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Mohamed Basel Al Mourad
Zayed University

Mohammed Hussein
Zayed University

Faouzi Kamoun
Zayed University

Zelal Wattar
Esprit School of Engineering

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Analysis of WCAG 2.0 data accessibility success criterion of e-government websites

Mohamed Basel Al Mourad¹, Mohammed Hussein², Faouzi Kamoun³, Zelal Wattar⁴

¹ Zayed University, College of Technological Innovation, UAE, baasel.almourad@zu.ac.ae

² Zayed University, College of Technological Innovation, UAE, Mohammed.hussein@zu.ac.ae

³ Zayed University, College of Communication & Media Sciences, UAE, zelal.wattar@zu.ac.ae

⁴ ESPRIT School of Engineering, Tunisia, Faouzi.kammoun@esprit.tn

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ABSTRACT

An accessible website enables the access to information and interaction for many people with disabilities so these people can contribute more effectively in the society. Today, most governments are enforcing their websites to follow the www consortium (w3c)'s Web Content Accessibility Guidelines (WCAG 2.0). This paper investigates the WCAG 2.0 success criterions that make a website accessible and explores the most violated WCAG 2.0 success criterions by the developers of e-Government websites.

Corresponding Author:

Mohamed Basel Al Mourad,
College of Technological Innovation,
Zayed University, UAE,
P. O. Box 19282, Dubai, UAE +971 4 40121464 · +56 2 2303 7001.
Email: basel.almourad@zu.ac.ae

1. Introduction

The Web and Internet are an increasingly essential resource in many aspects of human digital life which includes: education, employment, government, commerce, health care, recreation, and more. It is vital that the Web is accessible to everyone in order to provide equal access and equal opportunity to people with disabilities. Web accessibility focuses on people with all types of disabilities - visual, auditory, physical, speech, cognitive, and neurological disabilities - including older people with age-related impairments (Kurt, 2017). Web accessibility means that people with disabilities (i.e. including visual, auditory, physical, speech, cognitive, and neurological disabilities) can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web (Lawton, 2014).

The main self-regulatory body in relation to access to the Internet is the World Wide Web Consortium (W3C). The W3C created various working groups to develop web standards, guidelines, and supporting materials within the realm of the Web Accessibility Initiative (WAI) in (W3C, 2018). In 1999, the W3C established the first accessibility standard for the Web, WCAG 1.0. Almost ten years later, in December 2008, the WAI revised the WCAG guidelines and published an updated version (i.e., WCAG 2.0) (WCAG 2.0, 2018). The WCAG 2.0 guidelines are accepted as the primary standard by which accessibility should be measured. They are composed of 12 separate guidelines, organized under 4 principles: perceivability. (meaning that information and user interface components must be presentable to users in ways they can perceive), operability (meaning that user interface components and navigation must be operable), understandability (meaning that information and the operation of the user interface must be understandable), and robustness

(meaning that content must be robust enough to be interpreted reliably by a wide variety of user agents, including assistive technologies).

Section 2 focuses on the aim of the research. Section 3 presents the research methodology. Section 4 discusses the result of the research.

2. Aim of the research

Most governments today are promoting the transition of their countries towards an information-based society where e-Government websites are becoming the primary gateways to citizens and businesses for government information and e-service delivery (Goodwin et al., 2011). E-Government can be broadly defined as the unification of information and communication technologies, and administrative practices to provide government e-services to citizens, businesses and other e-Governments (Basu, 2004). The benefits of online government e-services include better efficiency, user convenience and more citizen political involvement (Freeman and Loo, 2009). To enable all citizens to benefit from the full potential of e-Government services, it is important to secure universal accessibility. This accessibility enables people with disabilities to take full advantage of the information and services offered by e-Governments; the same way a person with no disability would. Despite WCAG 2.0 guidelines have been widely accepted or adopted into policy and legislative frameworks, it is widely reported that the implementation of the WCAG 2.0 guidelines has thus far been quite slow (Kamoun & Almourad, 2014; Almourad et. al., 2016).

This research has two aims. The first aim is to present an analysis of web accessibility content established by the WCAG 2.0 guidelines. The second aim is to raise awareness among developers and webmasters about the importance of universal accessibility. We have tried to highlight the most violated WCAG 2.0 Success Criteria. This would help developers pay more attention to these success criteria and try to avoid the same mistakes that many developers are falling in.

3. Research Methodology

We have adopted a quantitative research method to measure the most violated WCAG 2.0 success criteria and provide guidance for the web developer and webmasters on how to avoid these violations. We selected 19 Dubai e-government websites as a case study for our measurement testing. Several automatic accessibility tools are available to assess web accessibility and which and how many WCAG 2.0 success criteria are violated. There many web accessibility assessment tools that are able to evaluate web site accessibility. We have chosen the AChecker tool (AChecker, 2018) as research demonstrates that this tool achieves better evaluation result than other tools (Pacheco et. El., 2016). The tool can test all the conformance levels (A, AA, and AAA).

AChecker is a holistic accessibility testing tool used to evaluate the HTML content for a single web page. A web page can be tested by entering the URL, uploading an HTML file, or by pasting the source code directly into the tool. AChecker provides a personalized accessibility assessment methodology, allowing users to select between different set of accessibility guidelines, impairments, and personas. The tool can test conformance against all the conformance levels (A, AA, and AAA). AChecker identifies 3 types of problems:

- **Known problems:** These are problems that have been identified with certainty as accessibility barriers. The web page must be modified to fix these problems;
- **Likely problems:** These are problems that have been identified as probable barriers but require a human to make a decision. The web page likely needs to be modified to fix these problems.
- **Potential problems:** These are problems that AChecker cannot identify, that require a human decision.

We used AChecker to test accessibility conformance on the 19 Dubai e-Government Websites. For each website we extracted the number of issues for each violated checkpoint. We gathered all the extracted numbers in an Excel sheet for analysis.

4. Result & Discussion

Table 1 summarizes the number of violations of every success criterion for each tested Dubai e-government website. The website names are hidden for confidentiality and have been renamed Q1 to Q19. For the purpose

of condensing this paper, we have only included the success criteria that are violated. The success criteria that are not violated are omitted from this discussion.

Table 1 checkpoint violations by every organization

Organization	Perceivable			Operable			Understandable		Robust	Total Errors	
	1.1	1.3	1.4	2.1	2.2	2.4	3.1	3.3	4.1		
	1.1.1 (A)	1.3.1 (A)	1.4.4 (AA) 1.4.6 (AAA)	2.1.1 (A)	2.2.2 (A)	2.4.4 (A) 2.4.6 (AA)	3.1.1 (a)	3.3.2 (A)	4.1.1 (A)		
Q1	16		58	3			1	1		89	
Q2	1	11	1			3	8	1	12	37	
Q3			95					1		96	
Q4			5	1		2			1	9	
Q5	18			3				1		23	
Q6	1		16	5						22	
Q7	75	41	3	5	2	4		1	25	156	
Q8		14	9	5	1			1	10	57	
Q	2		20		2			1		26	
Q10	13						1			15	
Q11	1	2	5			14	2		1	25	
Q12	3	2	6							12	
Q13	6	4	53	5		7	5			80	
Q14	9	6	17	6						38	
Q15							1		8	10	
Q16	10	4		1				1		17	
Q17	3		103	28			2			136	
Q18	9		81	1	1		1	1		95	
Q19		6	2				2		3	13	
Total Errors per Organization	182	90	474	73	5	1	30	23	9	59	10

As shown in table 1, none of the 19 tested websites have passed the test. All organizations have accessibility errors. However, websites (Q4, Q12, O15 and Q19). have generated less than 15 accessibility errors (see Figure 1)

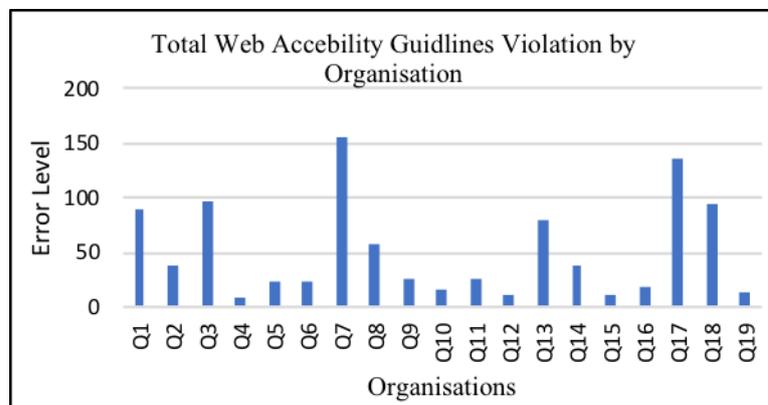


Figure 1 Total Web Accessibility Guidelines Violation by Organization

As shown in Figure 2, success criterion 1.1.1, 1.4.4, 1.3.1, 1.4.6, 3.3.2 and 2.4.4 are the most violated success criterion. In the following discussion, we will be analysing the success criterion and ignoring the success criterions that are violated fewer times and less frequently.

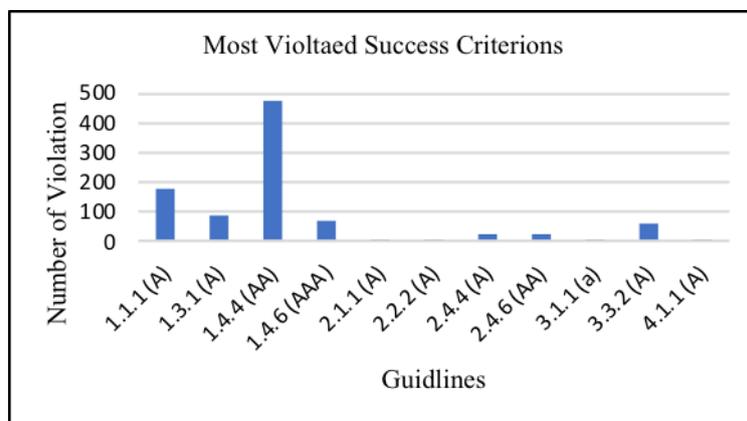


Figure 2 The Most Violated Success Criterion

Success criterion 1.1.1 belongs to conformance level A. It was violated 182 times (Figure 3). The aim of this success criterion is to make information conveyed by non-text content accessible through the use of a text alternative: “All non-text content that is presented to the user has a text alternative that serves the equivalent purpose”. For example, some users browse websites with images turned off. These must be true alternative text that describes the image content.



Figure 1 Violation Level of 1.1.1 Success Criterion

Success criterion 1.4.4 belongs to conformance level AA and it was violated 474 times (Figure 4). The aim of this success criterion is that text is scaled so that it can be read directly by people with mild visual disabilities, without requiring the use of assistive technology such as a screen magnifier. Website users may attempt to scale all content on the Web page, but text is most critical. Normally the user agent will provide support for zooming in and out of a page. Note that zooming in a browser (usually keys 'Ctrl+' or 'Ctrl-') may work differently from just increasing the text size. If the text size is increased, it may not necessarily increase the size of images whereas zooming generally increases the size of all content in the page. To meet this success criterion, the website should allow for up to a 200% resize of text without dropping any content or functions.



Figure 2 Violation Level of 1.4.4 Success Criterion

Success criterion 1.3.1 belongs to conformance level AA. It was violated 90 times (Figure 5). The aim of this success criterion is to ensure that any information and relationships specified by visual (or audio) methods may be determined programmatically by assistive technologies or a text description of the information and relationship provided where this may not be possible. Users who are blind (using a screen reader) benefit when information conveyed through colour is also available in text. For example, a form contains several required fields. The labels for the required fields are displayed in red.

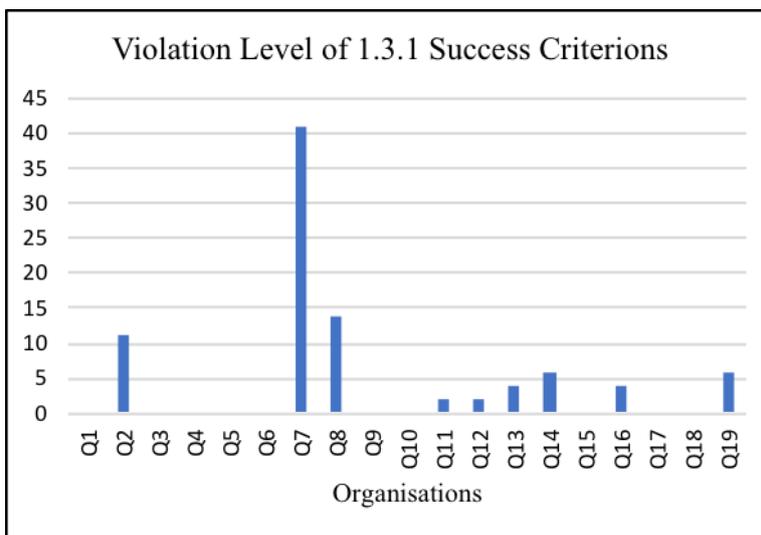


Figure 3 Violation Level of 1.3.1 Success Criterion

Success criterion 1.4.6 belongs to conformance level AAA. It was violated 73 times (Figure 6). The aim of this success criterion is to provide enough contrast between text and its background so that it can be read by people with moderately low vision. The visual presentation of text and images of text has a contrast ratio of at least 7:1. A colour contrast analyser would be needed to ascertain the ratio of the selected colours.

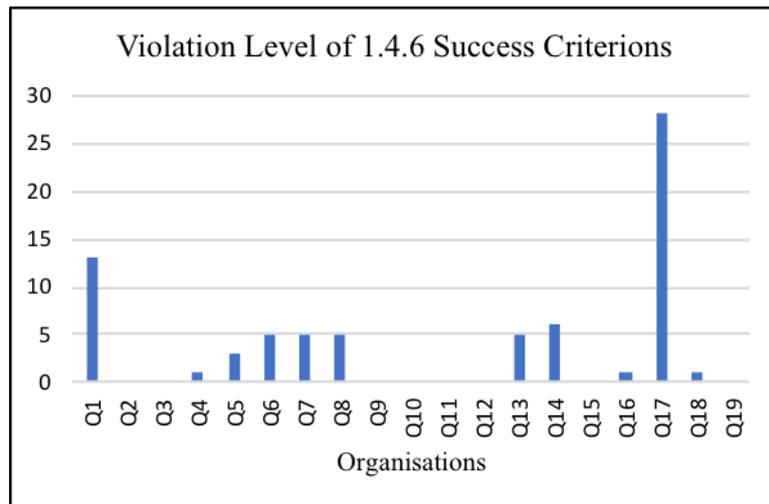


Figure 4 Violation Level of 1.4.6 Success Criterion

Success criterion 3.3.2 belongs to conformance level A. It was violated 59 times (Figure 7). The aim of this success criterion is to have content where authors place instructions or labels that identify the controls in a form so that users know what input data is expected. For example, when labels are used, they should be described appropriately. In a form, the label should correctly identify the field and also identify required fields.

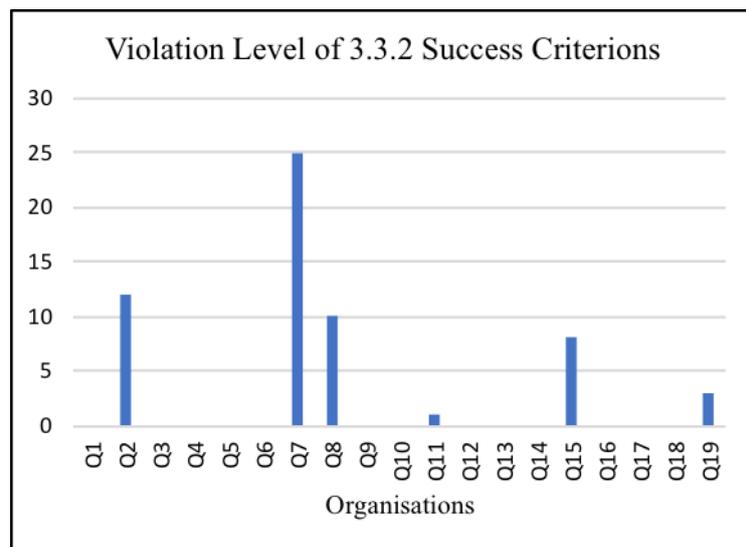


Figure 7 Violation Level of 3.3.2 Success Criterion

Success criterion 2.4.4 belongs to conformance level A. It was violated 30 times. The aim of this Success Criterion is to help users understand the purpose of each link so they can decide whether they want to follow the link. This includes providing link text that identifies the purpose of the link without needing additional context wherever possible. Assistive technology has the ability to provide users with a list of links that are on the Web page. Link text that is as meaningful as possible will aid users who want to choose from this list of links. Meaningful link text also helps those who wish to tab from link to link. Meaningful links help users choose which links to follow without requiring complex strategies to understand the page. For example, the text for the link should describe exactly the purpose of the link rather than a vague name of the page it's will take you to or its URL.

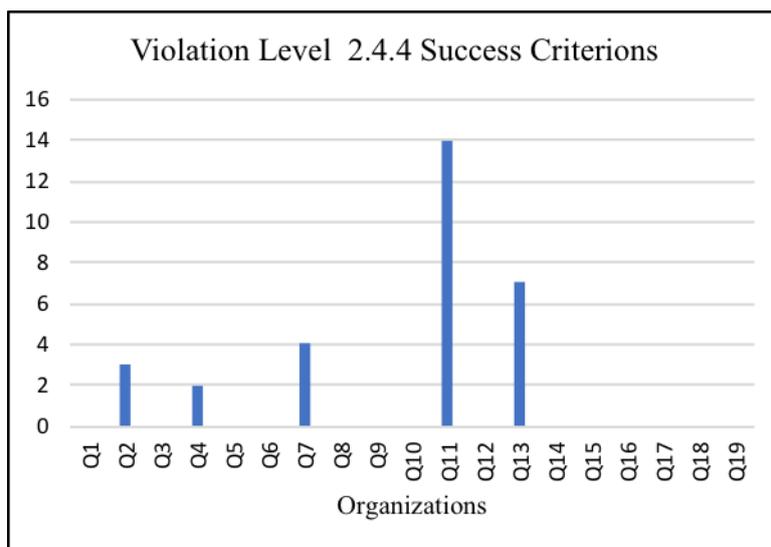


Figure 5 Violation Level 2.4.4 Success Criterion

5. Conclusion

None of the 19 tested e-Government websites were fully WCAG 2.0 accessible. Some e-Government websites have generated fewer accessibility errors. Many of the WCAG 2.0 success criteria are violated. We have discussed the most violated accessibility success criteria. Our aim is to raise the awareness to the web developers so these criteria can be avoided in the future and eventually making e-Government web sites more accessible by all members of the society.

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