

DESIGN METHOD ANALYSIS OF WEB INFORMATION SYSTEM FOR PEOPLE WITH DISABILITIES

Gatis Vitols

Faculty of Information technologies, Latvia University of Agriculture, Liela 2, Jelgava, Latvia

Keywords: Web Information Systems, Systems Usability, People with Disabilities.

Abstract: This paper refers to improvement of human-system interaction, more specifically, improving Web information system accessibility for people with disabilities. Besides fast developing Web, the problem of system usability remains live issue. There is a need to improve usability and accessibility of information systems. One part of an active matter is question about how to make Web resource more usable for people with disabilities. Importance of this topic is out of question, because besides wide spread interpretation of human with disability, sometimes it is forgotten that even color blindness is or some aging people have some sort of disability. This paper identifies groups of people with disabilities who use Web information systems and problems that they meet. By analyzing problems that this group of people meet, main categories of needs is brought forward, analyzed and basic solutions for Web developers are discussed.

1 INTRODUCTION

Web infrastructure develops with high speed. New solutions appear and more business processes are brought online. Live issue remains questions about usability of the Web. Great part of usability problems are met when people with disabilities use online services. By the term people with disabilities, there is a need to understand not only visually seen disabilities, but also such met disabilities as color blindness and disabilities which are caused by aging. For example as research (Henderson, 2008) show, 1 of 12 people has some sort of color deficiency.

When identifying groups of people who use Web information systems and problems they meet, it is possible to bring forward basic solutions that Web developers can take in notice.

The aim of this paper is to identify main criteria and bring forward solutions for developing Web information systems that could be more usable for people with disabilities. To reach the aim, following tasks has been brought forward:

- Identify Web information system user's groups with disabilities.
- Analyze existing guidelines and requirements.
- Bring forward main groups of criteria.
- Develop guidelines and solutions that can help Web information system developers improve accessibility of websites.

When analyzing published researches and guidelines by international organizations and projects such as Harmony (Paciello, 2000), Nordic (Thorén, 1998), WAI (World Wide Web Consortium, 2009) and local, for example, Latvian organizations, such as Apeirons (Apeirons, 2007), certain general requirements approximation can be made.

Common document that closely categorize user types with disabilities who use Web information systems, is World Wide Web Consortium managed Web Accessibility Initiative. More specifically, draft document "How People with Disabilities Use the Web" which was released in 2005. Until now this document still is considered as a draft, but final version is planned for a release in year 2010. (World Wide Web Consortium, 2009) Besides others, this fact shows that with fast developing Web solutions, the usability matters that relate to people with disabilities are analyzed and considered.

2 MATERIALS AND METHODS

From the previously mentioned analysis of researches (see the Introduction section) following categories of common met disabilities can be named (see Figure 1.) There is also possibility that Web

Vitols G. (2010).

DESIGN METHOD ANALYSIS OF WEB INFORMATION SYSTEM FOR PEOPLE WITH DISABILITIES.

In *Proceedings of the 12th International Conference on Enterprise Information Systems - Human-Computer Interaction*, pages 211-214

Copyright © SciTePress

information system users can be people with combined disabilities.

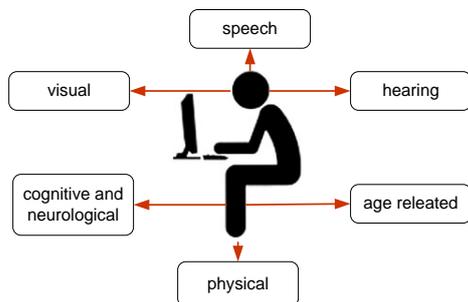


Figure 1: Categories of common met disabilities.

When analyzing Harmony, Nordic, WAI and Apeirons publications, (see the Introduction section) identification of common met problems for people disabilities can be done.

Major category is people who have visual disabilities. They mostly rely on screen readers, speech synthesizers and refreshable Braille display. People with hearing disabilities mainly rely on captions of audio content, amplification of audio and adjustment of volume for an audio file. People with physical disabilities rely on specialized mouse, a keyboard with a layout of keys that matches their range of hand motion or a pointing device such as a head-mouse, head-pointer or mouth-stick. Also voice-recognition software or an eye-gaze system can be used. People with speech disabilities rely on voice recognition or other voice data input methods. And people with cognitive and neurological disabilities rely on getting information through several modalities at the same time. For instance, someone who has difficulty of reading may use a screen reader plus synthesized speech to facilitate comprehension. These people also may need to turn off animations, video or audio and may take more time on a Web site. Table 1 shows the summary of selected categories and possible problems, which people with disabilities meet when using Web.

Main roles of Web system developers can be divided in three categories:

- programmer, who works mainly with structure and module creation,
- designer, who works on Web page visual sketch and appearance,
- content filler, providing or/and filling information into the Web information system.

There can be also merging between roles and at the same time role can be divided into smaller fractions. (Krug, 2006).

Table 1: Selected categories of people with disabilities and possible Web use problems.

Cat.	Problem
visual	images that do not have alternative text
	complex images that are not adequately described
	video that is not described in text or audio
	tables that do not make sense when read serially
	frames that do not have "NOFRAME" alternatives, or do not have meaningful names
	forms that cannot be tabbed through in a logical sequence or that are poorly labeled
	browsers and authoring tools that lack keyboard support for all commands
	web pages with absolute font sizes
	web pages that, because of inconsistent layout, are difficult to navigate when enlarged, due to loss of surrounding context
	web pages, or images on web pages, that have poor contrast, and whose contrast cannot be easily changed through style sheets
	text presented as images, which prevents wrapping to the next line when enlarged
	colour that is used as a unique marker to emphasize text on a web site
hearing	browsers that do not support user override of authors style sheets
	lack of captions or transcripts of audio on the web, including webcasts
	lack of content-related images in pages full of text, which can slow comprehension for people whose first language may be a sign language
	lack of clear and simple language
cognitive and neurological	requirements for voice input on web sites
	lack of alternative modalities for information, for instance lack of captions for audio
	distracting visual or audio elements that cannot easily be turned off
	lack of consistent organization of web sites
	use of unnecessarily complex language
	lack of graphics on web sites
	web pages with absolute font sizes
use of visual or audio frequencies that can trigger seizures	

Web information system development backbone tools are Hypertext markup language (HTML) and Cascade style sheets (CSS). These languages are used as main tools to layout the content in Web information systems. (Lane, 2008)

Problems, which partly are mentioned in Table 1, can address certain developer roles and can be divided in four groups:

- problems that address programmer,
- problems that address designer,
- problems that address content filler,

- indirect problems that are more related to environment in which people use Web information system.

If approximation of these problems is made, it is possible to merge them in following groups. (see Figure 2)

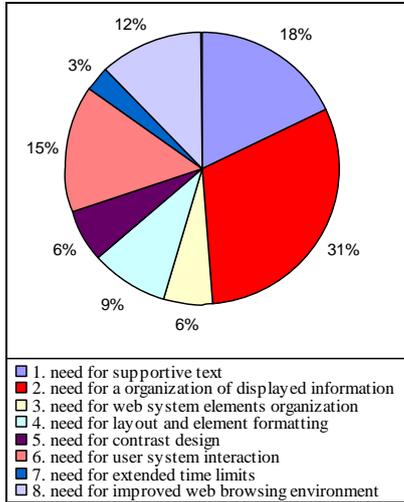


Figure 2: Requirement groups for improving Web usability for people with disabilities.

Graph in Figure 2 reflects distribution between needs or problems that need to be solved. As the base, mentioned problems in published researches (see the Introduction section) are taken and 8 need groups are formed. As it is seen, almost half (49%) of all mentioned problems are related to presence of supportive or descriptive text and structure of information in Web information system.

These problems directly address Web system programmer and content filler.

3 RESULTS AND DISCUSSIONS

Developers of Web sites, if paying attention on some basic matters, can solve certain problems for people with disabilities and at the same time improve their Web information system usability and accessibility also for other groups of people. To improve Web information system design, basic solutions are brought forward and partly presented in Table 2. (see Table 2) To analyze and evaluate developed solution, five randomly chosen various industry and type Web information systems were examined. This includes government website, t-shirts printing e-shop, cinema vortal, personal blog and e-learning system. Code reviewing and design evaluation has been performed as examination methods.

Table 2: Problem category and possible solution for usability and accessibility improvement.

Problem	Solution
1. need for supportive text	use HTML image ALT texts, to make comments on graphs, images and charts
	use labels for website elements
	use symbols or comments to mark some elements on websites
2. need for a organization of displayed information	if placing audio, video information, it's better to have comment or transcript of a file content
	test layout on various browsers before making it accessible online
	do not store text as pictures, if creating multi-language website, considering UTF-8 as main encoding option
3. need for web system elements organization	if uploading documents, for example formatted text on websites, use open and wide support standards, such as .PDF
	better not using HTML frames. As the website development tendencies show, count of web sites with frames decrease. If there is a need for frame use, then naming frames properly is main task; when creating forms, tab control is important, so it is recommended to use TABINDEX;
4. need for layout and element formatting	use fonts and text layout which is well recognized and supported on variety of operation systems
	use relative font size, so users can change font size using internet browser. One method would be to set a relative font size on specific containers or apply relative font sizing to specific elements. Both are done using cascade style sheets. For example: h1 {font-size: 160%;}
6. need for user system interaction	if video, audio or animation information is included in websites there is a need for simple and clearly understandable control over those elements – sound volume, stop button, play button
7. need for extended time limits	if programming time limits for example session time, time for completing the web form, there is a need to take into consideration that some people may take more time to fill up such elements

Table 3 partly shows the completed analysis results reflecting need, tested criteria and test result in percents comparing chosen systems. Percentage shows how many Web information systems pass certain criteria evaluation.

Table 3: Test results of Web information systems examination.

Need	Solution	Success
1. need for supportive text		
1. need for supportive text	always use HTML image ALT texts, to make comments on graphs, images, charts	40%
	use labels for website elements, such as forms	100%
	use symbols or comments to mark some elements on websites	60%
	if placing audio, video information, it's better to have comment or transcript of a file content	20%
2. need for a organization of displayed information		80%
3. need for web system elements organization		60%
4. need for layout and element formatting		80%
5. need for contrast design	allow changeable style sheets	0%
6. need for user system interaction	if video, audio or animation information is included in websites there is a need for simple and clearly understandable control over those elements – sound volume, stop button, play button	20%
7. need for extended time limits		100%
8. need for improved web browsing environment		80%

Results of examination by previously mentioned criteria shows that websites has relatively good performance towards usability and accessibility for people with disabilities. But it is also seen that critical improvements are needed. Examination method shows that main problems arise with such criteria as needs for alternative texts, control over animations, presence of extra graphical information and changeable design styles. Changeable design styles are not available in any evaluated website, but it is highly demanded feature for people who have visual disabilities, even color blindness. Solutions provided in Table 2 can be taken in notice to improve system page layout.

4 CONCLUSIONS

With the use of this method, developers can evaluate and prevent main problems for Web projects that

relate matters of resource accessibility and usability for people with disabilities. Improvements can be done with a use of client side programming languages which directly address information layout on pages.

But when developing Web information systems with critical usability and accessibility requirements, method mentioned in this paper can be used only as one of the tools. Method covers only Web content layout matters, not including server side tools and implementation of specific elements, such as integration of Braille code or special multimedia. These elements require another analysis and researches which results can be used in combination of client side layout requirements.

Improving presence of supportive text, including information structuring, could solve almost 50% of layout problems that arise in Web information system usage for people with various disabilities.

With a release of improved researches for accessibility and usability matters, there is a need for future investigation of new client and server side language possibilities examination, such as AJAX, as a tool to solve emerging demands.

ACKNOWLEDGEMENTS

Funding support for this research provided by Europe Social Fund program “Support for doctoral studies in LUA”, agreement 2009/0180/1DP/1.1.2.1.2/09/IPIA/VIAA/017.

REFERENCES

- Apeirons, (2007). Datoru pieejamības uzlabošana cilvēkiem ar īpašām vajadzībām. MS UP.
- Henderson C., (2008). Color Vision Statistics. Retrieved December 1, 2009, from <http://www.iamcal.com/toys/colors/stats.php>
- Krug S., (2006). Don't Make Me Think! A Common Sense Approach to Web Usability, (Second Ed.). USA: New Riders.
- Lane, J. Moscovitz, M. and Lewis, J. (2008). Foundation Website Creation with CSS, XHTML, and JavaScript. New York: Apress
- Paciello M.G., (2000). WEB Accessibility for People with Disabilities. USA. CMP Books.
- Thorén C. (1998). Nordic Guidelines for Computer Accessibility. Retrieved November 27, 2009, from http://trace.wisc.edu/docs/nordic_guidelines/
- World Wide Web Consortium, (2009). Web Accessibility Initiative. Retrieved November 25, 2009, from <http://www.w3.org/WAI/intro/people-use-web>