

Information Systems Accessibility of Educational Websites in the Kingdom of Bahrain

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Abstract—In today's age of pervasive computing, users have the ability to access information stored on powerful networks anywhere, anytime. Such things as personal digital assistants (PDAs), smart phones, wearable computers and other mobile devices give the user instant access to global information systems. The challenge is to ensure that the information from these devices take into account both the user's capabilities and his/her device. Therefore, by adapting video, images, audio and text to both individual devices and individual user requirements will help to ensure that people with disabilities can take advantage of the benefits of pervasive computing. The paper in this research investigate the e-accessibility of the educational websites in the Kingdom of Bahrain and recommends suggestion based on the data analyzed.

Index Terms—E-accessibility, WCAG, W3C, website development, education, e-learning universities.

I. INTRODUCTION

People with severe visual disabilities now have the opportunity to benefit from a wealth of information and services that was previously unavailable to them. With the help of synthesized speech and Braille display technology, even completely blind people can use the Web. Blind people now can read the available information from the sense of their fingers on Internet by a system called Braille [1]. Blind and visually impaired people can also read web pages over Internet by using software tools known as Screen Readers for example JAWS and WindowsEyes. These Screen Readers are able to generate speech and/or refreshable Braille output for visually impaired people. However the simplest web pages generally feature images and use tables to format their navigation menus and content, while many others use JavaScript, animations and other technologies hypothetically to make their navigation systems more user-friendly. This creates a number of problems for people with visual impairments, as they cannot see the images and their Screen Readers can have serious problems interpreting tables, animation and JavaScript. In many cases, this renders entire websites unusable for people with disabilities. Usability is paramount for the success of websites. The World Wide Web and its use are growing at a very fast rate and design for usability therefore is of principal importance. Education

websites are also becoming available through different channels like mobile telephone and personal digital assistants. The accessibility of these educational websites is now the burning issue for people with disabilities. Accessible educational information can be a lifeline to a basic educational service for people with disabilities. Most of the educational websites are unfortunately inaccessible to people with disabilities but minor changes to a site can turn it from an inaccessible or unusable site to one that is usable and accessible to people with disabilities.

II. E-ACCESSIBILITY/WEB ACCESSIBILITY

The World Wide Web supports multimedia i.e. sound, video and provides a graphical interface on many platforms. It is based on standards, so sharing is much easier than before which make it easier to access information and provide information throughout the world. It is true that the volume of information available is huge and growing rapidly. All of the world's major companies, universities and research organizations are on the Web today and no one exactly knows, how big the Internet is? However, with unlimited benefits the importance of the World Wide Web cannot be ignored in today's modern era. Web accessibility describes a person's ability to use a Website over the Internet [2]. It is a phrase, which is customarily referring to the development and designing of Websites that are accessible to all users regardless of any disability for physical limitations.

Tim Berners-Lee, W3C director and inventor of the WWW defines Web accessibility as "access by everyone regardless disability". Web Accessibility gives disabled people new opportunities. It gives them independence and freedoms as they no longer depend on the responsiveness of the outside world. The major and key principle of e-accessibility over the Internet is that Websites should be easy for everyone to use regardless of any kind of disability and physical limitations.

Web accessibility is about adapting the design of the web content to the various disabilities. Therefore, we have to ensure that websites facilitate the use of assistive technologies. The awareness of the E-accessibility is now the key issue of the world of E-learning.

E-accessibility is about social inclusion and equal opportunities. Disabled people are the part of our society and excluding them from accessing the modern technologies like Internet could direct to social exclusion. E-accessibility is now the essential element of the electronic society of the world. Disabled people have the equal rights to access modern technologies to be more dependent on digital technologies in industrialized nations.

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III. ADAPTIVE AND ASSISTIVE TECHNOLOGIES

People with different disabilities use diverse technologies in order to collect information and read Web pages over the Internet. Most of the websites designed and developed do not support the existing technologies. The designed websites may be closing some of the doors that they should be opening [3]. Accessible websites benefits business and open doors for greater market reach. There are significant numbers of disabled and elders people who use Internet because it makes them more independent in the society. According to World Health Organization, around 10 percent of the world's population (650 million people), live with disability (United Nations, 2004) and the figure is constantly increasing because of the increase in population.

The issue of visual impairment is one of the main barriers in the way of E-accessibility. A visual disability like blindness involves a substantial, uncorrectable loss of vision in both eyes [4].

There are several kinds of barriers and difficulties for people with visual disabilities such as Multimedia, Frames, Forms, Tables, Navigation, Complex Notation, Java Scripts, Image Rendering and Programming Code.

The content of the Web either it is educational or business material is often inaccessible to a blind person while accessing the Web. Complex notations like Math's and Science Notations are tremendously hard to provide in acceptable format for blind people [5].

A similar problem is the rendering of image. An image that does not include a textural description is a big problem as well because it does not convey useful meaning at all. By the use of "Synthetic Voice Output" [6] a blind user can only hear the word of "image" that can be repeated more than one times. Some of the tools like Dreamweaver are available to encourage alternative text prompting but still these tools are generally not accessible to the blind user.

If a Webpage is constructed by using poor designed tables then for a blind person the accessing of that webpage can cause different difficulties. This is because Screen Readers are only capable to read lines from left to right and cannot translate a Web page designed with a table that contains different types of information inside. The use of Forms in the design of the Web pages also have different issues for blind and partially blind people because most of the sites do not contain accessible HTML syntax to simplify the process of filling out that form.

People with visual disabilities i.e. individual's blind from both eyes depends on Screen Readers software. Screen Reader software is a type of software that helps the visually impaired person to read text on the computer screen and outputs this information to a speech synthesizer. For example, JAWS translates written words into synthesized speech.

Blind people use text-based browsers such as Lynx [7] that renders text line-by-line in Braille. Instead of a Graphical User Interface (GUI) browser plus Screen Reader, they use voice browsers to access their computer system. They may use rapid navigation strategies such as tabbing through the headings or links on Web pages rather than reading every word on the page in sequence [8].

The disability of low vision is also known as "partially sighted". People with low vision make use of extra-large

monitors normally. They also increase the size of system fonts and images sometimes to overcome the problem of low visions. They use screen magnifiers or screen enhancement software.

The majority of the colour-blind people hardly make a distinction between red and green or sometime between yellow and blue colours. Sometimes colour blindness results in the inability to recognize any colour. To overcome the problem, "People with colour blindness use their own style sheets to override the front and background colour choices of the author to access the web over the Internet" [9].

Visual disabilities also have some other problems like short sight, long vision, restricted field of view, obstructed vision and so on. It is also possible that a person with blind disability can still see some of the objects but his/her view of the objects may be affected in varying ways by his/her disability. It may be limited, indistinct or distorted in many other ways.

To overcome the visual disabilities, Text- To -Speech (Synthetic voice), Digital Audio, Braille, Screen Magnifiers, Screen Readers, Text Browsers, Visual Notification etc. are used by visually impaired people to access information over the websites.

IV. E-ACCESSIBILITY TOOLS DEVELOPMENT

Testing and validation of the accessibility of websites is still an art and the problem is that based on the definition several methods and techniques have to be used to investigate. Automated accessibility tools for accessibility and usability are a necessary component of the processes to overcome the barriers of E-accessibility [10]. A survey of automated accessibility tool is presented in the context of the user ability they support by [11]. Also a methodology based on a quality model for the site that can support the activity of the web developers and designers is discussed by [12].

Tools are systematic fast and reliable [13]. Unfortunately because of no standardization among available existing tools, the author's claim becomes erroneous due to the fact that these tools provide accessibility reports according to their own interpretation and provide different results for a single tested website. A Plethora of proposals have been made towards the development of accessibility tools to enhance the level of accessibility in web development process for visually impaired people. For example [14] explicitly dealt with the issues of table navigation and [15] summarized techniques to facilitate non-visual navigation by speech enable browser to provide access to web pages and describes the conceptual models people use to scan the web by Brookes-Talk (Browser for the blind and visually impaired, being developed by Oxford Brookes University). The principle to create intelligent software agents that can help visually impaired people in accessing complex online data organization is also examined by [16] but a quality model based on a set of criteria that are used to determine if a website reaches certain level of quality is essential [17]. A list of the Web evaluation accessibility tools could be found at <https://www.w3.org/WAI/ER/tools/>

V. E-ACCESSIBILITY AND INTERNATIONAL LEGISLATIONS

Although in every developed country there is some form of E-accessibility laws but unfortunately these laws are not in active format. This is certainly the most potent argument of all as a lack of compliance to the E-accessibility laws can result in expensive legal suits. The international framework is very vast in the area of E-accessibility, therefore, this research concentrated on a few examples. The Disability Discrimination Act 1995 made it illegal to discriminate against people with disabilities in all areas of employment and the provision of goods and services [18]. The Special Education Needs and Disability Act 2004 (SENDA) has now become Part IV of the Disability Discrimination Act (DDA), extending the DDA to include education. "Part IV of the Act currently requires schools, local education authorities, colleges and universities to provide information on access to education for disabled pupils and students" [19]. From the 1st October 1999, the Code of Practice of the Disability Discrimination Act stated that "a service provider has to take reasonable steps to change a practice which makes it unreasonably difficult for disabled people to make use of its services". The Disability Rights Commission published a Code of Practice in 2002 providing clarification that a website is a 'service' as described in the legislation [20].

The American with Disability Act (ADA), a federal law passed in July 1990, that broadens the existing responsibility of the Rehabilitation Act of 1973 requires protecting the individual from discrimination with respect to employment, public service, public accommodation, services operated by private persons and telecommunication services. The aim of the law is to stop discrimination against all disabled people. Discrimination on the basis of disability in the private sector employment is also becoming prohibited according to the law. Inaccessible pages are also in violation of Title III of ADA since the Internet is a public space [21].

The eInclusion@EU project ended in the start of year 2007 [22] which was setup to support and promote Information Society policy making process in European Union. E-accessibility is one of the components of eInclusion which means the using of ICT to overcome all traditional barriers.

The German law of e-accessibility stated "It is not allowed to put someone at a disadvantage because of his/her disability." The BGG, Behindertengleichstellungsgesetz, (the law for equal treatment of people with disabilities) was enacted on May 1, 2002. According to the law, the government should promote the interfaces and Websites of commercial products and make sure a barrier free access to information technology for people with disabilities. An addition to the law on July 24, 2002 the Barrierefreie Informationstechnik Verordnung (BITV) was enacted which is referred to WAI WCAG 1.0 for equal access to information technology for people with disabilities [23].

On 12th October 2000 a decision has taken by the inter-ministerial committee of France states that all the state Internet sites must be accessible to people with visual impairments [24]. All online public services belonging to the state should be accessible to handicapped people and if it is not the case then these websites must be made accessible within the period of three years according to a special law called "law number 2005-102 for the equality of rights and

chances for the participation and citizenship of handicapped people of France" [25]. This law came into force on 11th Feb 2005.

A policy formed by the Canadian government for federal government's organizations in May 2000 states that "federal government must comply with the standards developed by the World Wide Web Consortium and the guidelines of WCAG 1.0 to the checkpoints of Priority 1 and Priority 2" [26].

VI. E-ACCESSIBILITY AND W3C

The World Wide Web Consortium (W3C) WAI plays an important role to achieve the goal of E-accessibility and have developed a series of guidelines and standards to ensure that Web resources can be accessed by people with special need. If these standards and guidelines are followed then Websites can be made more accessible to a wider range of users with disabilities and more objectives can be achieved in public sectors.

The available standards to achieve the goal of E-accessibility used by developers of evaluation and repair products are Web Content Accessibility Guidelines 1.0 from the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) finalized in 1999 that provides a priority based (Priority 1, 2 and 3) checklist of guidelines. This document is used as a reference is now using as a reference for evaluation and assessment of the E-accessibility and web-based resources. However, on 11th December 2008 W3C introduced the new version of these accessibility guidelines called Web Content Accessibility Guidelines 2.0 which is now used as a reference and standard for the development of web pages.

VII. CASE OF BAHRAIN

The eGovernment of Bahrain portal is subject to a regular evaluation process to determine the extent of compliance with the standards and principles of accessibility and browsing [27]. The Academic Rehabilitation service provides rehabilitation and trainings for children with minor and medium intellectual disabilities by offering special programs that help them to incorporate and adjust socially. The Central Informatics Organization of Bahrain is committed to ensuring the accessibility of the Open Data website for people with disabilities. All the pages on the websites will meet W3C, WCAG2.0, Level AA conformance. However, in Bahrain the legislation about accessibility are at initial stages and needs improvements and real implementation to achieve the higher level of accessibility especially for the Government, Banking Sector and Educational websites.

VIII. E-ACCESSIBILITY AND UNIVERSITIES WEBSITE IN BAHRAIN

The Kingdom of Bahrain is a group of islands between the Qatar peninsula and the north eastern coast of Saudi Arabia. As of 1 January 2016, the population of Bahrain was

estimated to be 1 393 661 people [28]. However, the estimation shows that 9.8 persons per 1000 population were found to be disabled, including blind, deaf, inconvenience of body or limb, and mentally handicapped where a higher prevalence ratio of disability was found in males and with advancing age [29]. The Kingdom of Bahrain got the following Universities;

- 1) Ahlia University
- 2) AMA International University
- 3) Applied Science University
- 4) Arabian Gulf University
- 5) Bahrain Institute for Banking and Finance
- 6) Bahrain Polytechnic
- 7) Gulf University
- 8) Kingdom University
- 9) Royal College of Surgeons in Ireland-Medical University
- 10) Royal University for Women
- 11) Talal Abu-Ghazaleh University College of Business
- 12) University College of Bahrain
- 13) University of Bahrain

The research of this paper considered the home pages of the above 13 Universities of Bahrain and conducted the e-accessibility level test against WCAG 2.0. As mentioned

above, accessibility evaluation tools are available which can measure the level of the websites accessibility. However, manual check is still required before drawing any conclusion for this research. On the other hand, selection of the right e-accessibility tool is a challenge. There are many tools available where some are commercial and others are open source. The research in this paper used the tool named "Accessibility Checker". The tool was developed in 2009 by University of Toronto where the accessibility of the web pages could be evaluated against the HTML Validator, BITV, Section 508, Stanca Act, WCAG 1.0 and WCAG 2.0. Accessibility Checker review the accessibility of the websites based on following;

- 1) Review Known Problems: Known Problems are those that AChecker knows with certainty are accessibility barriers.
- 2) Review Likely Problems. Likely Problems are those that AChecker has identified as probably barriers, but cannot be sure. (A manual check is required in this case)
- 3) Review all Potential Problems. Potential Problems are those that AChecker cannot identify, that require a human to make a decision.

The table below shows the accessibility level of the universities websites of the Bahrain.

TABLE I: ACCESSIBILITY LEVEL

S.NO	University Name	Review Known Problems			Review Likely Problems			Review all Potential Problems		
		Level A	Level AA	Level AAA	Level A	Level AA	Level AAA	Level A	Level AA	Level AAA
1	Ahlia University	1	101	104	2	2	2	1032	1079	1085
2	AMA International University	1	8	8	0	0	0	121	126	131
3	Applied Science University	4	8		1	0		612	126	
4	Arabian Gulf University	16	24	24	5	5	5	122	125	160
5	Bahrain Institute for Banking and Finance	2	-	-	0	-	-	170	-	-
6	Bahrain Polytechnic	14	62	63	0	0	0	983	1022	1027
7	Gulf University	17	28	28	0	0	0	334	391	404
8	Kingdom University	5	19	19	0	1	1	143	158	163
9	Royal College of Surgeons in Ireland-Medical University	16	16	16	0	0	0	302	315	324
10	Royal University for Women	38	43	43	0	0	0	901	970	1016
11	Talal Abu-Ghazaleh University College of Business	27	39	39	0	0	0	396	415	413
12	University College of Bahrain	51	77	78	7	7	7	880	950	1186
13	University of Bahrain	51	5	892	77	5	962	78	5	1051

The analysis of the above table proved that 100% universities websites in Bahrain do not conform accessibility standards led by W3C. However, with little efforts some universities could achieve the basic level of accessibility or conformance level A if they provide appropriate alternative tags for all images used on the websites. Also, the tool did not generate results for some of the tests such in case of Bahrain Institute for Banking and Finance for Level AA and AAA conformance.

The educational institutes, government and public sectors have the basic responsibility to provide equal access to the modern technologies for all E-learners regardless any disability and any physical limitations, no matter where they are based. The achievement of total accessibility is really difficult because of different disabilities problems, language barriers, and hardware and software inconsistencies.

Also, the significant numbers of Websites of E-learning are either partially or totally inaccessible to people with disabilities. Although E-accessibility standards are defined by international organizations like W3C but the modern

world and the educational institutions are needed to play their role more seriously to achieve the highest level of e-accessibility and to overcome the barriers of E-learning for students with disabilities.

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