Technologies, Standards, and Approaches to Ensure Web Accessibility for Visually Impaired People

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Abstract. The report presents the technologies, tools and methods for achieving accessibility of information databases containing annotated information for people with disabilities and in particular people with visual deficits. An overview of existing web accessibility standards is made. Suggested approaches to achieving web accessibility in development of digitized information databases and software systems for processing and analyzing digitized information. The findings were used by the authors to create a model of digitalised database of physiological data.

Keywords: Web accessibility, Web standards, WCAG, database, people with visual deficits.

1 Introduction

Accessibility as a universal principle and methods for its achievement. Accessibility today can be seen as a global principle, the implementation of which has taken worldly action in recent years. The most affected groups of people in this regard are several: elderly people, people with limited functionality and people with different types of disability (Georgieva-Tsaneva, 2017). In this paper, authors address the accessibility of the world wide network of people with disabilities and, in particular, people with visual deficits. To address the issue of web accessibility, the World Wide Web Consortium (W3C) - an international organization - is working with ordinary people to create internationally accepted web standards (W3C, 1999), (WCAG Overview, 1999). Tim Berners-Lee founded the World Wide Web Consortium, the Massachusetts Institute of Technology, Laboratory for Computer Science [MIT/LCS] in collaboration with CERN in October 1994. The goal of web accessibility standards is to provide the necessary guidance and to impose the appropriate rules, compliance with which from web application developers, will increased the accessibility of sites in the global network for people with disabilities. As they themselves determine the goal is „by developing protocols and guidelines that ensure the long-term growth of the Web“. On August 29, 2012, five world Organizations signed an agreement to validate and comply with principles in

support of modern standardization to support the development of new technologies and innovation.

Global studies shows that a large proportion of public websites are inaccessible to people with disabilities. According to official statistics in 2011, 450,000 people in Bulgaria have some disabilities, and the number is actually more (Bogdanova, 2016).

According to results of a survey conducted in 2015-2016 by team of the Horizonte Foundation under the Project "Civil Initiative for Web Accessibility" (among the participants in the project are Assoc. Prof. Galina Bogdanova and Negoslav Sabev from the Institute of Mathematics and Informatics, at the Bulgarian Academy of Sciences) more than half of surveyed public sites in Bulgaria are inaccessible to people with various forms of visual impairment.

Under UN Convention on Rights of Persons with Disabilities adopted in December 2010, all human rights and freedoms of people with disabilities must be guaranteed.

Despite the accepted standards, information in the World Wide Web remains largely unavailable to people with visual deficits (Georgieva-Tsaneva, Bogdanova, & Sabev, 2017). The use of various services on the Internet, purchase of airplanes tickets, bus tickets and others. In most cases they are impossible task for people with visual problems (Hassouna, Sahari, & Ismail, 2017), (Kurt, 2011). The sites of respective companies offering online ticket purchase do not comply with the standards for web accessibility. Aspirational compliance with accepted standards is insufficient, measures requiring compliance with these standards are necessary.

2 Web Accessibility Standards

The WCAG standard were developed by the W3C consortium. The first version of this standard was created in 1999. In December 2008, the second version of the standard came out (WCAG 2.0, 2008). More recently, in 2018, the latest version of WCAG standard was created.

People with visual impairment are divided into: poorly-sighted, visually impaired and totally blind. People with impaired vision want to benefit from the latest technological advances. They use the world wide web for accessing interesting information, enhancing their education and qualifications, communicating, and entertainment. In order to be able to use the global network, they use assistive technologies (Bogdanova, 2018). Weak viewers use screen magnifiers, magnifiers that enlarge text and images, in this way users can perceive the content. Visually impaired and totally blind people use assistive technologies - called screen readers (Screen Reader User Survey #7 Results, 2018). These are software products which can convert text content into synthesized speech or braille text.

The latest version of WCAG 2.1 standard, which came into force as a recommendation for a measure of 2018, contains four principles with a total of 12 guidelines. Each criterion provides guidance for successful implementation of guidelines - a total of 78 guidelines. The standard contains the most up-to-date guidelines for improving the accessibility for 3 groups of users: persons with cognitive or educational disabilities, visually impaired people and disabled users.

Web Content Accessibility Guidelines (WCAG) 2.1 is the official W3C recommended standard of 05.06.2018 (WCAG 2.1, 2018). The new version 2.1 builds on and builds up the previous version. Between the two versions there is backwards compatibility - content that meets the requirements of version 2.1, meets the requirements of version 2.0. Version 2.1 does not contradict and cancel version 2.0. It is advisable to follow the requirements of the new version: they help to achieve better user accessibility. Using WCAG 2.1, sites will be compatible with the new requirements.

Reasons for creating WCAG 2.1: to develop some underdeveloped moments or to introduce new aspects. The criteria for success are complemented, adding a further 17 to the previous ones. Eleven of the new criteria are subordinate to the current version 2.0 guidelines, and six criteria form a new guideline, 2.5 entitled "Entry Modalities." Overall, the new success criteria address issues that affect:

1. Users of mobile devices;
2. Low-visibility users relying on enlarged text or screen magnifiers;
3. People with cognitive or educational difficulties;
4. Users of Speech-To-Text software.

3 New in the Latest Version of the Web Accessibility Standard

The following Success Criteria are new in WCAG 2.1:

- 1.3.4 Orientation (AA)
  Users can change the position of mobile devices themselves.
- 1.3.5 Identify Input Purpose (AA)
  The criterion will to help people with cognitive difficulties - linguistic constraints and memory problems, as well as disabilities affecting day-to-day functioning and decision-making.
- 1.3.6 Identify Purpose (AAA)
  It also extends and to people with a deficiency in concentration and attention. Adapting but not the user to the environment, but to the user environment.
- 1.4.10 Reflow (AA)
  The criterion is to support people with low vision, who need to scale the content up to 400%.
- 1.4.11 Non-Text Contrast (AA)
  For users with low vision, it is important that controls and graphic images are distinct from the background and surrounding elements.
- 1.4.12 Text Spacing (AA)
  Its implementation is for the benefit of people with low vision, dyslexia and cognitive difficulties: they can change the typeface and character spacing.
- 1.4.13 Content on Hover or Focus (AA)
  Occasionally, users inadvertently start an interaction, are not known for new content, or additional content prevents any task from being done. These may be hints, submenus, or non-movable pop-ups.
- 2.1.4 Character Key Shortcuts (A)

Quick keys provide easy and convenient access to a certain functionality, but users with mobility difficulties can create difficulties. Criterion requires facilitation by exclusion.

- 2.2.6 Timeouts (AAA)
  This criterion requires the user to be warned about for what time he has to accomplish a task.
- 2.3.3 Animation from Interactions (AAA)
  To be able to exclude animated effects.
- 2.5.1 Pointer Gestures (A)
  Provide Simple One-Way Alternative Ways to Perform Complex or Accurate Multipoint Gestures.
- 2.5.2 Pointer Cancellation (A)
  Facilitate the prevention of accidental or mistaken activation of touch or mouse functionality.
- 2.5.3 Label in Name (A)
  Often controls use visible text and programmed label. It is recommended that both texts match.
- 2.5.4 Motion Actuation (A)
  On portable devices, sometimes web content can react on the move. Providing an alternative that does not require device movement.
- 2.5.5 Target Size (AAA)
  The aim of the criterion is to provide all the controls in the web content and to provide enough space for their easy activation even on a small screen area.
- 2.5.6 Concurrent Input Mechanisms (AAA)
  Though a device has a basic mechanism for operating and inputting information, the user must be able to choose at any time another convenient mechanism.
- 4.1.3 Status Messages (AA)
  The user is notified about content changes without their focus being disturbed.

4 Methods to Create a Model of an Accessible Database

One of the tasks of the project team is to inform the general public on the issues of ensuring the accessibility of Internet-based digitized information databases (including physiological databases whose mathematical technology research is a major task of the project team). Informing both the general public in order to publicize the problems and rights of people with visual deficits and of the scientific societies in whose hands is the issue of ensuring the web accessibility of people with disabilities; as well as medical specialists, rehabilitators, social workers - all who have direct and frequent contact with people with disabilities. Explaining the standards adopted and need for them to be respected and implemented by web developers of sites both in the world and in our country. Our conviction is that it needs to be broad publicity for questions about web accessibility, informing people responsible for developing websites, maintaining on-line information databases, web-based software systems to put and solve these issues. From

technological and software point of view, the problems of web accessibility are not particularly complex. It is of paramount importance that these issues are set as a priority in the planning stages of software systems and web sites.

The main hypothesis underlying the scientific research in the project is: accessing information bases from physiological data from people with sensor deficits can be effectively resolved by using modern mathematical information computer tools and modern technological approaches. Ways will be sought to solve tasks such as facilitating people with sensor deficits access to computer information systems focusing on the health of individuals.

Persons with visual impairments should be able to access information in physiological databases and software systems, so the project has the following tasks:

- Exploring the possibility of creating a model for providing access to the database of people with sensory deficits.
- An analysis of current trends, the methods and means by which issues of access to information products for people with visual deficits are addressed.

To solve project tasks, appropriate ITC methods have been used to create a physiological database of patient records that can be accessed by people with visual deficits (Sabev, Georgieva-Tsaneva, & Bogdanova, 2018). For accessing the database, people with visual problems use technology to facilitate the use of technological devices.

Methods to solve the problems of accessibility of information databases with physiological information:

- All actions in the database (downloading and uploading entries, entering new and updating existing entries, adding and deleting entries) must be possible through the keyboard.
- All guiding information must be readable by the screen reader for the blind.
- If images are contained in the database, they should be described in an appropriate text field or a description of the image in a sound format.
- The content of the database should be well written and efficiently organized, to be able to located in an appropriately easy to find place, preferably at the top of the screen.
- Data records for individuals downloaded from the web physiological database to be in a format suitable for use by blind people - for example, Doc format.

5 Conclusions

The report presents part of the work of the project team. An overview of existing technologies to ensure accessibility for people with visual deficits is made. There is a brief description of the novelties in the WCAG 2.1 standard and to whom they are oriented. In the paper are indicated the methods, which the project team used to create a database of physiological information and the methods used to solve the issues of accessing the database for people with visual deficits.

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