

## Accessibility Analysis and Evaluation of Government-Websites' in Developing Countries: Case Study Bangladesh

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### Abstract

The Web has been blessed for all people regardless of their economic, social, political, cultural, mental or physical condition and behavior. But the proper utilization and distribution of the benefits of web is crucial. It is essential that the web be accessible to people with equal access and equal opportunity to all also with disabilities. An accessible web can also help elderly population and also people with disabilities more actively contribute in society. In this paper, researchers analyze and evaluate accessibility of government websites' in perspective of developing countries. They take Bangladesh as a case study. This paper concentrates on mainly two things; firstly, it briefly examines accessibility guidelines, evaluation methods and analysis tools. Secondly, it analyzes and evaluates the web accessibility of e-Government websites of Bangladesh according to the 'W3C Web Content Accessibility Guidelines'. We also present a recommendation for improvement of e-Government websites' accessibility in developing countries.

**Keywords:** Web accessibility, Accessibility guidelines, Assistive tools, e-Government, Accessibility testing and evaluation

### 1. Introduction

The use of information and communication technology (ICT) has been playing a vital role in the 21<sup>st</sup> century due to globalization and the governments of the developing countries are being encouraged to adapting with the coming future. ICT helps to shrink the digital gap between the developed and developing countries. But because of some socioeconomic factors, faster advancement of technologies this digital gap remains large (Chen and Wellman, 2004). And the digital gap among individuals in developing countries has been more widen e.g. people with disabilities are deprived of accessing web and technologies. However we can expect to lessen the digital gap among all people in the same country.

Though Web is an exciting technological tool to communicate with people, it does require innovative and easily recognizable design to make it accessible to everyone, including people with disabilities. Most of services and facilities provided in the past decades on behalf of the developing country governments for the poor or deprived community, it is found that these were not equally distributed all the targeted people. That means the persons with disabilities are often discriminated of their basic needs including health care, housing, education, employment and other opportunities. They are the poorest of the poor community. This situation is more or less same in all over the world.

In Bangladesh (one of the developing countries), the estimated number of persons with disabilities is around 10% of its total population (Country Profile on Disability People's Republic of Bangladesh, 2002). The persons with disability are most neglected part of the country. Disable people cannot participate in the current development stream in spite of the Disabled Welfare Act 2001 (Sultana, 2010). Widespread discrimination against them and their exclusion from mainstream society lead to extensive economic hardship and loss of their creative capabilities. In respect of web accessing facility the situation has been

more worsened. The democratic government of Bangladesh has declared the “Vision 2021” in the election manifesto which targets establishment of a resourceful and modern country by 2021 through effective use of information and communication technology - a "Digital Bangladesh" (Access to Information (A2I) Programme, 2009). The government of Bangladesh has realized the importance of ICT to improve the delivery of information and services to citizens and business. Hindering a large amount of people with disabilities in from accessing web, it will cause a delay to achieve the goal of “Digital Bangladesh”.

Accessibility in terms of web design generally refers to facilitating the use of technology for people with disabilities with any impairment, no matter what its severity (Satterfield and Writer, 2007). The researchers analyze primarily ten Bangladesh-government websites’ to assess its accessibility. This paper aims to discover to what extent web accessibility is considered by the government’s websites of Bangladesh. Therefore, it investigates whether the government websites’ conform to international accessibility guidelines W3C WCAG 1.0 (WCAG 1.0, 1999) or not and if not, what are the reasons behind that. This paper comes to an end giving a recommendation to improve the accessibility.

## **2. Web Accessibility and its impact**

The Accessibility can be defined as the quality of a web site that makes it possible for people to use it – to find it navigable and understandable – even when they are working under limiting conditions or constraints (Henry, 2006). Suppose a website has been developed with versatile & rich features. A large number of users are visiting the site daily to get services. Each page of the site has many images such as users’ avatars, products’ image etc. Can a blind person or with very low vision be able to browse the pages and get the service? Another thing may happen; users sometimes want to browse web pages without downloading images due to very low internet speed. So the web should provide proper information (e.g. alternative text) in the case of missing images. If the website neither cover this situation nor has an access into the targeted web users, the web has lack of web accessibility. Accessibility is about designing so that more people can use your web site effectively in as many situations as possible.

Web accessibility is not a new idea. Despite the extensive web accessibility work accomplished in few areas, the majority of web site designers and developers were, in the recent past, not aware of accessibility issues. This is not the case that they even know the term; actually they think that it will not cause any effect in their business. It is estimated that between 15% and 30% of the total general people (i.e. 750 million) in the world have functional disability to use technology tools (Chartbook on Disability in the U.S, 1996). Again in the coming days this figure will increase due to some factors e.g. as we are growing older, most people experience a decrease in vision, hearing, physical abilities, and cognitive abilities (Disability as a Function of Age, 2001). So we can think customers can be lost from a business in turn because of the accessibility limitations. Accessible web sites accommodate a wider range of customers and constituents, increasing the number of people who can effectively use a website which will promote businesses day by day.

In many countries, Web applications are increasingly used for government information and services, education and training, commerce, news, workplace interaction, civic participation, health care, recreation, entertainment, and more. In some cases, the Web is replacing traditional resources. Therefore, it is essential that the Web be accessible in order to provide equal access and equal opportunity to people with disabilities. The Web was initially designed as a medium for sharing information, where in addition of accessing information, one can also contribute information. People with disabilities are able to contribute content to the Web by ensuring its accessibility. Moreover an organization that is committed to corporate social responsibility (CSR), providing an accessible website is one way to demonstrate its commitment to rendering equal opportunities.

## **3. Web Accessibility Guidelines**

A numerous efforts and works for establishing standard Web Accessibility Guidelines are governed by many web-groups and organization separately or in cooperatively with World Wide Web Consortium (W3C) (Henry, 2006). In 1997, the World Wide Web Consortium established the Web Accessibility Initiative (WAI – <http://www.w3.org/wai>) and in 1999 the Web Content Accessibility Guidelines (WCAG) 1.0 (WCAG 1.0, 1999) were finalized as a recommendation. Its primary goal was to promote and achieve

Web functionality for people with disabilities. However, following the guidelines (by programmers, designers) make Web content more available to all users, whatever user agent they use (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.). Following these guidelines also help people find information on the Web more quickly. WCAG 1.0 encompasses a series of checklist which are available in a tabular form as in (Checklist of WCAG 1.0, 1999). Each checkpoint has a priority level assigned by the W3C Working Group based on the checkpoint's impact on accessibility. There are total three priority levels for the checklist and their conformance level according to number of priority level satisfied are listed in Table 1.

#### **4. Web Accessibility Evaluation Tools**

After Web accessibility evaluation tools are software programs or online services that are used to check your website's accessibility level under web accessibility guidelines. There is a huge number of accessibility tools for commercial purposes or freely available on the web such as WatchFire Bobby, AChecker (Achecker - Web accessibility evaluation tool, 2011), Cynthia Says (HiSoftware Cynthia Says, 2012), EvalAccess (EvalAccess 2.0, 2006) etc. Some good free web-based website accessibility evaluation tools are linked in (Free Web-Based Web Site Accessibility Evaluation Tools, 2011). A complete list of accessibility evaluation tools is in W3C (List of Accessibility Tools, 2006). These tools are very useful for programmers and designers to determine whether or not their sites follow WCAG. During the design, implementation, and maintenance phases of Web development if these tools are used carefully, it can help the targeted users in preventing accessibility barriers, repairing encountered barriers, and improving the overall quality of Web sites (Evaluating Accessibility, 1994).

#### **5. Assistive Technology**

Assistive technologies are hardware or software or combination of both used by persons with disabilities to increase, maintain, and improve the functional capabilities in spite of their physical or mental impairments. Assistive technologies enable people to communicate, receive instruction, learn, play, move about, achieve, and be independent. This can also help the families of people with disabilities and his surroundings to be benefited. Instead of a wife having to read the mail of a person who has visual impairment, he can read it himself using screen reader software. There are different types of assistive technologies for different purposes for example:

- Screen readers: NVDA, JAWS.
- Text enlargers: ZoomText
- Alternative input devices
- Adaptive keyboards and mice (e.g. one-handed keyboards)
- Voice-recognition systems
- Eye-tracking systems
- Mouth sticks and other mouth/tongue operated devices etc.

Making websites accessible will help the people with disabilities to access your sites more easily using the assistive technologies.

#### **6. Methodology**

Our whole investigation limits to evaluating accessibility level i.e. finding out the conformance level of websites by following the process described in W3C Evaluating Accessibility (Evaluating Accessibility, 1994). In the analysis and evaluation process we have tested each website manually as well as automatically with the help of some well-known accessibility tools (W3C Markup Validation Service, AChecker, EvalAcces) and assistive technologies (NVDA, Lynx). Then a total of 10 participants were invited from different age groups of which most of them were with visual disabilities. Based on W3C WCAG 1.0 the researches have prepared some questionnaires and taken feedbacks from the participants. In this research, both qualitative and quantitative methods have been used. To make the evaluation result more

accurate, they have also taken an interview of the participants. Additionally, an email or web base survey of the web designers of government websites was conducted for exploring some accessibility issues of such websites.

## 7. Evaluating Accessibility

The researchers selected ten government websites in Bangladesh for the evaluating of accessibility as a sample. The main aim was to determine the conformance level of government websites' accessibility. Determining conformance level is an approach such that if a website meets accessibility standards e.g. WCAG. As mentioned in section 3 (Table 1) if all priority 1, 2, and 3 checkpoints are satisfied then conformance level will be "AAA". All priority 1, 2 checkpoints are needed to satisfy conformance level "AA" and conformance level "A" will be determined when all priority 1 meets. According to the procedure of W3C Conformance Evaluation of Web Sites for Accessibility as in (Conformance Evaluation of Web Sites for Accessibility, 1994) we have divided our whole process into some subsections orderly.

### 7.1. Using Web accessibility evaluation tools

In this stage the researchers did the work in two phases: first validate each of the ten websites using W3C Markup Validation Service (W3C Markup Validation Service, 1994) and then used two online web accessibility tools: AChecker (Public AChecker, 2011) and EvalAccess 2.0 (EvalAccess 2.0, 2006). It should be mentioned here that only a single page (home page/index page) has been considered to test for each websites. The following results shown in different stages are not for the whole site rather than a single one page.

#### Phase 1:

Validation is the first step in evaluating web accessibility. If your website doesn't validate to W3C standards, you may preventing assistive technology users from accessing your web pages. Syntax errors that do not affect the visual presentation of your page can hobble screen readers and other assistive technology. When checking with W3C Markup Validation Service the researchers manually put the URL of each websites and listed the result as in Table 2.

This validator checks the markup validity of Web documents in HTML, XHTML, SMIL, MathML, etc. For the website in SL. 2 the validator could not display the result but leaves an error message "Sorry! This document can not be checked." due to "No Character encoding declared at document level". Besides this a huge number of errors and warning are found for each websites.

#### Phase 2:

In this phase the researchers adopted two popular open source web accessibility evaluation tools both of which share nearly common features. These tool checks single HTML pages for conformance with accessibility standards to ensure the content can be accessed by everyone. Both are extremely efficient because on a single page listing, they cite the line number of the accessibility violation, show the errant code, give the appropriate remediation, and links to a resource page specific to the problem. You can set the type and level of conformance you would like to achieve. It is very accurate as well. For making the process easy and convenient we applied only home page to determine conformance level "A", "AA" or "AAA". The accessibility tools produced a report of all accessibility problems for the selected guidelines WCGA 1.0.

#### AChecker's Review:

The AChecker identifies 3 types of problems:

- Known problems: These are problems that have been identified with certainty as accessibility barriers. You must modify your page to fix these problems;
- Likely problems: These are problems that have been identified as probable barriers, but require a human to make a decision. You will likely need to modify your page to fix these problems;
- Potential problems: These are problems that the Checker cannot identify, that require a human decision. You may have to modify your page for these problems, but in many cases you will just

need to confirm that the problem described is not present. We are avoiding this type of errors for our convenience.

The evaluation results are summarized as in the Table 3 according to conformance level.

EvalAccess's Review:

EvalAccess finds out two types of problems:

- Errors: Problems detected that require correction.
- Warnings: Potential problems that have been detected and require manual intervention to assess if correction is required (can consider similar type as AChecker's likely problems).

The evaluation results are summarized as in the Table 4 according to conformance level.

### *7.2. Manually evaluate representative page sample*

The selected sample pages with graphical user interface (GUI) browser Mozilla Firefox version 8.0.1 and a plug-in evaluation tool WAVE Toolbar for Firefox were analyzed according the following test cases:

- Turn off images: Missing alternative text and inappropriate text is available in most cases
- Use browser controls to vary font-size: It was verified that the font size changes on the screen accordingly; and that the pages were still usable at larger font sizes.
- Also it was examined pages with scripts, style sheets, applets, and other embedded objects are not loaded appropriately.

### *7.3. Examine pages using text browser*

The researchers examined the selected sample of pages with the text browser Lynx version v2-8-3 (Lynx: Web based text browser, 2009). The information and function (for example, links and scripted events) available through the text browser is not equivalent as is available through the GUI browser. Some menus are visible but most of the cases these were not navigated and page contents were not seen. The information presented in a little meaningful order and hard to recognize when read serially.

### *7.4. Examine pages using an assistive technology*

In this stage the researchers applied an assistive technology, one of the most popular open source screen reader Non Visual Desktop Access (NVDA, 2012). It enables blind or vision impaired people to access computers running Windows for no more cost than a sighted person. Researchers first manually checked the websites with NVDA and got that the sites are not readable in many cases. For example in the site [pmo.gov.bd](http://pmo.gov.bd), NVDA could not distinguish the picture of prime minister because of no alt attributes in image html tag. Actually this is the very common error that does not satisfy WCAG. In some cases menus, submenus or list could not be recognized.

Then researches invited some people with disabilities of different kinds of which most of them were visual impairments. They were supplied with NVDA and said just to browse the websites. Researchers prepared a checklist/questionnaire to take the feedbacks from the users. The users were also asked to express their overall experience when using the sites. Most of the user responded that the sites are little accessible or not friendly with them.

## **8. Results and Analysis of Accessibility**

The evaluation results found in various phases are listed below in tabular forms in Table 3 and Table 4.

AChecker's review (Table 3) reveals that no one of the ten websites of different ministries of Bangladesh passed any conformance level A, AA, or AAA. It means that the mandatory checklist which must be satisfied ensure that accessibility are absent in the ten websites. So according to the AChecker's review we can decide that the lack of accessibility in Bangladeshi government websites is severe.

On the other hand, EvalAccess's review (Table 4) shows us a slightly different result. Five of ten websites passed conformance level A. But the result also indicates that it is still in severe condition for satisfying the conformance level AA, or AAA.

The likely problems are huge for each type of reviews. From the other manual procedures for checking accessibility like WAVE toolbar, Lynx, NVDA, the researcher got the similar result as the accessibility review tools. The interviewed participants also expressed their dissatisfaction on the websites. W3C HTML validator's result (Table 2) also supports the analysis.

An email survey was conducted to the web designer of the sites to find the reason behind the result. It was found that – they did not aware of the importance of the web accessibility; most of them do not even know the terms “web accessibility” and WCAG; no government's policy was available regarding this.

### **9. Limitations and Future Scope**

Throughout the whole investigation to determine the conformance level of accessibility, the researchers adopted the various evaluation tools and assistive technologies (AChecker, EvalAccess, NVDA), all of them were open source application. However they are widely used and to ensure the scalability of the result we followed W3C Evaluating Accessibility (Evaluating Accessibility, 1994). Although the commercial tools (e.g. Bobby, JAWS) are not freely available and expensive, we will try to apply them in our next study.

The researchers did not employ the latest W3C accessibility guidelines WCAG 2.0 (WCAG 2.0, 2008) which published in December 11, 2008. The reason behind this is that all good evaluation tools (e.g. EvalAccess 2.0) still now do not support the newer version. The researchers found that to find out the conformance level of accessibility it was sufficient to use WCAG 1.0, and new version covers all the guidelines of it along with a wide range of recommendations for making Web content more accessible. Researchers now guess that if they applied the new version, the result found in this paper will be more severe. However to get the actual and more correct situation they are expecting to follow WCAG 2.0 for further research.

Another thing is needed to note here that all the results brought out were for only a single home page evaluation of each ten websites. So the outcomes are not the exact result. Naturally if we would evaluate all the pages of each websites, it surely gave more errors and warnings that violate the guidelines. Researchers avoids of evaluating multiple pages because it can be more time consuming. Most of the cases single page evaluation displayed huge faults that were enough to take a decision.

For the case study of analyzing and evaluating accessibility of developing countries, the researchers considered only the government websites of Bangladesh. It may be another future work of analyzing other developing countries in other regions of the world.

### **10. Conclusion**

The research provides an accessibility status of Government websites in Bangladesh, as a developing country in Asia. Similar situation may happen in other developing countries in the world. It also revealed that there exists a wealth of accessibility resources and accessibility guidelines that are usable and coherent; yet lack of awareness impedes their use. It seems that the governments in this part of the world have not yet grasped the importance of providing services for that part of the population with special needs. It should work on spreading awareness of equal opportunity for all clients, e.g. disabled as well as non-disabled visitors to websites. Based on the work described in this paper, the authors would like to recommend the following issues as critical initial steps forwards:

Government should either adapt the existing web accessibility guidelines or develop its own guidelines that are appropriate for their context. Also, government should set a policy for web accessibility together with an enforcement procedure e.g. making the accessibility of government websites a compulsory requirement. An incentive or reward for those who accommodate website accessibility may promote good web accessibility.

Website development should require skilled IT professionals in the fields of accessibility, usability, security, programming, user interface design etc. Therefore the governments need to speed up the process of acquiring such skills by focusing on IT institutions to increase the number of students who have well and enough training in the respective fields with up to date technologies.

Web programmers or designers may use tools that prevent accessibility errors. For example they can use editors (if it is available) which finds errors and vulnerabilities to make an error during coding time automatically. Or companies themselves may build a new editor which supports the accessibility issues for their employees. To detect accessibility errors they should check the html codes for validity, conformance level of accessibility by using the tools described.

Finally, organizations caring for disabled people have a responsibility to spread the awareness amongst government organizations for making e-Government websites accessible. The successful implementation of e-Government website accessibility would enable disabled peoples to get involved directly in the community thus making it better for all.

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Table 1. WCAG 1.0 Priority with Conformance Level

Priority	Description	Conformance Level
[1]	A Web content developer should satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing Web documents	"A": all Priority 1 checkpoints are satisfied
[2]	A Web content developer should satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing Web documents.	Double-A": all Priority 1 and 2 checkpoints are satisfied
[3]	A Web content developer may address this checkpoint. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to Web documents.	"Triple-A": all Priority 1, 2, and 3 checkpoints are satisfied

Table2. Markup validity check result

Website (Single Page)	Able to check?	Errors	Warnings
<a href="http://www.bangladesh.gov.bd">www.bangladesh.gov.bd</a>	Yes	98	29
<a href="http://www.bangabhaban.gov.bd">www.bangabhaban.gov.bd</a>	No	NA	NA
<a href="http://www.pmo.gov.bd">www.pmo.gov.bd</a>	Yes	45	43
<a href="http://www.moedu.gov.bd">www.moedu.gov.bd</a>	Yes	215	196
<a href="http://www.mosict.gov.bd">www.mosict.gov.bd</a>	Yes	123	105
<a href="http://www.lged.gov.bd">www.lged.gov.bd</a>	Yes	20	10
<a href="http://www.mohfw.gov.bd">www.mohfw.gov.bd</a>	Yes	84	17
<a href="http://www.moi.gov.bd">www.moi.gov.bd</a>	Yes	8	0
<a href="http://www.mofa.gov.bd">www.mofa.gov.bd</a>	Yes	22	11
<a href="http://www.mha.gov.bd">www.mha.gov.bd</a>	No	NA	NA

Table 3. AChecker's Review

Website (Single Page)	Known problems			Likely problems		
	A	AA	AAA	A	AA	AAA
<a href="http://www.bangladesh.gov.bd">www.bangladesh.gov.bd</a>	36	38	41	25	86	86
<a href="http://www.bangabhaban.gov.bd">www.bangabhaban.gov.bd</a>	38	71	75	38	55	55
<a href="http://www.pmo.gov.bd">www.pmo.gov.bd</a>	7	3	8	27	58	58
<a href="http://www.moedu.gov.bd">www.moedu.gov.bd</a>	9	4	15	33	112	112
<a href="http://www.mosict.gov.bd">www.mosict.gov.bd</a>	8	4	10	67	150	150
<a href="http://www.lged.gov.bd">www.lged.gov.bd</a>	28	23	57	42	169	169
<a href="http://www.mohfw.gov.bd">www.mohfw.gov.bd</a>	7	4	12	75	134	134
<a href="http://www.moi.gov.bd">www.moi.gov.bd</a>	6	9	11	0	0	0
<a href="http://www.mofa.gov.bd">www.mofa.gov.bd</a>	3	8	36	29	134	134
<a href="http://www.mha.gov.bd">www.mha.gov.bd</a>	19	43	59	32	38	38

Table 4. EvalAccess's Review

Website (Single Page)	Known problems			Likely problems		
	A	AA	AAA	A	AA	AAA
<a href="http://www.bangladesh.gov.bd">www.bangladesh.gov.bd</a>	36	123	58	301	284	233
<a href="http://www.bangabhaban.gov.bd">www.bangabhaban.gov.bd</a>	35	110	30	187	162	68
<a href="http://www.pmo.gov.bd">www.pmo.gov.bd</a>	0	37	14	78	94	91
<a href="http://www.moedu.gov.bd">www.moedu.gov.bd</a>	0	33	22	104	161	171
<a href="http://www.mosict.gov.bd">www.mosict.gov.bd</a>	0	48	33	181	237	212
<a href="http://www.lged.gov.bd">www.lged.gov.bd</a>	20	60	6	201	231	339
<a href="http://www.mohfw.gov.bd">www.mohfw.gov.bd</a>	0	53	28	121	173	159
<a href="http://www.moi.gov.bd">www.moi.gov.bd</a>	12	15	1	5	13	9
<a href="http://www.mofa.gov.bd">www.mofa.gov.bd</a>	0	58	5	181	237	147
<a href="http://www.mha.gov.bd">www.mha.gov.bd</a>	6	57	13	76	92	38

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