Using Web Pages Accessible Design for the Correct Web Visualization on Mobile Devices

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Abstract

The objective of this work is to use the recommendations for the accessible design of Web pages and applying them for the correct visualization of Web resources on mobile devices. A small study was made taking in account these considerations, obtaining that are feasible to apply these recommendations or practices of good design for their use on mobile devices. Also a proposal appears to solve the problem of correct Web pages visualization on mobile devices.

1. Introduction

The Web has result a revolution in mass media as were radio and television in their time.

At the moment, thanks to the advance of technologies such as wireless networks (they monopolize 52% of United States homes connections) and miniaturization of electronic components; they have brought like consequence that mobile devices are most frequently used every time by people in diverse activities specially at the Web.

In agreement with [1], by 2010 it is expected 1,300 million of PC users, by 2,500 million of mobile users.

On the other hand, the United States users only use 30 minutes per month for Web navigation through a mobile device (it’s less in the great majority countries, except for some Asian countries like Japan or Korea) [2].

As it can be observed, it exist a great contradiction: the use of mobile devices is growing vertiginously and, in the other hand, the Web access on mobile devices is minimum. This jump a question to the air: Why Web access through mobile devices is so low?

This must to diverse factors like: different markup languages (HTML, CHTML, WML, etc.), that they are incompatible to each other and they cannot be visualized in correct form, inherent limitations to mobile devices (small screen resolutions, few colors, low storage space, low bandwidth, high costs in telecommunication networks, etc.), but mainly Web sites are badly structurally designed. All this entails to a bad navigation experience for the users and they have to choose alternative methods for Web access.

Some of the visualization problems that present Web on mobile devices in agreement with [3] are:
1. Requires much interaction and documents scrolling.
2. The information entrance is extremely difficult. Mobile devices have small keyboards with few keys generally, and frequently they do not have pointers devices.
3. Most of the URIs are too long and contain characters difficult to key in.
4. Mobile devices have low bandwidth and the costs are very elevated.
5. Users have more specific search goals in the network; for example, they’re looking for near restaurants or location-based services.
6. The publicity mechanisms do not work in the same way on mobile devices.
7. The majority of mobile devices do not support scripts or plug-ins.

We can see some of this problem at Figure 1.

Some of the advantages that would have when having well designed Web sites for mobile devices are:
1. Increase the number of users that access the site.
2. Allow the content reusability (reuse content by multiple formats or devices).
3. Reduce the site maintenance.
4. Smaller servers’ workload.
5. Requires minor bandwidth.

The motivation for this investigation was originated because at cenidet we have been developed a multi-format Web pages converter (HTML reformatted for mobile devices, WML, XHTML-MP, PDF, PostScript, XML and plain text) [4], and when we did tests on this system we found that the great majority of Web pages cannot transform in correct way (only 29% of pages...
could be transformed) due to that they are badly structurally designed.

The hypothesis of this work considers if a Web page is well structurally designed and fulfills the accessibility norms, this page has high probability of visualizing correctly on a mobile device.

As the people with some physical incapacity can see Web resources if these are accessible, we can be seen mobile devices as devices with limited capacities that if the Web pages are structurally designed in good form, they will be able to visualize correctly the available resources in the Web.

2. Theoretical frame

Within the W3C (World Wide Web Consortium), an initiative called WAI (Web Accessibility Initiative) has arisen, whose intention is making the Web accessible to people who experiment some type of incapacity. This initiative is divided in three priority levels.

In priority one, the developers must change these recommendations on their Web site to make it accessible. In priority two, these changes should be satisfied; whereas in priority three, the changes could be satisfied.

Level A fulfills priority one, level AA fulfills one and two; whereas level AAA fulfills the three priorities. There are logos to certify these adjustment levels (see Figure 2).

At the moment, it is about to appear an initiative of good practices design on mobile devices and it’s near to appear a logo (mobileOK) that certifies when these practices are fulfilled.

In agreement with [3], the minimum characteristics that must to have a mobile device to guarantee the correct visualization of Web resources are the following ones: 120 pixels wide screen, XHTML BASIC as markup language, UTF-8 as characters codification, JPG and GIF89a (not transparent, not animated) as image formats, 20 Kb as maximum page size, Web safe (256) color, CSS Level 1 and HTTP/1.0 or HTTP/1.1.

Next recommendations are suggested for trying to achieve accessible Web pages on mobile devices in agreement with [3]:
1. Make sure that users have the same experience when visiting pages with different devices (the One Web principle).
2. Exploit the device capacities. Don’t take a minimum common denominator.
3. Prove the page in different devices and emulators.
4. Maintain the URIs the shortest possible.
5. Provide minimum navigation at the top of the page.
6. Use links at different document parts to facilitate navigation.
7. Put an identifier to each link.
8. Don’t use images maps unless we had the total certainty that they will correctly display on mobile devices.
9. Don’t show popup windows on mobile devices (they are irritating in traditional equipment as on mobile devices).
10. Don’t put Web pages auto-refreshment unless it is extremely necessary and exist a mechanism to stop it.
11. Don’t use pages that provide auto-redirection, it is recommended to use HTTP 3XX codes.
12. Minimize the number of external resources.
13. Use a clear and simple language.
14. Limit the content that users can solicit.
15. Make sure that the total page size is adapted with respect to the device memory limitations.
16. Limit scrolling towards a single direction.
17. Make sure that the main content is in the middle of the page.
18. Don’t use graphs for spaces.
19. Don’t use images that cannot be displayed on the device. Reduce images to the minimum where they are too big or in high resolution.
20. Make sure that the information in color is available also without color.
21. Make sure that color combination provides sufficient constraint.
22. When background images are used, make sure that content can be read on the device.
23. Provide a short but descriptive title.
24. Don’t use frames.
25. Use markup language elements to provide a logical structure to the document.
26. Don’t use tables unless we had total certainty that the mobile device supports them.
27. Don’t use nested tables.
28. Don’t use tables for designs.
29. Use alternatives forms to display information that is on tabular form.
30. Provide text alternatives for non-text elements.
31. Don’t use embedded objects or scripts.
32. Specify the image size in the markup language.
33. Change the image size on the server if it is possible.
34. Create valid documents.
35. Don’t use absolute measures in pixels, as well as units in the properties and values of the attributes in the markup language.
36. Use style sheets to control the presentation, unless devices not support them.
37. Organize documents so they can even be read without the style sheet.
38. Maintain the style sheets size the smallest possible.
39. Use efficiently the markup language.
40. Send content in the format that support the mobile device.
41. Make sure that characters codification is supported on the mobile device.
42. Indicate in the answer the codification type used.
43. Avoid less possible the use of cookies.
44. Minimize the number of keystrokes.
45. Avoid the introduction of text.
46. Provide predetermined values.
47. Specify entrances by default when some characteristics of the devices are not supported.
48. Create a logical order of tabulations to accede to resources.
49. Associate labels to respective controls.
50. Position the labels more close possible of the controls.

In spite of the accessibility levels metric exist others that allow to determine if the Web sites are accessible, such as 30/30 rule [5] (not more than 30 KB by page and not more than 30 seconds for loading pages with the slowest connection available), or cibermetric whose final mission is making metrics with respect Web sites and redesigning them in clear way on the basis of its usability [6].

Section508 [7] is a United States governmental organization who has proposed standards (recommendations) to obtain that people with incapacity can visualize the Web. Also it is taken in consideration to superficial level design, as they are the suggestions given by the guru of the usability: Jakob Nielsen [8].

3. Accessibility Web pages tools

The present tools only allow verifying if Web pages are fulfilled or not those recommendations suggested for the different levels from accessibility.

The W3C as well as other organizations have some validators online [9] that they allow to indicate to us that mistakes have our pages with respect to the accessibility.

The most complete tool is TAW (Test of Accessibility Web) [10] that besides to indicate failures to us it shows in HTML code where the errors are located for correct them easily (see Figure 3 and Figure 4).

![Figure 3. Accessibility levels of Web pages in a Web site.](image-url)
Until the moment, we have not found in the specialized Literature some tool that transform online a HTML document and corrects its accessible design errors.

4. Methodology of solution

In order to solve this problem, we propose a client-side Proxy for mobile devices like Pocket PC or Smartphones (Windows Mobile) whose main function will be to take a Web resource in HTML, analyze it and modify it so that it fulfills the accessibility norms of at least level A.

This Proxy will be made in C# (NET Compact Framework) language because it guarantees to us that it will be executed in traditional devices like PC, as well as devices based on Windows CE operating system (Pocket PCs, Smartphones, etc.).

Figure 5 shows the architecture of the system which we have called PAM (Accessibility Mobile Proxy), this intermediary will be in charge to make the pertinent modifications to a HTML resource for obtaining a document that it is accessible and it fulfills the Web accessibility norms.

The actions that can be made on the system are showed at Figure 6. Users can change the accessibility level, configuration parameters, as well as to visualize the errors during the accessibility transformation and if the transformation has been successful an accessible document is visualized correctly in mobile devices.

On the other hand, Figure 7 presents the general diagram of how a user interacts with the system. Firstly, user introduces a direction in its Web browser, this one sends a request which is intercepted by the PAM which obtains the resource and transforming it if the case occurs.

Figure 4. Accessibility level messages.

Figure 5. PAM Architecture.

Figure 6. Case use diagram of PAM.

Figure 7. Sequence diagram of PAM.
As can be appreciated, determining the meaning of an image is practically impossible to recognize by a machine (the most recent works on artificial vision are limited to detect geometric forms and in base of a predetermined dominion trying to deduce that it is what it treats), reason why the tag would have to be in the following form: `<img src="cenidet.jpg" alt="imagen5" >`. It is to say; this work will only make modifications at structural level so that they fulfill the recommendations of accessibility level and not to try "to understand" the document.

When finalizing the transformation and if this one were successful, user could see the Web page transformed with a logotype that indicates that it fulfills the accessibility norms.

Figure 7 shows in general way, the process that is followed to transform a Web resource and making it accessible in view of being correct visualized on a mobile device.

Others modifications that are expected the PAM make in views to obtain the accessibility of Web pages on movable devices are next. The amount of links in a page can be modified so that each x numbers of certain links the document converts several units of links for their better reading. Another modification consists of putting an identifier to each connection.

Each x text size amount is due to modify the document in several units so that it is more legible and clear. In the same way, if resource size exceeds the established limit, the document is due to fragment for making it more accessible.

The main content of the document is due to center for improving its reading. Cut the title size to the minimum established. If PAM detects background images, they are eliminated to guarantee that the document is clearly legible.

![Figure 8. Activities diagram of PAM.](image)

Scripts and embedded objects in the document are due to eliminated for avoiding that they are not possible to be shown on the mobile client. The appropriate image size in the document preference is due to specify for transforming the images size from the Proxy so that they occupy less space. Put order to the tabulations in the Web controls for a faster and efficient access. Put names or labels to the controls for knowing that it is what they do.

As it is possible to be appreciated, a great amount of modifications exists that can be made. The responsibility degree of document accessibility transformation will fall to user.

The system will count on a cache system to avoid returning for making the transformation whenever the document is required. At first, it is had contemplated only caching HTML documents due to the mobile devices storage limitations, but if user decides it will be able caching all type of resources.

5. Results and discussions

The tests were made on a HP Pavilion Entertainment Notebook PC with Intel Centrino to 1.7 Ghz processor with 512 MB RAM and a HP iPAQ Pocket PC rx3115 with ARM 300 Mhz processor and 56 MB RAM memory.

100 diverse Web sites were analyzed (based of an online survey by electronic mail means). One of the surveys determined that a Web mobile profile does not exist; that is to say, the users want to see exactly the same sites that see in their desktop equipments.

All sites could be visualized so in PC as in a Pocket PC. The size average of the main page was 30,476.81 (approx 30 KB), which contain an average of 56.99 objects (images, other resources, etc.).

With regard to the accessibility, the following statistics were obtained (Table 1):

<table>
<thead>
<tr>
<th>Level</th>
<th>%Error</th>
<th>Complain with norm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20.73</td>
<td>28</td>
</tr>
<tr>
<td>AA</td>
<td>50.74</td>
<td>1</td>
</tr>
<tr>
<td>AAA</td>
<td>32.90</td>
<td>7</td>
</tr>
</tbody>
</table>

In these statistics we can see that there are few sites that fulfill the normative to guarantee the Web pages access. Also sees that the difference is minimum of the obligatory norms, of secondary their percentage of badly use is high and small details had a decrement.

Another test consisted of doing a small accessible Web page of level AAA, which visualized in diverse computer devices (PDAs, cellular phones, etc.) and
emulators obtaining its correct visualization in each one of them.

6 Conclusions

It is evident that most of the Web pages have an inadequate structural design, reason by which cannot be accessible by any person and independent of device. For this reason, it is of extreme importance making a mechanism which in certain way it reconstructs the Web content in certain way that is accessible and can visualize of correct way. In base of the made tests the hypothesis was verified: if the document is accessible, this one can be visualized in correct way on mobile devices. In addition, we demonstrated that there are very few Web pages that are structurally well designed.

7 Further work

As future works must in mind make the architecture implementation previously described, that allows to detect and to correct Web pages online so that they can be accessible from any mobile device.

Later, we must in mind integrate the functionality of this module to the system that has been made in [4], with the intention of complementing it and determining in smaller time if the document can be transformed or it does not for mobile devices.

Another work that we propose is the creation of a page editor for mobile devices which support the most common format such as: HTML, WML and XHTML-MP. Moreover, the editor will have as main characteristic the creation of valid code taking in account the accessibility levels. This work tries to attack the origin of the problem, creating Web pages which are valid with respect to the accessibility norms.

8. References


