Web Accessibility in Romania: The Conformance of Municipal Web Sites to Web Content Accessibility Guidelines

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The accessibility of public administration web sites is a key quality attribute for the successful implementation of the Information Society. The purpose of this paper is to present a second review of municipal web sites in Romania that is based on automated accessibility checking. A number of 60 web sites were evaluated against WCAG 2.0 recommendations. The analysis of results reveals a relatively low web accessibility *of municipal web sites and highlights several aspects. Firstly, a slight progress in web accessibility was noticed as regarded the sample evaluated in 2010. Secondly, the number of specific accessibility errors is varying across the web sites and the accessibility is not preserved in time. Thirdly, these variations suggest that an accessibility check before launching a new release for a web page is not a common practice.*
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1 Introduction

Active participation in society requires usable and accessible ICT tools. Unfortunately, for a large part of the population the web content is difficult to use if not unusable. The consolidation of an information society in Romania requires equal access to the information technologies for all citizens. Most public web sites have barriers that affect the access to information for people with disabilities.

In 1997, the World Wide Web Consortium (W3C) launched the Web Accessibility Initiative (WAI) in order to improve the web accessibility for people with disabilities [27]. The purpose of WAI is to develop strategies, guidelines and resources to support web accessibility. Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the web. According to the ISO 25010 standard, accessibility is a sub characteristic of usability that includes disabilities related to age [11]. It could be measured either as the extent to which a product could be used by people with disabilities or by the presence of product attributes supporting accessibility.

WAI developed Web Content Accessibility Guidelines (WCAG) that provide with a set of recommendations for making the web content more accessible to users with disabilities. In 1999, W3C published the first version of accessibility guidelines (WCAG 1.0) [28]. The second version was published in 2008 (WCAG 2.0) and this is the reference recommended for use in accessibility policies [29]. There are four key principles that underlie WCAG 2.0: perceivable, operable, understandable and robust. Three levels of conformance testing were defined: A (lowest), AA and AAA (highest).

Following the commitment to promote e-accessibility in Europe expressed by the Riga Ministerial Declaration in 2006 [22], several initiatives and documents were published that are supporting the policy of the European Commission on e-inclusion: "European i2010 initiative on e-Inclusion" [4], "Towards an accessible information society" [5], and several studies regarding the measuring of web accessibility in Europe [6], [7].

Although the access to information for people with disabilities was stated as a priority at European level, the web accessibility of public web sites is still a problem. According to the MeAC survey, only a few of key government web sites in Europe respect the minimal accessibility requirements (12.5%

passed automated testing and 5.3% passed both automatic and manual testing). [6]
In a previous work we presented a preliminary review of municipal web sites in Romania [21]. A sample of 30 municipality web sites was evaluated in 2010 for conformance with WCAG 2.0 level A requirements (lowest level of conformance).
This paper presents the results of a second study carried on in 2011 based on a larger sample of municipalities. The purpose of this work is twofold. Firstly, by extending the sample we will get a larger view on the accessibility of this category of public web sites. Secondly, by comparing the evaluation results we will analyze the progress in web accessibility / the degree to which the web accessibility is maintained in time.
The rest of this paper is organized as follows. In the next section we present existing approaches in web accessibility research and web accessibility concerns and needs in Romania. The evaluation results are presented and analyzed in section 3. The paper ends with conclusion and future work in section 4.

2 Related work

2.1 Approaches in web accessibility

How to measure and improve the web accessibility is a key research concern in e-accessibility research. There are several approaches to accessibility evaluation and, consequently many accessibility evaluation methods. Brajnik distinguished between the following five categories: conformance review, subjective assessment, screening techniques, barrier walkthrough, and user testing [3]. Conformance review is an analytical method based on standards and / or guidelines and includes computer-aided testing with accessibility tools. As such it depends on the chosen checklist.
Abascal et al. [1] highlighted some difficulties in using accessibility guidelines that are often updated or changed. Kane et al. [12] reported an analysis of home pages for 100 top international universities. Results shows that many web sites have accessibility problems among which the lack of alternate text for non-text content was the most common accessibility error. Leuthold et al. [17] show that despite the fact that WCAG exist since 1999 and there are corresponding regulations demanding their application, few web sites are accessible.
Vigo and Brajnik [26] analyzed several web accessibility metrics and concluded that web accessibility quantitative metric, page measure, and web accessibility barrier present the highest level of quality.
Barrier walkthrough is another inspection method that takes it roots from the heuristic usability evaluation method [3]. An accessibility barrier is a condition that creates a difficulty for the user to achieve a goal. Barriers are based on well-known accessibility principles. Yesilada et al. [30] noticed that there are many overlaps between the guidelines for developing accessible web pages for disabled users. They used the barrier walkthrough method to identify communalities in usage between mobile and disabled web users.
Ruth-Janeck proposed a classification of barriers by defining dimensions and aspects. She concluded that the most important barriers are the understandability (in the broadest sense), the use of forms and the operability of multimedia components with assistive technologies [23].
A global evaluation has been carried on by Olsen et al. [20] on national government portals and ministry web sites. The most commonly accessibility barriers detected are invalid use of the HTML-standard and missing alternative descriptions for images.
Mbipom and Harper studied the interplay between the web aesthetics and accessibility [18]. The results of their study show that expressive designs are not necessarily a barrier to accessibility. They found that only one aesthetic dimension – visual cleanness – was significantly related to accessibility.
Hackett and Parmanto show that home page is not enough when evaluating web site accessibility [10]. As such, home page accessibility is not indicative of the accessibility of the entire web site. A similar conclusion resulted from our previous study [21].
Web accessibility is a key concern for the effective use of public administration web sites. Nevertheless, there are relatively few

papers in the literature that are targeting the accessibility of municipal (i.e. local public administration) web sites.

Lazar et al. [15] show that the societal perceptions and stakeholder perceptions influence the web development for accessibility. Based on a survey they concluded that webmasters' perception is the main explanation for the low web accessibility. In a similar vein, the study of Fagan and Fagan [8] reveals that web accessibility is a "hot" issue but not very popular. While some states are making efforts to develop standards, regulations and policies to increase web accessibility, others perceive just as an extra work for developers.

Nietzio et al. [19] evaluated the accessibility of a group of Norwegian municipalities wanting to improve the accessibility of their websites. The approach undertaken by them in the eGovMon (eGovernment Monitoring Project) national project integrates benchmarking and related services with the aim at supporting a community of practice.

In her study on e-government web sites accessibility in UK, Kuzma reported that 82 out of 130 web sites (63%) had an alt tag missing and 23 web sites (18%) have frames with no titles. Overall, she concluded that there is a preponderance of e-government websites that do not meet the legal requirements as regarding web accessibility [13].

2.2 Web accessibility in Romania

According to the statistical data provided by the National Authority for Disabled People, at 30 September 2011 there were 688,199 people with various disabilities from which 113,130 are visually impaired people. People with visual disabilities are the third category of disabled people in Romania (after somatic and mental), with a weight of 16.44%. From these, a total of 57,199 people (50.56%) have a severe visual impairment [2].

Accessibility research is a relatively new field in Romania and there is little accessibility data related to public web sites. Accessibility for visually impaired people is the main concern in this area [9], [14]. According to our knowledge, there is only one reported case study of testing a public web site for accessibility with visually impaired users [16]. The study targeted a municipal web site and revealed several accessibility problems: graphical items that are not accessible to screen readers, difficult navigation due to lack of landmarks for menus, lack of text alternatives for graphical elements, lack of textual description.

In general, there is a low awareness about the importance of accessibility evaluation. A recent study of Suduc et al. [24] shows that only 37% of users consider accessibility an important feature of user interfaces usability.

As mentioned in the introduction, a first accessibility evaluation of municipal web sites was carried on in 2010 [21]. Two web pages of 30 municipalities were evaluated against WCAG 2.0 accessibility guidelines. The study revealed that most developers are aware of both WCAG 2.0 recommendations and availability of accessibility checking tools. Most frequent violation of accessibility guidelines were the lack of alternatives for non-text content and the use of tags purely to create visual presentations (instead of using CSS).

3. Evaluation results

3.1 Method and tool

This study is reviewing the municipality web sites for accessibility. The sample consists of first 60 Romanian towns ranked upon population, according to the 2002 census.

We took a computer-aided evaluation approach by using Total Validator, an accessibility checking tool available on the web. (http://www.totalvalidator.com/. This tool performs HTML validation, broken links validation, and accessibility validation [25]. In this study, the web pages were evaluated against WCAG 2.0 guidelines (conformance level A).

For each web site two web pages were selected. Firstly, the home page of each web site was evaluated. Then a second web page was evaluated in order to check if the results are consistent along the web site. The evaluation was carried on in March - April 2011.

For each web page the accessibility score

was computed as the total number of accessibility errors level A. Then a comparison between the data in 2010 and 2011 was done based on the number of errors for the first 30 municipalities.

3.2 Home page evaluation results

Summary of evaluation results

The accessibility evaluation results are presented in Table 1 where towns were grouped according to the total number of errors (accessibility score). None of them passed the lowest level of WCAG2. Only 12 web sites had less than 10 errors. Overall, 4146 WCAG 2 errors were detected on the home pages. The average number of error per web page is 69.10 (SD=82.71) with a minimum of 1 (3 municipalities) and a maximum of 447 errors.

Table 1. Categories on total number of errors

Accessibility score	Number	Percent
1-10 errors	12	20.00
11-20 errors	5	8.33
20-50 errors	18	30.00
50-100 errors	11	18.33
Over 100 errors	14	23.33
Total	60	100.00

A more detailed analysis of results reveals several aspects regarding the conformance to WCAG 2.0 accessibility level A. In Table 2 a grouping of web sites following the WCAG 2.0 principle and error type is presented.

Most errors are related to the first WCAG 2.0 principle (perceivable). The average number of errors is 52.98 (SD=65.08) with a minimum of 1 (three web pages) and a maximum of 318. From these, two error types are more frequent: the lack of text alternatives for non-text content (29.96% from total) and the use of tags for visual presentation instead of using CSS (24.51% from total). These two error types alone account for more than a half of the total number of errors.

Other frequent accessibility errors that are related to perception are: lack of description for the purpose of a link (9.53%), improper ordering of heading elements (3.30%), and labels that are not properly associated with controls (2.48%).

Table 2. Main types of accessibility errors

Principle / Guideline	Number	%
1. Perceivable, from which	**3179**	**76.68**
Alternative text	1242	29.96
Title for controls	68	1.64
Link description	395	9.53
Table description	75	1.81
Headings ordering	137	3.30
Labels for controls	103	2.48
Tags instead CSS	1016	24.51
Other	143	3.45
2. Operable, from which	**829**	**20.00**
Stuttering effect	144	3.47
Confusing links	661	15.94
Other	24	0.58
3. Understandable	**20**	**0.48**
4. Robust	**118**	**2.85**
Total	4146	100.00

Regarding the second WCAG 2.0 principle (operable), the total number of errors is 829 (20% from total). The average number of errors is 13.82 (SD=25.69) with a minimum of 0 (16 web pages) and a maximum of 160. Two error types are more frequent: different links with the same link text (15.94%) and stuttering effect (3.47%).

The last two principles account for a total of 20 errors (0.48%) respectively 118 errors (2.85%). This suggests that the accessibility checking tool is mainly supporting the conformance for perceivability and operability.

Next we will briefly discuss four of the most frequently accessibility errors.

Lack of text alternatives for non-text content

If there is no „alt" attribute (alternate text description for non-text content), then assistive technologies are not able to identify the image or to convey its purpose to the user. This recommendation is a first priority for web accessibility.

The mean number of errors was 20.70 (SD=46.06) with a minimum of 0 and a maximum of 223. 15 home pages (25%) had no error, 8 pages had only one error and other 9 web pages had 2-5 errors (might be due to the adding of new images). This suggests that in general, this guideline is well known and respected. At the other side, we found 4 web sites with 21-50 errors and 7 web sites (11.67%) with more than 50 errors.

A comparison with 2010 data for the first 30 municipalities shows a reduced conformance to this guideline: a total number of 631 errors (M=21.03, SD=47.16) compared with 449 errors (M=14.97, SD=41.70).

Tags used for visual presentation
According to WCAG 2.0, tags that are being used purely to create a visual presentation effect should not be used. Instead CSS (Control Style Sheets) should be used to control layout and presentation.
The mean number of errors was 16.93 (SD=31.13, Min=0, Max=157). Many web sites under consideration are respecting this recommendation. 19 of them (31.67%) had no error and 14 (23.33%) had 1 to 5 errors. In 14 cases (23.33%) we found more than 20 errors, which suggest that this recommendation is either not known or well understood by developers.
A comparison with 2010 data for the first 30 municipalities shows a reduced conformance to this guideline: a total number of 525 errors (M=17.50, SD=30.60) compared with 414 errors (M=13.80, SD=22.82).

Different links with the same link text
Different links with the same link text can be confusing to the user. The mean number of errors was 11.02 (SD=16.43, Min=0, Max=83). Most web sites under consideration are respecting this recommendation. 21 of them (35%) had no error and 10 (16.67%) had 1 to 5 errors. Only in 10 cases we found more than 20 errors, which suggest that this recommendation is not known to the developers of those web sites.
A comparison with 2010 data for the first 30 municipalities shows a reduced conformance to this guideline: a total number of 442 errors (M=14.73, SD=20.37) compared with 310 errors (M=10.33, SD=19.80).

Description of the link purpose
WCAG 2.0 recommends describing the purpose of a link by providing descriptive text since the web address of the destination is generally not sufficiently descriptive. This way a user could distinguish this link from other links in the web page and helps the user determine whether to follow the link. The mean number of errors was 6.58 (SD=15.00, Min=0, Max=106). The evaluation data shows that in 16 cases (26.67%) no error was detected while in other 26 web pages (43.33%) only 1 to 5 errors were encountered. Only in three cases we found more than 20 errors showing that the developers are not aware of this recommendation.
A comparison with 2010 data for the first 30 municipalities shows a reduced conformance to this guideline: a total number of 162 errors (M=5.40, SD=9.07) compared with 124 errors (M=4.13, SD=8.22).

3.2 Second web page evaluation results

Summary of evaluation results
The accessibility evaluation results for the second web page are presented in Table 3 where towns were grouped according to the accessibility score.
There is no municipal web site without accessibility errors and only 10 with less than 10 errors. There are 11 web pages (18.33%) having more than 100 errors. The total number of errors is 3529 with an average of 58.81 (SD=62.88, Min=1, Max=258) which is slightly better than on the home page.

Table 3. Categories on total number of errors

Accessibility score	Number	%
No error	0	0.00
1-10 errors	10	16.67
11-20 errors	9	15.00
21-50 errors	19	31.67
51-100 errors	11	18.33
Over 100 errors	11	18.33
Total	60	100.00

In Table 4, a grouping of web pages following the WCAG 2.0 principle and error type is presented for the second page and cumulated. Most errors are related to the first WCAG 2.0 principle (perceivable). The average number of errors is 49.37 (SD=58.67) with a minimum of 1 (three web pages) and a maximum of 244.

Table 4. Main types of accessibility errors

Principle / Guideline	2nd web page		Cumulated	
	No	%	No	%
1. Perceivable	**2962**	**83.93**	**6141**	**80.01**
Alternative text	1004	28.45	2246	29.26
Title for controls	74	2.10	142	1.85
Link description	179	5.07	574	7.48
Table description	71	2.01	146	1.90
Headings ordering	74	2.10	211	2.75
Labels for controls	67	1.90	170	2.21
Tags instead CSS	1398	39.61	2414	31.45
Other	95	2.69	238	3.10
2. Operable	**524**	**14.85**	**1353**	**17.63**
Stuttering effect	91	2.58	235	3.06
Confusing links	421	11.93	1082	14.10
Other	12	0.34	36	0.47
3. Understandable	**18**	**0.51**	**38**	**0.50**
4. Robust	**25**	**0.71**	**143**	**1.86**
Total	3529	100.0	7675	100.0

Two error types are more frequent: the lack of text alternatives for non-text content (28.45% from total) and the use of tags for visual presentation instead of using CSS (39.61% from total). These two error types alone account for more than 68% of the total number of errors, a larger proportion than in the case of home pages.

Although the distribution of errors is different, most errors are due to the same four guidelines:

- Lack of text alternatives for nontext content (M=16.73, SD=39.78)
- Tags used for purely for visualization, instead of using CSS (M=23.30, SD=40.16)
- Different links with the same link test (M=6.98 SD=14.22)
- Lack of link purpose description (M=2.98, SD=4.21).

These kinds of error are especially reducing the web content accessibility for visually impaired users.

The analysis of cumulated results (home page + 2nd web page) shows that these four types of error account for 82.29% from the total.

Comparison with 2010 data

The results on the two web pages suggest some degree of consistency across the web sites with regard to both the number of guideline violations and the distribution of errors. This is different from 2010, when we noticed a clear orientation of developers towards the accessibility validation of the home page and less interest to perform a thorough validation of each page.

In Table 5 is presented a comparison of conformance scores for these guidelines with the data of 2010 for the first 30 web sites. The comparison is done on the cumulated data.

Overall, a slight progress could be observed: the total number of errors is with 409 less (8.68%). This is mainly due to the reduced number of errors for the first guideline in Table 5 (-181) and three other guidelines not mentioned in the table: unique identifiers within a document, stuttering effect and lack of table description, which had a larger weight in 2010.

On the other side, the conformance is worse for the other three guidelines in Table 5 which shows that the web page accessibility is not well preserved in time. This situation is general for the European public web sites, as shown in the follow-up MeAC report [7].

Table 5. Comparison with 2010 data

Principle / Guideline	2010		2011	
	No	%	No	%
Tags instead CSS	1323	28.08	1142	26.55
Alternative text	1136	24.11	1226	28.50
Confusing links	592	12.57	766	17.81
Link description	257	5.46	574	13.34
Other	1403	29.78	594	13.81
Total	4711	100.0	4302	100.0

In both years, the main WCAG 2.0 violations were the use of tags purely for visualization instead of using CSS and the lack of text alternatives for non-text content. Together, these two categories account for more than 50% from the total number of errors.

4 Conclusion and future work

This study is the second accessibility evaluation of Romanian municipalities' web sites. Overall, the web accessibility is still low, with many errors that are violating the first principle of WCAG 2.0. In order to be used by people with disabilities, the web sites content has to be perceivable. The analysis of evaluation results shows that most developers

are aware of these recommendations as well as of the availability of accessibility checking tools.

There are some limitations of this study. First of all, the automated accessibility evaluation has several inherent limitations, as mentioned by Vigo and Brajnik [26]. Moreover, we mainly focused on the conformance with WCAG 2.0 without using all features provided by the tool, such as: parsing errors, HTML errors, and link errors. Second, the sample size is still small since only 60 municipal web sites were evaluated in 2011. However, some degree of representativeness exists since these municipalities have a total population of 8.62 million people (39.76%). Third, by evaluating only one page apart from the homepage does not provide with a complete overview of accessibility.

Nevertheless, this accessibility evaluation provides with useful information. The most frequent errors that are highlighted in Table 4 could be used as a provisional metric for a periodic evaluation of municipal web sites accessibility at country level. In this respect the evaluation results may guide the developers to set up priorities in order to ensure conformance with WCAG 2.0.

The fact that accessibility is not preserved in time and that several specific errors are varying both in time and across a web site shows that there is not a systematic software engineering approach to testing for conformance before a new release. Rather, it suggests a conformance checking from time to time of the entire web site.

In the next future, we intend to carry on a third evaluation with a larger sample and on two other web pages apart from the home page, in order to better assess the progress of web sites already evaluated and better describe their accessibility.

This survey focused only on the public administration sector. The results show that much has to be done to make web services accessible. Further investigations should reveal how accessible websites are across private sectors: airlines, newspapers, banks, telecommunications etc. It is of interest to reveal if the private sector is more advanced than the public sector when it comes to web accessibility.

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