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## BSTRACT

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Web based Higher Education Information System is an Information system developed to perform dissemination and retrieval of universities and colleges information online. This application makes full use of the web technology which enables users to access to the internet from their desktops. Thus making this system accessible by a wider group of users compared to the local area network system application. Besides that, a web search engine also developed as an extended function to enable web searching.

This project starts with a report in chapter one by looking into the project background, defining the project objective, motivation and scope.

Chapter two concerns on the feasible study for this project. It will discuss about existing higher education systems in the internet.

Chapter three covers the analysis part of this project. Methodology, functional requirements and all the system requirements will be discussed here.

Chapter four discusses beginning stage design of this project. It will cover the design principles, process design and charts.

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University of Malaya



## CHAPTER 1: INTRODUCTION

### 1.0 Project Overview

In most of the countries education is strongly perceived as a public good, which implies free access and funding to be provided by the government through tax revenue. Education, especially higher education- benefits society as a whole and the costs of it should therefore not be left to the single individual.

Thus, investment in HE (teaching and research) is comparable to infrastructure, internal security or other common examples of public goods. The common argument is that the benefit to society finds its effects in higher productivity that is attributed to higher innovation capacity of the workforce.

Higher Education in Malaysia is directed at generating manpower leading to award of certificate, diploma, degree and professional qualifications. Generally, higher education is undertaken by way of:

- a. Formal Education
- b. Distance Learning

The Higher Education programmes are mainly provided by the Government's Public Institutions of Higher Learning. Currently, there are eight Public Universities, one International University, six Polytechnics and two Government Aided Colleges offering courses at various level of higher education [1].



Further more, public corporations have been invited to set up institutions of higher learning, including the University Technology Petronas (UTP), Telekom University (UNITEL), and Tenaga National University (UNITEN) in providing degree level courses. There are also proposals by the private sector to set up a multimedia university by Multimedia Development Corporation (MDC) and a Malaysia University of Science and Technology (MUST) in partnership with the Massachusetts Institute of Technology (MIT), USA [1].

There are currently more than 450 approved Private Higher Education Institutes (PHEI) by the Ministry of Education, Malaysia. These PHEIs are offering a wide range of courses ranging from Engineering, IT, Medicine, Management, Accountancy, Science, Arts, Hospitality to other technical and soft skilled related courses.

### **1.1 Definition**

Higher Education Information System (HEIS) is web-based informative application. It provides very useful information on higher education chances in Malaysia to the users especially school leavers. This will be a guidance to the local and foreign students to know what are the educational opportunities they could find in Malaysia

The user can retrieve current information on colleges and universities, provided courses, required qualification, duration of a course, fee, facilities, and a lot more. User can get the information directly by clicking the appropriate icons or by using search engine. Users can also demand for any additional information through e-mail and voice their views

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through feedback postings. Forum section will be provided where users can interact with other users to discuss any topics regarding education.

Besides that, application forms will be provided for selected colleges. They can apply through this online application. This will be more useful and effective to the users in foreign countries.

HEIS is a secured application by administrators. Administration site is a password-controlled section. They are allowed to add new records and update existing information. Besides security, this will make the maintenance services easier for the administrators.

## 1.2 Project Motivation

Undoubtedly Internet has emerged as an effective communication channel in the late 20 century. With the introduction of browser such as Mosaic and Netscape, which features graphical user interfaces, the www has become readily accessible (Ryder and Hughes, 1997) [2]. Universities and colleges rushed to become wired in order to provide information to of Internet usage among U.S. university students, the number of students who use the Internet to obtain university information ranged from 27.6 % to 57.4% for various groups [2].

By reviewing at the facts, it is clear that not only putting the college information on the web is a must but also assist them in choosing appropriate courses to study is vital as well, in order not to be left by the global trends.

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Internet has become a cheap mean of publicity and disseminating information. This project has been suggested for study and develop a HEIS (Higher Education Information System). In order to assist the target users especially those after SPM and STPM to choose not only appropriate college but also courses to further their study, based on the different criteria of the students. These criteria, for example, can be academic achievements, financial status. Besides, this software could also be used by working class who intends to further studies as well as caring parents for welfare of their children.

Based on the preliminary research, current market in Malaysia does not have suitable software to help or assist students to achieve the following things:-

1. To have a College Central Information System which can be accessed easily and at a lower cost.
2. To help the user to make the decision of which college and which courses to choose from.
3. To submit application form and inquiry in the fly.

Therefore, motivation to implement this project arose in order to help the respective users, furthermore, this system is of urgent in view the number of colleges and universities have grown tremendously.

This project is definitely feasible for implementation with the following reasons:-

1. Internet has become a cheap mean of publicity and disseminating information. Nowadays, we can get access cost as well as low hardware cost. Therefore, it is wise to develop a web based college information system.
2. Information can be acquired through, and respective bodies and so on.

### 1.3 Objective

The main objective of HEIS is to provide effective application and information that is developed based on current needs of users. This will be ensured by providing feedback modules in the application. This project also aims to develop a educational database system to house all data pertaining to the application. To develop a collection of interactive web pages on education as interface between user and web server. This web-based application should be effective in presenting information to the users. By this project a students administrative function can be managed more efficiently.

### 1.4 Scope

HEIS will include a search engine that can be used to search information in an easier way. Input string will be matched partially or fully. HEIS also includes a catalog-like system to browse the data easily and systematically. Users should be able to involve and interact with the application through online request, feedback, and forum modules. Developing software that acts as a communication channel that facilitates the application of courses by students and the application can be assessed by the corresponding college. Administrators can store and manipulate data and information in database. Data should be able to be displayed in various formats on the user screen. Publishing and



disseminating of information to the students under the guideline of proper web design techniques as well as Human Computer Interaction techniques. Maintenance features that include file uploading and downloading capabilities shall be provided. Administration facilities should also be provided. A database system to store and organize all the records pertaining to the application will be developed. Web pages that are password protected to publish certain information should also be provided.

### 1.5 Expected Outcome

A web-based application used to provide a variety information on education. Information files can be chosen and retrieve according to individual preference. Users can also give suggestion and request for additional information files of their choice. They can send their comments regarding this system. The system will ensure the interactive among the users. This will be through discussion forums. User may start any new topic or take part in existing topics. This will increase the chances of reaching the targeted group. By using HEIS, users mainly school leavers and those who wants to continue higher studies will satisfy with the retrieved information. Basically HEIS is an easy to maintain and ever growing information system.

## CHAPTER 2 : LITERATURE REVIEW

### 2.0 What is Information?

Information is data that have been put into a meaningful and useful context and communicated to a recipient who uses it to make decisions. Information involves the communication and reception of intelligence or knowledge. It appraises and notifies, surprises and stimulates, reduce uncertainty, reveals additional alternatives or helps eliminate irrelevant or poor ones, and influenced individuals and stimulates them into action, [3].

Diagram 2.1: The Information Cycle

Information consists of data, images, text, documents and voice often inextricably intertwined, but always organized in a meaningful context. A simple schematic that represents how we will think of information is shown in diagram 2.1. Notice that data to be processed can be input, stored or both. Another point to remember is the cycle of information. Data are processed through models to create information; the recipient receives the information and then makes a decision and takes action; this creates other actions or events, which in turn create a number of scattered data that are captured and serve as input; and the cycle starts all over again [3].

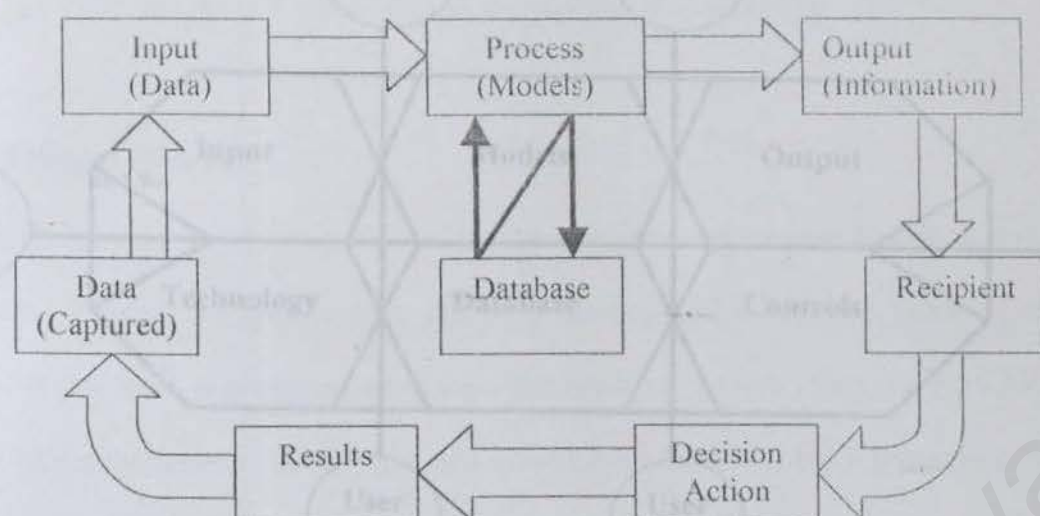


Diagram 2.1: The Information Cycle

## 2.1 What is Information System?

### 2.1.1 Input Block

An Information System can be defined technically as a set of interrelated components that collect (or retrieve) process, store and distribute information to support decision making and control in an organization. Information System may also help managers and workers analyze problems, visualize complex subjects and create new products [3].

All Information Systems are made up of the size building of input, models, output, technology, database, and controls. These are the basic building blocks of all Information Systems.



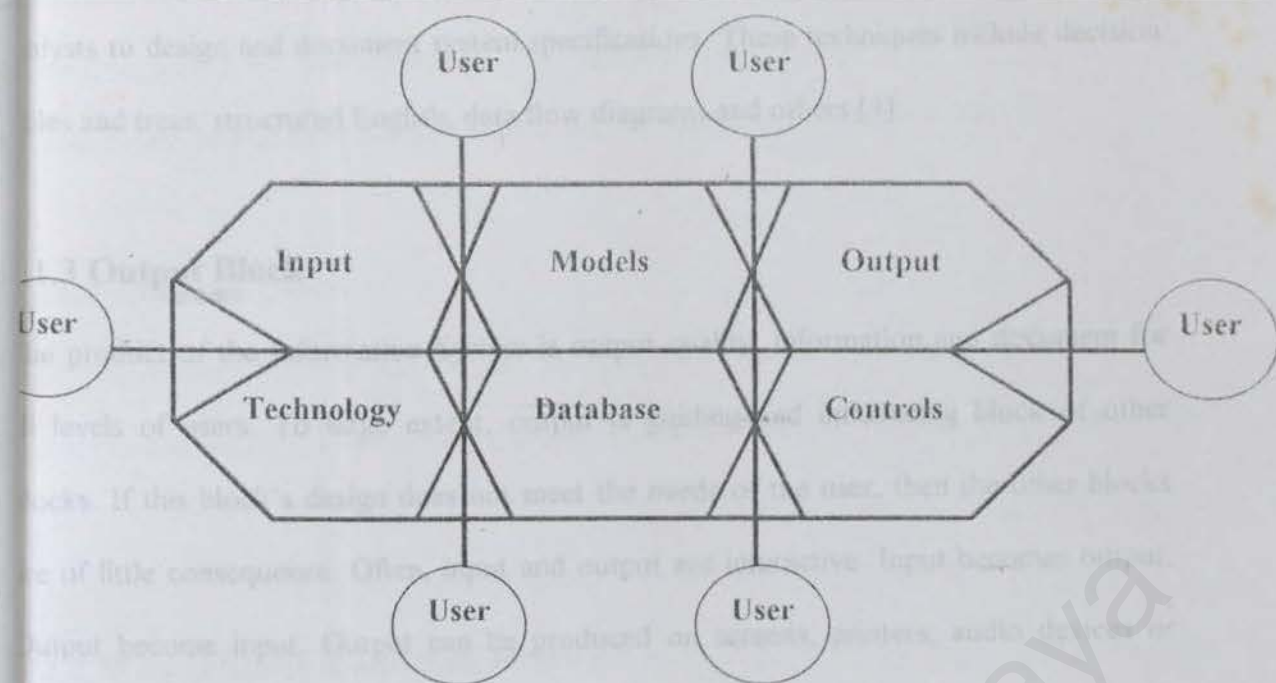


Diagram 2.2: The Information System Building Blocks

### 2.1.1 Input Block

Input represents all the data, text, voice and images entering the Information System and the methods and media by which they are captured and entered. Input consists of transactions, requests, instructions and messages. Generally, input allow protocol and format for proper context, identification, authorization, layout and processing [3].

### 2.1.2 Models Block

This block consists of logic or mathematical models that manipulate input and stored data, in a variety of ways, to produce the desired results of output. The models block also contains a description of some of the more popular modeling techniques used by system



analysts to design and document system specifications. These techniques include decision tables and trees, structured English, data flow diagrams and others [3].

### 2.1.3 Output Block

The product of the Information System is output-quality, information and document for all levels of users. To large extent, output is guiding and influencing block of other blocks. If this block's design does not meet the needs of the user, then the other blocks are of little consequence. Often, input and output are interactive. Input becomes output, Output become input. Output can be produced on screens, printers, audio devices or microfilms [3].

### 2.1.4 Technology Block

Technology is the 'toolbox' of Information System work. It captures the input, drives the models, stores and accesses data, produce and transmits output, and helps control the total system. It does all the toil and grunt works and binds all the building blocks together. Technology consists of three main components: the computer and auxiliary storage, telecommunications and software [3].

### 2.1.5 Database Block

The Database Block is where all the data necessary to serve the needs of all the users are stored. The database is treated from two viewpoints, physical and logical. The physical database is made up of storage media, such as tape, disk, diskettes, cassettes and others.

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this is how data are actually stored. The logical side of database is about how to search or associate, and retrieve the data stored to meet specific information needs [3].

### 2.1.6 Controls Block

All Information Systems are subject to variety of hazards and threats. Some of the controls are designed into system to ensure its, protection, integrity and smooth operation [3].

## 2.2 Why HEIS is made web-based?

HEIS is suitable to be made as a web-based application also as a kiosk-based application.

A web-based application is decided after looking at the advantages and the disadvantages of both types of technology. Before that, it is essential to explore the web technology and have a thorough knowledge on this technology.

### 2.2.1 An Overview of Internet

The Internet is the largest computer network in the world – “a network of networks”.

The Internet consists of thousands of interconnected networks of computers that allow all sorts of computers to interact to one another.

The Internet first began back in 1960's when the United States Department of Defense researched ways of decentralizing computer networks to survive military attack. When it all began, the idea was simple; create a very fault-tolerant network of military computers. By completely decentralizing administration and control and by providing automatic

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routing over multiple paths, the system would be able to withstand everything from minor localized outages all the way up to nuclear war. The first network system was called the ARPANet. Soon, it turned into Internet whereby the educational and government institutions began to form interconnected links among them, eventually resulted into a huge network system.

Like any other types of networks, the Internet has communication protocols. TCP/IP was the original requirement for a computer system or network to be connected to the Internet. The Internet provides a myriad of services, such as the World Wide Web (WWW), e-mail, USENET, FTP, Gopher and Telnet. [4]

### **2.2.2 What is World Wide Web (WWW) ?**

World Wide Web (WWW) was born in early 1989 as a result of efforts by researches at the European Laboratory for Particle Physics (CERN) in Geneva, Switzerland [McGee, 1996]. Their goal was to create an online system that would allow non-technical users to share data without the need to use arcane commands and esoteric interfaces. Within two or three years, users outside CERN were designing and creating powerful browsers. By 1993, the Web and its browsers had become the way to move around the Internet.

WWW is a global, seamless environment in which all information ( in the form of text, images, audio, video, computational services) that is accessible from the Internet can be accessed in a consistent and simple way by using standard set of naming and access conventions. Web sites all over the world can be accessed by connecting to the Internet.

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WWW is popular because it is easy to use, combines any data type, the availability of browsing tools (e.g. Internet Explorer and Netscape) and easy to publish information.

### 2.2.3 Overview of Intranet

Intranet is a private corporate or educational networks that utilizes the Internet's TCP/IP protocol for its underlying transportation. The protocols can run on a variety of network hardware and also co-exist with other network protocols, such as IPX. Users from Intranet can get into the larger Internet resources, but not vice versa because access to Intranet is restricted. Dialing into an Intranet in this way is similar to connecting to the Internet, except that the connection is to a private network. Security of the system can be ensured by having firewalls ( hardware and software combination) that allow access for specific purposes. [5]

### 2.2.4 Web Application Architecture

The web application architecture consists of several components. These components are the core features of any web-based application.

#### 2.2.4.1 Web Application

A web application is similar to any other application except that it resides on a web server. A web application uses the Internet/Intranet and browser to present data and retrieve input. One of the advantages of a web application has over a typical application is that it does not require the users to install any files on their computer. This enables

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users to access the application from any location at any time as long as they have access to the network. This allows developers to modify the application without having to distribute updates to all of the users. [6]

#### 2.2.4.2 Web Browser

The web browser provides a graphical, text-based terminal interface to the web server. This terminal approach provides an interface between user and the web server. The browser translates HTML codes into a graphical user interface within a browser. Two of the most popular browsers are Microsoft Internet Explorer and Netscape Navigator. [7]

#### 2.2.4.3 Web Server

The web server has several functions but basically sending HTML codes to the requesting client browser. The web servers eventually be able to process executable scripts that gave needed functionality and connectivity to other systems. The capability to process and establish these connections to other server-side components is made possible through program execution on the server from various executable sources.

The server-side scripts can transform the web server into a gateway that exposes information stored in other servers. Particularly the Internet Information Server can access information from database servers, mail and news servers, or other COM-based servers. [7]



#### 2.2.4.4 Database Server

Similar to any database management system, a web database is a data store or information repository that can be accessed via a query language. Unlike conventional database systems, access to the web database is not performed using instructions typed at a command line or issued through interfaces that are custom-made for use on a specific computer platform.

Web databases are accessed via other web applications. Specifically for applications that are developed using standardized HTML tags, ActiveX controlled and client-side scripts using VBScript and JavaScript. Using facilities available in HTML, application programs on the web server are accessed through server-side programs via CGI (Common Gateway Interface), server-specified interfaces such as Microsoft's Information Server Application Programming Interface (ISAPI) or server-side scripting environments such as Internet Information Server's Active Server Pages (ASP). HTML form interfaces enable the creation of applications that integrate database functionality and provide access to organizational data repositories on behalf of web clients ( a user or browser).

Applications can be designed solely for the purpose of querying a database and returning a specific information. The application also can use the information retrieved from a database to support more comprehensive applications, for example sales statistics. The capability of integrating a database into applications that can be accessed by users using a web browser is what makes a database a web database. [8]

#### **2.2.4.5 Multimedia on the Web**

Interactive multimedia is slowly entering into the web. Animated segments, platform-independent applications and audio elements are being utilized on the web. The capability of the web in supporting multimedia is increasing as the bandwidth and sophisticated online programming languages have increased. [9]

Multimedia web is more than a static and dynamic graphical environment. Multimedia also integrates auditory data to create a multi-sensory environment. Several browse plug-ins are emerging that which could allow audio data to be streamed over the Internet in real-time. Several digital video stakeholders are working on plug-ins that allow video and audio. One of the most significant contributors to audio streaming technology over the net is Progressive Networks with its Real Audio plug-in. With sound compression, users can hear real-time audio on the Web. Real-time Audio is the technology that allows an audio clip to be played as soon as it starts to come in and buffered in the background.

### **2.3 Web-based VS Kiosk-based**

The decision on why the HEIS is made a web-based application was done after looking at the functionality and the advantages of a web-based application. One of the most important features considered for HEIS is the accessibility of the users. HEIS should be able to provide services to as many users as possible and only a web-based application can support this. There are also other advantages of a web-based application that is discussed below.



### 2.3.1 What is a kiosk?

Information kiosks ( or infotainment kiosks) provide users with access to community and local information (in the case of infotainment also provides entertainment) in an easy understandable format. Kiosks are designed to be used by the average user who has little or no experience with computer or information system. Kiosks act as points of information and are becoming familiar sites at museum and shopping malls. Kiosks are usually operated using touchscreens.

#### 2.3.1.1 Advantages of kiosk-based application

Kiosks usually support different input modes such as using touchscreen, stylus, mouse and keyboard. In the event of failure of an input device will not affect much the input mode. Kiosk-based can be made suitable according to different environment and requirements though the application is the same. It is much easier to handle large audio and video files because usually each kiosk will manage its own database locally. The users do not have to be aware of software and hardware requirements to use the application. Failure of a kiosk will not cripple the application on other kiosk as each kiosk operates independently.

#### 2.3.1.2 Disadvantages of kiosk-based application

Implementing physical security features on a kiosk-based application is difficult. Thus the maintenance of the kiosk is costly as it is susceptible to damages. Providing different input modes are expensive and difficult to implement. The kiosk must be accessible to all types of people with different sizes, physical abilities and language skills. There is no

actual privacy to a user of the application as kiosks are located in high traffic areas to reach the mass. Updating each kiosk is difficult because usually each kiosk manages its own local database. Only a single user can use a kiosk, this limits the number of concurrent users of the application. The users are not allowed to download information because access to storage devices is limited to the administrators for security purposes. Another difficulty with kiosk-based application is determining the location of the kiosks in order to reach the mass.

### **2.3.2 Web-based application**

A web-based application resides in the web server and can utilize the services of Internet/Intranet to extend its services.

#### **2.3.2.1 Advantages of Web-based application**

Web clients are easy to use and most users are familiar with web environment. A web-based application can be used to access documents located not only locally but any other web server on the Internet/Intranet. Its ability to reach the geographically dispersed users with consistent content is another advantage. The web is capable of communicating at reasonably fast speeds, allowing audio, text, graphics and even video to be transmitted to diverse locations fairly inexpensive. [10] With CGI, users can gain access to a host of other Internet services. It is much cheaper to implement a web-based application compared to kiosk-based application. The functionality of the application can be extended easily. Users can have better privacy and freedom to use the application without any time limit or concerning other users to use the application. It is easy to maintain the



application because it resides in the web server. Updating the server will update the whole application. Users can download information from a web-based application

### 2.3.2.2 Disadvantages of Web-based application

The streaming of large audio files is difficult however can be overcome but using compression technology (real audio). Failure to the web server will cripple the entire application. Mouse is the main input device, failure of the mouse will discourage the users from using the application. The users must be aware of the software and hardware compatibility to use the application. A reasonable fast link between the user side and the server is necessary in order to communicate effectively.

## 2.4 Research On Other Higher Education Systems

This research method was done by browsing the internet to obtain and subsequently study the relevant Information System on the web about higher education in Malaysia in a better perspective. The studies were focus mainly on the web pages listed below.

### 2.4.1 Study Malaysia

This is a site where we can retrieve various information on education which is divided into sections [11]

- Course directory
- Colleges and Universities
- Help Desk
- Scholarships



#### 4.1.1 Links

provides direct links to web sites of colleges and universities, like:

- APIIT
- Kolej Bandar Utama
- Systematic
- Sunway College
- Inti College
- Informatics
- International College of music
- The One Academy

Besides that it provides links to education departments in Malaysia, like:

- Ministry of Education Malaysia
- Department of Private Education
- National Association of private Independent Educational Institution
- Malaysian Association of Private Colleges

#### 2.4.1.2 Study Guide

This section provides information of colleges and universities in various way, such as:

- Course directory
  - Colleges and Universities
  - Help Desk
  - Scholarships
-

### 2.4.1.3 Education Community

This is a section to make interaction between students, teachers and colleges. It has the following sub-sections:-

- Who's who – People behind our education Industry
- Education Information Centre – Provides articles on education
- Student's View
- Forum

### 2.4.1.4 Education Financing

This section information about financial aid or scholarship for students, such as:-

- STAR Education Fund 2000
- MAPCO Scholarship Fund 2000

### 2.4.1.5 Study Forum

This is a section where users can post question or comment on education system in Malaysia. This is to ensure the interactivity among the users.

## 2.4.2 The Star – Education

This is a site where users can find information on local and foreign institutes. Basically this is a search engine, where searching can be made by selecting city, course and level (Diploma, Higher Diploma and Degree) [12]. Following information will be provided:-

- Name of the institution
  - Address
-

## • Course

## • Level

## • Telephone And Fax number

## • Link to the web site

## 2.5 Conclusion

Based on these findings, HEIS was decided to be a web-based infotainment application to support various users. Through this web-based application, once connected to the Internet, users from anywhere in the globe can gain access to this application time and place independent.

Research has been carried out on available higher education system in internet. With the knowledge and research on other available course registering system, we can develop better software for this online application. This is the aim in Literature review to let us study and read the information.

With the advances of computer and communication technologies HEIS will provide an effective and efficiency system to the administrators and students. Furthermore, the system also can provide sufficient facilities to handle the course registration process. Therefore, it is no doubt for the administrators and students to totally migrate to this new approach.



## CHAPTER 3 : SYSTEM ANALYSIS

### 3.0 Introduction

Requirement analysis enables the system engineer to specify software function and performance, indicates software interface with other system elements, and establishes design constraints that the software must meet. A complete understanding of software requirements is essential to the success of a system development effort. No matter how well designed or well coded, a poorly analyzed and specified system will disappoint the user and bring grief to the developer.

### 3.1 Process of Web Publishing

The process of Web Publishing has been studied as to look into the best approach to build a web site. Knowing the right approach is vital to the success of the web site development, processes of web publishing are as followed [13]:

- **Determining purpose:-**

A general idea of what the site for, purpose of a web site can be business-to-business communication, commerce, information, research and education or others.

- **Determining the user:-**

The web site designer has to consider a site's user, either they are coming from within the organization or from outside, their age, the language they use, the time they visit, the technologies they support, and the browser they use.

- **Defining goals:-**

The specific idea of what the site is for and it is measurable. It can be the number of the visitors or the sales figures of products.

- **Setting the scope:-**

The scope of information reflects the purpose, however, having too much information makes it difficult to find essential information.

- **Organization of information:-**

Is a matter of grouping similar items in the same place in order to facilitate the visitors.

- **Determining the final plan:-**

Once the purpose, content and structure of the site have been determined, a plan can be developed. The plan should consist of a flow chart of the site, a time line, and a document that describes what is needed and how the site will be put together.

### 3.2 Development Strategy

In software engineering, there are many types of software process models. The software process model selected for this project is waterfall model with prototyping. As illustrated in Diagram 3.1 below, this model presents a very high-level of what goes on during project development. It also suggests to developers the sequence of events they should expect to encounter during the project development.

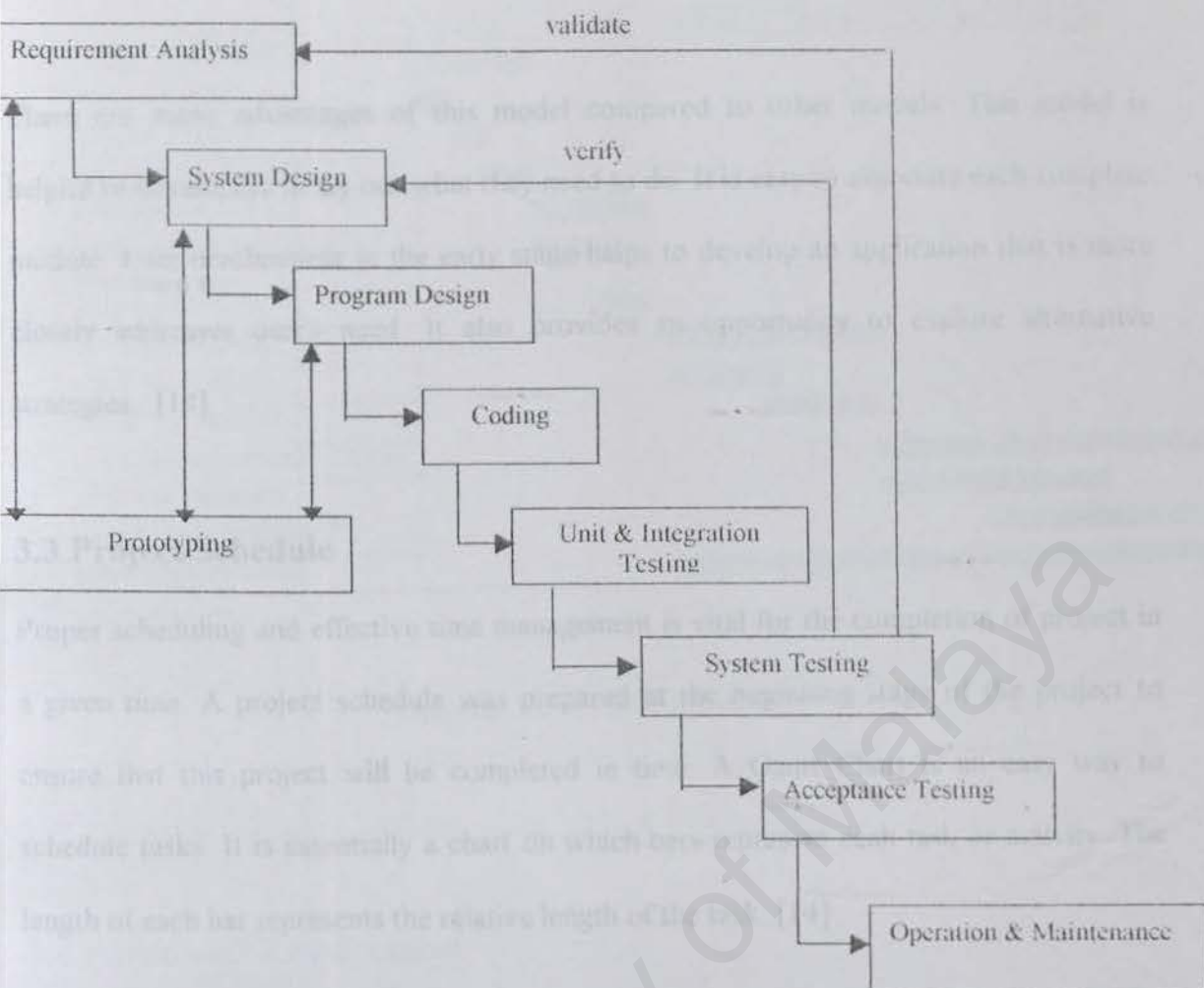


Diagram 3.1 Waterfall Model with Prototyping

Prototyping is incorporated to implement a small portion of some key requirements to ensure that the requirements are feasible, if not, revisions are made. Parts of the design may be prototyped to help assess alternative design strategies. Often this user interface is built and tested as prototyped. During the process, validation ensures that the system has implemented all of the requirements. Verification ensures that each function works correctly.



There are many advantages of this model compared to other models. This model is helpful to developers to lay out what they need to do. It is easy to associate each complete module. User involvement in the early stage helps to develop an application that is more closely addresses user's need. It also provides an opportunity to explore alternative strategies. [14]

### 3.3 Project Schedule

Proper scheduling and effective time management is vital for the completion of project in a given time. A project schedule was prepared at the beginning stage of the project to ensure that this project will be completed in time. A Gantt Chart is an easy way to schedule tasks. It is essentially a chart on which bars represent each task or activity. The length of each bar represents the relative length of the task. [14]

### 3.4 Functional Requirement

A functional requirement describes an interaction between a system and its environment.

Diagram 3.2 below shows the project schedule of this project.

Functional requirements for this system are described below.

#### 3.4.1 Client Section

Client Section consists of component for the client or user environment.

##### 3.4.1.1 Electronic Catalog

Users can browse information grouped by various categories. The catalog displays study levels like diploma, higher diploma and degree, and name of colleges and universities grouped under state.

ID	TASK NAME	JUL'00	AUG'00	SEP'00	OCT'00	NOV'00	DEC'00	JAN'01	FEB'01
1	FEASIBILITY STUDY								
2	IDENTIFY PROBLEM								
3	IDENTIFY SCOPE								
4	IDENTIFY OBJECTIVE								
5	SYSTEM ANALYSIS								
6	DATA COLLECTION AND ANALYSIS								
7	REQUIREMENTS								
8	SYSTEM DESIGN								
9	LOGICAL DESIGN								
10	PHYSICAL DESIGN								
11	SYSTEM IMPLEMENTATION								
12	SYSTEM TESTING								
13	SYSTEM MAINTENANCE								
14	DOCUMENTATION								

Diagram 3.2 Project Schedule

### 3.4 Functional Requirement

A functional requirement describes an interaction between a system and its environment.

Functional requirement for HEIS has been described below.

#### 3.4.1 Client Section

Client Section consist of component for the client or user environment.

##### 3.4.1.1 Electronic Catalog

Users can browse information grouped by various categories. The catalog displays study levels like diploma, higher diploma and degree, and name of colleges and universities grouped under states.

### 3.4.1.2 Search Engine

The search engine allows users to search for information according to various criteria such as college name, course and study level. Input string allows exact or partial match.

### 3.4.1.3 Post Feedback

Users are encouraged to post their feedback about the information through e-mail. This is to ensure that the users are being benefited by HEIS.

### 3.4.1.4 Online Request

Users can request for the details of any information. User may request for more details of any colleges or courses. The administrators will reply them by answering their request.

This will ensure a better user involvement with the application.

### 3.4.1.5 Forum Hub

This module enables users to share their views and opinions. Through this module the users can exchange and publish the information related to education. This ensures interactivity among the users of HEIS.

### 3.4.1.6 Online Application

This module enables the users to send application online to colleges. A form will be provided where the users can fill the required fields and submit. of the application to obtain assistance needed in using the application.

---



## 4.2 Administration Section

This section is for the administrator environment.

### 3.4.2.1 Catalog Maintenance

This module allows the HEIS administrators in adding, deleting and updating records of information and data.

### 3.4.2.2 Information Maintenance

This enables the administrators to update, delete and add information accordingly. This module also enables administrators in changing the information presentation mode accordingly.

## 3.5 Non Functional Requirement

Non functional requirements are a set of constraints under which a system must operate and the set of standards that which a delivered system must meet.

### 3.5.1 Browser

The application requires a browser at the client PC that is Microsoft Internet Explorer 4.0 or higher, or Netscape Navigator 4.04 or higher.

### 3.5.2 User Friendliness

A Graphical User Interface (GUI) is required for best visual effect. The application should provide easy navigation, meaningful messages to help users use the application confidently.

### **3.5.2 Multimedia**

The application should be attractive, delivering information and services using multimedia features such as images, animations and audio effects. This will ensure that this application is entertaining.

### **3.5.3 Security**

The system shall minimize the vulnerability of the information assets and resources by providing the mechanism of authentication and authorization security. This is to ensure identity authentication before authorize access rights.

### **3.5.4 Application Architecture**

The system should be based on publicly defined, open standards for fast creation and easy deployment of robust, dynamic, and platform independent application. [15]

### **3.5.5 Communication**

The system should provide secure and reliable communication between remote clients and we server through open Internet standards. Easy access and retrieval of required information should be available with a minimal transaction time. [15]

### **3.5.6 User Friendliness**

A Graphical User Interface (GUI) is required for best visual effect. The application should provide easy navigation, meaningful messages to help users use the application confidently.

---

## 5.7 Performance

high quality and consistent service is required.

## 5.8 Robustness

Robustness refers to the quality that causes a system to be able to handle or at least avoid the disaster in the case of unexpected circumstances such as input of improper data. HEIS supports robustness by developing a program's logic to process error in the input, such as testing for the presence of the numeric data that was accidentally keyed into alphabetic field. When such errors are detected, an error message will be displayed to acknowledge the user to re-enter data so that further correction can be taken.

## 5.9 Modularity

Program coding is done using modular approach where a complex large routine is broken down into smaller modules. This approach is used as it enhances maintainability of the program code and improves the readability of the program code.

## 5.10 Maintainability

This is to ensure that the program can be understood, corrected if an error is encountered, adapted if its environment changes or enhanced if the user desires change in requirements.



## 3.7 Consideration of Programming Technology

### 3.6 Runtime Requirements

#### 3.6.1 Server Hardware Requirements

The server computer requirements are :

- i) A server which is at least a Pentium 133 MHz processor.
- ii) At least 32MB RAM
- iii) Network Interface Card (NIC) and network connection with recommended bandwidth of 10 Mbps or more.
- iv) Other standard computer peripherals

#### 3.6.2 Client Hardware Requirements

Reasonable amount of RAM and a reasonable dial-up connection line. The recommended configuration is:

- i) At least 32 MB RAM
- ii) Network connection through existing network configuration or a modem (recommended at least 14.4 Kbps)
- iii) Standard computer peripherals that can support multimedia features

#### 3.6.3 Client Software Requirements

HEIS requires a browser at client PC that is Microsoft Internet Explorer or higher, or Netscape Navigator 4.04 or higher.

## 3.7 Consideration of Programming Technology

### 3.7.1 Active Server Pages

Microsoft Active Server Pages (ASP) is a server side scripting environment primarily used for the Microsoft Internet Information Server (IIS) 3.0 web server used to create and run dynamic and interactive web server applications. Recently, third party vendors have ported ASP to other web servers, such as the Netscape Enterprise Server. With ASP, HTML pages, script commands, and ActiveX components can be combined to create interactive web pages or powerful web-based applications, rather than merely publishing content. ASP applications are easy to develop and modified. [16]

#### 3.7.1.1 The Active Server Pages Model

An ASP script begins to run when a browser requests an .asp file from the web server. The web server then calls ASP, which reads through the requested file from top to bottom, executes any script commands and sends a web page to the browser.

Because ASP script s run on the server rather than on the client, the web server does all the work involved in generating the web pages that are sent to browsers. The web server does all the script processing, transmitting standard HTML to the browser. Server-side scripts cannot be readily copied because only the result of the script is returned to the browser. Users cannot view the script commands that created the page they are viewing.

Figure 3.1 shows the ASP model. Diagram 3.4 shows the components of ASP applications.

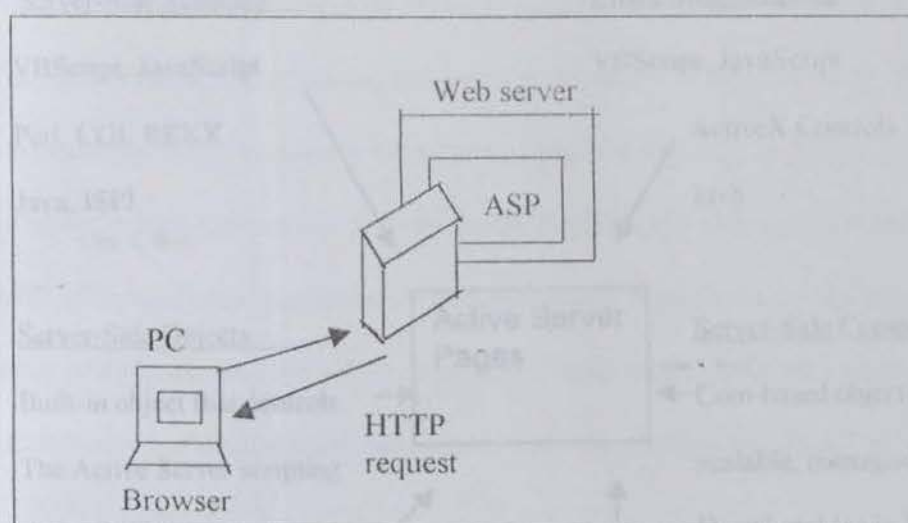


Figure 3.1 Active Server Pages Model

Diagram 3.2 The components that form Active Server applications.

### 3.7.2 Comparison between various web programming technology

#### 3.7.2.1 ASP compared to CGI

ASP provides all of the functionality of CGI application in an easy-to-use and secure robust environment. ASP is an easier way for the server to access information in a form not readable by the client (such as an SQL database) and then act as a gateway between the two to produce information the client can view and use.



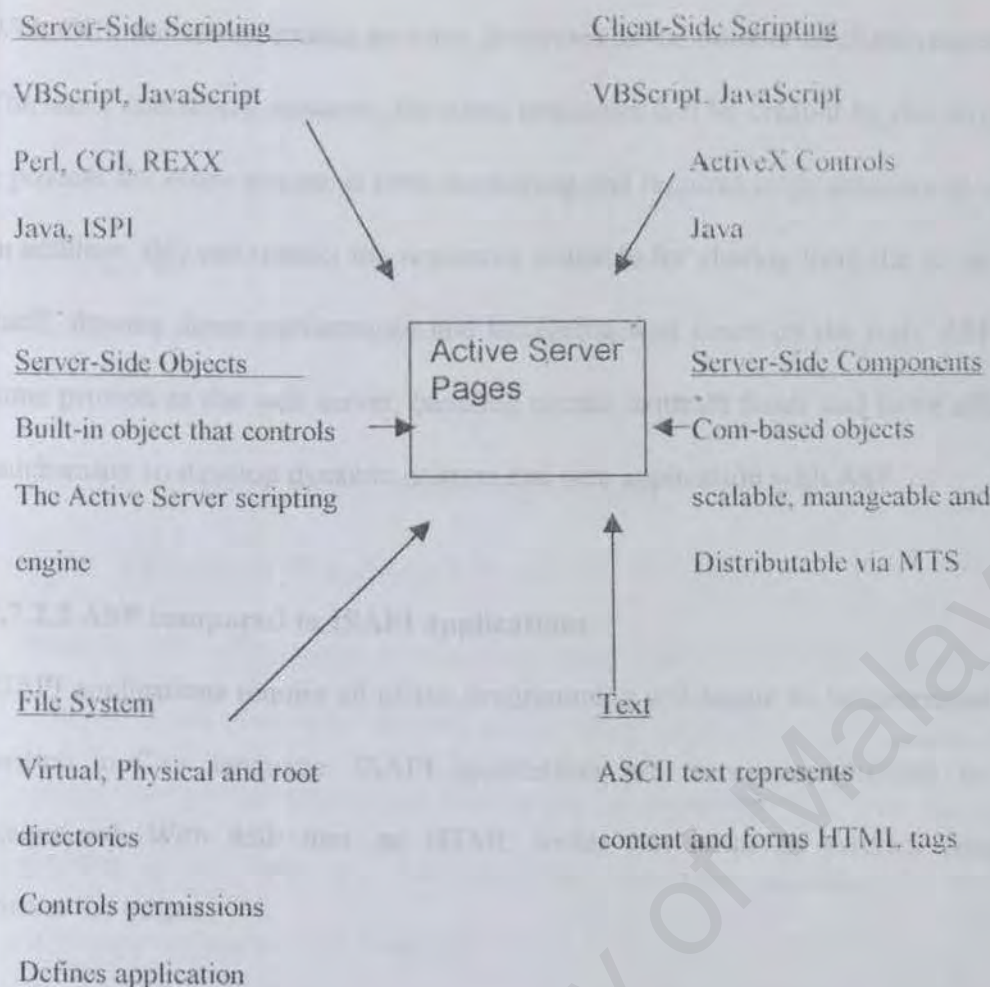


Diagram 3.3 The components that forms Active Server applications.

### 3.7.2 Comparison between various web programming technology

#### 3.7.2.1 ASP compared to CGI

ASP provides all of the functionality of CGI application in an easy-to-use and more robust environment. ASP is an easier way for the server to access information in a form not readable by the client (such as an SQL database) and then act as a gateway between the two to produce information the client can view and use.

With CGI, the server creates as many processes as the number of client requests received. The more concurrent requests, the more processes will be created by the server. Creating a process for every request is time-consuming and requires large amounts of server RAM. In addition, this can restrict the resources available for sharing from the server application itself, slowing down performance and increasing wait times on the web. ASP runs in the same process as the web server, handling clients requests faster and more efficiently. It is much easier to develop dynamic content and web application with ASP.

#### **3.7.2.2 ASP compared to ISAPI applications**

ISAPI applications require all of the programming and layout to be contained in a .dll file written in C++ language. ISAPI applications are thus more difficult to create and maintained. With ASP files, an HTML writer can script an external component and format the output.

#### **3.7.2.3 ASP compared to PERL**

PERL and other scripting languages are not robust development tools by themselves. ASP provides a familiar framework and objects for building complex applications that require data from relational databases and legacy sources. ASP supports virtually any scripting language to build these applications.



### 3.7.2.4 ASP compared to Netscape LiveWire

Netscape LiveWire requires the use of JavaScript, while ASP supports the use of almost any scripting language. With native support for VBScript, after each change made in the script, the application is stopped and restarted. ASP recognizes when an ASP file changes and automatically recompiles the application at the next request.

## 3.8 Consideration of Operating System

### 3.8.1 Microsoft Windows NT 4.0

Windows NT offers many benefits over other operating system. By making use of these benefits, developers will be able to be more productive and publish content on the Internet by exploiting various capabilities of Windows NT. The following are some features of Windows NT that developers can take advantage of when setting up information system on the Internet:

- i) compatibility with Windows 3.X and DOS applications
- ii) user friendly environment and ease of use
- iii) low administration costs
- iv) true Trunkey solutions
- v) cost saving

[17]

Like the UNIX operating system, Windows NT breaks its modules down into two modes: administrator and user. This separation allows the operating system to be more stable, as a module or program running in the user mode, is not likely to crash the whole system.



Windows NT 4.0 includes additional tools that specifically benefit its use as an Internet/Intranet server operating system such as Microsoft Internet Information Server (IIS) 4.0 which comes with NT server. Windows NT is a good fit in medium to large organizations that plan to have medium to large Intranets/ Extranets. [18]

## **Consideration of Web Server**

### **Microsoft Internet Information Server 4.0**

Microsoft IIS 4.0 is a high performance web server for Windows NT Server. IIS brings many advanced capabilities, both as a web server for corporate Intranets and public Internet sites and as a platform for the next generation of line-of-business applications.

IIS incorporates WWW, FTP, Index Server and Secure Sockets Layer (SSL) services. IIS provides a comprehensive set of tools for the web server and its components.

IIS makes it easy to build scalable and reliable applications for the web. With IIS, the benefits of transactions can be integrated into web applications. IIS brings together the advantages of Windows NT server, with a range of services for client server development, and the standard of the Internet to create a true web platform for distributed applications. Diagram 3.5 shows the relationship between IIS and the supporting web services that can be used.

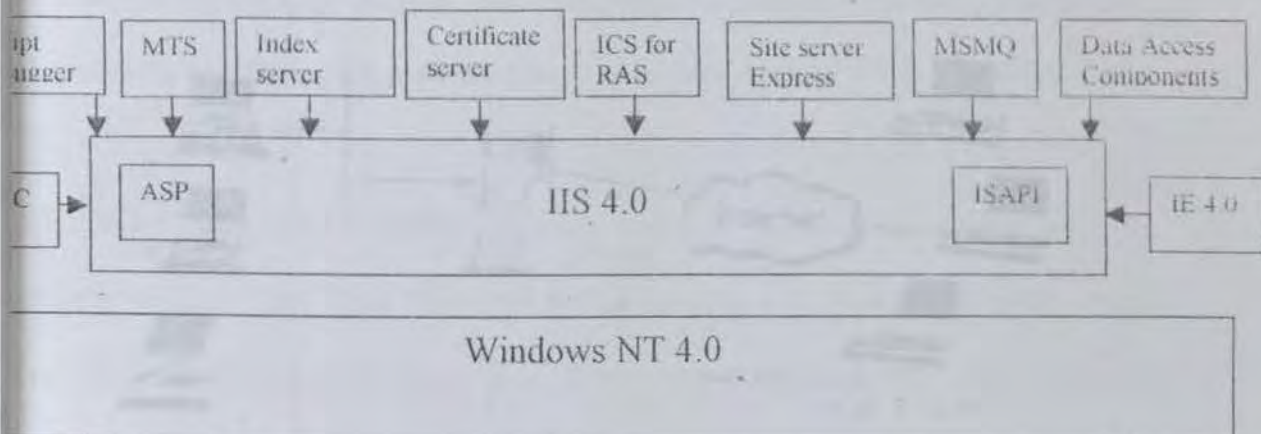


Diagram 3.4 Relationship between IIS and the supporting Web services

[19]

## 2 Lotus Domino

Domino is designed to provide Web client access to Notes data and applications. It transforms Lotus Notes into an Internet applications server. Domino combines the open working environment of Internet standards and protocols with the powerful application development facilities of Notes, enabling designers to develop a broad range of business applications for the Internet and Intranets.

Domino Web Server merges Web HTTP Server technology with Notes technology to allow any web browser or client to access data and application stored in Notes database.

[20]

Web page designers can use Domino to build applications that take advantage of core Notes functionality, such as replication, document management, security, workflow and full-text searching capabilities. Figure 3.2 shows the domino architecture.



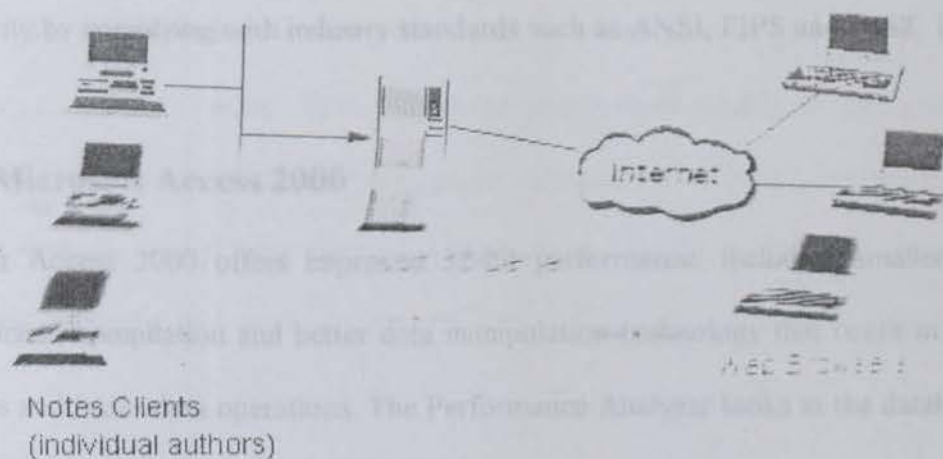


Figure 3.2 The Domino Architecture

## 10 Consideration of Database server

### 10.1 Microsoft SQL Server 6.5

Microsoft SQL Server 6.5 is a scalable, high-performance database management system designed specifically for distributed client server computing. Its built-in data replication, powerful management tools, Internet integration and open system architecture provides a superior platform delivering cost-effective information solutions.

Designed with the Internet and Intranet in mind, Microsoft SQL Server provides high-performance access to information on company's web page. The new Web Assistant enables to populate the web server with SQL data through a variety of methods, allowing distribution of company's data on a private Intranet or worldwide on the Web.



SQL Server 6.5 also meets the most demanding requirements for reliability, data integrity and security by complying with industry standards such as ANSI, FIPS and NIST [21].

## 10.2 Microsoft Access 2000

Microsoft Access 2000 offers improved 32-bit performance, including smaller forms, more efficient compilation and better data manipulation technology that result in quicker responses and faster data operations. The Performance Analyzer looks at the database and suggests ways to speed it up.

Access 2000 has an integrated development with Microsoft Visual Basic for Applications and ActiveX. Its Intuitive IDE features include drag-and-drop code, color-code syntax and improved debug window and in-place object browsing.

Visual Basic for Applications is the programming language shared across all Microsoft Office 2000 applications provides sophisticated programming, interface and debugging tools. ActiveX makes it a breeze to automate database functions, link to other applications and objects, and deploy custom solutions with rapid, automated control.

## 10.3 Lotus Notes

Lotus Notes starts with shareable, distributed, document-oriented database. It adds messaging in the form of fourth-generation (hypertext-enabled) electronic mail and the ability of Notes databases to pass messages to each other.

At the heart of Notes is its shared document databases technology. Notes databases consist of a collection of documents contributed by users or added automatically by the system in response to various events. The documents can include highly formatted text and embedded objects, such as spreadsheet ranges, references to record in external databases, graphics, images, sound bites and video clips. Notes databases can add to and access them simultaneously.

All Notes databases can be mail enabled, meaning that they can be made to send documents to each other via its built-in store-and-forward messaging capability. A by-product of this is Notes Mail, which is a built-in e-mail system. [22]

## 3.11 Consideration of Data Access

### 3.11.1 Active Data Object 1.0

Active Data Object (ADO) 1.0 is a technology that can be used by web page developers to add database access to their online content. Database access opens up a world of information that can be used to customize web-site offerings based on users preference, past usage history, or up-to-the-minute news. Database applications with ADO can be written as online applications, accessed anywhere over the global Internet.

ADO is a technology meant for applications and Web-site developers with modest programming skills. It is capable of condensing otherwise complex and lengthy programming tasks into simple-to-use with a full range of advanced features. ADO makes both common and advanced operation simpler to use than ever before.



language. This means that besides being consistent across multiple

... on various platforms. ActiveX Data Objects are accessible on any

can be built by using ADO on the server to deliver customized

Model is composed of six primary objects: Connection, Error,

rs, Recordset and Fields.



## 1.2 Remote Data Object 2.0

Remote Data Object (RDO) 2.0 is specifically designed to deal with remote intelligent sources. It provides a high granularity of control over remote data sources so that the need to resort to the exposed Open Database Connectivity (ODBC) interface is not required. RDO also includes the availability to create local cursors as well as dissociate the sets and connections.

RDO is also fully asynchronous and event-driven. With RDO 2.0, developers need not to wait for operation completion as an event is fired whether or not the operation succeeds. This technology allows for leveraging the ability of Windows 95 or Windows NT to run multiple threads of executions. RDO 2.0 is also thread-safe so it is suitable for use in multiple-threaded headless components executed on a remote server. RDO is also available when working with SQL Server, Oracle or any relational database that is exposed through an ODBC driver regardless of its ODBC compliance level.

## 2 Consideration of Programming Language

### 2.1 HyperText Markup Language (HTML)

In addition to being a markup language for displaying text, images and multimedia, HTML provides instructions to web browsers in order to control how documents are viewed and how and how they relate to each other. For all its simplicity, HTML is a very powerful language. HTML allows the individual elements on the web to be brought together and presented as a collection. Text, images, multimedia and other files can all be packaged together using HTML. [23]

## 2 Visual Basic Script (VBScript)

1 Basic scripting Edition or VBScript is Microsoft's scripting language for the net. The ability to provide scripting, automation and customization capabilities for browsers is a major feature of VBScript. VBScript embedded into HTML files adds HTML into something more than a page-formatting language. Pages with script can change every time they are loaded into browser. They can also respond instantly to user actions. VBScript is both a client-side and server-side programming language. A client-side programming language is a language that can be interpreted and executed by a browser. A server-side programming language is a language that executes on the server that serves a web site's files. [24]

## 3 Java Script

Script is an interpreted programming or script language from Netscape. Java Script another scripting extension to HTML, extends the ability to respond to user events without the need for client-server communication. Java Script eliminates much of the client-server communication by shifting responses to the use events such as mouse clicks and form activities, to the client side. Because network transmission is not required, the process goes much faster. Besides that, less load is incurred on the server.



### 13 Consideration of Programming Tools

#### 13.1 Microsoft Visual Interdev 1.0

Microsoft Visual Interdev (VID) 1.0 empowers web application developers to rapidly build fully interactive, dynamic web sites. With visual development features and powerful database tools, VID provides the most complete and technically advanced development system for building both Intranet and Internet applications.

The core features and benefits of VID are:

- i) Enables rapid, visual development by providing a visual, integrated development environment for building database-driven web applications.
- ii) Powerful, integrated database tools make it easy to create fully dynamic, database-driven web sites using a variety of databases supporting Open Database Connectivity (ODBC).
- iii) Allows team-based and stand-alone development.
- iv) Flexible and standards-based, delivering HTML-based applications that are browser and platform independent.

#### 3.13.2 Lotus Notes

Lotus Notes (NL) is a group ware product. LN addresses all aspects of group activity such as e-mail programs, bulletin board, discussion software, form routing products, etc. Besides that, it has document databases and messaging capability. Notes provides a rich programming environment, offering developers a collection of programming languages.



They range from simple Notes @ function language, to more powerful and complex ones like LotusScript, the LN API, HiTest Tools for Visual BASIC, HiTest Tools for C++ and numerous third-party programming tools. [25]

## 14 Conclusion

ASP is chosen to develop and for the implementation of HEIS for the following reasons:

ASP can contain support server-side scripts, allowing the creation of dynamic web pages.

It provides a number of built-in objects which allows retrieval and sending of information to and from browsers.

- i) It can interact with a database such as Microsoft SQL Server using objects like ADO.
- ii) It is browser independent, because its codes are executed on the server.

Windows NT 4.0 will be the operating system for the development and implementation of HEIS. The reasons for this are :

- i) It integrates with web server, IIS and thus can be used efficiently.
- ii) It is a robust and secure operating system that can manage mission-critical information systems.
- iii) It's ability to run multiple applications, preemptively multitasking each of them if there are enough resources.
- iv) Various web development applications are available in Windows NT thus offering an integrated environment to develop content for the WWW.

It is easy to administer through various GUI administration tools.

Microsoft IIS 4.0 is chosen as the web server. This is because:

It is the core Windows NT Service that provides Internet services and is available free with Windows NT.

It supports various Internet publishing protocols such as WWW, FTP, NNTP and SMTP.

Microsoft SQL Server 6.5 is considered as database server because:

It is tightly integrated with NT and thus has good NT-based security feature.

It supports high volume of storage up to 2 terabytes per database and can hold up to maximum 32,767 databases which is an advantage over Microsoft Access.

It provides ease of database administration with SQL Server Enterprise Manager, which has a point-and-click interface for setting up replication among multiple users.

Unlike Lotus Domino, SQL Server is a relational database model.

The ActiveX Data Object (ADO) will be the data access model to make connections to the database. ADO works seamlessly with ASP.

Web pages in HEIS consist of ASP files that are coded in HTML, VBScript and JavaScript. VBScript is used as server-side scripting while client-side scripting uses JavaScript. JavaScript was chosen because it is fairly simple to implement and maintain.

is readable, can be changed almost instantly by an administrator, and requires no supporting software other than the client's browser. One of the most valuable features of JavaScript is its ability to "sense" a user's actions (such as mouse clicks, form input masks] or page navigation) on the client side and respond to them via a predetermined script. VBScript is a high performance scripting language designed to create active, online content on the WWW. Furthermore, Microsoft IIS and ASP both fully support VBScript.

Microsoft Visual Interdev 1.0 will be used to provide the project development environment for HEIS. Although VID has newer versions but it is not chosen because it takes up large amount of system, which slows down the computer processing speed, thus affecting the development progress. Lotus Notes 4.6 is not chosen due to unfamiliarity to Lotus environment.

Figure 3.3 shows the overview of the web-based infotainment application, HEIS architecture.



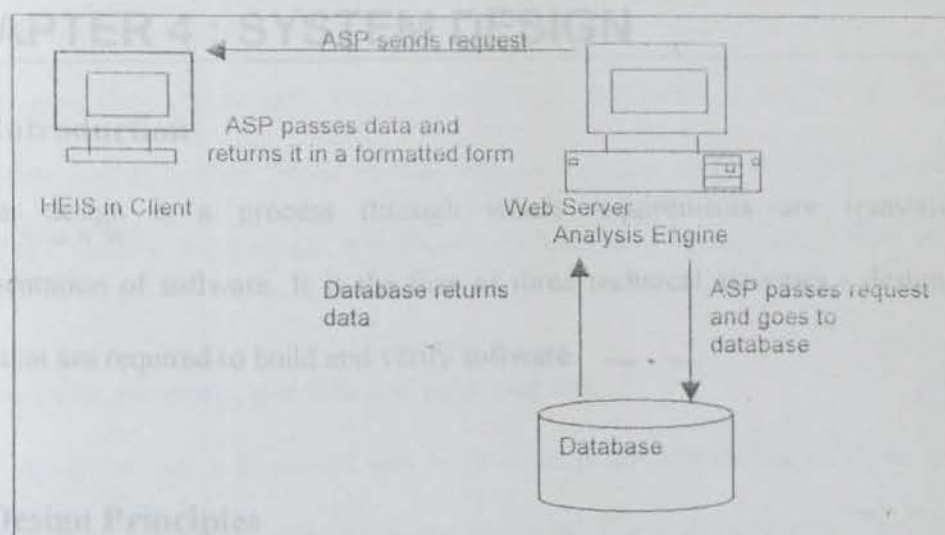


Figure 3.3 : HEIS Architecture.

## CHAPTER 4 : SYSTEM DESIGN

### 4.0 Introduction

System design is a process through which requirements are translated into a representation of software. It is the first of three technical activities - design, code and test - that are required to build and verify software.

### 4.1 Design Principles

Since HEIS is a web application, the following principles guide the design phase.

#### a) Build associative meaning

HEIS will take advantage of the power of hypertext to link related information. Web pages contain links to further context information as well as chunk information.

#### b) Maintain competitiveness

Because the Web is so competitive, HEIS will make sure that their designs include the lowest possible costs to their users. User costs include download time, information-retrieval time, and the effort required to use and understand information.

#### c) Efficiently use resources

When designing and implementing a web, select features that meet the user's needs with the least amount of space, access time, graphics, and long-term maintenance requirements.

d) **Recognize porousness**

Recognize that a user may enter a web from any other point on the Web. After entering a web, a user might not be able to interpret cues that depend on a web's linking structure; for example, Up, Down, or Next labels would mean very little.

e) **Consistent, pleasing, and efficient look and feel**

The design of the web should aim to give users an impression on all its pages of a common, coherent organization and consistent visual cues. Each page of the web should cue users to the web's identity and page purpose. The web's overall appearance should help users accomplish their objectives through interfaces that strike a balance between simplicity and completeness and aim for an aesthetically pleasing appearance.

f) **Support Interactivity**

At the minimum level, HEIS will allow users to communicate with the web developers for questions or problems. There are greater levels of interactivity, ranging from forms interfaces to computations and gateway programs. Such interactivity include an e-mail contact address to webmasters, interactive features (for example, identifying the security of forms transactions).

g) **Support user navigation**

A good web design should support user navigation by supplying navigation and information links. These links will cue users about how to use the information on a



page (information cues) and how to get further or contextual information (navigation cues).

### 4.3 Overview of HEIS Architecture

Figure 4.1 shows the overview of the web-based infotainment application, HEIS architecture.

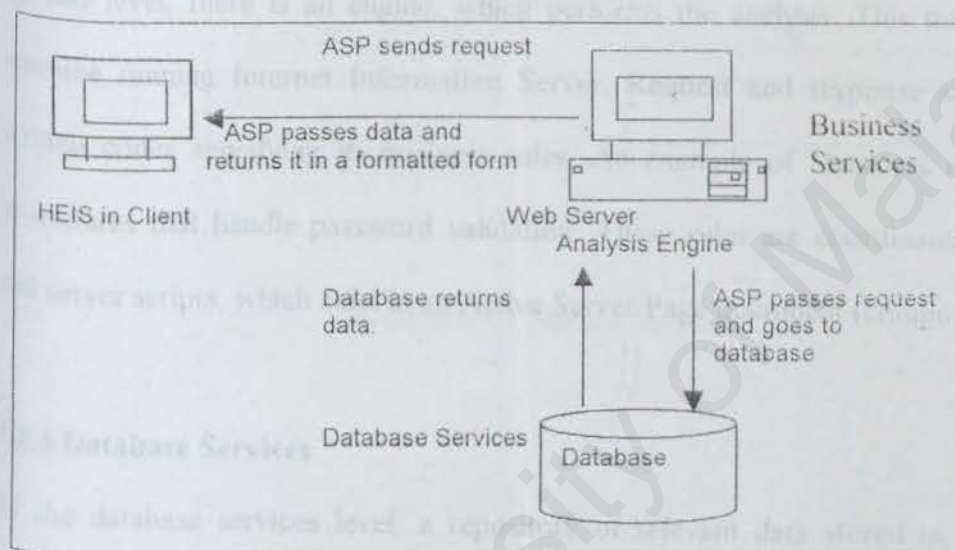


Figure 4.1 An overview of HEIS Architecture

HEIS will be designed to leverage the traditional client/server architecture and extends it to the web, which is divided into three distinct tiers – user services, business services and database services. Components were built into each tier to fulfill its role and then tied together to form a final solution.

## 4.3 Process Design

### 4.3.1 User Services

At the user services level ( which is the client browser), there is a component to gather input variables for the analysis(e.g. a user request on a web page). There is also a component to display the results of the analysis to the client.

### 4.3.2 Business Services

At this level, there is an engine, which performs the analysis. This tier resides on the machine running Internet Information Server. Request and response are controlled by written codes specifying its business rules. An example of business rule is a set of procedures that handle password validation. These rules are coordinated by both client and server scripts, which exist in an Active Server Page document (component scripting)

### 4.3.3 Database Services

At the database services level, a repository of relevant data stored in the database is available to support the work performed by the analysis engine.

## 4.4 Process Design

### 4.4.1 System Structure Chart

The system structure is based on the functionality modules. The figures below shows the system structure for the Client Section and Administration Section respectively.

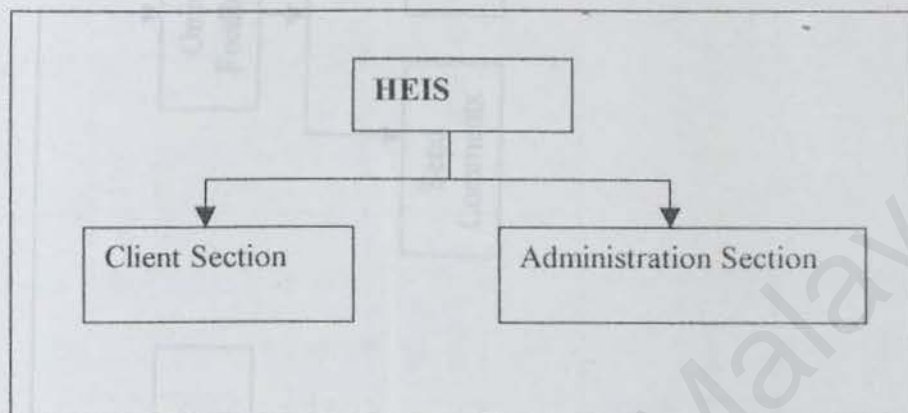


Diagram 4.1 System Structure Chart



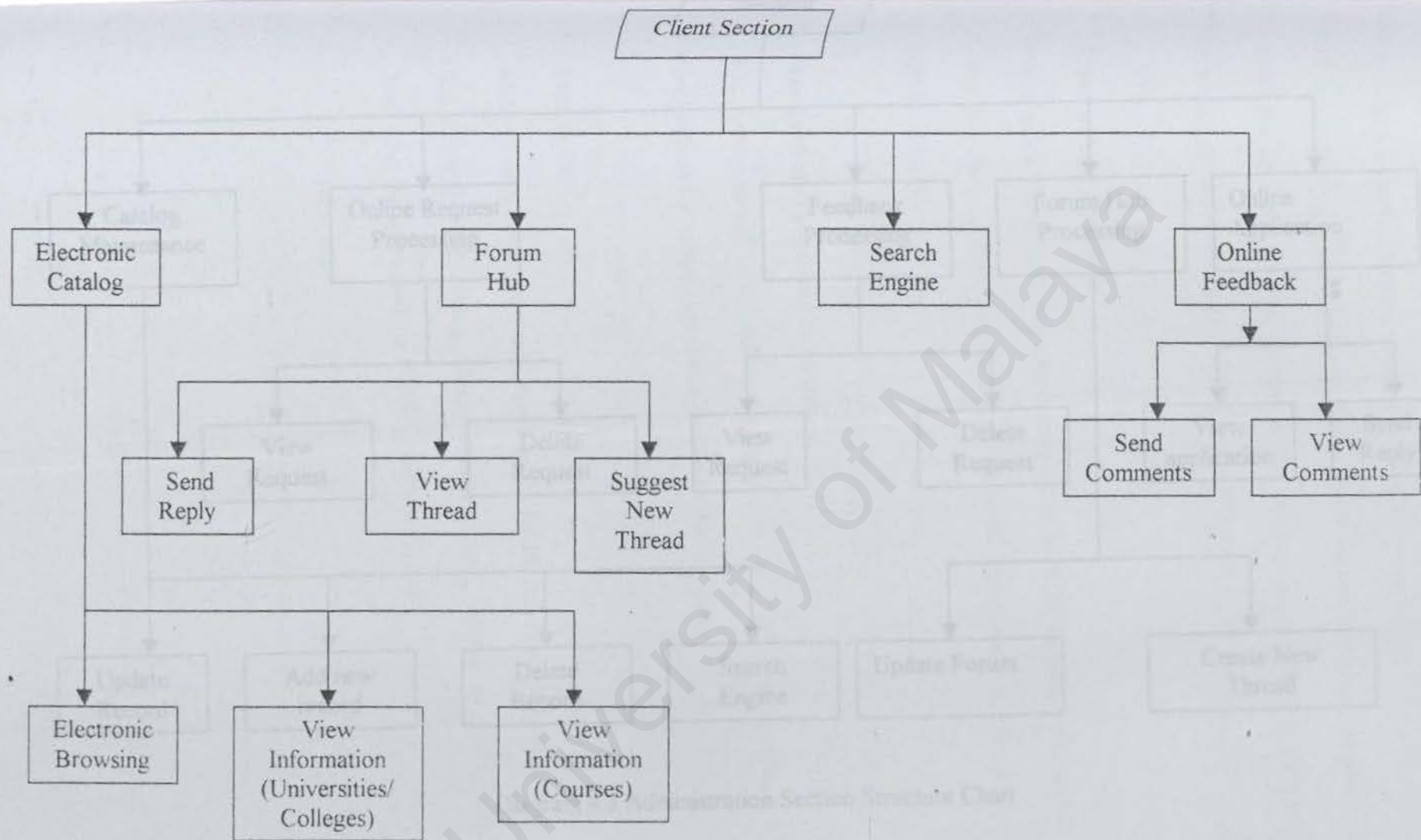


Diagram 4.2: Client Section Structure Chart

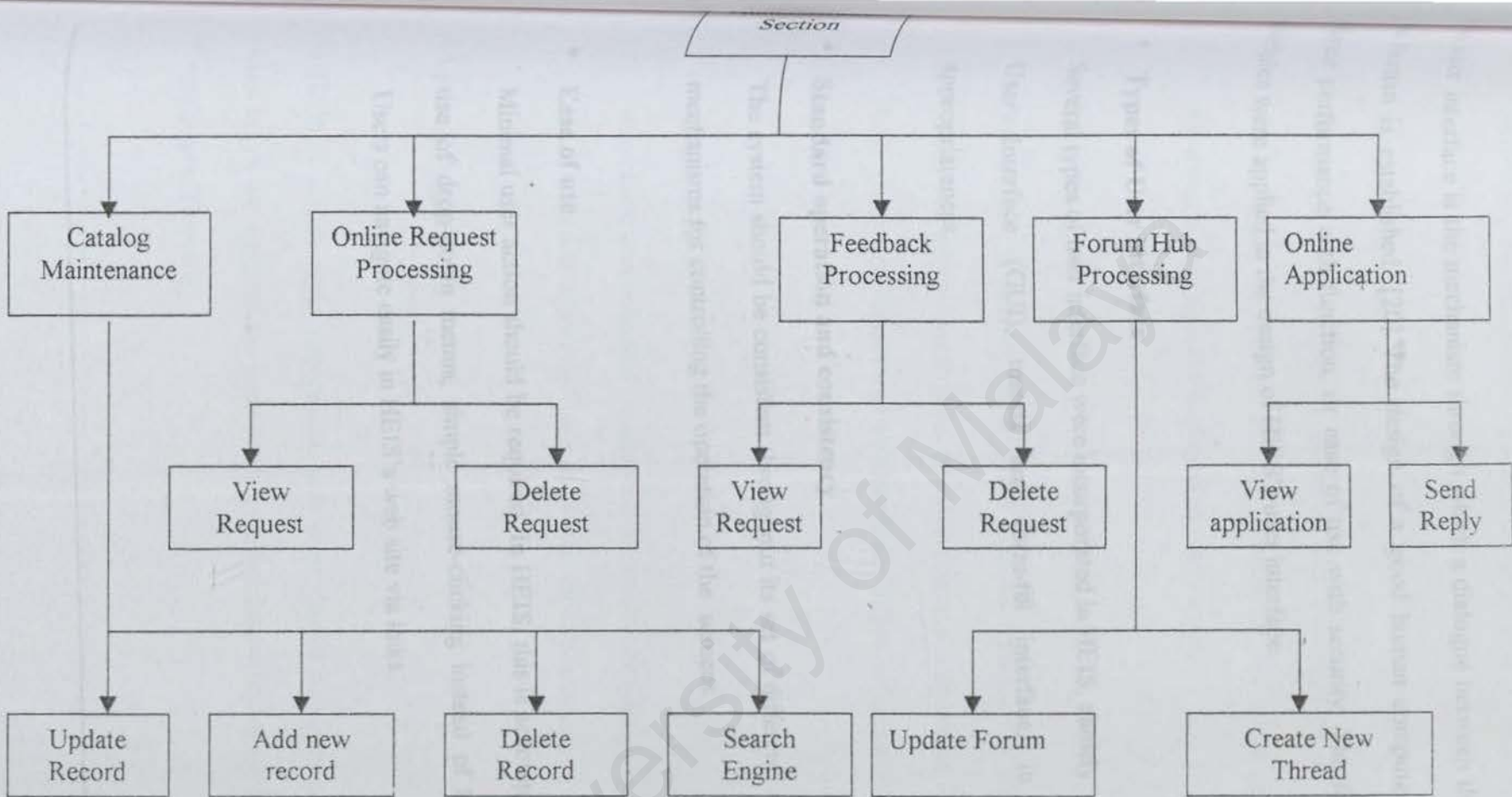


Diagram 4.3 Administration Section Structure Chart

## 5 User Interface Design

The user interface is the mechanism through which a dialogue between the programs and the human is established. [20] The design of a good human computer interface must balance performance with function, or ease of use with security. The following general principles were applied in the design of HEIS's user interface:

- **Types of User interface**

Several types of user interface were incorporated in HEIS, namely Graphical User Interface (GUI), menus and form-fill interface, in accordance to appropriateness.

- **Standard operation and consistency**

The system should be consistent throughout its set of different screens and in the mechanisms for controlling the operation of the screens.

- **Ease of use**

Minimal user action should be required. In HEIS, this is accomplished through the use of drop-down menus, simple mouse-clicking instead of keying operations.

Users can navigate easily in HEIS's web site via links.



- **Function grouping**

Activities are categorized by function and screens are organized accordingly.

- **Feedback to users**

HEIS users are constantly aware of the consequence of their actions. HEIS acknowledges acceptance of data submission via an acknowledgement page.

Meaningful messages are displayed to notify errors.

- **Robustness**

The system is able to protect itself from user errors that might cause it to fail.

When user enters invalid data, an error message is displayed on a pop-up dialogue box. Users are required to re-enter data before information is submitted to the server.

- **Attractiveness**

Animation and colourful images aid to convey messages to users instead of plain texts. This will encourage users to re-visit HEIS's web site.

#### 4.5.1 Web Page Design

As HEIS is a web-based application, web page design becomes an important feature.

Listed below are some of the considerations taken into while designing the user interface

of web pages. They are:

---

- Page layout and presentation; that is, does the page look like it is supposed to when rendered by the browser?
- Does the page appear as it is supposed to when rendered by different browsers? This is important when using nonstandard HTML tags (extensions) where different browsers may handle these nonstandard tags differently.
- Are the page elements (graphics, animations, font sizes and so on) of an acceptable size when viewed at a 640-by-480 resolution?
- Does the page load in a reasonable amount of time using a 14.4Kbps or a Kbps modem? This is because many users still use a 14.4-Kbps or 28.8 Kbps modems and cannot download pages faster than this. If a page is heavily laden with graphics, consider ways to reduce the graphic sizes.





Web page design in HEIS will be facilitated by the use of **Microsoft FrontPage 2000**, a web creation and management tool. FrontPage Editor enables creation, design and editing of Web pages by allowing users to add text, images, tables, from fields and other elements to the page. In the FrontPage Editor's HTML view, web page design tasks were performed such as entering text, editing HTML tags or script code using standard word-processing commands such as cutting , pasting, finding and replacing.



## Data Flow Diagram (DFD)

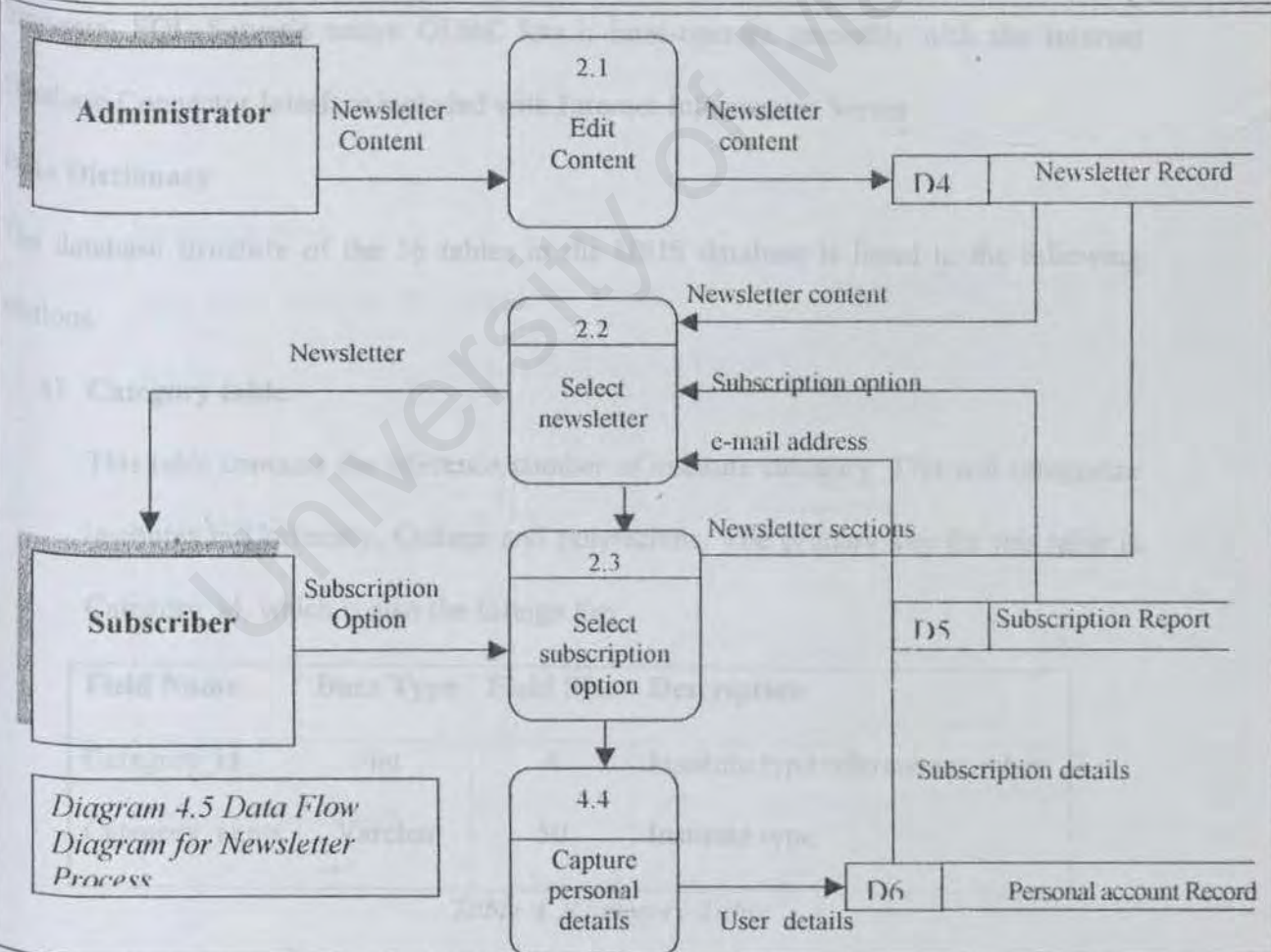
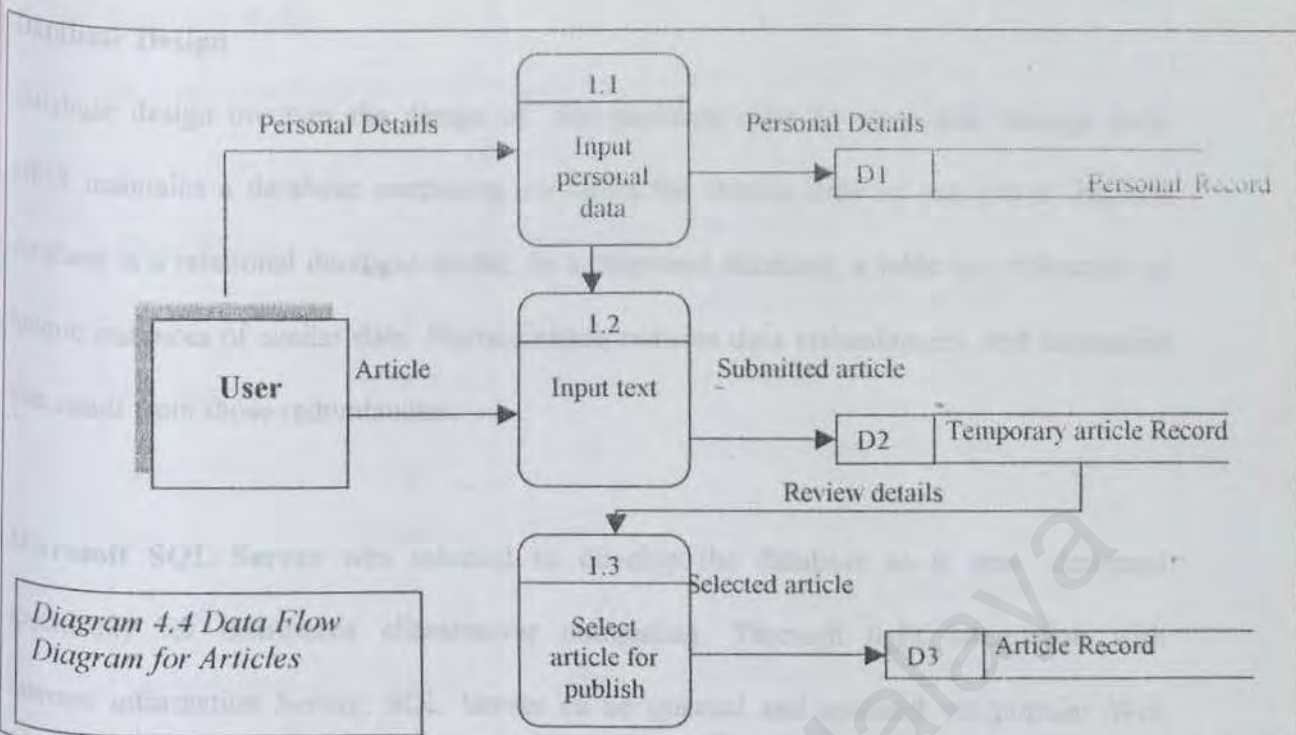
A data flow diagram (DFD) is a graphical technique to depict the information flow and the transform that are applied as data moves from input to output. [14] DFDs for HEIS use the Gane and T. Sanson notation. The components of the DFD are explained in Table (i).

Table 4.1 Components of DFD

Component	Description
	Entity.
	Process, which transforms or manipulates data within the System. A process is represented by a rectangle which has three parts: identifier, location or person performs the process, and the process name.
	Data store, where the data is held for a time within the system. It consists of two parts: identifier and the simple description of data stored.
	Data flow, is a directed line which represents the information flow between two objects. The arrow denotes the direction of the data flow. Each data flow is labeled with the name or details of the information represented by the data flow.

The following figures show the DFDs for HEIS in second level abstraction. The DFDs depict the data flow of few processes inn HEIS





## Database Design

Database design involves the design of the structure used to store and manage data. HEIS maintains a database containing 16 tables for storing data on the server. HEIS's database is a relational database model. In a relational database, a table is a collection of unique instances of similar data. Normalization reduces data redundancies, and anomalies that result from those redundancies.

Microsoft SQL Server was selected to develop the database as it was designed specifically for distributed client/server computing. Through tight integration with Internet information Server, SQL Server can be queried and updated via popular Web browsers. SQL Server's native ODBC lets it inter-operate smoothly with the Internet Database Connector Interface included with Internet Information Server.

## Data Dictionary

The database structure of the 16 tables in the HEIS database is listed in the following sections.

### a) Category table

This table contains the reference number of institute category. This will categorize institutes in University, College and polytechnic. The primary key for this table is Category\_id, which is also the foreign key.

Field Name	Data Type	Field Size	Description
Category_id	int	4	Institute type reference number.
Category_name	Varchar	50	Institute type

Table 4.2 Category Table



## b) Institutes Table

This table contains the details of all the institutes. The primary key for this table is Ins\_id. The foreign keys in this table is Category\_id.

Field Name	Data Type	Field Size	Description
Ins_id	Int	4	Institute reference number.
Ins_name	Varchar	100	Institute name
Ins_address	Memo	500	Address of the institute.
Ins_logo	Varchar	50	Logo of the institute
Ins_link	Varchar	100	Web site link for the institute.
Ins_description	Memo	200	Description of the institute.
Category_id	Int	50	Institute's category

Table 4.3Institutes Table

## c) Faculties table

This table contains the details of the faculties. The primary key for this table is Faculty\_id. The foreign keys in this table is Ins\_id.

Field Name	Data Type	Field Size	Description
Faculty_id	Int	4	Faculty reference number
Ins_id	Int	4	Institute reference number
Faculty_name	Varchar	50	Name of the faculty
Faculty_description	Memo	500	Description of the faculty

Table 4.4Faculties Table



**d) Coursetype table**

This table contains the reference number of course category. The primary key of this table is `Course_type_id`.

Field Name	Data Type	Field Size	Description
Course_type_id	Int	4	Course type reference number
Course_type	Varchar	50	Course type

*Table 4.5 Coursetype Table*

**e) Courses table**

This table contains details about Courses offered in faculties. The primary key of this table is `Course_id`. The foreign keys in this tables are `Faculty_id` and `Course_type`.

Field Name	Data Type	Field Size	Description
Course_id	Int	4	Course reference number
Faculty_id	Int	4	Faculty reference number
Course_title	Varchar	50	Title of the course
Course_type	Int	4	Type of the course
Overview	Memo	500	Course overview
Duration	Varchar	50	Course duration
Requirement	Memo	500	Course requirement
Fee	Varchar	50	Course Fee

*Table 4.6 Courses Table*

f) **Articles table**

This table contains the details articles. The primary key of this is Article\_id

Field Name	Data Type	Field Size	Description
Article_id	Int	5	Article reference number
Article_author	Varchar	50	Author of the article.
Article_title	Varchar	50	Title of the article
Article_message	Memo	500	Contents of the article

Table 4.7 Articles Table

g) **Country table**

This table contains information country reference number and code for application form. The primary key off this table is Ctr\_id.

Field Name	Data Type	Field Size	Description
Ctr_id	Int	4	Country reference code
Ctr_code	Varchar	50	Country code
Ctr_name	Varchar	50	Country name

Table 4.8 Country table

h) **Fieldstudy table**

This table contains reference number and code for study field. The primary key of this table is Field\_id.

Field Name	Data Type	Field Size	Description
Field_id	Int	4	Field reference number
Field_code	Varchar	50	Field reference code
Field_name	Varchar	50	Name of the study field

*Table 4.9 Fieldstudy Table*

**i) Grade table**

This table contains id and code for grade. The primary key for this table is Grade\_id.

Field Name	Data Type	Field Size	Description
Grade_id	Int	4	Grade reference number
Grade_code	Varchar	50	Grade reference code
Grade_name	varchar	50	Grade

*Table 4.10 Grade Table*

**j) Identity table**

This table contains reference number for the various identification. The primary key for this table is Identity\_id.

Field Name	Data Type	Field Size	Description
Identity_id	Int	4	Identity reference number
Identity_type	varchar	50	Identity

*Table 4.11 Identity table*



## k) State table

This table contains reference number and code for state. The primary key of this table is State\_id.

Field Name	Data Type	Field Size	Description
State_id	Int	4	State reference number
State_code	Varchar	50	State code
State_name	Varchar	50	State name

Table 4.12 State table

## l) Qualification table

This table contains qualification reference number. The primary key of this is qualification\_id.

Field Name	Data Type	Field Size	Description
Qualification_id	Int	4	Qualification reference number
Qualification_name	Varchar	50	Qualification name

Table 4.13 Qualification Table

## m) Application Table

This table contains details of the applicant. The primary key for this table is app\_id. The foreign keys for this table are country\_code, state\_code, fieldstudy\_code, qualification\_id, identity\_code and grade\_code.

Field Name	Data Type	Field Size	Description
App_id	Int	4	Application reference number
Name	Varchar	50	Name of the applicant

Birth_date	Int	4	Applicant birth date
Birth_month	Int	4	Applicant birth month
Birth_year	Int	4	Applicant birth year
Gender	Varchar	50	Applicant's gender
Marital_status	Varchar	50	Applicant's marital_status
Nationality	Varchar	50	Applicant's nationality
Identity_id	Int	4	Identity type
Identity_no	Varchar	50	Applicant's marital_status
Address1	Memo	200	Applicant's address
Address2	Memo	200	Applicant's address
City	Varchar	50	City
State1	Varchar	50	State
State2	Varchar	50	State
Postcode	Varchar	50	Postcode
Country	Varchar	50	Country
Homephone_no	Varchar	50	House telephone number
Offphone_no	Varchar	50	Office telephone number
Handphone_no	Varchar	50	Handphone number
Fax_no	Varchar	50	Fax number
Qualification	Varchar	50	Qualification code
Field	Varchar	50	Field study code
Major	Varchar	50	Majoring field
Grade	Varchar	50	Grade

Cgpa1	Varchar	50	Applicant's CGPA
Cgpa2	Varchar	50	Maximum CGPA
Ins_name	Varchar	50	Name of the institute
Ins_country	Varchar	50	Country of the institute
Graduation_month	Varchar	50	Graduation month
Graduation_year	Varchar	50	Graduation year
Course1	Varchar	50	Selected Course
Course2	Varchar	50	Selected Course
Course3	Varchar	50	Selected Course
Ins1	Varchar	50	Selected institute
Ins2	Varchar	50	Selected institute
Ins3	Varchar	50	Selected institute

*Table 4.14 Application Table*

**n) Users table**

This table contains details of authorized users of the system. The primary key for this table is Usr\_ID.

Field Name	Data Type	Field Size	Description
Usr_ID	Int	4	User reference number
Usr_Name	Varchar	50	Login Name
Usr_Pwd	Varchar	50	Login password
Usr_Group	Varchar	50	User group

*Table 4.15 Users Table*



### *User Interface Design*

The user interface is the mechanism through which a dialogue between the programs and the human is established. [25] The design of a good human computer interface must balance performance with function, or ease of use with security. [1] The following general principles were applied in the design of HEIS's user interface:

- **Types of User interface**

Several types of user interface were incorporated in HEIS, namely Graphical User Interface (GUI), menus and form-fill interface, in accordance to appropriateness.

- **Standard operation and consistency**

The system should be consistent throughout its set of different screens and in the mechanisms for controlling the operation of the screens.

- **Ease of use**

Minimal user action should be required. In HEIS, this is accomplished through the use of drop-down menus, simple mouse-clicking instead of keying operations. Users can navigate easily in HEIS's web site via links.

- **Function grouping**

Activities are categorized by function and screens are organized accordingly

- **Feedback to users**

HEIS users are constantly aware of the consequence of their actions. HEIS acknowledges acceptance of data submission via an acknowledgement page. Meaningful messages are displayed to notify errors.

- **Robustness**

The system is able to protect itself from user errors that might cause it to fail. When user enters invalid data, an error message is displayed on a pop-up dialogue box. Users are required to re-enter data before information is submitted to the server.

- **Attractiveness**

Animation and colourful images aid to convey messages to users instead of plain texts. This will encourage users to re-visit HEIS's web site.

## **Web Page Design**

As HEIS is a web-based application, web page design becomes an important feature.

Listed below are some of the considerations taken into while designing the user interface of web pages. They are:



- Page layout and presentation; that is, does the page look like it is supposed to when rendered by the browser?
- Does the page appear as it is supposed to when rendered by different browsers? This is important when using nonstandard HTML tags (extensions) where different browsers may handle these nonstandard tags differently.
- Are the page elements (graphics, animations, font sizes and so on) of an acceptable size when viewed at a 640-by-480 resolution?
- Does the page load in a reasonable amount of time using a 14.4Kbps or a Kbps modem? This is because many users still use a 14.4-Kbps or 28.8 Kbps modems and cannot download pages faster than this. If a page is heavily laden with graphics, consider ways to reduce the graphic sizes.

Web page design in HEIS was facilitated by the use of **Microsoft FrontPage 2000**, a web creation and management tool. FrontPage Editor enables creation, design and editing of Web pages by allowing users to add text, images, tables, form fields and other elements to the page. In the FrontPage Editor's HTML view, web page design tasks were performed such as entering text, editing HTML tags or script code using standard word-processing commands such as cutting, pasting, finding and replacing.



## CHAPTER 5: SYSTEM IMPLEMENTATION AND TESTING

### 5.1 Introduction

System Implementation is the construction of the new system and the delivery of that system into production. It involves the translation of the software representation produced by the design phase into a computer-readable form. This phase at times involves some modifications to the previous design.

### 5.2 Implementation Principles

As a web application, HEIS follows the following principles during the implementation phase:

- **Works continuously**

Just as a web's development process often is continuous, so is a web's implementation. Because of this, web-implementation procedures should be designed with process orientation, allowing for replication, improvement, and reliability in file management and coding techniques.

- **Separation of tasks.**

All web-development processes involve separating the processes of web development so that decisions about specific HTML structure are allowed to be made "just in time". It is during the implementation phase that decisions about the web are made based on tolerances and instructions provided.

- Involves layering of detail

It is most efficient to generic web components or software that works with templates for creating HTML or ASP files. This same template idea can be used to design file systems as well as page layout to achieve the goals of a consistent web.

## 5.3 Development Environment

### 5.3.1 Hardware Configuration

HEIS was developed using a computer with hardware specification as described in Table

5.1.

Hardware Component	Specifications
Central Processor Unit	Intel Pentium 133MHz
Memory	80MB
Cache Memory	512K Pipeline Burst Cache
Hard Disk	2.1GB
CD-ROM Drive	6 X speed
Floppy Drive	1.44MB
Monitor	15"SVGA
Other standard desktop PC components	

Table 5.1 Hardware specification of computer used for system development



### 5.3.2 Software Tools

#### Software tools for development

A listing of software used in the development of HEIS is provided in Table 5.2.

Software	Phase/Process
Microsoft Windows NT 4.0	Operating System
Microsoft internet Information Server 4.0	Web server host
Microsoft Visual Interdev 1.0	Coding the homepages
Microsoft Outlook Express	E-mail tool for sending &Receiving mails
Microsoft Internet Explorer 4.01	Viewing the homepage
Netscape Navigator 4.04	Viewing the homepage
Microsoft FrontPage 2000	Designing ASP & HTML document layout
Adobe Photoshop 5	Creating images for web pages
Animation Shop	Creating animated Gifs for web pages
Xara 3D	Creating 3D Animated Gifs

Table 5.2 Software tools for software Gifs for web pages

#### a) Microsoft Windows NT 4.0

Windows NT is a robust and secure operating system that can manage mission-critical information systems. As long as there are enough system resources, NT will happily run multiple applications, preemptively multitasking each of them. Various Web development applications are available in Windows NT thus offering an integrated environment to develop content for the World Wide Web. These



applications can be utilized to create richly interactive Web pages and to publish large amounts of information in a timely manner.

Because NT is extremely easy to administer through various GUI administration tools, even someone who is relatively new to Windows NT can quickly learn how to use them. This increase user productivity and results in more time being spent on finding innovative solutions to various problems as opposed to finding various innovative ways of dealing with an operating system that is not user friendly.

#### **b) Microsoft Internet Information Server (IIS) 4.0**

IIS is the core Windows NT service that provides Internet services. IIS runs on HEIS's Web site and is responsible for replying to Web browser requests for files and to publish documents on the Web. It is responsible for handling simultaneous requests from multiple browsers for the same information. IIS also manages form input and links forms and browsers with the database server, which is Microsoft SQL Server 5.5. HEIS also uses the following features of IIS 4.0:

##### **i) Microsoft Management Console (MMC)**

MMC, an integrated server management tool, was used to manage IIS. During the creation of a new Web site, MMC lets the developer choose the site name, IP address, map the virtual directory to a physical directory. Site administrator can also set directory privileges to the Web Site. Setting of the HEIS's default page was also done in MMC.

The Key Manager, administers **HEIS** web server's digital ID used for SSL encryption. Server digital IDs allow **HEIS** to identify itself and enable secure communications with customers. This is done by requesting a site certificate and then installing it using The Key Manager.

ii) **Certificate Server**

The Microsoft Certificate Server issues, revokes digital certificates that identify users for subsequent authentication using public key technology. The certificate server also supports installation and configuration of different certificate issuance policies and multiple certificates for use on the Internet by employees and customers. In **HEIS**, Certificate Server is used to simulate a Certification Authority.

c) **Microsoft Visual Interdev**

Microsoft Visual Interdev was used as the software development environment of **HEIS**. It integrates the following components of **HEIS**'s Web site in a single environment:

i) **Development workstation**

Used to create and edit content of HTML or ASP document.

ii) **Web Server**

The content of web documents is automatically updated to the Web server using FrontPage Server Extensions. The Web server also delivers the final contents to user browsers.

---



**iii) Web browser**

Web browser is integrated with Visual Interdev for use by the developer to view the Web pages during coding.

**iv) Database server**

Visual Interdev enables the connection from Web projects to **HEIS**'s database stored on Microsoft SQL Server 5.5. It enables the administrator to create and edit the database remotely from his workstation.

**d) Microsoft Access 2000**

Microsoft Access 2000 was chosen as the database server where **HEIS**'s database resides. Please refer to section 5.5 of this chapter for specific implementation details.

**e) Microsoft Outlook Express**

One of the functional requirements of **HEIS** is send Newsletter in the form of e-mail to its subscribers. Microsoft Outlook Express was used to test this function. Outlook Express can be configured to receive mails from multiple e-mail accounts.

**f) Microsoft Internet Explorer 4.01/Netscape Navigator**

**HEIS**'s Web site can be viewed with popular browsers such as Microsoft's Internet Explorer and Netscape Navigator. In other words, **HEIS** is browser independent.



#### g) Microsoft FrontPage 2000

FrontPage Explorer was used to manage the contents of a Web site. Tasks related include finding out information about files in the **HEIS** Website, such as what these files are, what is in these files, or if they have any URLs that point to other Web sites. Hyperlinks at **HEIS**'s Website be checked whether they actually work at all.

The FrontPage Editor is a powerful WYSIWYG HTML editor that was used to create **HEIS**'s Web pages with Tables, Frames and other tools was put into Web pages with the drag-n-drop feature of FrontPage Editor.

#### 5.3.2.2 Software tools for report writing

Microsoft Word 2000 was used to write the report and draw the DFD, Structure Chart, ER diagram and System Model.

### 5.4 Programming Language Used

HTML for displaying text, images, multimedia and to provide instruction to Web browsers in order to control how documents are viewed and how they are related to each other.

VB Script is embedded into HTML files to provide scripting, automation and customization capabilities for the Web browser. Since the only browser that can understand VBScript is Microsoft Internet Explorer, **HEIS** only uses VBScript for server-side scripting to support other browsers such as Netscape Navigator.

In **HEIS**, JavaScript is used for the following purpose:

- **Client-Side Data Validation**

When user filled in a form with information, JavaScript is used for validating the input before it is submitted to a Web server processing.

- **Managing Browser Objects**

Browser objects can be easily manipulated with JavaScript. For example, when a user moves the mouse pointer over an image hypertext, JavaScript is used to toggle images so that the image appears to be moving interactively.

- **Conserving Bandwidth**

Before invalid data in a form is sent to a Web server processing, JavaScript can validate the data.

Some critical program codes were written using Microsoft Visual Basic 6.0. These components are in DLL format and can be initiated and used using ASP code. An example of this component is the file upload component, HEIS.dll.

## 5.5 Coding

### Coding conventions

Coding is a process that translate a detailed design representation of software into a programming language realization.[20]

The following coding guidelines were followed to preserve the design quality of **HEIS**:

---



- **Coding conventions**

Coding conventions such as page labeling, naming conventions, and indentions should be adhered to.

- **Revising & Rusing**

Functions and procedures created earlier should be reused in subsequent modules.

- **Readability**

Codes should be easy to understand. Adherence to coding conventions contribute to readability.

- **Maintainability**

Codes should be easily revised or corrected. To facilitate maintenance, code should be readable, modular and as general as possible.

### 5.5.2 Methodology Used

Method used for coding this system is Top-down method where high-level modules will be coded first and the lower level modules will be left, which to be filled in later. The lower module is only a shell with an entry and an exit. This approach is used to allow testing to begin on some of the modules while others are still being coded.

## 5.6 Database implementation

Though Microsoft SQL Server 6.5 was suggested in the system analysis but eventually Microsoft Access 200 was used to create and manage the database for storing HEIS's data. This is because of unfamiliar development environment of SQL Enterprise

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Manager, its database administration tool enables enterprise-wide management of SQL Servers. MS Access 2000 was used because of its wide range of functionalities and ease of use for fast database development.

Microsoft Access 2000 offers improved 32-bit performance, including smaller forms, more efficient compilation and better data manipulation technology that result in quicker responses and faster data operations. The Performance Analyzer looks at the database and suggests ways to speed it up.

Access 2000 has an integrated development with Microsoft Visual Basic for Applications and ActiveX. Its Intuitive IDE features include drag-and-drop code, color-code syntax an improved debug window and in-place object browsing.

## 5.7 Testing

Testing is a verification and validation process. Verification refers to the set of activities that ensure that the correctly implements a specific function. Validation refers to a different set of activities that ensure that the software has been built is traceable to customer requirements. Software testing is a critical element in system development to discover a defect or bug that is present in the system. A successful test is one which no errors are found.

All newly written systems must be tested thoroughly, this is no exception for HEIS. Testing has to done throughout system development and not just at the end HEIS was tested with the following generic characteristic:

- Testing begins at the module level and works "outward" toward the integration of the entire computer-based system.
- Different testing techniques are appropriate at different points in time.
- Testing and debugging are different activities, but debugging must be accommodated in any testing strategy.

### 5.7.1 Testing Techniques

Two techniques were employed in the testing process:

#### 5.7.1.1 White Box Testing

White-Box testing, sometimes called *glass-box testing*, is a test case design method that uses the control structure of the procedural design to derive test cases.

[20] By using white box testing methods, the following test cases can be derive:

- Guarantee that all independent paths within a module have been exercised at least once;
- Exercise all logical decisions on their True and False sides;
- Execute all loops at their boundaries and within their operational bounds;
- Exercise internal data structures to assure their validity.

#### 5.7.1.2 Black Box Testing

Black-box testing, focuses on the functional requirements of the software. Black-box testing enables the software engineer to derive sets of input conditions that will fully exercise all functional requirements for **HEIS**. Black- box testing is not



an alternative to white-box techniques. Rather, it is a complementary approach that is likely to uncover a different class of than white-box methods.

Black-box testing attempts to find errors in the following categories [20]

- Incorrect or missing functions
- Interface errors
- Errors in data structures or external data base access
- Performance errors
- Initialization and termination errors.

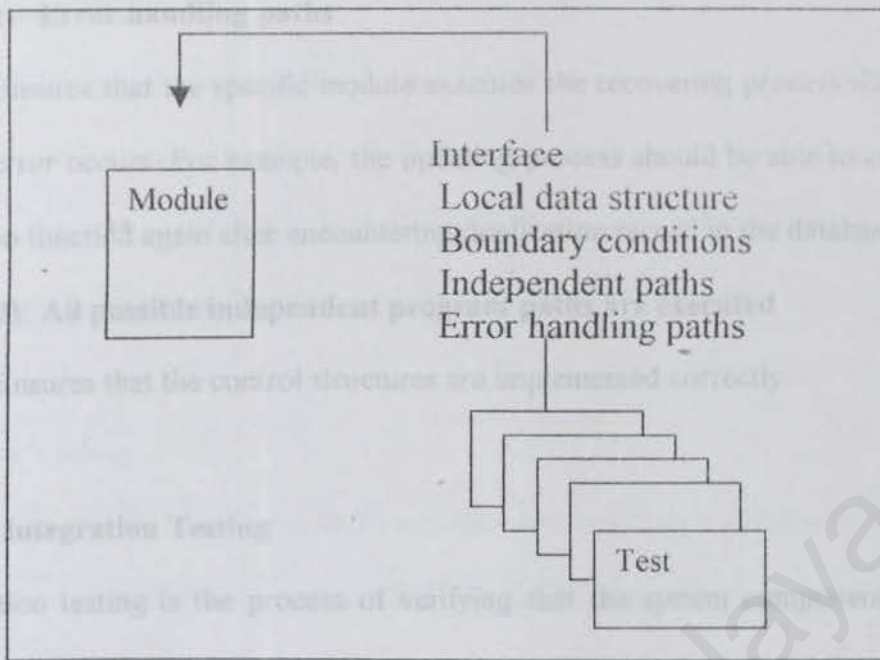
### 5.7.2 Testing Strategies

Testing strategies adopted during the development of HEIS consist of unit testing, integration testing, regression testing and system testing.

#### 5.7.2.1 Unit testing

In this first stage of testing, each program component is tested on its own, isolated from the other components in the system. Unit testing verifies that the component functions properly with the types of input expected from studying the component's design. Unit testing is done in a controlled environment. Unit testing is shown in Figure 5.1.





*Figure 5.1 Unit Testing*

The following areas are tested during unit testing for **HEIS**:

**a) Interface**

Testing the interface to ensure that information flows properly into and out of the program unit.

**b) Boundary value analysis**

Ensure that the module operates properly at boundaries established to limited or restrict processing.

### c) Error handling paths

Ensures that the specific module executes the recovering process should an error occurs. For example, the updating process should be able to continue to function again after encountering duplication record in the database.

### d) All possible independent program paths are executed

Ensures that the control structures are implemented correctly.

## 5.7.2.2 Integration Testing

Integration testing is the process of verifying that the system components work together as described in the system and program design specification. It ensures that the interfaces among the components in the HEIS are defined and handled properly. In HEIS, the Bottom-up integration approach was adopted. Each component at the lowest level of the system hierarchy is tested individually first. Then, the next components to be tested are those that call the previously tested one. This approach is followed repeatedly until all components are included in the testing. For example, general purpose functions are first tested, then the ASP pages which invoke them, followed by the functional module and the top-level pages.

This approach was chosen because HEIS integrates a large number of stand-alone modules and many of the low-level components are general-purpose utility routines that are invoked by others.



### 5.7.2.3 Regression Testing

Correcting faults during the testing process can introduce new faults while fixing old ones. Regression testing identifies new faults that may have been introduced as current ones are being corrected. It also verifies that a corrected version still performs the same functions in the same manner as the previous version.

### 5.7.2.4 System Testing

System testing is actually a series of different tests whose primary purpose is to fully exercise the computer-based system. [20] For HEIS, the primary purpose of this testing is to verify that all system elements have been properly integrated and perform the allocated functions.

## 5.8 Debugging

Debugging is performed as a consequence of successful testing. When a test case uncovers an error, debugging is the process of attempting to match symptom with the cause and if successful, leads to the correction of the error. The debugging approach employed was causes elimination. Data related to the error occurrence was organized to isolate potential causes. A list of all possible causes was developed and tests conducted to eliminate each. If initial tests indicate that a particular cause hypothesis promise, the data are refined in an attempt to isolate the error.[20]



## Chapter 6 SYSTEM EVALUATION AND CONCLUSION

### 6.1 Problems And Solutions

#### 6.1.1 Problem And Solution During System Studies And Analysis

##### 6.1.1.1 Wide Area Of Studies

In order to successfully develop and implement HEIS, researches have to be done. Furthermore, various technologies and tools had to be explored in order to choose the right tools.

The Internet was a great help in helping to obtain necessary information. Research papers published by academic institution and other organizations were studied. Other similar systems were also studied. Besides, knowledge was also obtained from reading of printed materials.

##### 6.1.1.2 Determining The Project Scope

During to the time frame given, it was impossible to incorporate too many features into system. Availability of tools was also considered in determining the project scope.

#### 6.1.2 Problems And Solution During System Implementation And Testing

As there is no prior knowledge in programming in a web-based environment, a lot of studies need to be done to familiarize with the concept of web programming.

Programming languages and various web development tools need to be learnt within a short time span. Choosing ASP as the programming language was a wise decision due to his short learning curve. Discussion with course-mates, seeking advice from the Internet and self studies also helped resolved the problems faced.

#### **6.1.2.2 Lack Of Knowledge In Web Security**

HEIS tries to ensure that confidential data submitted by client are protected. However, lack of knowledge in web security has been a hindrance. Research was done into SSL (Secure Sockets Layer) in order to gain knowledge on these current security technologies. In HEIS, SSL is implemented to provide secured transaction like product ordering and submission of customer information.

#### **6.1.2.3 Lack Of Knowledge In Network Operating system**

During the setting up of Microsoft Windows NT Server 4.0, problems have occurred due to unfamiliarity. Installation was tedious as there are many system configurations which need to be followed to ensure proper function of the NT. NT also takes up a significant amount of memory thus decreasing the system performance.

Besides reading relevant materials provided at Microsoft Corporation web site, advice from course mates and external NT administrators were sought to resolved the problems. RAM on the server was upgraded from 32 to 64 to provide sufficient memory.



#### 6.1.2.4 Difference Between Browsers

HEIS is meant to be browser independent, which means it should work the same way whether in Netscape Communicator or Internet Explorer. However, there are some difference in the interpretation of HTML tags in both browsers. E.g., `<P align=center>` only works in Internet Explorer. If the web page is viewed using Netscape Communicator, the alignment will be to the left. As the solution, codes had to be re-written to resolve the problem.

Also, both browsers interpret JavaScript in a slightly different way. Problems occur where the web pages work nicely in browsers but not so in another browsers. In order to solve the problem, some propriety features which only pertain to certain browser are sacrificed. Certain powerful features which work only in certain kinds of browsers were not implemented.

#### 6.1.2.5 No Integrated Debugging Tool

VBScript is used for server side scripting. However, problem occurs when record set is retrieved from database and used to display data to client. The records have to be displayed in order which they are stored in the database table if one of the fields contains the memo data type. Otherwise, an error message saying "*Unexpected Error*" will appear. A considerable amount of time is wasted in trying to find the cause of the error when actually the fault lies in a bug in the scripting language and not the coding itself. This problem was solved by



used the data into variables before displaying them.

#### 6.1.2.6 Inconsistency In Displaying Memo Datatype Web Pages

During web pages testing, problem was found in displaying memo datatype on web pages. Browser is incapable of detecting carriage return and line feed in the memo datatype, and as a result, memo will be displayed in a long and continuous string. To overcome this problem, a VBScript function was written to detect and convert carriage return and feed to line break tag <BR> at the server side before sending out the client:

```
<%Function FormatOutput ( theText )  
theText = Server.HtmlEncode ( theText )  
theText = REPLACE( theText, vbNewline & vbNewline, "<p>" )  
theText = REPLACE( theText, vbNewline, " <br>" )  
formatOutput = theText  
End Function %>
```

#### 6.1.2.7 Error In Submitting String Datatype To The Database

Whenever the client browser submits any sting that contains the apostrophe sign(') to the database, an error will occur when it is read into the database. This is because SQL interprets the sign as the opening and closing quote of the string.

---

A considerable time has been invested to trace this problem out. VBScript was used to correct this problem. For example:

```
Faculty_description=request.querystring("Faculty_description")
```

```
Faculty_description=Replace(Faculty_description, "", "")
```

## **6.2 System Strengths**

### **6.2.1 Use of multimedia interaction**

Appropriate use of tools in HEIS's Web site greatly enhances its attractiveness. Colors and images make the Web pages eye-catching especially the world. Users can retrieve the information easily. Visitors to HEIS's Web site will be drawn by its effective information which is arranged neatly.

### **6.2.2 Minimal user intervention in operations**

In some parts user do not have to type in text for a certain action. Select list was used where users can just select from the options given. This will also minimize errors created by users while typing in input strings.

### **6.2.3 User-friendly Interface**

HEIS has a very user-friendly and consistent environment that is similar to other web-based applications. Its Web Page design incorporates the WIMP techniques which Windows user are familiar to. Users who are experienced in web-based applications can easily use this system. Effective use of hyperlinks, icons and selection control eliminates



typing need when capturing data from users. Carefully planned Web pages make sure that users are able to navigate smoothly through the web site by simple point and click.

#### **6.2.4 Cross Browser Support**

Web pages of HEIS can be browsed using both Netscape Navigator and Microsoft Internet Explorer since both are the most popular browsers in the market currently. HEIS was designed not to be dependent on any of them.

#### **6.2.5 Effective Error Handling**

Input by users is validated by client-side scripting to filter out erroneous data as invalid data type. This is to ensure data consistency in the database. Validation that requires data from the database is done by server-side scripting and will generate appropriate feedback to user should any error occur. For example, user of the administration section who keyed in the wrong password will receive a meaningful message and will be allowed to reenter the password.

#### **6.2.6 Security Feature**

HEIS ensures high security in all transactions involving transmission of confidential data using the SSL protocol. Server authentication is achieved through server certificate. The system's security features also ensures that users information are protected from unauthorized access. This is done through the implementation of the login procedure before a user can gain access into administration section. Users cannot enter in to the admin section without a valid user account even though they know a specific page



location. This is done by having INCLUDE files in all the ASP pages developed for HEIS administration section. If anyone attempted to gain access by typing in specific URL address in the browser, the user will be automatically redirected to login the page. An example of VBScript that validates user and user group is shown as below, this script will allow only valid administrator to change the user account:

```
<%
```

```
If Session("ValidUser") = FALSE Then
```

```
Response.Redirect "../login/login.asp"
```

```
End If
```

```
If Session("ValidAdministrator") = false Then
```

```
Response.Redirect("../admin.asp?CreateUser=Failed")
```

```
End If
```

```
%>
```

## 6.3 System Limitations

### 6.3.1 No printing capability

There is no printing facility provided in the application. Administrator cannot generate listings for offline viewing. Though printing through the browser works well, a more powerful printing feature should be integrated into the application.

### **6.3.2 No Extensive Online Help Facility**

Currently the Web site provides a minimal online help. Though instructions are available on the Web pages, it cannot satisfy users who demand more detailed information.

### **6.3.3 Unable To Provide Remote File Deleting Facility**

HEIS supports remote file uploading using a dll file. However there is no facility to delete files from remote client PC. File deleting can only be done by accessing the server. Although this is good in terms of security however this limits the ability of remote system administrators.

### **6.3.4 File type restriction**

Image file for the electronic catalog is restricted to GIF and JPEG format. This is limited through setting in the file uploading program. Though any type of files can be permitted in the program however these files are restricted for streaming purposes. This is to ensure good system responses for low capacity line users.

## **6.4 Future Enhancements**

### **6.4.1 Provide Printing capability**

Currently HEIS does not support printing of information for offline viewing. A printing function can be incorporated to allow administrator to print the records retrieved from the database. This will help the user to print relevant information rather than copying them into disks.

---



#### **6.4.2 Incorporate 3<sup>rd</sup> party Software**

3<sup>rd</sup> party software can be integrated into the system for several functions such as e-mail retrieval and viewing at the client side and administration side. This enables these tasks to be carried out in one environment.

#### **6.4.3 Provide Comprehensive Online Help**

A comprehensive online help should be added to the system to provide timely response to user's questions and queries. This would also lessen the workload of the system administrator.

#### **6.4.4 Better Database Record Displaying**

Records could be paged to support systematic viewing. This will be an advantage because users do not have to view unwanted pages.

#### **6.4.5 Extra services**

Other interesting services like 'Virtual Chat Room', 'special Recommendation' could be added to the store to enhance its features. This would attract more visitors to the Web site and distinguish itself from other similar systems on the Internet.

### **6.5 Conclusion**

The project has achieved its objectives to develop an online information application which not only provides information for user but allows greater user interactivity and personalization elements.

---



## CONCLUSION

the process, invaluable insight was gained into the complexities and intricacies of Web programming. Knowledge gained throughout the life cycle of project development, from the planning of the project, studies on the subject and technologies, setting up of servers, programming, to implementing the system proves to be a valuable experience. At the same time, theories and knowledge gained throughout the course of computer science studies were put into practice. This experience will definitely prove useful in future software development projects.

There is still much room for improvement in HEIS. The successful development of HEIS is the first step towards the future development of similar systems. It is hoped that HEIS can provide a foundation and basis for the concept of infotainment and its implementation using web technology.

## CONCLUSION

HEIS is a web-based application. The main purpose of this application is to provide information on higher education opportunities, to the users. This system will be a good guidance to the school leavers and for those who wants to continue higher studies. Since this is a web based application, it will benefit both local and foreign users.

In the process, invaluable insight was gained into the complexities and intricacies of Web programming. Knowledge gained throughout the life cycle of project development, from the planning of the project, studies on the subject and technologies, setting up of servers, programming, to implementing the system proves to be a valuable experience. At the same time, theories and knowledge gained throughout the course of computer science studies put into practice. This experience will definitely prove useful in future software development projects.

There is still much rooms for improvement in HEIS. The successful development of HEIS is the first step towards the future development of similar systems. It is that HEIS can provide foundation and basis for the concept of informative web site and its implementation using the web technology.



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## HEIS User Manual

Welcome to HEIS Online Information Site. All the functions in this system can easily be executed by a simple point and click on the available function buttons and hyperlinks.

### About This Manual

This user manual will guide you through all the functions available in the system. This manual includes the following parts:

- System Overview and Essentials
- Chief Section User Manual
- Administrator section User Manual

## APPENDIX I USER MANUAL

### Conventions

To help you locate the needed information easily, this user manual uses consistent typographic. The conventions are explained as follows:

# HEIS User Manual

---

Welcome to HEIS-Online Infotainment Site. All the functions in this system can easily be executed by a simple point and click on the available function button and hypertext link.

## About This Manual

This user manual will guide you through all the functions available in the system. This manual includes the following parts:

- System Overview and Essentials
- Client Section User Manual
- Administrator section User Manual

## Conventions

To help you locate and interpret information easily, this user manual uses consistent typographic. These conventions are explained as follows.



## Item Represents

*Italic* Hardware requirement: Anything that must be type in exactly as it appears. For example, if you are required to type in http: typethetext, you would type in exactly as printed.

[Button] Indicates a button or a hyperlink in the system.

- Minimum 16MB RAM (32MB recommended)
- Modem/Network Interface card to connect to the Internet
- An SVGA Graphic Adapter
- Standard desktop computer peripherals

### 1.2 Software Requirements

Listed below are the software requirements needed to run the system:

- Windows 95 or Windows NT 4.0 server or above
- Microsoft Internet Explorer 4.0 or above, or Netscape Navigator 4.0 or above

### 1.2 Installing HMS

Copy the entire folder named "hms" into the wwwroot directory of the server. The exact path of the directory must be C:\inetpub\wwwroot\infotainment\ Make sure the server is running IIS4.0 and above.

## CHAPTER 1 : HARDWARE AND SOFTWARE REQUIREMENTS

### 1.1 Hardware requirements

Listed below are the hardware requirements needed to run the system:

- A 486 processor or above (Pentium processor is recommended)
- Minimum 16MB RAM (32MB recommended)
- Modem/Network Interface card to connect to the internet
- An SVGA Graphic Adapter
- Standard desktop computer peripherals

### 1.2 Software Requirements

Listed below are the software requirements needed to run the system

- Windows 95 or Windows NT 4.0 server or above
- Microsoft internet Explorer 4.0 or above, or Netscape Navigator 4.0 or above.

### 1.2 Installing HEIS

Copy the entire folder named 'heis' into the wwwroot directory of the server. The exact path of the directory must be C:\inetpub\wwwroot\infotainment\. Make sure the server is running IIS4.0 and above.

## CHAPTER 2 GETTING STARTED

HEIS is a web-application that can be accessed through typing the address of the site in the web browser. Before accessing HEIS web-site, make sure that your computer meets the minimum hardware and software requirements as stated in the previous chapter.

To use HEIS, the first thing that you need to do is to start your Web Browser. Then in the address text box area, type the Web site address of HEIS and press the Enter to access HEIS web-site.

### 2.1 Client Section

The URL address of HEIS client section is <http://computename/HEIS/> ( Substitute computename with IP address of the server eg. 202.185.108.133).

### 2.2 Administration Section

The URL address of HEIS administration section is <http://computename/heis/admin/login.asp> (Substitute computename with IP address of the server eg. 202.185.108.133).



## CHAPTER 3 : CLIENT SECTION

## 1. Homepage

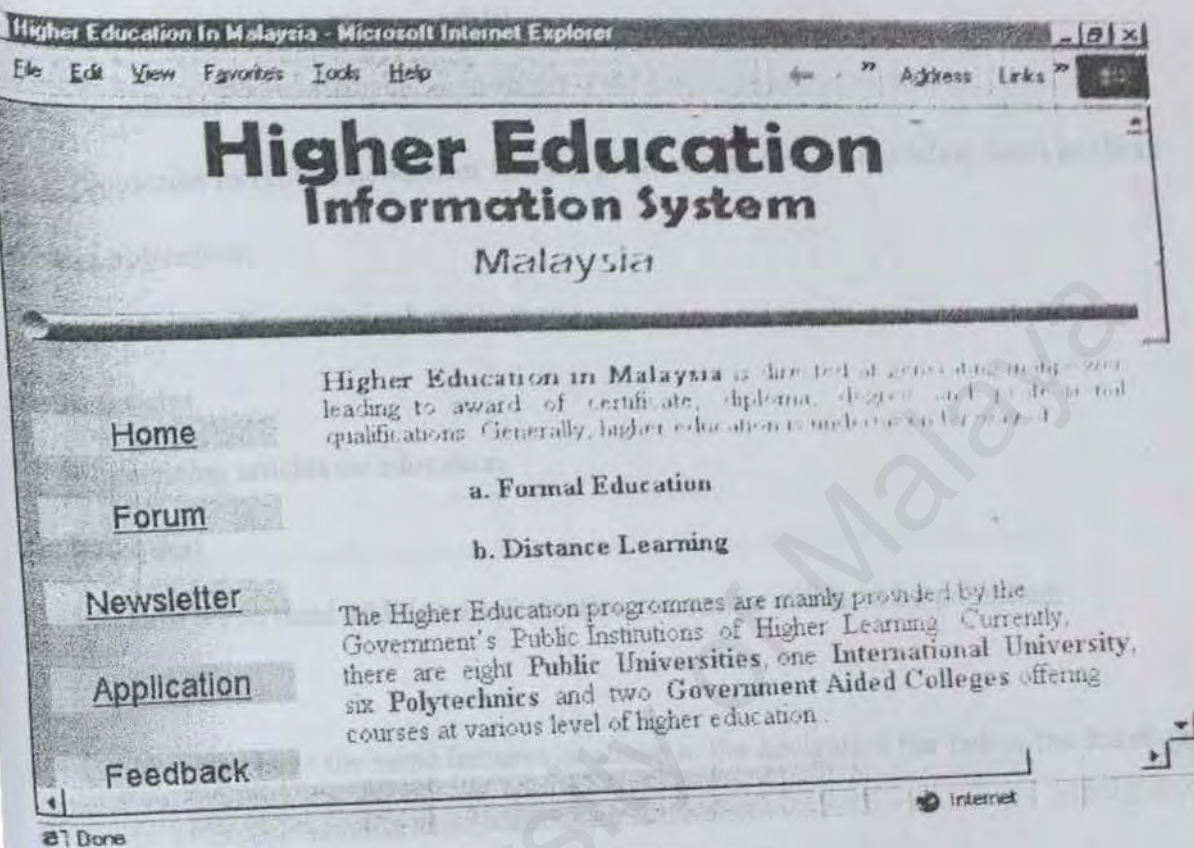


Figure 3.1 HEIS Homepage

A successful connection will bring you the homepage of HEIS as in Figure 3.1 above.

Within this page, you can:

1. Click on the navigation icons to select different services

✓ **'Enter'**

Browse for higher education information, which is categorized university, college and polytechnic, in this electronic catalog.

✓ **Forum**

Discussion Forum of HEIS

✓ **Feedback**

View and send comment to HEIS.

✓ **Newsletter**

Subscribe to HEIS's newsletter to keep yourself updated on the latest news in HEIS.

✓ **Application**

Apply to colleges through the system.

✓ **Articles**

Interesting articles on education.

✓ **Request**

In case if you need additional information, or send a article to be published.

2. You also have the same features as above in the navigation bar below the Jukebox.

### 3.2 Catalog

You can browse HEIS's catalog to view information on Universities, colleges and polytechnics. When you click ENTER in the first page, you will go the next page which has the summary of HEIS system. Below that there will be three options, Universities, Colleges and Polytechnics. You can choose either one of them to view the details. On the next page you will see the details like description and address of the institute together with a list of faculties or departments in that institute. You can view the faculty description and available courses by clicking any of the faculties. In the list there will be



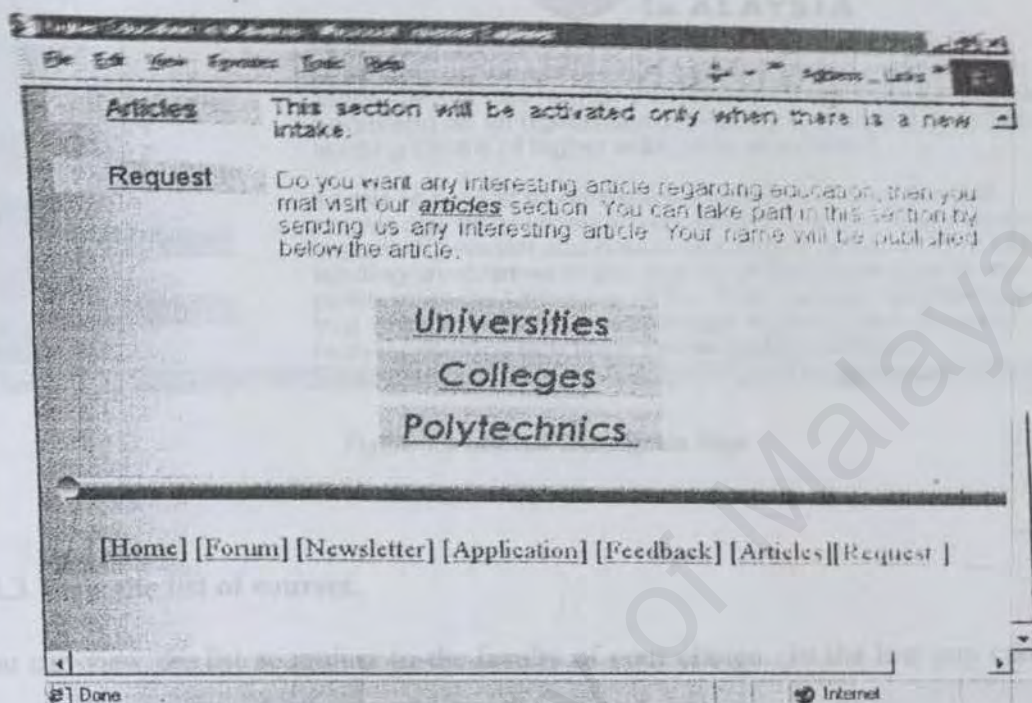


Figure 3.2 Catalog Page

### 3.2.1 View The List Of Institutes

You can view the list of universities, colleges and polytechnics in three different pages.

### 3.2.2 View record of institute.

You can view the description, link, address and logo of the institute.



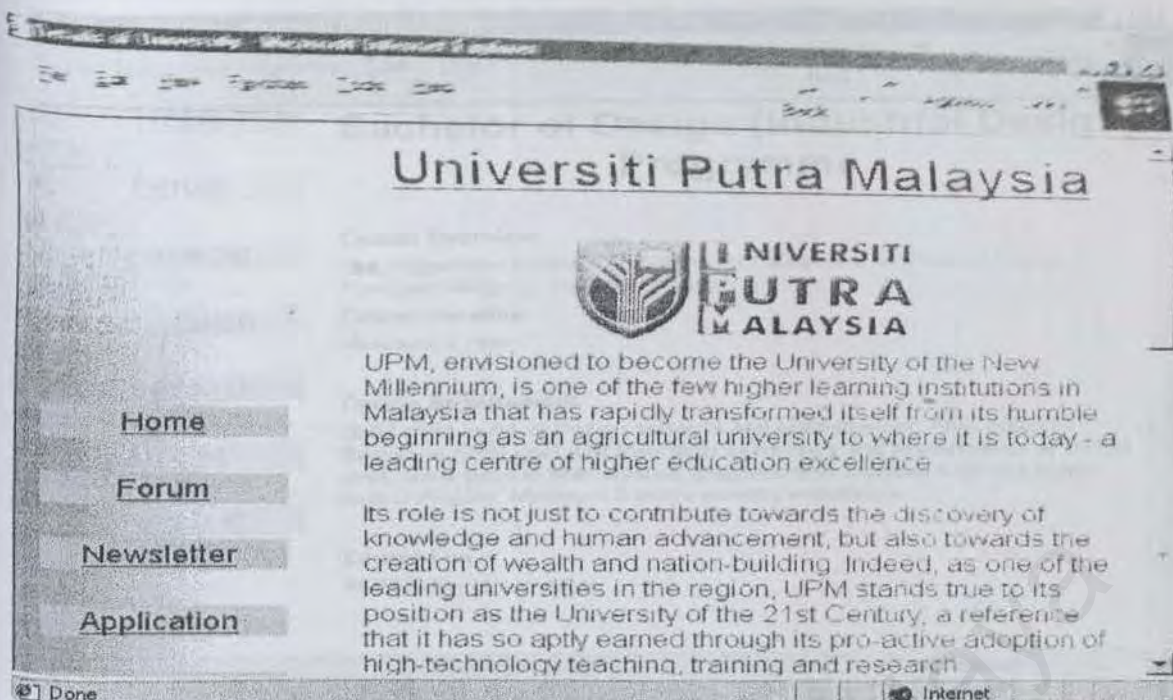


Figure 3.3 Institute Description Page

### 3.2.3 View the list of courses.

You can view the list according to the faculty of your choice. In the last you can see the type (undergraduate or diploma) of the course.

### 3.2.4 View Course description

You can view the description of the course. You will get details like course overview, duration, fee and requirement.

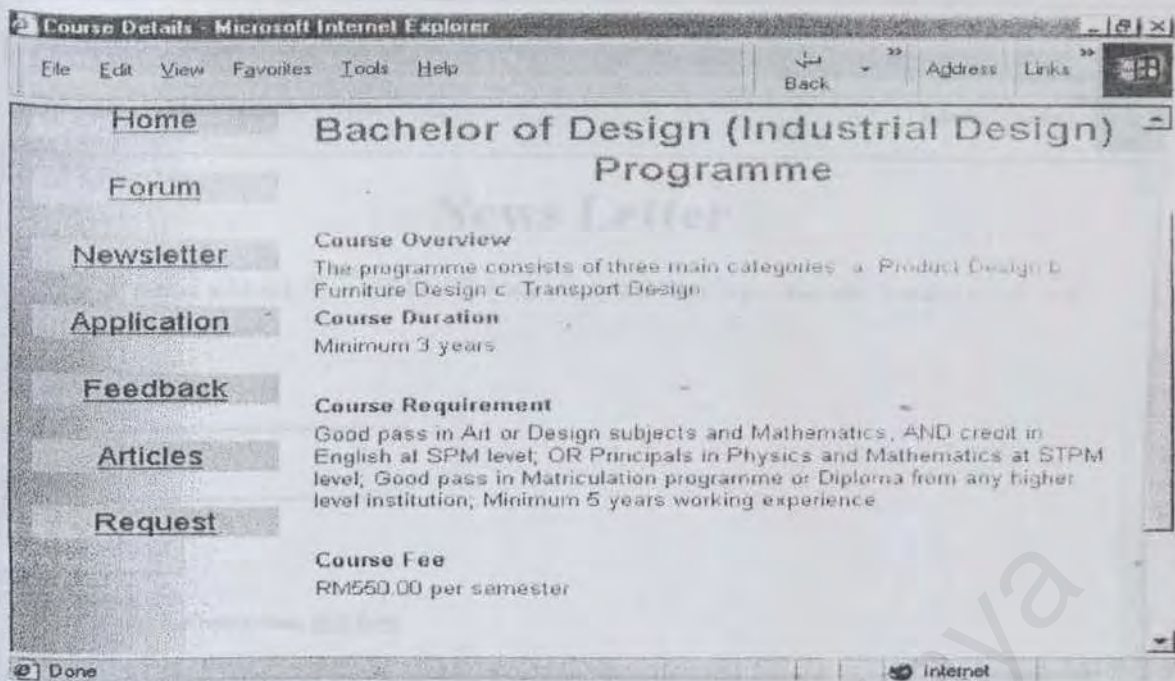


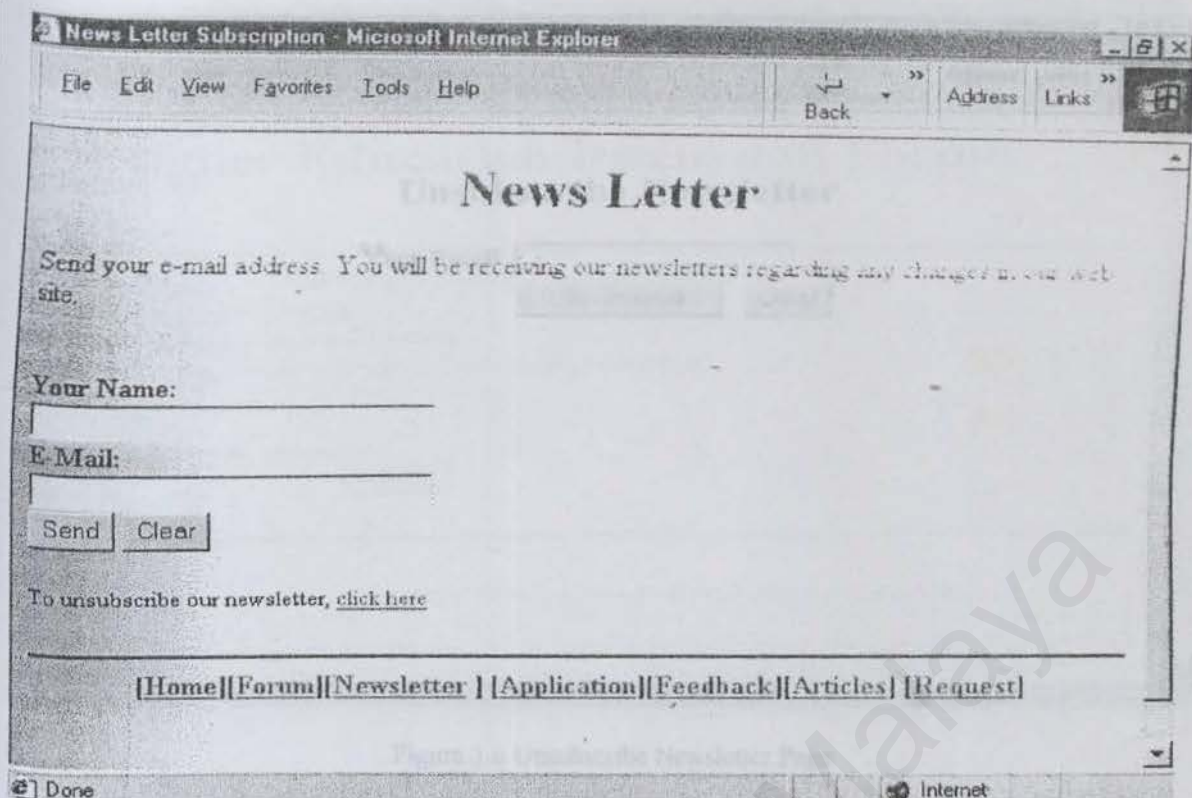
Figure 3.4 Course Details Page

### 3.3 Newsletter

#### 3.3.1 Subscribe Newsletter

You can subscribe HEIS's Newsletter to get the information on the latest happenings in HEIS by subscribing newsletter. Enter your name and email address in the text box and click send. You can see the notification that you have subscribed HEIS newsletter. Figure 3.5 below shows the subscription page.





The screenshot shows a web browser window titled "News Letter Subscription - Microsoft Internet Explorer". The address bar is empty. The menu bar includes File, Edit, View, Favorites, Tools, and Help. The toolbar has Back, Forward, Address, and Links buttons. The main content area has the heading "News Letter" and the text "Send your e-mail address. You will be receiving our newsletters regarding any changes in our web site." Below this, there are two text input fields labeled "Your Name:" and "E-Mail:". To the right of the "E-Mail:" field are "Send" and "Clear" buttons. Below the input fields, there is a link: "To unsubscribe our newsletter, [click here](#)". At the bottom of the content area, there is a horizontal menu with links: [Home], [Forum], [Newsletter], [Application], [Feedback], [Articles], and [Request]. The status bar at the bottom shows "Done" and "Internet".

Figure 3.5 Newsletter Subscription Page

### 3.3.2 Unsubscribe Newsletter

You can unsubscribe HEIS's newsletter by clicking on the hyper link below the text bow.

Enter your email address in the text box and click unsubscribe. You can see the notification that your record has been deleted. In case you want to subscribe again click the hyperlink accordingly. Figure 3.6 below shows the newsletter unsubscribe page.



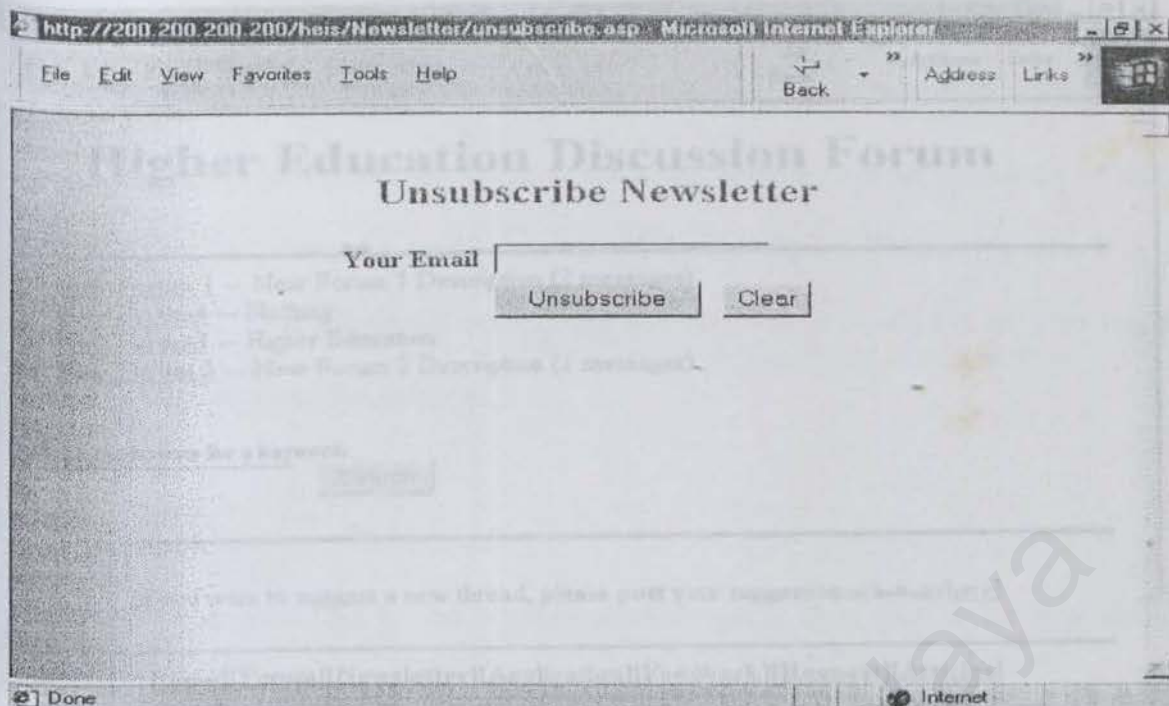


Figure 3.6 Unsubscribe Newsletter Page

### 3.4 Forum

#### 3.4.1 View Topics

Click on the hyperlink of the subject in currently available in the forum. Once you clicked the hyperlink, you will see the folder opens up and messages under that thread. You can reply to thread by clicking [Post a New Message to forum] or view the messages by clicking on the message hyperlink. You can send reply to the message by clicking [post a reply] or go back to folder by click [back to folder]. Figure 3.7 shows the Discussion Forum main page.

#### 3.4.3 Suggest a New Thread

You can suggest a new discussion topic by send you suggestion by clicking the hyperlink [click here] below the forum. You will see a feedback module. Send your suggestions as feedback. Your suggestions will be attended by the administrators.

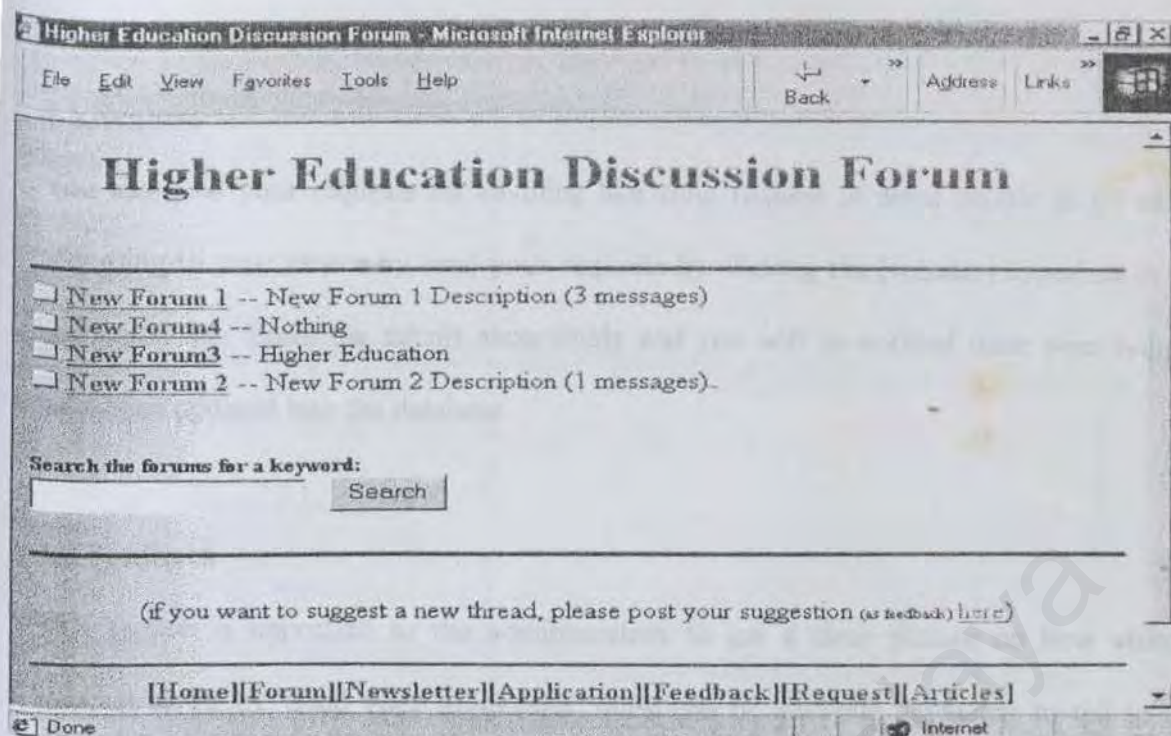


Figure 3.7 Discussion Forum Page

### 3.4.2 Search

You can search for specific topic in the forum by typing in your search text in the text box and click [search]. If there is no match for your input string then you will see an advanced search option. Choose accordingly and click [search]. If there is match for your search, you will see hyperlinks for your search results. Else you will see no match forum message.

### 3.4.3 Suggest a New Thread

You can suggest a new discussion topic by send you suggestion by clicking the hyperlink [click here] below the forum. You will see a feedback module. Send your suggestions as feedback. Your suggestions will be attended by the administrators.



### 3.5 Request

You can send your requests on anything like song request or artist profile to be added according to your choice by send your requests by clicking the [request] hyperlink in the navigation bar. Enter the details accordingly and you will be notified once your request have been updated into the database.

### 3.6 Feedback

This section is important to the administrators to get a clear picture on how visitors respond to HEIS. Send your suggestion, questions or anything you want to tell to the administrators so that they can serve your needs. You can send feedback by clicking the [feedback] hyperlink in the navigation bar at the bottom of the page. Enter the details accordingly and you will be notified if your feedback has been sent successfully.

### 3.7 Application Page

This section allows users to send application online to HEIS. HEIS will process them send them to appropriate colleges.



Online Application - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Address Links

## Application Form

\* Required Field

**Personal Particulars**

\* Name:

\* Date of Birth:  Jan

\* Gender:

\* Marital Status:

\* Nationality: Afghanistan

\* Identification:

**Current Address**

\* Address:

\* City/Town:

Done Internet

Figure 3.7 Application Form Page

### 3.7 Articles Page

This section will publish articles on education. The user may take part by sending any interesting articles.

## CHAPTER 4 : ADMINISTRATION SECTION

### 4.1 Administration Login

After typing the correct URL on the location bar of the browser, you will enter the Administrator's Login page. Enter your Login ID and password, then click [Login] to logon to HEIS's Administration section. Initial login ID for Administrator is 'admin' and Password is 'admin2' login ID for user group is user where the password is user2.

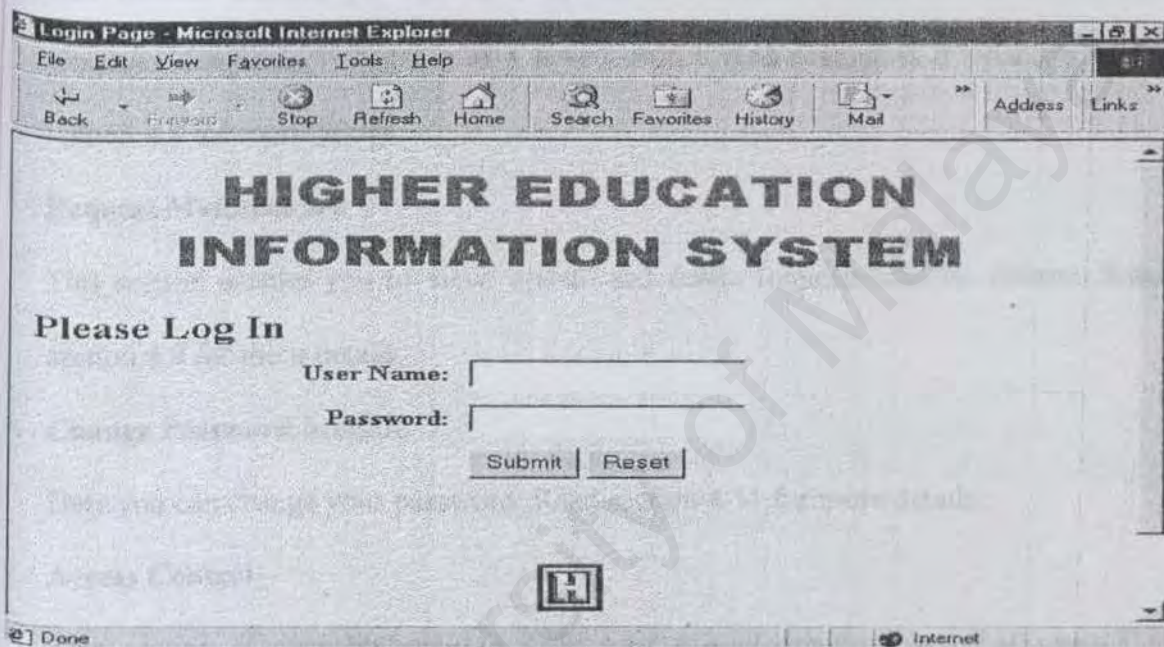


Figure 4.1 Login Page

### 4.2 HEIS Maintenance Menu

Within the Administration section, you have can perform the following tasks:

#### 1. Catalog maintenance

This section includes all the features in the catalog to be maintained. Read section 4.3 for more details.

#### 2. Feedback Maintenance



You can view, update and delete feedback sent by visitors of HEIS. Read section 4.4 for more details.

#### **Newsletter Maintenance**

This section allows you to view, update and delete subscribers record and send email to newsletter subscribers. Read section 4.5 for more details.

#### **4. Forum Maintenance**

This module enables you to view, update and delete records in the forum and messages database. You can add a new forum thread suggested by visitors. Read section 4.8 for more details.

#### **5. Request Maintenance**

This section enables you to view, update and delete requests sent by visitors. Read section 4.9 for more details.

#### **6. Change Password Module**

Here you can change your password. Read section 4.11 for more details.

#### **7. Access Control**

This section is available only to valid user group(administrator). For users this module cannot be accessed. This module enables administrators to view, delete and create user records. Read section 4.12 for more details.

Figure 4.2 below show the HEIS Maintenance Menu.



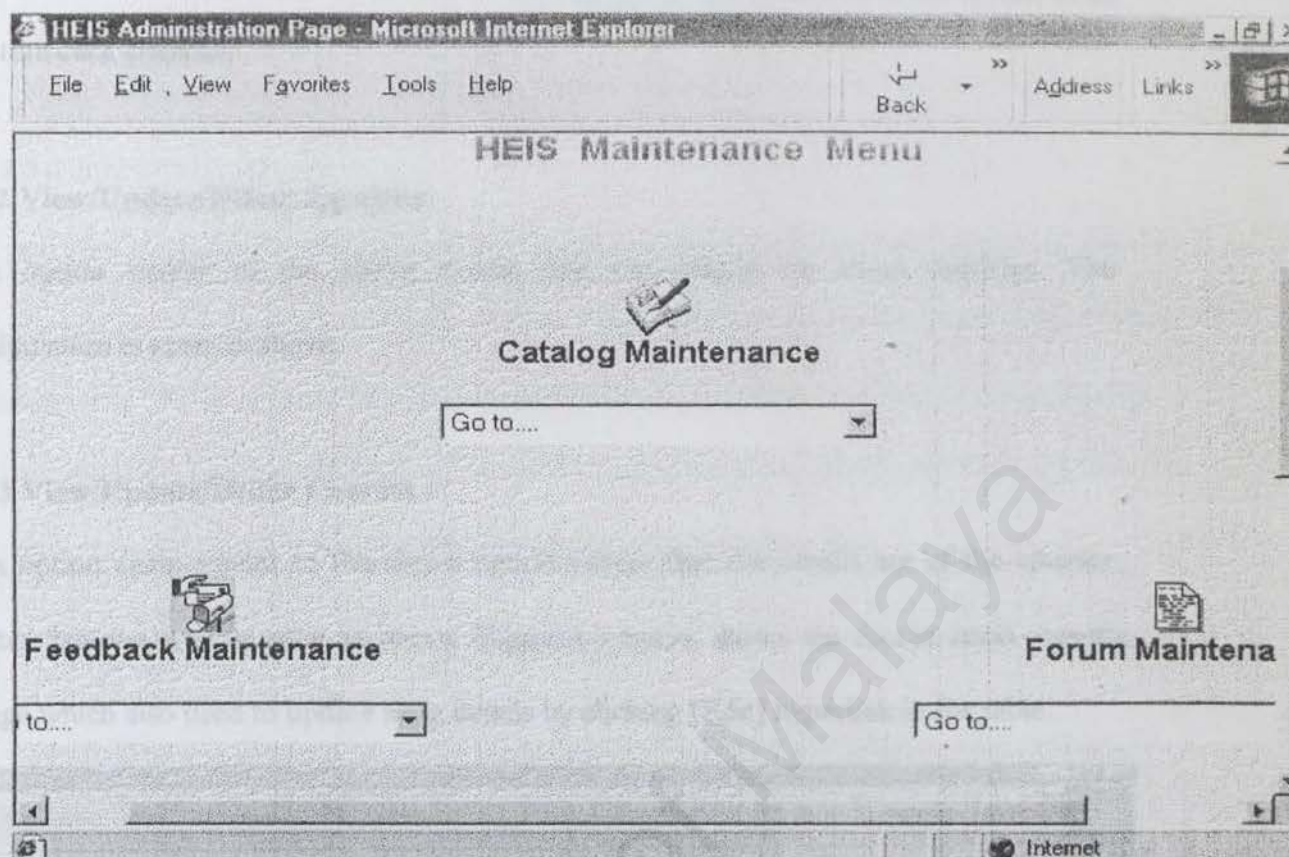


Figure 4.2 HEIS Maintenance Menu

### 4.3 Catalog Maintenance

This module contains 6 options to select from the selection bar. Each selection will bring you to the respective sections.

#### 4.3.1 View/Update/Delete Institute

This option will bring you to table with institute details. Click [Edit] the information pertaining to each category. To update the institute details, you can modify all the details in the text box except the Ins\_id. After modifying the details, click [Submit] to update the

status. Yes, will be decided on the status of the update process. To delete the record of an institute click [Delete].

### 4.3.2 View/Update/Delete Faculties

This option similar to the above except that the details are about faculties. The manipulation is same as above.

### 4.3.3 View/Update/Delete Courses

This option again similar to the above option except that the details are of the courses.

Other features are the same as above. Figure 4.3 below shows the course detail viewing page which also used to update song details by clicking [Edit] hyperlink in the table.

Action	Action	Faculty_id	Course_id	Course_title	Course_type	overview	duration
<a href="#">Edit</a>	<a href="#">Delete</a>	1	2	Master of Arts (Dissertation)	1	Dissertation	Minimum 2 year:
<a href="#">Edit</a>	<a href="#">Delete</a>	1	3	Master of Arts (Malaysian History)	1	Coursework & Dissertation or Research Report	Minimum 1 year
<a href="#">Edit</a>	<a href="#">Delete</a>	1	4	Master of Arts (Southeast Asian History)	1	Coursework & Dissertation or Research Report	Minimum 1 year
<a href="#">Edit</a>	<a href="#">Delete</a>	1	5	Japan Programme Studies	2	Toward and this end, the teaching programme of the Department is centred on three programmes of specialisation on	Minimum 3 year:

Figure 4.3 View/Update/Delete Courses

Figure 4.4 below shows the song update page which is accessed by clicking the [Edit] link as in Figure 4.3 above. Record is edited and updated to the database by clicking the [submit] button.



Figure 4.4 Update Course Record

#### 4.3.4 Add New Institute

This section enables you to add a new institute record in the database. Enter the details accordingly to create a new institute. The Image file for logo is the exact name of the image file, for example uia.jpg or upm.gif. When you enter the data for institute link, specify them as a link. For example, University Putra Malaysia's web site link is [www.upm.edu.my](http://www.upm.edu.my). When you enter the data please type in like this:

```
<a href="www.upm.edu.my">www.upm.edu.my</a>
```

For the institute description, address, use the html tags like `<p></p>` (for paragraph), `<b></b>` (to bold a text) and `<i></i>` (to italic a text).

#### 4.3.5 Add New Faculty

This option again similar to the above option except that the details are of the faculties. Other features are the same as above.

#### 4.3.6 Add New Course

This option again similar to the above option except that the details are of the faculties. Other features are the same as above.



#### 4.4 Feedback Maintenance

This section enables you to view, update and delete feedback records. The view and update section is similar to the ones explained above. The delete option will enable you to discard or delete any unwanted record. Click on the respective record to delete the row from feedback record. You will see a confirm delete record screen before the record is permanently deleted from the database. Click [Yes] to delete or [No] to go back to viewing option. Figure 4.4 below shows how delete operation being confirmed before record is permanently removed from the database.

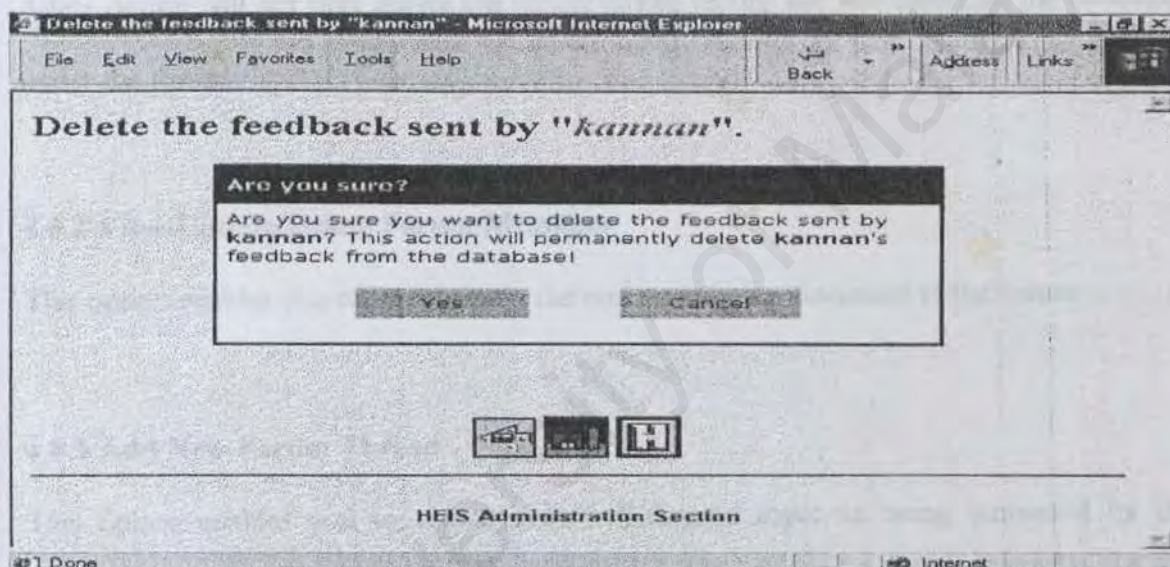


Figure 4.4 Confirm Delete

#### 4.5 Newsletter Maintenance

This section has two options, to view, update or delete record and to send newsletter to the subscribers. To send newsletter, select [Send Newsletter] option. You will see Newsletter Sending page. Enter your email address or HEIS official email address in the [From Email Address] field, enter the Newsletter title in the [Subject] field and enter the content in the [Body] field, then click[Send Message] button to send the newsletter. You

will see a broadcasting message appear on the screen when subscribers have been sent email.

#### **4.6 Forum Maintenance**

This section has 3 options which can be accessed by selecting the respective options.

##### **4.6.1 View/Update/Delete Forum Thread**

This option enables you to housekeep the subject being discussed in the forum. The delete option will not only delete the forum thread record but will delete all the messages under the thread.

##### **4.6.2 View/Update/Delete Forum Messages**

This option enables you too housekeep the messages being discussed in the forum.

##### **4.6.3 Add New Forum Thread**

This option enables you to create a new discussion topic as being requested by the visitors in the feedback module. Enter precise, concise and relevant Forum subject and the description. Figure 4.5 below shows the create new forum thread page. The forum grouping determines how the messages are being shown collectively. Enter number of days for example 7 days so that the messages are kept in folders on weekly basis.






**CREATE NEW THREAD**

Thread Name

Description

Forum Grouping

**HEIS Administration Section**

Figure 4.5 Create New Forum Thread

#### 4.7 Request Maintenance

This section is similar to the other maintenance section with view/update/delete options.

#### 4.8 Change Password

This option allows you to change your password settings. Enter your old password and your new password then click the [submit] button to change your password. You will be notified if your password has been changed successfully. Figure 4.6 below shows the change password option.



**CHANGE PASSWORD**

User Name

Previous Password

New Password



HEIS Administration Section

Figure 4.6 Change User Password Option

#### 4.9 Access Control

This option can only be accessed by valid administrators to view, delete and create new user accounts for the administration section. Figure 4.7 shows how valid administrators can create new user accounts setting in HEIS.


**CREATE NEW USER**

User Name

Password

User Group

User E-Mail



HEIS Administration Section

Figure 4.7 Create New User