The Accessibility of Moroccan Public Websites: Evaluation of Three e-Government Websites

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Abstract: Enabling people with disabilities to perceive, understand, navigate, contribute, create content and interact with the Web is the purpose of Web accessibility. The present research aims to evaluate the accessibility of three Moroccan e-government websites to people with disabilities. To achieve the realization of this research, we opted for the method AccessiWeb and we analyzed, following this methodology, four to seven pages in each website. The evaluation results show the presence of several problems of accessibility in each of the three websites. Some accessibility problems, found in the three websites, are relating to level A criteria, other to level AA criteria, while the rest is relating to level AAA criteria. The presence of level A criteria that are not respected, in the three websites, makes us conclude that the three evaluated websites don't meet the minimum level of accessibility. To reach the minimum level of accessibility, recommended by the W3C, all problems relating to level A and level AA criteria should be corrected. Various measures should be then taken to make the content of these websites perceivable, operable, understandable by users and robust. Thus, to make the content perceivable by users, the necessary measures to be taken can be summarized as follows : provide text equivalents for non-textual items, increase the contrast ratio, make time-based media clearly identifiable, provide summaries and titles for tables, make all links explicit, indicate changes of reading direction in the source code, organize the content by the use of titles, use CSS, associate form fields with relevant labels, offer accessible versions to documents for download and make it possible for users to control flashing contents. To make the content presented within the three websites operable, it is necessary to : make the control of time-based media and no time-based media possible by the keyboard, give pertinent titles for links and web pages, make explicit links that open in a new window, add links that help to bypass the blocks of content and the groups of links, provide information about the documents for download, ensure that navigation does not contain keyboard traps and that the sitemap page shows the general architecture of the website. Concerning the third principle, which consists on making the content understandable by users, context changes should be initiated by explicit buttons, language changes should be indicated in the source code, the labels associated with form fields should be appended with their fields, the indication of mandatory fields should be visible and the input control should be accompanied by suggestions that facilitate the correction of errors. Finally, the respect of the last principle, relating to robust content, requires to provide for each framework used a relevant title, to provide equivalent alternatives, working without Java, for scripts, to correct errors that exist in the source code, to make all media compatible with assistive technologies, to define the type of each document, to make sure that hidden texts are correctly rendered by assistive technologies and to provide an appropriate title for each form button.

Keywords: Web accessibility, e-government websites, Moroccan websites, Moroccan e-government, persons with disability, Web accessibility evaluation, AccessiWeb method, Web accessibility evaluation methodologies, Web accessibility evaluation tools

1 Introduction

Access to information is a universal right recognized by all international human rights conventions. In this regard, The Moroccan Ministry of Industry, Trade and New Technologies (2009) has launched the strategy "Maroc Numeric 2013"to modernize public administration in order to serve citizens and ensure easy and rapid access to knowledge and information.

However, among the projects of this strategy, they are some projects that are not fully accessible to a large number of citizens, including persons with disabilities. In addition to that, only few Moroccan e-government websites adopt international accessibility guidelines, as is the case of the Ministry of Health and the Ministry of Social Development's websites.

But the question that arises is whether these websites really meet all the criteria of international accessibility guidelines, and whether they don't contain accessibility barriers, thing which leads us to ask also about the measures that should be taken to solve existing problems in order to ensure equal access for all.

To answer these questions, we present, in the first part of this article, the contextual, theoretical and methodological framework of our research. Concerning the second part, it includes the results of the accessibility evaluation of three Moroccan e-government websites as well as the solutions that we propose to solve accessibility problems present in each of these three websites.

2 Context of The Research : E-Government in Morocco

To ensure the transformation of the country into an information society, Morocco has taken important initiatives to achieve this goal. The projects undertaken form part of the National Strategy for Information Society and Digital Economy (Maroc Numeric 2013) which aims to integrate information technologies into all the actors of Moroccan society (government, public administrations, companies and citizens).

Concerning citizens, the global vision of the strategy aims, on the one hand, to create online public services for citizens through e-government projects, and on the other hand, to encourage the integration of information technologies in citizens' lives and to accelerate also the process of democratization of Internet access at homes.

Several online public services have been created to bring government closer to citizens' needs, which has allowed the progression of the country in terms of e-government. Thus, we find that Morocco was ranked in 140th place in terms of e-government, in 2008, according to the United Nations (2008). In 2010, this ranking improved from the 140th place to the 126th place. Currently, Morocco is ranked in 120th place, according to the United Nations (2012) E-Government Survey 2012.

Certainly, Morocco progresses in terms of e-government. However, some other Arab countries have achieved greater results compared to Morocco, as is the case of Egypt (107th place) and Tunisia (103th place).

Moreover, despite the large number of e-services created by e-government program, only few take into consideration accessibility guidelines and recommendations to make their services accessible to all citizens, including persons with disabilities that represent, according to the Moroccan Secretary of State in charge of Family (2005) , almost 5.12% of the population (about 1,530,000 persons).

3 Theoretical Framework of the Research

The creation of online public services makes the administration closer to the needs of persons with disabilities and facilitates their integration in society. However, the use of these e-services is conditioned by the respect of a number of accessibility criteria by the websites that offer this kind of services.

3.1 Disability in the Digital Age

People with disabilities represent an important and growing category in our society. This category faces, in fact, several difficulties and challenges, which begin from physical inaccessibility to Web inaccessibility.

3.1.1 Definition and classification of disability

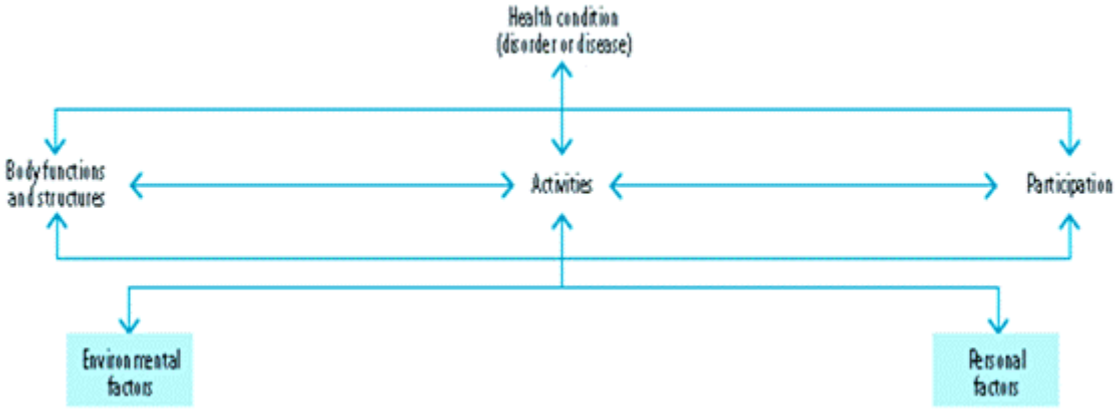
In Morocco, according to the law n ° 07-92, relating to the social protection of people with disabilities, a person with disability is " *toute personne se trouvant dans un état d'incapacité ou de gêne permanent ou occasionnel résultant d'une déficience ou d'une inaptitude l'empêchant d'accomplir ses fonctions vitales, sans distinction entre handicapés de naissance et ceux qui souffrent d'un handicap acquis* " (Morocco, Chamber of Representatives, 1993, p.559). In order to define disability, the Moroccan legislator has been inspired from the old definition of the World Health Organization (WHO) (INSERM, 1993), which takes into consideration the three following situations:

- Deficiency: loss or dysfunction of any part of the body ;
- Incapacity: difficulty or inability to perform daily activities, which results from one or several deficiencies ;
- Disadvantage: social problems resulting from a deficiency or an incapacity.

In 2002, the World Health Assembly adopted a new classification that replaces the International Classification of Disability (ICD) dating back to 1980. The new classification (the International Classification of Functioning, Disability and Health, ICF) defines disability taking into account the four following levels (WHO, 2001) :

- Body functions: physiological functions of body systems;
- Body structures: anatomical parts of the body;
- Activities and participation: execution of tasks and involvement in real-life situations;
- Environmental factors: physical, social and attitudinal environment in which people live.

In this new classification, disability is no longer considered simply as the consequence of a pathological condition, but it is rather considered as the result of a process that represents the interaction of many dimensions : body functions and structures, daily activities and social participation, environmental factors and personal ones (age, gender, motivation, etc..). The Figure 1 shows the interaction between these different factors.



Source : World report on disability 2011, WHO, p.5

Figure 1 : Representation of the International Classification of Functioning, Disability and Health (ICF)

Contrary to the ICD, the ICF takes into account the impact of the environment on people functionalities, considering the environment as a facilitator or an obstacle to the achievement of daily activities and social participation.

Considering this multidimensional approach, the National Disability Survey, conducted in Morocco in 2004, has adopted a new definition, which recognizes the responsibility of several factors in creating disability situations, especially environmental factors (Morocco, Secretary of State in charge of Family, Children and Persons with Disabilities, 2005, p.4) : discrimination, inaccessibility, exclusion from social life, etc.

The United Nations (UN) Convention relating to the Rights of People with Disabilities (UN, 2006), ratified by Morocco in 2008, focuses also on the impact of environmental factors on daily activities and social participation.

From that and as a conclusion, we can say that the integration of people with disabilities in our society must first pass by the adaptation of the environment (buildings, social rules, government services, laws, etc.) to enable this category to fully and actively participate, on equal terms with others, in all social life aspects.

3.1.2 Data on disability in the world

According to the World Report on Disability (WHO, 2011), published on 9 June 2011, by the WHO and the World Bank, people with disabilities represent more than one billion people (about 15% of world population). Concerning the World Health Survey, it estimates that approximately 785 million people (15.6%) aged 15 and over are living with a disability, and that 110 million people (2.2%) live with very high functional difficulties.

In fact, the number of people with disabilities is increasing. According to the report (WHO, 2011), this situation is the result of two main factors : the aging of the population and the rapid spread of chronic diseases associated with disabilities, which include diabetes, cardiovascular diseases or mental illness. Furthermore, the report estimates that, in countries where the incomes are low, these diseases are responsible for 66.5% of all the years lived with a disability.

In general, people with disabilities live in a poor state of health compared to other people. The report (World Health Organization, 2011) highlights also that poverty rates among this category are high while the educational level attained remains very low.

3.1.3 Data on disability in Morocco

In 2004, the State's Secretariat of Family, Children and Persons with Disabilities conducted a national survey on disability in Morocco. This study was financed by the State's Secretariat and the European Union within the MEDA program (A development program of the European Union for implementing cooperative measures to help south Mediterranean countries).

According to the survey (Morocco, Secretary of State in charge of Family, Children and Persons with Disabilities, 2005), people with disabilities represent, in Morocco, about 5, 12% of the population (1,530,000 people), 54.4% of them have several deficiencies, while 45.6% have just one deficiency. The most frequent deficiencies, according to the study, are motor impairments (51.9%). In second place come visceral or metabolic impairments (cardiovascular diseases, diabetes ...), which represent 31.8%. In third place, we find visual deficiencies (28.8%), followed by speech and language deficiencies (25.8%). For mental disabilities, they represent 23%, hearing impairments 14.3% and aesthetic deficiencies 4.7%.

The causes of these deficiencies are multiple : 38.4% are acquired (the result of some diseases), 24.4% are related to accidental causes, 22.8% to hereditary, congenital and perinatal causes, while 14.4% are related to aging (Morocco, Secretary of State in charge of Family, 2005, p.11).

In fact, in Morocco (Morocco, Secretary of State in charge of Family, 2005, p.16 & 18), the majority of people with disabilities are at the age of activity (56.4%). Those aged 60 years or older represent 28.1%, while children under 16 years constitute 15.5%. According to the survey, the school attendance rate of these children is almost three times lower than the other children (just 32% go to school).

The survey (Morocco, Secretary of State in charge of Family, 2005, p. 8 & 17) estimates also that only about 12% of people with disabilities are affiliated to the National Fund of Social Security, to an insurance or a mutual fund. The membership rate to the associations that operate in the field of disability remains also quite low, and only 14% of adults with disabilities and parents of disabled children (7%) are members in this type of associations.

Finally, the majority of people with disabilities (61.1%) consider that the beliefs and the perceptions of the environment (entourage) represent an obstacle to their social integration. The majority also declares, according to the survey (Morocco, Secretary of State in charge of Family, 2005, p.7-8), that they are incapable of working (74%) and participating in educational or training activities (76%). The primary need for the most part consists on having a better access to health care (55.3%) and getting financial aid (52.5%), because the majority of them live in poverty.

3.1.4 Computer use and people with disabilities

The considerable progress in the field of new technologies has provided solutions to many disabled people, enabling them to be more independent in their daily lives. These technologies include assistive devices or technical aids.

The concept of technical aids includes (ENJALBERT, M. et al., 2002) all the tools that reduce, or compensate disabilities and that help disabled people to carry out their daily life activities, such as personal care and protection, mobility, household activities, communication, information, entertainment, etc. and there are many technical aids that permit an autonomous access to computers for people with disabilities.

In fact, the computer has become the everyday companion of a large number of blind and partially-sighted people, and that through multiple technical aids that facilitate their access to computers. These aids include (Ligue Braille, 2011):

- The screen reader: it vocalizes the displayed information using speech synthesis. It can also display the information on a Braille display device;
- The Braille display: a device for displaying information in Braille;
- The embosser: a device for printing the documents in Braille;
- The large screen: a monitor with a higher dimension;
- The magnification software: for zooming the displayed information;
- The character recognition scanner (OCR) : used by the visually impaired to read printed materials;
- The note-takers, also called Braille notebook : help them to take notes, consult data, edit and save them on the computer;
- Etc.

For people with motor disabilities, the technical aid tools used include (Microsoft, 2012):

- The visual keyboard: to use the mouse instead of the standard keyboard;
- The alternative keyboard: a keyboard with a larger or smaller size than the standard keyboard;
- The electronic pointing devices: to manipulate the mouse without using the hand (respond to infrared rays, eye movements, etc.);
- Breath sensor: activated by the inhalation and the exhalation;
- Pencils and pins: to use the keyboard with the head, the mouth or the chin;
- The handheld game controllers: used to control the cursor;
- The tactile screens: to point directly on the screen without using the keyboard or the mouse;
- Etc.

Concerning hearing impaired people, they can easily use the computer without needing any technical aid, while that remains much more difficult for people with intellectual disabilities. In fact, there is no specific technical aid that facilitates the use of the computer for this category, because that, particularly, depends on the mental capacity of each and to their control level over this tool.

3.1.5 Internet use and people with disabilities

The use of Internet represents a veritable revolution for people with disabilities. This revolution has been made possible with the apparition of the technical aids and the navigation tools, which facilitate for them the consultation of the different web pages.

In fact, the Web represents, for blind and partially-sighted people, a wealth of information and knowledge that is much richer than Braille or audio files. The Web also enable people with disabilities to have access to public e-services, to communicate and exchange through social networks, to purchase from e-commerce sites and get home delivery, etc.

However, the use of Internet by this category is still limited and faces a certain number of difficulties and obstacles, which depend, in particular, on the websites' conception and design and on the accessibility barriers that exist in the majority of these websites.

3.1.6 Disability and navigation tools

Using a standard browser such as Internet Explorer, Firefox, etc., hearing impaired people can easily use Internet to view the different websites, while people with motor disabilities could need assistive technologies to use this type of browsers. For blind and partially-sighted people, web browsing is also possible using either a

standard browser (complemented by a screen reader or a magnification software) or through the use of a specific browser as BrailleSurf, Home Page Reader, PbWebSpeak, etc (BrailleNet Association, 2011).

Access software like DraculaWin, JAWS for Windows, ZoomText, etc. can enlarge the displayed text or interface browsers running on Windows with Braille terminals and reading systems. Concerning the specific browsers, they can directly manage Braille and vocal inputs/outputs or adapt the displayed information to the screen. They can also combine these different possibilities.

Even using these tools, the perception of the displayed content stays partial, because with a screen reader the perceived content is sequential (by word, sentence or paragraph). It can also be based on the HTML structure of the documents (HyperText Markup Language). For magnification software (Carpanini, P. and Coudert, C., 2011), the displayed information is collected fractionally. It results from this fragmentation a significant mental burden, which can be reduced if the web pages are designed in a clear and logical manner. The ergonomic design of the websites represents also an important element that facilitates the navigation of disabled people, especially for those with intellectual disabilities.

3.1.7 Disability and navigation difficulties

The majority of the websites are not adapted to the assistive technologies used by people with disabilities, and multiple barriers prevent thus millions of people to use the Web. Among these accessibility barriers, we find :

- The absence of alternative text for images. For example, when the image of a graphic link has no alt attribute, the screen reader reads the Url (Uniform Resource Locator) of the picture. This URL that can be "images/img1.jpg", for example, has no meaning for blind users. In this case, adding simply an alt attribute provides an alternative text for the image, which appears on the screen ;
- The presence of some information given only by color and also the poor contrast ratio between text color and the color of the background ;
- The absence of text transcripts and interpretations in sign language for multimedia files ;
- The incompatibility of some media and scripts with assistive technologies ;
- The absence of titles for the links, frames and data tables ;
- The difficulty to navigate using the keyboard ;
- The absence of readable and comprehensible content for visually and intellectually impaired people to understand the displayed information in its globality ;
- Etc.

Actually, these accessibility barriers represent just a part of the challenges that face persons with disabilities to be able to navigate and view the various websites. Whence comes the need to ensure the accessibility of the web to provide this category the opportunity to benefit from all published content.

3.2 Web Accessibility

The concept of web accessibility appeared with the emergence of the new technologies of information and communication, more specifically with the Internet. For Tim Berners-Lee, W3C Director and inventor of the World Wide Web, the aim of web accessibility is to make the web and its services available to all individuals, regardless of their equipment or software, network infrastructure, native language, culture, geographical location, physical or mental abilities (Carpanini, P. and Coudert, C., 2011). *I*n other words, web accessibility means that "*people with disabilities can use the web. More specifically, web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the web, and that th ey can contribute to the web. Web accessibility benefits others, including older people with changing abilities due to aging* " (W3C, 2005).

3.3 Importance of Web Accessibility

Web accessibility ensures equal chances and encourages the integration of persons with disabilities in society by enabling them to participate more actively in different activities (social, civic, etc.) and benefit also from multiple services available online (public, commercial, etc.).

It ensures equal access for all, but it also contributes to the general quality of services, to their ergonomics and their ease of use. Therefore, it benefits all by giving a better visibility of contents and a more logical and functional organization for the information presented in the different web pages.

The principle of flexibility benefits also the different users, including older people and those with a low bandwidth connection or a temporary incapacity, such as a broken arm for example (World Wide Web Consortium, 2005). In addition to that, the use of style sheets (CSS) to separate the content from the presentation helps to save time and money and reduces considerably the volume of documents.

In many countries, compliance with accessibility criteria is no longer a choice, but an obligation required by laws that are established to ensure the conformity of websites' content, especially public websites, to national and international accessibility standards and guidelines.

3.3.1 Legal framework of web accessibility

The respect of WAI's guidelines (Web Accessibility Initiative) ensures the accessibility of the different websites. For that, many countries, especially in Europe and North America, have developed their own standards on the basis of WAI's guidelines. They have also established laws obliging websites, especially public, to respect national and international web accessibility standards. The table n°1 shows the national laws relating to web accessibility at the European level (WAB Cluster, 2005).

Table 1: National legislations relating to web accessibility in Europe

Countries	Law on Web accessibility	Public Web sites	Indirect WCAG reference	"National" label	Sanctions
Austria	Yes	Yes	Yes	-	-
Belgium	-	Yes	Yes	Yes	Minor
Denmark	-	Not Applicable	-	-	-
France	Yes	Yes	Yes	Yes	Yes (to be defined)
Germany	Yes	Yes	Yes	-	Yes
Greece	-	Not Applicable	-	-	-
Ireland	Yes	Yes	-	-	Yes
Italy	Yes	Yes	Yes	Yes	Yes
Luxembourg	-	Yes	Yes	-	-
Netherlands	-	Not Applicable	Yes	Yes	-
Portugal	Yes	Yes	Yes	-	-
Spain	Yes	Yes	Yes	-	-
Sweden	Yes	Yes	Yes	-	-
United Kingdom	Yes	Yes	Yes	-	Yes

Source : National policies about Web accessibility, WAB Cluster D-WAB 2.8 deliverable, 2005

For the United States, the Rehabilitation Act of 1973 was amended by Section 508 (Section508.Gov, 1998). This amendment, adopted in 1998 by the US Congress, defines the obligations required for the accessibility of electronic technologies and information developed, obtained, maintained or used by federal agencies for persons with disabilities. This section is applied to federal structures, but its implementation has led to a generalization of the application of its rules to the level of states, regions and cities.

in October 2010, President Barack Obama signed a new law. This law (United States of America, 2010) amends the ADA (Americans with Disabilities Act) which prohibits discrimination against people with disabilities. According to the new Act (The 21st Century Communications and Video Accessibility Act), designers of hardware, software and services must take into account the access to web contents, through users' interfaces, by sight impaired and partially sighted.

For Canada, the institutions under the Financial Administration Act, are obliged to follow the guidelines of websites' standardization that have been approved by the ministers of the Treasury Board of Canada and which refer explicitly to W3C's guidelines (priority 1 and 2). A program for evaluating the accessibility of websites: WATS (Web Accessibility Testing Service) has also been established by the Canadian federal Government (Afchain, A and Lanceraux, J., 2004).

3.3.2 Web accessibility evaluation

In order to ensure the harmonization of the methods that are used to evaluate websites' accessibility, several organizations are working together to develop unified evaluation methodologies. Thus, several methods have been developed to allow the evaluation of accessibility and compliance with WAI's guidelines. Among these methods we find the Unified Web Evaluation Methodology UWEM (WAB Cluster, 2007) and the method AccessiWeb (Braille Net Association, 2009) created in 2003 by BrailleNet Association.

Compared to the other web accessibility evaluation methods, AccessiWeb represents a more simplified method to verify compliance with all the criteria of the latest guidelines, namely WCAG 2.0 (Web Content Accessibility Guidelines). While we find that the Unified Web Evaluation Methodology is elaborated to comply with WCAG 1.0 and not WCAG 2.0. In addition to that, this European methodology allows verifying compliance with just the criteria of the first two levels (A and AA).

In 2004, AccessiWeb repository (version 1.0) was adopted by the French administration as a reference document for compliance of online communication websites with the international recommendations of accessibility.

After the publication of the latest recommendations of WAI (WCAG 2.0), BrailleNet Association has set up a francophone committee to translate these guidelines which is, indeed, the first French translation officially validated by the W3C (2009).

The latest version of AccessiWeb repository (version 2.1) aims :

- To allow an operational understanding of WCAG 2.0 ;
- To allow verifying conformity to WCAG 2.0 ;
- To ensure coherence with RGAA 2.2 (France, DGME, 2009) General Repository of Accessibility in Administrations ;
- To provide a method for the certification of conformity.

The evaluation of websites accessibility can be done using a certain number of manual and automated tools.

3.3.3 Web accessibility evaluation tools

They are many tools that facilitate the evaluation of websites accessibility, and which include automated and manual tools.

Concerning automated tools (W3C, 2006), this kind of tools accelerates the evaluation process to quickly find many accessibility problems in the evaluated webpages. The use of these tools is therefore useful to have a quick and rough idea on the accessibility of a website. But they present, however, several limitations because they cannot detect reliably all existing barriers. Whence comes the need for a manual evaluation performed by an expert to complete the automated evaluation (Braille Net, 2011). Especially that many automated evaluation tools generate reports indicating where are the barriers that should be evaluated manually.

For manual tools, they are generally toolbars integrated into web browsers and which contain several functions that facilitate the verification of webpages source code and style sheets (CSS). The table n°2 presents web accessibility toolbars for certain browsers (Internet Explorer, Opera and Firefox):

Table 2: Web Accessibility Toolbars

Tools	Guidelines	Language	Description
Web Accessibility Toolbar for Internet Explorer (version 1.2)	WCAG 1.0 Section 508 BITV	Chinese Danish Dutch English French German Italian Japanese Korean Spanish	Web Accessibility Toolbar is a free tool developed to facilitate manual evaluation of web pages accessibility by a human expert.
Web Accessibility Toolbar pour Opera (version 1.1)	WCAG 1.0 Section 508	English	Web Accessibility Toolbar for Opera facilitates manual evaluation of web pages accessibility with Opera browser.
Web Developer Extension (version 1.0.2) for Mozilla/Firefox	WCAG 1.0 Section 508	English	Web Developer extension adds a menu and a toolbar to Firefox browser to evaluate manually web pages accessibility.

Source : Complete List of Web Accessibility Evaluation Tools, W3C, 2011.

The majority of these toolbars allow web accessibility evaluation with respect to the previous version of WAI's guidelines (WCAG 1.0). For that, it is necessary to analyze manually the source code to verify all WCAG 2.0 criteria and complete the evaluation.

4 Methodological Approach

Our research is articulated around three objectives: to detect accessibility barriers in the three evaluated websites, to determine their level of accessibility and conformity with Web Accessibility Initiative Guidelines (WCAG 2.0), and to determine finally the necessary measures that should be taken to repair existing accessibility problems.

4.1 Methods and instruments of research

The chosen method to conduct the evaluation, object of this work, is AccessiWeb method created by BrailleNet association. This method presents a clear approach and applicable methods to detect accessibility problems existing in each website and verify step-by-step the conformity to the latest version of Web Accessibility Initiative Guidelines (WCAG 2.0).

Thus, for the realization of this research and in order to achieve the first objective, which is to identify existing accessibility barriers, we conducted the evaluation of each website using an evaluation grid established on the basis of AccessiWeb 2.1 criteria. These criteria concern essentially:

1. The presence of alternative texts for images;
2. The presence of titles for frames (frames / iframes);
3. The appropriate use of color;
4. The presence of text transcripts for media;
5. The presence of titles and summaries for tables;
6. The presence of explicit titles for links;

7. The control and the presence of alternatives for scripts;
8. The presence of mandatory elements (page title, document type, default language, etc.);
9. The structure of information;
10. The use of style sheets (CSS);
11. The appropriate use of forms;
12. The ease of navigation;
13. The ease of consultation and the accessibility of downloadable documents.

The adopted grid is structured in thirteen themes : images, frames, colors, multimedia, tables, links, scripts, mandatory elements, structure of information, presentation of information, forms, web pages consultation and navigation.

Each theme of the grid includes a number of criteria. Checking each criterion requires the realization of several tests in each web page. Thus, to check the 133 criteria of the grid we realized 305 tests in each web page.

The tests performed in each web page are well detailed in the methodology AccessiWeb (Braille Net Association, 2009). In this study, all of these tests (305 tests) were performed manually, criterion by criterion, using the following tools :

- Web browsers (Firefox and Internet Explorer) ;
- Toolbars (Web Accessibility Toolbar for Internet Explorer and Firefox Web Developer Extension) ;
- Automated evaluation tools (adesigner, Colour Contrast Analyser and W3C Markup Validation Service).

To achieve the second objective and determine the level of accessibility and conformity of evaluated websites to WCAG 2.0 guidelines, we've used a correspondence table (Braille Net Association, 2009) between AccessiWeb 2.1 criteria (already checked) and the success criteria of WCAG 2.0. This analysis has allowed us to identify the guidelines that are not respected in each website as well as the level of accessibility and conformity of these websites to WCAG 2.0.

To realize the third objective, and in the light of the results obtained from the two previous steps, we have presented the measures that should be taken, in each website, in order to solve existing accessibility problems and make thus the content of the three websites perceivable, operable, understandable and sufficiently robust.

5 Definition of the Population of Study

The e-government program includes three types of websites: websites for administrations, websites for companies and websites for citizens. The websites evaluated in the context of this study are part of the third category, which includes the websites that present online services for citizens.

The three evaluated websites are : the website of the Ministry of Health, the Ministry of Social Development website and the website of the CNOPS (National Fund of the Social Provident Bodies).

5.1 Sampling

The evaluation is based on a sample that includes four to seven pages of each website. The selection criteria of the representative sample are as follows:

Principal pages of the websites :

1. Homepage of the website;
2. Sitemap page;
3. Search result page;
4. Page with form elements.

Pages with different technologies:

1. Page with data tables;
2. Page with scripts;
3. Page with multimedia files : Flash, Applet, sound or video;
4. Page with documents for download.

5.2 The conduct of the evaluation

We have evaluated all the accessibility criteria in the four principal pages of the three websites. These principal pages are more specifically: the homepage, sitemap page, search results page and contact page.

Considering that the principal webpages don't include all the elements that should be evaluated, it was necessary to analyze additional pages in each website. Thus, we have evaluated between 4 and 7 pages in each website.

5.3 Results, analysis and proposed solutions

The evaluation of the accessibility of the three websites has helped us to detect a certain number of accessibility barriers at each of these websites, and to determine their level of accessibility as well as their level of conformity to the four principles of WCAG 2.0. Finally, we have proposed solutions and measures that should be taken to correct existing errors and to achieve the minimum level of accessibility recommended by the W3C (Level AA).

5.4 Results of accessibility evaluation of the three websites

The accessibility problems found in the three websites are relating to the thirteen themes evaluated in this study: images theme, frames, colors, multimedia, tables, links, scripts, mandatory elements, structure, presentation, forms, pages navigation and consultation. These accessibility barriers concern essentially:

Table 3: Accessibility problems

	Accessibility problems found		
	Ministry of Social Development's website	**Ministry of Health's website**	**CNOPS' website**
Images	The absence of pertinent textual alternative for some images; The use of text images instead of styled text.		
Frames	-	The absence of titles for some frames; The presence of titles that are not pertinent.	
The use of colors	The low contrast ratio between text color and the color of its background (the contrast ratio is not high enough in the principal web pages of the three websites).		
Multimedia files	The incompatibility of non-temporal media with assistive technologies and the absence of alternatives for these elements ; The absence of text transcripts, audio-descriptions, synchronized captions and interpretation in sign language for time-based media; The incompatibility of certain temporal media with assistive technologies ; The presence of media that are not clearly identifiable.		
Tables	The absence of pertinent summaries and titles for data tables; The absence of appropriate techniques that associate cells with their headers; The absence of correct declarations for the headers of columns; The tables of presentation present only one problem relating to contents that become incomprehensible when the web pages are linearized.		
Links	The presence of links that are not explicit; The non-pertinence of certain titles of links; The presence of some links without labels; The presence of identical links that refer to different destinations.		
Scripts	The absence of alternatives for some scripts;		

	Accessibility problems found		
	Ministry of Social Development's website	Ministry of Health's website	CNOPS' website
	The presence of scripts that are not controllable by the keyboard as well as some scripts that initiate a context switch, but which are not explicit.		
Mandatory elements	The source code is not completely valid ; Language and sense of reading changes are not indicated in the code ; The presence of page titles that are not pertinent ; Some tags are used just for presentation purposes ; The absence of indications for default language and document type in some pages.		
Structure of information	The inappropriate use of titles; The presence of abbreviations that are not accompanied by their meanings.		
Presentation of information	The use of presentation tags in the source code; The text becomes not clearly legible when the font size is increased to 200% and it not stays also fully visible and understandable when we disable the CSS; Choosing the background color and text font is not controllable by the user; The space between lines and paragraphs is insufficient in some places.		
Forms	The absence of pertinent labels for some fields; The control of seizure is not used appropriately; The absence of data entry aids as well as suggestions that facilitate the correction of errors; The titles of certain forms buttons are not pertinent; Some labels are not placed right next to their associated fields.		
Pages navigation	The absence of skip and rapid access links to important groups and content area; The presence of keyboard traps and breadcrumbs; The active page is not always indicated in navigation menu; The sitemap page is not pertinent.		
Pages consultation	The opening of new windows is not always explicit; The absence of information about downloadable files; The absence of accessible versions for this type of documents.		

6 Accessibility levels of the three websites

Among the accessibility barriers found, in the three evaluated websites, we find that a certain number of these barriers are relating to level A criteria (Bronze), others to level AA criteria (Silver), while the rest is relating to level AAA criteria (Gold).

The number of bronze level criteria (level A) not respected in the three websites is almost the same (35 criteria in the website of the Ministry of Social Development, 28 criteria in the Ministry of Health's website and 33 criteria in the website of the CNOPS). The criteria not respected at this level in the three sites are relating to all evaluated theme and to the four principles of WCAG 2.0 (perceivable, operable, understandable and robust). The results obtained show that the three websites don't meet the minimum level of accessibility and that they don't totally respect the principles of WCAG 2.0.

Concerning AA level criteria (Silver), only five criteria are not respected at each website. These criteria concern three WCAG 2.0 principles (perceptible, understandable and operable) and six themes (images, colors, mandatory elements, presentation, forms and pages navigation). The analysis of the barriers relating to these criteria gives us an idea about all the errors that should be corrected in the three websites in order to achieve the AA level, which represents the minimum level recommended by the W3C.

For AAA level criteria, 13 criteria are not respected in the website of the Ministry of Social Development, 12 in Ministry of Health's website and 11 in the website of the CNOPS. The principles and WCAG 2.0 success criteria not respected at this level are almost the same in the three websites. These criteria are relating to three principles of WCAG 2.0 (perceptible, operable and understandable) and to the eight following themes: images, colors, multimedia, links, structure, presentation of information, forms & pages navigation.

7 Necessary measures for existing accessibility barriers in the three evaluated websites

To reach the minimum level of accessibility recommended by the W3C (AA level), a certain number of measures should be taken, at the level of each of the three evaluated websites, in order to correct existing accessibility barriers and make the contents perceptible, operable, understandable and sufficiently robust.
Thus, to make the contents of the three evaluated websites perceptible by users, it is necessary to :

- Provide pertinent alternative text and detailed descriptions (if necessary) for used images ;
- Use styled text instead of image texts ;
- Increase the contrast ratio between the text color and the color of its background ;
- Don't provide information only by color ;
- Propose pertinent alternatives for non-temporal media ;
- Add an adjacent text to temporal media to allow the identification of these elements ;
- Add text transcripts, synchronized subtitles and audio descriptions for temporal media (if necessary) ;
- Provide pertinent summaries and titles for used data tables ;
- Use appropriate techniques to associate header cells with data cells ;
- Make sure that the content of presentation tables remains understandable when the web pages are linearized ;
- Make explicit all the links ;
- Indicate the changes of the sense of reading in the source code ;
- Don't use tags only for presentation purposes ;
- Structure presented content by using titles ;
- Use CSS to control the presentation and ensure that the content remains readable and understandable when the CSS is not active ;
- Ensure that increasing the font size to 200% doesn't present problems for the legibility of presented text ;
- Associate form fields with pertinent labels ;
- Enable the control of flashing contents by the user ;
- Propose accessible versions for downloadable documents.

In order to make the presented content operable, in the three websites, it is necessary to make sure that :

- The non-temporal media can be controlled by the keyboard ;
- The links and the pages have pertinent titles ;
- The links that open in a new window are explicit and they alert the user of the opening of a new window ;
- The identical links have the same functions and destinations ;
- The skip and quick access links to important groups and content area are present in every web page ;
- The information on the size, weight and language are indicated for downloadable documents ;
- The navigation does not contain keyboard traps ;
- The sitemap page represents the general architecture of the website and not just some parts.

As regards to the third principle which is making the content of the three websites understandable by users :

- Context changes should be initiated by explicit buttons to alert users of each change ;
- Language changes should be indicated in the source code ;
- The labels associated to form fields should be joined to their fields ;
- The indication of required fields should be visible in the forms ;
- The control of input should be accompanied by suggestions that facilitate the correction of errors.

Finally, the respect of the last principle relating to robust contents, in the three websites, requires to :

- Give each used iframe a pertinent title ;
- Provide alternative content for scripts which run without Java ;
- Correct nesting errors, opening and closing tags errors as well as the errors relating to attributes and their values that exist in the source code ;
- Make temporal and non-temporal media compatible with assistive technologies ;
- Use the DOCTYPE tag in the source code to define the type of each document ;
- Ensure that hidden text are correctly rendered by assistive technologies ;
- Give a pertinent title for each form button.

8 Conclusion

The results of this study show that the three evaluated websites don't reach the minimum level of accessibility (level A) and that several measures should be taken to correct existing errors to reach the accessibility level recommended by the W3C.

In fact, the correction of all existing barriers represents a long and time consuming process, because we should correct all accessibility problems in every web page. Whence come the importance of taking into account accessibility criteria during the conception of any website.

In Morocco, web accessibility is still an option for the websites. While in other countries, it is an obligation legally required. Similar initiatives should be taken in the country and that can start by the creation of a Moroccon standard of accessibility, as it is the case of France with the RGAA. The objective of the standard is to adapt the WCAG 2.0 to Moroccan context by simplifying the principles, the rules and the criteria of accessibility and by presenting a clear approach to follow in order to make accessible the different websites.

Incentive measures may also help to encourage the different websites to make their content accessible (such as Imtiyaz price, for example). In addition to that, a law should be voted to make web accessibility an obligation, especially for new websites, and it should give a transition period for existing websites to make their content accessible.

Finally, our research is not intended to be exhaustive, but we have tried, through the evaluation of the accessibility of the three websites, to address the issue of web accessibility for people with disabilities and to demonstrate also the importance of the subject, the methodologies of evaluation used as well as some measures to take in order to make web contents more accessible. Other studies should be conducted to treat other aspects of the subject, such as the elaboration of a Moroccan standard on web accessibility in accordance with international guidelines or the accessibility evaluation of another type of websites, etc.

9 References

Afchain, A and Lanceraux, J. (2004) *Créer des sites Web accessibles à tous*. Paris : Editions Liaisons.

Braille Net Association. (2009) *AccessiWeb, méthode de vérification de conformité*. [Online]. Available from : http://www.braillenet.org/accessibilite/referentiel-aw21/#intro/. [Accessed : 9th July 2011].

Braille Net Association. (2011) *Les outils pour l'évaluation de l'accessibilité d'un site*. [Online]. Available from : http://www.braillenet.org/accessibilite/guide/outils.htm/. [Accessed : 17th September 2011].

Braille Net Association. (2011) *Comment les handicapés visuels accèdent au WEB*. [Online]. Available from : http://www.braillenet.org/accessibilite/livreblanc/handvis.html/. [Accessed : 22th June 2011].

Carpanini, P. and COUDERT, C. (2011) *L'accessibilité du Web aux personnes déficientes visuelles*. [Online]. Available from : http://www.certam-avh.com/content/l%E2%80%99accessibilit%C3%A9-du-Web-aux-personnes-d%C3%A9ficientes-visuelles-0/. [Accessed : 22th June 2011].

Enjalbert, M. et al. (2002) *Aides techniques et matériel d'assistance en gériatrie*. Paris : Editions Masson. p.21.

France.dgme (2009) *Référentiel Général d'Accessibilité pour les Administrations*. [Online]. Available from : http://references.modernisation.gouv.fr/rgaa-accessibilite /. [Accessed : 9th July 2011].

INSERM. (1993) *Classification internationale des handicaps : déficiences, incapacités et désavantages*. [Online]. Paris : C.T.N.E.R.H.I. Available from : http://classiques.uqac.ca/contemporains/handicap_et_inadaptation/documents_CTNERHI/CTNERHI_203/CTNERHI_203.pdf/. [Accessed : 2nd July 2011].

Ligue Braille. (2011) *Les adaptations techniques et l'accès à l'information*. [Online]. Available from : http://www.brailleliga.be/fr/services/vie_quotidienne/aide_technique.asp/.[Accessed : 22th June 2011].

Microsoft. (2012) *Outils d'assistance technologique*. [Online]. Available from : http://www.microsoft.com/france/accessibilite/at/types.aspx/. [Accessed : 11th March 2012].

Morocco Chamber of Representatives (1993) *Law n ° 07-92*. [Online]. B.O. n°4225 (20 octobre 1993). Article 2. p.559. Available from : http://www.sgg.gov.ma/BO%5Cbulletin%5CFr%5C1993%5CBO_4225_fr.PDF/. [Accessed : 20th June 2011].

Morocco Ministry of Industry, Trade and New Technologies. (2009) *Maroc Numeric 2013.* [Online]. Available from : http://www.egov.ma/Documents/Maroc%20Numeric%202013.pdf/. [Accessed : 17th March 2012].

Morocco Secretary of State in Charge of Family, Children and Persons with Disabilities. (2005) *Enquête Nationale sur le Handicap*. [Online]. p.6. Available from : http://www.abhatoo.net.ma/index.php/fre/Maalama-Textuelle/D%C3%A9veloppement-%C3%A9conomique-et-social/D%C3%A9veloppement-social/Soci%C3%A9t%C3%A9/Personnes-%C3%A0-besoins-sp%C3%A9cifiques/Enqu%C3%AAte-Nationale-sur-le-Handicap-Avril-2005/(language)/fre-FR/. [Accessed : 11th June 2011].

SECTION508.Gov. (1998). [Online]. Available from : http://www.section508.gov/index.cfm?fuseAction=AboutUs /. [Accessed : 15th September 2011].

United Nations. (2006) *Convention relating to the Rights of People with Disabilities*. [Online]. Available from : http://www.un.org/french/disabilities/default.asp?id=1413/. [Accessed : 8th June 2011].

United Nations. Department of Economic and Social Affairs (2008) *UN E_Governement Survey 2008*. [Online]. New York : United Nations. p25. Available from : http://unpan1.un.org/intradoc/groups/public/documents/un/unpan028607.pdf /. [Accessed : 19th March 2012].

United Nations. Department of Economic and Social Affairs. (2012) *UN E_Governement Survey 2012*. [Online]. New York : United Nations. p.15. Available from: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan048065.pdf /. [Accessed : 19th March 2012].

United States of America. (2010) *Text of S. 3304 [111th] : Twenty-First Century Communications and Video Accessibility Act of 2010*. [Online]. Available from : http://www.govtrack.us/congress/billtext.xpd?bill=s111-3304/. [Accessed : 9th July 2011].

W3C. (2005) *Introduction to Web Accessibility*. [Online]. Available from : http://www.w3.org/WAI/intro/accessibility.php/. [Accessed : 5th April 2012].

W3C. (2006) *Web Accessibility Initiative. Complete List of Web Accessibility Evaluation Tools*. [Online]. Available from : http://www.w3.org/WAI/ER/tools/complete/. [Accessed : 17th September 2011].

W3C. (2009) *Web Content Accessibility Guidelines (WCAG) 2.0 : Traduction Française Agréée (2009)*. [Online]. Available from : http://www.w3.org/Translations/WCAG20-fr/. [Accessed : 23th June 2011].

WAB Cluster. (2005) *Necessary Information for Policy Makers (WAB Cluster D-WAB 2.8 deliverable)*. [Online]. Available from : http://www.support-eam.org/Supporteam/Documentary/accessibility_policies.asp/. [Accessed : 14th September 2011].

WAB Cluster. (2007) *D-WAB4 Unified Web Evaluation Methodology (UWEM 1.2 Core)*. [Online]. p.6.Available from : http://www.wabcluster.org/uwem1_2/UWEM_1_2_CORE.pdf /. [Accessed : 9th July 2011].

WHO. (2001) *Classification Internationale du Fonctionnement du Handicap et de Santé*. [Online]. Available from : http://apps.who.int/classifications/icfbrowser/Default.aspx/. [Accessed : 20th June 2011].

WHO. (2011) *Rapport mondial sur le handicap (2011) : résumé*. [Online]. p.7-8. Available from : http://www.who.int/disabilities/world_report/2011/summary_fr.pdf /. [Accessed : 20th June 2011].

WHO. (2011) *Rapport mondial sur le handicap : Incapacités et réadaptation*. [Online]. Available from : http://www.who.int/disabilities/world_report/2011/fr/index.html/. [Accessed : 26th June 2011].

WWW Consortium. (2005) *Introduction à l'accessibilité du Web*. [Online]. AvailabUle from : http://www.w3qc.org/ressources/traductions/introduction-accessibilite-web/. [Accessed : 23th June 2011].