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Design of Web-based Information Services for the Visually Challenged Persons a Case Study on the Universities in West Bengal

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ABSTRACT

This Paper highlights the Web-based Information Services for the Visually Challenged Persons at the Universities in West Bengal and it also explain how the Universities have improved the accessibility of their web site, aiming for Web Content Accessibility Guidelines (WCAG). Website of an institution plays a key role in information dissemination. Nowadays we are shifting from traditional to digital environment and the access of digital information is more sensible and attractive. This paper could help the authorities to improve web site accessibility, as it covers negotiating with suppliers to upgrade their website. The results show that the most common checkpoint violations involve the provision of text alternatives for non-text content, contrast errors and the need to increase the computability of web pages with future technologies and tools.

KEYWORDS: *Web accessibility, Homepages, Websites, Visual Disabilities, WCAG*

INTRODUCTION

Visually challenged persons are deprived of information in this digital era. They should be equally enlightened with knowledge so that they can also participate in this digitization process and grow themselves accordingly. The constitution was amended with law **"The person with disabilities Act, 1995"** which covers blindness, low-vision among all other disabilities. The law emphasizes on the non-discrimination, fully inclusion in the society and also showing respect to the visually challenged persons as a part of human diversity, maintaining equality, accessibility etc.[6] "**The Right of Persons with Disabilities bill- 2016"**[7] was passed by both houses Rajya Sabha and Lok Sabha. The Disability bill-2016 replaces the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995. Under this law the Ministry of Social Justice of India has enacted Web Accessibility Initiative in 2016.[8]

University websites should take help of information technology to provide user friendly and enough helpful services to those people who are visually disabled and neglected for a long time. As per UNESCO and IFLA guidelines, Library websites should be created for the promotion of library. It should be W3C Content Accessibility Guidelines Level AA compliant and also contain media materials such as press releases so that print disabled people can also access them for their own good. As per the guidelines of National Education Policy (NEP) 2020, UGC has developed a draft **Comprehensive Accessibility Guidelines and Standards for Higher Educational Institutions and**

Universities to support HEIs in all possible manners so that persons with disabilities (Divyangian) have easy access to higher education [9,10]. That regulation states that the institution hires services or creates its website, it must follow clauses related to the websites within the BIS standard and the conformance requirements of the standard (these conform to W3C Web Content Accessibility Guidelines Level AA). The ICT products and services would include websites, apps, learning management systems, office equipment, software, etc.

Right of Persons with Disabilities Act (RPD)

In the year of 2016, 'Right of Persons with Disabilities Act (RPD)' passed as law. This law provides that "the appropriate Government shall ensure that the PWD enjoy the right to equality, life with dignity, and respect for his or her own integrity equally with others." The Government is to take steps to utilize the capacity of the PWD by providing appropriate environment. The objective of this law is to maintain the equal rights and equal opportunities for the disable person as everyone else. The RPD gives equal rights to an individual irrespective of age, sex, race, color, nationality and religion. This law also provides for the access to inclusive education, vocational training, and self-employment of disabled persons without discrimination and buildings, campuses, and various facilities are to be made accessible to the PWD and their special needs are to be addressed. Access to information and communication technology is to be ensured.

What is Web Content Accessibility Guidelines?

Web Content Accessibility Guidelines (WCAG) defines how to make Web content more accessible to people with disabilities. Accessibility involves a wide range of disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities. Although these guidelines cover a wide range of issues, they are not able to address the needs of people with all types, degrees, and combinations of disability. These guidelines also make Web content more usable by older individuals with changing abilities due to aging and often improve usability for users in general[11].

Applications that can be used to check RPD compliance and details.

Right of Persons with Disabilities Act is introduced for the beneficial for people with disabilities. But this act can be abided by if WCAG guidelines are followed properly during the development and design of a website. A website which follows WCAG guidelines makes itself more accessible to visually challenged persons and understandable. There are many free web applications or tools that can be used for web accessibility evaluation. This online service or software programs helps to determine whether web content meets the web accessibility guidelines or not. World Wide Web Consortium (W3C) has taken Web Accessibility Initiative (WAI) to promote a high degree of usability for people with disabilities. W3C introduced a 'Web Accessibility Evaluation Tools List' which will help users to identify potential accessibility issues in their websites quickly. This list can be filtered out as per the user need.
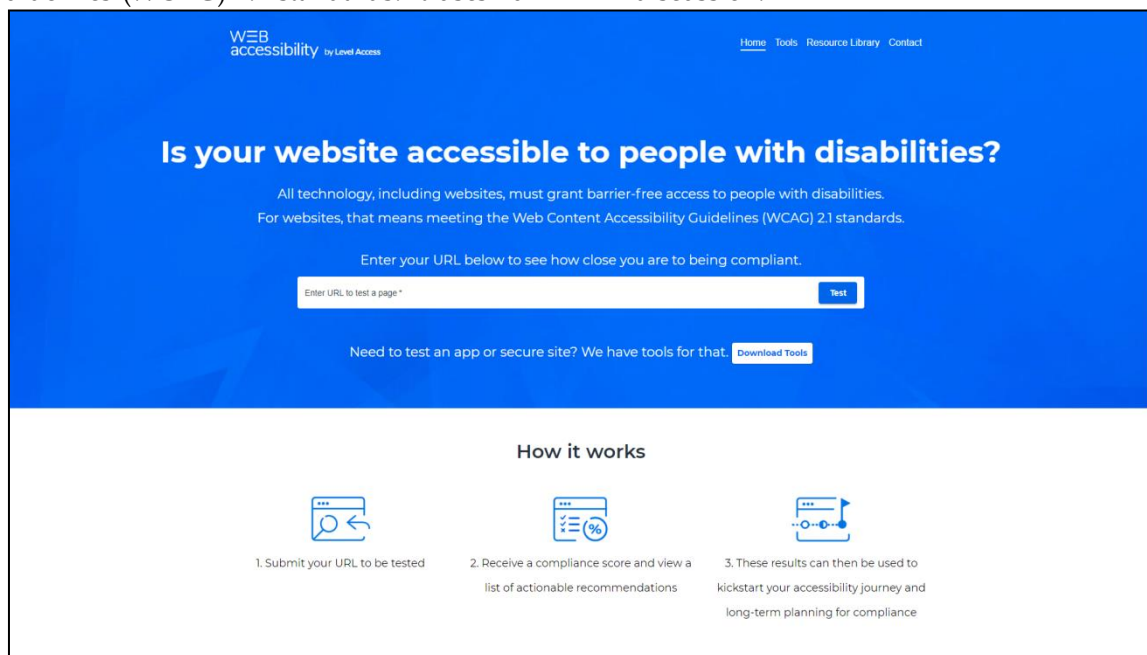
The W3C website (https://www.w3.org/WAI/ER/tools/) has some listed tools. A tool gives fully automated checking but should be followed by manual review. Here we will be working with 'Access Continuum Community Edition' by Level Access released on 13th of October in the year 2013. It is one such edition among many other editions of the 'Web Accessibility' tools by Level Access, identifies critical violations of a web page. It follows WCAG 2.1 standards and automatically checks 'Single web pages, groups of web pages or web sites, restricted or password protected pages' etc.

How to check website is RPD compliant or not?

Accessibility is an important idea behind many web standards. Designing accessible websites will help in creating an inclusive digital world. Accessibility compliance of the Website may be checked at Web Accessibility software. It is free online software with 'URL' https://www.webaccessibility.com/ which analyses the university websites and represents a report, generated by automation tests. **Figure 1** is a graphical user interface of that tool where one can submit the university website 'URL' as input. It analyses that intended web page and generates compliance score of that website using some internal

automation tests. Those test cases are written based on Web Content Accessibility Guidelines (WCAG) 2.1 standards. It uses 267

automated tests which are free. This tool has paid version also which is out of scope in this discussion.

Figure 1: The graphical user interface of online automation testing tool

How university websites can be RPD compliant?

University websites can be RPD compliant if it follows WAI accessibility guidelines, educational resources and technical specifications. W3C web standards such as HTML, CSS, etc. and consensus-based process is followed by WAI to develop web standards to help people with disabilities. WAI includes community input along with disability organizations, government, industry, accessibility research organizations and more.

Following criteria should be met to be RPD compliant:

- WAI accessibility standards should be supported
- Web content should be readable and understandable and accessible by persons with disabilities.

REVIEW OF LITERATURES

Kiruki & Mutula (2021) made a study of 'Accessibility and Usability of Library Websites to Students with Visual and Physical Disabilities in Public Universities in Kenya' This study carried out that all the libraries had library websites. However, the websites did not have disability services page or

information specific to individuals with disabilities. Additionally, the website design posed various access challenges.

Alim (2021) using three automated web accessibility tools (TAW, WAVE and EIII Page Checker), explores the accessibility of the homepages of 66 research-intensive universities with respect to the WCAG 2.0 checkpoints. It revealed that the most common checkpoint violations involve the provision of text alternatives for non-text content, contrast errors and the need to increase the computability of web-pages with future technologies and tools.

Cassner, Harris & Nebraska (2011) discussed their study on what services do academic libraries offer to the differently able? Is there a basic level of services that libraries identify or should offer? Are websites for people with disabilities easily located from the library's home page?

Carter (2004) suggested that enhanced service to students with disabilities, all students can benefit from increased sensitivity and understanding the different learning styles. He also argued that the improved quality of library service can provide better facilities to

the students to conduct research independently, and easier access to information.

Lisa (2014) undertook his study on how Edith Cowan University (ECU) Library improved the accessibility of their web site, aiming for Web Content Accessibility Guidelines (WCAG) version 2.0 Level AA. It describes the results obtained Library web site failed WCAG 2.0 Level A standard in the initial testing.

OBJECTIVES OF THE STUDY

This study will be focusing on the following objectives:

- To analyse the website of the Universities in West Bengal under UGC.
- To find those websites are RPD (The Right of Persons with Disabilities Act) compliant or not.
- To identify which application can help a person with disability to access these university websites.
- To check the technical aspect in relation to the compliance of WCAG guidelines by the websites of the Universities.

SCOPE AND COVERAGE

This study will cover only the websites of those universities, which are present in West Bengal (State University) under UGC (University Grants Commission):

1. Aliah University; (AU)
2. Alipurduar University; (APU)
3. Bankura University; (BKU)
4. Bidhan Chandra Krishi Vishwavidyalaya; (BCKV)
5. Biswa Bangla Biswabidyalay; (BBB)
6. University of Burdwan; (BU)
7. University of Calcutta; (CU)
8. Cooch Behar Panchanan Barma University; (CPBU)
9. Dakshin Dinajpur University; (DDU)
10. Diamond Harbour Women's University; (DHWU)
11. University of Gour Banga; (GBU)
12. Harichand Guruchand University; (HGU)
13. Hindi University; (HU)
14. Jadavpur University; (JU)
15. University of Kalyani; (KU)
16. Kanyashree University; (KAU)
17. Kazi Nazrul University; (KNU)
18. Mahatma Gandhi University, West Bengal; (MGU)
19. Maulana Abul Kalam Azad University of Technology; (MAKAUT)
20. Murshidabad University; (MU)
21. Netaji Subhas Open University; (NSOU)
22. University of North Bengal; (NBU)
23. Presidency University; (PU)
24. Rabindra Bharati University; (RBU)
25. Raiganj University; (RU)
26. Rani Rashmoni Green University; (RRGU)
27. Sadhu Ram Chand Murmu University; (SRCMU)
28. Senate of Serampore College (University); (SSC)
29. Sidho Kanho Birsha University; (SKBU)
30. The Sanskrit College and University; (SCU)
31. Uttar Banga Krishi Vishwavidyalaya; (UBKV)
32. Vidyasagar University; (VU)
33. West Bengal State University ; (WBSU)
34. West Bengal University of Animal and Fishery Sciences; (WBUAFS)
35. West Bengal University of Health Sciences; (WBUHS)
36. West Bengal University of Teachers' Training, Education Planning and Administration; (WBUTTA)
37. The West Bengal National University of Juridical Sciences; (WBNUJS)
38. The Bengal Engineering & Science University.(BESU)

METHODOLOGY

The survey method will be used to collect the data for this study. The data collection will be done by analyzing each university websites whether that is RPD compliant or not. This data will be collected using the online software tools Access Continuum Community Edition by Level Access. At the end the collected data will be used to generate a tabular report.

RESULTS AND DISCUSSION

An "Accessibility Score" is a part of marketing. Most of the accessibility tools companies generate "score" that is unique to their testing rules. Suppose they have 100 rules based on which automation tests are written for accessibility and a website pass 75 of them, then the score will be 75%. If same web page is tested by other online tool, it might get a score of 65% or 85%. There's no standard which can be followed blindly.

Here we are using 'Access Continuum Community Edition' tool which calculates compliance score for a rule set based on the total possible score for the rule set vs. the average of the paragraph / success criteria percentage scores.

Table 1 represents Compliance Scores with a percentage .The objective of this testing is to find compliance score of university websites. Here we have noticed that there are a maximum of 9 universities with compliance score of 70-80%, followed by 8 universities those compliance score of 30-40%. Automated accessibility testing is an integral and strategic method for maintaining an accessible web presence. A large number of techniques used to measure WCAG success criteria can be automated. For example: whether an image tag contains an alt attribute to provide a description for the image. But not all can be automated need human intervention.

The university website URL is submitted in 'Access Continuum Community Edition' tool and it has generated compliance score of that web page based on 267 automated tests which are free. This tool has 76 additional tests which are paid service. This discussion is out of scope.

Table 1: Compliance score report generated by Web Accessibility tool

Web Content Accessibility Guidelines (WCAG) Reports generated by an automated testing tool 'Access Continuum Community Edition' (url: https://www.webaccessibility.com/)					
Sl. No.	Name of the University	Web page	URL	Compliance Score	No of Violation Identified
1	Aliah University	Home Page	https://www.aliah.ac.in/	54	28
		Library page	https://aliah.ac.in//department/central-library	54	13
2	Alipurduar University	Home Page	https://alipurduaruniversity.ac.in/	41	51
		Library page	https://alipurduaruniversity.ac.in/university/library	54	10
3	Bankura University	Home Page	https://www.bankurauniv.ac.in/ (could not be tested)	---	----
		Library page	https://www.bankurauniv.ac.in/RulesAndRegulation.aspx	66	32
4	Bidhan Chandra Krishi Viswavidyalaya	Home Page	https://bckv.edu.in/index.php/en/	60	28
		Library page	https://bckv.edu.in/index.php/en/library-en/central-library-en	70	9
5	Biswa Bangla Biswabidyalay	Home Page	https://www.biswabanglabiswabidyalay.org/	40	61
		Library page	https://biswabanglabiswabidyalay.org/digital-library	55	15
6	University of Burdwan	Home Page	https://buruniv.ac.in/	54	75
		Library page	https://buruniv.ac.in/bunew/MobileFacilitiesTemplate.php#:~:text=The%20Central%20Library%20is%20housed,pm%20except%20Saturdays%20and%20Sundays.	66	35
7	University of Calcutta	Home Page	https://www.caluniv.ac.in/	66	8
		Library page	https://www.culibrary.ac.in/	70	8
8	Cooch Behar Panchanan Barma University	Home Page	https://www.cbpbu.ac.in/	18	86
		Library page	https://www.cbpbu.ac.in/elib_master.php	45	59
9	Dakshin Dinajpur University	Home Page	https://www.dduniv.ac.in/	45	67
		Library page	There have no separate library pages yet.	--	--
10	Diamond Harbour Women's University	Home Page	https://www.dhwu.ac.in/	60	30
		Library page	There have no separate library pages yet.	---	---

11	University of Gour Banga	Home Page	https://www.ugb.ac.in/	36	461
		Library page	There have no separate library pages yet.	---	---
12	Harichand Guruchand University	Home Page	https://harichandguruchanduniversity.com/	54	21
		Library page	There have no separate library pages yet.	---	---
13	Hindi University	Home Page	http://www.hindiuniv.org.in/	100	0
		Library page	There have no separate library pages yet.	---	---
14	Jadavpur University	Home Page	http://www.jaduniv.edu.in/	40	7
		Library page	http://122.15.82.40:9900/	66	9
15	University of Kalyani	Home Page	http://162.144.89.90/	45	29
		Library page	http://162.144.89.90/services-facilities/central-library/	63	13
16	Kanyashree University	Home Page	https://www.kanyashreeuniversity.in/	50	54
		Library page	https://www.kanyashreeuniversity.in/digital-library	55	14
17	Kazi Nazrul University	Home Page	https://www.knu.ac.in/	27	19
		Library page	https://www.knu.ac.in/get-page-details-sub-category-item/library/central-library/121	36	20
18	Mahatma Gandhi University, West Bengal	Home Page	http://mguwb.org.in/	83	2
		Library page	There have no separate library pages yet.	---	---
19	Maulana Abul Kalam Azad University of Technology	Home Page	https://makautwb.ac.in/	33	76
		Library page	https://makautwb.ac.in/page.php?id=232	41	13
20	Murshidabad University	Home Page	https://www.murshidabaduniversity.ac.in/	54	8
		Library page	There have no separate library pages yet.	---	---
21	Netaji Subhas Open University	Home Page	http://www.wbnsou.ac.in/	33	705
		Library page	http://www.wbnsou.ac.in/library_services/library_profile.shtml#active_library_profile	33	399
22	University of North Bengal	Home Page	https://www.nbu.ac.in/	44	66
		Library page	http://118.185.209.245:8081/nbulib/	30	97
23	Presidency University	Home Page	https://www.presiuniv.ac.in/web/	50	12
		Library page	https://www.presiuniv.ac.in/web/library/aboutlibrary.php	40	25
24	Rabindra Bharati University	Home Page	https://rbu.ac.in/	41	10
		Library page	https://rbu.ac.in/home/post/7f100b7b36092fb9b06dfb4fac360931	45	7
25	Raiganj University	Home Page	https://raiganjuniversity.ac.in/	81	51
		Library page	https://raiganjuniversity.ac.in/about-the-library-2/	100	13

26	Rani Rashmoni Green University	Home Page	http://rrgu.org/	63	13
		Library page	There have no separate library pages yet.	---	---
27	Sadhu Ram Chand Murmu University	Home Page	https://jhargram.gov.in/public-utility/sadhu-ram-chand-murmu-university/	90	7
		Library page	There have no separate library pages yet.	---	---
28	Senate of Serampore College (University)	Home Page	https://www.senateofseramporecollege.edu.in/	50	40
		Library page	There have no separate library pages yet.	---	---
29	Sidho Kanho Birsha University	Home Page	https://skbu.ac.in/	33	17
		Library page	There have no separate library pages yet.	---	---
30	The Sanskrit College and University	Home Page	https://www.sanskritcollegeanduniversity.org.in/	55	25
		Library page	There have no separate library pages yet.	---	---
31	Uttar Banga Krishi Vishwavidyalaya	Home Page	https://www.ubkv.ac.in/	55	172
		Library page	https://www.ubkv.ac.in/library/	55	172
32	Vidyasagar University	Home Page	http://www.vidyasagar.ac.in/	66	5
		Library page	http://library.vidyasagar.ac.in/	44	22
33	West Bengal State University	Home Page	https://wbsu.ac.in/	44	29
		Library page	https://wbsu.ac.in/about-library/	55	14
34	West Bengal University of Animal and Fishery Sciences	Home Page	http://wbuafscl.ac.in/	45	12
		Library page	http://wbuafscl.ac.in/central-library/	45	50
35	West Bengal University of Health Sciences	Home Page	https://wbuhs.ac.in/	40	13
		Library page	There have no separate library pages yet.	---	---
36	West Bengal University of Teachers' Training, Education Planning and Administration	Home Page	https://www.wbuttepa.ac.in/	44	1271
		Library page	There have no separate library pages yet.	---	---
37	The West Bengal National University of juridical sciences	Home Page	https://www.nujs.edu/	66	13
		Library page	https://www.nujs.edu/nujs-library.html	88	1
38	The Bengal Engineering & Science University	Home Page	https://www.iiests.ac.in/	25	28
		Library page	http://library.iiests.ac.in:30000/dqpas/?view=featured	90	1

Table 2: Violation Details of university web page

Name of the University	Violation Zone																		
	Provide alternative text image	Ensure text and images of text provide sufficient contrast	Ensure heading level matches the heading's visual importance/level	Ensure links do not directly target images	Ensure containing elements allow text resize without loss of functionality.	Ensure frame titles are meaningful	Ensure link text is meaningful within context	Ensure markup documents contain well-formed elements	Avoid use of placeholder values to label or explain input	Avoid the sole use of device-dependent event handlers	Ensure sub-lists are marked up properly	Ensure the marquee element is avoided	Ensure list items are found in a list container	Ensure the language of a document is set	Provide an informative, context-sensitive page title	Ensure ARIA roles, states, and properties are valid	Avoid the use of implicit headings	Provide a valid label for form fields	Ensure elements with multiple labels are rendered appropriately
A U	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	-	-	-	-
A P U	Y	Y	Y	-	Y	-	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	-
B K U	Y	Y	Y	-	Y	Y	Y	-	-	Y	-	Y	-	Y	-	-	-	-	-
B C K B	-	Y	Y	-	-	-	Y	Y	Y	-	-	-	-	-	Y	-	-	-	-

B B B	Y	Y	Y	Y	-	-	Y	-	-	Y	Y	Y	-	Y	-	Y	-	-	-
B U	Y	Y	Y	-	-	Y	Y	Y	-	-	Y	Y	Y	-	-	-	-	-	-
C U	-	Y	-	Y	Y	Y	Y	-	-	-	-	-	-	-	-	-	Y	-	-
C P B U	-	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	Y	-	-	-	Y	-
D D U	Y	Y	Y	Y	-	-	Y	Y	Y	Y	-	-	-	Y	-	-	-	-	Y
D H W U	Y	Y	Y	Y	-	-	Y	-	-	Y	Y	Y	Y	-	-	Y	-	-	-
G B U	Y	Y	Y	Y	-	-	Y	Y	-	Y	Y	Y	-	Y	-	-	-	-	-
H G U	Y	Y	Y	-	-	-	Y	Y	-	-	-	-	-	-	-	Y	-	-	-
H U	Y	Y	Y	-	Y	Y	-	-	-	-	-	-	-	-	-	Y	-	-	-
J U	-	Y	Y	-	-	Y	Y	Y	-	-	-	-	-	Y	-	-	-	Y	-
K U	-	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	-	-	-	Y	-

KAU	Y	Y	Y	Y	-	-	Y	-	-	Y	Y	Y	-	Y	-	-	-	-	-
KNU	-	Y	Y	-	Y	Y	Y	Y	-	Y	-	Y	-	Y	-	-	-	Y	-
MGU	-	Y	Y	-	-	-	-	-	-	-	-	Y	-	-	-	-	-	-	-
MAKAUT	Y	Y	Y	Y	-	Y	Y	Y	Y	Y	Y	Y	-	-	-	-	-	Y	-
MU	Y	Y	Y	Y	Y	Y	Y	-	-	Y	Y	Y	-	-	-	-	-	-	-
NSOU	Y	Y	-	-	Y	Y	-	-	-	Y	-	Y	-	Y	-	-	-	Y	-
NBU	Y	Y	Y	-	Y	-	Y	Y	-	-	-	-	-	Y	-	-	-	-	-
PU	Y	Y	Y	Y	-	-	Y	-	-	-	-	-	-	-	-	Y	-	Y	-
RBU	Y	Y	Y	-	-	Y	Y	-	-	Y	-	Y	-	-	-	-	-	Y	-
RU	Y	Y	Y	Y	Y	-	Y	-	-	-	-	-	-	Y	-	Y	-	-	-

R R G U	-	Y	-	-	Y	-	Y	-	-	-	-	-	-	Y	-	Y	-	-	-
S R C M U	-	Y	-	-	-	Y	-	-	-	-	-	-	-	-	-	Y	-	-	-
S S C	Y	Y	Y	-	Y	Y	Y	Y	Y	Y	-	Y	Y	-	-	Y	-	-	-
S K B U	Y	Y	Y	-	-	-	Y	-	Y	Y	-	Y	-	Y	-	-	-	Y	-
S C U	Y	Y	Y	-	--	-	Y	-	-	-	Y	-	-	Y	-	Y	-	-	-
U B K V	Y	Y	Y	-	-	-	Y	Y	-	-	-	-	-	-	-	-	-	-	-
V U	Y	Y	Y	-	Y	Y	Y	-	-	-	-	-	-	Y	-	-	-	-	-
W B S U	Y	Y	Y	-	Y	Y	Y	Y	-	Y	-	Y	Y	-	Y	Y	-	-	Y
W B	-	Y	Y	Y	-	-	Y	-	-	Y	-	-	-	-	-	-	-	Y	-

U A F S																			
W B U H	-	Y	Y	-	Y	-	Y	Y	-	-	Y	Y	-	-	Y	Y	-	-	-
W B U T T	Y	Y	Y	Y	-	-	-	-	-	-	Y	-	Y	Y	-	-	-	-	-
W B N U J	-	Y	Y	-	-	-	Y	-	-	Y	-	-	-	-	-	-	-	-	-
B E S U	Y	Y	-	Y	-	Y	-	Y	-	Y	Y	-	-	-	-	-	-	Y	-

Table 2 presents some common checkpoint violations when designing university web pages. By 'Y' we mean that in some areas of a webpage, violations have been noticed.

FINDINGS

Web accessibility means persons with disabilities can also understand, navigate, perceive and interact with the Web, and that they can contribute to the Web. It encompasses all type of disabilities like visual, auditory, physical, neurological, cognitive, speech etc. that affect users to access the Web.

This type of barriers can be overcome when websites, web technologies, or web tools are designed with conformance to standards. If these are badly designed, they can exclude people with disabilities from using the web.

The Website and apps should be designed and developed by following WAI standard so that irrespective of language, culture, location, hardware, software or ability can be accessed.

RECOMMENDATION

A detailed report for each website is represented and some of the university pages has an average score but no of violations are high. If WCAG guidelines are followed fully then only conformance level A, AA or AAA can be achieved which will be helpful for users with disabilities.

CONCLUSIONS

This study will give a brief idea how we can improve the university websites so that person with disabilities can access the web contents present in website. We will come to know how those web content in a university websites can be accessed and used.

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