

Running Head: WORLD WIDE WEB FOR VISUALLY IMPAIRED PEOPLE

World Wide Web for Visually Impaired People

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Abstract

“World Wide Web services” has contributed a lot in the spread of knowledge all around the world. Its popularity and the number of users are increasing very rapidly. Therefore, it is the right of everybody to have access to the Internet.

This project proposal involves the findings obtained by the help of various research studies conducted on the World Wide Web services. It is observed from the findings of the research studies that visually impaired people face a lot of difficulties in accessing the services offered by the Internet. The main objective of the proposal is to find whether the World Wide Web service can be designed and implemented for the visually impaired people or not. This proposal helps in analyzing the advantages and the disadvantages of the different softwares, screen readers, browsers, etc., which are available in the market for the aid of visually impaired people.

Research Question

Can the World Wide Web be designed and implemented for the visually impaired? If yes how?

Concept

World Wide Web services have contributed immensely in the spread of knowledge all around the world. The popularity and the number of users are increasing very rapidly. Therefore, it is the right of everybody to have an access to the Internet. The main concept behind this research proposal is related with providing the World Wide Web facility to the visually impaired people so that they might be able to use the Internet technology and be able to cope up with the present complexities of the Internet world. Another concept of this research is based on the reduction of technological gap between the normal people and handicapped people.

The aim of this project is to create a prototype of HTML web pages, where the web page speaks its content to aid the visually impaired user. The HTML page will embed java speech synthesis within the written HTML code. It is a fact that the World Wide Web was not initially invented or designed for the visually impaired computer users. It is estimated that there are 180 million people worldwide with visual impairment and out of these figures 40-45 million are completely blind.

Introduction

We can define World Wide Web as a unit or system that consists of interlinked hypertext documents, which the different users can access with the help of Internet. The main advantage of this system is that the user can access the relevant information from anywhere with the help of a computer and Internet. The information available on the World Wide Web is unlimited and the user can save his or her time by interacting on the Internet irrespective of their location and time.

The basic requirement that is needed is just a computer and an Internet connection (Rusinkiewicz & Zhang, 2002).

The documents available on the World Wide Web include text, image and different types of other multimedia components. Sir Tim Berners-Lee and Robert Cailliau created the World Wide Web in 1989 that were working at CERN (The European organization for Nuclear Research) in Geneva.

A web site is said to be accessible when the users have the technology to access the Hyper Text Mark-up Language. As far as the current era is considered, Web browser is the most used technique to access the contents of the web page. There are various accessible techniques that are currently available and include screen readers, Braille display, etc. The two most popular examples of screen readers are jaws and windows eye.

Literature Review

There are various advantages that are offered by the World Wide Web services, but the main limitation of the World Wide Web services is that the visually impaired people cannot use these services. The word visually impaired is used for the individuals who have some difficulty in viewing with one or two eyes even while wearing glasses. Many people have some type of visual problems at some point in their lives. Some can no longer see the objects that are far away; others have the problem related to the reading of small print.

There are many people in the world, who are facing the problem of being visually impaired. The problem of visual impairment arises by birth, at teen age, accidents or other reasons. This problem is a huge problem for not only a country but for the whole world. Many people who are talented and have the ability are unable to do anything because they are suffering from this problem.

In order to make the World Wide Web services accessible to the visually impaired people, a conference known as IFLA pre-conference for the section of Libraries for the Blind was held in Washington in 2001. The main theme of this conference was to develop Digital Libraries for the Blind.

These Digital libraries should be able to make accessible the benefits of the Internet to the visually impaired people. The information provided by this digital library should be in an audio format. The requirements to develop this kind of digital library are speech output, tactile devices and Braille output.

The Austrian Network on Research Teaching and Service Provision for Print Disabled People (i3s3) along with the University Library Graz and the Institute for German Literature Studies of the University of Innsbruck are working on Austrian Virtual Library ALO or the Austrian Literature Online in order to develop a standard virtual library to provide internet based services to the visually impaired people (Craven, 2001).

According to a study conducted by the Nielsen Norman group on both the visually impaired people and the people who have good sight, it was found that for people having good vision, it is 3 times easier to use the World Wide Web services as compared to people who have either a low vision or are completely blind (Coyne & Nielsen, 2001).

Since a long time, the World Wide Web consortium (W3C) is trying to make the web accessible to the visually impaired people. They have found that to make it possible, the following changes are required in the HTML:

1. Superseding the IMG tag that is used for inserting images by a different tag known as OBJECT that will help the browser to display the textual mark-up as an alternative. This

tag will make the browser to read the text written on the web page that is accessed by the visually impaired people.

2. Next is to separate the structural aspects of the documents with those aspects that make use of little or no layout. This will it make easier for enabling the software to read the text aloud to the visually impaired people.

In order to provide an efficient solution for the problem, the product must have the following requirements:

- Accept speech input from the users (via USB microphone; recommended). (In this case, the users will be visually impaired people that will provide instructions to the computer by the help of a USB microphone that they want to get the information related to the following product and the browser will automatically open the relevant web-page by following the voice instructions provided by the user).
- Ease of use. (The technology should be developed in such a way that a visually impaired person faces no difficulty in making use of that technology).
- Provide speech output in the form of audio/sound on the contents of web pages (Via speakers) (After receiving the voice input by a visually impaired person through a USB microphone, the browser will speak the contents on the relevant web page).
- Error messages always get focused and contain their own sound files so that the Speech starts automatically.
- Navigate the contents of the web pages in the application with use of speech.

Recognition

There are various technologies that can be used in order to achieve the objectives. These technologies are listed below:

- Voice XML
- Speech CSS
- Speech Synthesis
- Java Programming Language
- Human Computer Interaction
- Graphical User Interface (GUI)
- HTML (Hyper Text Mark-up Language)
- Web 2.0

It is found that with the help of a synthesized speech and Braille display technology; even the visually impaired people can make use of the World Wide Web services, but with mandatory requirements. The ability to view a page varies with the power of vision different people possess; therefore, a website needs to be flexible in design so that an individual can adjust the different settings according to his or her needs and the given situation.

The aid provided by both the synthesized speech and Braille software is different as the synthesized speech software reads the contents on the relevant webpage with the help of a speaker while Braille software produces the output in response to touch. Therefore, it is necessary to use a proper coded HTML language so; that there would be no chance of an error and there would be no difficulty for the visually impaired people in using the technology (Howell, 2000).

Hypothesis

The study of this research is based on the assumption, whether we can develop a World Wide Web for the visually impaired people? In my point of view; yes, we can develop a World Wide Web for the visually impaired people because the changes in the technology provide us a

path through which we can find out the various problems and solve them as well. In this research paper, I am going to explain the various methodologies and researches, which help us to develop this kind of web pages. By the means of the following research paper, I am going to summarize the various parameters that are associated with the problems of visually impaired people while assessing the World Wide Web.

Research Methodology

In order to do an effective research, I have accomplished the following steps:

- *Types of Universe:* This is the first step in my methodology. The definitive objects in the methodology are the visually impaired people.
- *Sampling Unit:* The sampling unit of my research is based on the numbers of users of the World Wide Web. The total number of users in the world is shown in the table.

WORLD INTERNET USAGE AND POPULATION STATISTICS						
World Regions	Population (2007 Est.)	Population % of World	Internet Usage, Latest Data	% Population (Penetration)	Usage % of World	Usage Growth 2000-2007
Africa	933,448,292	14.2 %	33,545,600	3.6 %	2.9 %	643.1 %
Asia	3,712,527,624	56.5 %	436,758,162	11.8 %	37.2 %	282.1 %
Europe	809,624,686	12.3 %	321,853,477	39.8 %	27.4%	206.2 %
Middle East	193,452,727	2.9 %	19,539,300	10.1 %	1.7 %	494.8 %
North America	334,538,018	5.1 %	232,655,287	69.5 %	19.8%	115.2 %
Latin America/Caribbean	556,606,627	8.5 %	109,961,609	19.8 %	9.4 %	508.6 %
Oceania / Australia	34,468,443	0.5 %	18,796,490	54.5 %	1.6 %	146.7 %
WORLD TOTAL	6,574,666,417	100.0 %	1,173,109,925	17.8 %	100.0 %	225.0

(Internet World States, 2007)

Number of visually impaired users of World Wide Web services

Type of use	OXIS (use of Internet)	This survey (use of the web)	% Differences
Information	60%	100%	+66.7%

Browsing	59%	63.6%	+7.8%
E-mail	45%	72.7%	+61.6%
Shopping	33%	63.6%	+92.7%
Education studies	26%	47% (averaged)	+80.8%
Music	22%	50%	+127.3%
News	18%	40.9%	+127.2%
Entertainment	16%	47.6%	+197.5%
Instant messaging	14%	18.2%	+30.0%
Banking	13%	27.2%	+109.2%
Public services	11%	83.6%	+660.0%
Chat-room	10%	13.6%	+36.0%
Looking for work	7%	35.0%	+400.0%
Information about Visual impairment	Not applicable	78.3%	Not applicable

(Lewis, 2004)

- *Size of Sample:* The above tables show the number of people who use World Wide Web, but the sample size of my research is 40 people.
- *Parameter of Interest:* The main interest behind this research is to find out the various problems that are faced by the visually impaired people.

A study was conducted by taking a sample of 40 people. Out of these 40 people, 20 have good vision and 20 are visually impaired. The motive of the study is to find the level of comfort in both the groups. The age of participants is from 21 to 50 years. The sample having visually impaired people includes the following participants:

Number of people	Age group
3	21-30

8	31-40
4	41-50
5	50

The sample having people who have good visions include the following participants:

Number of people	Age group
3	<21
10	21-30
3	31-40
2	41-50
2	>50

With a web page having (14"-15") screen, this experiment was completed.

Results: It was found that the sample of people having proper vision do not face any problem while reading the content on the web page having (14"-15") screen. But the sample of people having visually impaired people is unable to read the content. Therefore, it was concluded that the visually impaired people require some form of assistive technology to read the content on the web page of (14"-15") screen. These assistive technologies involve Braille, screen readers and screen magnification with speech output. (Craven, 2003)

Problems that are commonly faced by the visually impaired people are:

1. A lot of time is required by the visually impaired people in accessing the correct web page.
2. They face difficulty in searching a particular word on the Internet.

3. It is very difficult for them to identify where the paragraph starts or ends.
4. Visually impaired people cannot access information about the images present on the WebPages.
5. While using the current technology, it is very difficult for them to escape a particular line as by the current technology, they can access the information from line to line.
6. Visually impaired people cannot use the help of pointing device in providing input or command to the computer.

People who are visually impaired generally use screen magnification programs to enlarge those text and images that they are unable to see with normal fonts. The software that supports speech synthesizer and Braille display make use of an off-screen model, which is a database that consists of text, graphics and control.

Technical problems that are commonly faced by the visually impaired people are:

1. *Images in which the "ALT" comment is missing*: It is very necessary to put a suitable comment on the images when we use these images as a link or a heading. These comments are mainly used to describe the function of the image. For the purpose of heading, images should not be used otherwise it would create a problem related to accessibility.
2. *Maps of images*: It is observed that some browsers ignore them as they are the graphical elements and consider them as a problem in the way of accessibility. This problem could be solved by specifying an "ALT" attribute or by using the name of HTML file. But in order to get a full accessibility, it is suggested to avoid the use of image maps.
3. *Link formulations*: This problem arises when sufficient information about a specific document is not provided.

4. *Tables and texts that are multi-column*: Visually impaired people face difficulties when tables are included in the web page. Braille displays the output in the form of line to line. Therefore, visually impaired people can only read the contents present on a single line. Therefore, tables are not advised to be used. In place of tables, style sheets should be used as the use of table in a web page could affect the level of accessibility.
5. *Scripts, applets and animated events*: It is observed that many browsers are unable to display scripts. Therefore, it is the responsibility of the designer to ensure that the information should be accessible even in the absence of applets or scripts.
6. *Frames with no explicit titles*: On the basis of frames, browsers can be classified into two categories. These types of browsers are the standard browsers that are used with screen readers.

Data Analysis

After completing the research with the help of sampling methodology, we find some problems regarding the research question. In order to analyse the data and problems, there is a need for some resources, which are as follows:

1. Web Designers
2. Computers
3. Software
4. Internet connection
5. Headsets
6. Speech synthesizers
7. Braille display
8. Maintenance staff

In order to analyse the data obtained by the sampling methodology, the following resource usage sheet helped me in an expanded manner. With the help of the following activities, I was able to accomplish the research and able to meet my hypothesis.

Resource usage sheet:

Task No.	Task Name	Duration	Start	Finish	Predecessors
1	Select the survey team.	4			
2	Provide training to the survey team.	7			1
3	Identify the targets.	7			2
4	Design the questionnaire.	2			3
5	Conduct survey.	7			4
6	Store the data.	1			5
7	Analyse the data.	3			6
8	Identifying the problems.	5			7
9	Finding Solutions.	7			8
10	Recruitment of web developers.	6			9
11	Identifying best solution.	2			10
12	Development of a new product.	14			11
13	Evaluation of a new product.	7			12

Ethical Issues

World Wide Web offers a wide range of services that are applicable to a wide range of areas. The main advantage of this system is that the user can access the relevant information from anywhere with the help of a computer and the Internet. The information available on World Wide Web is unlimited and users can save his or her time by interacting on the Internet irrespective of their location and time. The basic requirement that is needed is just a computer and an Internet connection.

The degree of difficulty is higher among the visually impaired users as compared to other users who are suffering from other kinds of disabilities. According to the discrimination act, it is

very essential that the visually impaired people get the same degree of accessibility as that of the visually perfect user. For many years, the researchers have been trying to develop a technology that can solve the problems faced by the visually impaired users while accessing the World Wide Web services, so that they would be able to utilize the advantages of the World Wide Web and able to live a life like a normal person. It should be noted that the current assisting technologies that provide an aid to the visually impaired users, are not much efficient, as some of them do not offer personal settings to the user. The degree of impairment is different in different users, as some of them have a poor level of vision, while some of them are completely blind.

Conclusion

It can be concluded with the help of the above discussion and through the data collected from various research studies that the users who are suffering from disabilities face a lot of problems while using these services. The degree of difficulty is higher among the visually impaired users as compared to other users who are suffering from other kind of disabilities.

According to the discrimination act, it is very essential that the visually impaired people get the same degree of accessibility as that of the well-sighted user. It should be noted that the current assisting technologies that are providing aid to the visually impaired users are not much efficient as some of them does not offer personal settings to the user. The degree of affliction is different in different users, as some of them have a poor level of vision, while some of them are completely blind.

With an increase in the technology, there is a huge advancement in the contents of the web page. Now web developers are trying to make the web page more and more attractive in order to attract the user towards the web page. The web page can be made more attractive by

adding more and more frames, tags, colors, and backgrounds in to it. However, the problem faced by the visually impaired users increases with the increase in the attractiveness.

Most of the screen readers and browsers that are currently available have the following limitations:

1. User does not have any information about the image or from the image that is present in the specific web page.
2. Visually impaired users are unable to access the hyperlinks and links that are present in the web page.
3. Visually impaired users are not alerted about the end and the start of the paragraph.
4. They are also unable to get the information about the header and the titles.
5. Some of the assisting tools currently available enable the users to access the web page by reading a single line-to-line format and a user cannot escape any line. Therefore, the process becomes highly time consuming.

There is a serious need to rectify these problems. Some of the recommendations to solve these problems are to use alternative tags. It is also suggested to remove those tables and links that are less significant on a web page. The changes which are identified as the possible solutions for the problems faced by the visually impaired users are as following:

1. It would be good to make use of such a combination of the text and background color that would provide maximum contrast to the visually impaired user. A good contrast ensures a higher degree of support and access to the visually impaired user.
2. The final design needs to be flexible so that the visually impaired user can make changes in the settings of their browsers. The design should be such that the colors and size of the

text can be changed according to the preference of the user. This would help in increasing the accessibility of the visually impaired user towards the World Wide Web services.

3. Alternative texts should be used along with the images. These alternative texts would help in providing information related to the images that are beyond the access of users who are visually impaired.
4. A site map should be included in the website which would provide a trailer of the contents that are present in the website. This would help the visually impaired user in making easy navigation of the site. This map would also reduce the time taken by the user in performing web searches.
5. Text links should be provided with the image maps, as most of the softwares that are used by the visually impaired user are unable to read the image maps. These text links would enable the softwares to provide information related to the image maps to the visually impaired user.
6. In the web pages where frames are used, titles need to be provided along with them. It would be good to use a frame free version for the web pages as most of the software used by the visually impaired user is unable to read the frames due to which the visually impaired users are restricted to access those web pages which include frames.
7. It should be noted that the PDF documents, which are made by a version of Adobe Acrobat, that is earlier than 5 are not accessible by the help of software used by the visually impaired user. Therefore, it is advised to create the PDF documents by the newer Adobe Acrobat version than 5. Online conversion tools have been made by the company in order to provide access to these earlier PDF documents.

These online conversion tools completely convert the PDF files in to HTML. These tools are available from the official site of the Adobe. The latest version of the Adobe Acrobat can also be downloaded from the above site (Improving Your Site, 2005).

Acid test and the use of an expert would be highly beneficial to test the accessibility of the web page as it would help in identifying the problems that are faced by the visually impaired users while accessing the World Wide Web services. World Wide Web consortium has made some Web content accessibility guidelines as listed below:

- a. Authoring tool accessibility guidelines or ATAG designed in February 2000.
- b. User agent accessibility guidelines or UAAG in December 2002.

These guidelines should be followed by the web developers during the development of a new website (eAccessibility of public sector services in theEuropean Union, 2007).

Finally, it can be concluded on the basis of discussion carried out above that there are many accessibility tools that are currently available in the market, which enable visually impaired users to access world wide web services but still a lot of research and development is required in this area in order to rectify the limitations that exist with the currently available technologies.

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