Websites Accessibility Compliance of Official Agencies for Disabilities

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ABSTRACT

The design of official websites that care for people with special needs is a key indicator of the extent of compliance of governments with international standards, as it sends a clear message of commitment to accessible design practices. Since the design of accessible web pages is highly challenging, regulations in most cases do not enforce the mandatory adoption of accessibility standards; rather, it is left as an optional preference. This is also true for most Arab countries. To assess the degree of accessibility compliance of the official websites of governmental institutions responsible for disability in Arab countries we evaluated accessibility options under the Web Content Accessibility Guidelines (WCAG 2.1) standard using two free online tools, WAVE and Acheker. We also included a by-hand evaluation of certain accessibility choices. Only 13 Middle East and North Africa (MENA) country websites were evaluated due to the lack of available data in the rest of the countries. Our results show the non-compliance of all tested websites and demonstrate the need for a better design of accessible websites. We ranked the evaluated websites based on the results of the two evaluation tools.

Keywords: Accessibility, Digital Accessibility, E-accessibility, Web Accessibility, Web Content Accessibility Guidelines, WCAG 2.1

1. INTRODUCTION

E-accessibility is a central dimension of the more general accessibility issue. While accessibility includes how easily persons with disabilities (PWD) can navigate and reach services and products, e-accessibility has to do with electronic means of accessing e-products, e-services, and all internet and technology-enabled ecosystems. The issues include and are not limited to websites and mobile-based apps, TVs, assistive technologies, and public service terminals designed to overcome barriers that might limit their use by persons with functional disabilities.

Many countries have implemented e-government programs over the last decade have achieved significant and tangible results in the inclusion of their citizens to benefit from what technology can bring [1]-[5]. These programs, with the advancements of web-based portal design, provided essential governmental e-services not only to individuals and organizations in big cities but also to citizens in rural areas, particularly for persons with special needs. This paves the way for more inclusive information society to achieve the 2030 Sustainable Development Goals (SDGs) adopted in 2015.

The technological revolution and digital opportunity had a significant impact on many Arab countries, the majority of which have implemented ambitious plans to move towards digital and knowledge-based economies [6]-[10]. These achievements are influenced by the rise in Internet penetration rates with affordable broadband connectivity and an upsurge in the use of smartphones. E-government programs in many Arab countries, mainly Gulf countries, have reached a world-class maturity level in providing e-services that are accessible to all citizens, including persons with special needs and disabilities. However, e-accessibility is still in need of considerable attention, especially in economically and politically challenged countries such as Iraq, Libya, and Yemen. On the other hand, recent disability statistics in all Arab countries are dependent on how each country disaggregates disability data, either through national censuses or surveys by the government [11].

While websites are the leading means of delivering e-services, their design would be unsuitable for persons with disabilities if they lack consideration of the needs of this important sector of the society. Therefore, many international organizations, such as the United Nations, the International Telecommunication Union (ITU), the World Wide Web Consortium (W3C), and standards organizations, recommended the adoption of a sound and inclusive set of guidelines for the design of websites. In this study, we used the WCAG 2.1 guidelines to evaluate accessibility compliance [12]. The remainder of this paper is organized as follows. Section 2 reviews recent literature and related work. Section 3 details the method of this study and testing tools. Results are detailed in section 4. Section 5 discusses the results and their impact on accessibility followed by the conclusion and future work section.

2. LITERATURE REVIEW

The design of official government websites has received great attention from researchers since they provide key governmental services for citizens [13]-[16]. Accessibility of these sites has attracted many researchers to evaluate its effectiveness in providing services for all and particularly for people with disabilities. Public health websites have received noticeable attention especially during the COVID-19 pandemic [17]-[18].

Al Ajarmeh [17] evaluated the accessibility of public health websites from 25 countries in four continents: Asia, North America, South America, and Europe. The selection of the countries was influenced by their ranking based on the pandemic outbreak and the size of their population that exceeds 4 billion people. The study reported the lack of compliance of most websites with web accessibility WCAG 2.0 in all three

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levels of compliance. Only three web pages from Italy, the UK, and China were fully compliant with no errors. The rest of the web pages had average errors of 15.7 at the lowest conformance level and a higher average at the other two higher levels. The study ranked the continents according to average errors discovered. North America was ranked first with a low error average of 9.9 followed by Asia with 33.13 average and South America with 33.92 and finally Europe with an average of 37.45. An important finding of the study concluded an overall lack of compliance of public web pages at all levels and recommends the need for better education and awareness of accessibility issues from developers and government agencies.

New studies [18]-[20] addressed accessibility issues for different disabilities for users using different types of devices such as smartphones or tablets. The overall conclusion is shared among all studies, mainly the lack of compliance with WCAG standards and the need for better adherence to regulation in the design of health-related websites.

A number of studies evaluated the accessibility of different public sector official websites in different countries and reached similar findings of non-compliance of the web accessibility WCAG 2.0 or WCAG 2.1 and at all three levels. Such as [16] [21] in Indonesia, [22] in Cyprus, [23] in the Philippines, and [24] [25] in Saudi Arabia.

Ilhan et al. [22] evaluated the accessibility of 12 e-government portals in North Cyprus and 16 portals in south Cyprus. Nearly 82% of 479890 pages tested have accessibility errors at both A and AA level under WCAG 2.1. According to the authors, these errors and the lack of compliance lead to digital inequality.

Web accessibility in Arab states has received less attention when compared with that in other regions and countries around the world. Tashtoush et al. [26] evaluated 10 Arab state official websites using four automatic evaluations. The results of the evaluation show that none of the websites met the success criteria of WCAG 1.0, and only 30% of the websites received a satisfactory level of accessibility. Akram and R. Bt [27] explored web accessibility issues in official websites of the Saudi government and universities, highlighting the need to follow proper WCAG guidelines in the design of websites. Al-Khalifa [28] compared the progress in accessibility compliance of Saudi e-government websites from 2010 to 2016. The authors carried out their tests using the Achecker and total validity online testing tools. Their results showed clear improvements in the adoption of accessibility guidelines, where more than 50% of errors encountered in 2010 were corrected in 2016. The authors emphasized the need for more government involvement to enforce accessibility compliance with adequate training and awareness of e-accessibility issues. Karaim and Inal [29] evaluated Libyan government websites for level A accessibility compliance in 2017. The study concluded that none of the tested websites met the requirements using the TAW tool.

Marincu and McMullin [30] conducted a comparative survey to assess the conformance of websites to content accessibility in four European countries, the United Kingdom, Germany, France, and Ireland concluded a poor rating in the overall conformance of sampled websites in all countries. While none of the sites satisfied the AAA WCAG level, only 6% of sites in all four countries satisfied the WCAG–A level. The survey reported that almost 50% of e-commerce site compliance has major inaccessibility issues, mainly poor content navigation and screen readers. The Click-Away Pound survey in 2019 [31] found that many websites still suffer from accessibility issues. More than 50% of websites are not compliant and 66% show crowded content, which makes navigation by people with disabilities very difficult. These issues include difficulties with filling forms, color contrast, and animated images.

3. METHODOLOGY

This study aims at evaluating the compliance of official government agencies responsible for disabilities websites in MENA Arab states according to the WCAG 2.1 guidelines. Also to measure how accessible these sites to identify any shortcomings with recommendations and fixes. The research is carried out in three main steps:

- Identifying official government agencies responsible for disabilities and select websites for evaluation.
- Identifying websites free on-line evaluation tools, to determine content accessibility compliance with WCAG 2.1 criteria and level of conformance.
- Analysis of produced reports and results by compare results of evaluations.

Identifying Official Government Agencies

Official disability inclusion departments are identified including ministries or high commissions in Arab countries. We found only 13 out of 22 websites that are eligible for evaluation basing this on their global ranking. For example, Tunis, Yemen and Algerian websites could not be reached. Only main (Index) pages are evaluated in all websites since they are the main entry for users and their accessibility maturity is indicative for the entire site accessibility.

On-Line Evaluation Tools

Evaluations in this research were carried out using two online evaluation tools based on popularity and the number of criteria tested: WAVE [32] and Achecker [33]. Both tools test web content accessibility and compliance with the WCAG 2.1.

The WAVE tool provides details on errors, alerts, structure, and accessible rich internet applications (ARIA) attributes that make web content and web applications easily accessible. The AChecker tool report identifies accessibility problems that fall into three categories of problems. These include "known problems" that fail to meet certain guideline criteria. The second category is "probable problems" that, when fixed, improves accessibility. The last category includes "potential problems" that cannot be identified by the tool and require human confirmation. Additional options are also available for testing, such as HTML Markup Validation and CSS Validator, both of which are important for web designers and developers.

Selected Features for By-hand Testing

For our evaluations, five accessibility features were hand-tested, and the results are tabulated in Table 1. They include reader view control, keyboard accessibility for navigation, zoom to 200% without text loss, contrast control for people with vision impairment, and talk aloud that converts text to speech. The table also includes four important testing categories generated by the WAVE. They include errors of empty links, contrast errors, alerts (long or no alternative text and redundant links), and accessible rich internet applications (ARIA).

4. RESULTS

WAVE and By-hand Testing Evaluation

In this section, we introduce the analysis results of the WAVE and by hand testing to the 13 websites against WCAG 2.1. The WAVE tool includes the following tested features: errors, contrast errors, alerts, and ARIA. The hand-tested features are: reader view-control, keyboard-navigation, zoom, contrast control, and talk aloud were also evaluated and reported. The results are presented in Table 1.

Table 1: WAVE and By-hand Evaluation Results

Disability inclusion website	Hand-test					Wave results						
	Reader view control	Keyboard navigation	Zoom to 200%	Contrast control	Talk aloud	Errors	Contrast errors	Alerts	Aria	features	Structural elements	Total errors
Qatar	✔	✔	✔	✔	✔	7	2	61	159	14	34	277
Oman	✔	✔	✔			4	5	22	1	8	32	72
UEA		✔	✔			15	1	3	28	6	19	72
Jordan	✔	✔	✔	✔		8	0	22	1	22	17	70
Egypt	✔	✔	✔			26	37	132	52	19	63	329
Bahrain	✔	✔				23	4	77	0	10	15	129
Iraq		✔				83	18	130	0	27	12	270
Kuwait		✔	✔			6	6	17	12	11	4	56
Lebanon		✔				3	45	81	2	6	27	164
Mauritania		✔				69	10	36	0	19	3	137
Morocco	✔	✔	✔	✔	✔	35	33	128	216	51	113	576
Saudi Arabia	✔	✔	✔	✔	✔	106	28	177	477	14	13	815
Syrian		✔	✔				1	2	7			10
Total						385	190	888	955	207	352	2977

Selected Features for By-hand Testing

Based on the hand evaluations, the results shown in Table 1, only three web pages (Qatar, Morocco, and Saudi Arabia) out of the 13 (23%) evaluated web pages have implemented all tested accessibility features. Only four web pages (i.e., 30.1%) implemented only two features, while only one country (Jordan) implemented four features. While all websites support keyboard navigation, only three websites have a working talk aloud feature. In addition, four websites only have the ability to control contrast, while nine websites (i.e., 70%) provide 200% on page zoom.

The WAVE tool evaluation results show a total of 2089 errors (after excluding alerts) for all 13 evaluated websites, with an average of 160. Surprisingly, the two websites with the highest number of errors implemented all the tested accessibility features.

Table 1 shows 385 errors for all websites, with an average of 29.6 errors. Of all websites, eight had lower than average error counts, while two websites had very high error counts (i.e., 106 and 83). Without going deep in analyzing the different types of errors, "Empty links" dominated the most frequent error in all sites, and "Missing alternative text" for images. All other reported results (i.e., ARIA, features, and structural elements) exhibit the same pattern of occurrence of the first two errors. These results clearly show that none of the 13 websites had 100% WCAG compliance. Furthermore, each error violates certain criteria and must be fixed. A deeper analysis of these errors and potential errors would help not only in identifying areas of weak design, but would also prevent unnecessary website rendering issues.

Figure 1 shows the ranking of the evaluated websites based on the number of detected errors because WAVE evaluates all 79 criteria in all 13 major guidelines that comply with the four accessibility principles. Our results show that Qatar and Oman maintain their local and global top rankings with seven errors, respectively. On the other hand, Saudi Arabia ranks last with more than 106 detected errors. Syria is not included in this ranking because we could not obtain a credible count due to a bad gateway during evaluation.

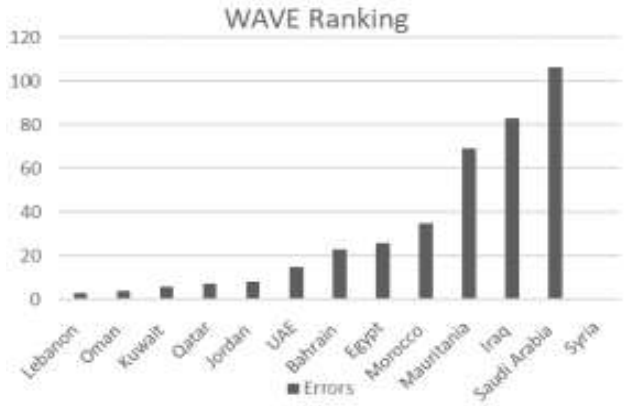

Figure 1. Country ranking based on number of errors

Table 2: Acheker Web Accessibility Evaluation Results

Country	Known problem		Likely problem		Potential problem		Html validate	CSS validate	Total
Level	A	AA	A	AA	A	AA			
Qatar	28	74	0	0	325	361	0	23	839
Oman	1	5	0	0	300	312	0	38	657
UAE	10	11	0		220	225	21	14	511
Jordan	3	0	1	1	267	284	62	7	628
Egypt	96	26	10	10	605	646	67	35	1591
Bahrain	17	27	0	0	272	300	18	4	655
Iraq	5	3	0	0	17	26	13	1	70
Kuwait	7	33	0		151	161	30	10	399
Lebanon	7	0	1	1	397	216	202	4	835
Mauritania	71	9	6	6	494	531	0	0	1188
Morocco	37	NA	8	NA	1039	NA	131	202	1417
Saudi Arabia	49	46	0	NA	500	512	79	39	1274
Syrian	9	32	NA	NA	241	238	9	1	539
Total	340	229	26	18	4828	3812	632	378	

ACHECKER Evaluation

This section presents the Achecker Web Accessibility evaluation tool by submitting a URL. It evaluates the main page according to WCAG 2.1 conformance levels A, AA, and AAA (not evaluated in the study) with optional HTML validation and CSS validation, as shown in Table 2. It is important to note that passing WCAG 2.1 level 2 is not achieved unless level A is fully passed and level-A problems are also included in the level AA problem count. For clarity, we separated the known problems in both levels and were not added together in Table 2.

The results show that none of the evaluated pages passed any WCAG conformance level. The average number of known problems in level A are 26 out of 340, with a high of 96 problems in Egypt and a low of 1 problem in Oman. The most frequently detected known problem in level A is the absence of "Text Alternatives" for any non-text content to meet the success criteria 1.1.1 Non-text Content.

Similar results were found in level AA, with an average of 17.6 problems out of the 229 known problems. The reported problems at this level range between a high of 74 of that of Qatar and no problems reported in two websites that of Jordan and Lebanon. These errors, if not corrected, cause the web page to be inaccessible to persons with disabilities. The same assumption is true for other likely and potential problems.

On the other hand, the HTML validator detected a total of 632 errors, 202 of the errors (i.e., 32%) were found on the Lebanese website and three websites with no reported errors (Qatar, Oman, and Mauritania). As for the CSS errors, 378 violations were reported with a high of 202 violations (53%) that of Morocco.

HTML validation indicates compliance with best design practices that have a significant effect on the overall design of a website. Figure 2 ranks the website based on the number of detected HTML errors and clearly shows that Qatar, Oman, and Mauritania stand out without errors.

5. DISCUSSION

The evaluation was conducted to test web accessibility of official web disability websites in 13 Arab countries to show the points of concern and shortfalls of web accessibility design that have the greatest effects on accessing content and services provided by government websites for people with special needs. Results of our evaluation clearly show that all tested web pages have serious accessibility issues at both A and AA conformance levels of WCAG 2.1. The number or detected errors and problems tend to increase at the high level which addresses more specific issues as shown in both table 1 and table 2.

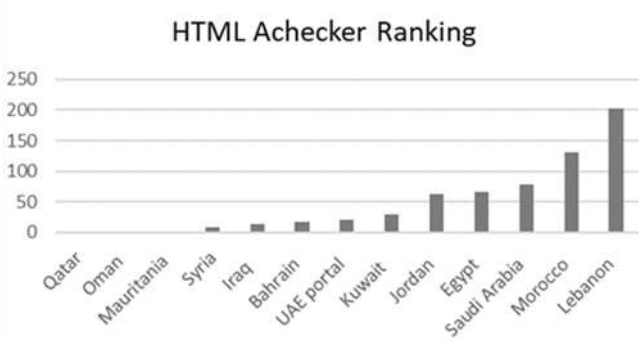

Figure 2. HTML Achecker country ranking

Results of the WAVE tool for all web pages show an average of 160 errors influenced by the high error counts in two web pages of both Saudi Arabia (815 errors) and Morocco (576 errors) while four countries have lower than average errors as shown in Table 1. Noticeably, ARIA errors are also the highest in both pages with 477 and 216 errors respectively. These errors have significant drawbacks for persons using assistive technologies. The overall number of errors and alerts calls for more careful web design to ensure accessibility and to overcome serious difficulties in providing critical information and services.

The by-hand evaluation revealed significant weakness in implementing two important features, talk aloud and color contrast. Only two web pages have talk aloud service (Saudi Arabia and Morocco) and three web pages with color contrast. These two features are important for users with hearing impairment and vision problems. While no web page has implemented all features, two features, zooming and keyboard navigation, are implemented by most web pages. While the five functionalities provide minimum requirement for accessible

web page, the absence of more than two features would represent serious barrier to accessibility.

The Achecker tool results show significant number of known problems in all web pages with a total of (340 problems) at level A and (229 problems) at level AA. It also shows a high number of potential problems in all web pages at both level A (4828 problems) and level AA (3812 problems). While the likely problems are low, the overall detected issues indicate inadequate design and the need to correct these problems.

HTML and CSS markup validation have noticeable problems in 12 web pages, and only the page of Mauritania has no issues. While only three web pages passed the HTML test, two pages have significant points of incompatibility (Lebanon with 202 issues and Morocco with 131). These incompatibility issues influence the accessibility of HTML, XHTML, CSS documents and the use of assistive technologies

Limitations

In this study we only tested the landing web pages of each website since their compliance is indicative of the entire site compliance [17]. Websites in some countries like Yemen and Libya were inaccessible which affected the overall evaluation of all official websites in the region.

While testing all web pages in a website provides more accurate data and would reveal the overall evaluation of each site, deeper evaluation of each error type and problem in all pages can significantly provide more ideas for improvement and presents designers with detailed issues to be corrected. These details are left for future work.

6. CONCLUSIONS

As accessibility gains more attention for technology inclusion, significant design and improvement of accessible websites and web-based applications are becoming more essential than ever. This study aimed to evaluate accessibility design in official disability websites in many Arab states as an indicative measure of compliance with international accessibility standards. Our results show a significant gap among the different states that calls for better design and a need for better compliance to meet the needs of persons with disabilities. Since none of the evaluated websites had 100% compliance, the number of errors and violated or unmet accessibility criteria suggests a lack of design experience among web designers and an absence of regularity enforcement for standard compliance. While no deep and specific errors were reported and analyzed in this study, further exploration of error details combined with the rest of the evaluated criteria would reveal the fundamental design deficiencies and would improve the overall accessible web design.

Based on the findings of the study, we recommend the following points: First, developing official websites for people with disability must adhere to international accessibility standards. Second, governments need to enforce by sound legislations the compliance of websites accessibility design. Finally, awareness of various accessibility standards and its importance for inclusion ought to be taught at all educational levels to promote the adoption of accessibility.

Our future work will examine all website pages to better evaluate all existing gaps, in addition to the mobile version of the tested website.

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