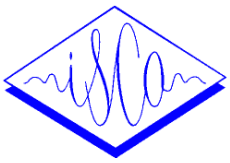
ISCA Archive
http://www.isca-speech.org/archive



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Customizable Web Access for the Blind

Yacine Bellik & Siwar Farhat

LIMSI-CNRS
B.P. 133, 91403 Orsay cedex, France
bellik@limsi.fr

ABSTRAC

This article deals with blind user access to the Web. We first present the different existing approaches that facil i-tate Internet access to blind users and the different erg o-nomic rules that HTML page designers should respect. Then, we present our approach for a dynamic improve-ment of the accessibility. This approach uses a customi-zation interface that allows the user to choose the mod i-fications he would like to perform on the Web pages and the information to visualize. Our system, SeeWeb, should operate between the user and a traditional navi-gator (Netscape, Internet Explorer, etc). It allows the analysis of the HTML document and its content. It also enables to modify the page structure, according to user's preferences and some ergonomic rules. The user inter-face coupled to a screen reader allows the restitution of the information in a more comprehensive way for the blind user. This work has been carried out as a coope a-tion between LIMSI-CNRS (a research laboratory) and TECHNIBRAILLE (an industrial partner).

1 INTRODUCTION

The World Wide Web (WWW) presents an interesting opportunity for direct access to information by blind us-ers. But the very visual nature of the Web may be con-sidered as a major difficulty (for these users). This paper deals with the different aspects of Web accessibility b blind users. It presents the solution we adopted in orde to improve the access to HTML pages according to users preferences. This work takes part of a project dealing with Internet access. We first studied the different ap-proaches used to solve Internet access problems. Then we present some studies that concern ergonomic rules in designing accessible HTML pages. After that, we present a method that allows the reorganization of HTML pages according to some ergonomic rules. This method enables the modification of original Web pages and the addition and/or the suppression of information contained within these pages in order to improve the accessibility and to facilitate the navigation for blind users. The modified pages can then be consulted using a screen reader in a more adapted way.

2 THE STATE-OF-THE ART

Electronic documents and the infrastructure being devel-oped in Internet and World Wide Web [10] are interest-ing technologies to increase information access for blind users. Electronic documents can be structured with lan-guages like HTML (Hypertext Markup Language) and XML (Extensible Marking Language). The HTML for-mat is a labeling system that delimits and identifies the different logical and physical components of the doc u-ment. It uses, very largely, multimedia possibilities o f-fered by nowadays microcomputers. It can hold images, audio and video, animations, etc. This fact can be co n-sidered as a navigation problem for blind users. But there exist some access tools for blind users that allow blind users to access and to read HTML pages (e.g. pwWe b-Speak[1], Lynx[2], WAB [6] [7] and Smart-Net [8] [9]). These tools have some limitations at the access level as they cannot describe images, tables, frames and Java applets. An access to these objects by blind users is still a difficult task.

2.1 Approaches for Web access

This research revealed three main approaches that allo Web access for blind users [4]:

- The dedicated approach: consists in the development of browsers which are specially dedicated to the blind persons. The non-visual interface is designed as ergonomic as possible for blind users.
- The generic approach: is based on the use of screen readers that allow access to a graphical operating system in a generic way. The screen reader is used with a traditional visual navigator, such as Netscape, Internet Explorer or Lynx to allow Web access fo blind users.
- The intermediate approach is an extension of the ge-neric approach. It consists in the modification of HTML pages through a proxy server in a way that it will be more easily readable by a blind user, before sending them to the traditional visual nav igator.

2.2 Comparing the three approaches

With the first (dedicated) approach, the dedicated browser is in charge of the downloading of the HTML page, of its interpretation as well as the restitution of the page contents. This allow a better adapted access. For in-stance, multi-modal interaction can be optimally e x-ploited by the system [2] [9]. This method allows the

[1] http://www.prodworks.com/ pwwovw.htm
[2] ftp://ftp2.cc.ukans.edu/pub/DosLynx/ readme.htm

modification of the HTML page in accordance with some ergonomic rules, in order to make the navigation process easier for the blind user. Since the navigator takes charge of the interpretation process, the system depends on the HTML syntax. Consequently, it is necessary to update the navigator to each evolution of the HTML norm. Furthermore, this approach requires the direct interpretation of the source code of certain languages such as JavaScript and VbScript as well as Java. The generic approach which consists of using of a general filter [3], used by the screen readers, allows to avoid the problem of interpreting HTML and other languages (JavaScript, VbScript), as this task is done by the visual navigator (Netscape, Internet Explorer). On the other hand, this approach highly depends on the operating system. Actually, the screen readers developed in a specific environment cannot be used in other different environments. For instance, the screen readers that exist for Windows 3.11 cannot be used under Windows 95. The code needs to be rewritten for the new environment. Furthermore, the screen readers that begin to work under Window 95 cannot identify all the graphical elements of the interface, fact that does not allow the blind user to perceive all the pertinent elements of the Web page. In the other hand, some ergonomic problems may reduce the quality of the adaptation. Instead of focussing the blind user to the significant elements of the HTML page, this method provide a large amount of information that is not necessarily useful for him. The intermediate approach attempts to resolve the inconvenient of the generic approach. It introduces some static treatments on the original HTML page in order to product a new page, whose organization and contents are more adapted to a non visual consultation. But this implies an obligatory passage through the proxy server. For example, if the proxy server is located in the U.S. and the user in France, a transmission of the information between France and U.S.A. is necessary even if the visited Web site is in France.

2.3 Design rules of accessible Web pages

The problem of Web document accessibility for blind users has been examined by different research groups [5]. Some Web pages design guidelines are under definition. This may help authors of Web pages to make the information more accessible for handicapped people[3]. These design guidelines have been originally provided by the Trace Center at the United States [1]. Actually, the World Wide Web Consortium (W3C) currently attempts to provide some detailed directives for Web pages author [4]. This most recent work is being done under the "Web Accessibility Initiative (WAI)" project[5].

In this section, we provide the main design rules of a accessible HTML pages. These rules are parts of the design guidelines of WAI project and Starling[6].

2.3.1 Links

The problem of links concerns the loss of the semantic context when the text link do not provide the amount of words, necessary for the understanding of the link reference. It is very frequent that blind users navigate from link to link, rather than from line to line. The simplest solution is to attribute more text in HTML links, in order to explicit context information.

2.3.2 Images

We know that the screen readers cannot describe an image if the author of the HTML page did not comment it. Systems that would allow a verbal reproduction of a pixel image do not exist yet. Research works about indexing images, is a first step toward this aim, but the results are still rather premature. On the other hand, the reconstitution of the image in relief is much more costly. Furthermore, its pertinence is not yet proven. Actually, the only solution for the moment, that allows a blind user to perceive images is that the author of the HTML page provides supplementary textual information that describes the images.

2.3.3 Tables

For tables, the conception rules recommend that the author of the page provides an equivalent version in a text mode. This should help the screen reader program to describe the table clearly.

2.3.4 Punctuation

It is recommended that the phrases, the titles and the lists should be terminated by a point or any other convenient punctuation. Considering that voice synthesis screen readers provide the complete punctuation to the listener, the lists, titles and lists that have no punctuation, will be read without interruption. This may confuse the listener and compromise the good understanding of the text. For seeing users, the titles are typographically and spatially separated and so well perceived. Lines or numbers separate the list elements. This simplifies the visual reading, but it can be a source of confusion for blind users.

3 CONTRIBUTION OF OUR WOR

The rules of Web pages design that were described above are important for accessibility by blind users. Unfortunately, these rules are not always respected from the Web authors. To resolve this problem, we have developed a system that dynamically improves accessibility of HTML pages. A customization interface allows the blind user to choose the modifications that are going to be performed on the Web pages and the information that are going to be visualized. Furthermore, we have carried out

[3] http://trace.wisc.edu/
[4] http://www.w3.org/WAI/
[5] http://www.w3.org/TR/WD-WAI-PAGEAUTH/
[6] http://www.starlingweb.com/acc/

a study on the use and the evaluation of design guidelines of HTML pages. We also taken into account some queries provided by the blind users and by some teachers specialized in access at graphical interfaces, particularl those of the "TECHNIBRAILLE" company. This allows us to generate reconstruction rules for HTML pages that were considered by our system in order to improve the accessibility for the blind persons. In the following we will first present the different approaches allowing access to the Web for the blind persons. Then, we will compare them and discuss their advantages and drawbacks. Then we will describe the conception and implementation of our system.

4 DESCRIPTION OF THE ADOPTED APPROACH

The approach that we have adopted, consists in an improvement of the intermediate approach under two principles points: local spy and dynamic customized adaptation.

4.1 Local spy

The interpreter of the original Web page and the generator of the new modified page is a local application. It takes place between the user and his navigator (Netscape, Internet Explorer, etc). It allows the analysis of the HTML document and the modification of its contents and of its logical structure according to user preferences. In contrast to the third approach, we do not use a distant proxy server. This allows us to avoid the unnecessary transfer of information between the navigator client, the proxy server and the visited Web site.

4.2 Dynamic customized adaptation

The modifications done by existing systems on HTML pages are static and don't allow the user to choose which information will be presented and how. In contrast to this principle, each modification we do on the HTML document can be enabled or disabled by the user. An interface that allows a customizable adaptation has been developed. The new page that is generated by the system in this way, is more adapted to each blind user.

5 ARCHITECTURE OF THE SYSTEME

The figure 1 presents the general architecture of the system. When the user wants to consult an HTML page (1) the system attributes the task of downloading the desired page to the download program (2). The page is then examined by the analyzer/generator (4). Thanks to the representation language of the HTML norm, all the syntactic, morphologic and typographic elements of the electronic document are identified (5). The generator will analyze these elements in order to extract the key elements of the page and to modify them according to the user specified modifications. The process performed b the analyzer depends on the parameters of the user customization (8). A new modified page is then generated (5) and provided to the user (6). Using the customization interface (9), the user has the possibility to choose the elements that he wants to add and/or suppress and the tags to modify in the Web page. With this choice (7), specific treatments will be executed by the generator (8). This affect instantaneously the reorganization of the document, in a dynamic way. It is based on the new parameters introduced by the user. The user can then consult the page adapted to his preferences (9) using a screen reader.

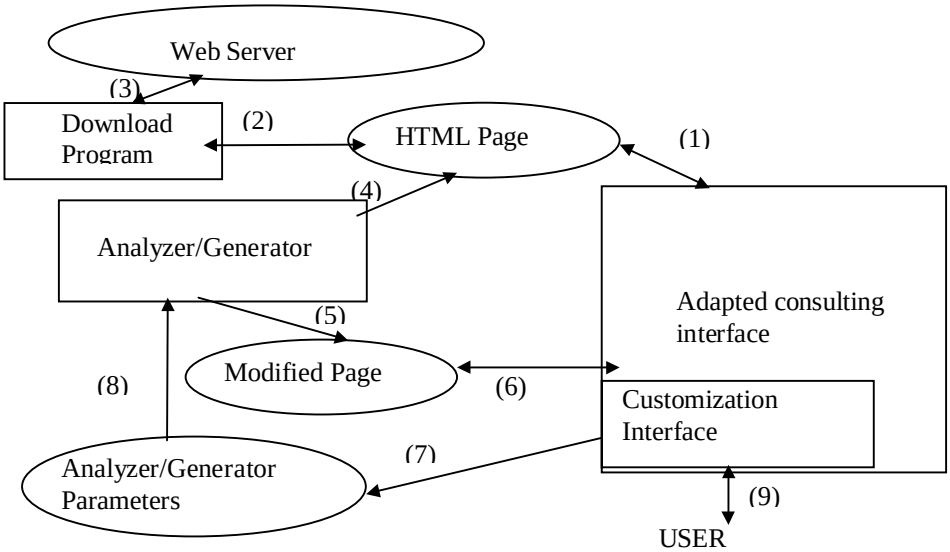

Figure 1: General architecture of the system

6 MODIFICATION OF HTML PAGES

The HTML pages are reorganized on two levels. The first one concerns the page contents and the second one it's interpretation. The first level (fig. 2) consists in:

- adding the information necessary for the navigation, such as the list of the links,
- adding references of key elements of the page (such as tables) for direct access,
- adding global information (statistic summary for the different elements contained in the page),
- adding a key word before images, tables and interaction objects (radio buttons, edit objects, check-boxes, etc.).

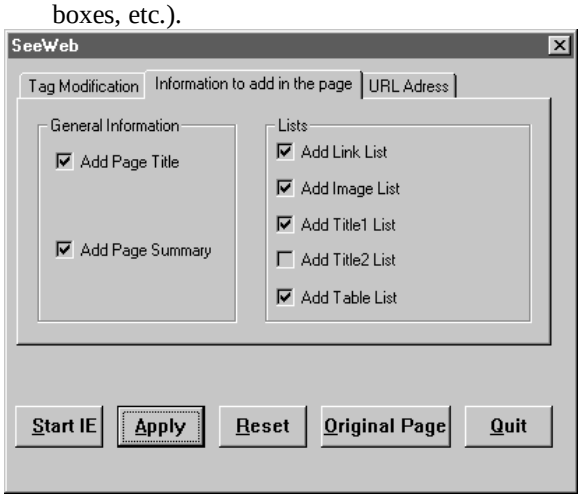

Figure 2: Customization interface: adding information

Adding this information is aimed at focusing the attention of the blind user to the pertinent elements of the HTML page. The second level (fig. 3) consists in modifying:

- the structure of the active images (containing links) by generating a list of hypertext links.
- the cell space in tables,
- the style attributes such as indicating title levels using [T1],[T2], etc.

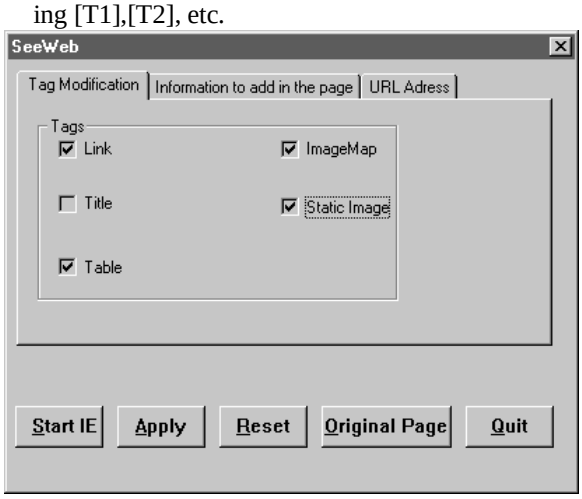

Figure 3: The customization interface: tag modification

7 CONCLUSION

Internet access by blind users is a non-trivial problem fo the research in Man-Machine communication. The multimedia nature of HTML documents is not the unique difficulty. Java applets, scripts, and the very visual conception of HTML pages are also important problems. To solve these problems the existing approaches provide only partial solutions. The approach we presented here has been adopted because of its two major qualities. The first one is the respect of the blind user work habits. This aim is reached because our approach uses a usual screen reader associated to a traditional Web browser. The second one is the ability for a blind user to configure b him-self the modification process of HTML pages. The customization interface allows a complete personal adaptation. This customization interface has another advantage. It will allow us to make in the near future, detailed evaluations about different adaptation types without having to change the source code of our system.

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