respondents to check more than one response. By convention, the researchers usually use the checkmark format when they want to allow the respondent to select multiple items. To check the answer, the

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respondent places a check next to the answer options. The respondent can uncheck a box simply by clicking the box again. Some researchers argue the use of "Check all that apply" only when necessary or not to use at all, because respondents tend to merely satisfy their task rather than optimizing (Dillman 2000).

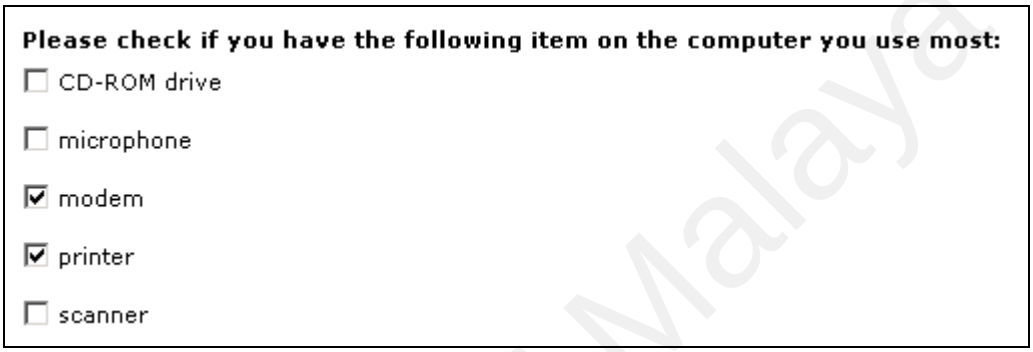

Figure 2.5: Check box as response format.

Text box is response format used to collect the respondents answer in a freeform where the respondents have freedom to answer in their own words by entering their answer into text box. There are two type of text boxes used in web-based survey: single-line text box and multi-line text box. Single-line text boxes are commonly used for collecting respondents' personnel details such as name, addresses and etc. Multi-line text boxes are commonly used for collecting comments from the respondents. Text boxes are the only suitable response format for open-ended questions in web-based surveys. The text entry boxes have potential to collect more accurate data from the respondents. However, the results of Coupler (2001) experiment on the use of radio buttons versus text entry boxes showed that more missing data from the questionnaires with text entry boxes than those with the radio buttons.

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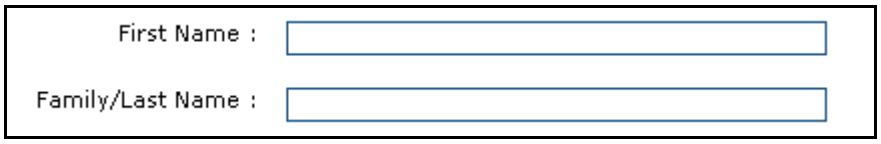

Figure 2.6: Text box as response format

Another type of standard response format for web usage is the placement of answer options in a matrix. Quite often, researchers will want to ask several questions that have the same set of answer categories. In such a case, it is often possible and desirable to construct a matrix of items and answers. The matrix format has a number of advantages. Respondents will probably find it faster to complete a set of questions presented in this fashion. In addition, this format may increase the comparability of responses. Usually, in matrix format, the question text is placed at the left-hand side of the screen and the answer columns start next to this and continue until the end of the right-hand side of the screen. However some conservative researchers found that this format places too much cognitive burden on the respondents whereby the respondents have to position the mouse and click on the desired answer.

Please rate the bellowing operating system according to their reliability. (Scale: 1-Poor to 5-Excellent)

Operating system	1 Poor	2	3	4	5 Excellent
MS Windows NT	○	○	○	○	○
MS Windows 98	○	○	○	○	○
MS Windows 2000	○	○	○	○	○
MS windows XP	○	○	○	○	○

Figure 2.7: Matrix response format.

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Response formats should not be restricted to a single one because alternating between formats could counteract monotony and respondent boredom (Heerwegh & Loosveld, 2002). Researchers and designers need to evaluate the benefits and disadvantages of each of the formats in light of his or her project.

2.6.3 Questionnaire Layout

The physical layout of the questionnaire is important for self-administration questionnaire. The structure and layout of the questionnaire can affect the quality of responses from the respondents and as well as the overall response rate. Self-administration questions need clear and simple layout so that the respondent finds it easy to complete the questionnaire. A confusing layout will confuse the respondents and may cause the respondents refuse to complete the questionnaire. A well designed layout and proper guidelines can help respondents answer the questions and minimize the effort necessary for them to comply with the researchers' request. Therefore, in constructing web-based surveys, the attention in designing the appropriate interfaces has ventured into determining the appropriate layout such as how to set up navigation, the use of color, the use of multimedia features, how to structure the flow of the questionnaire on the web pages and data entry buttons so that they are intelligible (Dillman, 2000).

The use of Welcome screen

It is good a practice to introduce the web questionnaire with a welcome screen that is motivational, emphasizes the ease of responding, and instructs respondents about how to proceed to the next page (Dillman, 2000). The web questionnaire is self-administration

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questionnaire and there is no surveyor or interviewer to convince the respondent to go further from the initial page. Therefore, the first screen is designed to help the respondents get to the content of the questionnaire as quickly and with as little effort as possible.

The use of color

A proper use of color could provide visual indication that may simplify the web-based survey process such as mandatory information highlighted with bold color. Inappropriate use of color represents one of the biggest threats in the development of web questionnaires.

2.7 Comparing Current Web-based Survey Software and Related Services in the Current Market

In the current market, there are a number of software packages and related services available to researchers in implementing a web-based research. From the Internet, we can find a number of online survey software packages and web-based survey services that can provide assistances in constructing and conducting web-based surveys. In this paper, author presents a comparison of features, pricing issues, and limitation of selected online products and service companies.

2.7.1 CreateSurvey

CreateSurvey is an online survey management system being developed since 1999. CreateSurvey is a subdivision of TB Labs, LLC (founded 1998), a software development

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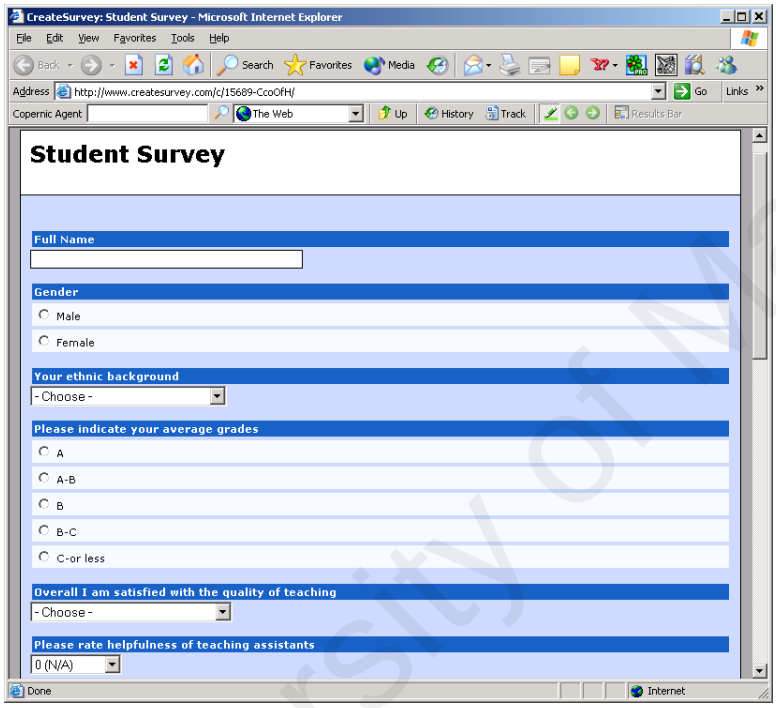
company primarily targeting small and medium businesses. CreateSurvey provides web-based survey software called Create Survey that lets surveyors to build and run online surveys.

URL : www.createsurvey.com

Sample survey screen from CreateSurvey:



Features:

a. System requirements to create a survey

- Internet connection, web browser

b. Security and privacy

- Password-protected account
- Password-protected surveys

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c. Survey management

- Allow multiple users access using the same login and password. It is not recommended to edit the same survey by different users.
- Allows to copy survey or to create survey templates and backups

d. Survey design

- Allow to edit survey after publishing
- Able to add logos, animated images, illustrations, photos to the survey
- Design questions in Single text line, Multiple text lines, Single choice (radiobuttons), Single choice (drop-down box), Multiple choices, Matrix questions and support text comments and images

e. Survey publishing

- Surveys are hosted at createsurvey.com
- E-mail notification
- Stop the survey from being available for submission
- Unlimited surveys and responses

f. Reporting

- Real time online summary stats
- Browsing the list of responses
- Downloadable stats

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g. Pricing

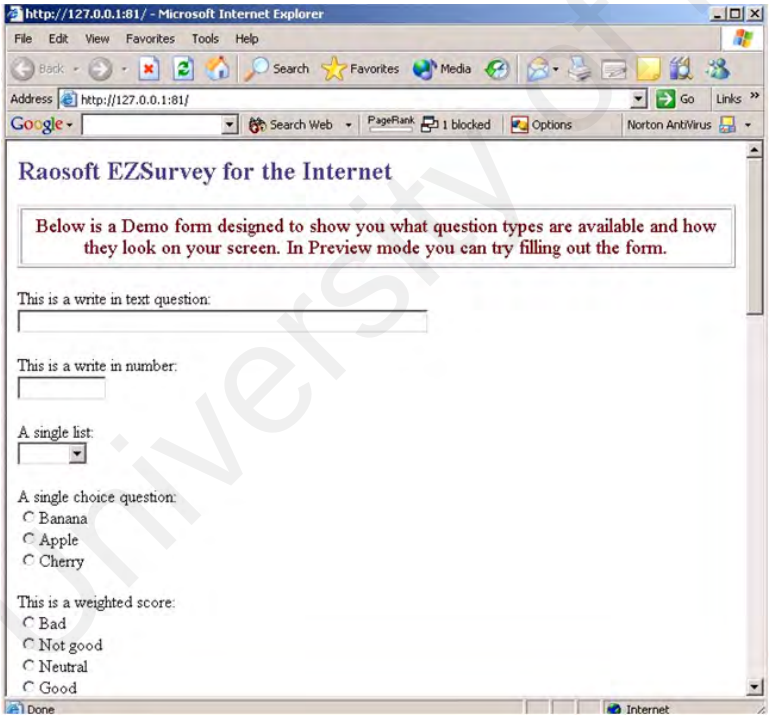
- $99 a month for unlimited surveys and responses; free email support

2.7.2 Raosoft EZSurvey for the Internet

EZSurvey for the Internet is web survey software produced by Raosoft, Inc for information gathering and analysis. Raosoft EZSurvey for the Internet is designed for an average computer user to write web surveys, gather responses online, and analyze results.

URL : http://www.raosoft.com/products/ezsurvey/

Sample Survey Screen from EZSurvey:



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Features:

a. System requirements to create a survey

- The desktop application installs on Win2000, NT and XP
- Internet connection to a web server
- Standard browsers: IE 4+, Netscape 4+, and many others

b. Security and privacy

- Password-protected account
- 32-bit auto-generated unique session ID is used

c. Survey management

- Survey participants can save their responses and return later to finish.
- Allows skip to a different question or to different pages depending on the question or response to a question that is selected

d. Survey design

- Provides templates to speed up the design process
- Provide HTML links at survey forms
- Design questions in yes/no, multiple choice, open-end comment, weighted score, date, time, numeric format, use the Raosoft developed Rank Order question type and draw from question libraries

e. Survey publishing

- Surveys are hosted at own web server or at Raosoft EZSurvey Web Server

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- Provide option to send e-mail to Respondent
- Unlimited surveys and responses

f. Reporting

- Instant HTML web reports for online, real-time results viewing
- Quickly create a Summary displaying pie, horizontal, and vertical bar charts, or view tables
- Printer-ready Adobe Acrobat documents are included

g. Pricing

- $399 for basic software; additional software is extra; telephone training is $150 an hour

2.7.3 FormSite.com

FormSite.com is a service of Vroman Systems, Inc. FormSite.com is a self-service tool that enables the creation of HTML forms using only a web browser. Forms are created and stored in FormSite.com's servers. Customers can create forms and receiving results via the Internet.

URL : www.formsite.com

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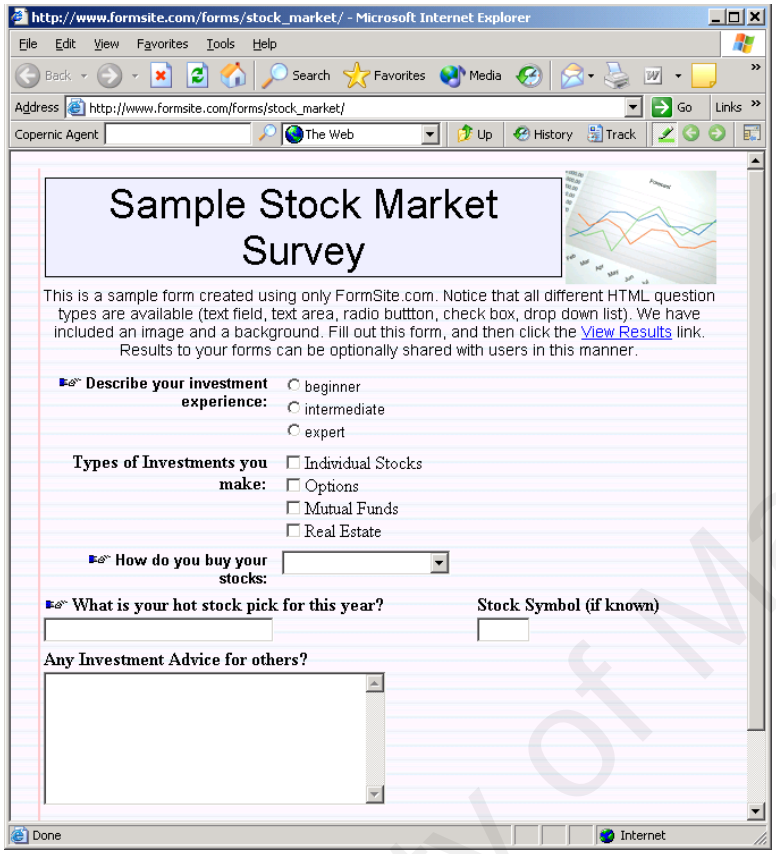
Sample Survey Screen from FormSite.com:



Features:

a. System requirements to create a survey

- Internet connection, web browser

b. Security and privacy

- Optional Password-protected user account
- Optionally share form results with others for read and/or update

c. Survey management

- Survey participants can save their responses and return later to finish.

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- Skip/branching logic is available based on user response
- Multiple Page Forms

d. Survey design

- Provides templates to speed up the design process
- Provide HTML links at survey forms
- Color Chooser to specify text color, font, link, and background color
- Add a common header and footer to each page of the form
- Design questions in Text Box, Text Area, Radio Button, Drop-Down List, Check Box, Radio Button Matrix Style Questions, Text Field Matrix Style Questions, Text Area Matrix Style Questions, Radio Button Multiple Scale Questions, Ranking (order items from 1 to X) and support attachments and Images (gif or jpeg images)

e. Survey publishing

- Surveys are hosted at FormSite.com Web Server
- Provide option to send e-mail to Respondent
- Limited number of response per month depends on the service package

f. Reporting

- Results are downloadable in CSV (spreadsheet) format
- Statistical Calculations and graphs are provided for results
- View results in summary format or view each result individually

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g. Pricing

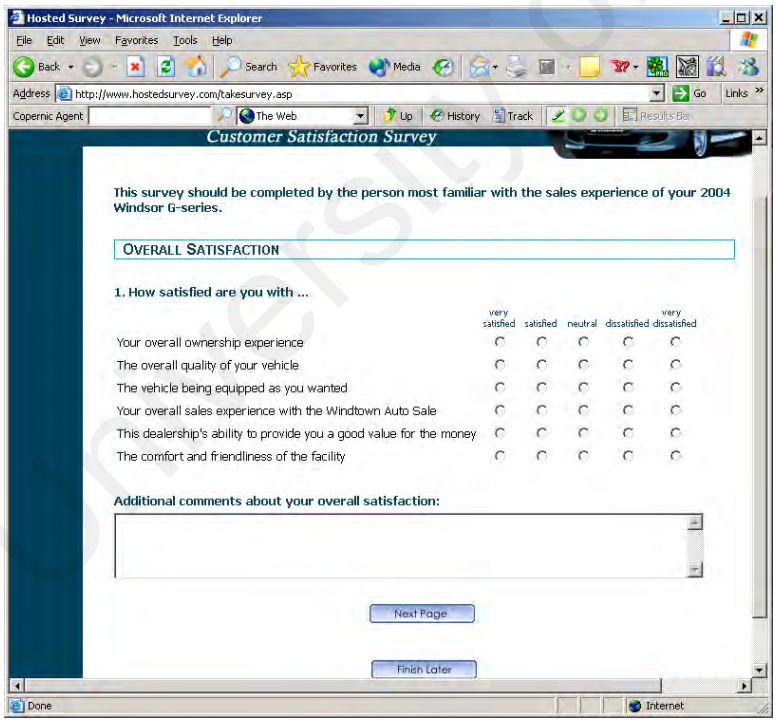
- $9.95 up to $99.95 per month depending on desired number of response

2.7.4 Hosted Survey™

Hosted Survey™ is produced by Hostedware Corporation, based in Irvine, California. Hosted Survey™ is a fully web-hosted survey software application developed for researchers, evaluators and organizational improvement specialists to conduct web surveys online.

URL: www.hostedsurvey.com

Sample Survey Screen from Hosted Survey:



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Features:

a. System requirements to create a survey

- Internet connection, web browser

b. Security and privacy

- Password-protected account

c. Survey management

- Survey participants can save their responses and return later to finish.
- Skip/branching logic is available based on user response
- Allows to copy survey

d. Survey design

- Provide survey template
- Custom background color
- Move or re-sequence questions in a survey
- Able to add logos and images to the survey
- Design questions in Multiple Choice, Select Just One (Radio buttons), Check all that apply (check box), Rank along scale, Dropdown box, List box, Single line text response, Multi-line text response (User-defined length or unlimited length), Rating Scale (horizontal or vertical scale), Matrix Question and support animation in survey

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e. Survey publishing

- Surveys are hosted at Hosted Survey
- Provide option to send e-mail to Respondent
- Unlimited surveys
- Number of responses is depend on the service package

f. Reporting

- Statistical Calculations and graphs are provided for results
- Provide configurable reports with filter
- Downloadable results data in tab-delimited, Microsoft Excel, Access or XML format

g. Pricing

- Charge is per number of responses; first 250 response are free, then around $20 for every 50 responses.

2.7.5 Key Survey

Key Survey is a survey software services company, founded in 2001. Key Survey provides an online survey tool that allows any business, large or small, to create and distribute a survey online.

URL: www.keysurvey.com

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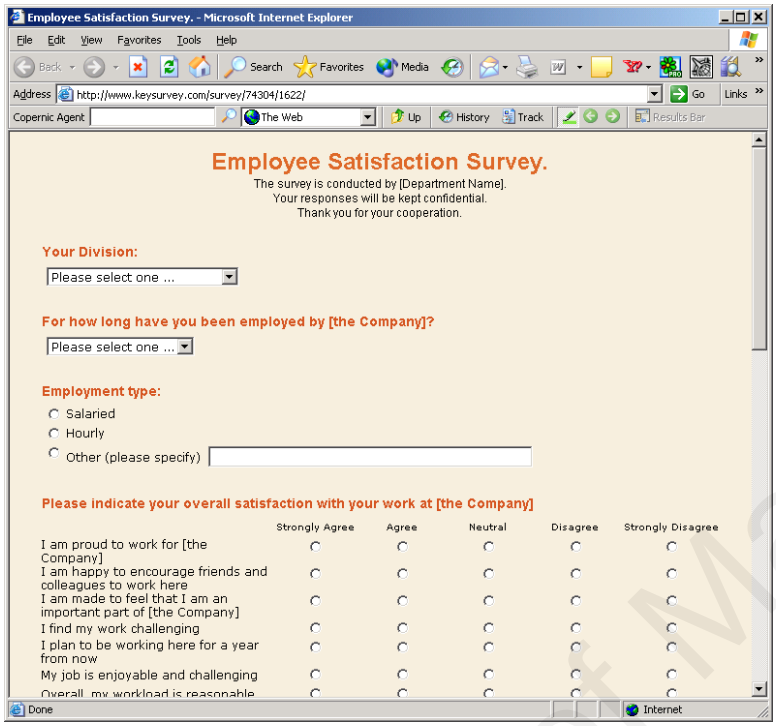
Sample Survey Screen from Key Survey:



Features:

a. System requirements to create a survey

- Internet connection, web browser

b. Security and privacy

- Password-protected account

c. Survey management

- Allows to copy survey
- Survey participants can save their responses and return later to finish.
- Allows redirect to any URL after survey submission

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- Skip/branching logic is available based on user response

d. Survey design

- Provides survey templates
- Provide HTML links at survey forms
- Able to add logos and images to the survey
- Design questions in Pick one (with or without comments),Check all that apply, Rank along scale, Dropdown box, List box, Pre-format answers, Single line text response, Multi-line text response, Numeric or percentage allocation, Most preferred matrix, 3D Matrix

e. Survey publishing

- Surveys are hosted at Key Survey Web Server
- Provide option to send e-mail to Respondent
- Number of surveys and responses are depend on the service package

f. Reporting

- Online report, Real-time Results
- View results in summary format or view each result individually
- Support export results to Excel and PDF Report Print
- Statistical Calculations and graphs are provided for results

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g. Pricing

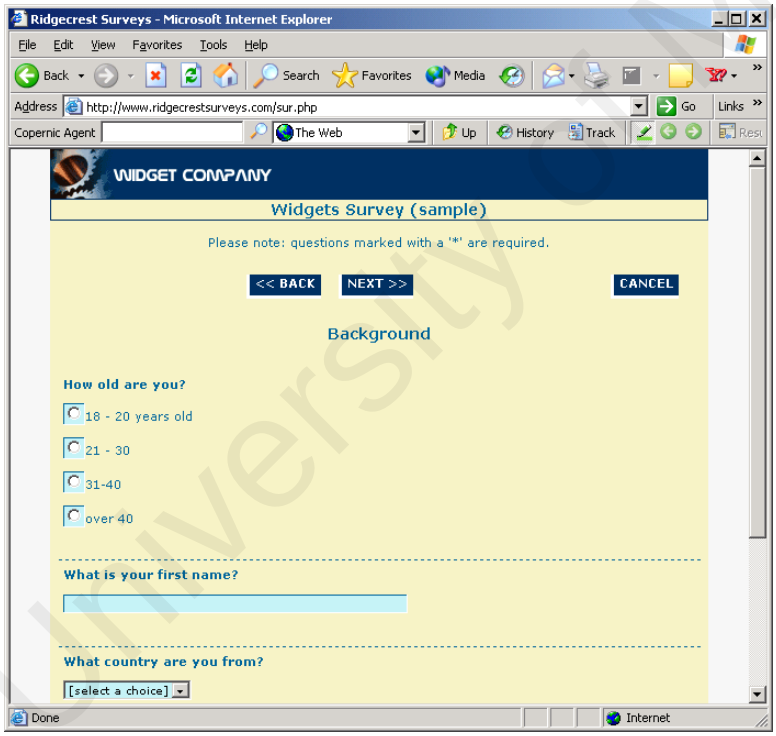
- $670 per year for a basic subscription limited to 2000 responses; free 30 day trial

2.7.6 Ridgecrest

Ridgecrest Surveys is a division of Ridgecrest Marketing. Ridgecrest Surveys provides online hosted survey capabilities for small to mid-size businesses and organizations.

URL: www.ridgecrestsurveys.com

Sample Survey Screen from Ridgecrest:



Features:

a. System requirements to create a survey

- Internet connection, web browser

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b. Security and privacy

- Password-protected account

c. Survey management

- Allows to copy survey
- Option to allow survey participants save their responses and return later to finish.
- Allows redirect to any URL after survey submission
- Skip/branching logic is available based on user response

d. Survey design

- Provide HTML links at survey forms
- Able to add logos and images to the survey
- Custom color schemes
- Design questions in choices choose one (vertical or horizontal), choices choose many (vertical or horizontal), dropdown box, matrix choices (choose one or many per row), matrix choices rating (choose one per row), numeric assign choices, single line text, multiple lines text and support picture.

e. Survey publishing

- Surveys are hosted at Ridgecrest Survey Web Server
- Anonymous survey taking
- Provide option to send email notification
- Number of surveys and responses are depend on the service package

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f. Reporting

- Live results viewing report
- Responder statistics report
- Results viewing using specific responders filter
- Exported results and survey information into Excel

g. Pricing

- $54.95 for 30 days and limited to 2000 responses for basic package; free 30 day trial limited to 20 responses.

2.7.7 SuperSurvey

The SuperSurvey™ online survey system is the core product of Tercent, Inc., a Massachusetts corporation. Tercent has been producing professional online survey tools since 2001.

URL : www.supersurvey.com

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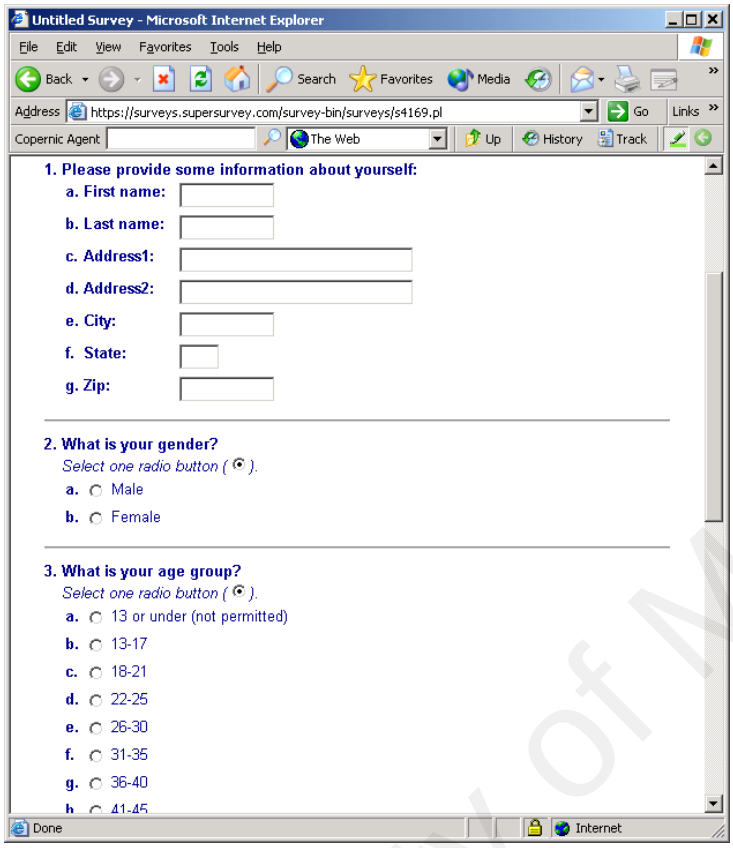
Sample Survey Screen from SuperSurvey:



Features:

a. System requirements to create a survey

- Internet connection, web browser

b. Security and privacy

- Anonymous surveys
- Password-protected account

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c. Survey management

- Manual copy survey by send a request to support@supersurvey.com
- Skip/branching logic is available based on user response
- Multi-page survey

d. Survey design

- Customizable fonts, sizes, colors, titles
- Able to add logos and images to the survey
- Design questions in multiple-choice questions with only one answer possible (Radio buttons), Check all that apply (check box), pull-down box questions with only one answer possible, Single line text response, Multi-line text response and Matrix Question.

e. Survey publishing

- Provide option to send e-mail to Respondent. Basic surveys are limited to sending 25 invitation emails
- Survey housed in SuperSurvey server for only a set amount of time depends on service package;
- Number of surveys and responses are depend on the service package

f. Reporting

- View the results online, in real time
- View the full data or an online summary report

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- Downloadable results in CSV (comma separated values) format
- Graphs are provided for results

g. Pricing

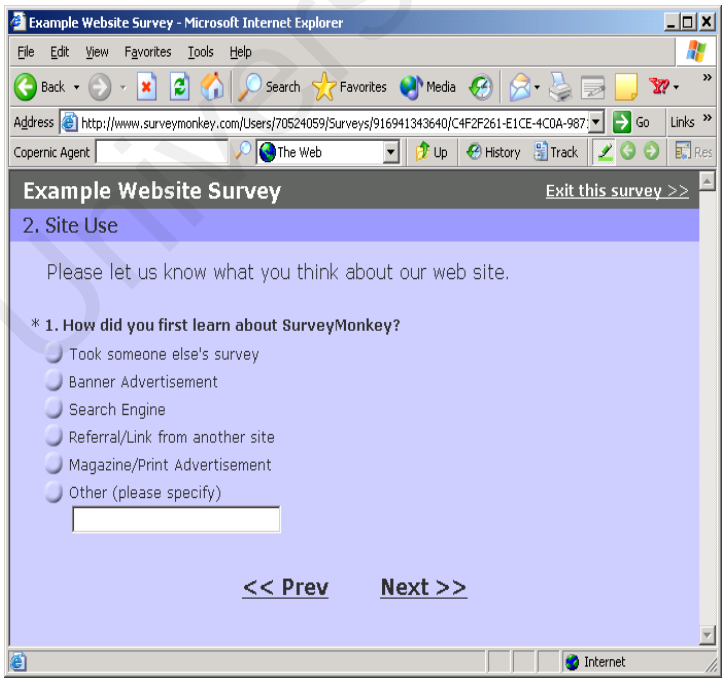
- Single surveys are priced on a weekly basis, based on the set of features used. $149 per week for basic package with 2000 response per week limit.

2.7.8 SurveyMonkey

SurveyMonkey is online survey software provided by SurveyMonkey.com. The purpose of SurveyMonkey is to enable anyone to create professional online surveys quickly and easily.

URL: www.surveymonkey.com

Sample Survey Screen from SurveyMonkey:



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Features:

a. System requirements to create a survey

- Internet connection, web browser

b. Security and privacy

- Password protect surveys

c. Survey management

- Allows redirect to any URL after survey submission
- Skip/branching logic is available for professional package
- Support multi-page survey

d. Survey design

- Custom color schemes
- Able to add logos up to 50K in size at every survey page
- Able to copy question
- Design questions in Choice - One Answer (Vertical or Horizontal), Drop down box, Choice - Multiple Answers (Vertical or Horizontal), Matrix - One Answer per Row (Rating Scale), Matrix - Multiple Answers per Row (check box),Matrix - Multiple Answers per Row (Dropdown box),Single Line text box, Multi line text box, Text box support Date and/or Time, support Descriptive Text and Image

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e. Survey publishing

- Unlimited number of surveys.
- Number of questions and responses are depend on the service package
- Survey housed in Survey Monkey server for a set amount of time depends on the service package

f. Reporting

- View the results online
- View results in summary format or view each result individually
- Filter Results only for professional package
- Result view in graphs and charts
- Downloadable result into Excel or SPSS for professional package

g. Pricing

- Free for a month for a basic subscription. $19.95 a month for Professional subscription with limited responses up to 1000 responses per month;

2.8 Summary of Comparison

As the changes on Internet are rapid, the selected products and service companies may not be a comprehensive list of the web-based survey software package and services. Furthermore, the pricing and features might be changed from time to time. However, this study provides a guideline to the researchers on current available online survey products

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and services with brief comparison of feature, pricing and service limitations. The summary of the comparison is listed at below table:

Table 2.2: The summary of the web-based software packages comparison.

Features \ Survey Software	CreateSurvey	EZSurvey	FormSite.com	Hosted Survey	Key Survey	Ridgecrest	SuperSurvey	SurveyMonkey
a. System requirements to create a survey								
- Creating survey using web browser	•	•	•	•	•	•	•	•
- Creating survey using desktop application		•						
b. Security and privacy								
- Password-protect account	•	•	•	•	•	•	•	•
- Anonymous surveys						•	•	
c. Survey management								
- Allows to copy survey	•			•	•	•		
- Skip/branching logic		•	•	•	•	•	•	•
- Survey participants can save their responses and finish later		•	•	•	•	•		
- Allows redirect to any URL after survey submission					•	•		•
- Multiple page survey			•				•	•

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Table 2.2, continued

Features \ Survey Software	CreateSurvey	EZSurvey	FormSite.com	Hosted Survey	Key Survey	Ridgecrest	SuperSurvey	SurveyMonkey
d. Survey design								
- Provide survey templates	•	•	•	•	•			
- Create new template	•							
- Add HTML links	•	•	•		•	•		
- Add logos and images	•	•	•	•	•	•	•	•
Design questions								
-Choose one	•	•	•	•	•	•	•	•
-Check all that apply	•	•	•	•	•	•	•	•
-Single line text	•	•	•	•	•	•	•	•
-Multiple lines text	•	•	•	•	•	•	•	•
-Dropdown box	•		•	•	•	•	•	•
-List box				•	•			
-Matrix Question	•	•	•	•	•	•	•	•
-Support text comments	•	•	•	•	•	•		•
-Support animation				•				
e. Survey publishing								
-Surveys are hosted at provider server	•	•	•	•	•	•	•	•
-Surveys are hosted at own server		•						
-send e-mail to Respondent	•	•	•	•	•	•	∅	•
-Unlimited surveys	•	•		•				•
-Unlimited responses	•	•						

∅ - depends on the service package

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Table 2.2, continued

Features \ Survey Software	CreateSurvey	EZSurvey	FormSite.com	Hosted Survey	Key Survey	Ridgecrest	SuperSurvey	SurveyMonkey
f. Reporting								
-Online report	•	•	•		•	•	•	•
-View results in summary format	•	•	•	•	•		•	•
-View each result individually		•	•		•			•
-Result in graph	•	•	•	•	•	•	•	•
-Filter Results				•		•		∅
-Downloadable results in CSV or Excel		•	•	•	•	•	•	∅
-PDF Report Print	•				•			
g. Pricing								
-Free 30 day trial					•	•		•
-User need to purchase the service	•	•	•	•	•	•	•	•

∅ - depends on the service package

2.9 Common Features of a generic web-based survey generator

Based on the summary of the comparison that has been presented at previous section, there are some common features among the selected products such as offer survey template, provide common response format like “choose one format”, “check all option”, “single line text box”, “matrix options format” and etc. For a general research such as customer satisfaction, employee evaluation and etc, a generic generator with common

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features is sufficient. The common features that have been included in the prototype of My-WEBQ are:-

- Creating survey using web browser.
- Password authentication.
- Provide survey templates.
- Copy survey.
- Online reporting.
- View results in summary format.
- Downloadable results in CSV or Excel.
- Design questions different option format they are “choose one option”, “check all that apply”, “single line text”, “multiple lines text”, “dropdown box” and “matrix Question”.

However, there are some limitations in the current products in the market such as:

- Limited trial survey period
- Limited responses volume
- Charges incur for online survey service
- Most of the services require the surveys to be hosted at provider server
- Data are stored at provider server

To overcome these limitations, the dissertation has developed My-WEBQ as a free web-based survey generator that is capable to automate and simplify the development process

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of web-based survey for researchers. This system also supports multiple database platforms and the researchers can store the research data locally at their server.

2.10 Proposed Framework

Study on developing a web-based survey has been discussed in previous sections. Knowledge earned from this study has been incorporated with the findings of the common features of existing survey software to form the design framework of the proposed system: My-WEBQ. Figure 2.8 illustrates the conceptual framework of My-WEBQ with the external knowledge sources and system output. The purpose of this framework is to provide a fundamental structure for My-WEBQ development within the scope given.

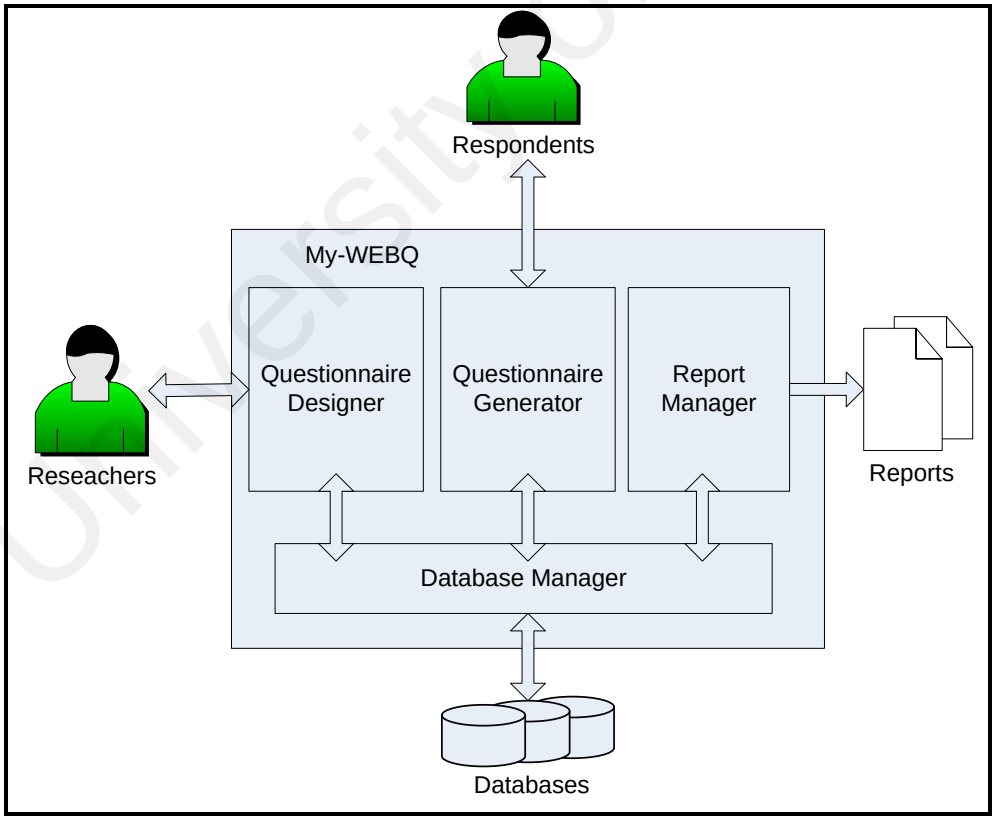

Figure 2.8 Conceptual Framework of My-WEBQ

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The primary external knowledge sources are Researchers, Respondents and Databases. Each of this external knowledge sources contributes specialized knowledge needed for the creation of a web-based questionnaire or provides input as response to a web-based questionnaire.

Researchers and Respondents are the users of the system. Researchers provide the knowledge to the system to construct a web-based questionnaire such as the design of the questions, the layout format of questionnaire and etc. Respondents are the users who answer the questionnaire. The population and type of respondents are more depend on the type of web-based survey whereby either it is using non-probability method or probability-based method (Couper, 2002). This will contribute to the design of the system on controlling the access of the respondents such as password control, only invited respondents and prevent multiple replies.

Databases are external knowledge storing the system defined data (system attributes and properties) and users' data such as questions and response. My-WEBQ is a generic web-based survey generator that provides the ability to support multiple platforms of databases.

There are four main components in My-WEBQ to provide the functionalities and completeness of the proposed generic web-based survey generator. These four components are Questionnaire Designer, Questionnaire Generator, Report Manager and Database Manager. Questionnaire Designer is an internal component that responsible to

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handle the questionnaire design process. The rules and procedures for composing a questionnaire items are defined in this component. With this component, researches are able to add, edit and delete a question from a web-based questionnaire.

Questionnaire Generator is the main component to produce the questionnaire in web page format to the respondents. Questionnaire Generator consists of 2 subcomponents. One of the subcomponents is a back end component that contains the rules and procedures for formulating a web-based questionnaire and the other subcomponent is the front end component for presenting the questionnaire to the respondents according to the instructions and format defined by the survey researchers.

Report Manager is responsibled to handle the requests on presenting the result of the questionnaire in text report format or graph. The output of the Report Manager can be later saved into external file either in an Adobe Acrobat document format (pdf) or Microsoft Excel Worksheet format (xls).

Database Manager is an under layer component that responsible to handle all the communication between the system and the external relational database server such as Oracle or MS SQL server. Database Manager acts as an interface between the other components and the database server. The purpose of having the Database Manager is to separate the functional components from database connectivity in order to support heterogeneous databases. The Database Manager provides configurable properties to

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support different relational database server. These configurable properties provide a flexibility to support future release of relational database server or future enhancements.

The proposed framework provides a conceptual design of My-WEBQ. The purpose of the My-WEBQ is to provide the researchers a free and easy-to-use tool to simplify the process of constructing a web-based survey. The second significance of My-WEBQ is this system is able to be implemented with multiple database platforms. This will improve the flexibility of the system implementation.

2.11 Conclusion

This chapter presented the study on type of web-based survey, advantages and disadvantages of web-based surveys. The designs of web-based survey and the survey instrument are very important in obtaining unbiased answers from respondents especially for self-administered surveys. Hence, this chapter also presented the study on the design of web-based questionnaire focusing on three categories: type of questions, response format and questionnaire layout. Understanding of these areas serves as an input which is used to conduct a survey, with the objective to collect the requirements of a desired web-based survey system by the survey developers. Common features of a generic web-based survey generator and proposed framework had been discussed in this chapter also. Overall, this chapter presented a literature review of the dissertation that serves as the foundation for developing a generic web-based survey generator.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explains the research methods used to collect the research data and the system development methodology used to develop the prototype of web-based survey generator.

3.2 Research Method

There are many ways to obtain information. The most common research methods are: literature searches, talking with people, focus groups, personal interviews, and questionnaire. The research methods used in this dissertation to collect the research data are document reviews method and questionnaire. These research methods are important for collecting information such as what are the common features of web-based survey generator, the users' habits and user preferences on constructing web-based surveys.

3.2.1 Document reviews Method

Document reviews method is a non-intrusive form of research. This method involves reviewing documents, reports or other pieces of written information for content and themes. There are a lot of documents written based on market studied and reports. These kinds of documents are useful source of information on program activities and processes, additionally; they can generate ideas for questions that can be pursued through observation and interviewing.

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The advantage of this method is the information already exists and comprehensive. The result from this research method can be easily quantified and analyzed. It's the comprehensiveness of the information available thru this method that this research method is chosen as the fundamental way to gain knowledge on the requirement of a generic web-based survey generator. Thru this method, we understand the basic common feature available in a generic web-based survey generator, factors that need to be considered when constructing a web-based survey which will be the framework for My-WEBQ.

3.2.2 Questionnaire Method

Questionnaires are very cost effective when compared to face-to-face interviews. The result of questionnaires can be easily analyzed with the help from computer software tools. In this dissertation, an online questionnaire was developed to collect information from respondents with regards on constructing web-based surveys. The researcher designed and programmed the web-based questionnaire using HTML, ASP .Net and hosted with Microsoft IIS server. This online questionnaire consists of four sections and total of 15 questions (Appendix A). The time required to complete the questionnaire is estimated at approximately seven minutes.

A convenience sample that consisted of 50 respondents was generated from this questionnaire. The sampling of this questionnaire covered public sector and a few industry sectors including automotive sector, information technology sector, finance

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industry, manufacturing sector, education sector and service industry. The invitations were sent out to the respondents by using email.

3.2.2.1 Purpose of Questionnaire

The intent of the questionnaire is to collect the user preferences and opinion on the use of the web-based survey and the features of a generic web-based survey generator. The result of the questionnaire is important for the study to understand the user requirements before system design phase. The questionnaire consists of four sections:-

i. Current used and preferable survey type

- To find out what are the current used and preferable survey type. This result is important to ensure that the study is on the right timing and provides the right solution at the right time.

ii. Response Format

- To find out what are the most use response formats used by the respondents and the preferred response formats. This is to ensure the prototype of My-WEBQ will provide all the most used response formats for constructing a web-based survey.

iii. The questionnaire Layout

- To find out the more preferable questionnaire layout from the respondents. This provides an input to the user interface design of the web-based survey.

iv. Features of web-based survey software.

- To find out the more preferable features that should be included in a generic web-based survey system.

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3.2.2.2 Questionnaire design

The questionnaire design influences much the degree of response. A well-designed online questionnaire that is used effectively can gather information from the respondents on both the users' habits and user preferences on constructing web-based surveys. The type of questions and the time required to complete the questionnaire also play an important role. In order to improve the quality of the result of the questionnaire, some design principles (Dillman 2000) had been adopted in the questionnaire design and will be described in more details in the following section.

3.2.2.3 Introduction page

The questionnaire was started with an introduction to introduce the purpose of the questionnaire. The purpose of the questionnaire was to collect data from the respondents to investigate the users' habits and user preferences when constructing web-based surveys. In the introduction, the topic of the questionnaire was mentioned and the respondents were assured that the information will remain confidential and would not be used for profitable activities or against them. Simple guidelines about the questionnaire process, the number of questions, and the approximate time needed to complete the questionnaire gave the respondents an idea of what to expect. Such information can increase the response rate as the respondents would not feel ambiguous about the questionnaire and leave the questionnaire uncompleted.

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3.2.2.4 Questions

In self-administration questionnaire the only interaction with the respondents are the questions. The wording of a question is extremely important (Sekaran, 2003). In the questionnaire, most of the questions used simple sentence structuring and wording in order to improve the transparency of the questions. The type of questions used in the questionnaire was mainly closed-ended questions and with only one open-ended questionnaire. For closed-ended questions, the respondents are required to choose one or more of the given answer options. For open-ended question, the respondents were free to give their comments or opinions on the specific question.

3.2.2.5 Layout

Layout is another very important feature of the questionnaire that will affect the response rate. Self-administration questions need clear and simple layout so that the respondent finds it easy to complete the questionnaire. In order to increase the response rate, the layout of the questionnaire was neat, logical and carefully organized.

3.2.2.6 Questions Order

Well order of the questions will encourage the respondents to continue the survey (Aldrige & Levine, 2001). Therefore, the early questions in the questionnaire were easy and pleasant to answer. Besides that, items on the questionnaire were grouped into logically coherent sections. Grouping questions that were similar will make the questionnaire easier to complete, and the respondent would feel more comfortable.

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3.3 System Development Methodology

Systems Development Methodology is a set of guidelines, procedures and standards intended to ensure the development of quality application systems that meet the users' requirements in an efficient manner. The system development methodology involves a series of operations and procedures that are used to build a system. In this section, the type of development process model to be used will be discussed. Many process models are described in the software engineering literature (Sommerwille, 2001). Some are prescriptions for the way system development should progress and some are descriptions of the way the system is done in actuality. There are several types of system development process model that are common practiced by most organization such as the Waterfall Model, Rapid Development, Spiral Model, Phased Development Model (Iterative and Incremental development) and etc.

To develop the proposed generic web-based survey system generator – named as My-WEBQ, the Iterative and Incremental development process model had been chosen as software development process. Iterative and Incremental development model is more manageable as opposed to the traditional waterfall model. As indicated by the name, this approach is broken down into two development phase, incremental and iteration. At incremental development where the software specification, design and implementation is broken into a serial of increment which are developed in turn. Each of the iteration is consists of requirements collection, analysis and design phase, implementation and testing phase and result in the release of an executable subset of the final product. The initial system is to start with a simple implementation of a subset of the requirements. At

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each of this iteration, design modifications are made and new functional capabilities are added, and the system grows incrementally from iteration to iteration to become the final system.

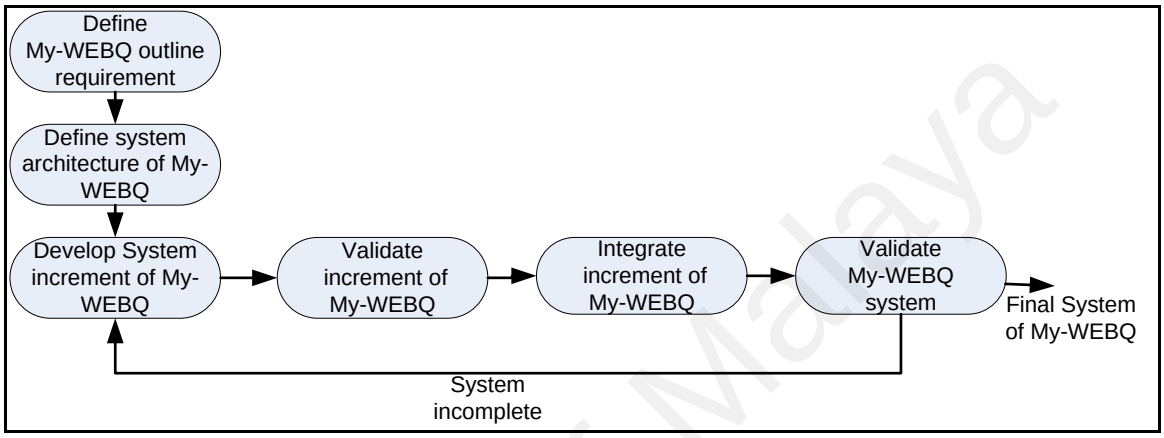

Figure 3.1 Incremental Development Process model for My-WEBQ

The basis of choosing this model as development process model is this model provides iterative enhancement to develop a software system incrementally. At each of the iteration, design modifications were made along with addition new functional capabilities. Early feedback can be obtained and used to enhance the analysis of subsequent cycles and thus make the requirements easier to modify. This model also allows the developers to take advantage of what was being learned during the development of earlier versions of the system and apply their growing skills to subsequent cycles. Learning comes from both the development and use of the system, where possible.

Moreover, this project would utilize Object-Oriented technology so that the proposed system would be easier to adapt with any changing requirements. Besides that, a system

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developed with object-oriented technology is easier to maintain, more robust and promote greater design and reusable code.

In system development process, testing is one of the important processes of developing the generic web-based survey system generator. The system testing is a process used to identify the correctness, completeness and quality of developed system (Summerville, 2001). During system testing process, unit testing, module testing and system testing will be performed to ensure the correctness of the system.

3.4 Conclusion

In this section, the research methods used in this dissertation to collect the research data had been discussed and a questionnaire was designed to collect information from respondents with regards on constructing web-based surveys. The methodology to be used in the system development is Iterative and Incremental development process model. This model was chosen as the development methodology because it provides a number of advantages such as lower risk of overall project failure and the users could use the early increment as a form of prototype and gain experience which enhances the requirement for later system improvements.

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CHAPTER 4

SYSTEM ANALYSIS

4.1 Introduction

Analysis is an activity that involves understanding the problem, arising constraints and methods to overcome the constraints. System analysis involves the analysis activities. This chapter presents the result of the questionnaire analysis and requirement analysis, functional and non-functional requirement are described as well.

4.2 Survey Method: Questionnaire Distribution

A web-based questionnaire was developed (Appendix A) and researcher had invited 61 respondents to join the questionnaire via email. The reason email was used as medium to collect information from public was due to the time and location constraints. 61 invitations had been sent out via email but only 50 respondents join the questionnaire. Researcher was pleased with their feedback. However, some of them refuse to join or not to join the questionnaire were due to either:

- They had no time to join the survey
- They had no interest on the survey
- The email was filtered by the email server and sent to recipients' junk mail folder.
- The email was categorized as spam mail and rejected by the recipients' mail server.

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After the result of the questionnaire was collected, the data gathered was analyzed. The main reason for the analysis of the data is to get an insight on the users' opinion on Web-based survey and survey generator. The questionnaire-survey results also give us an idea to determine the requirements of the system.

This chapter also explains how the analysis was done by introducing some statistics and presentation of the results. From 50 respondents, there were 23 male and 27 female. The respondents were from different industries such as Education, Finance, Manufacturing and etc (Figure 4.1).

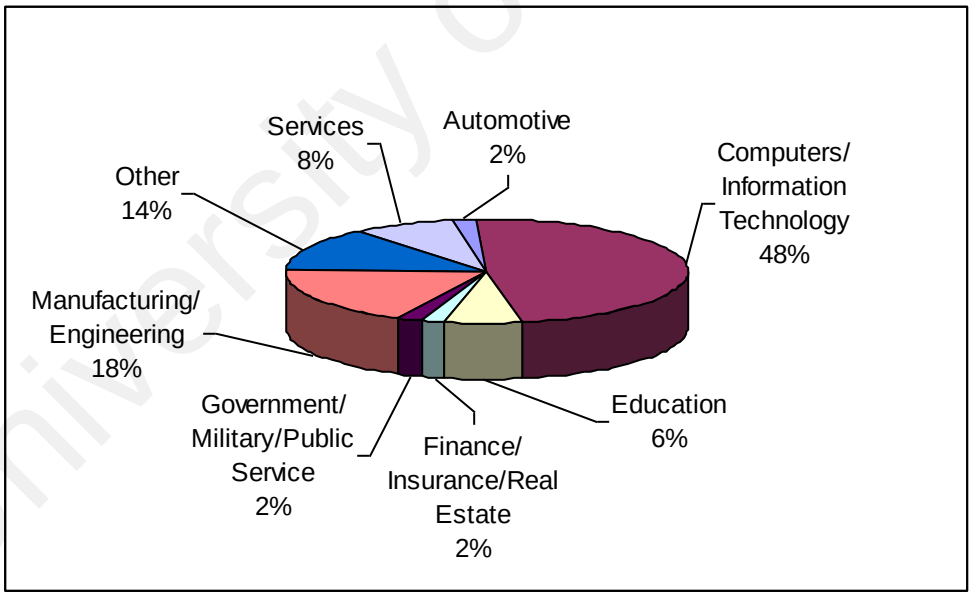

Figure 4.1 Respondents' industry

At last, this chapter discusses more detailed analysis on the feature of a web-based survey and its importance to the users.

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4.3 Result from Questionnaire Return

In this section, the analysis of the feedback by the respondents was done based on each of the category below.

1. Survey Type
2. Response Format
3. The questionnaire layout
4. Features of web-based survey software

4.3.1 Survey Type

In this questionnaire, the questions about the respondents' experience on conducting survey and type of survey had been asked. From the feedback, 34% of the respondents had experience in conducting surveys. Referring to Table 4.1, a majority of respondents claimed that they had carried out the questionnaire on Customer Satisfaction (20%), Market Research (17%), Employee Satisfaction (15%) and Social/Scientific Research (15%). Based on the data collected, some common templates can be developed to help researchers to speed up the process for developing a common web-based survey.

Table 4.1 Type of survey conducted by respondents

	Frequency	Percent
Customer Satisfaction	8	20%
Demographics / Profiling	3	7%
Employee Satisfaction	6	15%
Fun or Entertainment	3	7%
Manager Feedback	3	7%
Market Research	7	17%
Public/Popular Opinion	4	10%
Social/Scientific Research	6	15%
Others	1	2%
	41	100%

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The overall result on preferable survey mode is summarized graphically in Figure 4.2. Overall, many of the respondents choose web-based rather than traditional survey type because it is more convenient to conduct a public survey. The result on preferable survey mode has proven the hypothesis of this dissertation that web-based survey is a preferable tool for conducting a survey in local study. This finding is important to ensure the study is carried out at the right time.

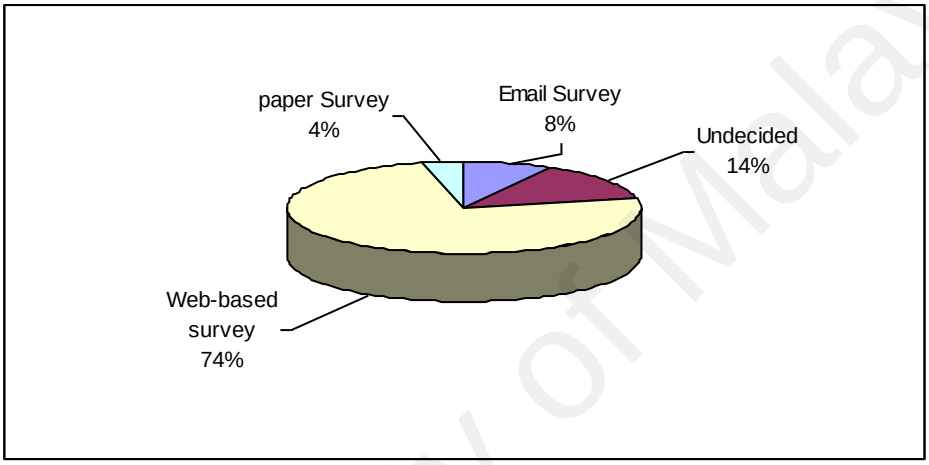

Figure 4.2 Preferable Survey modes.

4.3.2 Response Format

In this section, the questions on response format were asked. The purpose is to get the feedback from respondents about which type of response format that the respondents use or prefer to use in a web-based survey.

Referring to Table 4.2, most of the respondents agreed that short response option is better than long response options for web-based questionnaires. This shows that in a self-administer questionnaire, short response is more preferable because it is easy to read and straightforward.

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Table 4.2 Response Rates for comparison of short response option and long response option

Question: Short response options are better than long response options for Web-based questionnaires	Responses	Percent
Strongly Agree	13	26%
Agree	29	58%
Neutral	5	10%
Strongly Disagree	3	6%
Total	50	74%

The use of Pulldown Menu or Drop-down box is an attractive feature of web-based survey. However, some researchers reported that Pulldown Menu also has a high potential for misuse. In order to find out whether the respondents of this questionnaire fully understand the use of the Pulldown Menu, a question on the comparison of the use of Radio Button with Pulldown Menu was asked (Table 4.3). Referring to the result as shown at Table 4.3, we found that 94% of the respondents agreed that Radio Buttons are better choice than Pulldown Menus for Yes/No questions. This question was asked to ensure the respondents understand clearly the use of the Pulldown Menus and to avoid biases when answering the questions related to responses formats.

Table 4.3 Response Rates for comparison of the use of Radio Buttons with Pulldown Menus for Yes/No questions.

Question: Radio Buttons are usually a better choice than Pulldown Menus for Yes/No questions.	Responses	Percent
No	3	6%
Yes	47	94%
Total	50	100%

In this survey, the question on the frequent use of the type of response format was asked. The purpose of this question is to understand what are the most frequent use response

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formats. The result was compiled and shown in Table 4.4. The mean value ($\bar{x}_m$) was calculated using below formula:

$$\bar{x}_m = \frac{\sum` fixi}{n}$$

$\bar{x}_m$ = mean of rating score for equation m

fi = Frequency of *xi*

xi = rating score *i* for response format m

n = total number of respondents

Based on the Table 4.4, the $\bar{x}_m$ values for each response format is plotted on a Bar Chart as illustrated at Figure 4.3. The highest rate is 4.36 for Radio Buttons while the lowest rate is 1.52 for multiple line text entry formats. This shows that simple and short response format is most preferred by respondents in conducting a web-based survey.

Table 4.4 Response Rates for preferable response format used in a web-based survey

Type of Response Format	Not used 0	1	2	3	4	Most used 5	Mean
Check box	1 (2%)	1 (2%)	5 (10%)	9 (18%)	15 (30%)	19 (38%)	3.86
Radio Buttons	0 (0%)	0 (0%)	4 (8%)	7 (14%)	11 (22%)	28 (56%)	4.36
Matrix - Check box	13 (26%)	3 (6%)	11 (22%)	12 (24%)	6 (12%)	5 (10%)	2.2
Matrix - Radio Button	7 (14%)	2 (4%)	9 (18%)	12 (24%)	10 (20%)	10 (20%)	2.92
Pull down Menu/Dropdown box	8 (16%)	5 (10%)	15 (30%)	10 (20%)	7 (14%)	5 (10%)	2.36
Single line text entry box	7 (14%)	12 (24%)	7 (14%)	7 (14%)	11 (22%)	6 (12%)	2.42
Multiple line text entry box	15 (30%)	14 (28%)	6 (12%)	11 (22%)	3 (6%)	1 (2%)	1.52

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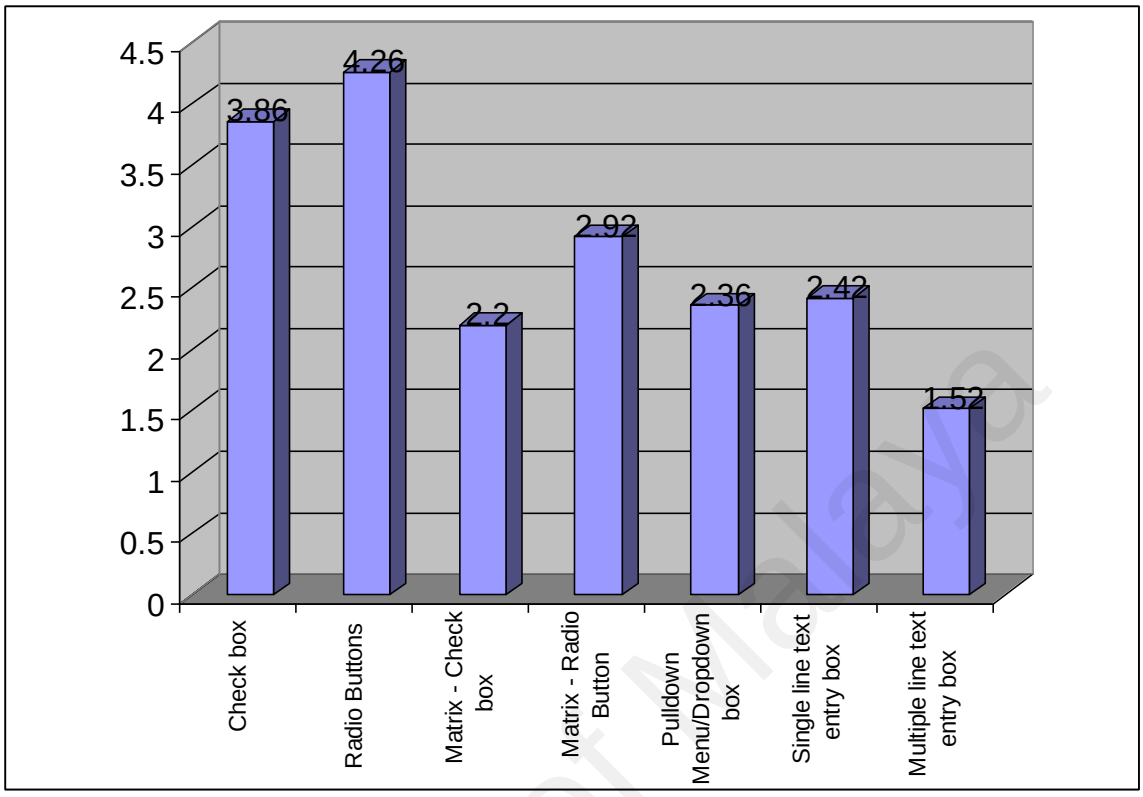

Figure 4.3 Average mean rate of the preferable use of response formats

4.3.3 The Questionnaire Layout

The layout of a questionnaire is very import in conducting a web-based survey. The questions about organization of questionnaire and the format of question text were asked in this section.

Referring to Table 4.5, 72% of the respondents would like to organize their questionnaires in a single page. 4% of the respondents would like to organize their questionnaires using multiple pages layout where each question per page and there is 24% of the respondents would like to organize their questionnaires using multiple pages where multiple questions per page.

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Table 4.5 Response Rates for preferable survey page format used in a web-based survey

Question: How do you like to organize your questionnaire?	Responses	Percent
Single page	36	72%
Multiple pages - each question per page	2	4%
Multiple pages - multiple questions per page	12	24%
	50	100%

In this questionnaire, question regarding the preferable color format used in web-based survey was asked. The response rates for preferable color format used in a web-based survey are summarized in the Table 4.6. Overall, there is 60% of the respondents preferred single color themes for all questions, 22% of the respondents preferred to use plaint text in a web-based survey and there is 18% of the respondents preferred multiple color for different questions in web-based survey. It is important to use a suitable color theme when designing the layout of a survey. Some researchers have the opinion that the design of a survey will affect the response time. Dillman (1998) in his report also commented that it took less time for respondents to complete the plain survey than a fancy survey.

Table 4.6 Response Rates for preferable color format used in a web-based survey

Question: How do you like to format your question text?	Responses	Percent
Plaint text (black and white format)	11	22%
Single color themes for all questions	30	60%
Multiple color for different questions	9	18%
	50	100%

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Table 4.7 Response Rates for preferable font format used in a web-based survey

Question: How do you like to format your question text?	Responses	Percent
Same font type and font size	39	78%
Multiple font type and font size	11	22%
	50	100%

4.3.4 Features of web-based survey software

Good software must meet the user requirements and provide the features required by the users. In this section, the questions about the features of web-based survey software had been asked. The purpose of this question is to understand what are the useful features that required in a web-based survey software.

The result was compiled and Table 4.8 shows the responses result. The mean of the response rates also been calculated. As it can be seen from the Table 4.8, the difference of the response rates among the features is small, but still noticeable. The highest rate is 3.68 for having the feature to set the mandatory questions to answer while the lowest rate is 2.98 for having feature of self-branding with images on web-based surveys. Although all the features were not rated highly, we could distinguish a difference between some of them. As we have discussed in previous section that there is only 34% of the respondents had experience in conducting surveys so it is understandable to have such response rates for the questions related to the features of web-based survey software.

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Table 4.8 Response Rates for useful features that required in web-based survey software

Features	Not useful 0	1	2	3	4	Very useful 5	Mean
Help Option	5 (10%)	5 (10%)	4 (8%)	13 (26%)	14 (28%)	9 (18%)	3.06
Survey templates	2 (4%)	2 (4%)	11 (22%)	12 (24%)	14 (28%)	9 (18%)	3.22
Support multiple response options	1 (2%)	2 (4%)	5 (10%)	18 (36%)	14 (28%)	10 (20%)	3.44
Self-branding with images on surveys	2 (4%)	4 (8%)	10 (20%)	18 (36%)	9 (18%)	7 (14%)	2.98
Themes and Backgrounds for Web questionnaires	2 (4%)	3 (6%)	6 (12%)	21 (42%)	8 (16%)	10 (20%)	3.2
Skip patterns for Web-based surveys and assessment	1 (2%)	3 (6%)	10 (20%)	20 (40%)	11 (22%)	5 (10%)	3.04
Ability to set the questions that are mandatory to answer	1 (2%)	2 (4%)	7 (14%)	6 (12%)	20 (40%)	14 (28%)	3.68

4.4 Proposed System – My-WEBQ

The information extracted from the data analysis is used to design a generic web-based survey generator. Based on the information gathered from the document reviews and the analysis of questionnaire data, researcher has put together a design of the proposed system as shown in Figure 4.4.

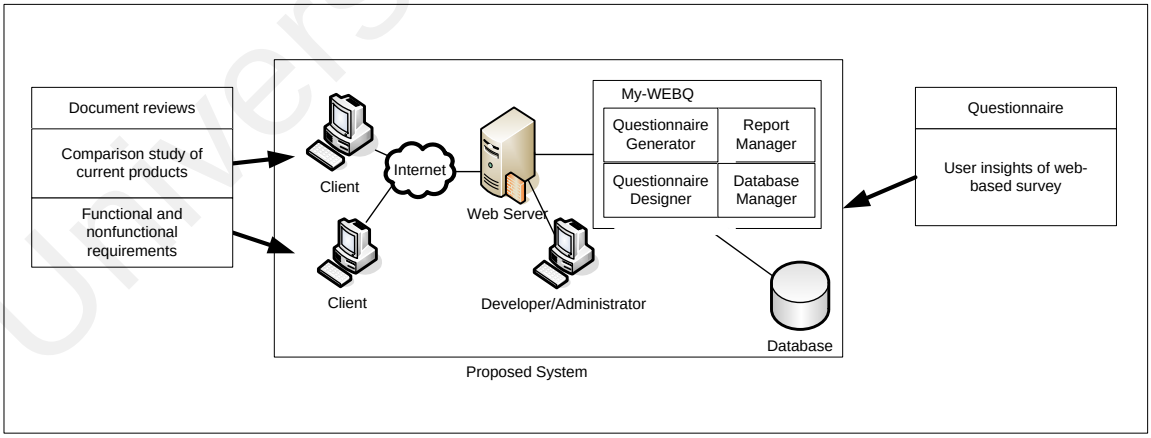

Figure 4.4 Proposed system and the source of the requirements.

Meaningful names are usually given to a tool or any applications. The name of the proposed system is My-WEBQ where the first two characters "My" is having the

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meaning of the tool was developed in Malaysia and last four characters "WEBQ" is stand for web-based questionnaire. The design of My-WEBQ are based on the proposed framework that presented in the literature review. The Questionnaire Designer, Questionnaire Generator, Report Manager and Database Manager are the four main components in My-WEBQ to provide the functionalities and completeness of the proposed generic web-based survey generator. The details of the system architecture will be presented in the subsequent chapter.

4.5 Requirement Definition

Requirement is a feature of a system or the description of task that the system must perform in order to achieve the objective of the system. It is essential to define system requirement by identifying services that the system will provide. Such system requirement can be divided into functional requirements and non-functional requirements that form the total functionality or features of a system.

In previous section, we briefly discussed the feedback on the requirement and features of the web-bases survey application based on the survey result. As mentioned, My-WEBQ has all the basic features to perform the basic functions for creating a web-based survey such as create a new survey from scratch or from a template, edit function, color theme and etc.

Based on the result of the questionnaire survey, the above are basic features required in the web-based survey application. Even though the help feature is rated high by the

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respondents, simple help function and user manual are developed in this project due to time constraints (Appendix B). In this project, the security feature is kept at minimum, where only basic user name and password is used.

4.5.1 My-WEBQ Functional Requirements

Functional requirements are statement of the services or functions that describe how a system should reacts to a particular input, and how the system should behave in a particular situation. Functional requirements are those tasks that the system must perform. The generic web-based survey generator will be developed to provide the following functional services:

Authentication

The system shall be able to handle the respondent authentication and registration. The users need to have a valid user account and password in order to logon to the system. The respondents required to register their detail particulars and use a valid user id in order to start a questionnaire.

Questionnaire creating

The system shall be able to create a new web-based questionnaire from scratch or from a template. If the users choose to create a new web-based questionnaire from scratch, the system will display an empty questionnaire for the users to start creating the questionnaire with their own questions and layout. If the user chose to create a new web-based questionnaire from a template, the system shall provide a list of template to the users. The users shall be able to choose a template to start creating a new questionnaire.

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The function of copying questions from an existing survey when creating a new survey is also provided.

Questionnaire Editing

The system shall be able to allow the users to edit the existing questionnaire and save the changes into the system. The system shall be able to allow the users to delete unwanted questions from the surveys. The features for auto-renumbering the question also provided when the users delete a question from the survey.

Questionnaire Layout

The system shall be able to allow the users to create a multi-pages survey or single page survey format. The system shall be able to allow users to choose the preferred color theme when creating a new survey.

Questionnaire Publishing

The system shall be able to publish the questionnaire after the user finished the creation of the questionnaire.

Reports

The system shall able to generate simple report about the survey information. The system shall able to generate the listing of the survey. The system shall able to generate simple reports on the questionnaire result.

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4.5.2 My-WEBQ Non-functional Requirements

Non-functional requirements are those requirements that are not directly needed but are equally important in implementing the system. In this system, security, user friendliness and latency were identified as part of the non-functional requirements.

Modularity

Modularity is very important for designing a good application. The coding for a system shall be implemented with a modular approach so that less effort is required when modifying or enhancing the system in the future. The working system is broken down into modules of function, so that it is easier for testing and maintenance facility. This will also lead to easy modification in future because of its modular design. For future programming, this will provide the developer a better understanding in the program codes.

Security

Each access by the user should be authenticated and validated. Each user has a unique login name. To prohibit unauthorized access to the administration module, only user with administration access right is granted the capability to perform the specific task such as creating new, editing or deleting records.

User Friendly

The system's design and interfaces must be user friendly and be able to use easily. The system shall have consistency in term of screen design and the display of error messages.

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The functional buttons or commands used in the system are designed with clear indication where user can easily understand the use of each button or command.

Reliable and accurate

The system should be reliable in performing its task. The system should be able to perform accurately to compute the result accordingly. The web-based survey generator is an online system, thus this system should be reliable and should not cause unnecessary downtime to the overall system. The system shall be set up based on the acceptable failure rate.

Error detection

The system should be able to display error message when an error occurs. The error message shall be easy to understand by the users.

4.6 Conclusion

Analysis of survey result is presented in this chapter. This analysis helped researcher to understand the overall system requirements of a web-based survey software. The result will be the basic framework in the development phase as it represents the respondents requirements on web-based survey which is in line with the main objective of developing a system that fulfill user requirements.

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CHAPTER 5

SYSTEM DESIGN

5.1 Introduction

A design specification describes the features of the system, the components or elements of the system and their appearance in a system. This chapter describes the details of how My-WEBQ will meet the requirements identified during the system analysis. In general, a system design is formulated to

- Incorporate system features that are easy to understand and use
- Have the functions in a manner that seems natural to the users
- Identify user error and carelessness
- Prevent failures or improper procedures that will cause system failure

In system design phase, the information collected earlier is used to accomplish the logical design of the information system. Part of the logical design of the information system is designing the user interface. Besides this, the designing phase also includes designing files and database that will store much of the data needed by the decision makers (Shari Lawrence Pfleeger, 1998).

The objective of the Design Phase is to transform the detailed, defined requirements into complete, detailed specifications for the system to guide the work of the Development Phase. The decisions made in this phase will address in detail, how the system will meet the defined functional, physical, interface, and data requirements. Design Phase activities

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may be conducted in an iterative fashion, producing first a general system design that emphasizes the functional features of the system, then a more detailed system design that expands the general design by providing all the technical detail (Ian Sommerville, 2001).

In the system design phase, the first process is defining the general system characteristics follows by designing the data storage and the access of the database layer. In this phase also, user interface at the presentation layer will be finalized and lastly designing the business rules layer or application logic.

In My-WEBQ development, the design phase can be divided into 4 sections: architectural design, database design, user interface design and program design. In system design, first the general system characteristics are defined. This is an important task to transform the software requirements into an architecture that describes its top-level structure and identifies the software components. This is to ensure all the software requirements are allocated to its software components and further refined to facilitate detailed design. The design of data storage and access for the database layer is completed and followed by designing the user interface at the desktop layer. The business rules layer or the application logic also completed during the design phase.

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5.2 Architectural Design

The architectural design process is concerned with establishing a basic structural framework for a system. It involves identifying the major components of the system and the communications between these components (Ian Sommerville, 2001). Designing an application system involves making decisions about its logical and physical architecture and the technologies and infrastructure used to implement its functionality. In order to make these decisions effectively, it is very important to have a sound understanding of the business processes that the application will perform (its functional requirements), and the levels of scalability, availability, security, and maintainability required (its nonfunctional, or operational requirements).

5.2.1 System Architectural Design

In My-WEBQ development, client-server model is chosen as the architectural model. The client-server architectural model is a distributed system model with shows how the data and processing are distributed across a range of processors. The major components of this model are:

1. A set of stand-alone server which offer services to other sub-systems.
2. A set of clients that call on the services offered by the servers. There may be several instances of a client program executing concurrently.
3. A network which allow the clients to access these services.

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My-WEBQ is built around the client-server model as shown in Figure 5.1. This figure is derived from Figure 4.4.

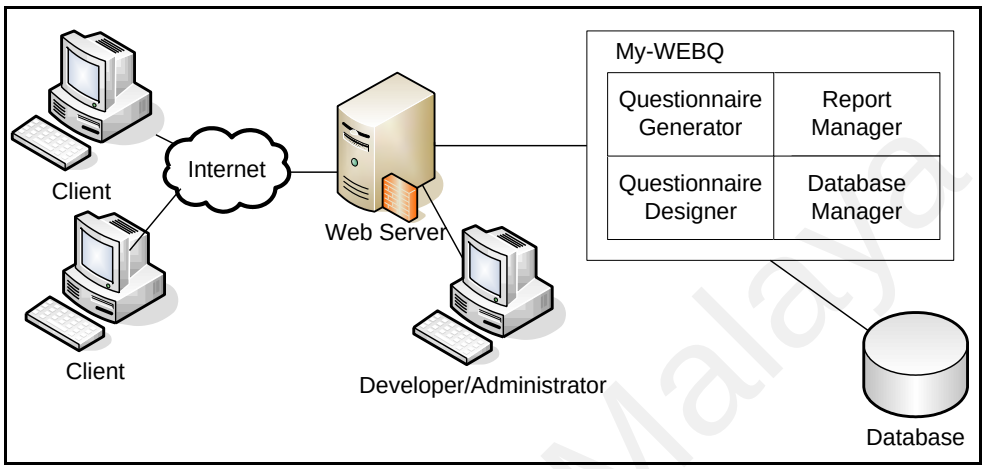

Figure 5.1 System Architecture of My-WEBQ

My-WEBQ is designed to run on both Internet and Intranet network system. In this system, there are several servers which provide the service to the clients such as web server is used to host the web services and a database server is used to process and store the data. In My-WEBQ, different type of web browsers can be used as clients interface to access the system. Within My-WEBQ, four main components are built to provide the service to the clients, there are Questionnaire Generator, Questionnaire Designer, Report Manager and Database Manager. Questionnaire Generator will handle the respondents' requests and reply with the formatted questionnaire in web-based form. Questionnaire Designer is the component that responsible to provide the service to the user for designing a web-based survey. Report Manager is one of the main components that enable the users to generate report from the system. Database Manager is responsible to handle all the communication with database server such as retrieving and storing the data into the database server.

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5.2.2 Application Architectural Design

During application design, application models that determine how to meet system objectives and requirements will be created. The application models represent the logical view of the architecture for an application (Michael Platt, 2002). Architects here are concerned with the overall structure of the application. It describes the structure of an application and how that structure forms the functional requirements of the system.

In distributed application design, it is a common practice to divide the application into components providing presentation, business, and data services. Components that perform similar types of functions are grouped into layers, which in many cases are organized in a stacked fashion so that the components at the higher layer can use the services provided by it. In this design approach, a given component will use the functionality provided by other components in its own layer and also, other components at the lower layers to perform its work.

Layers are merely logical groupings of the software components that make up the application or service. They are important in differentiate between the different tasks performed by the components, making it easier to design reusability into the solution. Each logical layer contains a number of discrete component types grouped into sub-layers, with each sub-layer performing a specific kind of task (Microsoft Corporation, 2002). The Microsoft .Net Framework was adopted in My-WEBQ development and the generic components are identified during the design phase. Figure 5.2 shows a simplified view of My-WEBQ application architectural design and its layers.

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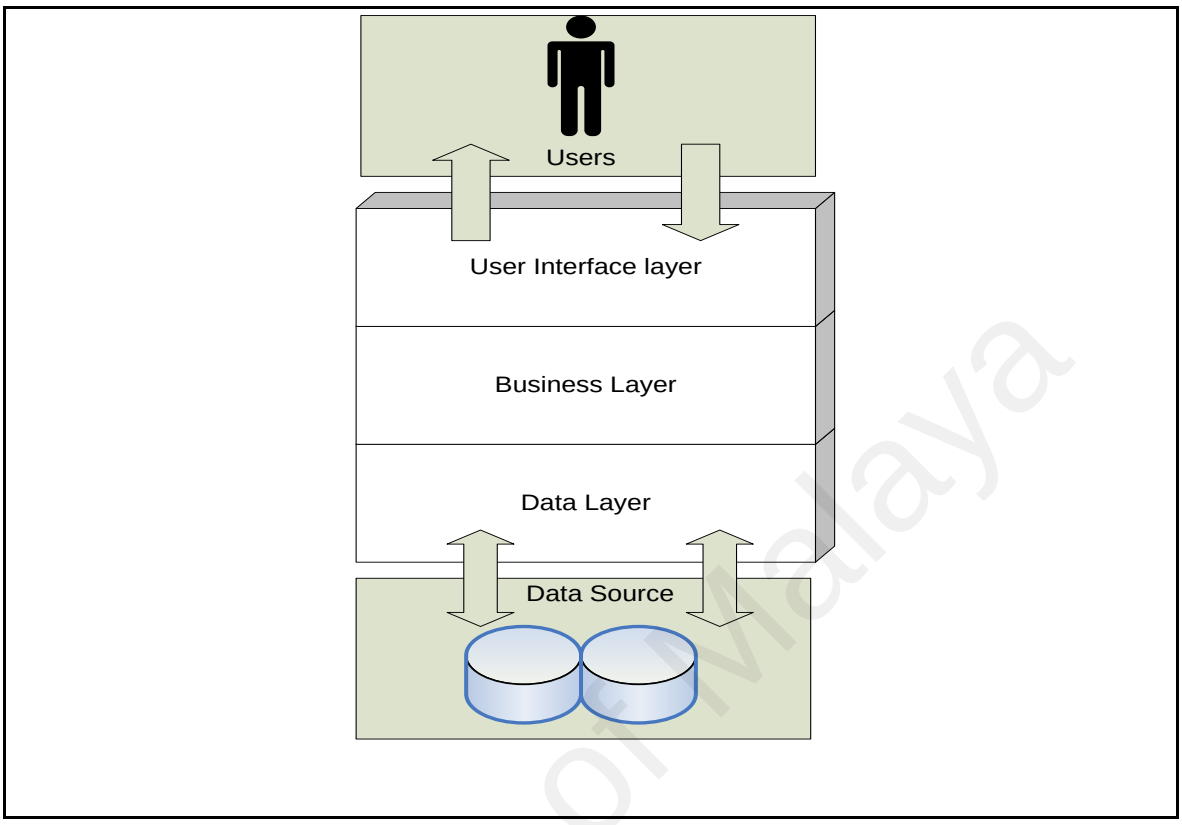

Figure 5.2 My-WEBQ application architectural design and its layers.

5.2.2.1 The User Interface (UI) Layer

The user interface (UI) layer consists of services or components that perform tasks such as requesting information from a user or passing information to a user. In My-WEBQ, these services are implemented by using Microsoft technology such as ASP.NET controls, which are ideal candidates for reuse.

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5.2.2.2 The Business Layer

The business layer consists of a combination of these three layers: Business process layer, Business entity layer and Data representation layer.

The business process layer is responsible for the business process; it defines the business processes in terms of steps and it does not perform any data manipulation other than assembling the requests for the business logic layer.

The business entity layer is responsible for carrying out the individual steps of the process. This layer is typically designed using business entities. The business entities implement the business rules, they do not store the business data; instead they may hold references to data entities that store the data.

The data representation layer holds the data in a form that can easily be used by the business logic layer. It has only generic logic for data manipulation and no specific knowledge on the business domain. The data representation layer uses data accessors to store the data. It typically used to map the difference in structure between the database layout and the data accessors; this gives the freedom to change the database design without changing the code and to change the internal data representation without changing the tables.

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5.2.2.3 The Data Layer

The logical data layer of an application consists of one or more data stores, and depicts a layer of data access logic components that are used to retrieve and manipulate the data in those data stores. The logic used to access data in a data source will be encapsulated in data access logic components, which provide methods for querying and updating data. The design of data layer offers many benefits such as more efficient data access and simplifies access to multiple type of databases system.

The application architecture affects the performance, robustness, distributability and maintainability of an application. The benefit of this model is that business rules are centralized and can be updated and maintained easily. The presentation layer does practically no work beyond interacting with the user. In a multi-tier application, the client does not directly access a data storage system. The separation of presentation, business rules, and data services allows the developer to modify any layer of the system without having to change the other layers. This significantly improves the level of maintainability of the system. In a small system that has less than 10 users for example, this is not too much of a problem. But when the number of clients reaches hundreds or thousands, the cost of updating business rules and application logic can be significant. Another advantage to use this architectural model is to improve code reuse. For example, the code written for business logic in one sub-application can be reused within different applications or sub-application. The design of My-WEBQ is flexible and makes it easy to expand for further development.

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5.3 Database Design

Planning and designing a database is an essential step in developing a database application. Designing the database for My-WEBQ is an important process because data need to be kept and maintained easily. During the system development, the data structure design had few changes when some of the analysis was redo. This is because there were problems encounter while the coding was carried out, and a few changes had to be made to rectify the problems. Appropriate measurements were taken so that system could be ready according to schedule.

The database of My-WEBQ was designed as a relational database. The relational databases are the most widely used database and the majority of systems built today are using relational database system. Relational database management systems, or RDBMSs, provide several benefits such as maintainability, data integrity, enforce and use relationships between data.

5.3.1 Normalization

When developing a logical data model, the important thing is to create an accurate representation of the data; its relationships and constraint by identify a suitable set of relations. A good logical database design can be achieved by applying normalization rules to the design (Microsoft Corporation, 2004). In My-WEBQ development, normalization technique was used for controlling data redundancy and avoiding data anomaly. The process of normalization was first developed by E. F. Codd. The process of normalization is a formal method that identified relation based on their primary key and

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the functional dependencies among them (Hoffer *et al.* 2004). Normalization provides several benefits such as reducing redundant data and maintaining data integrity.

5.3.2 Logical and Physical Database Designs

In My-WEBQ database design phase, it was divided into two main phase: logical database design, in which the logical structure of the database was finalized and physical database design, in which how the logical structure was physically implemented. The logical database design phase begins with the creation of a conceptual data model of the My-WEBQ system. The conceptual data model is then mapped to a logical data model of the system. The logical data model of the system is a source of information for the physical design phase. Physical database design is the second phase of the database design process, where the actual database structure designed is finalized. The base relation and integrity constraints were designed during physical design phase. Specific storage structures and access method for the data was selected to achieve good performance for the database activities.

5.3.3 Entity-Relationship Model

The Entity-Relationship model was used to facilitate the database design of My-WEBQ. The Entity-Relationship (ER) model is a high-level conceptual data model developed by Chen (1976). The basic concepts of the entity-relationship model include entity types, relationship types and attributes. Entity is an object or concept that is uniquely identifiable. Attribute in the ER model is a property of an entity or a relationship type.

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Relationship is a meaningful association among the entities. Each relationship is given a name that describes its function.

In My-WEBQ, 8 entities had been identified, they are:

1) User

   A user entity is a valid user that allows access to the system by providing user id and password. The password is important for user authentication.

2) Survey

   Survey entity is a single survey that the user plans to publish to the web. A survey entity can have one page entity or multiple page entities.

3) Page

   A page entity is a single page in a survey that may consist of single question section or multiple question section

4) Question Section

   Question section entity is a question section that is the lower layer of a survey page that contain single or multiple questions.

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5) Question

Question entity is a question. A question can be an open or close question with defined option type such as single choice radio button option, multiple choice and etc. Multiple questions can be grouped under a question section according to the content of the questions. A question can have multiple question option too.

6) Question Option

A question option is the lowest element in a survey. A question option has a text property to store the option description.

7) Respondent

A respondent is the person who joins the survey and answers the questions. All the respondents must register themselves before a survey is started.

8) Response

A response is the answer from a respondent for a particular question. A response must be a valid option of a survey question.

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In summary, the relationship between these entities and their attribute had been identified as shown in figure 5.3.

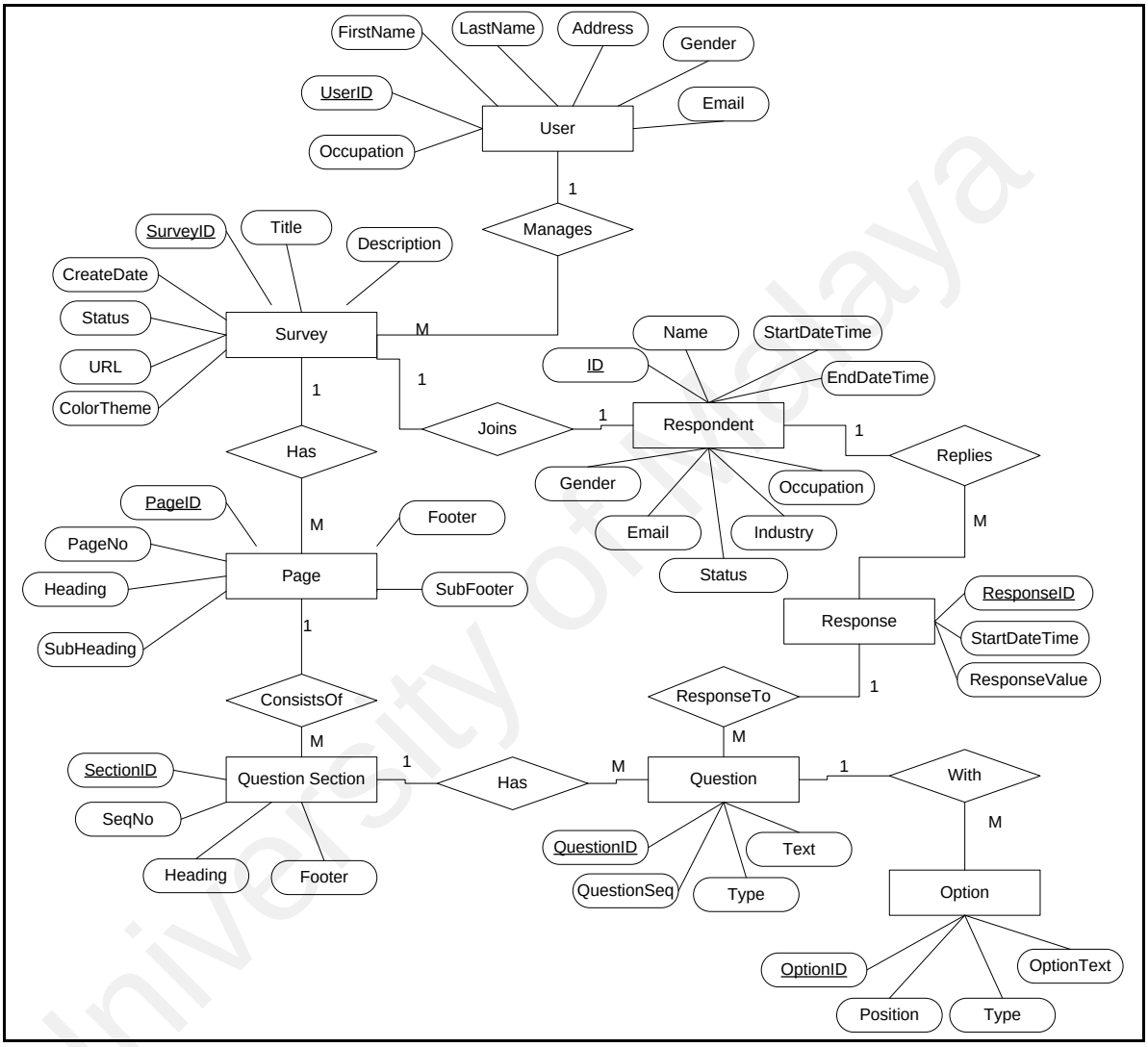

Figure 5.3 ER model diagram of My-WEBQ

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5.4 User Interface Design

The process of designing user interfaces is a user-focused activity. Designing the user interface for this system was done simultaneously with the coding phase. An interface, which is difficult to use, will result in high level of fault and errors. This may cause the system to be discarded, irrespective of its functionality. Hence, when designing the user interface, it is important to take into consideration the user's needs and preferences in order to avoid system fault and errors. Since the system was developed for non-experience users with less knowledge of computers knowledge, especially the use of Internet, a friendly user interface was designed and built. This friendly approach was adopted by using mouse, buttons and simple language that is easily understood. The user interface design can be divided into 2 sections as described below:

a) Survey Maintenance Information Section

In this surveys maintenance section, the user interface is designed to be simple so that the system administrator and survey administrator will be able to create surveys and maintain the information easily (Figure 5.4 and Figure 5.5).

Figure 5.4 Login screen of My-WEBQ

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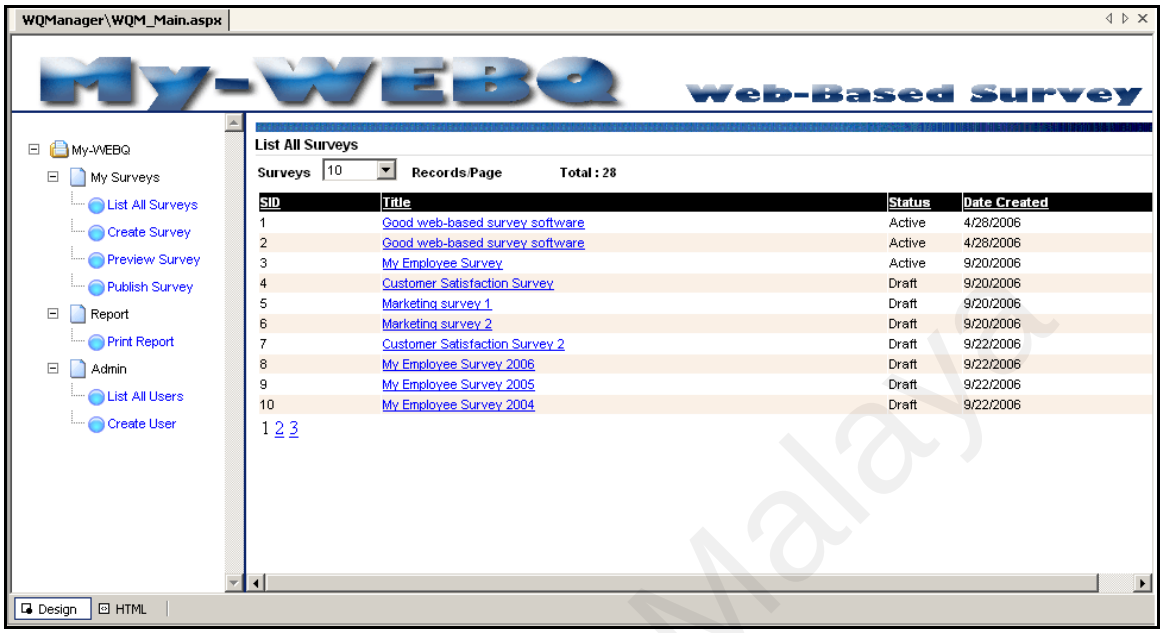

Figure 5.5 User interface design of My-WEBQ

b) Questionnaire Section

User interface for displaying the questionnaire was design to be simple so that it could be used easily and understood quickly. Figure 5.6 shows the user interface design of questionnaire register screen. The buttons and the instructions are displayed clearly so the respondents get familiarize quickly and does not feel stressed with the system. Furthermore, the simple language also used to make the user understand clearly and able to respond to the questionnaire quickly. Figure 5.7 shows a sample screen of a questionnaire.

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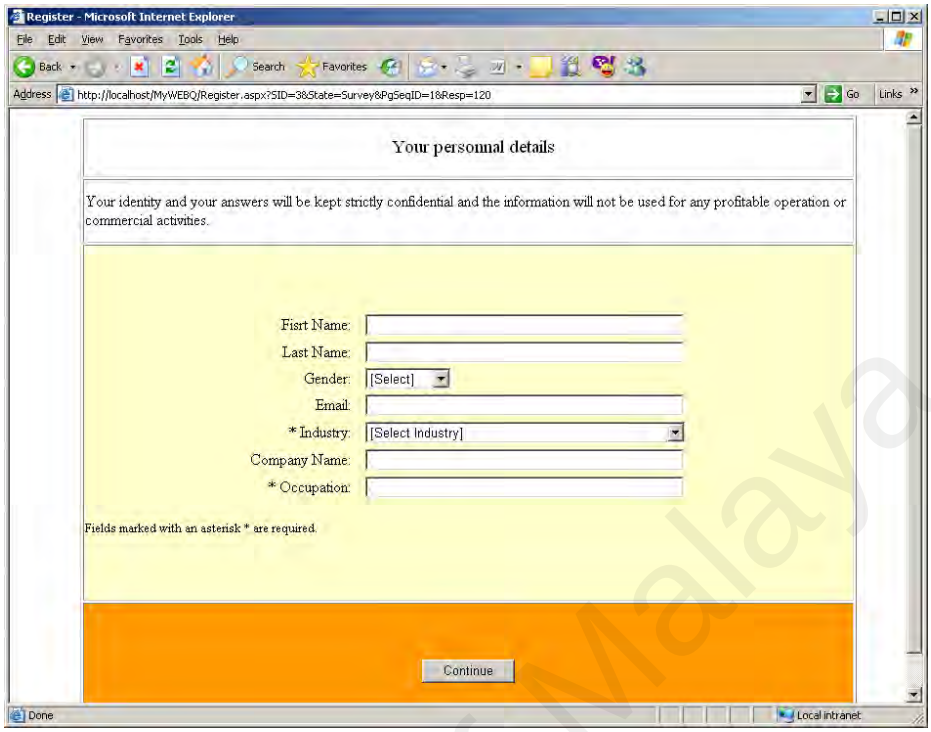

Figure 5.6 User interface design of questionnaire register screen

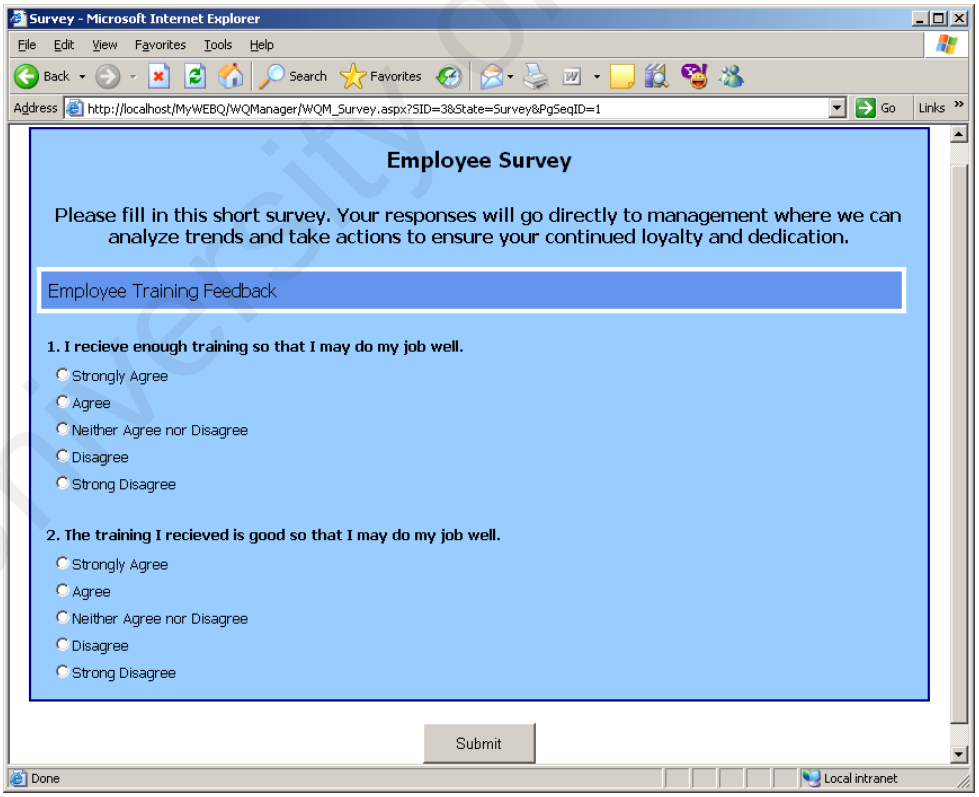

Figure 5.7 Sample screen of a questionnaire

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5.5 Program Design

In this program design construction, a few modules were developed based on the requirements, which were obtained during the analysis phase. The main modules are listed as hierarchy menu in Figure 5.8.

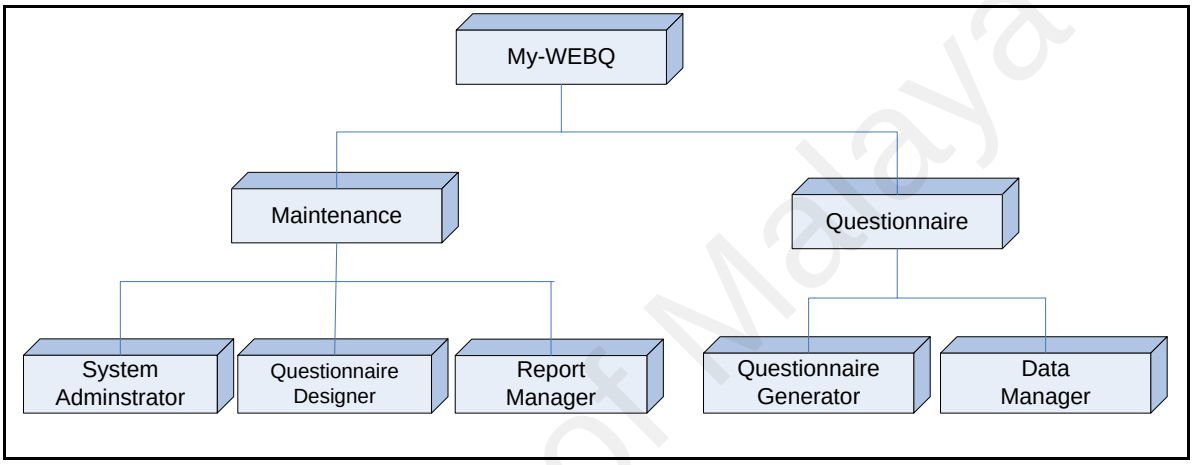

Figure 5.8 Main modules in My-WEBQ

5.5.1 System Administrator Module

The System Administrator module enables the system administrator to add and maintenance the users in the My-WEBQ system. Only valid users can access the Maintenance module to perform surveys creation, maintenance and generating of reports.

5.5.2 Questionnaire Designer Module

The Questionnaire Designer handles all the survey functionalities such as create a new survey, edit an existing survey, publishing a survey and stop a survey from publishing.

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5.5.3 Report Manager Module

The Report Manager enables the users to generate reports such as survey detail information and the result of a questionnaire.

5.5.4 Questionnaire Generator Module

The Questionnaire Generator is the module which handles the respondents request and generates the questionnaire in web-based format. Questionnaire Generator will format the web form based on the defined color theme format and display the survey according to the defined page sequence, question section sequence, questions sequence and etc.

5.5.5 Data Manager Module

The Data Manager Module is the module handles the responses from respondents and submits the data into the database server. This module is responsible to handle the communication between the system and the database server. The data manager was designed to be flexible, able to support multiple database platforms and maintainable for future expansion.

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5.6 Conclusion

System design is an important phase in developing a system regardless of whether the system is a new system that is to be built or modification of an existing system. In this phase, the requirements are translated into a model or representations of the software which then can be evaluated or assessed before coding begin. The requirements which are identified earlier were translated into system features and characteristics. Thus every single part must be taken into account and apply careful consideration to avoid losing control in the process of system development.

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CHAPTER 6

SYSTEM IMPLEMENTATION AND TESTING

6.1 Introduction

This chapter explains the implementation of the system and describes the testing activities and its results in detail. Development environment, platform, database implementation and system development process will also be discussed in this chapter. My-WEBQ is a web-based application, in order to simplify the application development, Microsoft .Net Framework was adopted in My-WEBQ development. Although My-WEBQ is designed to support multi-database platforms, to increase the effectiveness, efficiency and reliability of database management, MS SQL Server was chosen for this system database implementation.

6.2 Development Environment

Having a right development environment is important during the system development phase. Development environment consist of two components which are:

- Hardware requirements
- Software requirements

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6.2.1 Hardware Requirements

The recommended hardware requirements are as follow:

Table 6.1: The hardware requirement

Hardware	Requirement
Processor	Pentium IV 1.2MHz or higher or other equivalent processors
Memory	Minimum 512 MB (Recommended 1 GB or more)
Hard Disk Space	Minimum of 4GB (Recommended 8GB or more)
Others	Network Interface Card and other standard computer peripherals

6.2.2 Software Requirements

The recommended software requirements are as follow:

Table 6.2: The software requirements

Software	Requirement
Operating System	Microsoft Windows XP or higher
Web Server	Microsoft Internet Information Server 5.0 or higher
Database System	Microsoft SQL Server 2000 or Oracle Database server 9i (alternative)
Internet Browser	Microsoft Internet Explorer 6 or higher
Programming tools	Microsoft .NET Framework 1.1 Visual Studio .NET 2003

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6.3 Programming Language and Development tools

6.3.1 Microsoft .NET Framework

Microsoft .Net Framework is a set of programming services designed to simplify the application development. The key components of the .NET Framework are the common language runtime and the .NET Framework class library, which includes ADO.NET, ASP.NET, and Windows Forms.

The advantages and benefits of Microsoft .Net Framework are:

- **Multiple Language Support**

The main advantage of the .NET Framework is the interoperability between different languages that speeds up the development tasks while enabling the developer to create more reliable and dynamic Web pages with any of the programming languages supported by the .Net Framework. For example, a developer can use an object written in C# from Visual Basic.NET. The same applies for all the other Microsoft .NET languages.

- **Improve Performance**

.Net improves the performance of web application. Prior to ASP .Net, ASP code is interpreted when the code is running. In ASP .NET, all code is complied into Microsoft Intermediate Language (MSIL). MSIL is a set of instructions that can quickly be translated into native code. Subsequently, the intermediate language is complied "just in time" (JIT) into native code when the application or component is run.

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- **Improve development time**

The .NET Framework class library is a collection of reusable types that tightly integrate with the common language runtime. It also provides plenty of build-in-control that developer can use directly without writing their own function or control. This makes the .NET Framework types easy to use, and also reduces the time associated with learning new features of the .NET Framework. In addition, third-party components can integrate seamlessly with classes in the .NET Framework.

- **Run More Reliable**

Microsoft .Net Framework includes set of technologies to make application run more reliably. It provides memory management, thread management, and remoting, while at the same time, enforcing strict type safety and other forms of code accuracy that ensure security and robustness

- **Simplified Deployment**

When come to deployment stage, it is very simple to setup an application under .Net environment. To setup the application under .Net environment, the developer only required to use "Copy" function to copy the source files into the destination folder. Previously, the entire component must be registered into windows registry setting before it can be run and operate correctly. However, under .Net platform, all the developed component does not require to be registered into windows registry setting. This simplified the system deployment process.

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6.3.2 MS Visual Studio.NET

MS Visual Studio .NET had been chosen as one of the development tool for My-WEBQ. MS Visual Studio .NET is Microsoft's visual programming environment for creating Web services and applications based on the use of Extensible Markup Language (XML). Visual Studio .NET provides a visual interface for developing a program as a Web service, forms for building a user interface, features for integrating existing application data, and for debugging. By using the high-performance Microsoft .NET Framework run-time environment, Visual Studio .NET provides the developer with powerful tools for designing, building, testing, and deploying Web services and applications. Visual Studio .NET is an ease tool for developing application for the Web.

6.3.3 MS Visual C# .NET

MS Visual C#.NET had been selected as programming language for My-WEBQ development. Visual C# .NET is designed to be the fast and easy way to create a .NET application. C# is an object-oriented language that very similar to C++. C# contains the best features of C++ but leave out other features that does not required in .NET Framework such as typedefs and templates. As a result, developers familiar with C/C++ or Java can master the skill of C# easily. C# is fully integrated with Microsoft .Net Framework and the Common Language Runtime (CLR). C# can be used in developing a Windows application, Web application, Windows components or even XML Web services.

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6.4 Development Platform

Windows XP was chosen as the development platform for My-WEBQ. The reasons for choosing Windows XP as development platform are it's easy of use and the stability of the system. The stability of the system is an important feature need to be considered because it could affect the effectiveness and the fluency of the application. Windows XP uses the 32-bit architecture that minimizes the application failures such as unhandled exception and unplanned reboots.

6.5 Database implementation

Database implementation is one of the important phase when developing My-WEBQ. The use of database is to manage the data, such as insert, edit, retrieve and remove the data from the system. The SQL statement is the command which use to add, modify, read and delete the data from database.

6.5.1 Database servers

During system implementation phase, MS SQL Server 2000 had been chosen as database tools for the proposed system. Oracle 9i (9.2.0) database sever will be the alternative database tools as My-WEBQ is designed to be able to support multi-database platform.

The reason why MS SQL Server 2000 is chosen as main database tools instead of Oracle 9i database is because MS Visual .NET is the chosen development tools and it provides tight integration with MS SQL Server 2000 as compared to Oracle 9i database. MS SQL

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Server 2000 provides graphical user interface for database management and queries analyze, which simplified the management of database.

6.5.2 Database Connection Setting

The database connection setting for My-WEBQ is configured at ASP .NET web.config file. The database of My-WEBQ is named as mywebq.

The database connection setting for MS SQL Server is set up as below:

```
<configuration>
  <appSettings>
            <add key="DBType" value="SQLServer"/>
            <add key="DBConnStr" value="Password=sa;User
ID=sa;database=Mywebq;server=localhost"/>
            <add key="ResxLoc" value="stmtsmssql.resources"/>
  </appSettings>
```

However the database connection setting for Oracle Server is set up as below:

```
<configuration>
  <appSettings>
            <add key="DBType" value="Oracle" />
            <add key="DBConnStr" value="Password=mywebq;User
ID=mywebq;Data Source=orcl" />
            <add key="ResxLoc" value="stmtsora.resources" />
  </appSettings>
```

The key “DBType” indicating database server type used. The keyword “SQLServer” is for MS SQL Server and the keyword “Oracle” is for Oracle database server. The key “DBConnStr” is used to configure the authentication information that required when making a database connection. The key “ResxLoc” specify location of SQL statement resources file.

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6.5.3 SQL Statement Resources Files

In a application that deployed using Microsoft .Net Framework, a resource is any non-executable data that is logically deployed. A resource can be error messages or system defined data used as part of the application. Storing system defined data in a resource file allows the developers to change the data without recompiling the entire application. In My-WEBQ, all the SQL statements are stored as resources in a separate binary file called application resources file. The purpose of using SQL statement resources files is to physically separate the SQL statements from the data layer components and make the data layer components independent from the database platform.

The use of SQL statement resources files make the design of My-WEBQ become more flexible and easier to expand for further development. By using Microsoft .Net Framework, this can be easily achieved. The .NET Framework provides comprehensive support for the creation and localization of resources. The .Net Framework tool - Resource File Generator (Resgen.exe) is used for creating a resources file. The Resource File Generator converts ".txt" files and ".resx" (XML-based resource format) files to common language runtime binary ".resources" files that can be embedded in a runtime binary executable.

Resgen.exe performs the following conversions:

- Converts .txt files to .resources or .resx files.
- Converts .resources files to text or .resx files.
- Converts .resx files to text or .resources files.

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The syntax of the resgen command is as below:

resgen [/compile] *filename.extension* [*outputFilename.extension*][...]

Where:

filename.extension	is the name of the input file to convert.
outputFilename.extension	is the name of the resource file to create

6.6 Program Development

6.6.1 Coding Approach

There are two common coding approaches when developing a program; top-down approach and bottom-up approach. The top-down is a traditional approach that started by specifying the solution at the highest level of functionality and then dividing them into successively smaller pieces and small routines that can be easily documented and coded. In top-down approach, the understanding of the complete system is very important when designing and developing a program. One of the advantages of using top-down approach is developers are always clear with the goal and stays focused on the goal. However the top-down approach may complicate the testing because no executable will even exist until near the end of the project.

In bottom-up approach, the individual parts of the system are specified in small detail first. These small details can be executable by themselves. Subsequently, these small details are linked together to form larger components, which are in turn, are linked until a complete system is formed. This approach is commonly used for object-oriented programming. The bottom-up approach helps to clarify the ideas about the design of the

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program and promotes code re-use. In the bottom-up approach, usually the developers will start with a simplified version of the problem and develop the solution to get it works. This workable part will then be added with new features and capabilities until it solves the entire problem completely. Bottom-up programming may allow for unit testing, but until more parts of the system come together it will be often cause complications near the end of the project when the system is tested as a whole.

In My-WEBQ development, bottom-up approach was chosen to develop the program. The development was started with developing the data objects and business entities objects at data layer and business layer component. It will follow by with developing of the higher level of business component and user interfaces component. Finally is the integration of all the system components to form a complete system of My-WEBQ. This development involved the unit testing after the completion of each object and followed by system integration testing at the end of the development phase.

6.6.2 Coding Style Adopted

My-WEBQ was developed using ASP .Net with C# as the programming language. It is important to have a set of rules to make the source code easier to read and understand. Therefore, some of the .NET programming standards and naming conventions for user interface controls were adopted in this development as shown at Table 6.3.

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Table 6.3: Programming naming conventions adopted for user interface controls.

UI controls	**Pre-fix of the UI controls name**
Button	Btn
Check box	Chk
Data grid	Dg
Label	Lbl
Option button	Opt
Report	Rpt
Textbox	Txt

6.7 Testing and Evaluation

In modern system development, testing phase is a very important phase. Software testing is the process used to help identify the correctness, completeness, security, and quality of the developed software system. Regardless of how competent and careful the analysts and develops are in designing and coding a software system, there are always will be human mistakes during design and coding, or unknown system issues such as system incompatibility when system goes life in production environment. System failures and errors occur mainly due to inadequate or improper testing. A thorough testing is one that can identify the correctness, completeness, security and ensure the quality of the software. The goal of designing a thorough testing is to produce a test process that can identify the correctness, completeness, security of the software to ensure the quality output. A quality testing will lead to an independent and reliable system.

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6.7.1 Testability

Testability is an important non-functional requirement when developing a system especially in the modern era of system development. Testability can be defined as the property that measures the ease of testing a piece of code or functionality that satisfies system specifications and requirements. A testable software will ensures complete execution of the test scripts. The test plans and test scripts can be executed systematically with a well design of testing. Thus, a testable system is easier and less costly to maintain.

6.7.2 Designing Test Case

Designing test cases give us a chance to analyze system specifications from different angle. The test cases include a description of the functionality to be tested taken from either the requirements or use cases, and the preparation required to ensure that the test can be conducted. A test case is repeatable and can be executed by other people other than the person who wrote the test cases. In a system development project, test cases should be written by the person who understands the function or technology being tested, and each test case should be submitted for peer review.

In My-WEBQ development, coding and testing are carried out in parallel. This development involves the unit testing at the completion of each object. At each module in My-WEBQ, module tests are carried out for errors detection and any error discovered will be rectified. At the end of the development, the modules are integrated to form a complete system and follows by system integration testing. Other testing approaches executed to ensure the correctness and completions of the system. They are:

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- Function Testing

In functional testing, each function in the system is tested to make sure that the function is working in the manner that satisfies system specifications and requirements. It derives the test cases from the program specification.

- Interface Testing

Interface testing is to test the user interface. This testing is very important and very critical for My-WEBQ because My-WEBQ is a web-based system. This testing is very critical to ensure the user interface meet the user's needs for maximum effectiveness.

- Performance Testing

This testing is to test if the performance of the system meets the required specifications. This testing is to avoid system failure such as system timeout failure.

6.7.3 Test Results and Evaluation

6.7.3.1 Unit Testing

Unit testing is to validate a particular component of a module is functioning properly. Any error discovered during the unit testing will be corrected immediately to ensure the correctness of the system. The unit test is carried out simultaneously with coding.

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The results of the unit testing are shown at below tables:

Table 6.4: Result of unit testing on survey object.

Procedure	Expected Result	Actual Result
New survey object	The new survey object will be created.	The new survey object is created.
Update survey object	Update the data to the survey object.	The data is updated at survey object
Remove survey object	Remove survey object from object collection.	The survey object is removed from the object collection.
Insert new survey	Insert new survey into the database.	The data is successful added into the database.
Saving survey	Save the survey data into the database.	The data is successful updated into the database.
Deleting survey	Delete the survey data from the database.	The data is successful deleted from database

Table 6.5: Result of unit testing on survey page object.

Procedure	Expected Result	Actual Result
New survey page object	The new survey page object will be created.	The new survey page object is created.
Update survey page object	Update the data to the survey page object.	The data is updated at survey page object
Remove survey page object	Remove survey page object from object collection.	The survey page object is removed from the object collection.
Insert new survey page	Insert new survey page into the database.	The data is successful added into the database.
Saving survey page	Save the survey page into the database.	The data is successful updated into the database.
Deleting survey page	Delete the survey page data from the database.	The data is successful deleted from the database

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Table 6.6: Result of unit testing on question section object.

Procedure	Expected Result	Actual Result
New question section object	The new question section object will be created.	The new question section object is created.
Update question section object	Update the data to the question section object.	The data is updated at question section object
Remove question section object	Remove question section object from object collection	The question section object is removed from the object collection.
Insert new question section	Insert new question section into the database	The data is successful added into the database.
Saving question section	Save the question section data into the database	The data is successful updated into the database.
Deleting question section	Delete the question section data from the database.	The data is successful deleted from the database

Table 6.7: Result of unit testing on question object.

Procedure	Expected Result	Actual Result
New question object	The new question object will be created.	The new question object is created.
Update question object	Update the data to the question object.	The data is updated at question object
Remove question object	Remove question object from object collection.	The question object is removed from the object collection.
Insert new question	Insert new question into the database.	The data is successful added into the database.
Saving question	Save the question data into the database.	The data is successful updated into the database.
Deleting question	Delete the question data from the database.	The data is successful deleted from the database

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Table 6.8: Result of unit testing on question option object.

Procedure	Expected Result	Actual Result
New question option object	The new question option object will be created.	The new question option object is created.
Update question option object	Update the data to the question option object.	The data is updated at question option object
Remove question option object	Remove question option object from object collection.	The question option object is removed from the object collection.
Insert new question option	Insert new question option into the database.	The data is successful added into the database.
Saving question option	Save the question option data into the database.	The data is successful updated into the database.
Deleting question option	Delete the question option data from the database.	The data is successful deleted from the database

Table 6.9: Result of unit testing on respondent object.

Procedure	Expected Result	Actual Result
New respondent object	The new respondent object will be created.	The new respondent object is created.
Update respondent object	Update the data to the respondent object.	The data is updated at respondent object
Remove respondent object	Remove respondent object from object collection.	The respondent object is removed from the object collection.
Insert new respondent	Insert new respondent into the database	The data is successful added into the database.
Saving respondent	Save the respondent data into the database	The data is successful updated into the database.
Deleting respondent	Delete the respondent data from the database.	The data is successful deleted from the database

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Table 6.10: Result of unit testing on response object.

Procedure	Expected Result	Actual Result
New response object	The new response object will be created.	The new response object is created.
Update response object	Update the data to the response object.	The data is updated at response object
Remove response object	Remove response object from object collection.	The response object is removed from the object collection.
Insert new response	Insert new response into the database.	The data is successful added into the database.
Saving response	Save the response data into the database.	The data is successful updated into the database.
Deleting response	Delete the response data from the database.	The data is successful deleted from the database

Table 6.11: Result of unit testing on user object.

Procedure	Expected Result	Actual Result
New user object	The new user object will be created.	The new user object is created.
Update user object	Update the data to the user object.	The data is updated at user object
Remove user object	Remove user object from object collection.	The user object is removed from the object collection.
Insert new user	Insert new user into the database	The data is successful added into the database.
Saving user	Save the user data into the database.	The data is successful updated into the database.
Deleting user	Delete the user data from the database.	The data is successful deleted from the database

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6.7.3.2 Module Testing

Table 6.12: Result of module testing on My-WEBQ.

Test cases	**Pass**	**Fail**
User login to the system	✓	
List surveys	✓	
Display a survey details	✓	
Create a new survey from template	✓	
Create a new survey by coping an existing survey	✓	
Create new survey page	✓	
Display survey pages	✓	
Modify a survey page	✓	
Delete a survey page	✓	
Create new question block	✓	
Display question block details	✓	
Create new question	✓	
Display question details	✓	
Modify a question	✓	
Delete a question	✓	
Create new question option	✓	
Modify question option	✓	
Delete question option	✓	
Preview a survey	✓	
Publish a survey	✓	

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Table 6.13: Result of module testing on online questionnaire.

Test cases	**Pass**	**Fail**
Respondent login to the questionnaire	✓	
Display the requested questionnaire to the respondent	✓	
Navigate to the next page if the questionnaire is multi-pages and not at the last page	✓	
Navigate to the previous page if the questionnaire is multi-pages and not at the first page	✓	
Submit the questionnaire result	✓	
Redirect to the user defined URL upon completion of the questionnaire	✓	

Table 6.14: Result of module testing on reporting.

Test cases	**Pass**	**Fail**
Display the surveys that are already published online.	✓	
Select the survey to generate reports.	✓	
Print survey details.	✓	
Print survey summary report.	✓	
Print the questionnaire result for selected question.	✓	

Table 6.15: Result of module testing on system administration online.

Test cases	**Pass**	**Fail**
Administrator login the system	✓	
Display all users	✓	
Create new user	✓	
Modify user details	✓	
Delete a user profile.	✓	

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6.8 Conclusion

During the system implementation phase, the appropriate software tools and hardware tools had been chosen for My-WEBQ development. . In this chapter, author explained the database implementation and testing approach used in the implementation phase. Various test result also presented in this chapter. Based on the test result, it can be concluded that My-WEBQ is a functioning system that meets the objective of this dissertation to develop My-WEBQ based on the proposed design that is capable to automate and simplify the development process of web-based survey.

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CHAPTER 7

CONCLUSION AND FUTURE WORK

7.1 Conclusion

In this dissertation, research works had been carried out to identify the current issues in web-based surveys. The current issues and problem of web-based survey is explained in the literature review. A web-based questionnaire was conducted to gather the user's opinions and requirements on the web-based survey. The result of the web-based questionnaire was analyzed and the hypothesis (Ha) of web-based survey is a preferable tool for conducting a survey in local study has been proven by results tabled in Chapter 4.

From the literature study and the result of the survey conducted, it's found that a good web-based survey generator should consist of the following features:

- Support multiple response options.
- Provide color theme.
- Provide help option.
- Provide survey templates and copy survey feature.
- Provide questionnaires result in summary format.

Based on the proposed framework, an initial prototype of My-WEBQ was developed with a flexible architecture that can be enhanced for future expansion. Testing also had been conducted on My-WEBQ to ensure the correctness and completion of the system.

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The contributions of My-WEBQ are summarized as follows:

- Simplify the web-based survey creation.
- Support multiple response options.
- Allow the users to create survey from template or from existing survey.
- Allow the users to format the survey with different color theme.
- Provide a free web-based survey tools for researches.
- Support multiple database platform and internet browser platform.

The contribution of My-WEB has proven the hypothesis (Hb) that the process of constructing a web-based survey can be simplified by implementing My-WEBQ.

7.2 Challenges and Problems Encounter

During system development, there were some challenges and problems encountered. In order to solve the problems, some solutions were applied to resolve the issues. The following are some of the problems and approaches taken for resolution during the system development.

- Inexperienced in using .Net Technology and Programming Language

  Visual C# is a new programming language that provides the powerful features such as object oriented programming, strings, exception handling, data access component and many others features for implementing web-based application. Author had no experience in Visual C# programming at the initial stage of the project. However, with the graphical user interface of integrated development environment of Visual Studio and the powerful help files in Visual Studio, author had managed to learn the

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new programming language and developed the prototype with C# within the limited timeframe.

- Time consuming for developing a web-based questionnaire

A web-based questionnaire had been developed by author using Microsoft Visual C# to gather user's opinions and requirements about web-based survey. The creation of the questionnaire is time consuming to this project because more time was required to develop this web-based questionnaire with C# programming language. Furthermore, necessary follow up with the respondents are required if the respondents refuse to join the questionnaire.

- Time Limit

Due to time constraints, some features have to be limited to only minimum requirement for this initial prototype. The help feature is a simple help instruction provided in MS Word document (Appendix B). In this project, only basic security feature is implemented where only user name and password is used.

7.3 Future Works

Although the initial prototyping of My-WEBQ is developed to help to improve the process of creating a web-based survey, we are still in the earlier stage of having the entire complete system that are fully functioning and contribute to all researchers whom like to implement a web-based survey. However, the results in this dissertation had provided a strong foundation for future work in web-based survey generator system.

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There are a couple of efforts required to enhance the system in the future in the following areas:-

- Interactive and Dynamic Interface

Additional interactive images and Flash objects can make the system more interesting and attractive.

- Security enhancements

Additional security enhancement can be added to My-WEBQ such as detecting the user is a valid user not only by checking the user id and password but it can be enhanced with IP address or a valid network domain.

- Access right control

More user access right control can be added into My-WEBQ to differential different type of users, such as create survey access right, edit survey access right, delete survey access right, report generation access right and administration access right. This is important for a big organization with different type of system users.

- Other Survey Features

Finally, there are a number of other optional features that we can add on to My-WEBQ in the future. These include support of animation object, random questions and options, skip logic, auto-sending email to the respondents and alerts to the users about the survey status.

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