

# Web Accessibility for Disabled: A Case Study of Government Websites in Pakistan

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**Abstract—** It is the era of information technology and governments around the world opting for electronic government and official websites are now under the use of a diverse population for the purpose of information retrieval. A number of disabled persons are becoming the part of this society but they are ignored when web projects are planned and developed. If this practice of software development is kept continuing then disabled persons would not take the advantage in the electronic government era. This study evaluates the websites of central government in Pakistan including all ministries and divisions using accessibility evaluation tools based on World Wide Web Consortium's (W3C) web accessibility standards. Functional accessibility evaluator and total validator are the tools which are used for the evaluation process. The results shows that most of the web sites are not developed according to the accessibility standards for disabled persons. In the light of these results, recommendations are made to improve the accessibility of these websites for disable persons.

**Keywords-** WWW, e-Government, Information and communication technology, Web accessibility, web design framework, people with disability

## I. INTRODUCTION

The use of information and communication technology (ICT) such as World Wide Web (WWW) has become embedded in everyday life and progressively becoming indispensable for public and private sector organizations [1]. It has fundamentally changed the way organizations work and provide services to their clients. The proliferation of WWW and the Internet has provided governments with an opportunity to offer services to the citizens at their door steps giving birth to e-government [2]. Today, numerous governments around the world have been offering e-government services to their citizens. These government websites give easy access to electronic information to every citizen.

Government websites are very important for the government-citizen relationship and most of the websites are designed for normal persons [3]. Studies show that presently most of the government websites are inaccessible for the impaired users [4]. Statistics also shows that normal people use the websites three times more than the people with disabilities

[5]. However, more than 750 million people in the world are disable and this number is increasing day by day as the population increases [6]. Pakistan has an estimated population of 180 million [7] out of which 4.48 million are disable [8, 18]. The visually impaired make up one million of the total disable people (color blind are not included in this figure as we do not have the demographic data of color blinds). To handle the special needs of the disable people, managers should give attention to the designing and implementation of these websites during the planning phase of the project. It is very important to create equal opportunities for all the citizens, especially for disable one, in using the web based services so that they can take benefit form the online services. The challenge faced by government departments is, how to provide published information to every citizen through web.

The government of Pakistan launched its web portal containing the web link of all ministries and divisions of the central government with an aim to implement the e-government in all the ministries and divisions. The electronic government directorate was established in 2002 with an aim to implement the e-government concept in all the ministries and divisions. The websites of all the ministries and divisions are developed under the technical assistance of e-government directorate and are in working for the last five years. The accessibility of these web sites, especially by the people with disabilities, has not been evaluated to date. This has motivated us to assess the accessibility of e-government web sites for people with disabilities. The purpose of this study is limited to the accessibility assessment of the central government websites and to find out whether the web based public services are provided in equitable manner to all the citizens, especially people who are visually impaired.

The rest of the paper is organized in six sections: Section 2 presents web design framework to Improved Accessibility for People with Disabilities (WDFAD), W3C standards, and guidelines. In Section 3, we review the relevant literature. Section 4 describes the adopted methodology to make the complete analysis of selected websites of central government. Section 5 presents the results and their detailed description. Section 6 concludes the paper with recommendation.

## II. WEB ACCESSIBILITY FRAMEWORK AND W3C STANDARD

According to World Wide Web Consortium's (W3C) guidelines, web accessibility refers to the access of a website contents by any person regardless of browsing technology. The accessed information shall be fully understandable and user shall be able to interact with website if required [9]. In broader sense, user friendly web designs are said to be accessible designs [5]. The quality of accessible web designs is measured by considering layout, readability, color scheme, browser independency and some special requirements of using adaptive or assistive technologies [10].

The Web Design Framework for Improved Accessibility for People with Disabilities (WDFAD) is an approach for presenting Web accessibility guidelines into concise and Web developer oriented format [11]. In the extended framework, content accessibility, navigational accessibility, user interface accessibility and scripting & HTML standard of Web applications are classified as the primary goals of Web accessibility, as shown in Figure 1.

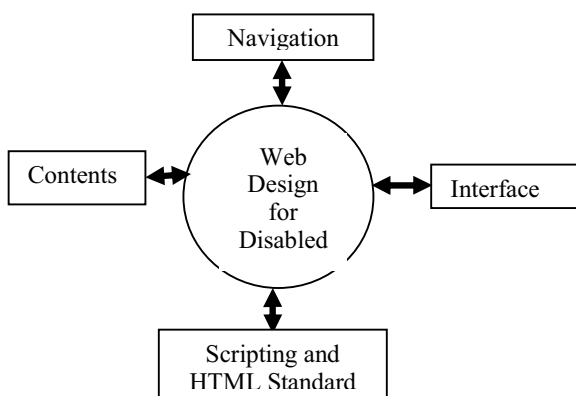


Figure 1. Web accessibility Framework

By content, we mean that information transported to the user in the form of natural language, images, sounds, movies or animations [11]. Web content includes text, images, video and audio files. Contents can be viewed or accessed by all users including People with Disabilities (PWDs) if they contain informative and decorative images as well as image map. Web navigation refers to move within the website and on to other Web pages. A Web application's navigation system is accessible if Web users with disabilities can perform all the navigational tasks with ease. The blind rely on audio to perform navigational tasks. Hence Web navigation to be usable to such users. The user interface refers to the objects or elements that the end user perceives and interacts with. This covers the way in which navigational objects are represented, which interface objects activate navigation, the way in which multimedia interface objects are synchronized, which interface transformations take place and the presentation of tasks that require users to input information (e.g. to fill out a survey form, to purchase software or to request information [3], [5]). An accessible user interface is one where all the perceptible and interactive tasks of a Web application can be understood,

perceived and utilized successfully by PWDs. Therefore for the user interface of Web applications to be accessible to the blind, it should cater for the access needs of non-visual users. The web developer need to follow the W3C scripting and HTML standards as provided in the Web Content Accessibility Guidelines 1.0 or Web Content Accessibility Guidelines 2.0.

### A. Standards and Guidelines

There are many standards and guidelines that can help web developer to design accessible website or make their website accessible by disabled people through using assistive technology like screen reader. The most common standards-Based website Design and development are W3C Web Content Accessibility Guidelines 1.0 or 2.0 (WCAG 1.0 or WCAG 2.0).

World Wide Web Consortium's (W3C) Web Accessibility Initiative (WAI) has established standards for web developers about the accessibility these are named as Web Content Accessibility Guidelines (WCAG), developer can follow these guidelines to make website accessible to people with disabilities. Web Content Accessibility Guidelines 1.0 (WCAG 1.0) was published in May 1999. WCAG 2.0 was published on 11 December 2008 (WCAG 2.0) applies broadly to more advanced technologies; is easier to use and understand; and is more precisely testable with automated testing and human evaluation [12].

Web contents accessibility recommendations are categorized into three categories [5, 13] which are as follows:

Category	Description	Symbol
1	The developer must follow these guidelines in order to make all the information on a website accessible for all users including the persons with disabilities.	A
2	The developer should follow these guidelines to remove the important accessibility barriers in accessing the information on a website.	AA
3	The developer may follow these guidelines as these are not so important but make the website more comfortable for the use of disable person.	AAA

Table 1: accessibility recommendations catagories

## III. LITERATURE REVIEW

There are a number of studies conducted to evaluate the websites accessibility. Abanumy et. al. [5] used Web Content Accessibility Guidelines to evaluate web accessibility of e-government websites of Saudi Arabia and Oman as these two countries are the members of the GCC. The evaluation processes include testing each site manually as well as automatically using well-known accessibility evaluation tools. Another study was conducted by Mehmood [14] to evaluate the 150 government websites of the GCC countries. The variations in websites from country to country are explored as well as how e-government sites respond to citizen requests along with number and type of online services offered. The sites were compared and ranked on the basis of average score. The most

usable services on GCC websites were service on request, document request complaint filing, job applications, Applying for passport and renewing vehicle licenses, these services vary from country to country.

Contents accessibility analysis of 66 government websites of Australia, United Kingdom and United States of America for disabled is conducted by Beaudin [15] on the basis of W3C accessibility guidelines by using automatic evaluation tools and font size, navigation and general usability were considered. The results of the study shows that 86% in USA, 23% in UK and 54% Australian are accessible for disabled or developed according to the W3C accessibility guidelines. The USA federal electronic government websites were evaluated by Jaeger [16] for accessibility under USA Section 508 of Rehabilitation act. The results show that all the tested websites fails to pass accessibility standard.

Baguma et.al[11] proposed a web design framework for improved accessibility for people with disabilities. In the presented framework guidelines are précised into three components that are content, navigation and user interface, used to develop accessible web applications for visually impaired peoples.

Huang [17] made an in-depth evaluation of Taiwan’s central government websites for disabled based on the W3C accessibility guidelines. Accessibility analysis of U.S senate websites for disabled was made by Kuzma et.all[19] based on Section 508, WCAG 1.0 and WCAG 2.0 by using evaluation tool. The study shows most of the websites do not meet the accessibility guidelines.

Some similar studies on accessibility of web contents were also conducted by Venter et.al [13], Mankoff et.al [20], Lazar et.al [21] etc and give suggestions for improvements.

#### IV. RESEARCH METHODOLOGY

The aim of this study is to provide the evaluation of 45 websites of the central government of Pakistan. The evaluation is made on the basis of Web Contents Accessibility Guidelines provided by W3C by using free web accessibility online web analysis tools. This analysis determines the adherence of central government websites with W3C accessibility guidelines. To measure the web accessibility and objective of this research, two online freely available tools were selected for the analysis shown in table 2.

<i>Evaluation Tools</i>	<i>Link/URL</i>	<i>Accessibility standards</i>
Total Validator	<a href="http://www.totalvalidator.com/">http://www.totalvalidator.com/</a>	WCAG 1.0(A,AA,AAA) WCAG 2.0(A,AA,AAA)
Functional Accessibility Evaluator 1.0.2	<a href="http://fae.cita.uiuc.edu/">http://fae.cita.uiuc.edu/</a>	Overall

Table 2: Evaluation Tools

The first tool, Total Validator, is used to check whether the websites meet WCAG 1.0 and WCAG 2.0 accessibility

requirement or not. The second tool, FAE, has been used to compare the accessibility level based on the percentage of success evaluation results. This tool has been built based upon the best practices of the main accessibility categories like Navigation and Orientation, Interface/Text Equivalents, Styling, Scripting and HTML Standards. These Practices are not a new standard, but rather a statement of techniques for implementation of the W3C Web Content Accessibility Guidelines (WCAG).

The selected web accessibility evaluation tools are applied on the web sites of central government of Pakistan. The uniform resource locator of home page of each web site of the ministry or division is manually entered in the text box, provided online on the website of Functional Accessibility Evaluator. To limit the evaluation to the home page only, top level evaluation option is selected from the depth of evaluation. DHTML contents are also included in the evaluation. The Functional Accessibility Evaluator have online web interface while Total Evaluator is freely downloadable and can be installed on the machine. These two tools are used to evaluate the accessibility of each web site homepage and a diagnostic report is generated which have issues and warnings of each site, either it is according to the web accessibility standard or not. Warnings and failure in the diagnostic report are in informational context about the problems and missing things respectively.

There are seven ministries and divisions, which either do not have the websites or that are not accessible. The website of Capital Administration and Development division is showing only one page that is “under construction”, which is also omitted from the evaluation process. The remaining thirty eight websites are evaluated and results are generated.

#### V. RESULTS AND DISCUSSION

##### A. Functional Accessibility Evaluator (FAE)

The results generated by evaluating the home pages of each ministry and division website with FAE annexed at B (Ten results), are categorized into four on the basis of Navigation, Interface/Text Equivalent, Contents and Scripting & HTML Standards. The figure-2 shows the status of navigation implementation in percentage. There is no website in the central government which has complete implementation, 2.63% have almost complete implementation and 97.37% have partial implementation. Navigation is very important to fully explore the web contents of a website and to make it accessible for all users including disabled. The below figure shows the results in more clear form. The website of Ministry of Foreign Affairs has almost complete implementation of navigation standard.

In case of interface or text equivalent of graphics, figure-3 shows that 28.95% websites have partial implementation and 71.05% have complete implementation. The website of Federal Public Service Commission also has partial implementation which provides services to Pakistani citizen in government recruitment process.

The figure-4 shows the results of contents for the access of visually disabled people. The results remain same as for interface/text equivalent.

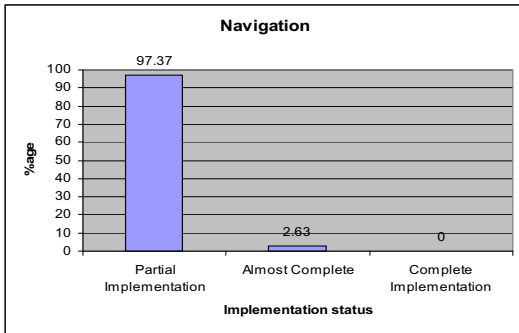


Figure-2: Navigation

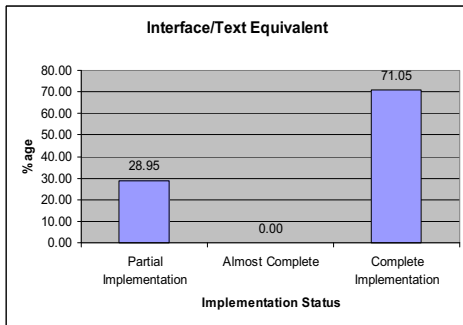


Figure-3: Interface /text equivalent

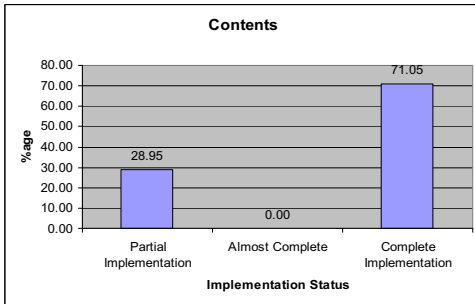


Figure-4: Contents

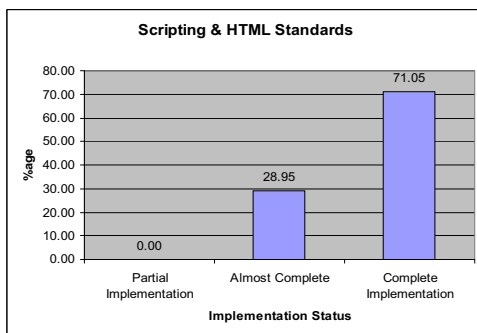


Figure-5: Scripting and HTML Standards

The figure-5 shows the results about scripting and HTML standards followed during the development process of the websites. It shows that 71.05% completely follow the scripting & HTML standards while 28.95% have almost complete implementation. If we evaluate the over all results then it is concluded that navigation area requires more attention during development which make the websites accessible for the disabled.

### B. Total Validator

The results generated from the Total Validator by checking each website home page, to check how much accessibility guidelines are followed. The evaluation has been made for WCAG 1.0 and WCAG 2.0 and errors identified against each website showing divergence of website from the guidelines. The websites with zero average error are fully compliance with the accessibility guidelines. Figure-6 and figure-7 shows the top five websites with highest and average highest errors or failures on the basis of WCAG 1.0. Accessibility guidelines.

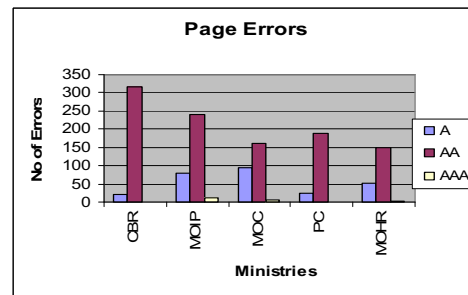


Figure-6: Five Minitries websites with high error rate

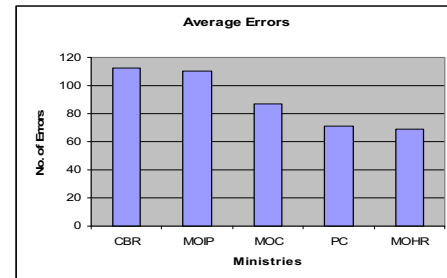


Figure-7: Five Minitries websites with Average high error rate

Figure-6 and 7 shows the top five websites with highest errors and average highest errors while Figure-8 and 9 shows the five websites having minimum errors and average minimum errors respectively on the basis of WCAG 1.0. Here an error refers to inaccessible content. The web site of Central Board of Revenue is ranked top in errors/failures while Ministry of Foreign Affairs and Economic Affair Division Training websites have minimum errors and failures. The websites of four ministries/divisions which includes Ministry of Information & Broadcasting, Ministry of Human Resource Development, Ministry of Foreign Affairs and Federal Public Service commission pass the level A of accessibility guidelines only.

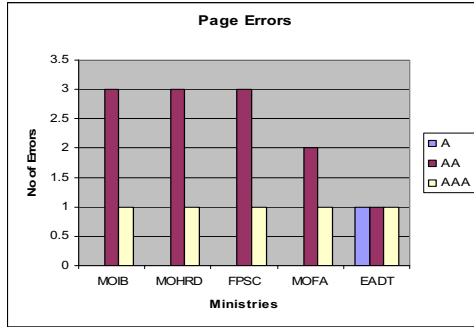


Figure-8: Five Ministries websites with minimum errors

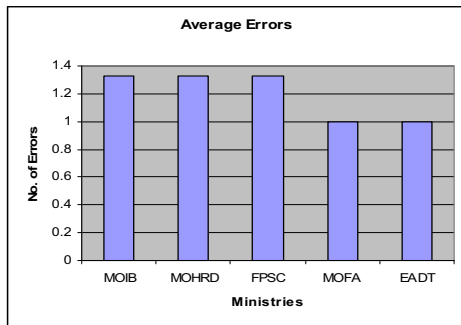


Figure-9: Five Ministries websites with Average minimum errors

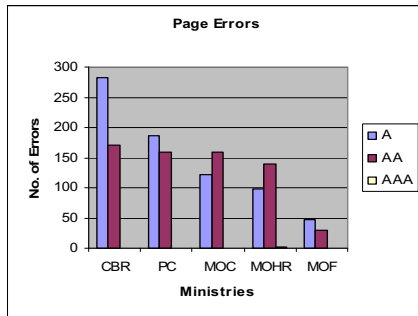


Figure-10: Five Ministries websites with high error rate

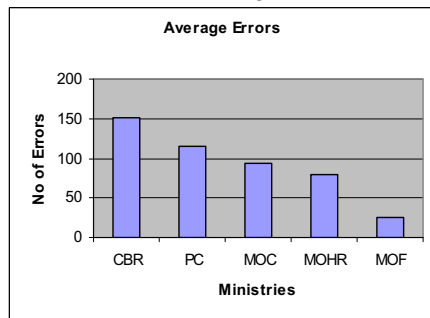


Figure-11: Five Ministries websites with average high error rate

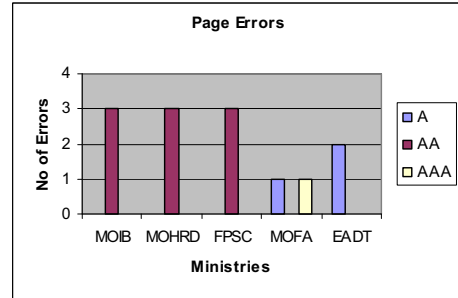


Figure-12: Five Ministries websites with low error rate

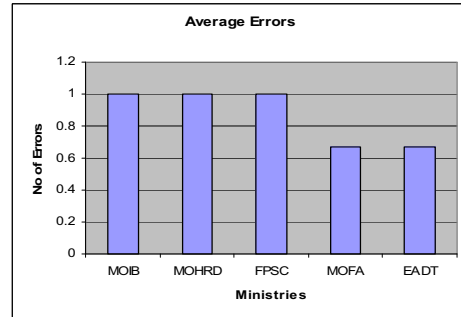


Figure-13: Five Ministries websites with average low error rate

Figure-10 and 11 shows the top five websites with highest errors and average highest errors while Figure-12 and 13 shows the five websites having minimum errors and average minimum errors respectively on the basis of WCAG 2.0. The web site of Central Board of Revenue is ranked top in errors/failures while Ministry of Foreign Affairs and Economic Affairs Division Training is lowest in errors and failures. The websites of three ministries/divisions which includes Ministry of Information, Ministry of Human Resource Development and Federal Public Service Commission got the zero score in A and AAA with no errors/failures. The website of Ministry of Foreign Affairs got zero score in AA, which is mandatory to remove the accessibility barriers and Economic Affairs Divisions Training got zero score at both levels AA & AAA.

The results show that almost 100% websites in Pakistan are not developed according to the accessibility guidelines. The websites which are making less violation of accessibility standards are from Ministry of Information and Broadcasting to Economic Affairs Division Training in the list, are developed by using HTML 4.01 transitional only. Most of the website missed the basic category two "AA". While accessibility guidelines show that this category shall be followed by the developer during the development processes as it deal with the removal of accessibility barriers for the disable persons. There is only one website that is Ministry of Foreign Affairs which zero score in category two AA.

This evaluation shows, the government of Pakistan must make considerable effort to make websites accessible for the disabled as disabled are almost three percent of total population and having two percent job quota also. The inaccessibility of information to such a huge portion of population causes disparity and inequality. It is very important that the websites

of services department and federal public service commission shall be in full access and according to the accessibility standards and guidelines as in Pakistan public sector is the main employment provider and federal public service commission is the body involved in recruiting process.

The accessibility resources and guidelines are freely available but lack of awareness is the main hurdle in their use in the process of implementation. This study shows that in this area of subcontinent no importance is given to disabled in providing the information and services. This ignorance not only makes the disabled to cut off from the society but also pressurizes them to use unfair means for the survival in the community.

The government of Pakistan must review the existing policies of disabled and modify it according to the international standards. The accessibility policies of USA, UK, Germany, Europe Union etc are examples for Pakistan to make policies and to accelerate the accessibility of e-government websites. The accessibility guidelines of W3C can be adapted in Pakistan.

To develop websites according to the web accessibility standards requires expertise in the field of information technology and computer science. The universities which producing graduates in information technology or computer science must review and modify their curricula according to the new technologies, accessibility standards and guidelines.

It is already mentioned earlier that science and technology commission was renamed as e-government directorate to implement the e-government projects in Pakistan. This directorate staff is almost involve in all the e-government related projects at federal government. This directorate shall initiate the policy draft of web accessibility for government websites for future use. In future new projects and developments may be made according to that new policy as accessibility at development level is easy to implement and less costly as compared to after the completion of the project.

Furthermore the ministry or division dealing with needs of disabled must start the awareness program in all the ministries and divisions for making government websites accessible for disables. The accessible government websites make the disabled to become well informed about the recent information.

## VI. CONCLUSION

The results shows that in Pakistan it is very difficult or impossible for a visually disabled person to access the electronic information available on the government website because the websites are not developed according to the W3C accessibility standards. The inaccessibility of information for disabled causes discrimination between disabled and non disabled. It is like an injustice with the visually disable persons. This study is limited to central government websites only. The evaluation of provincial government websites may be made. The study may be further broadened to include the web sites of district government in the evaluation process as most of the citizen services are at district level.

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