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DIGITAL EXAMINATION QUESTION PAPER MAKER AND ANALYSER

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Abstract

For the past few years, the increased numbers of student in education institution make it more time consuming to evaluate the student assessments. In order to reduce the teaching staff's workload, they must be either set fewer assessment tasks or propose some possible solutions to save time and energy.

Following from those reasons, Digital Examination Question Paper Maker & Analyzer have been developed to achieve these objectives. The system has provided the functionalities for lecturers easily organize, mark, and analyze their assessment papers. Besides, it's also to serve the purpose of providing a secure online examination which allows students sit for the examination by accessing the web-based system. The results from student will be further analyzed by system and displayed in various forms of report.

The waterfall model with prototyping has been chosen to be the methodology in developing the system. Functional and non functional requirements is stated clearly early the development process for the purpose to controlling and monitoring in the future. System architecture design, system functionality design, database design and user interface design are used to develop the prototyping before the system is completed.

After all the technologies have been reviewed and analyzed, ASP.Net is selected in the system development because of its powerful features and complete architecture for developing Web sites

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CHAPTER 1
INTRODUCTION

1.1 Project Overview

Common institutions have experienced a sharp growth in student numbers in recent years. Increased numbers of student make it more difficult to assess student assessments; if assessments are graded manually, staff must either set fewer assessment tasks or resign themselves to a greater marking workload.

The workload of academic staff is increasing in this country because of the increased pressure to achieve quality education. The academic staff is expected to be active researchers while being effective lecturers in teaching, research and community service. Furthermore, as the student numbers at a specific institution increase, the task of evaluating students becomes more and more time consuming. Under such circumstances it is expected from lecturers to handle larger groups and in order to maintain quality education lecturers must do more in less time. It is thus evident that lecturers will look at techniques to equip themselves better and save time wherever possible. In Malaysia, a few other institutions have been experimenting with a variety of online assessment techniques to alleviate these problems.

This project is taken up with the intention to create a question examination paper maker and analyzer which provide a modern technology to ease the staff's burden

and save time and energy while maintaining high standards. The tools provide a few modules for the lecturers in organizing, marking, and analyzing their exam paper.

Besides, it's also to serve the purpose of providing a formal web-based examination which allows students sit for the digital examination. The examination paper and submission system will be web-based using Asp.Net web form and the marking workload will drastically reduced by using a semi-automated marking system which consist of marking phase follow by a much faster human moderation of the automatically generated mark. This also has the addition advantage that the submissions will be available in a machine-readable format which is amenable to some form of automated marking system.

On the other hand, the Digital Examination Question Paper Maker and Analyzer will provide powerful examination management system that allows administrator to enter an unlimited number of course, students, and even lecturers to the database. The system will be deployed on internet and a centralized database system will be located on a LAN, effectively managing thousands of students and tests. Administrators can assign students to courses; students are allowed to sit for examination that specified in the courses. In addition, administrator also can assign a lecturer with a user account to access the web server so that they can organize, mark, and analyze a specific examination. The user's logs kept user activities which indicate the time of user's login into the system.

By using Digital Examination Question Paper Maker and Analyzer system, it would certainly increase the effectiveness and quality of an examination management in the institutions.

1.2 Project Objectives

Digital Examination Questions Paper Maker and Analyzer system is targeted on some objectives listed below:

- Enable lecturer easily create the examination papers in digital format.
- To help lecturers in marking questions paper.
- Automatically marking in objectives questions and subjective questions.
- Support manual marking in subjective questions.
- Analyze the result of examination and generate reporting solution for displaying multiple view on result, chart, and rendering result in a web application.
- Provide a system for students to sit their examinations.
- Enhance security method into the process of examination system to prevent online collusion and plagiarism.
- To establish paperless examination system and distribution data entry.

1.3 Project scope

The scope of this project will cover more than one education departments in a Local Area Network. It is a system, which may simulate the processes and advantages of having DEQPMA. The target users are the lecturers from different departments, administrator of the system, and the students who sit for the online examinations.

The system will divide into three sub-systems: Lecturer, System Administrator, and Student. However, the project's priority will be the Lecturer sub-system. Lecturers can organize a questions paper, mark, and analyze the result of a specific exam to generate reports in text, table, graphs or other formats. Each system is divided into a few modules. For Lecturer sub-system, it will cover questions paper maker module, objective and subjective questions marking module, and etc. The Student sub-system on the other hand will cover digital format questions and result checking module.

The scope for Lecturer sub-system will cover:

- Assessment Management Explorer
- Questions paper maker
- Automate marking of objective, fill in the blank, short essay and true/false based questions
- Add-in artificial intelligence element in helping lecturer manually marking the subjective questions

- Result analyzer and report solution
- Searching function to search for student personal information and test information
- Publishing of test questions
- Questions Bank

The scope for Student sub-system will cover:

- Questions in various forms (objective, fill in the blank, true/false, subjective or short essay) will be prepared for students who sit in a specific examination.
- View Exam Score and Result

The scope for System Administrator sub-system will cover:

- Registration of Lecturers and Student.
- User's login into each sub-system.
- Activities log of current Lecturers and Student.

1.4 Expected Outcome

The expected outcomes of the proposed system are show as below:

- The target users of the system are administrator, lecturer student from universities and colleges. The system will be user-friendly and easy to operate. Once the Digital Examination Maker & Analyzer is developed, students are able to take their examination paper within the campus or from anywhere as long as the computer is connected to Internet.
- Standard graphical user interface is provided.
- Acceptable response time when users use the examination system.

The proposed system can be easily expanded if additional capabilities and functionalities are required.

1.5 Project Schedule

Project scheduling

Project scheduling is the cursor of the software development activities that must be carefully planned out to achieve a systematic progress and ensure on-time delivery of the product. It is important to schedules all project activities as it help the developer to control the time management and make sure he is in the route of the direction of the project.

Project Initiation and Planning

Around two weeks are needed to define the objectives, scope, project limitation and project schedule of the proposed Digital Examination Maker & Analyzer in the chapter Introduction.

Literature Review

It is estimated that three weeks is needed to do research to gather information from various sources like reading materials, article from Internet. This included the time needed to analyze on existing examination system.

Methodology

About two weeks is needed to determine the proper methodology for this system. Surveys and interviews with target users will be conducted. Methodology to be used for this project will be chosen.

System Analysis

About three weeks time is needed to complete the analysis of the system requirements. The data collected in the methodology will be analyzed to get the user requirements. Analysis of the hardware and software for the system will also be conducted.

System Design

System design is estimated to take around four weeks time. The design of the module for the system is expected to be completed during this period. DFD (data Flow Diagram) that shows the relationship between entities will be presented. A user-friendly interface will be designed during this period. Viva will be held during the period too.

System Implementation

Implementation and coding of the system is expected take six weeks time as many technical problems will be faced during the process. It is also to ensure the quality of the system.

System Testing

Testing of the system will take place upon the completion of the coding. It is estimated to take around five weeks time. During the period, unit, module, integration and system testing will take place to make sure that the system is functional according to the requirements.

System Evaluation

Implementation of the final product will be done in around three weeks time. All the modules in the proposed system will be evaluated.

Documentation

Documentation has been carried out during the whole system development process.

Discussion with supervisor is held whenever there are any problems faced.

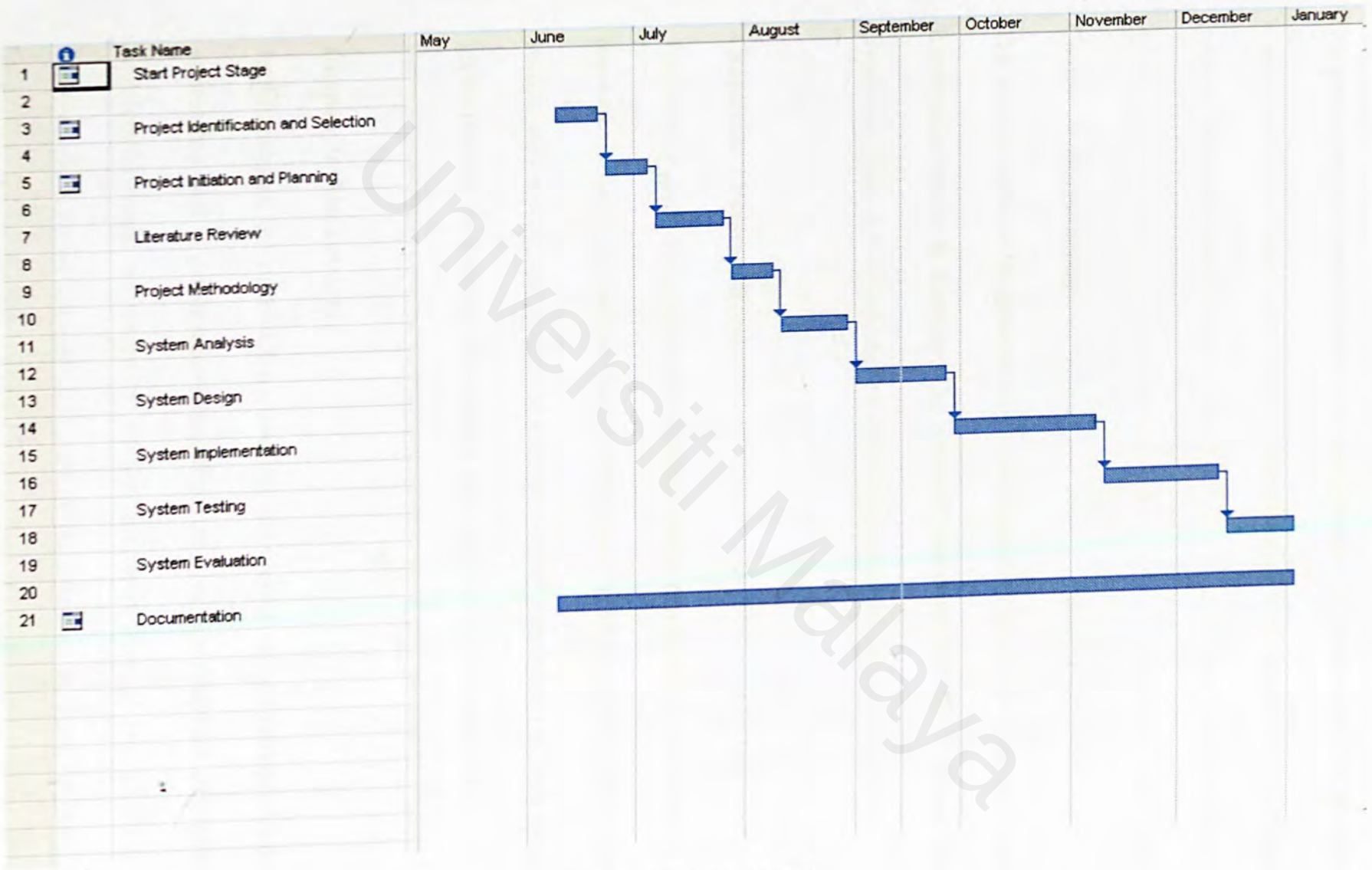


Figure 1.1 Project schedule

1.6 Report Layout

This project proposal report consists of eight chapters. The purpose of this layout is to give overview of the major phases involved during development of the project. Below is the report layout:

Chapter 1: Introduction

This chapter presents the general review and the definition of the proposed Digital Examination Maker & Analyzer. The overview, objectives and the limitation of the project are given. A brief explanation of the scope of project is also included.

Chapter 2: Literature Review

This chapter gives the detail of the literature survey that has been conducted by the previous scholars. Information related to the system is obtained from various sources such as web articles, text books and journals. A brief introduction of each system is given. Besides, the analysis of the similar existing system is also available.

Chapter 3: Methodology

In this chapter, the methodology used for the project was introduced. Method or approaches used to gather information about the system is described. The functional and nonfunctional requirements of the proposed system are provided. The Comparison between software and hardware requirements are made to justify which software and hardware is most suitable to develop the system.

Chapter 4: System Analysis

It explains the information gathering techniques needed to obtain relevant information regarding the system. Also included is the research and investigation on the system requirements analysis, which consists of functional requirement and non-functional requirement, based on similar system available in the market. Programming language selection is another main ingredient that should be taken into consideration. Another description will be in the system requirement.

Chapter 5: System Design

This chapter presents the design of the Digital Examination Maker & Analyzer. The system architecture, database structure design, data dictionary, interface design program design and data flow diagram will be included in this chapter. Detail diagram of each module will be described as well.

Chapter 6: System Implementation

Chapter 6 focuses on system implementation, the process of putting the design specification in actual operation. This leads to the discussion of system coding whereby the coding approach being used is the architecture that consists of these distinct layers: user interface layer, data layer, and transaction layer. It explains the various languages that are used to construct the system.

Chapter 7: System Testing

This chapter describes the approaches used to debug and test the system. The achieved and unachieved objectives of system are listed. Problems faced and solutions taken during the system development are outlined.

Chapter 8: System Evaluation

This chapter concludes the experience gained during the system development. The strengths, weakness and limitations of the final product are described. Proposal and suggestion for future enhancements is forwarded.

CHAPTER 2
LITERATURE REVIEW

2.1 Domain Studies

This chapter contains all the research has been done on the existing current system including reviews on the features, capabilities, and so on. The strengths of existing examination paper maker were studied so that it can be adapted into this project. The weaknesses on existing current system were identified in order for this project to overcome.

2.1.1 Definition

Examination, or "assessment," plays a vital role in education today. Exam results are often a major force in shaping public perception about the quality of our schools. As a primary tool of educators and policy makers, assessment is used for a multitude of purposes. Educators use assessment results to help improve teaching and learning and to evaluate programs and schools. Assessment is also used to generate the data on which policy decisions are made. Because of its important role, educational assessment is a foundation activity in every school, every school district and every state--a vital component in innovation, higher standards and educational excellence.

Assessment is used to

- Monitor educational systems for public accountability
- Help provide information to better identify instructional practices
- Evaluate the effectiveness of instructional practices
- Measure student achievement
- Evaluate students' mastery of skills

2.1.2 Acronyms and Terminologies

Web hosted assessment.

Recent changes in education have resulted in increased demands upon tutors for instruction and assessment, including summative examination assessment, whilst at the same time per-student resources has declined considerably. Increased investment in and deployment of information technology by using the web hosted assessment may mitigate some of these problems.

In **fixed response systems** the user is constrained in the response which they can make. This can include the entering of a particular word or phrase into a text entry box, the selection of a single response from a drop down list or list box, making multiple selections from a list box or selecting an option (or options) from a list of phrases (multiple choice). The major advantage of fixed response systems is that

marking of the responses can be automated.

In **free response systems** the response from the user is less constrained and can include free text responses, construction or completion of designs, diagrams and/or program code. The disadvantage of free response systems is that it is very difficult, if not impossible, for the marking of the responses to be automated. However, it is possible for automation to play a part in the administration of the assessment and of the processing of the responses.

Kinds of Tests

Educators recognize the value of using a variety of tests. A comprehensive assessment program may include several different measures, among them the following basic types and formats:

- **Standardized achievement tests**. These tests are commonly used to provide valid, reliable, and unbiased information about students' knowledge in various areas. "Standardized" means that the test is always given and scored the same way. The same questions are asked and the same directions are given for each test. Specific time limits are set, and each student's performance may be compared with that of all the other students taking the same test. Most standardized achievement tests are norm-referenced, multiple-choice tests.

- **Norm-referenced tests**. Norm-referenced achievement tests measure basic concepts and skills commonly taught in schools throughout the country. These tests are not designed as precise measures of any given curriculum or single instructional program. Results from norm-referenced tests provide information that compares students' achievement with that of a representative national sample. This gives teachers the opportunity to compare their students with other students.

- **Criterion-referenced tests**. This type of assessment is designed to compare a student's test performance with clearly defined curricular objectives, skill levels, or areas of knowledge. Criterion-referenced tests compare the performance to a predefined set of objectives--and demonstrated mastery (knowledge) of a specific subject, such as long division.

- **Multiple-choice tests**. Many standardized tests give students the opportunity to select responses to test questions from among a number of specific choices. Carefully designed multiple-choice questions can provide valid information about students' knowledge and their ability to reason logically and apply complex thinking processes to solve problems. In most instances, multiple-choice tests are scored by computers and provide impartial, accurate results.

- **Performance assessments** are types of tests that directly assess pupil performance. Students may be asked to write an essay or short response, draw a conclusion, respond to a reading passage, or perform a science experiment. Teachers or other school personnel observe students' performances and rate the outcomes. This kind of assessment is also useful in measuring listening skills, writing, and the process of problem solving. Performance assessments can also be standardized so that the test is given and scored the same way at each administration.

Four Principles to Consider

Although educational testing is a complex field, four basic principles provide a foundation for further understanding.

- **Standards First, Then Testing.** When states and communities reform their education systems, a logical sequence of events must be followed. First, the goals for each education system must be set. Second, standards must be adopted to outline what children should know and be able to achieve. These standards should be written in a way that will help students meet the stated goals. Following the adoption of standards, curricula must be set and instructional materials selected to help teachers assist their students in meeting the standards. Finally, assessments are developed to measure

student progress toward meeting the standards. In other words, assessment should follow, not lead, the movement to reform our schools. As we continue to find ways to improve education, it is important for educators and policy makers to use a sequence that starts with goal setting and ends with assessment. Only then can we build and use new tests that accurately measure our progress toward meeting standards.

- **Tests Measure Educational Progress--They Don't Create It.** The purpose of testing is to deliver accurate and reliable information, not to drive educational reform. Some politicians and policy makers have suggested that new tests alone will create higher levels of educational achievement. What they are really looking for is better results. It is important for school administrators and policy makers to understand that a new assessment system cannot cure ailing education systems. Tests do not create better students; good teachers and good schools do! The problems facing our nation's schools are serious. There is no single cause, and therefore no simple cure for these problems. There are no shortcuts to improving student achievement and creating a world-class workforce. We continue our search for ways to improve student achievement, not rush into thinking that a new testing system will create better schools.

- **No Single Test Does Everything--The Importance of Multiple Measures.** No single test can do it all. A diagnostic test to determine the emission level of an automobile engine will not tell you that the tires need air. A different procedure is needed to provide that information. The same goes for tests in education. No single test can ascertain whether all educational goals are being met. A variety of tests, or "multiple measures," is necessary to tell educators what students know and can do. And just as different tests provide different information, no one test can tell us all we need to know about one student's progress. This "multiple-measures approach" to assessment is the keystone to valid, reliable, fair information about student achievement. Any one type of test, whether norm-referenced, multiple-choice or performance assessment is only one part of a balanced approach to assessment.

- **The Importance of Valid, Fair, and Reliable Assessments.** All tests and test types, whether standardized, multiple-choice, or performance assessment, should be held to the same high technical standards for producing accurate information. No test should be selected and administered without first determining how its results will be used and its appropriateness to the subject matter. Furthermore, no test should be used without reviewing its technical strengths, including fairness, validity, and reliability. All assessments should be designed, piloted, and published using nationally accepted technical standards such as those developed by the American

Psychological Association, the American Educational Research Association, and the National Council on Measurement in Education. In recent years, many new assessments and test formats have been developed. These tests, too, must be held to the same high standards. Invalidated tests, especially those with high-stakes outcomes, should not be administered (Michael H. Kean, 2003).

2.1.3 Existing System Review

There are a lot of digital examination paper maker either appear in the market or Internet that are using by educational organization to conduct the online assessment. There are a few current digital examination paper makers that have some parts and concepts that similar to this project system.

Case Study 1

Online Evaluation System (OES)

Online Evaluation System has been developed as a product by MIND for online examination and opinion polls. Online Examination System has been designed to provide a cost effective solution to organizations for conducting exams and opinion polls.

Figure 2.1: Online Evaluation System

Its key features are:

Question Bank

- Questions with varying complexity can be included in different exams from a question bank and assigned to user as per the level.
- User defined exams and polls.
- Questions from various topics can be included..

Control over time

- Does not allow user to give exam after the defined time limit.
- Stopwatch is displayed so that user can manage the time during the examination.

Security

- Robust security system takes care that no unauthorized user can have access.
- User can only see his own result but an Administrator can see the result of all candidates.

Other features

- Report Cards are generated so that user can immediately view the result.
- Results of opinion poll can be analyzed.
- Navigation is user friendly with user having options to move back and forth while taking the exam.

Benefits

- Saving of resources both manpower and time
- Better organization and control
- Better security options.
- Faster cycle time in selection process in case it is used for recruitment
- It can be deployed on web and used by organizations conducting online courses.

Summary:

- The system only allows one administrator to manage the result. It isn't suitable for using in the campus because there is always more than one

lecturer who will be using the system on their own purpose either provide the test or examination for the students.

(http://www.mind-infotech.com/case_studies/oes.htm)

Case Study 2

Questionmark Perception

Questionmark Perception is packaged as Perception for Windows and Perception for Web. Perception for Windows is used to create, deliver and report on assessments using the Windows PC platform. Perception for Web, our most popular package, is used to administer assessments using the Internet or Intranets.

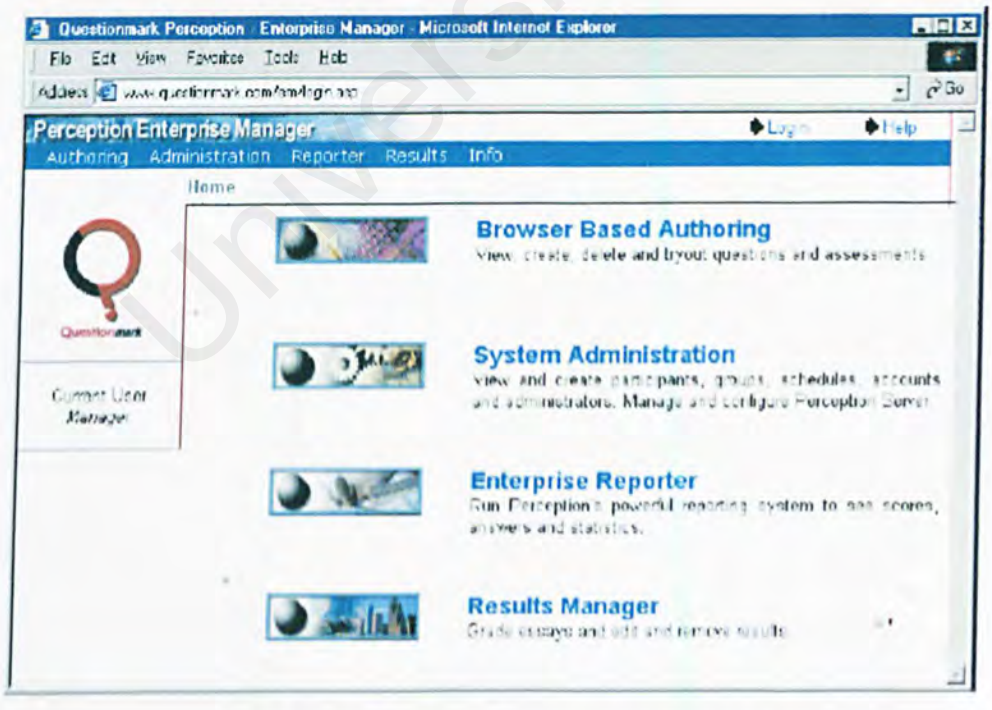


Figure 2.2: Questionmark Perception

Question types

- Perception's authoring wizards makes it easy to create many types of questions including multiple choices, multiple response, essay question, word response, numeric, matching/ranking (selection question), hot spot, drag and drop, matrix, IT simulations, and explanation screens. If you like, you can use can use sound, video, Java and Macromedia Flash in creating Perception questions.

Reports

- When a participant finishes answering the questions, the answers are stored and immediately processed. All answers are stored in the Perception answer database and then report directly from the database using a browser or Windows PC. Perception for Web offers nine pre-defined report styles also define able reports.

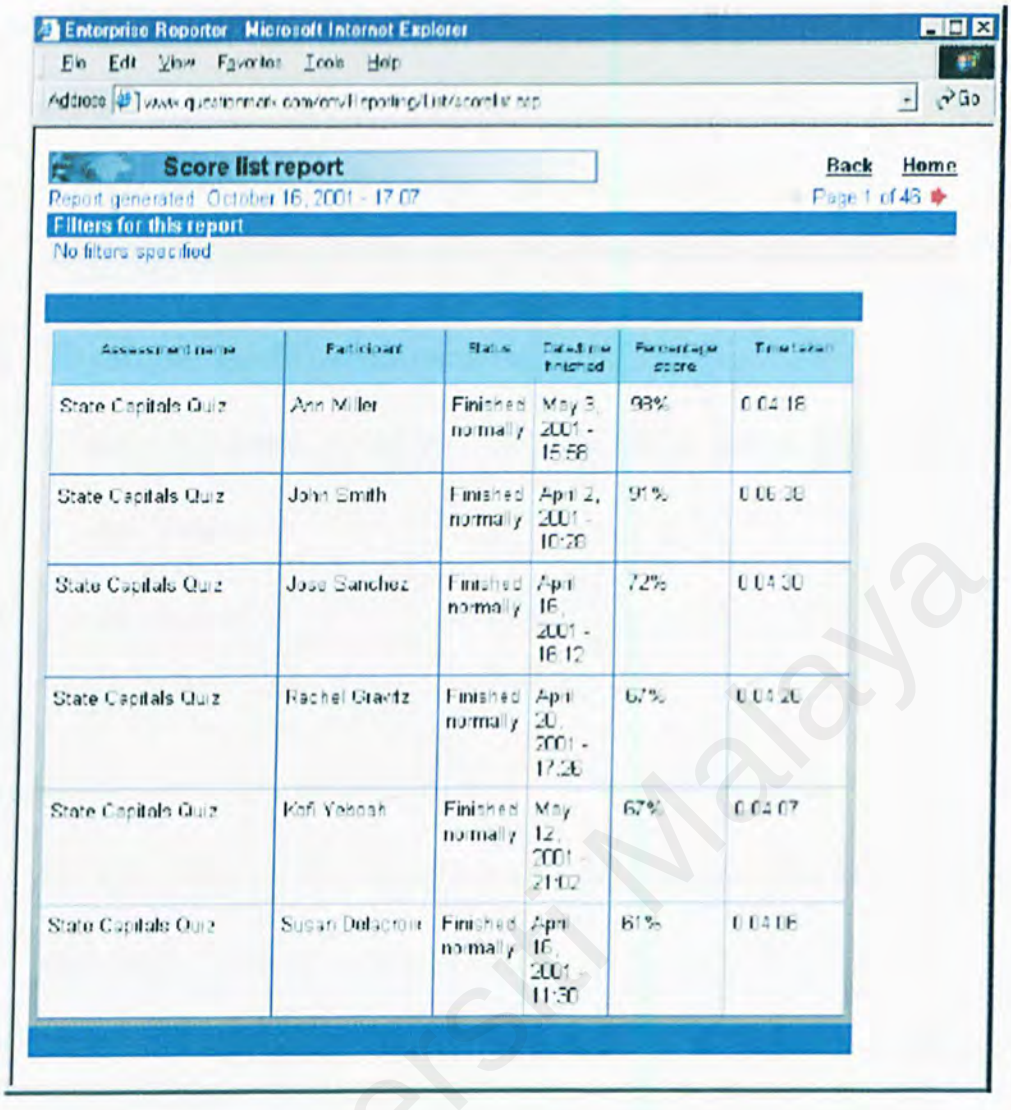


Figure 2.3: Score View Report

Questionmark Perception offers:

- Secure or open environment for your assessments
- Easy-to-use assessment authoring tool
- Question banking organized by learning objective
- Interactive delivery on Intranets, the Internet and using Windows PCs
- Shuffle choices, with easy selection and randomization of questions
- Instant feedback to participants at item, topic and/or assessment levels

- Feedback can include hyperlinks to learning materials and web applications
- Adaptive branching based on how questions are answered
- Online viewing of results, reports and item analysis
- Nine report styles that you can customize
- Export answers for custom reporting
- Storage of answers, scores, and results in MS Access or SQL (Microsoft or Oracle) databases
- A spell checker

Summary

- The Questionmark Perception faces the same problem that as the system do not concern to the role of the lecturer.
- Absence of the Control over time feature which does not allow user to give exam after the defined time limit.

(http://www.questionmark.com/)

Case study 3

TestMate Clarity (Test results reporting system)

An innovative database software system that offers complete data storage,and custom reporting to meet local or state reporting requirements. Manage test data more effectively and create reports that can enhance the overall understanding of test results.

TestMate Clarity lets you access test results and create custom reports using all standard norm-referenced and aptitude score types. You can restructure any test information to meet local reporting needs any time during the school year.

TestMate Clarity allows you to:

- Generate any of the most frequently needed reports with a click of a button;
- Modify the standard TestMate Clarity report templates to meet your specific reporting requirements;
- Track special groups of students, such as GATE or Title I students, by using special codes; and
- Use Multiple Measures to create reports that compare one test with another (either the same test taken at different times by a group of students, or different tests taken by an individual student).

Benefit

- Quickly accessing and using school and district data
- Analyzing results and reporting on specific test subpopulations
- Creating reports with exactly the data you need
- Receiving full support of single-site and district-wide installation

Summary

- TestMate Clarity is a compliment system of an online assessment. It does not support for other online assessment system except the its complimentary package. The user who wants to utilize this system must purchase the online assessment system from the same software vendor.

(http://www.ctb.com//testmate_overview.jsp)

Case study 4

TerraNova, The Second Edition (CAT/6)

TerraNova is a comprehensive, modular assessment series, offering multiple measures of both English- and Spanish-language student achievements. TerraNova assessments changed the way teachers and students respond to standardized tests. TerraNova CAT offers the same innovative approach to design, content, and results-oriented scoring. TerraNova CAT has a graphics-rich format that reflects educational material and encourages students to do their best.

TerraNova CAT decision-making assets include:

- Comprehensive score reports with easy-to-understand graphics--including customized reports directly aligned with your curriculum or standards.
- Reports and data on CD-ROM for easy archiving, data retrieval, and report output.

- Observations and General Interpretations of test results in reports presenting comprehensive data.
- New information packages and options to meet specific decision-making needs.

Benefit

- Addressing different test purposes with different components, and obtaining comparable results.
- Promoting top performance with engaging content and format
- Assessing important learning goals while addressing IDEA, Title I, and other special program needs
- Receiving clear, comprehensive, instructionally-relevant results

Summary

- The system only marking the objective question. It is not a good measurement for the student educational progress by only provide the objective question.

(http://www.ctb.com/TerraNova/tn_intro.jsp)

2.1.4 Proposed System

The digital examination paper maker is software that used to it is used to create, deliver and report on assessments using the Internet or Intranets. The system integrates information from the running assessments into a master database at headquarters office. System synchronized and perform frequently update of the database through the Internet connection. Straight forward software architecture allows us to easily expand from single to multiple locations.

The administrator manages the user record and defines the role for each user. In example each lecturer will be given the privilege to access their student's examination result in order to do marking, analyzing and reporting. At the same time the student will not be able to do this except for sitting the exam.

Each exam has its own code, fixed time, total number of questions and pass marks. The examination paper is automatically generated by the application and taking questions input form the lecturer. The question paper is objective based with multiple answers and subjective based. The student has the option to navigate through all of the questions of his choice. In case the allotted time elapses, the message will be displayed to intimate the student that the exam was terminated.

The system will automatically mark the objective question and subjective question. There is also option for the lecturer to mark the subjective question manually.

The system will analyse the collected data. Powerful report generator offers flexible access to all data collected. Reports and graphs previewed on screen or printed with just a few clicks.

2.2 Technology Review

2.2.1 Development Models

Methodology

A methodology is a collection of procedures, techniques, tools and documentation aids which helps system developers in their task of implementing a new information system. It consists of a set of phases, which consist of a set of sub phases. This guide the developers to the choice of techniques at various stages in the project and helps them to plan, manage, control and evaluate info systems project.

There are many types of development model in the software engineering. Waterfall model, V-shape model, and prototyping model are three basic models which can be used in small project. Incremental model and spiral model are usually used in the large project. When the large project is divided into well-defined small project (or phase or stage or iteration), a small project can use waterfall, V-shape, or prototyping model. Which model is chosen for development depends on the organization.

Waterfall Model is well-defined development process in which one phase has to be finished before the next phase. The model is very simple to use. The model can be used if the requirement is well understood and defined.

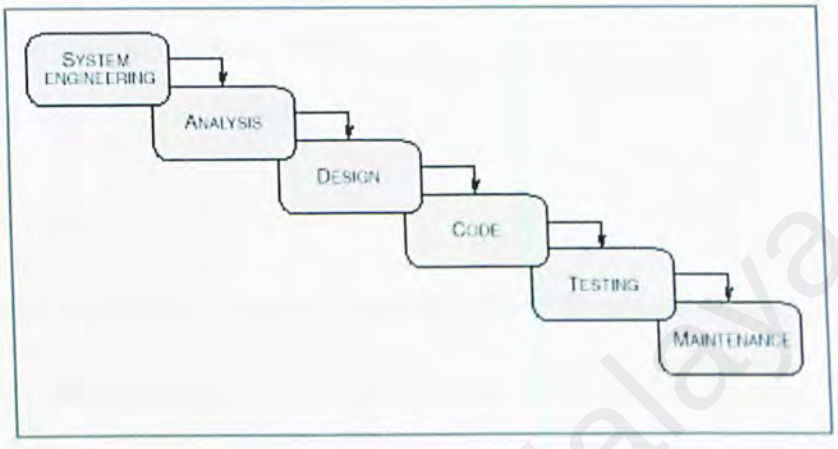


Figure 2.4: Waterfall Model

Waterfall model is used if the problem is very well understood. Usually, designers use the waterfall model to develop a simple system because it is hard to change if the model is used. If customers come by and ask for changing requirements, designers will have to start from the scratch because there is no fast way to design the system with the new requirement. Also there is a big problem for testing later if there is a change in requirement. The testers do not have well-define set of test cases, so the test is easy to fail. In brief, waterfall model is used if designers have a well-defined list of user requirements.

Waterfall Model with Prototyping is the technique which helps to control the trashing by including prototyping that enhance understanding. A prototype is a partially developed product that enables customer and developer to examine some aspect of the proposed system and decide if it is suitable or appropriate for the finished product (Ng Koon Wah, 2002).

V-Shaped Model is similar to waterfall model. The difference is that each test phase matches each development phase: requirements with system testing, high-level design with integration testing, and detailed design with unit testing.

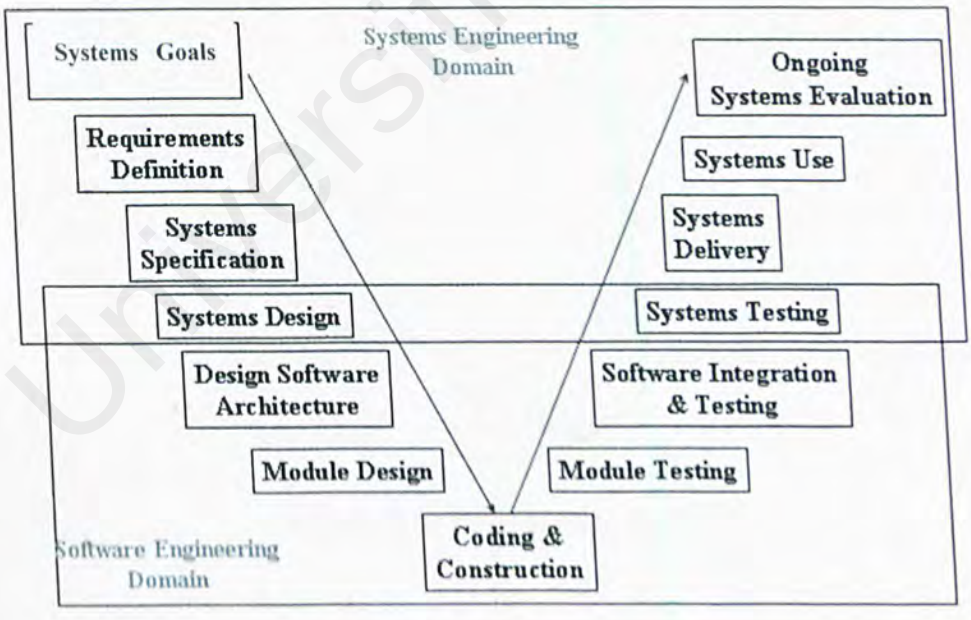


Figure 2.5: V-Shaped Model

V-shape model is an improved version of waterfall model. V-shape model does not run into the problem that the software is impossible to be tested because system test,

integration test, and unit test are planed ahead. For example, when we plan the requirement, we also plan for system testing. Therefore, when the system is built, we have a whole set of test cases for system testing. By that way, the system does not meet user requirements.

Prototyping Model is the technique which helps designers and users to clarify the requirement of the system. A throw-away prototype is developed by designers and is evaluated by users. From feedback of users, designers will understand the system better and improve the prototype.

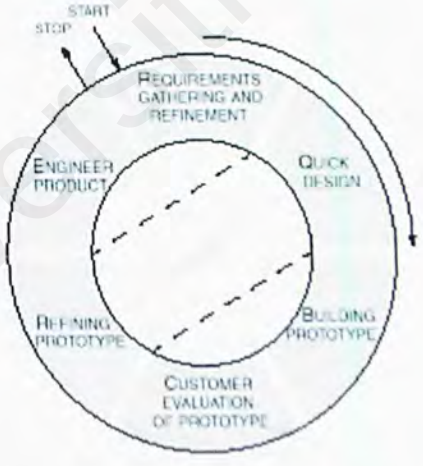


Figure 2.6: Prototyping Model

The Prototype model is a good model for the project which has unambiguous user requirement. The model will helps users to understand what they actually want. A throw-away prototype is developed so that users can realize what the system like. Human computer interface (HCI) is a big problem in requirement engineering

because HCI depends on different user groups. Different user groups have different need or desire for the interface; therefore, designers have to build the prototype so that users can see and feel it.

The prototype model is also good for deploying the new technology. Before the technology is used, users are interested in know whether the technology works or not. Therefore, the prototype is a neat way to demonstrate the idea to users or customers.

Incremental Model. The designers develop the software in a number of stages and are able to deliver the product early. At each phase the designers have a goal to deliver certain features to customers. Incremental model is good for fast delivering product to the marker place.

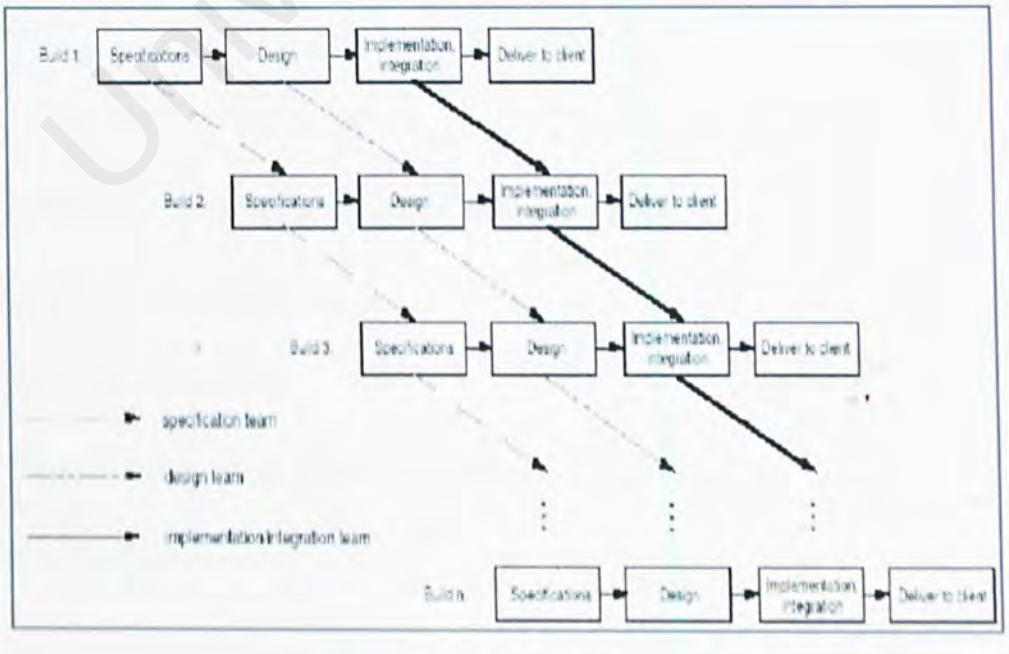


Figure 2.7: Incremental Model

Incremental model has many advantages over the other techniques. One of advantages is that the system can be developed at several stages. Each stage has its own requirement; usually it has certain features or core of the system. Each stage can use V-shape, prototype or waterfall model to develop the requirement for this stage. Regardless what kind of model is used in each stage, the product with certain features must be done at the end of the stage. Incremental model satisfies the requirement of fast delivery to the market place, so business people are interested in this model.

Spiral Model is an iterative approach. The model carefully takes risks into account. The designers develop a small part of the project and evaluate the risks. If the risk is low, designers keep developing more features. For each iteration, there are six steps:

- Determine objectives, alternatives, and constraints.
- Identify and resolve risks.
- Evaluate alternatives.
- Develop deliverables and verify that they are correct.
- Plan the next iteration.
- Commit to an approach for the next iteration.

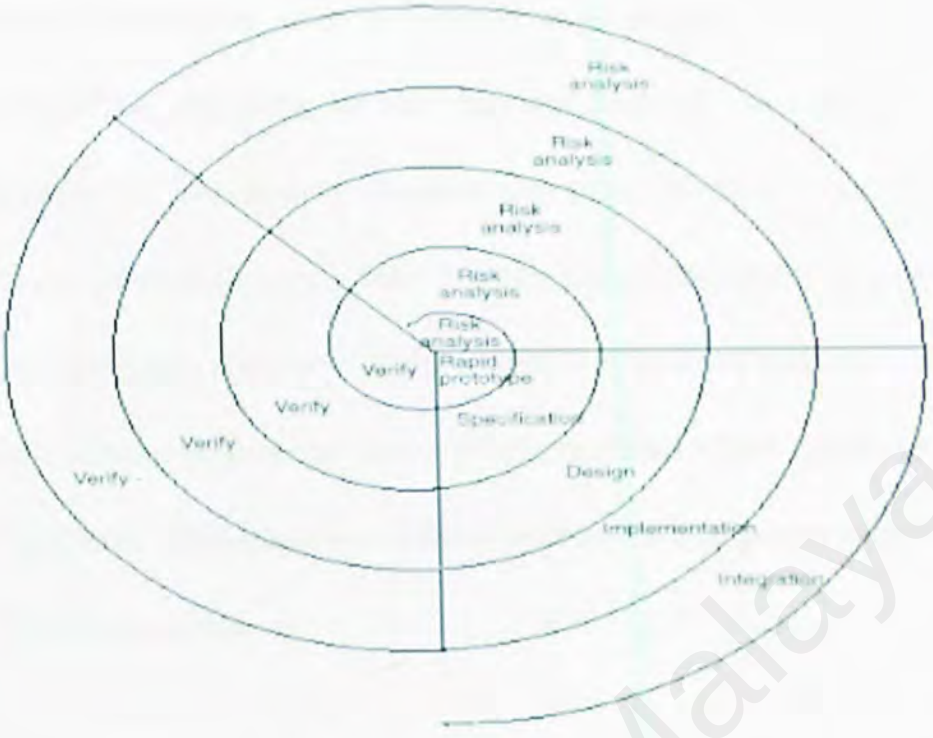


Figure 2.8: Spiral Model

Spiral model is heavily involved in risks management. If you have a project with a very high risk, you should use spiral model. Every iteration, you have a chance to evaluate the risks and to forecast whether the project keeps going or stops. For each iteration, similar to incremental model stage, designer can use V-shape, prototype, or waterfall. Spiral model is usually used in the large project such as financial system, wireless cellular communication management system, network management system.

2.2.2 System Architectures

Client-server architectures exist to provide organizations flexible and robust infrastructures that, depending on how they are designed, can cater to specific business needs. A client-server environment very simply involves a client computer that calls for information from a base or server that has the ability to process the request and send back a response. This response will be either positive or negative and often a positive response can have multiple variations. Client software needs to be able to present these responses in the appropriate fashion to present to the user (John Urbanowicz, 2001).

Many aspects of a business including its size, its focus and the tasks required of it, can help determine the ideal client/sever architecture to implement. Below are descriptions and key advantages and disadvantages of different client/server environments, as well as an analysis of the debated strategies used in a client-server/Web-server environment.

- **Host-client**. In a typical Host-client application, often referred to as "mainframe" architecture, most users find themselves on a "dumb" terminal while strapped to a host computer. This architecture although effective, often is expensive, difficult to maintain and does not easily support graphical user interfaces. Flexibility and change is not an option without extensive cost considerations or careful planning.

Pro: Easy client installation, reliable

Con: Expensive, high maintenance, older technology

- **Basic client-server**. Basic client-server architecture allows a client to send a request to a server through a query, thereby reducing network traffic. The server then queues and processes the request by interpreting; analyzing and "serving up" the information back to the client. The client application then has the ability to present this information to the user via a graphical user interface or if it is preferred, through a host terminal. This process allows for a multi-user environment using a shared data source.

  Pro: Ideal for small businesses, shared data environment

  Con: Software deployment, software control, poor performance

- **Client-server 2-tier**. The 2-tier architecture generally describes a client-server environment with additional processing being provided by a database-management server. The main advantage of this set-up is that heavy processing on the client side is minimized and therefore, less client-side software is required. In this case, since many changes are made on the server itself, costly deployment costs can be avoided, especially in a larger organization.

Pro: Ideal for large business, inexpensive workstation software

Con: Expensive server

- **Client-server multitier.** With the multitier architecture, often called the 3-tier architecture, processing can be centralized in at the middle tier. In larger enterprise level environments, many database servers may be storing information for a variety of application and business requirements. In these environments, the middle tier will easily support each different database server by using shared and reusable rules and models. These rules can be changed from a central location, providing standardization and organization for the corporation.

  Pro: Performance balancing, rules sharing, organization

  Con: Software costs, multiple vendors, complicated infrastructure

- **Client-server multitier distributed**. A variety of other configurations exist that also qualify as client-server. The distributed server architecture can be used to provide localized processing of data based on information sent from a central processing server. This allows the local servers to process data, content and message as a subset of the entire enterprise while consolidating the interactions with the central system.

Pro: Performance balancing, lower data transmission, good for multifaceted businesses

Con: Expensive, additional servers, data integrity, complex infrastructure

- **Client-server/Web-server**. The Internet has provided another definition of client-server architecture. A Web server can be viewed as a second-tier, middle-tier, or other tier. As a request comes from the browser (client) the Web server has the ability to forward the request to a database server. At this point, the Web server actually behaves as a client. Another form of Web serving occurs when the Web server sends a tiny application to the client that can be run on the browser. This offers additional control and flexibility. Content management is mostly associated with Web servers and is an integral part of providing Web sites with video, pictures and other media content.

  Pro: Easiest client deployment, good for e-businesses

  Con: Expensive, multiple vendors, equipment

2.2.3 Application Platforms

Windows 2000 Professional

Pros

- Stable and reliable
- IEEE 1394 (FireWire), USB, and AGP support
- Enhanced features for notebooks, including ACPI support and hot-swapping of PC Cards
- Runs vast selection of Windows software
- Strong security and corporate-management capabilities

Cons

- Hardware and software compatibility problems, especially with gaming and multimedia devices.
- Can be a treacherous upgrade from Windows 95/98 (See first con)
- Fairly hefty hardware requirements
- Expensive

Windows 98

Pros

- Excellent support for hardware and software
- Fewer hardware requirements than Windows 2000

Cons

- Despite better stability than Windows 95, still crashes too often

Win NT4

Pros

- Stable and established
- Fewer hardware requirements than Windows 2000

Cons

- Poor mobile-computing support
- Lacks USB and AGP support
- Expensive

Mac OS 9

Pros

- Most intuitive interface
- Supports USB and IEEE 1394 (FireWire)
- Runs on cool-looking systems (c'mon, those translucent cases are pretty cool)

Cons

- Poor multitasking capabilities
- More crash-prone than Windows NT, Windows 2000, and Linux
- Fewer available software titles than Windows variants

Linux

Pros

- Free -- or very inexpensive
- Extremely stable and reliable
- Fast, with minimal hardware requirements
- Much free software available
- Open-source development allows for fast improvements/refinements

Cons

- Hardware configuration can be tricky
- UI is too difficult for mass consumption
- Limited commercial software options
- Requires more technical expertise than Windows or MacOS

Windows XP

Pros

- Reliability
- Straightforwardness. If you do encounter a snag, Microsoft serves up apologetic "We are sorry for the inconvenience" notices, instead of fatal errors and "blue screens of death."
- Good looks, user-friendly GUI
- User accounts. You can set up a separate password-protected account for each member of your household with different access levels.
- Network friendliness, simple wizards for setting up a home network
- A control panel under control
- smart folder

Cons

- Activation headaches.30 days to activate XP via the Net or over the phone before the OS stops working.
- Some software and hardware won't operate under XP (Edward C. Baig, 2001).

2.2.4 Web Servers

Web server software is the application that runs on your computer and makes Web pages stored on your computer available to Internet users. It also co-ordinates such things as secure e-commerce transactions and streaming audio and video. Web server

software can also be integrated with databases to make information stored in your database available to Internet users.

Usually, Web hosts use either Linux or Microsoft Windows NT Server, but some may let you choose. Selecting a server is more crucial when you are purchasing a machine that will be maintained by your own Web developers, most likely for a collocation setup or if you are going to maintain the website yourself (Navneet Kaushal, 1999).

Web servers generally fall into one of two categories:

- **Linux-based and**
- **Microsoft Windows NT.**

Linux a clone of Unix, the older and more popular of the two systems, has a strong reputation for reliability and power.

On the other hand, many new to the Web find it difficult to understand and navigate. NT is regarded as easier to use than Linux for data-driven Web sites; it also supports the user-friendly Web page design tools in Microsoft's FrontPage software.

Apache

Apache lends itself particularly well to projects that are heavily Java based. It offers superior handling of the Java Database Connectivity (JDBC) application program interface (a program which allows Java-based services to access information stored in SQL-compliant databases).

Apache, like Linux, is a piece of open-source software. It's maintained by a group of programmers who create the software for the thrill of it - not for any expected financial gain. Apache was born in early 1995, as free Web server software based around NCSA httpd 1.3, which was the most popular Web server of the day, and a bunch of software patches. Since then, it has been completely re-written, and has become the most popular WWW server on the Internet.

Apache pros:

- Open source updates. it's constantly being updated and you can add functionality as it becomes available.
- Free. The software is free. It's hard to beat that price.
- Multi-platform support. Apache can be used on systems that have 80x86-series (i.e. Intel) processors running either Linux or NT as an OS, or on other computers running a Unix-type OS on a different processor.
- Popular. Apache is the most-used Web server software package in the world. As such, it's unlikely that further development of the software will ever cease.

Apache cons:

- No Support. Apache's developers do not provide any type of support for their product. There are third-party companies that provide Apache support, but you have to pay for it.
- Runs best on Linux. Given two machines with the same hardware and different operating systems (Linux and NT,)
- Apache runs faster on the Linux machine. This means that if you decide to go with Apache, you should also use Linux to get maximum performance. If you've decided to use NT, it makes more sense to use the Web server Microsoft includes with that OS.

Microsoft Internet Information Server (IIS)

Essentially, IIS is the server software of choice if you want to run an ASP-based site. IIS is Microsoft's main business offering in the Web server software market. Billed as more of an extension of the operating system, it is included on the "Windows NT Option Pack" CD that comes bundled with NT 4.0. As a Windows-based application, it offers the same ease of use as many other Windows applications, including "Wizards" that assist with setup and maintenance of the software. It should be easy for anyone familiar with the NT OS to set up.

IIS really shines when it comes to the handling of Active Server Pages (ASPs), pages

that are generated by the Web server software using Active X scripting - usually Visual Basic Script or JavaScript code. IIS offers superior ASP-based interface to ODBC sources like Access and SQL-Server.

IIS Pros:

- Microsoft product. Since IIS is a Microsoft product, it not only has the same heavy backing as other Microsoft products, but is integrated seamlessly into the OS itself.
- Comes free with NT. If you do decide that NT is the best OS to use, IIS is included in the box.
- Limits bandwidth. Unlike other server software, IIS has the ability to limit how much bandwidth your web pages have available.
- Crash protection. If one application running on the server crashes, the Web server and other applications continue to run, and the failed application restarts the next time a user requests it.

IIS Cons:

- Limited to NT-based systems. IIS is not available for use on non-NT systems.
- Closed source. As with NT, the source code to IIS is Microsoft's proprietary information. This also means that there aren't many third-party developers working on improving the core software.

2.2.5 Programming Languages

Table 2.1 Comparison between ASP, JSP, CGI and ColdFusion

Scripting Language	Pros	Cons
ASP (Active Server Pages)	• ASP is integrated into Microsoft Web Servers and as a consequence is widely used. • ASP is easy to learn. • More efficient than CGI because it runs as a service and can take advantage of multithreaded architectures. • It is an open, compile-free application environment in which can combine HTML, scripts and reusable Active X server components to create dynamic and powerful web-based business solutions. • Enables server-side scripting for Internet Information Server (IIS) with native support for both VBScript and JavaScript.	• ASP requires to adopt Microsoft as the platform and web server.

JSP (Java Server Pages)	• The portability of code between different servers. • It is similar to ASP.	• This technology is just introduced and lack of reference. • It needs a skillful knowledge in Java programming.
CGI (Common Gateway Interface)	• Consistence with Unix practices. • CGI processes run in separate address spaces separated from the server.	• It was inefficient to boost. • Each time some one hit CGI script, a new process was created on the server. • If the script was written in a interpreted language like Perl, the server had to startup another Perl interpreter, taking up processing time and memory. • Could not program in any of the nifty development interfaces.

ColdFusion	• Because it work directly with the web server, ColdFusion is faster than server side includes. • Because ColdFusion commands are just like HTML tags, anybody can create ColdFusion pages with just a text editor.	• Have to buy and install the ColdFusion software (or convince the internet service provider to do it). • ColdFusion is not available for all server platforms (for example, support for Linux will be available only with the upcoming release).

(http://php.weblogs.com/asp , Results March 4, 2002)

ASP.NET

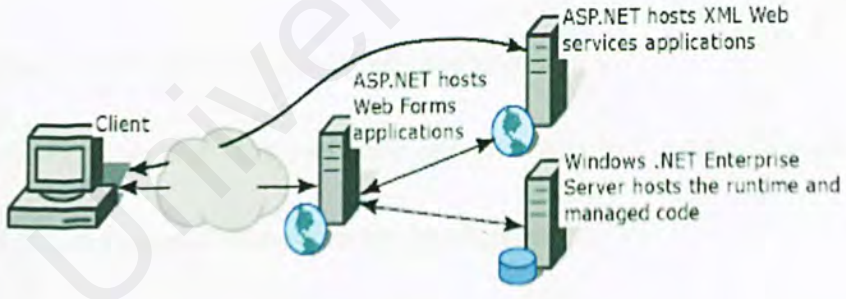


Figure 2.9: ASP.NET Architecture

ASP.NET is the hosting environment that enables developers to use the .NET Framework to target Web-based applications. However, ASP.NET is more than just a runtime host; it is a complete architecture for developing Web sites and

Internet-distributed objects using managed code.

A key feature of ASP.NET is the separation of code into a separate file from the HTML page that calls it. This 'code behind' concept helps clarify the roles of designers and developers, and neatly accommodates another important .NET technology, namely XML Web Services. From the coder's point of view, this makes it a lot easier to discern the logic behind a Web Form or Web Service.

Pros

- Data access, windowing, connecting to the Internet, and much of the functionality of the Win32 API is now accessible through a very simple object model.
- The VB language has been hugely upgraded, so it now includes classes and most of the features previously accessible in C++.
- A new language, C#, has been introduced, which combines the efficiency of C++ with some of the ease of development of VB.
- Memory management for .NET applications is much more sophisticated, meaning that a badly behaved .NET component is extremely unlikely to crash other components running in the same process.
- ASP.NET, the replacement for ASP, offers compiled web pages (making processing of web requests much more efficient) and includes a large

number of pre-written components that can generate commonly used HTML form and user-interface items for you (the so-called *server controls*).

- The main programming languages have been moved far closer together, so code written in VB, C++ and C# can be intermixed. Freely step between the languages in the debugger.
- Components are wrapped up in a new unit called an *assembly*, which is highly self-describing, making installation and use of components very easy.

Java 2 Platform, Enterprise Edition (J2EE)

The Java 2 Platform, Enterprise Edition (J2EE) was designed to simplify complex problems with the development, deployment, and management of multi-tier enterprise solutions. J2EE is an industry standard, and is the result of a large industry initiative led by Sun Microsystems.

The J2EE architecture is based on the Java programming language. What's exciting about Java is that it enables organizations to write their code once, and deploy that code onto any platform. J2EE is an application of Java. J2EE components are transformed into bytecode and executed by a JRE at runtime. Even the containers are typically written in Java.

J2EE has historically been an architecture for building server-side deployments in the Java programming language. It can be used to build traditional web sites, software

components, or packaged applications.J2EE has recently been extended to include support for building XML-based web services as well. These web services can interoperate with other web services that may or may not have been written to the J2EE standard.

2.2.6 Authoring Tools

FrontPage 2002

FrontPage 2002 is part of the Microsoft Office XP family. It runs on the Windows 95/98/NT/2000/XP operating system, and is one of the simplest and least complex HTML editors available in the market today. Microsoft FrontPage is aimed at making basic Web document publishing and site management easy for business professionals and end users who are not full-time Web publishing professionals.

Using the same visual interface as Windows, FrontPage like Internet Assistants allows users to create multimedia Web sites with just a few mouse clicks. FrontPage enables non-expert user to create and maintain sophisticated, interactive site from their desktop with a powerful yet simple "web top publishing" system (Robert Dominy, 2002).

Pros

- Comes with Microsoft Script Editor, a richly featured source editor and debugger
- Excellent site management and deployment tools
- With server extensions provides a number of advanced web application features
- Ability to add scripting features like rollovers without having to write script

Cons

- The Script Editor is somewhat hidden, so many users may never even know it is there
- Like other Office XP products, requires product activation

Dreamweaver 4

Dreamweaver 4 is a professional visual editor for creating and managing Websites and pages. With Dreamweaver, it's easy to create and edit cross-platform, cross-browser pages.

Dreamweaver provides advanced design and layout tools, as well as making it easy to use Dynamic HTML features such as animated layers and behaviors without writing a line of code. Browser targeting checks your work for potential problems on

all popular platforms and browsers. Macromedia's Round-trip HTML technology imports HTML documents without reformatting the code.

Dreamweaver is fully customizable. You can create your own objects and commands, modify menus and keyboard shortcuts, and even write JavaScript code to extend Dreamweaver with new behaviors and property inspectors.

Pros

- Dreamweaver does have a Clean Up HTML command for files created in other programs, such as FrontPage.
- Fireworks is a web-graphics software. Flash is Web-animation software. Both are from Macromedia
- It generates very clean HTML that is easy to customize.
- It has useful interface items. Enable view in full design, full code, or half design and half code.
- Dreamweaver comes with a complete HTML debugger.
- It has unique built-in Web objects including a rollover-button interface and a tabular-data table builder.
- Animation capability is built in.
- User can download extensions.

Cons

- No back-end programming available for form submission.

Microsoft Visual Studio .NET

Visual Studio .NET is the tool for rapidly building enterprise-scale ASP Web applications and high performance desktop applications. Visual Studio includes component-based development tools, such as Visual C#, Visual Basic, and Visual C++, as well as a number of additional technologies to simplify team-based design, development, and deployment of your solutions.

Visual Studio supports the .NET Framework, which provides a common language runtime and unified programming classes; ASP.NET uses these components to create ASP Web applications and XML Web services (Azwina, 2003).

An itemized list of the technical components making up the .NET platform:

- **C#**, a "new" language for writing classes and components, that integrates elements of C, C++, and Java, and adds additional features, like metadata tags, related to component development.
- A "**common language runtime**", which runs bytecodes in an Internal Language (IL) format. Code and objects written in one language can,

ostensibly, be compiled into the IL runtime, once an IL compiler is developed for the language.

- A set of **base components**, accessible from the common language runtime, that provides various functions (networking, containers, etc.).
- **ASP+**, a new version of ASP that supports compilation of ASPs into the common language runtime (and therefore writing ASP scripts using any language with an IL binding).
- **Win Forms and Web Forms**, new UI component frameworks accessible from Visual Studio.
- **ADO+**, a new generation of ADO data access components that use XML and SOAP for data interchange.

Pros

- It offers multiple language support.
- It has a rich set of libraries, a la JVM.
- It's open-standard friendly (e.g., HTTP and XML) -- it may even become a standard itself.
- Its code is compiled natively, regardless of language or deployment (Web or desktop).

Cons

- It's yet another platform to consider, which generally means rewriting and learning new tricks.

- Microsoft tends to have good ideas, but mediocre implementation.
- Currently, it's only available on Windows.
- Microsoft claims C#, IL, and CLR/CLS will be submitted to ECMA, but there's still no clear view on what will be standardized from the platform.

2.2.7 Database Management Systems

Microsoft SQL Server 2000 (RDBMS)

Microsoft SQL Server 2000 is a modern, full-featured SQL database designed for small or midsize organizations. Its complete set of tools, high-end engine features, and robust analysis capabilities provide most of what other corporations could offer only in their Enterprise Edition databases, all at a reasonable price. In addition, SQL Server 2000 is amazingly easy to use, yet still powerful enough to crank through hundreds of complex transactions per second without choking. Customer needs and requirements have driven significant product innovations in ease of use, reliability and scalability and data warehousing. SQL Server 2000 runs on Windows NT 4.0 or Windows 2000.

Many engine settings in SQL Server 2000 are self-tuning. Developers need not assign memory to the data cache or store procedure cache separately. SQL Server dynamically balances memory between the two. SQL Server expands or contracts the amount of memory it is using as a whole. It can automatically make room in memory

for other applications when they are running, expand again to fill extra memory when the applications are closed down.

Automatic memory tuning is not especially important on a dedicated database server machine. But on a server that has to run other applications like a mail server and Web server at the same time as a database, dynamic memory sizing makes a huge different to system usability. SQL server's unmatched auto-tuning features also mean that it is extremely suitable for organizations that do not have database administrators on staff. With SQL Server 2000, a part time or beginner administrator is all it takes to manage the database effectively. SQL Server is a client/server relational database management system (RDBMS) that is highly integrated with the Windows NT operating system. By using SQL Server, modern application can be developed that separate the client application and the database service. SQL Server Transact-SQL supports the ANSI-92 standard and provides extensions to the SQL language.

Oracle 9i

Oracle is the world's leading vendor of database software. Oracle's ability to have all data and documents stored in a small number of high-performance databases benefits customers by centralizing all their data, making information management and access easier, more reliable and less expensive. The ground-breaking capabilities of Oracle 9i's Internet File System (IFS) provides a single, easy to use data management

interface for all data types, thus minimizing customer's reliance on a proprietary operating system. Oracle is an open solution and it supports all kind of platform.

Oracle uses a Java-based utility that provides everything needs to get a pre-tuned and pre-configured Oracle 9i database up and running. Oracle Enterprise Manager provides a single integrated management console for central administration of multiple servers. It also contains some advance functionality for tuning and diagnosing the database, and managing complex change in the database environment. Oracle's advanced security features allow for enforced granular privileges advanced auditing, enhanced access control, secure distributed processing and replication, and the ability to use additional external authentication mechanisms.

MySQL

MySQL is a true multi-user, multi-threaded SQL database server. SQL is the most popular and standardized database language in the world. MySQL is a client/server implementation that consists of a server daemon mysqld and many different client programs and libraries.

The main goals of MySQL are speed, robustness and ease of use. MySQL was originally developed because we needed a SQL server that could handle very large databases an order of magnitude faster than what any database vendor could offer to

us on inexpensive hardware. We have now been using MySQL since 1996 in an environment with more than 40 databases containing 10,000 tables, of which more than 500 have more than 7 million rows. This is about 100 gigabytes of mission-critical data.

The base upon which MySQL is built is a set of routines that have been used in a highly demanding production environment for many years. Although MySQL is still under development, it already offers a rich and highly useful function set.

Microsoft SQL Server versus Oracle 9i

The SQL Server 2000 advantages:

- SQL Server 2000 is cheaper to buy than Oracle 9i Database.
- SQL Server 2000 holds the top TPC-C performance and price/performance results.
- SQL Server 2000 is generally accepted as easier to install, use and manage.

The Oracle 9i Database advantages:

- Oracle 9i Database supports all known platforms, not only the Windows-based platforms.

- PL/SQL is more powerful language than T-SQL.
- More fine-tuning to the configuration can be done via start-up parameters (Alexander Chigrik, 2003).

Conclusion

It is not true that SQL Server 2000 is better than Oracle 9i or vice versa. Both products can be used to build stable and efficient system and the stability and effectiveness of your applications and databases depend rather on the experience of the database developers and database administrator than on the database's provider. But SQL Server 2000 has some advantages in comparison with Oracle 9i and vice versa.

CHAPTER 3
METHODOLOGY

3.1 Software Development Life Cycle (SDLC)

A model of the process of systems development is used by organizations to describe their approach to producing computer systems, also known as the *System Life Cycle.* Software development life cycles are abstract model that define the activities, ordering of activities and information flow associated with the development of software.

A system life cycle divided the life of an information system into two stages, system development and system operation and support – first you build it; then you use it.

A system development methodology is a very formal and precise system development process that defines a set of activities, methods, best practices, deliverables, and automated tools that system developers and project managers used to develop and maintain information systems and software.

3.1.1 Software Process Model

A software process model is an abstract representation of a software process. In contrast to software life cycle models, software process models often represent a networked sequence of activities, objects, transformations, and events that embody

strategies for accomplishing software evolution. Such models can be used to develop more precise and formalized descriptions of software life cycle activities.

3.2 Methodology Consideration

A methodology is a collection of procedures, techniques, tools and documentation aids which helps system developers to speed up and simplify the software development process. This guides the developers to the choice of techniques at various stages in the project and helps them to plan, manage, control and evaluate info systems project.

The main objectives of following a methodology is to make the development cycle as efficient as possible, to complete development within lowest possible cost keeping the highest quality, and to achieve the fastest turn-around. Another important objective is to make future maintenance easier and faster.

There is no one piece approach to develop a system. Every development method has its strength and drawback. It depends on circumstances applied and people who involve in the development activities.

3.2.1 Requirements for Development Methodology

A good methodology that able to provide the effective ways of system development is best defined before the project starts and then becomes the framework to development staff.

- A Methodology must offer a step-by-step approach to the desired situation – and each step should offer some success and benefit.
- Methodologies have to be robust. They had to take into account bad or incomplete specifications, changing requirements, slipping schedules and unexpected problems.
- A Methodology has to take into account the sociological aspects of software development, for example of team dynamics, corporate and departmental politics, career ambitions, motivation, promotion and the desire for personal growth, job security and empowerment.
- Methodologies must clearly outline the underlying prerequisites, assumptions and believes. They must also show their constraints and boundaries.
- A Methodology must make sense to all stakeholders.

3.2.2 Conclusion On Development Methodology

The methodology used in the development of Digital Examination Paper Maker & Analyzer is the Waterfall model with prototyping. As the name implies, the stages of development of Waterfall model cascades from one phase to another. Each stage of a development is required to be completed before proceeding to the next phase. The Waterfall model offers the benefit of a structured development, in addition to good visibility and proper documentation for each development stage.

Waterfall approach difficult to define all requirements at the beginning of a project but changes during product development are inevitable, costly, time consuming and a source of disagreement between the developer and the client. Another drawback of Waterfall model is usability problems aren't revealed until after product release, when changes are very costly.

But experience has proven that these negative aspects can be overcome by:

- Using prototyping to avoid major changes during product development
- Applying usability testing to anticipate unforeseen user requirements

With prototyping and usability testing, we can improve the cost efficiency of the development workflow, by allowing client and user representatives to be involved in the process, discover interface problems at an early stage, and thus avoid major

overheads on reworks down the line. Design prototyping helps developer assess alternate design strategies and decide which the best for a particular project is.

Major problems in the requirements are addressed and fixed well before the requirements are officially validated during system testing. Validation ensures that the system has implemented all of the requirements, so that each function can be traced back to a particular requirement in the specification. Verification ensures that each function works correctly. Validation makes sure that the developer is building the right product according to the specification, and verification checks the quality of the implementation.

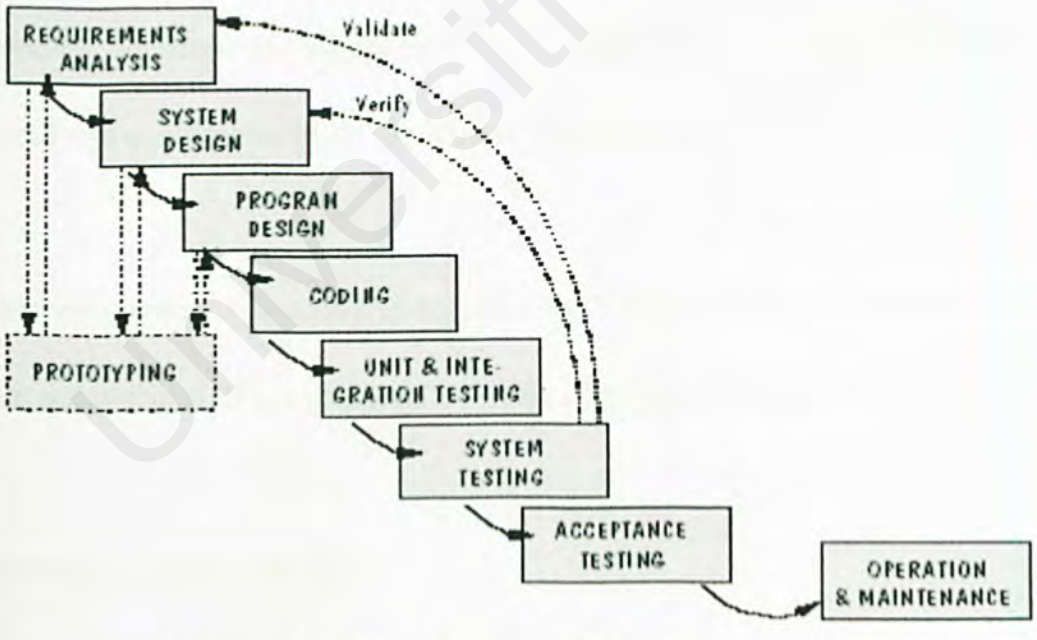


Figure 3.1: Project Development Methodology

The stages of the Waterfall Model with prototyping:

1. Requirements analysis and definition.

This stage could be called the conception of a software product and might be seen as the very beginning of the life cycle. It is the requirements gathering stage and includes meetings and/or consultations with the user (system developers and the supervisor) to determine requirements, constraints and the goals of the software. This stage is often precluded by a feasibility study or a feasibility study is included in this stage.

To developing the DEQPMA, the requirements gathered would include the interaction between subsystem, system functionality, information retrieval, behaviour, performance, interface and constraints of the system. The requirements including functional and non-functional are documented and reviewed.

Requirements prototyping activities are amended to ensure that the requirements are feasible and practical, if not revisions are made at the requirements state.

2. System and program design.

In this stage the established requirements, flowing from the requirements analysis and definition, are identified as software or hardware requirements. The software requirements are then translated in such a way that they can be readily transformed into computer programs.

For this project, system design focuses on distinct attributes of the modules in DEQPMA program. The main page appearance and the organization of subsystem were designed in this stage. The overall system architecture, content design, interface representation, data structure, conceptual design and technical of DEQPMA are also required in this stage. In addition, the project system design also includes transforming the requirements into a representation that can be assessed for quality before the code generation (implementation stage) begins.

Design prototyping activities help me to assess alternative design strategies and decide which is best for the DEQPMA.

3. Implementation and unit testing.

This is the stage where the computer programs are created. Each program is called a unit, and unit testing is the verification that every unit meets its specification.

During this stage, set of programs or program units section in DEQPMA modules like User Login Section, Change Password Section, Examination Paper Maker and Result Marker will be create in the system based on the project system design. After code has been generated, unit testing is performed to verify that each unit meets its specification.

4. System testing.

All the units are combined and now the whole is tested. When the combined programs are successfully tested the software product is finished.

This stage tests the complete of DEQPMA system. All the program units will be combining together (integrated) and tested as a complete system to verify that each function works correctly and as need. Then validation is made to ensure that the system has implemented all of the requirements, so that each system function can be traced back to a particular requirement in the specification.

5. Acceptance testing

Each requirements specified by the end user will be checked to make sure the developed system is the right product according to the user specification. The system is delivered to the user after the testing process.

6. Operation and maintenance.

Maintenance takes place after the system is put into practical use. This stage is part of the life cycle of a software product, and not of the strict development, although improvements and fixes can still be considered as "development".

Maintenance involves correcting errors that have gone undetected before (in earlier stages of the life cycle), improving the system implementation, adding performance

or functional enhancements or making changes due to accommodate changes in the software external environment for overall DEQPMA.

3.2.3 Justification Of Methodology

The reasons for choosing Waterfall model as the development methodology are:

The implementation of waterfall model is simple. Its simplicity means that the development methodology is simple and easier to understand. During development process, we can have a better understanding and guideline on what we shall do.

With the adoption of the waterfall model, I just need to concentrate on one stage at one time and do not need to think of the next stage before the current stage is completed. Therefore allowing me to have more focus and attention on what I am currently doing instead of over burdening myself with the upcoming stage.

Cost and time restrictions are often an important issue in the software development process. The Waterfall model itself can be used for single projects that are cost or time restricted because of the easy way to manage it. This methodology is more emphasize on planning stage. It allows estimation of the completion of each stage so that the system can be developed within the time frame.

Simplicity is also important when we are to explain our development progress to the user especially those who are not familiar with software development cycle. The user will have a better understanding on what is going on of the progress of the project development. If I am to adopt a more complex methodology, user may find it difficult to understand what I am trying to tell them.

Besides using the Waterfall model, I also adopt the prototyping into the previous approach to overcome its major drawbacks. Prototyping can save me both time and money because it's a fast and inexpensive way to concretize, what a requirement specification fails to do. Since prototypes can visualize the product's workings to the user, I can deal with the shortcomings, misconceptions and disagreements that tend to appear as the product takes form.

3.3 Information Gathering Methods

Information gathering is required to know what is needed in a system. Method of gathering information regarding a system is necessary in order to establish understanding of the state and future requirement on the system study and provide the groundwork for the system design.

There are a certain number of methods that are commonly used in

gathering-information such as collecting written data like documents or reports, doing research, interviewing, using questionnaires, observation and sampling.

The main data sources for system analysis were written documents, reference books, observation, questionnaires and other sources from the Internet.

I. *Internet Surfing*

Surfing through the Internet is an efficient fact-finding technique. Through the Internet, existing similar system could easily found which giving ideas for the features that will be developed. Besides, I also get a lot of information on distributed system, development tools and technologies, programming languages, database, project methodology, and also client-server computing knowledge. The result from this research has been elaborated in detail in Chapter 2.

II. *Books and References*

Book and references are used to get the information that needed to develop the system. This including information from information system references, development tools references, programming references and database references.

FSKTM's documents room has a lot of senior's thesis that can be as a guideline

for to write the thesis report. The format type of the report, organization of the heading and the content of the report can be referring from senior's thesis.

III. Observation and Informal Interview

Observation allowed analysts to gain information they cannot obtain by any other fact-finding method. By observing some of the current system, the carried-out processes of system can be clearly understood. The symptoms and problems that always occur also can be identified and defined by observing the current actual examination system. As a user, the need for a better service when using the digital examination paper maker & analyzer also can be identified through personal observation.

IV. Discussion With Supervisor

A discussion with supervisor has been practiced from time to time in order to get help and advices during the development of the project.

3.4 Conclusion On Tools and Technology

After all the technologies have been reviewed and analyzed, the most suitable and appropriate tools for developing the system are identified and selected. The tools to be selected include the development software as well as the entire platform on which the development of the project is occurred.

Selected Web Architecture

For this project, DEQPMA is designed to be **3-tier architecture**. The 3-tier architecture is more suitable apply in the development of the system to perform its business functionality.

Advantages of Three-Tier Architecture

- processing can be centralized in at the middle tier.
- Performance balancing, rules sharing, organization.
- allows for the parallel development of individual tiers by application specialists.
- Provides for more flexible resource allocation.
- Modularly designed middle-tier code modules can be reused by several applications. Reusable logic reduces subsequent development efforts, minimizes the maintenance work load, and decreases migration costs when switching client applications.

Selected Platform

Review has been done in purpose of choosing a suitable platform/operating system for this project. After all the consideration, I have decided to choose **Windows XP** as

my system platform, as it is the most suitable operating system that are able to support all the development tools I choose to bring this project into success.

Besides that, Windows XP provide graphical user interface for user friendliness whereby user just interacts with icons instead of typing command which is common in DOS and UNIX based operating system.

Advantages of Windows XP Server:

- An enhancement of Windows NT family (including Windows 2000).
- Built-in application such as Microsoft Internet Information Server 5.1 (IIS) and Internet Explorer 6.0 browser
- It is suitable for enterprise or organizational level.
- Showing high performance, reliable, secure and easy-to-manage characteristics for information sharing and running applications.

Selected Web Server

I have decided to use **Microsoft Internet Information Server (IIS)** as the system web-server, because it can be fully supported by Windows XP and provide powerful security, administration and development functionality. It is also one of the best web servers on the market and it is a high-end enterprise-level server. IIS is considered by

experts to be just as powerful as and much easier to set up and maintain than many of its UNIX-based competitors.

Advantages of IIS:

- Offers a superb platform for building sophisticated Internet applications.
- Easy to install and uninstall
- Accessible since all kinds of browsers can work with it.
- Allows for hosting multiple sites.
- Provides capabilities for secure transactions with the SSL (Secure Sockets Layer) support and for authentication.
- Windows-based Web authoring and development tools are supported.
- Integration with existing industry-standard database and other ODBC-compliant databases.

Selected Database Server

Microsoft SQL Server 2000 works well with databases of any size. It contains all the user-friendly features, works more efficiently and has the ability of handling hundreds of transactions simultaneously without affecting performance. Therefore, SQL Server 2000 will be chosen to act as the database management software for the development of DEQPMA.

Advantages of SQL Server 2000:

- It is able to handle larger amount of data during transaction and it is able to support more than 5 simultaneous users.
- Most viable solution to accommodate the vast storage requirements.
- Through tight integration with IIS, SQL Server can be queried and updated via Web browsers.
- Scalability and high performance

Selected Programming Language

With **ASP.net** the pages are compiled common language code executing on the server. This allows for advantages and forces some changes in the traditional ASP programming.

Advantages of ASP.NET

- It has a rich set of libraries
- It's open-standard friendly
- Its code is compiled natively
- Performance - 28 times faster
- Productivity - One third the code

Selected Development Tools

The **Microsoft Visual Studio.NET** provides the programming environment for building, deploying, and running Web-based applications, smart client applications, and XML Web services. The Microsoft Visual Studio.NET delivers business value with faster time to market, improved systems flexibility, and reduced costs.

Advantages of .Net Framework:

- *Improved Reliability* - Advanced ways of monitoring the health of running applications, and isolating applications.
- *Increased Performance* - Advanced compilation and caching techniques and results a significant increase in speed.
- *Developer Productivity* - The intuitiveness of the programming model, the amount of code already provided in the class libraries, and the amount of work handled behind the scenes has enabled developers to reap huge productivity gains.
- *Powerful, Granular Security* - The .NET Framework runtime environment combines all evidence with administrator-set.
- *Integration with Existing Systems* - Applications connect with existing systems and packaged applications-regardless of their underlying platform.

- *Ease of Deployment* - simply by copying the application directory to the target machine-no registration is required.
- *Mobility Support* - provides one unified programming model for developing smart client and Web applications for both personal computers (PCs) and mobile devices.
- *Native XML Web Service Support* - XML Web services can be used to integrate applications running on different platforms, or to offer software as a service.
- *Support for over 20 Programming Languages* - enabling the right programming language selection for the task at hand.
- *Flexible Data Access* - Using ADO.NET technology to data access frees up database connections and results in significantly greater scalability.

CHAPTER 4
SYSTEM ANALYSIS

Introduction to System Analysis

System analysis includes defining problems, gathering information, developing alternative solutions and choosing the best solution to develop a system. A system is a collection of objects and activities plus a description of the relationship that ties the objects and activities together.

A requirement is a feature of the system or a description of something the system is capable at doing in order to fulfill the system purpose.

A software requirement definition is an abstract description of the services, which the system should, provide the constraints under which the system must operate. There are two types of requirement to be analyzed – functional requirements and non-functional requirements.

4.1 System Requirement Analysis

4.1.1 Functional requirements

Functional requirement is a statement of service or function that a system should provided, description of how the system react to particular input and how the system should behave in particular situation.

The DEQPMA is an integration system that consist of there sub-system. These are Administrator sub-system, Lecturer sub-system and Student sub-system. Each sub-system has its own modules. There are components recognized as the main functional requirements (module) for the DEQPMA system. These components are Administration Module, Online Examination Module, Assessment Management Module, Assessment Paper Maker, Marking Module, and Analyzer & Report Generating Module. These Modules are divided into smaller sub-modules for further elaborations.

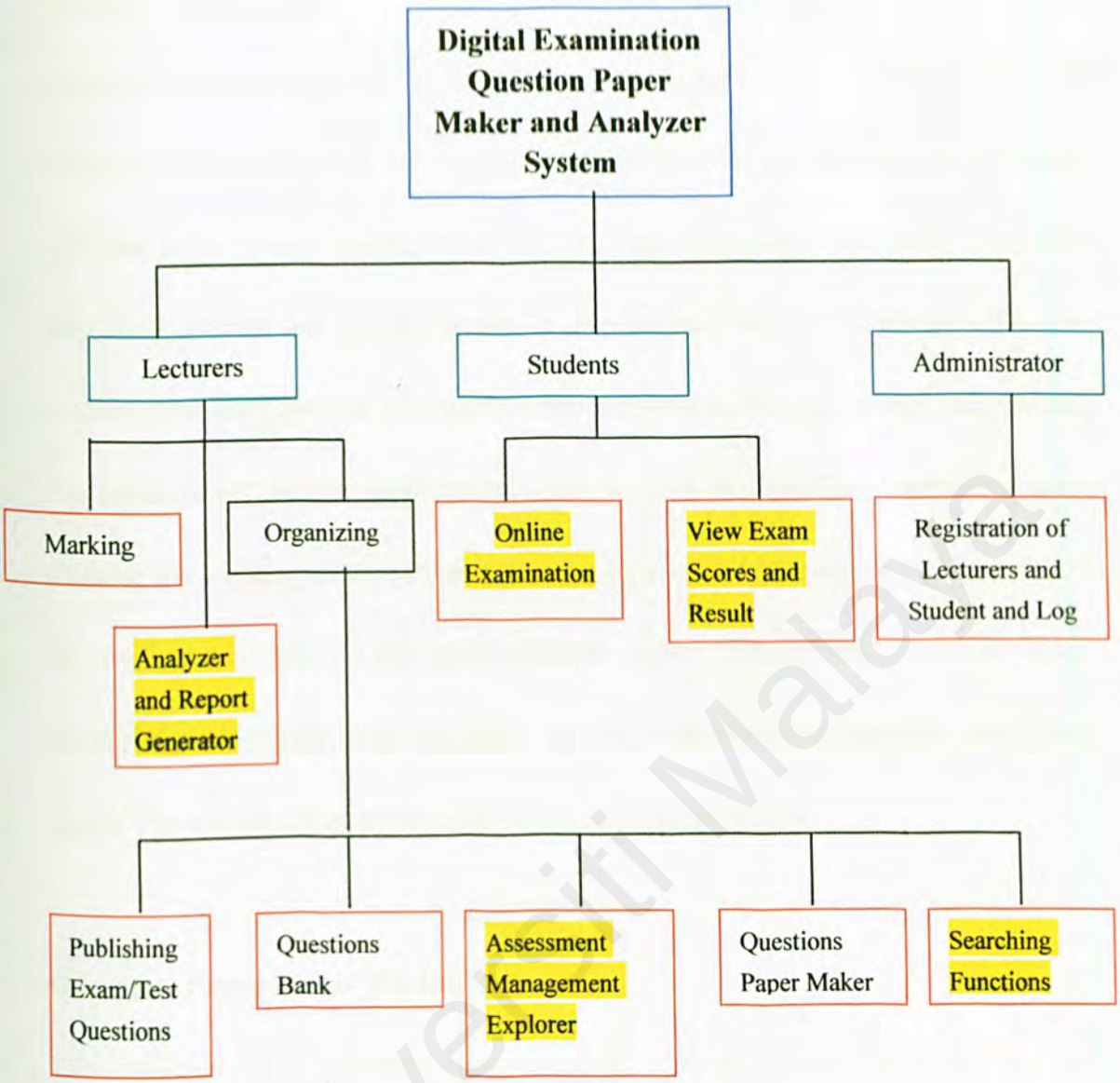


Figure 4.1: Subsystems and Modules for the Project

Note: **The highlighted modules is under my WXES3181 project, and others modules will be developed by my partner.**

Lecturer Subsystem

The lecturer is the main user for the Digital Examination Question Paper Maker and Analyzer System. They will be the working from the system's backend. The lecturers will also act as system administrator of the system examination in such a way that they shall control the content of the system output, which will displayed to the students after they inserted information into the system database through this system. The lecturers will be able to do various of tasks such as organizing questions papers, marking the existing examination or test sat by the students, analyzing the result of the particular exam or test and generate report, Organizing Question Bank, Management Explorer, and searching for particular existing questions and result report. The modules that are include in this subsystem involve:

Questions Paper Maker Module

This function is to facilitate lecturers who want to organizing a test or final examination in a subject. The lecturer can use this function to prepare test / examination questions. The lecturers can use the friendly user web based interfaces to organize a test or examination questions in easy way. Various types of questions are available as test or examination questions, ranging from true/false questions, objective-based questions, subjective-based questions, and fill in the blank. Besides that, the lecturer can review the questions created from time to time as reference. Thus, the lecturer also can delete, modify the content of an exiting question by replace the existing question.

The requirement of this of this function are:

- The lecturer shall decide which types of question (subjective, objective etc.) should include in the test or exam.
- The lecturer shall be able to view and edit the question from time to time according to their current needs.
- The system shall provide user interface for lecturer organizing a test / exam questions paper.
- Only the lecturer are given access to the modification of the examination question paper maker.
- The lecturer shall be able to modify, delete any question at any time when necessary.
- The lecturer shall be given an option whether to upload graphic as supplemental to the test or exam question.
- The system shall be able to validate all important particular key in by lecturer such as question and answer require by a question.
- The lecturer shall be given an option to add questions from question bank for a subject.

Questions Marking Module

This function will act as a 'virtual examiner' in which, it search for the test, define the type of the test, get the correct answer provided by the lecturers when setting the questions and then make comparison with the student answers. After that the system will compute student's final scores for that particular part of the examination. The function will guide the lecturer marking the other part of the exam and finally return the student's final marks in the particular examination. The ability of this function to mark the exams is not only restricted to objective-based questions but it also support partly automate marking the subjective-based questions. While the exams are in the process to be examined, this function shall automatically put every submitted exam in the 'hold' status. Once the scores have been computed and verify by the lecturer, only then the results shall be released. The lecturer acting as the course administrator who can review the students' scores and result. Therefore, the requirements for this function are:

- The function shall be able to mark fill in the blank, true/false and objective based questions by comparing the students' answer with the answers submitted by the lecturers.
- The function shall be able to help lecturer manually marking the subjective based questions by using add-in artificial intelligence elements.
- The function shall be able to compute the scores based on the lecturer's requirements.

- The lecturers shall be able to modify the marking schemes and the grading formulas.

Questions Publishing Module

This function will activate the publishing of test / examination questions on the date selected by the lecturer. In the event where these test / examination questions have been complete made, the lecturer can decide the date and time in which he/she wants those questions to be publish and available to the students. Besides that, the lecturer also can reschedule the examination date if required. This function acting as a scheduler will automatically publish these examination based on the dated selected.

Therefore, the requirements of this function are:

- This lecturer shall be given an option to insert the test/examination date and time
- The function shall be able to stop the system from accepting students' answers that are submitted after the exam / test time. However, the lecturer shall be given the full authority to control the exam /test date and time.

Questions Bank Module

This function will provide several options for lecturers to view the existing questions of a particular subject. This function acting as a questions storage where all questions

made by the lecturers will automatically store in the system. The lecturer will be able to view all the existing questions only when he/she submit enough required information to the server. The information required include the subject name, code, view questions type, sorting method and others. In addition, the requirements for this function are:

- The layout of the questions bank should resemble an electronic form, which is submitted by the lecturer upon completion.
- The lecturer shall be able to select the type of questions to be viewed.
- The function shall be able to show the existing questions for a particular subject and sorting by name, date modified, marks provided in which selected by the lecturer.

Analyzer & Report Generating Module

- This sub-module is for collecting the statistic from the examination result. The statistic may include the passing rate, the average marks, the distribution of grades and others.
- It provides reports and information on students and assessments. The information is stored in a SQL database and the lecturers can manipulate results to produce detailed analysis.

- These reports can be viewed in different formats. Lecturers can access different forms of report such as line graph, histogram and tables just by clicking on the appropriate buttons.

Assessment Management Module

- The main interface to help lecturers in organizing the test.
- Displaying the test that conducted by the user and its relevant information.
- Edit and delete the test.

Searching Module

- This function provides the querying function for the reservation system.
- User are allowed to search for the test /examination information such as date and time of a particular exam / test, existing questions, results of an exam and others.

Student Subsystem

The student will be the front end user of the system. They shall be given access to the online examination, their personal results as well as the overall results of other students. However, they are restricted from editing and deleting the data in the system. The subsystem will divided into several modules, they are:

Authentication Module

- This module will check the validity of users before they could login into the sub-system to sit for the online examination.
- This module will only check for the user allowed to sit for that particular examination at that particular time.
- The users may be requested to input their personal information such as user id, password and other information for identification and authentication check.

Online Examination Module

- This module is the core function of the environment to conduct the examination for students.
- Students view and answer the questions and in a web-browser.
- Students will be tested on true-false questions, multiple-choice questions and short essay questions.
- Should the connection to the server be lost during on-line exams, by pressing the refresh button in the Web-browser or by logging back on, the student returns to the last question they were working on.

Timer

This module will include a timer to track the time elapsed while the examination take place. After the examination has ended, all 'electronic answer sheet' will be sent to

the server for processing.

Online result Checking

After the 'electronic answer sheets' are processed, this sub-module will pass the results back to the appropriate computer. Students can check their examination result after their answer sheet being marked.

Administrator Subsystem

The administrator is actually the person who responsible to manage the lecturers, administrator, and students' registration and log in process in the Digital Examination Question Paper Maker and Analyzer System. Among three types of users of the system, only administrator can add other administrator into the system. Besides that, administrator too can view the current lecturers' activities which is not available to a lecturer login. The modules categorized in this subsystem are:

Registration and Log In Module

This function is where the system shall process all the registration information inserted by the administrator. Administrator, lecturers, and students will have a different log in page respectively. In other words, administrator can add / delete any lecturer from accessing the system and he / she can restrict the authority of a student to the system. In addition, only an administrator can modify the authority of any user to use this system. This is important to prevent the students from altering the

system's content. The requirements of this function are:

- The function shall provide different login page to administrator, students, and lecturers.
- The system shall be able to differentiate between a user, a lecturer, and a administrator when they log in as users.
- The administrator shall be given an option to insert students' registration information to the database.
- The administrator shall be able to add / delete lecturers from accessing the system, and add / delete students' authority to sit for a particular exam / test.
- The system shall be able to authenticate each user correctly.

4.1.2 Non-functional Requirements

Non-functional requirement will define the constraints imposed upon the e-Stationery Reporting System. It will place restrictions on the freedom of design. Besides, it also lists the product and standard process which must be followed. Non-functional requirement have to be defined as it will clearly affect the operations of the system

Learning curve

It is better to have a system which is easy to use. The time required for training the system users to be proficient in the usage of the system should not exceed two working days. It should be easy for the user to understand the web site so that the services provided can be fully utilized.

Usability and user friendliness

An appropriate user interface and adequate documentation will enable usability of the system. The system provides usability by designing user-friendly interface, an easy to use and easy to understand user manual for customers. The system minimizes text-based commands to perform various tasks but instead maximizes the use of hypertext linkage to launch commands. Some messages are displayed as guidance during the operation of the system. Furthermore, it provides a better visualization to users and reduces the risk of making mistakes when using the system.

Functionalities

The functionalities stressed here are the searching and retrieving capability, which is very important in any web application that deals with data retrieval from existing database. Besides, navigation and browsing features as well as application domain-related features will be taken into account.

Reliability

Reliability extends to which a system can be expected to perform its intended function with required precision and accuracy. Thus, the system should be reliable in performing its daily functions and operations correctly.

Robustness

Robustness refers to the ability of the system to continue in operation despite facing unexpected problems. e-Stationery Reporting system is able to process unanticipated errors by having validation for the input field on the client side before it is sent to the server and saved in database. For example, a user may accidentally key in alphabets instead of numeric for date. Thus, the system can validate this input before sending to the server. When error is detected, the system will prompt an error message and the cursor will focus on the filed where the error had occurred.

Correctness

Correctness is to extend to which the program satisfies its specification and fulfills the customer's needs. The final e-stationery Reporting System must meet the objectives, specifications and requirements stated earlier. The system will be built according to the requirements and specifications.

Maintainability

This application is designed so that the effort required to maintain, locate and fix an

error in the program is as minimum as possible. Adequate comment is required to ensure that the application is easy to maintain.

Security

The security feature enables the system to meet the security requirements for storage, communication and displaying of data. Company records are confidential and need to be protected against viewing by unauthorized personnel. Besides, the system must prevent the data from being modified by unauthorized personnel. The authentication module plays a major role in ensuring the security of the system.

On time

The system should be developed according to the schedule so that the final product can be delivered before the deadline. All the requirements and system analysis should be completed in time.

4.2 Development Requirements

4.2.1 Server Side Requirements

The server side hardware requirement as follows:

Table 4.1: The hardware requirement for server side

Hardware	Requirement
Processor	Pentium 4 2.0 Ghz or higher and other equipment processors.
Memory (RAM)	Minimum of 256 MB (512 MB or more recommended)
Hard Disk Space	Minimum of 10GB
Other	Network Interface Card and other standard computer peripherals.

The server side software requirement as follows:

Table 4.2: The software requirement for server side

Software	Requirement
Operating System	Microsoft Windows XP Professional
Web Server	Microsoft IIS server 6.1
Web Database	Microsoft SQL server 2000
Web Authoring Tools	Microsoft Visual Studio.NET, Macromedia Dreamweaver MX, Adobe Photoshop 7.0
Browser	Microsoft Internet Explorer 6.0

4.2.2 Client Side Requirement

The client side hardware requirement as follows:

Table 4.3: The hardware requirement for client side

Hardware	Requirement
Processor	266MHz or higher Pentium compatible processors.
Memory (RAM)	Minimum of 64 MB (128 MB or more recommended)
Hard Disk Space	Minimum of 2GB
Other	Network Interface Card and other standard computer peripherals.

The client side software requirement as follows:

Table 4.4: The software requirement for client side

Software	Requirement
Operating System	Microsoft Windows XP Professional
Browser	Microsoft Internet Explorer 6.0

CHAPTER 5
SYSTEM DESIGN

Introduction of System Design

Design is the creative process of transforming the problems into and constraints into a solution and the description of solution. System design is the essential nucleus of the software development process and is applied regardless of the development model or standard that is need. The common steps included analyzing, designing, coding and testing the system to ensure that it conforms to the software specification and requirements. Each activity transforms into a manner that ultimately results in validated computer software.

System design is a process through which requirements are translated into a model or representation of software that can be accessed for quality before coding begins (Whitten, Bently & Dittman, 2000).

System design is an iterative process, which developers need to move back and forth among the specific activities, which are understanding the requirements, proposing possible solution, testing aspect of solution and documenting the design. Therefore, the prototyping model that chosen is suitable for the proposed system.

5.1 Architecture Design

There are some factors have to be considered before choosing the type of architecture, such as the complexity of application, the level of integration and interfacing required, the number of user, user's geographical dispersion, the nature of software and overall transaction needs of application. Otherwise, response time, development time and future flexibility and maintenance of the application would be affected (Gallanghur, 1995). In our case, the three-tier architecture will be adapted for the proposed system.

The first tier, which is the client tier will be all application needed is resided. The browser will be the application in the client tiers. Browser like Internet Explorer and Netscape Navigator are used to display the user interface (web pages) to the user of the system.

The second tier is the middle tier where the application server of the system, Internet Information Service (IIS) resided. In this tier, the application server process the request form the client tier and then return required result in the web pages format. It will process any data requested by linking it to the database server.

The third tier consists of the Microsoft SQL Server 2000 as the database server. Microsoft SQL server maintains the data repository of the system. Every query requested from the application will be authenticated first and result will pass back to

the middle tier.

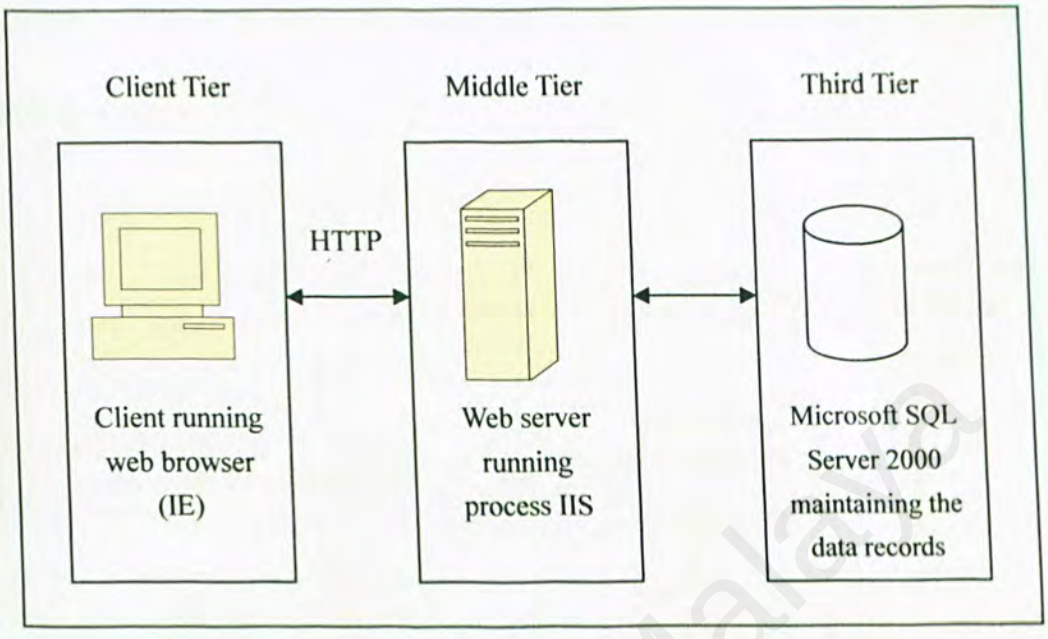


Figure 5.1 The Illustration of the System Architecture Design

5.2 Database Design

Database design is concerned with identifying the business entities relevant to the application, and hoe they are related to each other. It is also concerned with identifying the attributes needed for each of the entity (Sallapan, 2000). Normally, the Entity Relationship Diagram is used to present the information graphically.

5.2.1 Entity Relationship Model

The database used in DEQPMA is a relational database model. The Microsoft SQL Sever 2000 is selected to develop the database for this system because of its powerful database application.

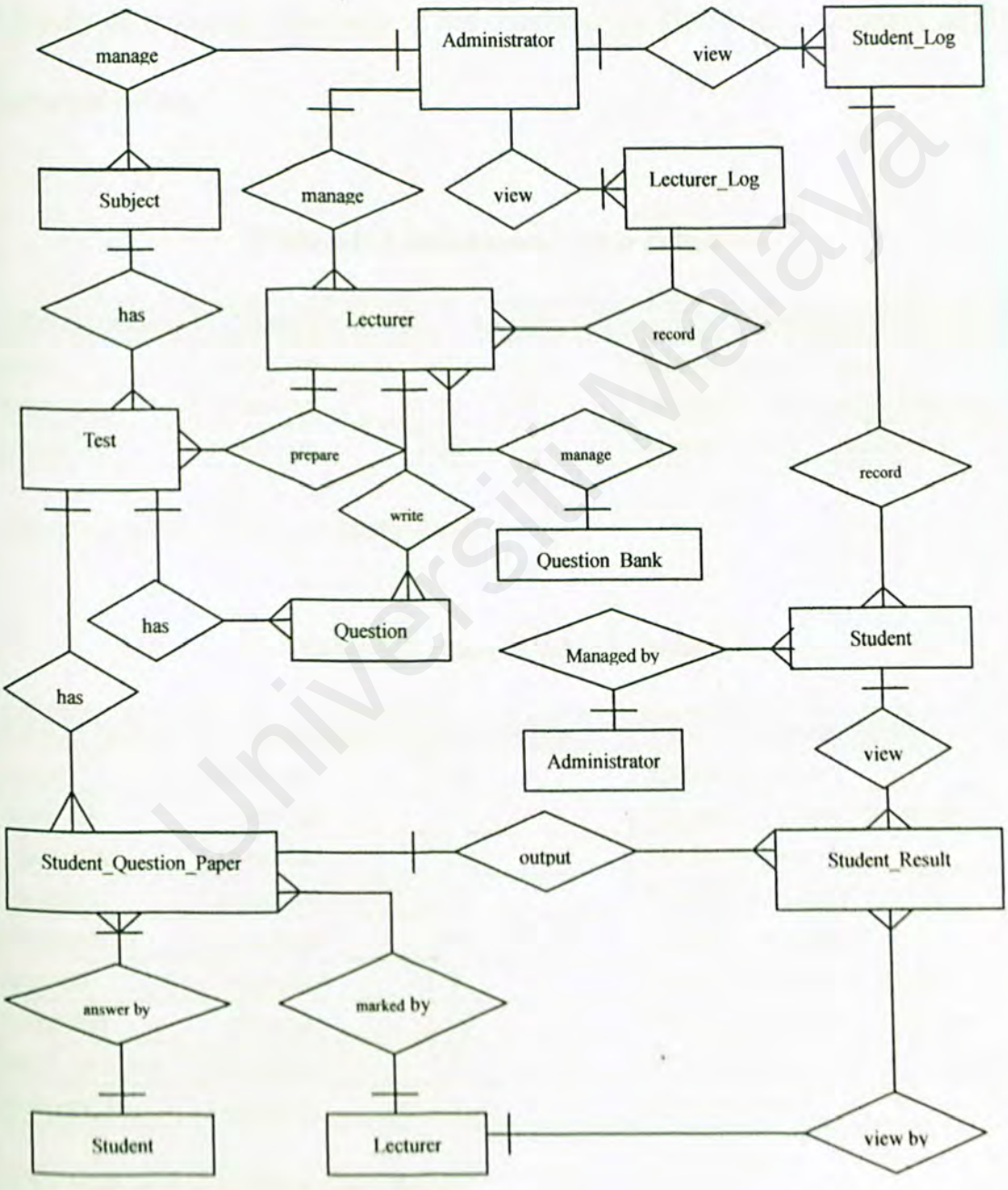


Figure 5.2 Entity-Relationship Diagram of the Proposed System

5.2.2 Data dictionary

A data dictionary is a collection of description of the data objects or items in a data model for the benefit of programmers and others who need to refer to them. When developing programs that use the data model, a data dictionary can be consulted to understand where a data item fits in the structure, what value it may contain, and basically what the data item mean in real- world terms. The structure of tables will be explained below.

Table 5.1: Administrator table definition

Field Name	Data Type	Length	Description
name	nvarchar	40	Administrator's name
user_id	nvarchar	40	Identity of the administrator
password	nvarchar	20	Administrator's password

This table stores the administrator detail.

Table 5.2: Student table definition

Field Name	Data Type	Length	Description
name	nvarchar	40	Student's name
user_id	nvarchar	40	Name to identify the student
password	nvarchar	20	Student's password
faculty	nvarchar	40	Student's faculty
department	nvarchar	40	Student's department
session	nvarchar	9	Current session of student
semester	numeric	9	Current semester of student
total_subject	numeric	9	Total subject taken by student
subject_id	numeric	9	ID of subject

This table stores all the student detail.

Table 5.3: Lecturer table definition

Field Name	Data Type	Length	Description
name	nvarchar	40	Lecturer's name
user_id	nvarchar	40	Name to identify the lecturer
password	nvarchar	20	Lecturer's password
faculty	nvarchar	40	Lecturer's faculty
department	nvarchar	40	Lecturer's department
session	nvarchar	9	Current session of lecturer
semester	numeric	9	Current semester of lecturer
total_subject	numeric	9	Total subject taken by lecturer
subject_id	numeric	9	ID of subject

This table stores all the lecturer detail.

Table 5.4: Subject table definition

Field Name	Data Type	Length	Description
subject_name	nvarchar	40	Name of subject
subject_id	numeric	9	ID of subject
session	nvarchar	9	Session of subject
semester	numeric	9	Semester of subject

This table stores all the subject detail.

Table 5.5: Lecturer_Log table definition

Field Name	Data Type	Length	Description
user_id	varchar	40	ID of lecturer
datetime	datetime	8	Date and time that user login

This table stores lecturer's activities.

Table 5.6: Student_Log table definition

Field Name	Data Type	Length	Description
user_id	varchar	40	ID of user student
datetime	datetime	8	Date and time that user login

This table stores student's activities..

Table 5.7: Test table definition

Field Name	Data Type	Length	Description
test_name	nvarchar	40	Name of subject
test_id	numeric	9	ID of subject
subject_id	numeric	9	ID of subject
date	datetime	8	Date of test
from_time	datetime	8	Start time of test
to_time	datetime	8	End time of test
venue	nvarchar	40	Venue of test
status	nvarchar	20	Status of test (published or marked)

This table stores all the test detail.

Table 5.8: Question table definition

Field Name	Data Type	Length	Description
question	nvarchar	1000	question
question_id	numeric	9	ID of question
answer	nvarchar	1000	Answer of question
score	numeric	9	Score of answer
test_id	numeric	9	ID of test

This table stores all the question detail.

Table 5.9: Test_Question table definition

Field Name	Data Type	Length	Description
test_id	numeric	9	ID of test
question_id	numeric	9	ID of question

This table indicates which question had been included in a test.

Table 5.10: Question_Bank table definition

Field Name	Data Type	Length	Description
question	nvarchar	1000	question
question_id	numeric	9	ID of question
answer	nvarchar	1000	Answer of question

This table stores all the question bank detail.

Table 5.11: Student_Question_Paper table definition

Field Name	Data Type	Length	Description
student_id	numeric	9	ID of student
question_id	numeric	9	ID of question
test_id	numeric	9	ID of test
answer	nvarchar	1000	Answer from student
score	numeric	9	Student's score of the answer

This table stores the detail of the student's question paper.

Table 5.12: Student_Result table definition

Field Name	Data Type	Length	Description
student_id	numeric	9	ID of student
test_id	numeric	9	ID of test
mark	numeric	9	Total mark of the particular test
grade	char	1	Student's grade of test

This table stores all the detail of student's result.

5.3 System Functionality Design

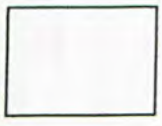
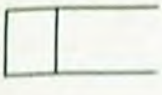
System functionality design enables the team members of the proposed system to utilize the collected information concerning the requirements of the users, so that the data flow of the system could be visualized.

5.3.1 Data Flow Diagram

A database designer often classifies the system requirements by using graphic tools such as data flow diagram to describe the system for user acceptance. A data flow diagram (DFD) is a graphic representation of data movement, processes, and files (stored data) used in support of an information system (Awad & Gotterer, 1992). The

DFD approach uses four symbols to illustrate the system processes in a logical way.

Table 5.13 Description of the Convention Used in Data Flow Diagram

Symbol	Meaning	Description
	Entity	To describe an external entity that supplies data to the system or receive output from the system. The system boundary separates the system from the external entities. An external entity may be a source or sink.
	Flow of data	To represent the path that the data taken in moving from one system component to another. The arrow shows the direction of the flow, with the arrowhead pointing to the data's destination. Each data flow is label with the detail of the data.
	Process	A process accepts input data and transforms the data to output data. The symbol consist of two sections: 1. The top section is the unique identifier indicating its level, and 2. The lower section contains the description of the process.
	Data store	To represent a situation when the system must retain data because one or more processes need to use the stored data at a later time. The symbol consist of two sections: 1. The top section is the unique identifier indicating its level, and 2. The lower section contains the description of the process.

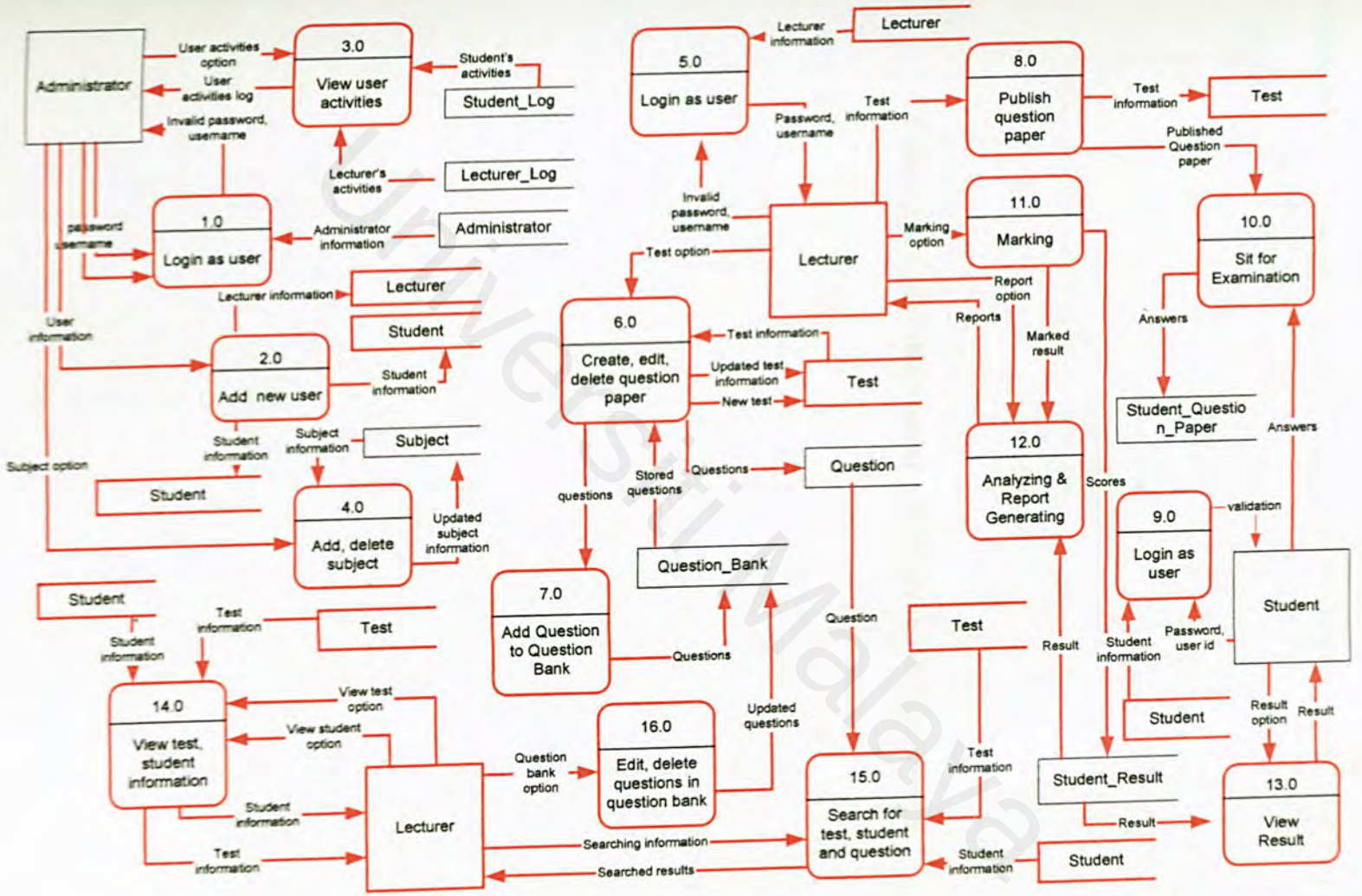


Figure 5.3: Diagram 0 of the Digital Examination Paper Maker & Analyzer (DEQPMA)

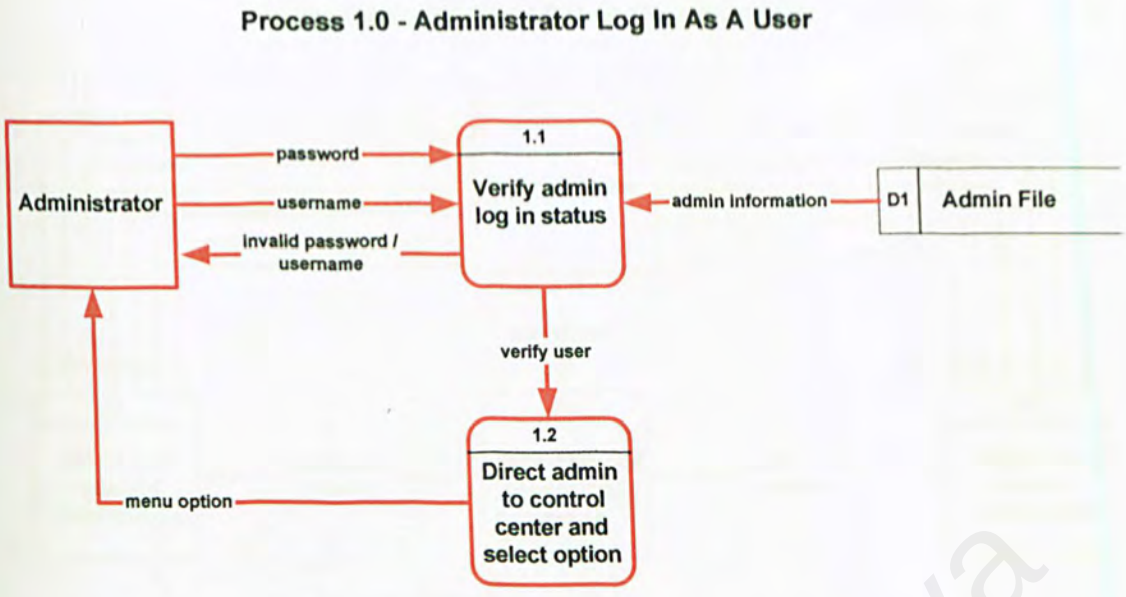


Figure 5.4: Child Diagram of Administrator Login Process

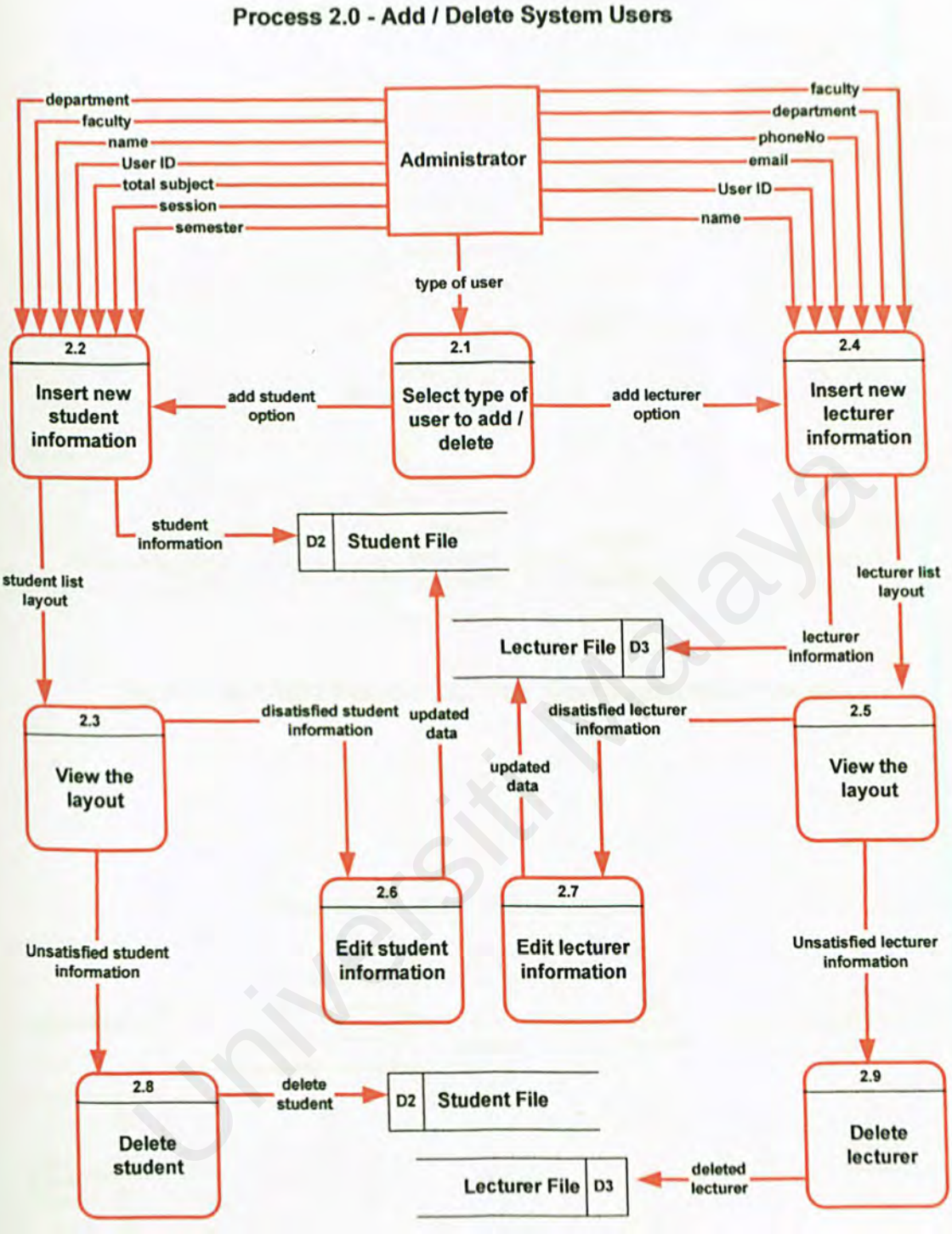


Figure 5.5: Child Diagram of Add/delete System User Process

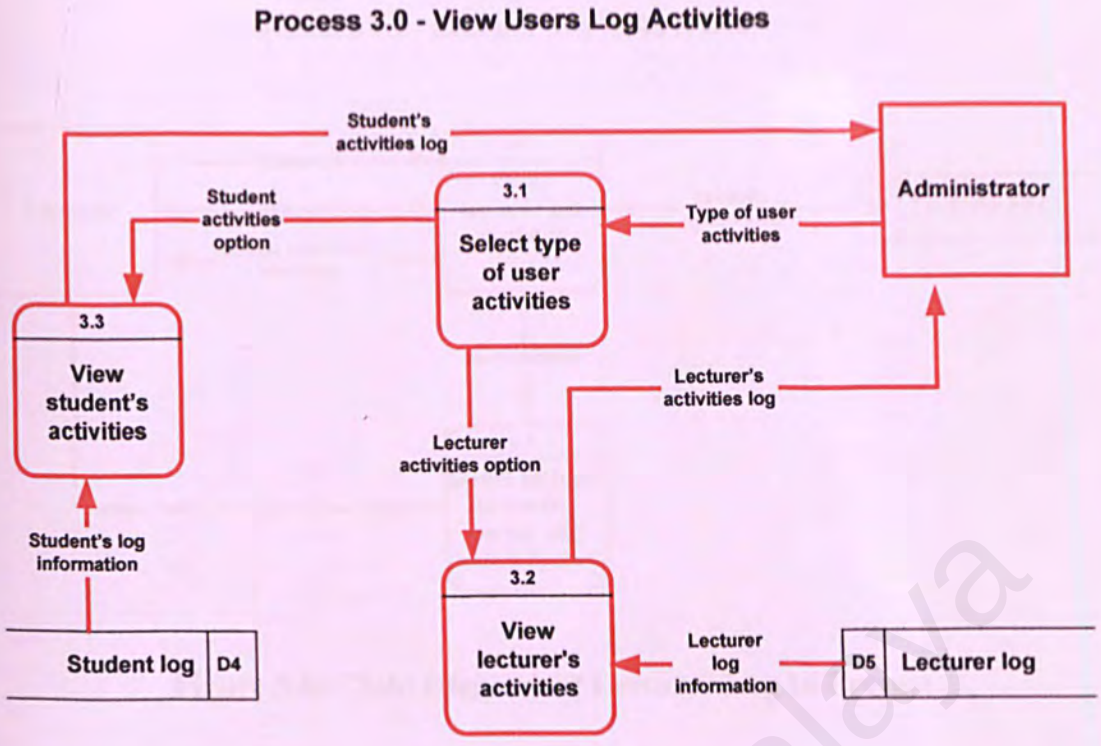


Figure 5.6: Child Diagram of View User's Activities Process

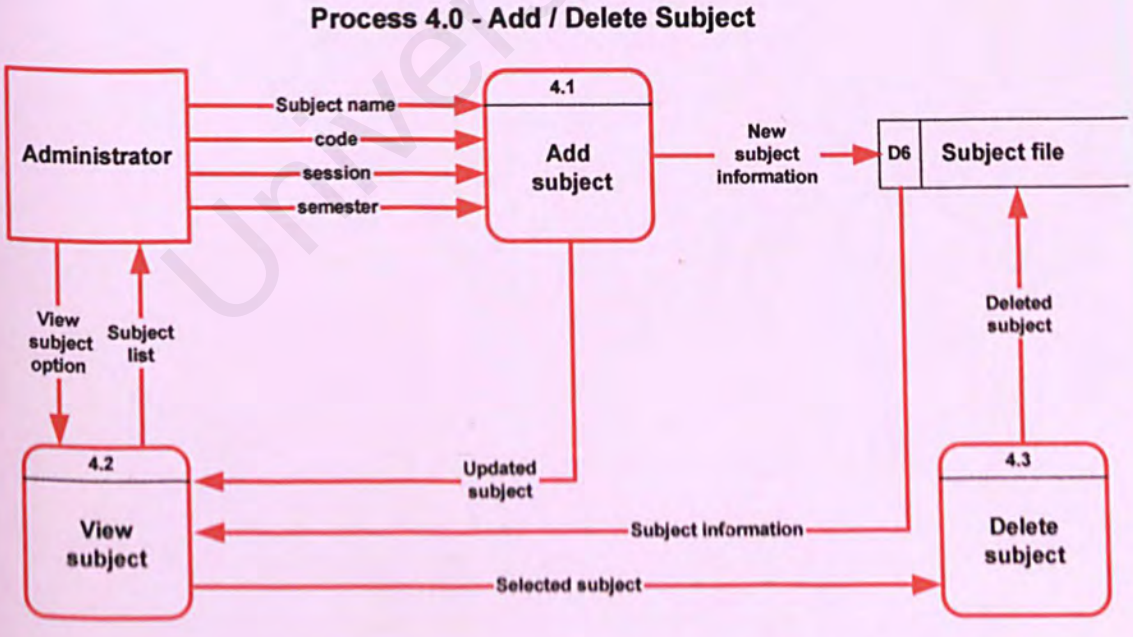


Figure 5.7: Child Diagram of Add/Delete Subject Process

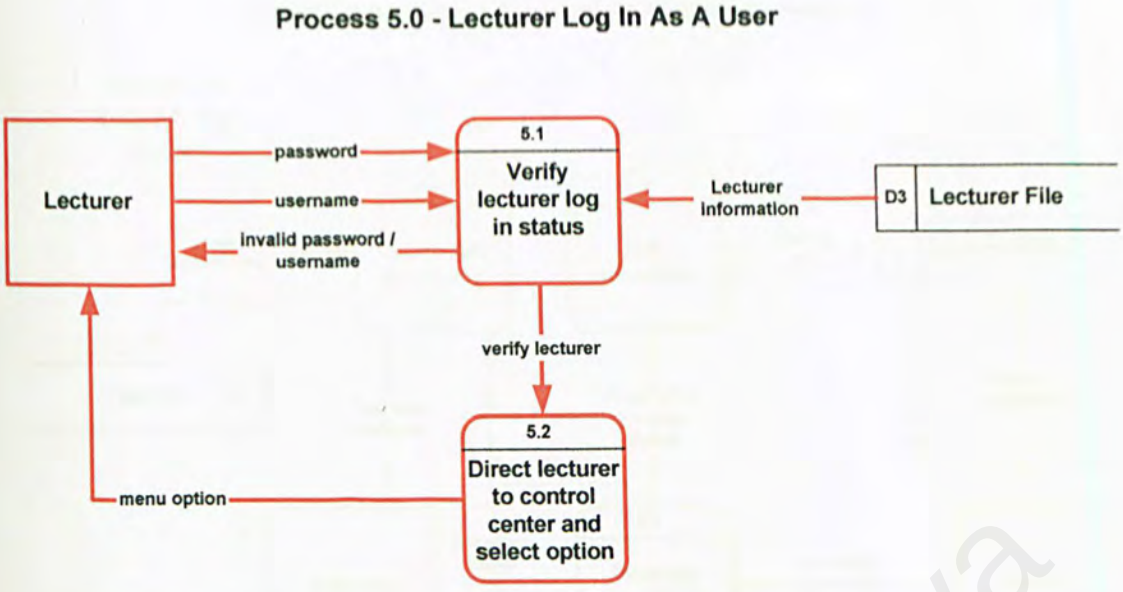


Figure 5.8: Child Diagram of Lecturer Log In Process

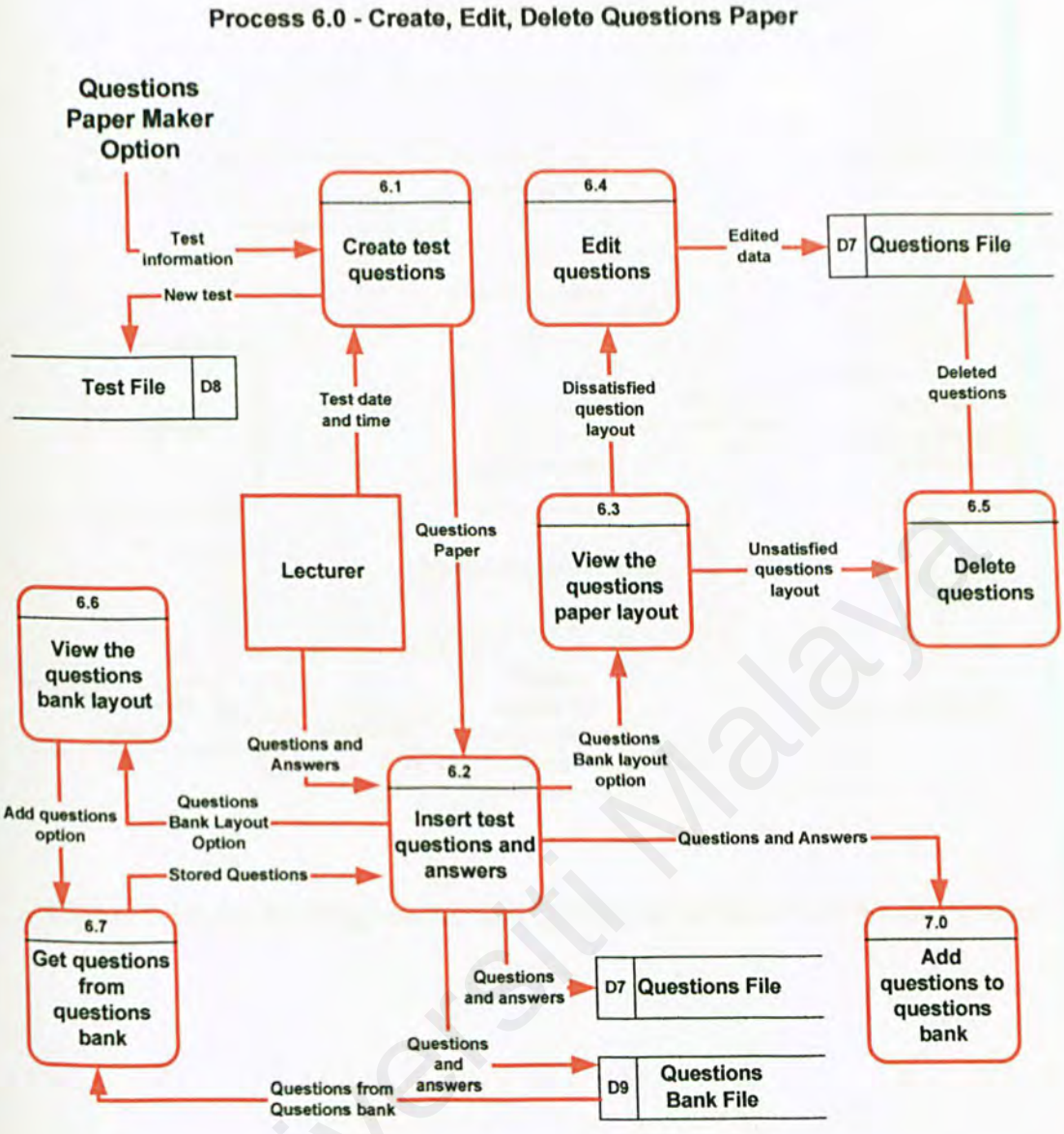


Figure 5.9: Child Diagram of Organizing Question Paper Process

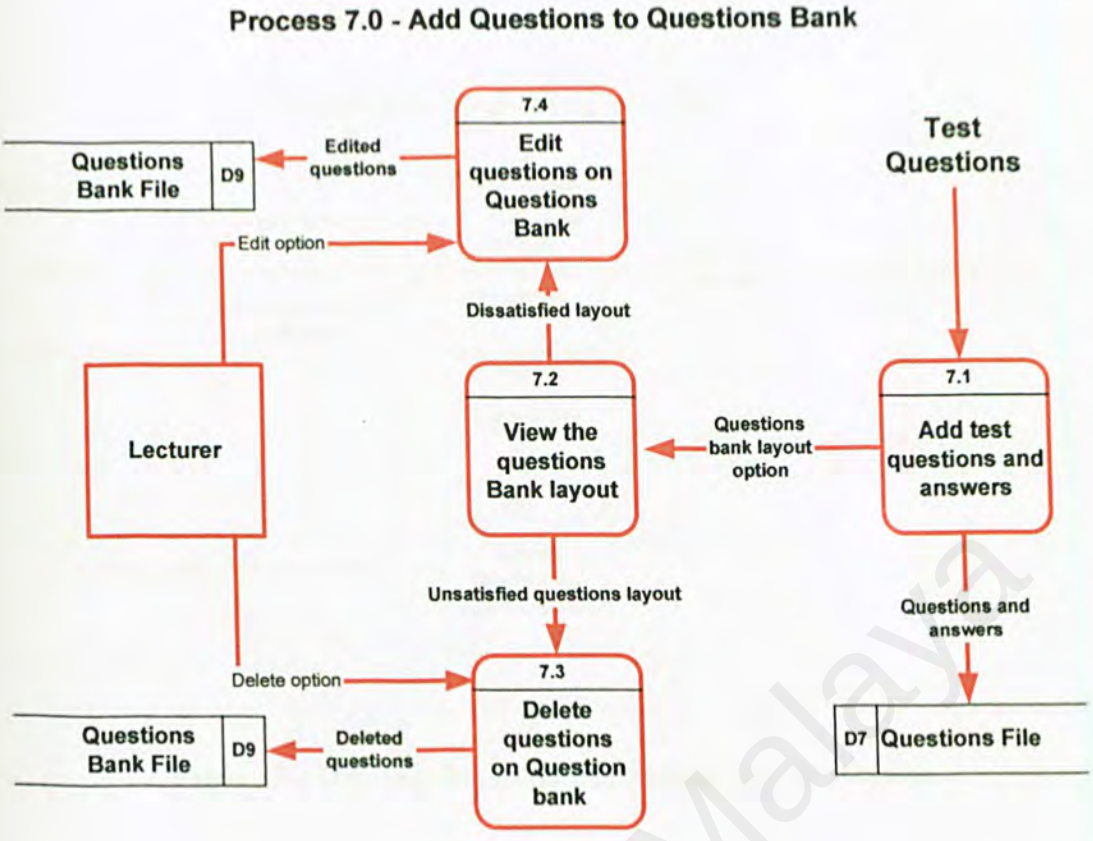


Figure 5.10: Child Diagram of Add Questions to Questions Bank Process

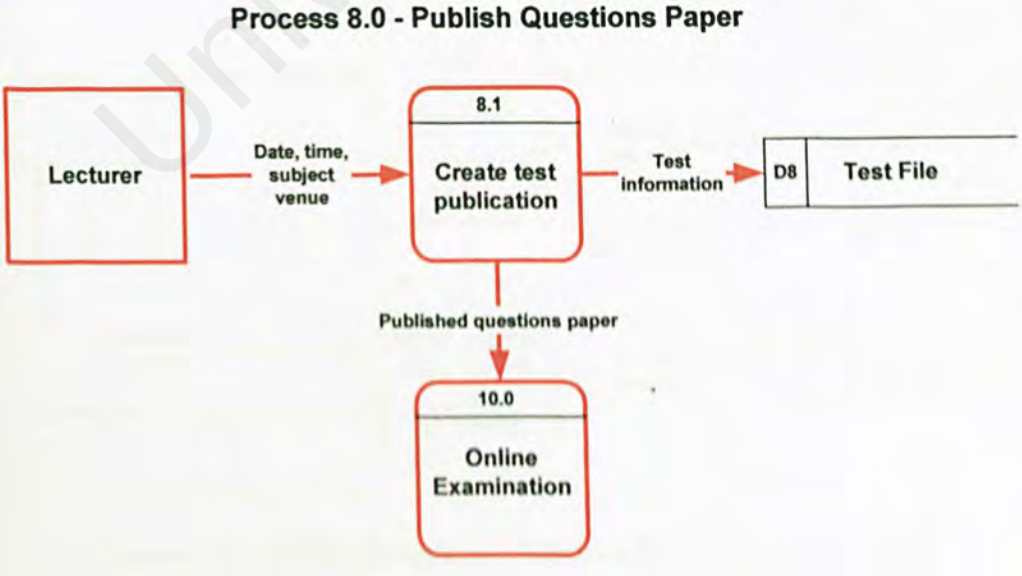


Figure 5.11: Child Diagram of Questions Paper Publishing Process

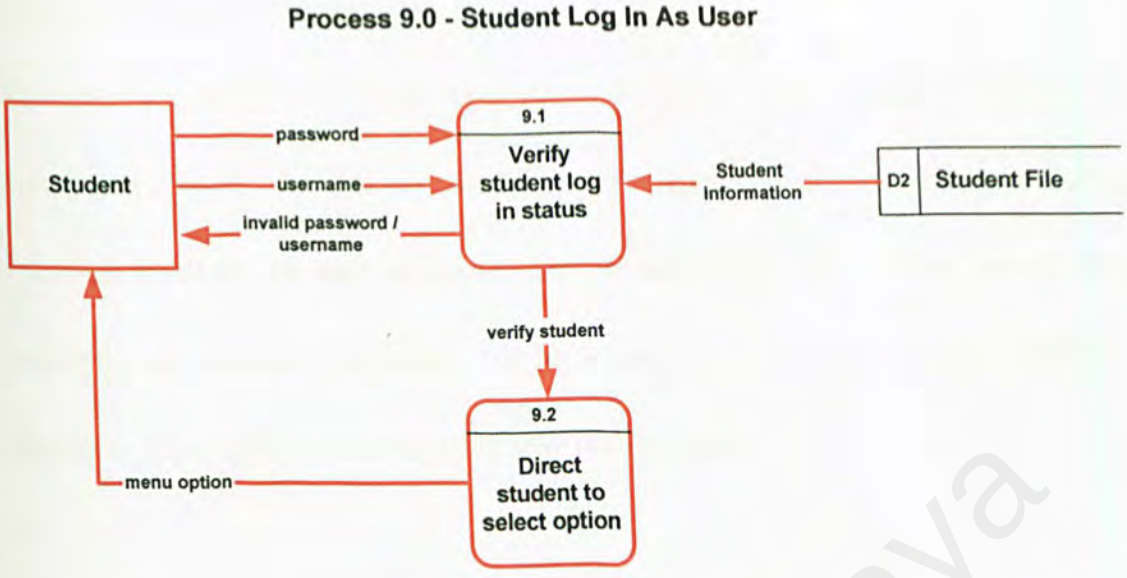


Figure 5.12: Child Diagram of Student Log In Process

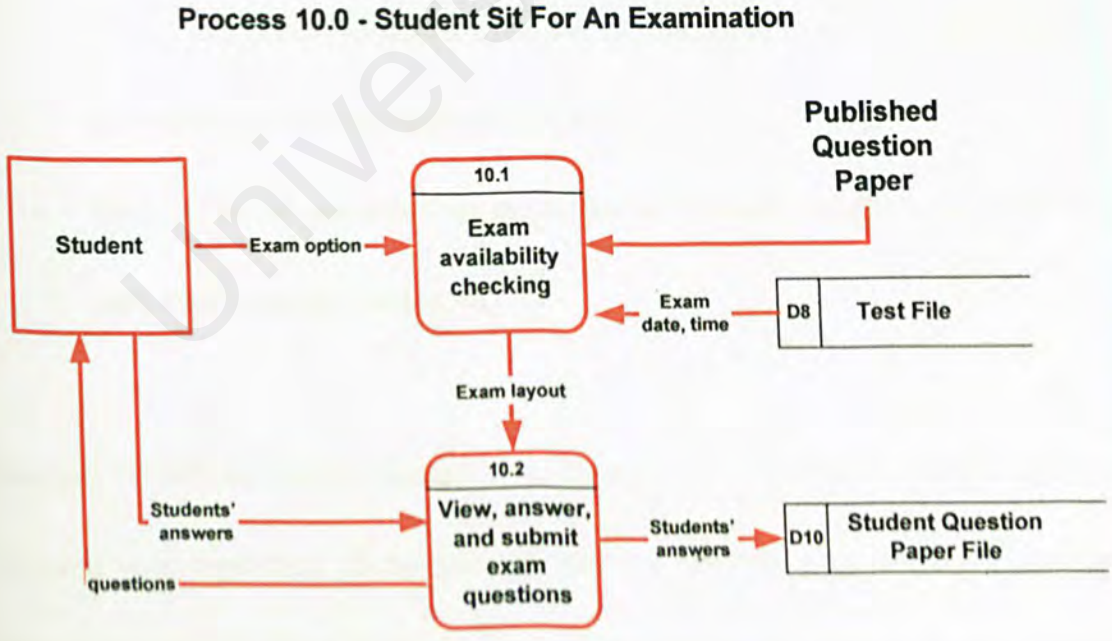


Figure 5.13: Child Diagram of Online Examination Process

5.4 User Interface Design

5.4.1 Adopted Principles

The interface is the system for most users. It stands as the representation of the system no matter how well or poorly it is designed. An Interface is specifically intended to allow the user to access the internal components of the system in a relatively easy fashion. The easier it is for a user to access the system the better the interface. The objectives of designing user interface are:

- Effectiveness as achieved through the design of interfaces that is congruent with their individual needs.
- Efficiency as demonstrated through interfaces that both increase the speed of data entry and reduce errors.
- User consideration as demonstrated in the design of suitable interface and by providing appropriate feedback to users.
- Productivity as measured by ergonomically sound principles of design for user interfaces and workspace.

Standard HTML documents needed by a variety of web browser are rendered in a common way regardless of the browser and the platform they are on. Users can concentrate on their work an retrieve the information from these application instead of worrying about the detail of making the application run.

5.4.2 User Interface For DEQPMA

Figure 5.14: Interface of Login Screen

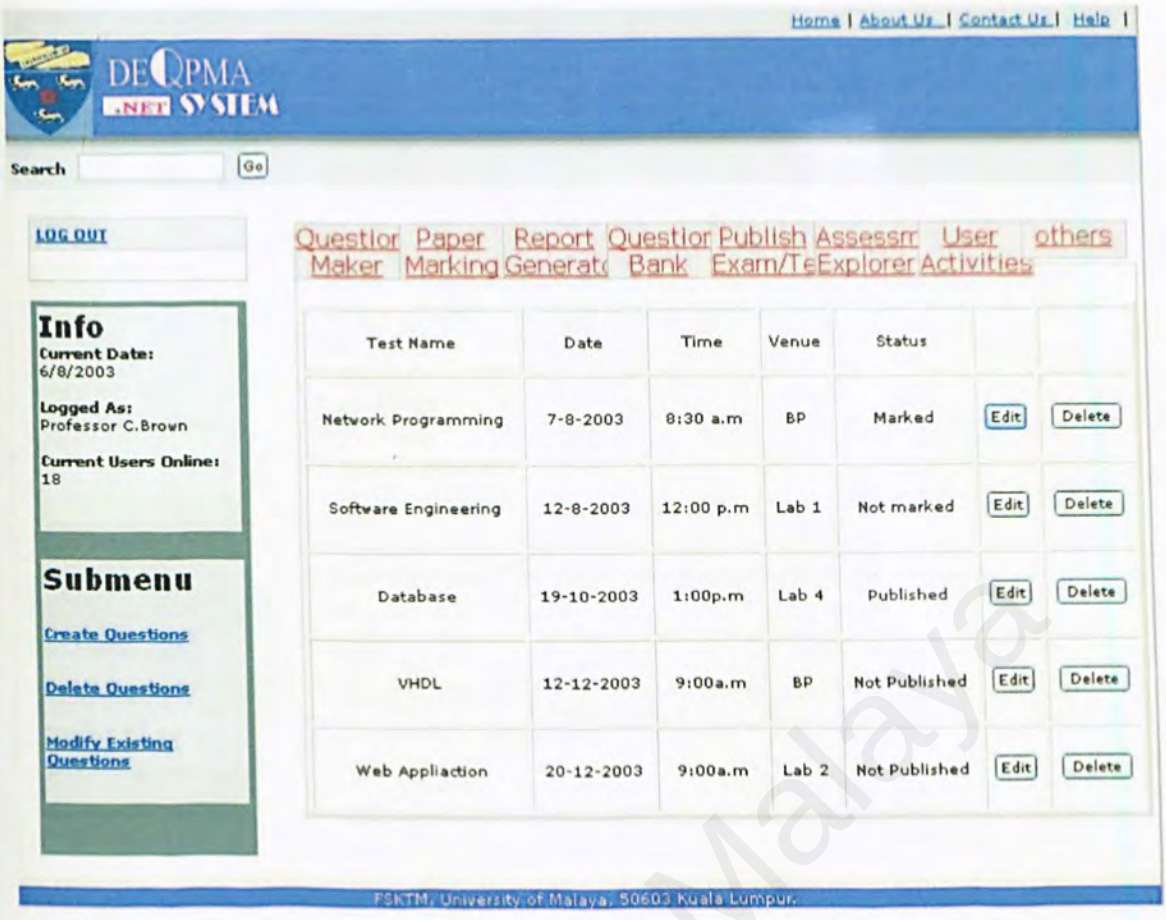


Figure 5.15: Interface of Assessment Management Explorer

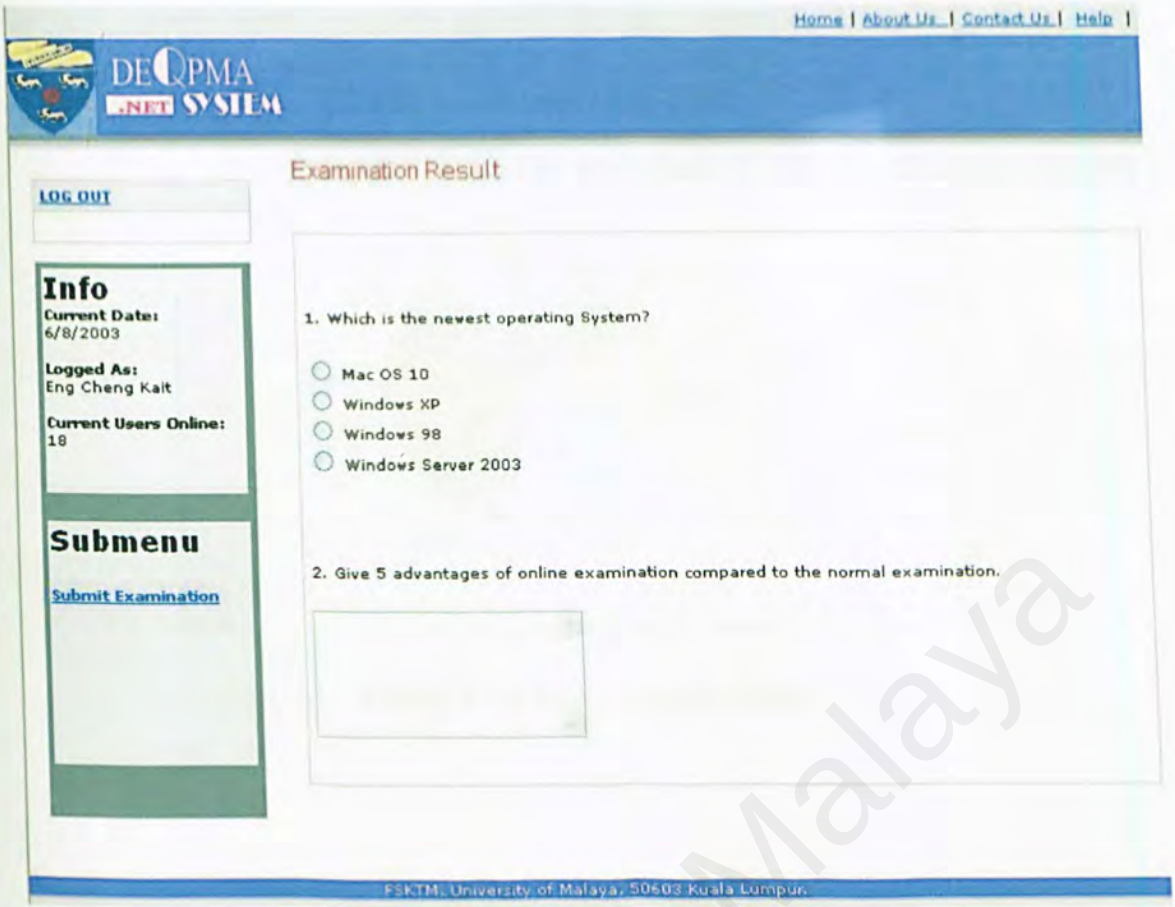


Figure 5.16: Interface of Student's Examination

5.5 Output Design

The design of output serves the purpose of providing the information that the user needs, based on criteria selected by the users. The Digital Examination Paper Maker & Analyzer provides the functions of generating analysis reports and the summary listing for the record. The reports are designed in such a way that it can be printed out according to the format needed by the user. Following is the designs of the expected output.

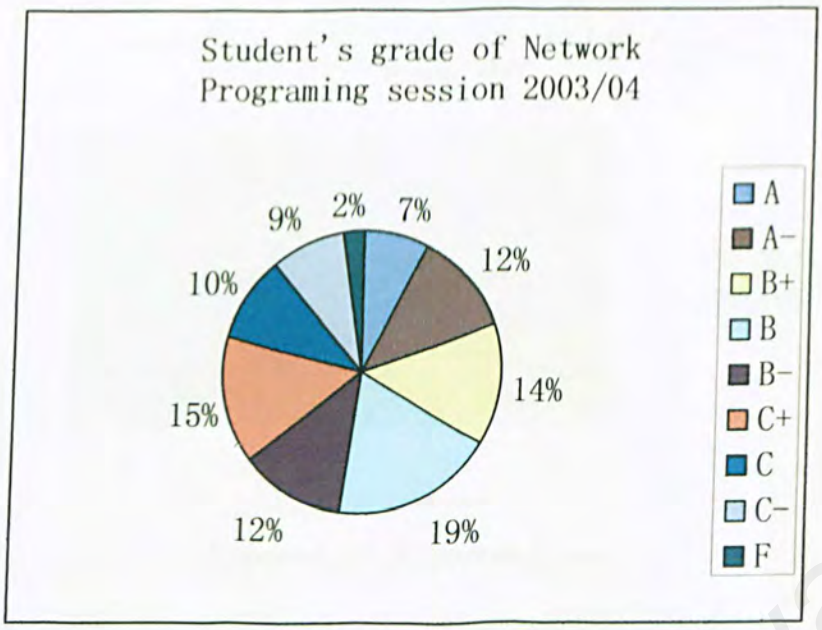


Figure 5.17: Report in Pie Chart

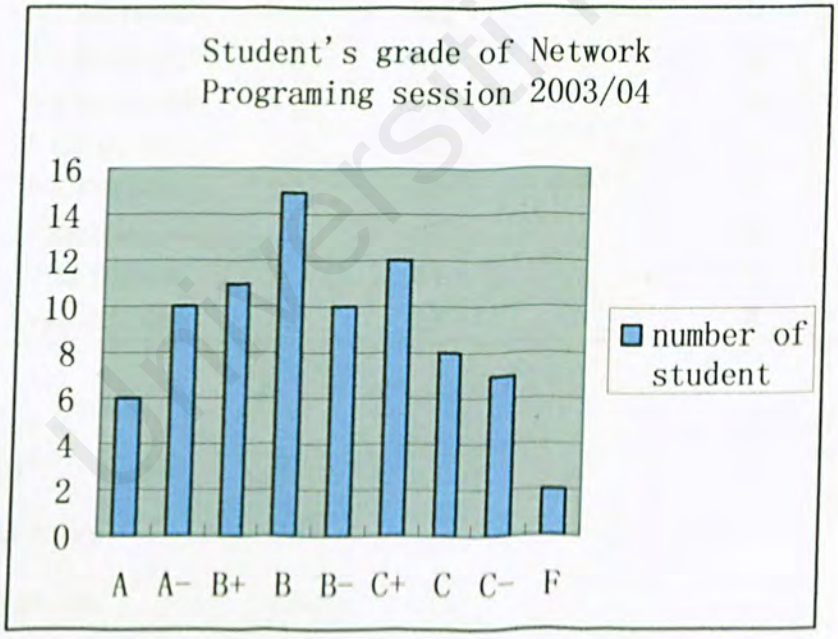


Figure 5.18: Report in Histogram

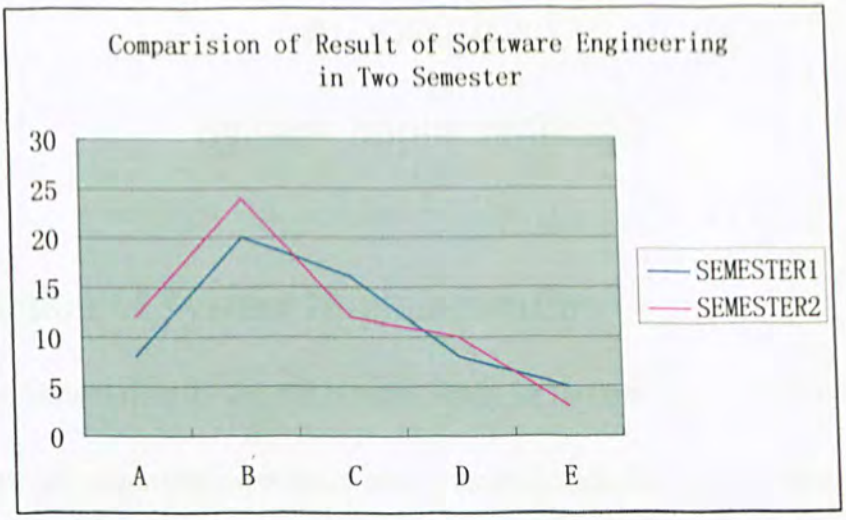


Figure 5.19: Report in Lines

Result of Software Engineering session 2003/04

MATRIK NUMBER	SCORE	GRADE
WEK010001	80	A
WEK010002	90	A
WEK010003	75	A
WEK010004	60	B
WEK010005	45	C
WET010003	37	F
WEK010004	66	B+
WEK010007	47	C-
WEK010008	25	F

Student	**9**
Highest score	**90**
Lowest score	**25**
Fail	**2**
Average	**58.3**

Figure 5.20: Report and Analyzing Result

CHAPTER 6

System Implementation

Introduction of System Implementation

System implementation is the continuous stage to the previous system design. It is the delivery of system requirements and system design into production (meaning a day-to-day operational system). The implementation will focus on the process of developing the programs. Programs design and implementation are needed for a numbers of reasons in a system. It will determine the data transfer correctly and to make sure that the system will work accordingly to the user's expectation.

Writing program code is one of the big steps in system implementation. It transforms the idea from the system design to program code. At the same time, it will implement the idea to the workspace and platform in order to produce what we call the pilot version or prototype of a product.

The development phase can be categorized into system design, system development and program documentation process. DEQPMA is developed within separate modules and later integrated into a fully functional system once every module has been tested to be free from error.

System Design

Microsoft Vision 2000, Excel and Word are used to prepare the diagrams includes the data flow diagram (DFD), Graphs, and flows charts in documentation. Many changes have been made to the initial system design during the implementation in order to match the actual needs and requirements. Some considerations and adjustments were added because we found that a number of early proposed techniques were not suitable or need lot of time to implement.

System Development

Table 6.1: Basic Tools for System Development

Operating System	:	Microsoft Windows XP Professional
Web Server	:	Internet Information Server (IIS) 6.0
Database Management System	:	Microsoft SQL Server 2000
Integrated Development Environment	:	Microsoft Visual Studio .Net
Web Authoring Tools	:	Macromedia Dreamweaver MX
Web Browser	:	Internet Explorer 6.5
Image Editing Tool	:	Adobe Photoshop 6.0
References	:	Microsoft Developer Network, MSDN Library

The riches of programming languages are an important factor to produce a high quality system. To develop the proposed system, a web-based GUI (Graphical User Interface) programming tool from scratch was needed. Therefore, Visual Studio .NET was used. All the source codes are kept in files in a virtual directory which created using Visual Studio .NET.

Program Documentation

Program documentation is a set of written description that explains to a reader what the programs do and how they do it.

6.1 Program Implementation

6.1.1 Coding Approach

Coding is an iterative process whereby it is done until the programmer obtains the desired output. There are two types of coding approach; one is top-down and the other one is bottom-up.

The top-down approach shows the higher-level modules to be coded first before the lower-level modules. The codes in the lower modules contain only an entry and an exit. A module with such characteristics called a shell. The higher-level modules will reference the lower one if they are coded and available. This approach will ensure that most of the important modules will be developed and tested first. It also gives a preliminary version of the system soon.

The bottom-up coding is based on coding some complete lower-level modules and leaving the higher-level modules merely as skeletons that are used to call the lower modules, whereas the top-down approach is the reverse.

For this Digital Examination Question Paper Maker & Analyzer, coding is done with the bottom-up approach. The advantages of this approach are: testing can be carried out on some of the functions as soon as it is completed, and critical functions can be coded first to test their efficiency.

6.1.2 Coding Style

Coding style is an important attribute of source code and it determines the intelligibility of a program. Several elements is being implemented in the coding of system to ensure the system consistency, maintainability and readability.

The elements of style included in the proposed system's internal (source code level) documentation are the methods for data declaration and approach to statement construction. The following lists some of the style used using the proposed system coding.

- Selection of meaningful identifiers (variables and labels) name to increase the coding readability.
- Description and appropriate comments written in source code to increase the maintainability and consistency.
- Indention of codes increases the readability of source code.

6.1.3 Programming Language

Most of the codes in DEQPMA are HTML tags, ASP.NET web controls and Visual Basic.

The application logic of ASP.NET pages in this system is written using the Visual Basic. It is the default language for ASP.NET pages (most popular programming language in the world). Anyway, we can create the ASP.NET pages by using any language that supports the .NET Common Language Runtime. This includes C#, Jscript.NET, and the Managed Extensions to C++.

All the most common HTML tags can be represented equally well with a web control in ASP.NET pages. Web control is a more rationalized version of standard HTML tags. The web control can be divided into different groups. The first group consists of web controls that correspond to existing HTML controls. They include TextBox, DropDownList, ListBox and etc. The second group contains controls used for validation. They do not correspond to any existing HTML tags. They include CompareValidator, RangeValidator, CustomValidator and etc. The third group of controls displays the data. For example, the DataGrid control is used to display data from a database table.

The source code for ASP.NET pages is created into a text file, and the .NET framework handles all the hard work of converting it into compiled code.

```
<SCRIPT Runat="Server">

Dim conDeqpma As SqlConnection
Dim dadSearch As SqlDataAdapter
Dim dstSearch As DataSet

Sub Page_Load

End Sub



Sub BindDataGrid
   conDeqpma = New SqlConnection( "Server=localhost;UID=exam;PWD=password;Database=DEQPMA2" )
   strSearch = "SELECT Test.test_name, Test.test_id, Test.[date], Test.from_time, Test.to_time, Test.venue, " & _
                  "Test.status, Subject.subject_name, Subject.[session], Subject.semester FROM
Lecturer_Subject " & _
                  "INNER JOIN Subject ON Lecturer_Subject.subject_id = Subject.subject_id INNER JOIN "
& _
                  "Test ON Subject.subject_id = Test.subject_id " & _
                  "WHERE Lecturer_Subject.lecturer_id = '" & strLecturerID & "' " & _
                  "AND Test.test_name LIKE '%" & txtSearchPhrase.Text & "%'"
   conDeqpma.Open()
   dadSearch = New SqlDataAdapter( strSearch, conDeqpma )
   dstSearch = New DataSet
   dadSearch.Fill( dstSearch )

   dgrdTest.DataSource = dstSearch
   dgrdTest.DataBind()

   conDeqpma.Close()
End Sub

</SCRIPT>
```

Figure 6.1: A sample of application logic of Visual Basic

```
<form Runat="Server" ID="Form1">
      <asp:datagrid id="dgrdSubject" Runat="Server">
            <HeaderStyle ForeColor="White" BackColor="Orange"></HeaderStyle>
            <SelectedItemStyle BackColor="NavajoWhite"></SelectedItemStyle>
            <Columns>
                  <asp:TemplateColumn HeaderText="Subject">
                        <ItemTemplate>
                              <asp:LinkButton ' Runat="Server" />
                        </ItemTemplate>
                  </asp:TemplateColumn>
                  <asp:BoundColumn DataField="subject_code" HeaderText="Subject
Code"></asp:BoundColumn>
            </Columns>
      </asp:datagrid>
            </asp:datagrid>
</form>
```

Figure 6.2: A sample code of web control

6.2 Database Implementation

The database of DEQPMA is stored inside a database server with MS SQL Server 2000 is installed. Any database transaction will be directly communicated to database server.

In ASP .NET framework includes a rich set of classes and controls for working with database data in ASP .NET pages. The SQL classes communicate with MS SQL Server directly on the level of the Tabular data Stream (TDS) protocol. TDS is a low-level proprietary protocol used by SQL server to handle client and server communication.

To access the database, a database connection needs to be created first. A few line of code are inserted into each ASP .NET page.

```
<%@ Import Namespace="System.Data.SqlClient" %>

<Script Runat="Server">

Sub Page_Load
   Dim conPubs As SqlConnection

conPubs = New SqlConnection( "Server=localhost;uid=sa;pwd=secret;database=pubs" )
   conPubs.Open()
End Sub

</Script>

Connection Opened!
```

Figure 6.3: Code for Database connection

CHAPTER 7
System Testing

Introduction to System Testing

Testing is an important phase in developed an operational system. All of the individual event or modules of system, either newly written or modified, must be tested thoroughly. Testing of a system does not come at the end of system implementation but is a carry-out process during the development phases.

The purpose of testing is to check whether the system is working according to the design and requirements. Besides, the system-testing phase also ensures that the system is bug free and performs as expected. During the testing procedures, the fault will be discovered and to be corrected soon. Many types of tests were performed to ensure that the errors were detected and corrected. This increased the reliability and integrity of the system and consequently assured the quality of system.

7.1 Types of Testing

There are four major stages of testing will be done in DEQPMA.

- Unit Testing
- Module Testing
- Integration Testing
- System testing

7.1.1 Unit Testing

Unit testing is a test performed on all individual events and components to ensure their functionality. It verifies that the components functions properly with the types of input expected from studying the component's design. Each program component is tested individually, isolated from the other components in the system. In other words, it is the testing of an isolated subset of program. The unit testing involves:

- Test the interfaces to ensure the input/output of data flows correctly into and out of the program unit.
- Test the boundary condition to ensure that the boundary values that input into the component is operate correctly.
- To make sure that all the independent paths in a control structure are tested at least one time.
- Test the error handling events.

Table 7.1: Unit Testing of Lecturer System

Test Procedure	Output / Error	Analysis of Test result
Key in the correct user name and password	Redirect to the first page of system	Authentication of user is successful.
Forget to fill in the password when clicking the login button	A warning message was pop up	Error handling is working.
Click the link button to view the student list in each subject	Student list was displayed	The link or path is working.
Test the date with boundary values and null value when edit a test.	A warning message pops up to indicate the range of valid value.	Boundary values that input into the component is operate correctly.

7.1.2 Module Testing

Module testing is the test whereby all the events and modules that have been coded and stub tested are tested as an integrated unit (module). A module consists of a collection of dependant components to perform a task or function. Different possible test cases are applied to the module and the test results will be verified. Unusual output of results will be analyzed. They will help in debugging of error in order to produce the desire output.

Table 7.2: Modules Testing of Lecturer Sub-System

Module	Test Procedure	Output / Error	Analysis of Test result
Searching	Search a subject by giving the name of subject.	The subject which matches to the subject name was displayed.	Module of Searching functions properly.
	Incomplete name of subject was given.	The subjects which match to the incomplete subject name were displayed.	
	Search a subject that doesn't in charged by the current user.	No result was displayed.	
Test Explorer	Click to view the student list in each subject.	Details of the students were displayed.	Module of Test Explorer functions properly.
	Click to view a particular test.	Details of the test were displayed.	
	Modify the details of test by key in different values and click update button.	The test was update successfully.	
	Cancel the modifying of data.	No changes applied to the test.	
	Delete a particular test.	The test was deleted.	
Report and Analysis	Check result of particular test.	List of students' results was displayed. Analysis of students' results was produced. Pie chart of analysis of students' grade was generated.	Module of Report and Analysis functions properly.

Table 7.3: Modules Testing of Student Sub-System

Module (Student)	Test Procedure	Output / Error	Analysis of Test result
Sitting for Test	Follow the link to the available test.	Question paper displayed	Module of Sitting for Test functions properly.
	Fill in the answers for each question. Then submit the question paper.	Data submit successfully.	
	Continuously update the answers by clicking the submit button.	Data was update successfully.	
	Try to submit the question paper after the end time.	Question paper cannot be submitted.	
Test information	Select a subject to view its tests.	Tests in the category of the subject displayed.	Module Test information functions properly.
	Select a test to view the result.	Result of student was displayed (if question the test is marked).	

7.1.3 Integration testing

The integration testing is performed after module testing. Once the individual components and modules are functioning correctly, the modules were then combined into a working system. The integration testing was used for constructing the system's program structure and at the same time to detect and eliminate errors associated with integration. Just because a single module works properly doesn't mean that it works properly with other modules. Several independent or dependant modules integrated may cause some unpredictable errors. Therefore, integration testing is a systematic approach for conducting tests to uncover the errors associated with different components and module that constructing the application.

Table 7.4: Integration Testing of Student System

Step	Test Procedure	Output / Error	Analysis of Test result
1	Login as a lecturer	Redirect to the first page of system	Authentication of user is successful.
2	Create a new test.	Confirmation of new test was created.	Create test successfully.
3	Go to Test Explorer to view the test information.	The new test was shown in Test Explorer.	Viewing test is working.
4	Published the test. This will allow the student for sitting the test.	The test status is shown as 'Published'.	Publishing test is working.
5	Another user login as student.	Redirect to the first page of system	Authentication of user is successful.
6	Sit for published test.	The published test was displayed as the student was allowed to sit for the test.	Sitting for Test functions properly.
7	Changed the test status to 'Unpublished'.	The test status is shown as 'Unpublished'.	Modifying of test status is working.
8	Another user login as student.	Redirect to the first page of system	Authentication of user is successful.
9	Search for published test.	No test was displayed.	Sitting for Test functions properly.
10	Logout	Page was redirected to the login page.	All session is closed successfully.

7.1.4 System Testing

The correctness of entire system must be validated after all the modules have been integrated as a complete application. On the stage, the system testing will be performed. System testing is ultimate testing procedure. It studies all the concerns issue and behaviors that can only be exposed by testing the entire integrate system or major part of it. This process is entirely different from previous testing but it is based on the result of the previous tests. The major difference compared to module

and integration test is it needs to consider with the entire environment of system such as hardware, software and databases.

The testing process is also concerned with validating the system meets its functional and non-functional requirements of the system which defined in chapter 4, System Analysis. The following testing description has been carried out on the DEQPMA system.

Functional Testing

Functional testing is based on the system functional requirements. In other word, a functional testing is used to check whether the integrated system performs its functions as specified in the requirements. The testing is carried out for three sub-systems. The three sub-systems are tested individually to determine it is functional. Example is check whether it can be generating report and analysis in DEQPMA system.

Performance Testing

Performance testing addresses the nonfunctional requirements of the system. That mean once the function are convinced work as specified, the performance test compares the integrated components with the nonfunctional system requirements.

Security Testing

This test was performed to ensure that the application fulfills the security requirements. Such as verify the protection mechanism in the system against improper penetration and unauthorized access. Example is the authentication of user. Each role of user (lecturer, student, admin) can only access to the system which their role are permitted.

Timing Testing

This test was performed to evaluate the requirements dealing with the response time for user and time to perform a function. The page generation time of the developed system is good because ASP .NET is a speed-optimized technology. The problems occurred when there are a lot of users make the connections to the database at the same time. The performance of database server is an important factor for the load.

Recovery Testing

This test was carried out to address the response to the loss of the data, power, devices or services. This test was done, where some of the critical services like Internet Information Server (IIS) and SQL Server were stopped, and the system recovers properly after rebooting the computer.

CHAPTER 8

System Evaluation

Introduction to System Evaluation

In the system evaluation phase, the system's effectiveness and efficiency was evaluated. Besides, this chapter includes the evaluation to analyze the system and identifies its strengths and limitations. Various problems encountered and the solutions for the system are also explained. Possible enhancements to the system are being explored as suggestion to further improve the system.

8.1 Problems Encountered & Solutions

Unable to decide on the development tools

Deciding on the right and most suitable hardware and software was indeed a very big dilemma. The operating system and programming tool that was chosen during the system analysis phase in the previous semester was Microsoft Windows XP Professional and Visual Studio .NET respectively. This was because they are newer technologies with better features and they were more flexible especially to develop a web-based application like the DEQPMA.

Inadequate experience in database design

Due to insufficient knowledge and experience in creating a good database, the database design had gone through a lot of changes before the final product was completed.

User able to access the system without login

If the users know the correct the path the page, they can simply type the URL and bypass the login page to access the system. This problem was overcome by applying the session control on each consequence page after login. By doing this, the users can't access the page even they know its path.

8.2 System Strengths

Simple and user friendly interface with a consistent looks and feel

The system provides a very simple and consistent interface to the user. The user can easily familiarize themselves with the application within minutes. The interface provides the bright links and buttons to indicate the availability of linking pages. Besides, the drop down menu will give the hints to the user about its features.

User and password validation

This system is a password-protected application for the users. Therefore the security feature ensures that unauthorized users are prohibited from using the system.

Easy information retrieval

This system provides step-by-step information viewing in tabular format and displaying the analysis in a chart. User can search for the needed information with no difficulty.

Reliable system with effective error recovery

To avoid error, this system is developed with error handling. Error message will be displayed when system encounters invalid input and it will not terminate suddenly. For instance, if the user inserts a wrong username and password, the system notifies the user with an alert message.

8.3 System Limitation

Non-portability

The DEQPMA system is platform dependant. It means this system can only run on Windows operating system and only can display properly by using the web browser - Internet Explorer. In other operating system such as Linux, UNIX and Mac OS, it doesn't operate at all.

8.4 Future Enhancements

Report Generation

Due to the time constraints, there is only one type of report generated. More types of report with various types of charts will be added in the future system.

More Functions

More functions could be added to make this application a better examination system. For example, a function to export the data to other format such as pdf and excel.

User Manual

The manual that linked to each pages would benefit the new user. It would help them to learn the functions of each component.

Encryption of Password

The current user password is stored in the database as plaintext. Encryption to the password by using encryption algorithm will reduce the risk of exposure of password to third party.

Notice for Time in a Test

There will be a notice to the user who sitting a test. There should be a message that told the user it is almost at the end of a test and they should submit their question paper.

8.5 Knowledge and Experienced Gained

This entire project had provided a great deal for knowledge and experience to me. This project gave me great opportunity to apply the knowledge learned from books. The various techniques, paradigms and software development approaches in system analysis and design were well read. The programming tools and application such as Visual Studio .NET, SQL Server 2000, Adobe Photoshop and also Macromedia Dreamweaver were also learned in detail. Therefore accomplishing this project had given me an excellent privilege and opportunity to widen my knowledge in the respective field. During the entire system development phase, the sense of responsibility to complete a task on time and the attitude to give the best developed in me.

Besides, in the midst completing this system, I also manage to identify my weaknesses in web-based application development technologies and improve myself in whatever that was lacking to accomplish the desired system successfully.

8.6 Conclusion

The Digital Examination Question Paper Maker & Analyzer is an examination system targeted to be utilized in intranet of university. Development of the whole system is not an easy task because it involves various objectives and new technologies. It can be considered as a contemporary effort to build a new kind of examination. Overall, this project has fulfilled the objectives and requirements as determined during the analysis phase.

In the development process, invaluable insight has been gained from using the programming language and development tools. The schedule of development is very important to ensure the job finished on time. Besides, the application of software engineering principles throughout this project has served to further enhance the system. The valuable experience will be very useful in future system development. Although it is not a complex system, the successful development of DEQPMA is the first step towards more comprehensive and innovative system in future. The problems and experiences gained definitely provide the foundation of my future endeavor.

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