Web Accessibility Evaluation of Higher Education Institutions of Pakistan for Visually Impaired Persons

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Abstract: The use of the Internet and digitalization of data is increasing rapidly worldwide. Almost every organization and institution provides essential information or services through the World Wide Web and mobile applications to attract/interact with users/clients worldwide. Researchers have noticed significant accessibility problems in the websites, particularly for people with different disabilities. To assess the accessibility issues, especially for visually impaired users, the websites of Pakistan's top 30 educational institutes were evaluated using three automated Web accessibility tools. All three different accessibility tools showed a different ratio of errors in results. The educational institutes were categorized in public and private sectors to compare the ratio of accessibility errors. The results showed significant accessibility errors related to visual impairment in the websites of educational institutes in both the public and private sectors.

Keywords: Accessibility, visual impairment, WCAG, Web design, Web standards.

1.   Introduction

1.1.   Web Accessibility

Web accessibility provides the guidelines to remove the access barrier between the website and users having different disabilities. In other words, an "accessible website means that a website should be designed so that even people with disabilities can understand, operate, and interact with it [1]". Thus, Web technology must be usable, perceivable, and understandable to improve interaction and engagement in a learning environment [2]. The World Wide Web Consortium (W3C) [3]–[5] develops protocols and guidelines to ensure the long-term growth of the World Wide Web. One of the primary principles of the W3C is to make a system or services available for everyone [4]. Accessibility makes a product, service, or framework usable efficiently, effectively, and satisfactorily for individuals with different disabilities. By considering the standard's principles[5]–[7], various accessibility evaluation matrices are presented in the literature. Web Accessibility Initiative (WAI) [6], [8]collaborates with experts from industry, academic, and research organizations trying to build up the guiding principles and properties that make the website more accessible to people with disabilities (e.g., auditory, cognitive, neurological, physical, and physical visual). So, web designers should remember that people with different types of disabilities should not face any hurdles while

accessing the website [9]. The website [10], [11] should be perceivable, operable, understandable, and robust for people with disabilities. Accessibility [12]–[16] is very important in the online context, and to ensure it, WAI developed some web content accessibility guidelines called Web Content Accessibility Guidelines. It is important to the accessible context in the learning environment through assistive technologies, especially for visually impaired people. Visual impairment [17][18] (e.g., total blindness, low vision, and color blindness) is the most often cited disability regarding web accessibility amongst all disabilities. Mostly the educational institutions provide their academic information (e.g., admission, registration, class, schedules, research trends, and other academic-related activities) on their websites. Especially during the COVID-19 pandemic, all of Pakistan's educational institutes remained close. So, students and teachers use online services to continue their academic activities. However, due to the ignorance of accessibility guidelines during the development of technologies, it was quite difficult for visually impaired individuals to continue learning due to accessibility barriers. Access to information [3]–[5] is declared a legitimate and fundamental right of every member of society.

2.   Literature Review

Various researchers have conducted several studies [19], [20] to determine accessibility issues in information-related technology. Such as, Goodwin et al. [21] conducted a global survey of web accessibility of National Governments and Ministry websites. They found numerous accessibility issues in these websites that require serious effort to fix them. Bousarhane et al. [22] conducted a study to evaluate three Moroccan e-government websites. They used the AccessiWeb method to assess the websites. The results revealed significant accessibility-related problems even though these websites didn't meet the minimum conformance (Level A). Prior research [23] also observed the lack of accessibility guidelines white developing government websites for deference of public information. Similarly, Nazar [24] conducted a study to examine the accessibility of e-banking sites in Pakistan according to WCAG standards. This study aimed to improve the level of interaction and propose the design related to guidelines to develop accessible Content in the banking sector.

Schmetzke [25] also observed serious accessibility-related issues in the academic website using automated tools in the academic sector. In a study, Zaphiris et al. [26] evaluated the website Accessibility of top Universities in the US using automated accessibility tools (e.g., Boby and Lift). The authors selected 50 top-ranking Universities. However, they do not consider these automated tools useful to determine the issue related to the significance of graphics, aesthetics, navigation structure, and information layout. Harper et al. [27] examined the web accessibility of educational institutions, and twelve institutions were involved in this study initially. The evaluators observed that 4 out of 12 institutional websites' homepages do not achieve the minimum conformance. Where, only six institutional websites achieved the minimum level of accessibility. Finally, only two universities satisfy AA and AAA's conformance level of web accessibility. Sakuma et al. [28] argue that excessive multimedia stuff (i.e., videos, animations, and dynamic graphics) while designing interfaces mainly affects web accessibility. The poor design [29]–[31] aspects are considered an important barrier in perceiving required information or services, especially for people with different disabilities. Several researchers also [32]–[34] conducted sophisticated studies to evaluate the acceptability of commercial websites. These studies aim to develop the awareness and importance of accessibility and related guidelines among the design and development communities to offer accessible services in the educational sector.

Public Sector Universities are indicated with the "PU," and Private Sector Universities are indicated as "PR" in this paper.

3. Research Methodology

To determine the accessibility-related issues, Pakistan's top 30 Universities (both public and private) were selected for assessment. The websites of all selected universities were evaluated using three different online accessibility evaluation tools (e.g., A checker, TAW, and WAVE) to determine the incorporation of accessibility guidelines and related standards to improve the permeability through design. TAW and WAVE are two important accessibility evaluation tools adopted numerous times in the previous research. The selected institutional websites were analyzed using these automated tools' optimum conformance level (WCAG) 2.0. Using these tools, the evaluators can easily generate the reports by including the URL or code of the selected websites per the guidelines. Finally, the websites of all selected educational Institutes in Pakistan were evaluated using these automated tools separately. The report generated for each website includes the number of errors and brief detail of errors.

4. Results and Discussion

The top thirty (30) websites of the Educational Institutes of Pakistan were evaluated using three accessibility evaluation tools, i.e., ACheker, TAW, and WAVE. According to the results of AChecker, Pr2 has the highest number of accessibility errors, i.e., 1223, and Pr9 and Pu20 have the lowest number of errors, i.e., Zero (0). According to TAW results, Pr10 has the highest number of accessibility errors, i.e., 238, and Pr6, has the lowest number of accessibility errors, i.e., seven (7). According to WAVE, Pu9 has the highest number of accessibility errors, i.e., 283, and Pu13 has the lowest number of accessibility errors, i.e., two (2). AChecker and TAW could not find errors in one website, i.e., Pr3, whereas WAVE could not find errors in eight (8) websites out of thirty (30), which indicates that WAVE is less efficient than Achecker and TAW. However, WAVE's interface is user-friendly because users can see all the errors graphically. However, AChecker shows in detail the types of error and its solution. Furthermore, AChecker shows A, AA, and AAA type errors separately.

Out of these 30 websites of Educational Institutions of Pakistan, 20 institutes belong to Public Sector, and at the same time, 10 Institutes belong to the Private sector. According to ACheker, Private Sector University named Pr2 has the highest number of accessibility errors on its website. According to TAW, Pr10, a private sector university, has the highest accessibility errors. However, according to WAVE, Pu9, a public sector university, has the highest accessibility errors on its website. The results show that two different accessibility evaluation tools showed the highest accessibility errors in private sector universities.

After that, the errors were analyzed from all 30 websites of Pakistan's Educational Institutes and evaluated by Achecker. There were twelve (12) different types of errors found in the results. The found types of errors such as 1) non-text Content, 2) info and relationships, 3) distinguishable, 4) contrast (minimum), 5) resized text, 6) keyboard accessible, 7) navigable, 8) headings and labels, 9) readable, 10) predictable, 11) input assistance, and 12) compatible.

The results show that Pu7 is top regarding different types of errors. Pu7 has nine (9) types of accessibility errors, and Pr4, Pr9, and Pu20 have zero (0) types of errors. The Non-text Content error was found in 20 websites out of 30, indicating Alternative Text Missing is the most common error in all the websites. In contrast, the "Not Predictable" error is only present in two (2) websites out of 30.

The 2nd most common error is "resize Text" and "Navigable" It was revealed that 11 out of 12 different problems/errors in all websites are directly related to visual impairment.

5. Conclusion, Limitation, and Future Work

A comprehensive literature review was conducted regarding web accessibility, global recommendations, evaluation approaches, and factors developers should consider for people with

different disabilities when designing any application or website. Web accessibility evaluation results of the top 30 Educational Institutions of Pakistan indicate that WCAG guidelines are not being followed during the development of websites, which causes a huge difficulty for people having different types of disabilities. There is a dire need of time for the Government of Pakistan to legislate about web accessibility. During the registration of any new organization or institution, web accessibility should be evaluated on its website.

On the other hand, web designers should educate themselves about web accessibility to follow the WCAG during designing or developing any website or application. All the 30 websites were categorized in the public sector and public sector universities to analyze the difference in conformance level of web accessibility. During the analysis of the results, it was revealed that public and private sector universities are the least accessible. It is a common perception that there is no budget issue in the private sector universities so that they can provide the best services to their students relevant to public sector universities with a limited budget. But during this study, the results found quite the opposite to this perception. The private sector universities were found less accessible than the public sector universities.

The overall results of all the 30 websites were not up to the mark or satisfactory because each website has severe accessibility issues, especially for visually impaired persons. The web designers in Pakistan don't bother to follow Web accessibility protocols during the designing/developing of the websites, resulting in inaccessibility for persons with different disabilities. It can be said easily by analyzing the results that the designers in Pakistan don even check the web accessibility after designing any website.

It was also revealed that Pakistan has no public awareness about web accessibility. There is no check and balance from the governing bodies of Pakistan about web accessibility. As a result, persons with different disabilities face severe problems browsing these websites. We know that this is a fundamental right of every human being to access information even if they have some disability. It is determined that the government should take serious measures and develop a mechanism to check the web accessibility problems. Moreover, web developers should have training/awareness sessions about web accessibility. Regarding, limitation the sample size of the educational institute's websites was comparatively small. Future work can be expanded by including more samples for websites of educational institutions and other institutions/departments of Pakistan or by comparing the results with western intuitions.

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