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Support for Decision Making on the World Wide Web

A thesis presented in partial fulfillment of the requirements for the degree of

Masters of Information Science

in

Computer Science

at Massey University, Turitea Campus

Palmerston North

New Zealand.

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2004

Abstract

This research explores tool support for information retrieval and comparison of multiple pieces of information on the web. The study identifies the main goals users may have in mind when using the Internet in this way, and the necessary activities users complete to fulfill their goals. The main goals web users have are information search, entertainment and consumer to business transactions. The tasks users perform on the web to fulfill their goals include collecting, comparing, filtering and processing web information. These tasks form a decision-making cycle on the web and depending on the goal at hand, users may or may not necessarily undertake all the tasks or sub-steps in any sequential order.

Industry web support tools have been analyzed to find out how effective they are in supporting a common user's activities. These tools include web browsers (Netcaptor Browser and Internet Explorer), editing tools (Notes Pilot and Edit Pad), plug-ins, research tools and window management systems. Both browsers are poor at arranging multiple windows and excellent at opening web sites. The Internet Explorer browser proved to be better than the Netcaptor browser at a number of activities including, selecting web content, copying web text and images and pasting web content into editing documents. When used with either browser, Microsoft Windows is good for arranging windows but poor in switching windows views, scrolling windows and re-sizing and re-positioning windows. Both editing tools are poor at re-positioning and formatting web content from an HTML environment to a text-based environment. The Notes Pilot tool is also poor in making calculations and returning to the browser. It is excellent at saving work and retrieving old files. The Edit Pad tool is successful at all other activities except re-positioning and formatting web content. It can be seen that tool support is lacking or current web-based tools support the user poorly in a number of areas.

The need for an integrated web support tool has been identified. The functional and non-functional requirements have been specified, the tool designed, implemented and evaluated by users. The users were requested to complete a questionnaire and conduct

a think-aloud walk-through session while completing three tasks using the integrated web support tool. The sessions were observed and results recorded. Most of the users strongly agreed with the proposition that the tool would be useful for personal or academic activities. The users recognized the tool's novelty, its efficiency, and also indicated an overall level of satisfaction. The users were less satisfied about referring back to web sites, getting the software to do exactly what they wanted and arranging the work space to meet their needs. Changes were made to the tool.

Acknowledgements

I would like to dedicate this thesis to my beloved parents, Late Dr Kazi Firoz Alam and Nazneen Ara Khanom. They have raised me to be the best I can be and never to take a day for granted. I thank them for supporting all the decisions I have made in my life.

I wish to thank my two supervisors, Associate Professor Elizabeth Kemp and Associate Professor Chris Phillips for all their dedication and contribution towards this thesis. Their direction has helped me shape this thesis into my best work to date and I am very grateful to the both of them. My sincere thanks goes to Mr Paul Lyons who assisted me throughout the programming part of Networker.

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Chapter 1: Introduction

The focus of this thesis is on information retrieval and comparison on the Web, and the tools that are available to effectively carry out these activities. The research identifies the key activities in web decision-making, and how current tools assist web users to complete these activities. A tool that addresses the features lacking in current web support tools is designed and prototyped. Useful insights are provided into an average user's activities on the Web.

1.1 Background

The World Wide Web is a hypertext system. A pointer from the main text to a related document is called a "link". Most documents on the Web contain links to navigate to other web pages. Users traverse the links using a pointing device, e.g. a mouse. The process of reading web pages and traversing links to more web pages is called browsing or surfing. Users may browse with serious goals in mind or for entertainment (Lehnert, 1998).

The Web is a vital information resource for users. It is the complete set of electronic documents residing on all Internet servers that use the HTTP protocol (Johnson, 2000). Users can access web sites i.e. electronic pages full of valuable information, in a consistent and readable format using web browser software. Users will only feel satisfied that their goals are fulfilled if the tasks are conducted in an orderly fashion, i.e. their goals are met efficiently. It is very critical that the information content is easily located and read, and is both reliable and recent so that it can be sourced.

There are about 655 million users on the Internet in the world according to the CIA's world fact book (ClickZ Stats, 2002). This may increase to 709.1 million in 2004 (Emarketer, 2004). The number of ISPs in 2002 was 24,666 according to the CIA World Fact book (2003). Nielsen//NetRatings tracks the number of active users for approximately 20 nations, which account for more than 90 percent of the world's

Internet users (Nielsen //NetRatings, 2003). Web pages are being added at a rate of 7.3 million pages a day worldwide.

Researchers at the Online Computer Library Center claim that the Web in 2001 contains 8.4 million unique sites, compared to 7.1 million in year 2000 (Pandia, 2001). The Web continues to remain predominantly an English language medium. 73 percent of the sites have material predominantly written in the English language. Out of the present 8.4 million web sites, 3.1 million are classified as public sites (i.e. a site that offers content that is freely accessible to the general public), 2.1 million are classified as private (with restricted access) and 3.2 million are classified as provisional or in a transitory or unfinished state according to the Online Computer Library Center (Pandia, 2001).

Although increased emphasis is being placed on the Web, little empirical research has been done on the effectiveness of this hypertext-publishing medium, its user interfaces (web browsers), and users' mental models of the Web and hypertext (Nahl and Paervaiz, 1997).

There are seven classifications of the different types of content available on web sites (Landsberger, 2001):

- personal with biographic data: to market oneself, often called "vanity pages";
- promotional: to sell a product;
- informational: to share information on a particular topic or hobby;
- persuasive: to convert people to a particular point of view;
- instructional: to teach a unit or course of study;
- registrational: to register for courses, information, and/or products, accumulate a database of, and simplify communication with, registrants;
- entertainment: to purchase concert tickets, play electronic games and watch movies etc.

Most importantly, it is difficult to understand the nature of the interaction between users and information resources. Access can be rapid; links might cross boundaries of location, subject matter, content form, style and interactivity in a way that has no real equivalence in the paper world (Vaughhan and Dillon, 1998). Studies show that the three critical tasks for web users are to choose, collect and compare information (Nielsen, 2001).

1.2 Goals of the Project

Users commonly make purchasing and other decisions after comparing information downloaded from multiple web sites. The value of this information increases when it is combined (Krug, 2000). Comparing multiple pieces of information defines an important web activity that deserves explicit support from web applications. Currently, standard web browsers and text editors provide lower level support; the former allows a user to download information, the latter allows a user to collate information, but a higher level of support would be ideal in a tool that integrates the two functions.

Specifically, the goals of this project are:

- To identify user goals on the Web and the tasks users complete to achieve these goals.
- To derive a process for decision-making on the Web.
- To analyze current tools and determine to what extent these tools support user tasks.
- To develop key functions for a web support tool that overcomes the shortcomings of the current tools and assist users to deal with multiple web sites.
- To design and implement a web support tool, and address future development areas.

1.3 Method

The approach adopted in this study is as follows:

- *Analyze the critical tasks for users on the web interface during information retrieval and comparison*

  This process begins with a review of expert opinions and scientific research on the pertinent tasks web users currently undertake. Different approaches used to collect, compare and choose multiple information on the Web are studied. This information is used to derive a comprehensive framework, based on the key tasks a web user conducts when making choices between multiple pieces of information. This framework is presented in the context of Norman's interaction model.

- *Review web browsers, window systems and web tools to support these activities*

  Two web browsers are discussed in detail, Internet Explorer and Netscape Navigator. Microsoft Window Systems and other supporting web tools that use similar window mechanisms are explored. The features of the web support tools, which support the user's decision-making cycle, are described.

- *Test the web support tools in a decision-making framework using three common web user tasks*

  Each web support tool is tested to find out how effectively it can support steps in the decision-making framework. These tests are conducted in the context of common web user tasks.

- *Analyze and summarize these results*

  Each web support tool is analyzed in the context of the decision-making process, and the tools are compared. The results are presented in tables and discussed.

- *Develop a tool specification from the results*

  A set of functional and non-functional requirements which define the key functionality of the new tool, is derived.

- *Design and develop a prototype of a web support tool*

  The tool is designed according to the stated requirements. Any functionality not implemented is also noted. A prototype is implemented using a standard industry integrated development environment, and documented.

- *Evaluate the prototype*

  Expert opinions and scientific research on the common software evaluation techniques are reviewed, and relevant techniques selected. Documentation is provided for the evaluation session. A number of web users are employed to test the prototype. Results are documented. The prototype is modified.

1.4 Report Structure

This report is structured as follows:

Chapter 1: Introduction

This chapter is an introduction to the report. It introduces the Web, scopes the problem, overviews the problem description, illustrates the method used to address the problems, and describes the report structure.

Chapter 2: Information Retrieval and Comparison on the Web

This chapter sheds light on the collection and comparison of information on the Web. Web Information is introduced, how users process information on the Web is discussed and a framework of how web users conduct decision-making is developed. This framework is put in place in a Human Computer Interaction (HCI) context.

Chapter 3: A Review of Web Support Tools

This chapter is a background literature review on the current components of a web browser. Also, the Microsoft Window Systems Manager and plug-in software are described. Current web based tools such as, editing tools and web document organizational tools are also explored. A comparison is made between these tools and the shortcomings of these tools are also examined.

Chapter 4: Specification and Design of Prototype

This chapter is concerned with the requirements specification and interface design of the prototype. Functional and non-functional requirements for the prototype are detailed. Different design approaches for the prototype are considered and a rationale behind the final design is given. Draft snapshots of the interface of the prototype are shown.

Chapter 5: Implementation of Prototype

This chapter reviews the implementation of a lo-fi prototype of the web based analysis tool. Implementation issues are discussed in detail. The requirements implemented are also discussed. Finally, screen shots of the completed tool are provided.

Chapter 6: Evaluation of Prototype

This chapter evaluates a prototype of the web based analysis tool. Background literature on user evaluation is provided. The methodology used for usability evaluation is presented. The user background and the results from the survey and usability tests are discussed. Common threads and differences in the results are reviewed. The minor changes made in the tool are listed.

Chapter 7: Conclusion

This chapter highlights the main conclusions of the thesis and discusses the opportunities for future work.