Web Accessibility: A Depth Evaluation of Government Organizations and Non Government Organizations of Bangladesh

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Abstract

World Wide Web (WWW) gives riches of information and services to the people of its digital society. It's obliging to develop people's lives and lift up their standard of living is massive. The World Wide Web Consortium (W3C) is playing an imperative role to set of guidelines in the form of different versions of Web Component Accessibility Guidelines (WCAG), about facilitating people with disabilities to use the Web without barriers. In inaccessible website, numerous groups of persons like person with disabilities, elderly persons, illiterate persons, rural areas persons, having limited bandwidth, person speaks only a vernacular language, having mobile devices with small display are at risk of being completely excluded from information society and this inaccessibility is the largest and most common barrier to implementing effective e-governance and e-learning.

This research explores the accessibility issues with regard to government organizations and non government organizations websites in Bangladesh. Web content and a Web survey were carried out as the methods to extract data on web accessibility. Issues avoiding accessibility were hypothesized as a preliminary experiment. This paper provides a quantitative evaluation of different aspects of accessibility, which can pave the way for better design of websites by taking care of the deficiencies inherent in the web portals of government and other organizations. The hypothesis test showed that there has gigantic divergence regarding accessibility between government organization websites and non government organizations websites of Bangladesh

Key terms: Accessibility; Websites; WCAG 2.0

Introduction

In modern digital society, organizations exposed their user centric services to their patrons electronically by hosting web portals, explicitly website have been hosted in the web. Progressively the number of websites on the web is rapidly increasing. As there have wide range of user community so design of a website is vital for it to be accessible. Availability of the website on web does not mean that this website is accessible for all. This things clearly explained by web Accessibility in Mind (WebAIM, 2016) that "at the click of a mouse, the world can be 'at your fingertips'-that

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is, if you can use a mouse... and if you can see the screen... and if you can hear the audio in other words, if you do not have a disability of any kind" (WebAIM, 2016)

W3C Director and inventor of the World Wide Web, Tim Berners-Lee prominently noted that "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."(WAI, 1999). Whatever the software, hardware, culture, location or mental or physical ability, the web is necessarily intended to work for all people and this is the main goal of web. When the web fulfill this goal, it is then accessible to all people with diverse range of sight, movement, hearing and cognitive ability (WAI,1999). On the other hand, when websites, web technologies, or web tools are badly or poorly designed, they can create barriers that exclude people from using the Web.

Literature Review

Background

To maintain the standard accessible website, enabling people with disabilities to participate equally on the Web, W3C taken initiatives named Web Accessibility Initiative (WAI,1999). WAI develops a series of accessibility standards and guidelines in the form of different versions of Web Component Accessibility Guidelines (WCAG). The most recent and standardized version being WCAG 2.0 released on 2008 and first version named WCAG 1.0 released on 1999.Some research have been carried out to evaluate the compliance of the guidelines provide in WCAG 1.0 version. The primary goal of these guidelines is to promote accessibility. However, upholding these guidelines will also make Web content more available to all users, whatever user agent they are using (e.g., desktop browser, voice browser, mobile phone, automobile-based personal computer, etc.) or constraints they may be operating under (e.g., noisy surroundings, under- or over-illuminated rooms, in a hands-free environment, etc.)"(WAI, 1999).

Related Research

An accessibility analysis of the government web portals of Saudi Arabia and Oman have been done by a group of authors using WCAG 1.0 guidelines (Abdulmohsen A. et al, 2005). Where the authors studied websites manually and using software tools (Multi web, Lynx, and W3C Validation) to verify the compliance of the guidelines with respect to WCAG 1.0. In manual check they tried on some assistive technologies and Haptic devices for users having problems like mobility and total blindness where as they have not addressed the issue of persons with color blindness. Another manual study carried out by Irina and Ben where they analyzed 50 US state websites randomly and initial recommendation were made with 10 rules (Irina C. and Ben S.2002).

Updated version of the guidelines WCAG 2.0 released to make the web content more accessible, by incorporating wide range of recommendations. Following these guidelines will make web content accessible to a variety of people with disabilities, including low vision and blindness, hearing loss and deafness, cognitive limitations, learning disabilities, speech disabilities, limited movement, photosensitivity and combinations of these. A conceptual model with two parts have been developed where one part explore the present status of information system another part evaluate the compliance of the guidelines WCAG 2.0 (Uthayasankar and Zahir 2012). The goal of the study was whether it is implemented the guidelines of WCAG 2.0 in e-government websites. In Jordan one of the researchers evaluated government websites taking 25 sample. Same types of study were carried out in Malaysia by Malaysian researchers (Mohd H. et al 2010).In their research they have maintained WCAG 1.0 guidelines with priority 1.0 and automatic tool (Bobby) where they have taken only nine (9) samples and they pointed only the number of errors found in different websites instead of calculating the percentage of the error (Mohd H. et al 2010). Thus, it doesn't give a correct depiction of the general error percentage which can be used as a relative measure among different websites.

Objective and Scopes

The Bangladesh government applies the benefit of the internet and deployed digital Bangladesh by providing the web services to the people. The main objectives of the digital Bangladesh are allowed the people to expand entrée to the e-services of its ministries and divisions in a proficient way. As websites are playing vital role to achieve the effective services so it is the main tactic between mass people and the government. At the same time non-government organizations (NGOs) are working for the mass people where mostly they work for advantage less people and their interaction happen via e- services mainly websites. The websites are the gateway for the people to access information and services provided by the government organizations and Non-government organizations. In modern digital society, people are excited to use the website to fulfill their needs and users are increasing rapidly. So the organizations websites should be easy to access by all kinds of people including differently able people. For that reason, government and non-government websites should be incorporate the WCAG2.0 guidelines and considered in a serious manner. In this study, government and non-government websites are manually and electronically (web tools) investigated to ensure that they give not only improved service to the people but also a handy service to differently abled people in the country.

Methodology

Research Strategy

Most web accessibility studies have used automated web accessibility

evaluation software and a few others have used manual evaluation method. For the present study both automated accessibility evaluation tools that check the conformance of a web page according to the WCAG 2.0 and Expert (manual) inspection of accessibility on the basis of heuristics that complement automatic evaluation carried out.

Subjects

The sample for the study is Government Organizations domain (URL) and Non-Government Organization (NGO)'s domain (URL) where NGO's are classified into domestic and international.

A list of leading domestic and international NGO's was profiled by Asian Development Bank (ADB)'s NGO and Civil Society Center in august 2008. From the list randomly 5 (five) domestic and 5 (five) international NGO's were selected for sample. Websites URL's were collected for these organizations by utilizing Google's Custom Search API. The process carried out by submitted the search queries to Google for the term "Bangladesh government" and Google returned number of results and 10 (ten)organizations have been selected considering the URL from top searched results.

Sample

The sample of 5 domestic NGOs and 5 international NGOs are in Appendix - I in a row. And 10 sample of government organizations are in Appendix II.

Procedures

The Ratings, score and observable of hypothesis has been constructed with 100 scale point scale to measures the websites' functionality. At the top of scale is 81 and above is considered that this scale meets the WCAG 2.0 - W3C Web Content Accessibility Guidelines 2.0. On the other hand in context of Bangladesh 30 and bellow scale is marked as not implemented or not accessible means that developers of the website do not understand the accessibility requirements of the rules or did not consider accessibility in the design of the website. Following table expressed all the observable with the scale.

Table 1: Ratings, Scores and Observable of Hypothesis

Rating	Scale	Observable	Descriptions
6	81 - 100	Accessible/ Implemented	Meets the WCAG 2.0 guidelines
5	71 - 80	Mostly Accessible/Implemented	Users can perform intended functions easily but site does not comply with all accessibility guideline.
4	61 - 70	Partially Accessible/ Implemented	Major accessibility guidelines implemented.
3	51 - 60	Fairly Accessible/ Implemented	Accessibility problems exist; skilled users can perform the desired task with patience.
2	41 - 50	Poorly Accessible/ Implemented	Accessibility problems exist; skilled users can perform the desired task but with the huge difficulty.
1	31 - 40	Mostly Inaccessible/Few Implementation exist	Major accessibility problems exist; may not possible for unskilled users to perform the desired task.
0	0 - 30	Not Accessible / Implemented	Not possible for some users to perform intended tasks even with the help of assistive technology.

In manual investigation Mozilla Firefox browser with the web developer toolbar was used. Web elements were investigated by following technique to ensure well-formed design and accessibility.

i. To make sure, all graphic items have equivalent text by turning off the images. In this case assigning the hotkeys technique used.
ii. To make sure, all the audio and video contents have equivalents text and moving, blinking, or scrolling information that starts automatically have a way for the user to pause, stop, or hide the movement.
iii. By changing the font size, checked whether the page is readable to the user or not. Also examine the forms and tables throughout the site.
iv. Observe how the site uses color, and discover that color is not used exclusively to express information. When inadequate contrast suspected, print the page to ascertain whether all information is readable.
v. To make sure, page is accessible without using the mouse; keyboard Tab is used through the links and forms on a page.

For the above rules researcher developed 100 points scale by providing 20 points of each (5) rules.

The researcher conducted parallel evaluations using the web accessibility evaluation

tools. Web accessibility evaluation tools are software programs or online services that help to determine if web content meets accessibility guidelines. The tools that have been used in the research is recognized and approved by W3C. Researcher used a Functional Accessibility Evaluator (FAE) which has been developed by the University of Illions at Urbana-Champaign (UIUL, n.d.1).

Using FAE, each website was automatically evaluated on 31 rules across six categories that are also implemented in manual evaluation.

Findings

Overall Web Accessibility

Outcome for both manual and automated evaluation approximate a normal distribution, with most websites falling within the rating 1 to 4. The mean rating of government organization assigned for combined (both manual and automated check) was 1.42, with a standard deviation 2.12. On the other hand non government organizations combined mean rating was 1.42, with a standard deviation of 1.49. The standard deviation difference of both government and non government organization is 0.63. A frequency distribution for both organizations, showing frequency of each rating, is provided in Table 2 and Table 3.

Table 2: Government Organization Ratings

Rating	Count	Percentage
0	0	0
1	3	30
2	6	60
3	1	10
4	0	0
5	0	0
6	0	0
Total	10	100

Table 3: Non Government Organization (NGO) Ratings

Rating	Count	Percentage
0	0	0
1	4	40
2	3	30
3	1	10
4	2	20
5	0	0
6	0	0
Total	10	100

Inter-Rater Dependability:

The researcher compared raw evaluation data of the two methods to determine the inter-rater dependability of the projected functional accessibility Rule sets and associated points scale. A summary of manual, automated, average score with rating is presented in Table 4 for government organizations. Where, the Pearson Correlation Coefficient (r) for two data sets is 0.5156. This is a moderate positive correlation, which means there is a tendency for high manual variable scores go with high automated variable scores. The value of r2, the coefficient of determination, is 0.2658.

A summary for non-government organizations (NGO) of manual, automated, average score with rating is presented in Table 5. Where, the Pearson Correlation Coefficient (r) for two data sets is 0.5169. This is also a moderate positive correlation, which means there is a tendency for high manual variable scores go with high automated variable scores. The value of r2, the coefficient of determination, is 0.2672.

Table 4: Government Organization

Organization Initial	Manual Score	Automated Score	Average Score	Ratings
PROB	49	15	32	1
MOFA	70	34	52	3
MOHFW	67	20	43.5	2
MSW	63	26	44.5	2
MOPME	57	23	40	1
MHA	48	25	36.5	1
MOI	60	25	42.5	2
MOWCA	58	25	41.5	2
MOST	65	23	44	2
MOCAT	58	25	41.5	2

Table 5: Non-Government Organization (NGO)

Organization Initial	Manual Score	Automated Score	Average Score	Ratings
BRAC	57	30	43.5	2
GRAMEEN	78	44	61	4
DAM	34	23	28.5	0
PROSHIKA	45	19	32	1
TMSS	39	40	39.5	1
ActionAid	52	42	47	2
Handicap	63	39	51	3
Helen	79	44	61.5	4
Save the Children	66	24	45	2
Terre Hommes	48	29	38.5	1

Comparison of Government and Non-Government Website:

Government and non-government organizations websites are almost similar in their accessibility. Non Government websites performed slightly better in ratings. 2 of the NGO(1 domestic and 1 international) websites rated (maximum grade) 4 with the scores of 61% and 61.5%, while government websites reached maximum 3 grade rating by only one institution with the score of 52%. 6 out of 10 government websites rated 2 suggest that this 60% websites are poorly implemented the guideline of WCAG 2.0. However, surprisingly, 1 NGO websites fall into 0 ratings which is showing the ignorance by the developers to maintain the WCAG 2.0 guide lines. It is traceable that mean rating of international NGO (2.4) is far better than domestic NGO (1.6) with the difference of 0.8.Among them standard deviation of international NGO (1.02) is better than the standard deviation 1.35 of the domestic NGO with 0.33 difference.

Comparison of Manual System with Functional Accessibility Evaluator (FAE):

Data obtained using the manual evaluation was further compared to that obtained automatically using FAE. Manual evaluation and automated evaluation have significant difference in their score. In NGO's manual check, 22.7% score variances exist in between of 56.1% and 33.4% score with compare to government's website score variance 35.4% in regards to 59.5% and 24.1%. A striking variance is present between manual and automated (FAE) evaluation as a consequence of the manual check recommendation (Appendix - III) by automated tools to justify the real assessment. There was notable agreement in scores when examined on all categories of website. The full comparisons provided in Figure 1 and Figure 2.

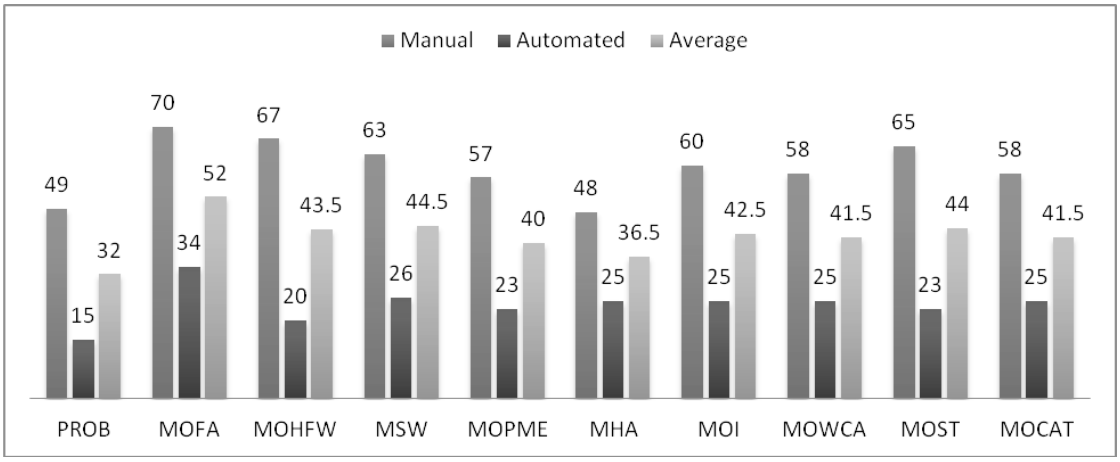

Figure 1: Government Organizations manual, automated and average score comparison

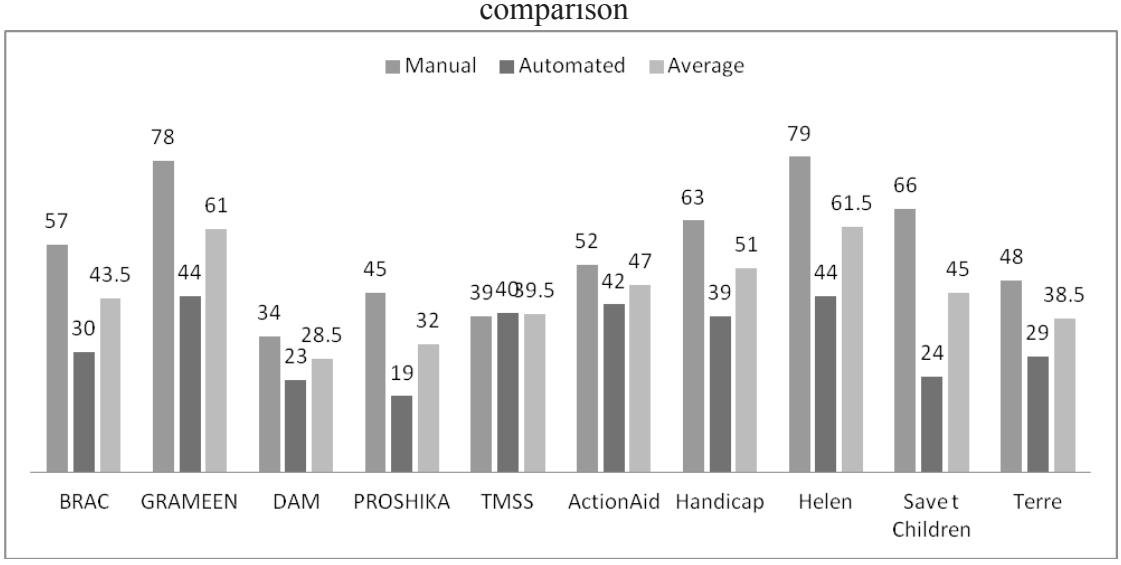

Figure 2: Non-Government Organizations manual, automated and average score comparison

Keyboard Tab: A Promising Practice:

As mentioned in the manual checked results, use the website without using mouse Rulesets score was outstanding. This Rulesets received the highest total raw scores in the sample from the manual checks whereas automated evaluator indicated for all the organizations for manual check. The percentage of 74.75% is the highest percentage from each individual category of Rulesets whereas lowest percentage is 49.65% in Rulesets i (All graphic items have equivalent text).Details are illustrated in figure 3.

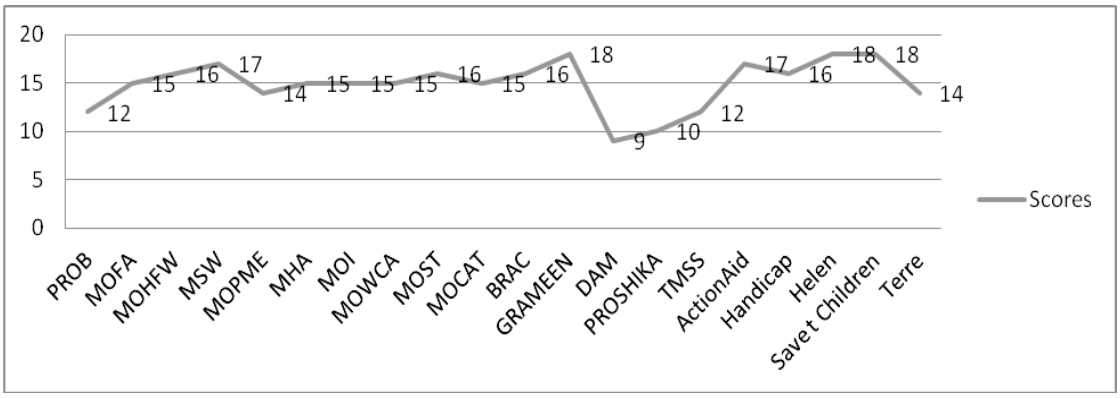

Figure 3: Keyboard functionality scores for all organizations

Analysis

The accessibility problems that were found in the both government and non government organizations include the following:

- Alternative text of Graphical information: Most of the websites failed to provide the text alternative in the cases where images are exclusively used to express information for comprehension. In case of navigation like web links to other pages, decorated texts, and diagrams, the information conveyed by images are not be available to constrained access contexts of the users with visual impairments, users with low bandwidth, and users with minimal content display devices.
- Associate text or supported information into the forms: Though few websites use keyboard access to navigate into the forms but the majority of the websites forms didn't included alternative text for describing the information requested from the user and associate labels with form controls. Unless they include, it is not accessible.
- User to control the communication of interactive elements of the page: the user should be in control of the interaction at all times is one of the most traditional usability principles. Maintain the usability principles are not true in case of few websites with some inaccessible interactive web technologies such as auto-refreshing, animated text and animated images of the contents of a websites.
- Consistent and effective navigation: Some homepages endure from major navigation problems like the navigation bars disappearance; this is happen when they are designed as same color of text with background, images with no alternative text and others.
- Consistent and meaningful information organization: Some homepages endure from major interruption to the organization of information, particularly when style sheets are turned off.

The findings may imply that non-government organizations are showing leadership in compare to government organization in the adoption of WCAG 2.0 guidelines, but without corresponding leadership in accessibility.

Again, it is evident that there are significant accessibility problems in the government organizations websites and that not one homepage was judged as adequately designed to meet all the criteria offered by the heuristic. 6 out of 10 websites are in got rating 2 which mean government websites have major accessibility problems. These problems are different for each websites and mainly concern information structure, visibility, navigation and user control and only 1 website reached up to satisfactory or mid level ratings.

It is important to note that non government organizations website gave slightly better result in terms of navigation, image or audio or video's alternative text, forms and exclusively keyboard functionality. In compare to domestic and international organization, international organization typically showed consistent outcomes.

Limitations and Future Research

Though all those websites are highly centralized to the public but a small number of individuals are responsible for their creation and maintenance. Knowledge and motivation may be reflected in their work when these individuals are knowledgeable about accessibility and motivated to improve it. This might argue that a very useful strategy for influencing accessibility at a less significant organizations with a extremely centralized web management approach is to ensure that the individuals who create and maintain the intuitions websites are knowledgeable of accessibility issues and practices, perhaps by both making accessibility knowledge a required qualification when hiring new staff and investing in accessibility-related training for these individuals.

However, In order to reach and maintain web accessibility, organizations stakeholders need to establish a web accessibility policy that will be applied during the design, development, and operation of their web site.

The researcher was challenged to find a good example of an accessible websites from the used sample. Another limitation is that the number of pages evaluated for each institution is very small. Most large size organizations have hundreds to thousands to millions of pages and a sample of 10 pages; no matter which 10 researcher choose-may have limitations in its reliability as an indicator of whether the organizations as a whole has embraced web accessibility.

This study provides a preliminary part for understanding and usefulness of the universal status of web accessibility. Regardless of the limitations, the present study presents the data to support the complexity of the problem facing organizations. Given that the independent variables measured in this study seem to have only modest influence on accessibility ratings, additional factors must contribute to organizations

web and IT accessibility. Additional research is warranted to identify these contributing factors, which may include:

- A focus on standard compliance among web designers and developers
- A large population with disabilities
- Funding to support web and IT accessibility efforts

Conclusion

The present study was undertaken to create and test a manual system for evaluating websites for accessibility. The proposed manual system evaluates website based on their primary function and addresses the limitations of automated accessibility testers such as FAE. The present study also tested the accessibility of key websites of organization who directly involved with the mass people. The results provide information that can help guide organizations in their efforts to improve the accessibility of the websites. Although few websites evaluated in this study were totally inaccessible, the opposite is also true: few were moderately accessible. This confirms that continued efforts is needed in order to aware and educate the policy makers, owners and web designers about the need for web accessibility and the techniques for implementing it. Disability is referenced in various parts of the SDGs and specifically in parts related to education, growth and employment, inequality, accessibility of human settlements, as well as data collection and monitoring of the SDGs.

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Appendix-I

Non Government Organization (Domestic):

S.L	Organization Name	URL
1.	Bangladesh Rural Advancement Committee (BRAC)	http://www.brac.net/
2.	The Grameen Bank	http://www.grameen.com
3.	Dhaka Ahsania Mission (DAM)	http://www.ahsaniamission.org.bd/
4.	Proshika	http://www.proshikahrdc.org.bd/
5.	Thengamara Mohila Sabuj Sangh (TMSS	http://tmss-bd.org/

Non Government Organization (International):

S.L	Organization Name	URL
1.	ActionAid Bangladesh	http://www.actionaid.org/bangladesh
2.	Handicap International	http://www.handicap-international.org/
3.	Helen Keller International	http://www.hki.org/
4.	Save the Children	http://www.savethechildren.org
5.	Terre Hommes	http://www.terredeshommes.org/

Appendix-II

Government Organization:

S.L	Organization Name	URL
1.	Peoples Republic of Bangladesh	http://www.bangladesh.gov.bd
2.	Ministry of Foreign Affairs	http://www.mofa.gov.bd/
3.	Ministry of Health and Family Welfare	http://www.mohfw.gov.bd/
4.	Ministry of Social Welfare	http://www.msw.gov.bd/
5.	Ministry of Primary and Mass Education	http://www.mopme.gov.bd/
6.	Ministry of Home Affairs	http://www.mha.gov.bd/
7.	Ministry of Information	http://www.moi.gov.bd/
8.	Ministry of Women and Children Affairs	http://www.mowca.gov.bd/
9.	Ministry of Science and Technology	http://www.most.gov.bd/
10.	Ministry of Civil Aviation and Tourism	http://www.mocat.gov.bd/

Appendix-III

Manual Check Evaluation Form:

Organization Name	(i) All graphic items have equivalent text by turning off the images.	(ii) All the audio and video contents have equivalents text and moving, blinking, or scrolling information that starts automatically have a way for the user to pause, stop, or hide the movement.	(iii) By changing the font size checked whether the page is readable to the user or not. Also examine the forms and tables throughout the site.	(iv) Observe how the site uses color, and discover that color is not used exclusively to express information. When inadequate contrast suspected, print the page to ascertain whether all information is readable.	(v) Page is accessible without using the mouse; keyboard Tab is used through the links and forms on a page.	SUM
	20	20	20	20	20	100