Web Content Accessibility of Municipal Web Sites in Turkey

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Abstract—The accessibility of the public web sites is crucial for the successfulimplementation of the information society. Therefore, it is essential that all citizens must have equal accessible opportunities to all e-government recourses. This research evaluates the accessibility of each of the 30 metropolitan municipal web sites in Turkey by the disabiledpeople based on the Web Content Accessibility Guidelines (WCAG) 2.0 and employing automated testing tool. It identifies the major problem of accessing the website content to those who have hearing, listening, impairments or other physical disabilities. The Intention of this study is to highlight the ignorance of the government and common people towards people with the disabilities. The Slight concern of the developers during the website development can assist these people in their website usage significantly. The Detailed results are presented after comprehensive evaluation of the metropolitan municipal websites against WCAG 2.0. The analysis of the results reveals a relatively low web accessibility of the municipal web sites and highlights several aspects.

Index Terms—accessibility, WCAG 2.0., metropolitan municipal web sites

I. INTRODUCTION

The use of Information and Communication Technologies for the delivery of the publicservices is becoming more and more popular throughout the world. In the last few years, The Turkish municipalities have made great efforts to harness the implementation and the employment of the information technologies. The municipalities' portals have become a significant source of information for the authorities and citizens, within the scope that denominates e-government.

While the proportion of the people with disabilities (visual impairment, hearing impairment, cognitive disability etc.) in the society has been rapidly increasing due to the demographic trends long documented by many researchers, governmental leaders have paid little attention to their needs when planning and implementing the web projects. Therefore, it is essential that all citizens must have equal accessible opportunities to all e-

government recourses. The Web accessibility encompasses all disabilities that affect access to the web, including visual, auditory, physical, speech, cognitive and neurological disabilities. WCAG 2.0 identifies the techniques to create and manage web content (i.e. dynamic and static textual, visual, or audio electronic information) in ways that are more accessible to the people with disabilities–for instance, through assistive technologies like the screen readers. The Websites that are more accessible are also generally more user-friendly to everyone.

Currently, there are a number of guidelines and tools that the web designers and webmasters can use to make their websites accessible to the people with disabilities. Such guidelines include the Web Content Accessibility guidelines (WCAG) developed by the World Wide Web Consortium (W3C), the US government's Section 508 Initiative, Americans with Disabilities Act (ADA), Australians with Disabilities Act and the National Institute on Ageing Guidelines (NIA). The Similar guidelines exist in Canada, UK and Portugal. The most common standards Based website Design and the development are W3C Web Content Accessibility Guidelines 1.0 or 2.0 (WCAG 1.0 or WCAG 2.0). WCAG 2.0 was approved as an ISO/IEC 40500 International accessibility standard in October 2012 [1]. In other words, more countries can formally adopt WCAG 2.0 and many countries are updating their laws to the new version.

An international organization World Wide Web Consortium (W3C) launched the web accessibility initiative (WAI) inorder to improve the web accessibility for the people withdisabilities [2]. For the consortium, web accessibility was defined as "access to the web by everyone, regardless of disability" [3]. The Web accessibility means that the people withdisabilities can perceive, understand, navigate, and interactwith the web. In 1999, W3C published the first version ofthe accessibility guidelines (WCAG 1.0) [4]. The secondversion was published in 2008 (WCAG 2.0), and this is thereference recommended for use in the accessibility policies [5]. There are four key principles that underlie WCAG2.0: perceivable, operable,

understandable, and robust. "Perceivable" means the web contents and user interface modules which must be offered tothe people as obvious objects. "Operable" refers to the user interface modules and navigationcomponents which should be designed in a way that they work properly. "Understandable" is about the design of a website with a friendly version. "Robust" refers to the capacity ofthe website must be interpreted by a variety type of user agents. Each principle is divided intothe success criteria which offer three conformance levels: A, AA, AAA. Three levels of conformance testing were defined as follows: A (lowest), AA, and AAA (highest).

A considerable number of the users of the web have various types of disabilities such as vision, hearing, motor and cognitive impairments [6]. The Studies show that presently most of the government websites are inaccessible for the impaired users [7]. However, more than one billion people in the world are disabled and this number is increasing day by day as the population increases [8], [9]. Turkey has an estimated population of 77.7 million, out of which about 8.5 million are disabled [10]. Although the access to the information for the people with disabilities was stated as a critical, the web accessibility of both the government level and the local government level is a problem.

The accessibility of these web sites, especially by the people with disabilities, has not been evaluated to date. This has motivated me to assess the accessibility of the metropolitan municipal web sites for the people with disabilities employing the automatic testing tools for checking of target websites. The purpose of this study is limited to the accessibility assessment ofthe metropolitan municipal web sites and to find out whether the web based public services are provided in equitable manner to all the citizens.

The rest of the paper is organized in five sections: In Section 2 presents the relevant works. Section 3 describes the adopted methodology to make the complete analysis of selected websites of government. Section 4 presents the results and their detailed description. Section 5 presents limitations, future work and concludes the paper with recommendation.

II. Prior Studies of the Municipality Web Sites Accessibility

A sample of 30 a preliminary review of the municipality websites in Romania was evaluated in 2010 for conformancewith WCAG 2.0 level A requirements (lowestlevel of conformance) [11]. Pribeanu *et al.* [12] presented the results of a secondstudy carried on in 2011 based on a largersample of municipalities. The purpose of thiswork is twofold. Firstly, the larger view on the accessibility of this category of the public web sites will be obtained. Secondly, the progress in the web accessibility / the degree to which the web accessibility is maintained in time will be analysed [12]. The other studies have been carried out to evaluate theconformance of Romanian municipal web sites withWCAG 2.0 accessibility guidelines [13]-[15].

Evans-Cowley [16] presented the results of an evaluation of the level of accessibility of the 100 largest municipalities' websites. The results of this study showed that while a number of cities have accessibility statements, overall compliance with Section 508 is low.

Freire *et al.* [17] presented a metric based on the approach for evaluating the municipalities Web pages using the automatic accessibility evaluation tools. The Results exhibited that much work should be done to improve the accessibility of the Brazilian municipalities'web sites.

Kumar and Sareen [18] examined the relationship between the income levels of the city and the quality ofthe municipal website.

Youngblood and Mackiewicz [19] employed a heuristics-based content analysis to determine the extent to which municipal government websites comply with the basic usability and accessibility best practices. The Authors applied this technique to 129 official websites for Alabama cities. The other studies have been carried out to evaluate the conformance of the American municipal web sites with the usability and accessibility guidelines [20]. Youngblood and Youngblood [21] found that the portal adoption is associated with each of the demographics above and that accessibility has a weak inverse relationship to the per-capita income.

Miranda *et al.* [22] evaluated 84 Europeanmunicipal web sites using a model that focusedon four categories of factors: accessibility, speed, navigability and content to access the quality ofweb pages.

Abdelgawad *et al.* [23] presented a demonstrator simulation model, built employing System Dynamicsmethodology. The model focused on the accessibility of the Norwegian Municipal websites, and was intended to be used as a decision support tool, mainly for the managers responsible for the website development and maintenance.Nietzio *et al.* [24] evaluated the accessibilityof a group of the Norwegian municipalitiesdesiring to improve the accessibility of theirwebsites. The approach undertaken by themin the eGovMon (eGovernment MonitoringProject) national project integrates the benchmarking and related services with the goal at supporting a community of the practice [23].

Kopackova *et al.* [25] focused on the accessibility of locale-government web pages in the Czech Republic. The web pages were analysed both from a citizen's point of view (with disadvantage due to the disability or to the technical equipment) and from the point of view of fulltext search engines.

Shi [26] tried to provide an overview of the accessibility of Chinese local government Web sites. Research results indicated that all the surveyed Chinese e-government Web sites failed one or more W3C's accessibility measures and thus many disabled the Chinese people may have substantial problems to access them.

Sun and Chen [27] tried to find out how accessible they are by means of almost all the examined websites of the provincial and municipal government.

A global evaluation has been carried on by Olsen *et al.* [28] on the national government portalsand the ministry web sites. The most commonlyaccessibility barriers detected are invaliduse of the HTML-standard and missingalternative descriptions for the images.

To some extent, the accessibility research is a new field in Turkey and there is no accessibility data related to the local public web sites. The Accessibility and usability for the disabled people is the main concern in this area [29]-[33]. According to the auhor's knowledge, there is no one reported who had done such kind of case study of testing a public web site for the accessibility with the disabled users.

III. METHODOLOGY

There are several approaches to the accessibility evaluationand, consequently, many accessibility evaluation methods. Brajnik [34] mentioned the following five categories: Conformancereview, subjective assessment, screening techniques, barrier walkthrough, and user testing.This study is reviewing the metropolitan municipality websites for the accessibility. The sample consists of the first 30 Turkish towns ranked upon the population, according to the 2014 census.

The Conformance review is an analytical method based on the standards and/or the guidelines and includes the computer-aided testing with the accessibility checking tools. As such, it depends on the chosen checklist.After the web accessibility evaluation tools are the software programs or online services that are employed to check your website's accessibility level under the web accessibility guidelines. There is a huge number of the accessibility tools for the commercial purposes or freely available on the web such as Watch Fire Bobby, AChecker, Cynthia Says, EvalAccess, Accessibility Valet Demonstrator (WebThing), AccMonitor Online (HiSoftware), Torquemada (WebxTutti), Wave 3.5 (WebAIM) and Tawdis etc. Some good free web-based website accessibility evaluation tools are linked in [35]-[38]. The whole list of the accessibility evaluation tools is in W3C [39]. These tools are very beneficial for the programmers and designers to determine whether or not their sites follow WCAG. During the design, implementation, and maintenance phases of the web development if these tools are employed carefully, it can assist the targeted users to prevent the accessibility barriers, repair the encountered barriersand improve the overall quality of the web sites [40]. This study will employeTAW automatic evaluation toolwhich is considered as the web accessibility test tool which is capable of providing the complete analysis of the website accessibility and have been the pioneers and are the most well-known, due to their usability, the ease of use and its quick results. TAW is a limited online free service to check the web accessibility against WCAG 1.0 and 2.0 [41]. In this study, the sampled the web pages were evaluated against WCAG 2.0 guidelines (conformance level A).The home page of each one of the websites has been analysed from the accessibility point of view. The home page of a website is the first contact a

user has with the website. If the home page displays problems or is not accessible, it would be very difficult that a disabled user can access other pages of the website. Therefore, it is essential to ensure the accessibility of the home page of a website. All the tests of a web page were conducted during the same day in order to avoid alterations in its content. The evaluation was conducted in December 2014-January 2015.

IV. RESULTS

Thirty metropolitan municipalities were evaluated for compliance with the WCAG 2.0 accessibility criteria. Fig. 1 illustrates the overall violation results per guideline for each principle. Due to the lack of space, the author cannot include the whole outcomes of the web accessibility analysis. Therefore, Fig. 3 summarizes the number of the problems detected with the automatic evaluation tools and some information has to be discarded. Unfortunately, the home pages of all the websites have the accessibility issues. The study targeted the metropolitan municipality web sites and revealed several accessibility problems: graphical items that are not accessible to the screen readers, difficult navigation due to the lack of empty links, the lack of text alternatives for the graphical elements, the lack of textual description.
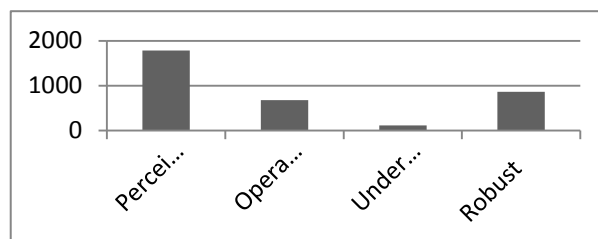

Figure 1.   Overall violation of accessibility guidelines for each principle.

In general, the worst results regarding the web accessibility were obtained with the websites of Konya metropolitan municipality, Antalya metropolitan municipality and GaziAntep metropolitan municipality. On the other side, the best results were obtained with the websites of Van metropolitan municipality, Şanlı Urfa metropolitan municipality and Muğla metropolitan municipality. Overall, 3440 WCAG 2 errors were detected on the home pages with a minimum of 4 (one metropolitan municipality) and a maximum of 275 errors (See Fig. 2).
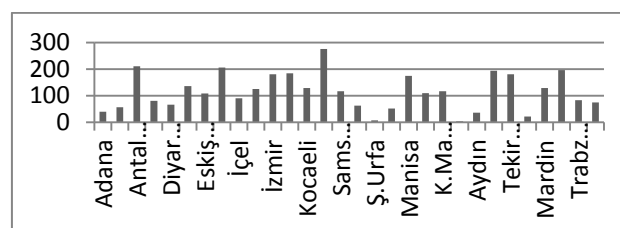

Figure 2.   Overall violation of accessibility guidelines for each metropolitan municipality.

A more detailed analysis of results reveals several aspects regarding the conformance to WCAG 2.0 accessibility level A. In Fig. 3 a grouping of web sites following the WCAG 2.0 principle and the error type is presented. In the following section each accessibility principle is analysed and described in depth.
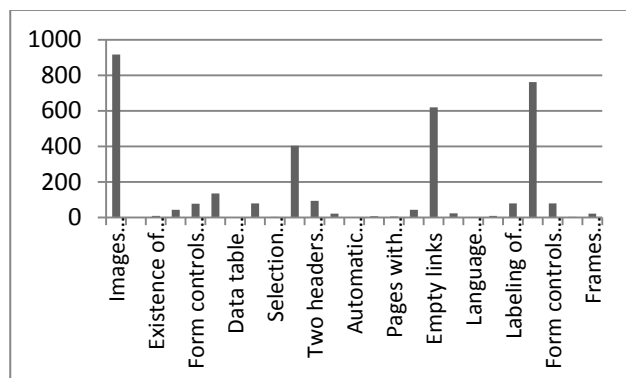

Figure 3.   Main types of accessibility errors.

A.   *Principle 1: Perceivable*

The perceivable accessibility principle is the highest violated principle across all metropolitan municipalities. Most errors are related to the first WCAG 2.0principle (perceivable) 52% with a minimum of 1 (one metropolitan municipality) and a maximum of 154 errors. From these, two error types are more frequent: the lack of text alternatives for the nontextcontent (26.62% from total) and the use of labels to modify the presentation (11.71% from total). These two error types account for 38.33% the total number of errors.

The highest violated success criteria in this guideline are the thelack of text alternatives for non-text content. The purpose of alt attribute is to read the text associated with an image that serves the same purpose and conveys the same essential information as the image. It is read out loud by the screen readers for those with visual impairment.

Two home pages had no error. 17 home pages had 1-20 errors. At the other side, 4 web sites with 21-50 errors and 7 web sites with more than 50 errors.

B.   *Principle 2: Operable*

In regard to the operable accessibility principle, this is concerned with ensuring the operability of User interface components and navigation. Other frequent accessibility errors that are relatedto the perception are: consecutive text and image links to the same resource (3.92%), two headers of the same level with no content in between 2.73%, form controls without associated label 2.29% and form controls without label 2.26%.

Regarding the second WCAG 2.0 principle (operable), the total number of errors is 676(19.65% from total). Two error types are more frequent: empty links (18%) and image maps without alternative (1.25%).

The highest violated success criteria in this guideline are the theempty links. This failure condition occurs when a link contains only a non-text content, such as an image, and the non-text content has been implemented in

a way that it can be ignored by the assistive technology. Since there is no text content within the link to be used as the name, assistive technology employs a variety of the repair techniques to find some name to use for the link. The Conclusion is that the most accessible link is the one that contains the link text.

Five home pages had no error. 14 home pages had 1-20 errors. At the other side, 7 web sites with 21-50 errors and 4 web sites with more than 50 errors.

C.   *Principle 3: Understandable*

In regard to the understandable principle; this sets guidelines to ensure that information and the operation of user interface are understandable. Regarding the third WCAG 2.0 principle (Understandable), the total number of the errors is 113(3.28% from total). Two error types are more frequent: Labeling of form controls (2.29%) and the declaration of language of the document (0.67%).

The highest violated success criteria in this guideline is the providing labels for form controls, or usage the attribute 'title' to indicate the control functionality.

The second highest neglected criterion is the language of page, where every web page is required to have a correct language declaration, this criterion is very important for screen readers. For example, if German is not indicated for a German-language website, the screen reader will read the site in English.

D.   *Principle 4: Robust*

The robust accessibility principle is the second highest violated principle across all metropolitan municipalities. The last WCAG 2.0 principle (robust) account for a total of 867 errors (25.20%) respectively the web page well-formedness 762 errors are more frequent (22.15%). Two error types are more frequent: Form controls without label (2.29%) and frames without title (0.64%).

The objective of this technique is to avoid the ambiguities in the web pages that often result from the code that does not validate against the formal specifications.

Only one home page had no error. 15 home pages had 1-20 errors. At the other side, 8 web sites with 21-50 errors and 6 web sites with more than 50 errors.

The highest violated success criteria in this guideline are the theuse of labels to modify the presentation. The objective of this technique is to facilitate the interaction of the assistive technology with the content via separating the content's structural encoding logically from the presentational encoding. The Structural encoding is the indication of the elements such as headings, paragraphs, lists, tables, etc., and is done through using the technology features reserved for the purpose.

Sixteen home pages had no error. 8 home pages had 1-20 errors. At the other side, 3 web sites with 21-50 errors and 3 web sites with more than 50 errors.

V.   CONCLUSION

This paper endeavors to discover the significance of the website content accessibility focusing the disabled

people. The study further investigates that most of the metropolitan municipality web sites of Turkey are failed to follow W3C WCAG 2.0 guidelines. There are two types of errors that are frequentlyencountered in most web sites: the lack ofalternate text for non-text content and the useof tags purely to create the visual presentations (instead of using CSS). These issues mainly affect the people with visual disabilities. This can cause an accessibility barrier to the screen reader users.This paper is also an eye opening study for all the website developers which will hopefully assist them to identify the key problems of the website accessibility that should be taken into account during development.

Like any other study of this kind, the analysis presented above suffers from number limitations. The first limitation is related to the exclusive reliance of our accessibility analysis on the automated testing results. TheWeb accessibility evaluation tools and expert inspections cannot substitute user testing, because the difficulties of comprehending all the interactions between the web content and the assistive technology. Vigo and Brajnik [42] mentioned the automated accessibility evaluation has several inherent limitations [42], [43].

Hackett and Parmento [44] another limitation is the restriction of our automated accessibility testing on the home page of each tested website. Hackett and Parmantoindicate that home page is not enough when evaluating the web site accessibility.

Moreover, researcher mainly focused on the conformance with WCAG 2.0 without using all features provided by the tool, such as: parsing errors, HTML errors, CSS errors, Browser compatibility, HTML 5 and ARIA usage and broken link errors. Second, the sample size is small since only 30 metropolitan municipal web sites were evaluated. Turkey has 1397 municipalities nevertheless in this study, 30 metropolitan municipal web sites were evaluated. However, some degrees of the representativeness exist since these municipalities have a total population of 58.999.801million people (77%).

Throughout the whole investigation to determine the conformance level of the accessibility, the researcher adopted the TAW evaluation tool which was open source application. However, which is widely used and to ensure the scalability of the result researcher followed W3C Evaluating Accessibility (W3C, 2014). Although the commercial tools (e.g. Bobby) are not freely available and expensive, I will try to apply both the commercial evaluation tools and also open source and commercial assistive Technologies (NVDA, JAWS, etc) them in my next study. In addition to, in order to obtain more conclusive results, I plan to compare the results across countries and across different municipal websites. Finally, another future work I plan to address is to detect the most common problems that recur in the same site and between different sites. And also, I intend to carry on a future evaluation after one year with a larger sample as a second evaluation. In this way I could measure the progress of the web sites already evaluated and better describe the accessibility of the municipal websites.

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