A Tool for Development and Evaluation of Accessible Web 2.0 Applications

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Orodje za razvoj in testiranje dostopnih aplikacij spleta 2.0

Many Web applications are not designed in a way which would allow persons with disabilities and older adults to fully benefit from modern Web 2.0 services. Implementation of Web accessibility has traditionally been plagued by inefficient tools and tedious evaluation procedures. The I2Web project is developing software frameworks that will support Web developers better during the implementation phase and is introducing new methods for accessibility validation based on simulation of user preferences and device models.

Keywords: Web 2.0, accessibility, evaluation, IDE, user modelling, device modelling, I2Web

1 Introduction

Due to widespread use of Information and Communication Technologies (ICT), noticeable in all fields of our lives, today's society is often being named Information Society. Most of its members benefit from modern ICT solutions and thus experience improved quality of life. However, there are also certain groups of people who experience significant difficulties when trying to use ICT – this often occurs due to inadequate accessibility of ICT solutions. People with disabilities and older adults are user groups that face significant problems in this respect.

The Web, as an essential and omnipresent tool, indispensable in everyday life of any person working, learning or engaging in free time activities, shows many weak points in terms of accessibility. Being a hybrid ecosystem where exchange of content requires interaction of various distributed systems, such as server back-end, communication infrastructure, client machines and user agents (Web browsers), the Web has always been relatively difficult to regulate and standardise. In the past, we have seen significant efforts to try to enforce accessibility requirements and persuade Web content providers to design their sites in a way that i) as many people as possible could use them without adjustments, and ii) they are compatible with users' Assistive Technology (AT) in cases where AT needs to be used (a common example of AT being a screen reader for blind and low vision users). In practice, merely technical guidelines, such as W3C Web Content Accessibility Guidelines (WCAG) [1] or Section 508 Standards Guide [2], were published and they were followed by relatively few content providers. Organizations that implemented accessibility guidelines were predominantly from the public domain [3].

With the emergence of Web 2.0, the content became ever more interactive and is even produced by users [4]. Widespread use of media-rich, highly interactive Web applications, such as social networks, e-government, and e-banking, brought additional accessibility problems and further exclusion of disabled users. It became clear that new approaches are required to ensure an adequate level of Web accessibility, and that they be more to the point than general-level guidelines used in the past [5].

Currently, there is very little support for developers of Web 2.0 applications on how to make their applications usable by people with disabilities and older adults. This was the motivation to start the 7th Framework Programme project I2Web – Inclusive Future-Internet Web Services [6]. The project team is developing tools and services that will help Web developers create applications that are more accessible to users.

In the following chapter, we discuss current state-of-the-art methods and tools for accessibility evaluation of Web content. Next, we present novel research leading to a better understanding of how disabled users tend to interact with Web sites. In the fourth chapter we argue that it is essential to support the Web developers better during, and not after, the process of Web design. All these considerations serve as basis for the implementation of the I2Web tools currently under development. Some tools' features are presented in the fifth chapter. As last, we make a conclusion and briefly sketch our plans for future work.

2 State-of-the-art

Accessibility of Web sites has traditionally been comprised of automated and manual testing. The automatic part included the use of a software tool that checked the code behind a Web site for violations of accessibility guidelines and then rated the Web site's accessibility level based on the number and significance of violations found. For example, if significant graphic content on the site lacked text descriptions (HTML alt attribute). The missing attributes would then be added to the code and the cycle would be repeated until the desired degree of accessibility is reached.

Of course, the mere existence of accessibility elements after an improvement cycle didn't ensure that those elements actually made sense (e.g. alt attributes could be there, but contain useless information). This is why a manual test had to follow to verify such issues. In most cases, manual testing solved more issues, but is also expensive and more time-consuming than automated evaluation.

Most accessibility validation tools are desktop or Web-based applications with a graphic user interface. In the case of Web site validation, the user typically has to enter the location (URL) of the Web page she wants to test. After the tool has finished the analysis, results are calculated and displayed, ready to be examined by the user. Typical visual interpretations of the results include error lists, various accessibility scores, animations, and impairment emulation views.

Validation tools vary from simple online Web forms to complex desktop or Web 2.0 applications. Graphic user interfaces of the more advanced tools contain various building blocks, each displaying one of the abovementioned visual interpretations of the test results. Examples of automated accessibility evaluation tools available today are the following:

- HiSoftware® Cynthia Says™ [7] is a simple Web tool; its front-end is a form where an URL has to be entered. After a Web page has been analysed by the server, an error list is generated. All information is given in text form.
- Worldspace Enterprise [8] is a server application for WCAG compliance verification designed for software development companies. Its error lists are supplemented with graphic information in the form of diagrams and bar graphs. Various accessibility score calculations are also available.
- IBM/ACTF aDesigner [9] is a desktop application which incorporates several visualisation techniques. Upon testing a web page, this software generates error lists, calculates an accessibility score, displays graphic information on accessibility defects, and emulates both blind and low vision user experiences. The emulation feature provides an informative insight into how such users experience Web content.

However rich the user interaction or the visual interpretation of results, current accessibility validation tools rely heavily on the technical inspection of (predominantly HTML) code and simply determine if the code's structures are designed in compliance with guidelines such as WCAG or Section 508. Most tools cannot tell if accessibility elements are implemented so that they are useful or if interactive content, such as JavaScript or embedded third-party software such as picture galleries and video players, is accessible or not. Therefore, results of automated evaluations of common Web 2.0 sites are often close to useless when trying to determine a Web site's actual level of accessibility bearing in mind a real user trying to perform a common task on the site.

3 Bringing Accessibility Closer to the Web 2.0 Developer Community

Current methods of implementing Web site accessibility features require an interaction of many different expert profiles: Web developers, Web designers, persons with expertise in Web accessibility, experienced (disabled) end-users of ICT and AT, as well as persons in charge of the organization owning the Web site. With so many actors, the process of implementation and verification of accessibility elements often becomes complicated, time-consuming and costly – not only because of the number of profiles, but also because their attitudes toward accessibility often differ. For example, the person in charge may see accessibility requirements primarily as a cost, while the accessibility expert may be highly motivated to make every site as accessible as possible.

Tools that could be used independently by developers and would do more than just "proof-read" the HTML code for obvious technical violations would make the abovementioned process more effective. By supporting developers during their work, many mistakes that are otherwise revealed post-festum and improved in ever-repeating cycles of development and evaluation could be avoided in advance. Bringing a proper tool closer to developers could reduce implementation time, save manpower and raise awareness in the developer community.

For these reasons the I2Web team observed a sample group of 60 Web developers and analysed their habits related to Web development as well as tools they tend to use during their work. Based on the results of this survey it was concluded that a new-generation of tools for development of accessible Web 2.0 applications needs to be implemented. Our tool is being developed as a plug-in for one of the mainstream integrated development environments (IDE). This way the tool would always be readily available to the developers during the coding process, verifying the Web content structure and code in real time and providing the developer with useful features such as accessibility information, suggestions, code completion etc. It would be important for the tool to formulate accessibility issues as clear, plastic requirements which would make

developers better understand both what is required from them and how disabled users benefit from it.

Supporting developers in this manner is viewed as an important step forward from the current practice where development and evaluation alternate in ever-repeating cycles and the accessibility requirements are formulated as rather general, formalistic guidelines.

4 Analysis and Modelling of User Interaction for Web 2.0 Accessibility Evaluation

As mentioned, current accessibility evaluation systems are not aware of all aspects relevant for accessibility and usability of Web 2.0. The focus is on technical compliance of HTML, while other crucial aspects are often ignored.

The I2Web project's objective is to implement a tool that will take into account how disabled users go about performing tasks on Web sites, i.e. what their strategies are. A strategy tells what users try first, what they do second, what happens if they fail and have to try again etc. Of course, user strategies differ greatly among various disability groups. Many disabled users also use AT, so it is actually the combination of disability specifics and the concrete AT that defines a range of strategies that a user is likely to employ and, consequentially, the evaluation tool has to be aware of. Accessibility validation of interactive content is also an issue that has not been addressed properly thus far.

To make the tool aware of all these specifics, user interaction with Web 2.0 applications must first be analysed and modelled. Once the models of various types of users and their devices are defined and implemented, simulation algorithms can be added to the tool. The goal is to let the tool simulate the user interaction with the Web site and discover possible problems a certain user using a certain device combination is likely to come across. Based on that, the tool can validate and rate Web sites more effectively and with less end-user engagement, and also suggest improvements the Web developer should implement to make the application more accessible.

To collect data related to user behaviour on the Web 2.0 sites, 13 users with various disabilities (3 blind, 2 partially sighted, 2 dyslexic, 2 hearing disabled, 2 physically disabled and 2 older adult) performing tasks on a number of different platforms were observed. The data was analysed through a combination of content analysis that looked at the individual strategies applied by users during their interaction with a platform. The strategies were classified into one of 7 main categories: Navigation, Discovery, Exploration, Anchoring, Help Seeking, Abort and Operations. Each of these categories represents a goal that a user has when applying a strategy.

For better support of users in their interactions with Web 2.0 applications and devices, it is essential that designers and developers begin to understand these strategies and produce designs that support them. However, in order to do this, designers and developers need tools to better support them in their design practices. By designing models of users and devices [11], implementing simulation algorithms and incorporating them into a tool for development and evaluation of accessible Web 2.0 applications, the I2Web project is looking to support Web developers and designers, as well as accessibility evaluators and site owners, in a new way.

5 EASI: Evaluation of Accessibility Support and Integration tool

The I2Web project team is currently working on a tool named EASI (Evaluation of Accessibility Support and Integration) where all abovementioned considerations are going to be implemented in practice. The tool will be available as a plug-in for the Eclipse [10] IDE, a widely used software for development of applications, including Web 2.0 applications in various programming languages. By relying on Eclipse, the I2Web team is looking to reach a large number of Web developers and accessibility experts as well as to ensure that EASI as a tool remains future-proof.

EASI is going to support both development and evaluation of accessible Web 2.0 applications. Thus, the users of EASI are divided into three groups:

- Developers: EASI is going to provide them with various functions useful for understanding accessibility and building accessible Web sites.
- Accessibility Experts: by using their expertise, they perform in-depth accessibility evaluations; EASI is going to help them verify Web sites not only in terms of guideline conformance, but also by means of user behaviour simulation.
- Web Site Commissioners: since they operate the organization behind a Web site, a proper level of accessibility is their responsibility; EASI will provide features that will give them an illustrative insight into the site's accessibility and enable them to monitor progress during development.

EASI will support separate user interface arrangements (views) depending on the user role (developer, expert, commissioner). In a certain view, functions and sub-windows that are expected to be the most useful for the user role in question will be in the foreground, while other features will be less apparent. If the user role is changed, the user interface and its features will be re-arranged accordingly.

The following key features of EASI are foreseen to be used mainly by developers:

- Creation of an accessibility standards-compliant Web site template
- Explanation of automated test performed
- Recognition of code type
- Accessibility tips for inserted code

On the other hand, among the features, foreseen to be used mainly by evaluators (experts and commissioners), the following can be named:

- Visualize user's path through the page/site
- Select simulation settings (selection of end-user type, subpage, end-user goal etc.)

- Generate simulation report
- Generate overall accessibility report

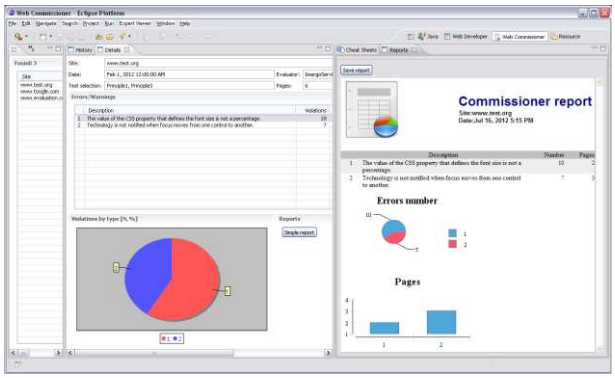

Figure 1: EASI prototype user interface, commissioner view.

6 Conclusion and Future Work

In this article, current practices related to Web accessibility evaluation and development were found to have many downsides, most problematic among them being exaggerated reliance on accessibility guidelines, time and manpower-consuming evaluation cycles and weak developer engagement. In the Web 2.0 environment, a new approach is ever-more needed, therefore, the I2Web project team is looking to develop a next-generation tool. It is going to support accessibility evaluators by applying various models and algorithms for end-user behaviour simulation while on the other hand, Web developers will profit from its practical development-related features as well as its integration with an IDE

The future work on the EASI prototype is going to include implementation of various features that are mainly connected to the definition of user and device models and the formulation of various simulation algorithms. This will require additional development and testing activities, mainly in the field of software integration, publishing and testing.

The expected impact of the I2Web project is to help achieve that Internet services take into account the variety of needs of their users. Whereas the traditional approach to accessibility is based on trying to eliminate the problems that people encounter, the I2Web approach is based on the positive strategies that people use and building applications that adapt to the user, instead of the other way around.

Acknowledgement

This work has been undertaken within the framework of the Inclusive Future-Internet Web Services (I2Web) project, co-financed by the 7th Framework Programme of the European Commission under its ICT Programme (Grant Agreement number 257623).

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