A Review of Municipal Web sites for Accessibility: a Computer-aided Evaluation Approach

Costin Pribeanu[1], Paul Fogarassy-Neszly[2]

[1] National Institute for Research and Development in Informatics – ICI Bucharest,
10, Mareşal Averescu Blvd., Bucharest 011455, Romania,
pribeanu@ici.ro

[2] BAUM Engineering,
8, Str. Traian Moşoiu, Arad 310175, România,
pf@baum.ro

Abstract: Although the access to information for disabled people is a priority at the European level, the web accessibility of public web sites is still a problem. The purpose of this paper is to present a preliminary review of municipal web sites in Romania. We took a computer-aided evaluation approach which is based on semi-automatic accessibility evaluation tool. The analysis of results reveals a relatively low web accessibility of municipal web sites and highlights some interesting aspects. Firstly, the web accessibility score computed by counting the accessibility errors is higher on the homepage than on other pages. Secondly, while some developers ignore many accessibility guidelines, there are several websites where some accessibility guidelines are not well understood.

Keywords: Accessibility, usability, heuristic evaluation, municipal web sites.

1. Introduction

The establishment of the information society in Romania requires granting an equal access to the information technologies for all citizens. Public web sites should address a wider segment of users with specific characteristics and increasing demands (Ivan et al, 2009). According to the ISO 25010 standard, the software product quality model has 8 quality characteristics. Accessibility is a sub characteristic of usability that includes disabilities related to age. 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.

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. Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the web.

Web Content Accessibility Guidelines (WCAG) provide a set of recommendations for making web content more accessible to users with disabilities. It is expected that by following these recommendations the web content will also be made more usable.

In 1999, W3C published the first version of accessibility guidelines (WCAG 1.0). The second version was published in 2008 (WCAG 2.0) and this is the reference recommended for use in accessibility policies. 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).

On 12 June 2006, ministers of 34 member states signed the Riga Ministerial Declaration and decided that all public web sites are accessible by 2010. 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 a recent survey only 5.3% of public web sites comply with the minimum accessibility requirements (MeAC, 2007).

This paper aims to present a preliminary review of municipal web sites in Romania. A sample of 30 municipality web sites was evaluated for accessibility with a semi-automatic accessibility evaluation tool. The evaluation results were then analyzed with respect to WCAG 2 A requirements.

The rest of this paper is organized as follows. In the next section we present existing approaches in web accessibility research and web accessibility situation 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. Web Accessibility

2.1 Approaches in web accessibility research

There are many approaches to improve the web sites accessibility. Abascal et al. (2004) are highlighting some difficulties in using accessibility guidelines that are often updated or changed. Kane et al (2007) 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.

Hackett and Parmanto (2008) show that home page is not enough when evaluating web site accessibility. Takagi et al (2009) are exploring the potential of collaborative evaluation to make web content more accessible by including users in the improvement process. Abou-Zahra and Henry (2010) are taking a universal design approach by arguing that accessibility solutions for people with disabilities are key drivers for innovation since users may benefit from them regardless their abilities.

Leuthold et al (2008) show that despite the fact that WCAG has been around since 1999 and there are corresponding regulations demanding their application, few web sites are accessible. Lazar et al (2004) 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 (2004) 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.

In her study on e-government web sites accessibility in UK, Kuzma (2010) 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 concludes that there is a preponderance of e-government websites that do not meet the legal requirements as regarding web accessibility.

Accessibility research is a relatively new field in Romania. Recent approaches show some concerns for e-inclusion (Osiceanu and Ghioc, 2008), accessibility evaluation (Alecu, 2008), and aspects regarding the accessibility of e-learning technologies (Isailă and Smeureanu, 2010; Pădure, 2009). According to our knowledge, there is only one reported case study of testing a public web site for accessibility with visually impaired users (Lesneanu and Iordache, 2010). In general, there is a low awareness about the importance of accessibility. A recent study of Suduc et al (2010) shows that only 37% of users consider accessibility an important feature of user interfaces usability.

2.2 Web accessibility in Romania

According to statistical data provided by the National Authority for Disabled People (ANPH, 2010), at 31 March 2010 there were 686,798 people with various disabilities from which 120,189 are visually impaired people. People with visual disabilities are the second category of disabled people in Romania, with a weight of 17.50%.

Another category of disabled people who need assistive technologies (screen reader) to read a website are dyslexic people (McCandiliss and Noble, 2003; Czepita and Lodygowska, 2006; Birsh, 2005). It is estimated that dyslexia affects between 5% and 17% of the population.

Although the need for accessible information and communication technologies is widely recognized, there are no clear policies and action plans for making accessible the public web sites content, apart from those stated by the European documents. Therefore there is no current action of monitoring the accessibility of municipal and other public web sites.

2.3 Web accessibility in Europe

Several European countries have already implemented some of the activities stipulated for the member states in the eEurope 2002 and 2005 action plans (e-Europe 2002; e-Europe-2005). The largest part of the European countries used WCAG as a basis for setting up their policies. Nevertheless, there have been different approaches and implementation strategies and also different interpretations of the guidelines recommended by W3C. This already led to fragmentation in the field of Web Accessibility- a problem which Europe is challenged to overcome during the next years.

In Table 1, European countries are ranked according to the average percentage of barriers detected.

Table 1. Countries ranked according to web site accessibility (Olsen, 2008)

	Country	Score
1.	United Kingdom	17%
2.	Sweden	20%
3.	Czech Republic	21%
4.	Netherlands	22%
5.	Denmark	23%
6.	Ireland	24%
7.	Iceland	25%
8.	Germany	26%
9.	Italy	26%
10.	Poland	27%
11.	Norway	27%
12.	EU level sites	28%
13.	Austria	28%
14.	Slovenia	28%
15.	Switzerland	29%
16.	Portugal	30%
17.	France	30%
18.	Cyprus	31%
19.	Belgium	31%
20.	Hungary	32%
21.	Luxembourg	34%
22.	Romania	34%
23.	Spain	35%
24.	Bulgaria	38%

These accessibility barriers are as follow (the most frequents firsts): a) Invalid or deprecated (x)HTML and/or CSS, b) Graphical elements without textual alternative; c) Form elements without labels; d) Links with the same title but different target; e) Mouse required.

3. Web Accessibility of Municipal Web Sites in Romania

3.1 Method and tool

This study is reviewing the municipality web sites for accessibility. The sample consists of first 30 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. Accessibility validation could be performed against WCAG 1.0, WCAG 2.0 or US Section 508. There are three WAI levels to choose from for the WCAG v2 guidelines: A2, AA2 and AAA2. Web pages were evaluated against WCAG 2 A2 guidelines.

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. We selected the web page related to citizen requests and required documents. The evaluation was carried on in September 2010.

There are some limitations of this study. Firstly, the sample size was small since only 30 municipal web sites were evaluated. Secondly, by evaluating only one page apart from the homepage does not provide with a complete overview of accessibility.

3.2 Home page evaluation results

3.2.1 Summary of evaluation results

The accessibility evaluation results are presented in Table 2 where towns were grouped according to the total number of errors (accessibility score).

Table 2. Municipality web sites according to total number of errors

Accessibility score	Number	Percent
No error	3	10.00
1-10 errors	7	23.33
11-20 errors	5	16.67
20-50 errors	5	16.67
50-100 errors	4	13.33
Over 100 errors	6	20.00
Total	30	100.00

Only 3 municipal web sites had no accessibility errors (Suceava, Târgu-Jiu and Bistrița). However, the fact that a third part of web sites

have less than 10 errors (these might be due to recent changes) seems promising from the point of view of web content accessibility.

Overall, 2215 errors were detected from which 2051 (92.60%) are related to 7 error types, as illustrated in Table 3.

The average number of errors per web site was 73.83 (SD 116.63) with a minimum of 0 and a maximum of 459 errors. A more detailed analysis of results reveals interesting aspects regarding the compliance with WCAG v2 A accessibility level.

Table 3. Main types of accessibility errors

Guideline	Number	Percent
Alternate text	449	20.27
Stuttering effect	142	6.41
Link purpose description	124	5.60
Table description	113	5.10
Tags for visual presentation	414	18.69
Unique IDs in the document	499	22.53
Different links with same link text	310	14.10
Other errors	164	7.40
Total	2215	100.00

3.2.2 No Alt attribute for images

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 14.97 (SD 41.70, Min=0, Max=218). 14 web sites (46.67%) had no error whilst 4 (13.33%) had only 1 to 5 errors (might be due to the adding of new images), which suggest that this guideline is well known and respected. At the other side, we found 9 web sites (30%) with 5 to 20 errors and 3 web sites with more than 20 errors.

3.2.3 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 13.80 (SD=22.82, Min=0, Max=80). Many web sites under consideration are respecting this recommendation. 12 of them (40%) had no error and 7 (23.33%) had 1 to 5 errors. Only in 6 cases (20%) we found more than 20 errors, which suggest that this recommendation is not known to the developers of those web sites.

3.2.4 Other WCA2 v2 A errors

Unique IDs in the document

According to WCAG 2.0, IDs must be unique within a document to ensure that Web pages can be interpreted consistently. Although the greatest number of errors was related to this recommendation, the evaluation data shows that in 24 cases (80%) no error was detected while in other 4 web sites (13.33%) only 2 or 3 errors were encountered. Only in two cases we found 79 respectively 411 errors showing that the developers are not aware of this requirement.

Different links with same link text

Different links with the same link text can be confusing to the user. The mean number of errors was 10.33 (SD=19.80, Min=0, Max=82). Most web sites under consideration are respecting this recommendation. 15 of them (50%) had no error and 6 (20 %%) had 1 to 5 errors. Only in 5 cases (16.67%) we found more than 20 errors, which suggest that this recommendation is not known to the developers of those web sites.

Stuttering effect

The "stuttering" effect occurs when the same link text as the 'alt' text of an image within the link. Only one web site had one error (a slip) and another web site 141 errors. This suggests that the developers of this web site are not aware of this recommendation.

Link purpose description

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 4.13 (SD=8.22, Min=0, Max=42). The evaluation data shows that in 13 cases (43.33%) no error was detected while in other 11 web sites (36.67%) only 1 to 5 errors were encountered. Only in one case we found more than 20 errors showing that the developers are not aware of this recommendation.

Table description

WCAG 2.0 requires providing either a <caption>, 'title' or 'summary' attributes to describe the table. Most web sites under consideration are respecting this recommendation. 25 of them (83.33%) had no error and 3 (10%) had less than 20 errors. Only in 2 cases we found 23 respectively 54 errors, which suggests that this recommendation is not known to the developers.

3.2.5 Second web page evaluation results

The accessibility evaluation results for the second web page are presented in Table 4 where towns were grouped according to the accessibility score.

There is no municipal web site without accessibility errors and only two with less than 10 errors. Moreover, the last category is the largest, with 11 web pages (36.67%) having more than 100 errors

Table 4. Municipality web sites according to total number of errors

Accessibility score	Number	%
No error	0	0.00
1-10 errors	2	6.67
11-20 errors	5	16.67
21-50 errors	8	26.67
51-100 errors	4	13.33
Over 100 errors	11	36.67
Total	30	100.00

The results are contrasting with those aforementioned for the home page and show that developers are mainly concerned to provide a good „first impression" on web content accessibility.

A comparison of evaluation results for each web site shows that the three best home pages (no errors) have 91, 114, and 426 errors on the second web page. Also, two of three web sites having only one accessibility error on the home page have 98 respectively 107 errors on the second web page.

Overall, 2496 errors were detected on the second web page from which 2243 (89.86%) are related to 7 error types, as illustrated in Table 5. The cumulated number of errors for the two web pages was 4711, with a mean number of errors of 157.03 (SD 172.85), a minimum of 3, and a maximum of 722 errors.

Except for one guideline (IDs should be unique in the document), the distribution of errors is similar. Most errors are due to following guidelines:

- Tags used purely for visual presentation: 1323 errors (28.08%)

- Lack of alternate text: 1136 errors (24.11%)

Table 5. Main types of accessibility errors: second web page and cumulated

Guideline	Web page	%	Cumu-lated	%
Alternate text	687	27.52	1136	24.11
Stuttering effect	100	4.01	242	5.14
Link purpose description	133	5.33	257	5.46
Table description	132	5.29	245	5.20
Tags for visual presentation	909	36.42	1323	28.08
Unique IDs in the document	8	0.32	507	10.76
Different links with same link text	282	11.30	592	12.57
Other errors	164	7.40	916	19.44
Total	2215	100.00	4711	100.00

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

The cumulated results are revealing a clear orientation of developers towards the accessibility validation of the home page and less interest to perform a thorough validation of each page.

Another aspect that is relevant for both accessibility and usability is the lack of consistence in the web site organization. The

web page with information and forms for making a request is located in different parts of the web site. While some municipalities are providing with a central location where documents and forms could be found, in other web sites these are widespread along the municipalities' directions and offices.

3.3 Impact of accessibility errors on users

Diverse accessibility barriers have a different impact on users. For example, the sites using CAPTCHA codes are inaccessible to users with visual disability or reading difficulties, therefore these peoples will be unable to perform the protected task. For this reason, sites implementing CAPTCHAs may provide an audio version of this in addition to the visual method; unfortunately even on public sites this accessible solution is not implemented.

Another severe accessibility barrier is the mouse requirement. Websites which requires the use of a mouse causes problems for people with severe visual disabilities, but also to peoples with motor impairment who often have challenges with using such devices.

Links with the same title but different target is a rather common error. There is usually a problem that links on web pages are not accurately describing the target pages. For a screen reader user, this situation leads to confusions and in order to solve the situation several trials should be performed; of course, this negatively affects the user's efficiency.

Form elements without labels are accessibility error that seems to occur in more than half of the web pages (Olsen, 2007). For example, if a search button is not correctly labeled, visually impaired persons and dyslexic people will be unable to use the element. This is caused by the fact that screen readers cannot find a meaningful description for this object and the users are unable to see or understand the meaning of the label.

Graphical elements without textual alternative are rather common accessibility errors. Images without alternative text cause challenges for visually impaired persons who are unable to see the pictures. Any information contained in the image is lost for them.

Invalid or deprecated (x) HTML and/or CSS is a very common error. Because the latest versions of these technologies are built with accessibility in mind, this means that assistive technologies can more easily and successfully present the web page content. Nevertheless, advanced and state of art screen readers are in most of cases able to successfully sort out this kind of errors.

4. Conclusion and Future Work

Overall, the evaluation of municipal web sites of main Romanian towns shows that most developers are aware of WCAG 2.0 recommendations. The results are also suggesting that many developers are also aware of the availability of accessibility checking tools and probably used them.

There are two types of errors that are frequently encountered in most web sites: the lack of alternate text for non-text content and the use of tags purely to create visual presentations (instead of using CSS). These issues mainly affect people with visual disabilities.

We intend to carry on a future evaluation after one year with a larger sample. In this way we could measure the progress of web sites already evaluated and better describe the accessibility of municipal web sites.

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