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Framework for Covering the Limitations of Web Accessibility Improvement Tools

Navdeep Kaur[1] and Vijay Kumar[2]
[1]*Department of Computer Science, Chandigarh University, Gharaun, India, Navdeepk120@gmail.com*
[2]*Department of Computer Science, Chandigarh University, Gharaun, India, Vijaykumar_nrw@hotmail.com*

*Correspondence: *navdeepk120@gmail.com*

ABSTRACT- From the last few decades World Wide Web (W.W.W) has become an important part of our life. Internet plays a vital role in all important sectors including education, health, and business. An equal access of web is the basic right of all groups of society .The web should be accessible to user with disability as it is accessible to normal user. It is the responsibility of web developers to make accessible web site in order to provide equal opportunity of web to all users. Although World Wide Web Consortium (W3C) publishes guidelines to guide web developers about web accessibility rules but few web designers follow guidelines. The main reason is lack of awareness of the web accessibility among developers. Some organizations take web accessibility into account. In the market different kinds of web accessibility improvement tools are available which can check the accessibility of websites. The organizations are still unable to tackle web accessibility problems. The organizations should pay attention on web accessibility from initial stage of web development. The framework should be used in organizations which can instruct web developers to make accessible web sites. The paper gives review of existing web accessibility Improvement tools and their comparative merits and demerits. The paper also describes different web accessibility frameworks which are described in research papers to cover the limitations of existing web accessibility tools.

General Terms: Web Accessibility Evaluation Tools, Web Accessibility Framework, Web Accessibility Authoring Tools.
Keywords: Web Accessibility Framework, Web Accessibility Improvement Tool.

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1. INTRODUCTION

The web content should be accessible to person with disability as it is accessible to normal people. To provide equal access of web to people with disabilities web developers must follow guidelines and standards of W3C. However, making an accessible website is not an easy task. Most of the websites do not comply with accessibility rules. It is still a challenge for web developers to develop completely accessible website. The reason behind why web developers do not pay attention on web accessibility rules while developing website is time constrain. The developers cannot learn all web accessibility rules as they do not have sufficient time. To overcome this problem automated web accessibility tools must be adapted by organizations. Although automated web accessibility tools reduce testing effort but these tools have some limitations.
Some web accessibility testing tools do not support changing or newly developed accessibility guidelines. Automated testing solutions often do not test the true Document Object Model (DOM)[7]. So, it is necessary for the organizations to provide integrated environment for developing the accessible web sites. The tools which can also highlight the elements with missing or violation of web accessibility rules and the user can manipulate the code. Thus, the web developer can develop accessible websites for visually impaired persons.

The rest of the paper describes the importance of web accessibility in *Section 2.* In *Section 3* assistive technologies which are helpful for blind to access the websites. *Section 4* W3C guidelines for accessible web design. *Section 5* web accessibility problems which are faced by visually impaired people. Section 6 the review of web accessibility tools. *Section 7* merits and demerits of web accessibility evaluation tools. *Section 8* literature survey related to web improvement tools *Section 9* conclusion of the paper.

2. IMPORTANCE OF WEB ACCESSIBILITY

Web accessibility is defined as an equal access of web to all people in society regardless of their ability, age and equipment. According to U.S census 2000 19% [29] of the Americans have disability problems and it is growing day by day. The different web users may have different form of disabilities problems while using web. The [30] disability in the form of:

- Hearing: When the users are unable to hear the sounds on websites.
- Mobility: The users may not to use mouse or keyboard.
- Cognitive: The users cannot distinguish between colors
- Blind: The people who are completely blind and cannot see the web content.

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Web accessibility provides a way to people with disabilities to participate equally on web. Web accessibility has also technical, financial and legal benefits also [2].

The web accessibility is not only useful for disable persons; it has also lot of benefits to normal users. The web accessibility is the subset of usability [3] if web accessibility rules are used it automatically increases the usability of web site. The web accessibility also increases technical performance of web sites. The acceptance rate by the client automatically increases. The web accessibility is also beneficial for SEO (Search Engine Optimization).

The web accessibility is strict law adopted by many countries such as U.K. and America [33]. ADA (Americans with Disabilities Act) was introduced by USA government to instruct universities to provide accessible activities to persons with disabilities. Section 508 which [32] is an amendment of rehabilitation law states that all information technology and electronic product should be accessible to persons with disabilities.

3. ASSISTIVE TECHNOLOGY

The visually challenged people use computer with help of assistive technologies such as Screen reader [6].Screen reader is a software which provides access of the screen information to blind people in the form of speech. The blind cannot use mouse, by using keyboard shortcuts can access the information. The screen reader relays the screen information to blind either in form of speech or brail display. TTS (Text To Speech Engine) is used by the screen reader to convert information of the screen in form of speech. The information can be heard through head phones or speakers. Jaws [34] for windows product is world famous screen reader used by the blind. It converts the screen information into speech.

Brail display is hardware device which gives screen information in form of brail characters. It contains cell of rows as the information on screen changes the brail characters also changes and provide refresh information to users. The blind by touching their fingers on cells get the information.

Some smart phones provide inbuilt functionality of text to speech conversion. Touch screen is also accessible by blind. Most of the smart phone use Voiceover option. Voiceover allows the blind users to use touch screen by taking input as gesture and speech as output. The android smart phones use Slide Rule [5] option for making touch screen more accessible. Slide Rule is also more accessible device as compared to other devices. It tells the users about the current location of screen reader as well as the select option for users to select the desired item on screen.

4. WEB ACCESSIBILITY ISSUES

The structure and the content of web pages are complex. The large portion of the web pages is in the form of graphics, animation, links, and images. Accessing the web pages for users with disability can be difficult in many senses. The blind take more time than visual users to access the information because the web accessibility problems. Majority of the web sites have common web accessibility problems. The web sites failure to include text alternatives for images, some provide text alternatives to images but there is no guarantee that text is meaningful. CAPTCHA (Completely Automated Public Turing test to Tell Computers and Humans Apart) is used to distinguish between a human and computer. For visually impaired people it is totally inaccessible [27].The text alternative should be used for CAPTCHA but most of the web sites fail to provide text alternatives for CAPTCHA. Flash, ambiguous links, complex form, missing improper heading, too many links, complex data forms, inaccessible search, and lack of skip tag are the inaccessible web elements which cause frustration to blind people [21].

5. W3C GUIDELINES

5.1 WCAG

WAI (Web Accessibility Initiative) of W3C (World Wide Web Consortium) published a first version of the web content accessibility guidelines WCAG 1.0 in 1999 and second version WCAG2.0 [1] in 2008. There are mainly four principles for WCAG guidelines. Further check points are provided for each guideline. There are priorities for checkpoints. Priority 1 checkpoint means the checkpoints which must be included to make website accessible. Priority 2 checkpoints which remove all the web accessibility problems. Priority 3 checkpoints improve accessibility of web sites. There are three levels A, AA, AAA, level:

- A : it defines all priority 1 checkpoints
- AA: both priority 1 and priority 2 check points are defined
- AAA: all the three priority checkpoints are satisfied

Mainly there are four principles for WCAG guidelines:

1. **PERCEIVABLE.** Make Content Presentable to user so that they can perceive the content easily.
2. **OPERABLE.** Ensure that Interface Elements in the Content are Operable by any user.
3. **UNDERSTANDABLE.** Make content and controls understandable to as many users as possible.
4. **ROBUST.** Use Web technologies that maximize the ability of the content to work with current and future accessibility technologies and user agents.

5.2 ARIA

Accessible Rich Internet Applications ARIA elements are introduced by WAI (Web Accessibility Initiatives) to handle the dynamic content [28]. The ARIA describes roles, properties and states to notify the screen reader users about the updated content for *e.g.* new message in mail. The roles, states and properties are assigned to the html elements in order to provide semantic information to the dynamic content. Most of the screen readers support ARIA.

ARIA live property: It uses three values off, polite and assertive.

- aria –live=”off”-when “aria –live” is off the screen reader do not jump the updated content. This property is mostly used for irrelevant content updates.

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- aria –live=”polite”-The screen reader will directly jump to the updated content. It is helpful for screen reader users to use chat and messages features.

Thus, by using ARIA elements the dynamic content of web pages become accessible for blind. However, the main problem with web designers is that they forget to use ARIA. It is very difficult to assign manually ARIA to web pages so there is need of framework or tools which can design the web pages with all ARIA elements.

6. WEB ACCESSIBILITY IMPROVEMENT TOOLS

The different kinds of web accessibility improvement tools are available in the market [15], [11]. The accessibility tools are broadly classified into two parts: web accessibility evaluation tools and web accessibility authoring tools. The web accessibility evaluation tools evaluate the accessibility of web pages. The web authoring tools help the web developers to create accessible websites.

6.1 Evaluation Tools

6.1.1 WAVE by Web AIM

WAVE [24] is an online and free web accessibility testing tool. It has ability to parse the html code and generate error against WCAG2.0 guidelines. It can check the single web page or group of pages.

6.1.2 WCAG Compliance Auditor

WCAG [22] has ability to check the single web page, web site or even the group of websites. It checks the accessibility against WCAG.

6.1.3 Total Validator

Total Validator [25] is a HTML validator, accessibility validator, spelling checker and a broken link checker which supports WCAG and Section 508.It can check the web page online or it can be installed on desktop.

6.1.4 A Check

It [9] evaluates the accessibility of web pages according to section 508 and WCAG 2.0. It also based on OAC (Open Accessibility Checks) and it allows web developers to create their own guidelines.

6.2 Web Authoring Tools

6.2.1 Dreamweaver

Adobe Macromedia Dreamweaver 8[12] provides web accessibility tools which help web developers to make accessible web sites. The developers can check the accessibility of web page. The web page can also be converted into XHTML 1.0 which is more accessible by blind people.

The Dreamweaver also provides accessible properties for html tags which increase the accessibility of web page. The developer can open window for each html tag and can add more accessibility features like, alt for image tag, meaningful text for links, use of color property, title text for links, use of CSS and frames.

6.2.2 Micro SharePoint and Visual Studio

The Microsoft SharePoint and Visual Studio [13] are the Microsoft platforms which help web developers to create accessible web sites. Share point provides accessible mode for replacement of the non-accessible elements with accessible elements. Visual Studio offers web accessibility check option to check the web pages against W3C guidelines and section 508.The W3C guidelines such as use logical site organization and navigation, add alt tag to images, closed captions for audio and video, keyboard navigation, use of high color contrast, meaningful hyperlink and avoid flashing content are covered by the tools.

7. PROS AND CONS OF WEB ACCESSIBILITY TOOLS

Manually, it is not possible for web developers to test the accessibility of web pages. Web Accessibility tools are easy to use [8] and make web accessibility testing process fast. The use of web accessibility tools is great way for organizations to establish a base line of accessibility. Although web accessibility tools are cheap and easy to use but these tools have certain limitations. The main limitation [7] of these tools is that the tools do not cover all accessibility requirements. For example, A web accessibility tool can check whether image tag has alt property or not but it cannot check whether the alt text is meaningful or not. Some of the tools do not follow changing web accessibility guidelines. There are some other limitations like all tools are not free to use, some tools are license based, and some tools are browser dependent. Majority of the tools are platform dependent. The W3C has published guidelines Authoring Tools Accessibility Guidelines (ATAG) [31] but there is no authoring tool in the market which can create fully accessible web sites [27]. So there is need of development of user friendly and platform independent tool to automate the development process of accessible websites.

8. RELATED WORKS

Michele Kirchner [35] in this paper author gives a complete review of web accessibility evaluation tools. The paper also describes the main functionality of web accessibility tools. De Sousa e Silva [17] evaluates the accessibility of Integrated Development Environments (IDE). The author also measures the capacity of Integrated Development Environment to generate accessible software. The two papers [13], [19] show that if the web accessibility is included in requirement face it will improve the quality of the software automatically. Helani Wanniarachchi et al. [16] proposes a frame work to automate the development process of accessible web sites. The author describes a web accessibility generator tool which can scan code and give immediate warning of violated web accessibility rules. The web developers can correct those warnings and improve the web accessibility of the web sites. The tool is platform independent. Mayol, J.J. [20] presents development of a web accessibility improvement tool. The tool can check html code and give warning if violation in the rules. The tool covers the critical points of W3C guidelines as compared to existing web accessibility tools. G.A. Di Lucca et al. [23] the paper

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represents a tool to identify and fix the web accessibility problems. The author uses a model to correct and fix the web accessibility problems which is based on WCAG 2.0. Thi-Huong-Giang et al. [10] the paper presents a framework which checks the client as well as server side code. The framework directly reports and suggests solution for web accessibility violations. The tools which are described in these research papers cover the limitations of existing web accessibility tools and automate the process of web accessibility. The web accessibility improvement tools which are presented in the research papers with their features are shown in the given table.

Table 1: Web accessibility improvement tools to automate the process of web accessibility

No	Tool	Features Covered by Tool	Accessibility Evaluation/ Authoring Tool	Client /Server Side Code
1	Web Accessibility Generator Tool	1.Platform independent 2.Browser Independent	Both	Client-Side Code
2	Web Accessibility Improvement Tool	1.Covers the critical points of web Accessibility guidelines	Evaluation Tool	Client - Side Code
3	The Accessibility Tool	1.Identifies the web Accessibility Problems 2.Fixes the web Accessibility Problems	Evaluation Tool	Client - Side Code
4	CHECORSER	1. WCAG Checker and Corrector tool for ASP Server-side scripting language	Both	Both

9. CONCLUSION

The web should be accessible so that everyone can avail the opportunity of internet. But making the accessible web sites is a difficult task for web developers. The manually rules and standards are not sufficient for web accessibility development. The web accessibility evaluation tools are used to check the accessibility of webpage but still these tools fail to give adequate results. Most of the web sites which are checked with these tools still lack accessible rules. There is need of integrated development environment for web accessibility. The framework should be used by organizations for enhancement of web accessibility. The framework can assist the web developers to create accessible web sites. The framework can cover more accessibility requirements as compared to existing web accessibility tools.

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