Kasetsart J. (Nat. Sci.) 34 : 139 - 144 (2000)

Electronic Knowledge Delivery: Developing a Web-based System for Computer Course

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ABSTRACT

The universe of information provided on the World Wide Web (WWW) has been delivered to users tremendously. These millions of Web documents induce the oversupply of information. The study which improved a Web-based system development might increase the successful experience and satisfaction of users. This present study identifies the WWW publishing and highlights methods and tools for developing a Web-based system. Further, this paper describes the design and the development of a Web-based system for a computer course. The system allows a personalised user interface and a presentation of course materials through the WWW.

Key words: Web-based system, electronic knowledge, WWW, development.

INTRODUCTION

The WWW is a wide area hypermedia information system providing a global access to large amounts of documents (Foo and Lim, 1997). The multitude of Web sites has created much comment on the existence of information overload.

Hyper Text Markup Language (HTML) is a hypermedia language used to build WWW documents. This language allows the user to define the logical organizational and various formats including ordinary text documents, graphics, multimedia, hyperlinks to other HTML documents and Internet resources. Hyperlinks are powerful utilities for navigating and cross referencing information. The WWW resource has a unique address namely Uniform Resource Locator (URL).

Components of web publishing

The essential elements required for publishing and access information on the WWW are as follows:

1. Web server. It is compulsory that an individual or enterprise subscribes to an information system service providing access to the internet. Organizations which have substantial computing resources can set up their own HTTP server and connect to the internet.

2. HTML authoring tool. To compose the Web pages an authoring tool is needed. Web pages are made of HTML which is an ASCII text file consisting of HTML tags. Common text editors can be used for this task. To create commercial or more complicated HTML, such as multimedia Web pages, a higher functionality tool such as Perl (O'Rielley and Associates Inc., 1998), HoTMetal (SoftQuad, 1998) and FrontPage (Microsoft Corporation, 1998) are used for PC based editors. Alternatively, Pheonix (University of Chicago, 1998) , EMAChhm (Minar, 1998) and HoTMetal

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(SoftQuad, 1998) are Unix based editors.

3. Web browser. Web browsers are client software which can be used to navigate and access the large volume of Web pages stored in different Web servers on the internet. The browsers are text and graphics-based, however the later is more preferred because they can display graphics and icons which are more user friendly. The most commonly used Web browsers are Netscape Communicator (Netscape Communications 1998) and Microsoft Internet Explorer (Microsoft Corporation 1998).

Development of web-based systems

Previous studies have suggested different factors involved in the design and development of the Web-based systems. These factors include styles of Web sites, objectives of designers, communities of users and spectrum of tasks (Schneiderman, 1997) and domains of user works (Erskni, David, Carter-Tod and Burton, 1997; Picciano, 1998). Interestingly, no study has introduced the framework or the relationships between the factors of the system development.

As in any development process of Information Systems, it requires the developers to undertake a number of related activities. Benyon (1997)'s study proposes six essential processes for developing Web-based systems. They include system specification, instructional design, multimedia design, integration, implementation and evolution. However, Benyon (1997) suggests that new tools and approaches are needed to enhance the effective development of a Web-based system. Thus, a study of the comprehensive process of design and development of Web-based system is required to improve the efficiency and the effectiveness of the system.

This paper aims to present a model of Web-based system development and to provide tools and methods to guide Web designers. Besides, difficulties of the Web publication and some recommendations for improving communication through the WWW will be presented.

MATERIALS AND METHODS

A web-based system for computer course

CPI is a Web-based teaching system designed for an undergraduate course named 418211 Computer Programming I. It is a 3 credit course which is offered at the Department of Computer Science, Faculty of Science, Kasetsart University.

Various Web-publishing tools had been used for developing CPI. These tools include a Web server, a Web browser and HTML authoring tools. First, the Web server (HTTP) is a Sun Sparc 1000E residing at the Department of Computer Science, Faculty of Science, Kasetsart University. This server is connected to the Internet via Kasetsart University network. Second, the two commonly used Web browsers, Netscape Navigator (Netscape Communications, 1998) and Microsoft Internet Explorer (Microsoft Corporation, 1998), can be used for CPI. The former browser is preferred because it is more popular in Thailand. Third, HTML authoring tools are text editor and Web authorizer. The text editor, Microsoft Word 97, was used to compose large text documents for the Web. Additionally, Perl (O'Reilley and Associates Inc., 1998) and Java (Sun Microsystems Inc., 1998) were selected to build more attractive features on Web sites and allow users to interact with the system easily.

The Computer Programming I course was used as the information profile designed to be published on the WWW. The information profile was broken systematically and logically to tree structures revealed in Figure 1. The hierarchical tree structure can be used as a model to define and cross-link the components of the Web-based system.

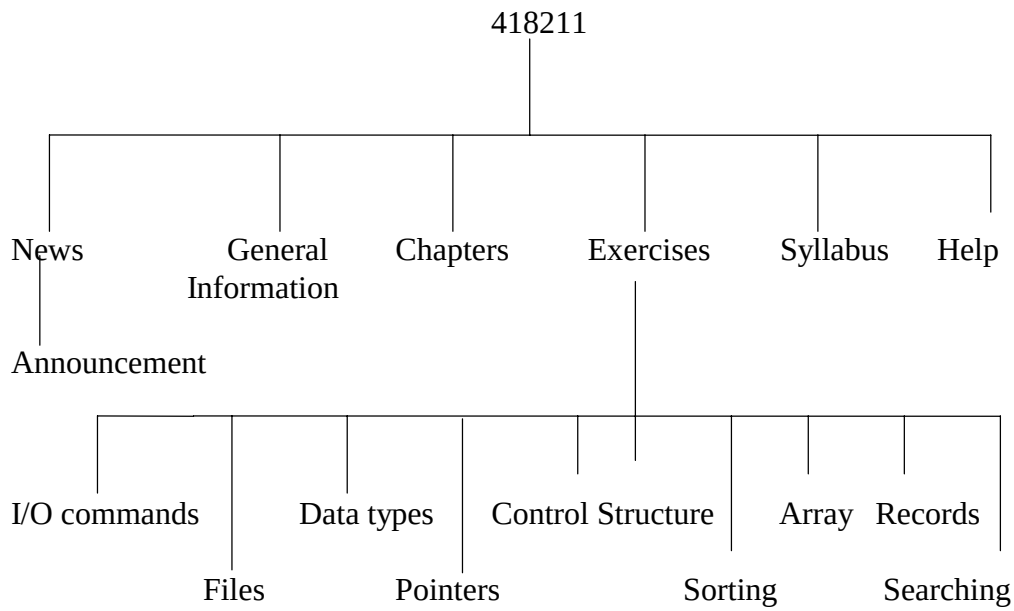

Figure 1 Information profile of 418211 Computer Programming I course on Web sites.

The hyperlinks connect different information together, further cross-hierarchical tree structures can be connected by linking these structures. For this purpose, these structures are used for making a model to publish Web documents.

The Web home page referring to the first document intended to be viewed is placed at the top of the tree. This home page includes an introduction and a main menu of documents within the publication. Generally, it is associated with a particular web site, person, named collection, or private or public enterprise. The main menu consists of the hyperlinks to other home pages or documents.

With the homepage, the main menu of CPI contains the principal focus and is differentiated into different common components as depicted in Figure 2.

The components of CPI

1. *Chapters*. The important parts of each chapter are selected and published on the Web pages. The reasons are the limitations of the space on the Web site and a large graphic Web page requires overly long response time. Users can download full text of all chapters from the server by using the given password. The materials in these chapters are comprehensive and fulfilled the requirements provided in the course outline.

2. *Exercises*. The exercises of each chapter are provided in both HTML and text.

3. *Help*. It offers the details of hardware and software configuration required to work with the system. Furthermore, it includes the methodology in download document files provided by the lecturer.

4. *Course Syllabus*. It provides the objectives of the course, course outline, course description, text books, contact address, grading system and schedule.

5. *News*. It reveals an announcement which the information from the lecturer to users such as assignments and current news.

6. *General Information*. It provides the objectives of the current Web-based system.

Figure 2 CPI home page using Netscape Communication, the URL address is http://www.sci.ku. ac.th/~fsciang2/index.html.

By using HTML tools, the Web documents are coupled and cross-linked with the detailed information provided for each component. As the information comes from various sources of documents, it is noted that the published information should be uniform and homogenous. Consequently, a schedule of regular maintenance to manage proposed changes and to present information is also required to enhance overall effectiveness and efficiency of the system.

RESULTS AND DISCUSSIONS

Since June 1998, CPI was published on the Web. Students who enroll in 418211 Computer Programming I class can access the course materials on Web sites and communicate with the lecturer via email through the links provided on the Web page. However, there are still problems in utilisation of the system. These problems are presented in the following paragraphs.

Difficulties of web-based system implementation

Some problems of CPI implementation have been raised by the users after the system was published on the WWW.

1. Inappropriate search engine. There are many search engines provided in the WWW includes Lycos, Infoseek, Excite and Yahoo. Interestingly, these engines often provide very long lists of matching documents if the index is provided. Then, the documents have to be navigated one at a time. The home page of the document is revealed in order to access the hypermedia areas via hyperlinks. This is performed until the relevant information is delivered. That is appropriate for searching information from several resources. Still this is time consuming and unsuitable for cases when a specific and detailed query is known. Additionally, not many search engines in other languages from English are provided. Applying English-based search engine to a foreign language

database such as Thai creates some difficulties in data presentation on the Web. In this case, developers need to build their own search engine for specific purposes and tasks.

2. Degradation of performance. The large number of WWW users decrease the system performance, the network is overloaded due to the extremely heavy traffic. This situation always occurs with the popular Web sites. It leads to the frustration of the users and loss of interest in utilization of the WWW.

3. Maintainability of publication. As the time passes, more information is always added on the WWW. This can result in a high growth rate of Web documents. As a result this will lead to the point which is difficult to maintain and ensure the accuracy of information. It is suggested that the management of Web documents is needed.

4. Data transmission. In developing countries such as Thailand, there are various limitations of data transmission. These factors include poor communication infrastructure, low-cost devices, and low-bandwidth wireless access. Since the data transmission is very slow, multimedia which require high speed of transmission cannot be applied on the Web effectively. The text version of Web-based system is recommended for this case.

CONCLUSIONS

The major contribution of this study is an attempt to present tools and methods in developing a Web-based system. CPI has been implemented to demonstrate the research idea and allow the structure and contents to publish on the Web. The design is practical and might be used in developing a prototype for Web-based systems, specifically a courseware for internal or for distance learning. Future research on the development of Web publishing might be done to improve the effectiveness and efficiency of the system. The study of the new designing techniques or the framework of Web-based system is recommended for further research.

ACKNOWLEDGEMENT

The author would like to acknowledge the Kasetsart University Research and Development Institute for providing funding for this study.

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Received date : 13/10/98
Aecepted date : 23/06/99