

ASSESSING ACCESSIBILITY OF ONLINE GOVERNMENT SERVICES IN SERBIA FOR VISUALLY IMPAIRED USERS

Milica Škembarević^{*1}, Olga Jejić¹, Marija Đukić¹

¹Faculty of Organizational Sciences, University of Belgrade

^{*}milica.skembarevic@fon.bg.ac.rs

Abstract: *In the digital age, organizations must incorporate online platforms as a part of their operational activities. A website serves as a visual representation of an organization's expertise, utilizing eye-catching elements to captivate human attention and encourage interaction. However, this kind of user interface development strategy is not suitable for people with visual impairments, and therefore those websites might not be accessible to them. This paper analyzes and studies accessibility principles, standards, and existing regulations. The primary focus is on evaluating these practices in the design of a Serbian e-government website as a case study. The benefits and limitations of current practices were identified alongside the recommendations for user interface design improvements to enhance website accessibility, particularly for users with visual impairments.*

Keywords: *accessible websites, human-computer interaction, interface design, e-government, visual impairments*

1. INTRODUCTION

With the increasing reliance on the Internet, particularly during and post the COVID-19 pandemic, the development and upkeep of web presence for any organization operating in the public domain have become essential. Websites typically rely on visual elements organized into a sophisticated structure to convey valuable information to users. However, not all users can access information in this manner, necessitating special attention during website development to ensure accessibility for those with visual impairments. According to Ackland et al. (2017), there were an estimated 253 million individuals with visual impairments in 2015 (Figure 1). Looking ahead, predictions suggest that by 2050, the total number of people with visual impairments will decrease to 55.7 million, but there will be a shift in the ratio between blind individuals and those with severe visual impairments (Figure 2), indicating a relative increase in the percentage of blind individuals (Fricke et al., 2018).

The data presented indicates the necessity for websites to cater to the current and forthcoming needs of users with visual impairments. The importance of addressing these challenges is recognized by the European Union, which has established a directive on website accessibility requirements that is still in the process of implementation (European Union, 2019).

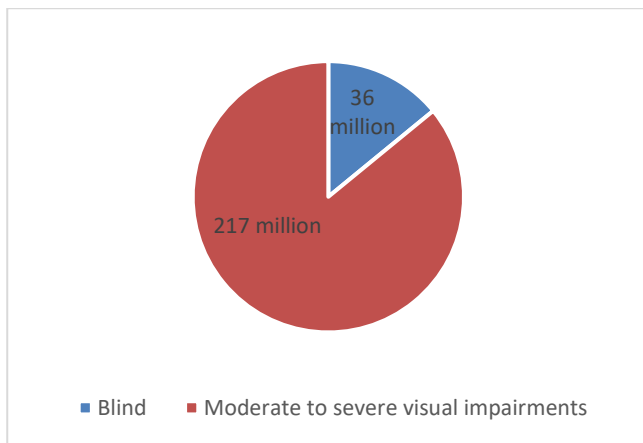


Figure 1 - Current ratio of people with visual impairments

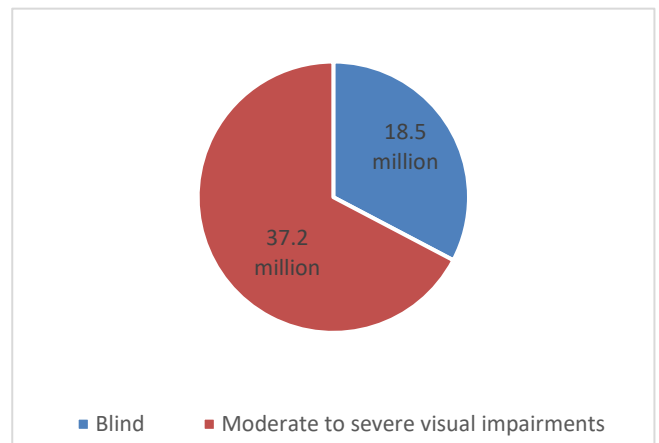


Figure 2 - Predicted ratio of people with visual impairments by 2050

This paper focuses on governmental services and websites, as access to such services is mandated by law in Serbia for all citizens, regardless of any disabilities they may have. According to Law on the Prevention of Discrimination against Persons with Disabilities (2016), a violation of the principle of equal rights and obligations occurs when an individual is unjustly denied rights primarily due to their disability, rights that are not denied or imposed on another individual or group in a similar situation. It is imperative that every citizen can exercise their rights without discrimination. In addition, in 2009 the Republic of Serbia passed the Law On The Ratification Of The Convention On The Rights Of Persons With Disabilities. Article 21 of the Convention (United Nations, 2006), states that the state will take actions that would lead to people with disabilities' freedom to seek and receive information equally to other people by using communication channels of their choice. A part of the defined actions is also a practice of providing information aimed at the general public in accessible ways and formats that would cater to the different variations of disabilities with no difference in time and cost of the obtained information. As of 2024, approximately twelve thousand people are living with visual impairments in Serbia (Union of the Blind of Serbia, n.d.), which accounts for around 0.1% of the total population, based on recent data from the Statistical Office of the Republic of Serbia (2022).

2. RELATED WORK

Accessibility encompasses the design and development of websites and tools to ensure usability for people with disabilities. Despite being highly recommended and even mandated by law in some countries, many government portals still face notable accessibility challenges. While web accessibility aims to facilitate website usage for individuals with disabilities, usability extends to ensuring ease of use for all users, irrespective of disability. Multiple studies have indicated a significant positive relationship between usability and accessibility scores. Adhering to the Web Content Accessibility Guidelines (WCAG) improves accessibility for users with disabilities and enhances the experience for all users.

(Hambley et al., 2022) introduced a new framework alongside WCAG Conformance Evaluation Methodology (WCAG-EM). (Bai, 2019) examined 342 US government online portals, finding an average accessibility score of 41/100 and a strong correlation between accessibility and usability. (Król & Zdonek, 2020) examined 182 Polish government websites, which collectively attained 57.23% of the available Aggregate Accessibility Rating points. (Csontos & Heckl, 2021) analyzed 25 Hungarian public sector websites, revealing none fully complied with WCAG recommendations and half exhibited only minimal usability compliance. (Valtolina & Fratus, 2022) investigated Italian municipal websites and developed a web application to aid in addressing accessibility issues, highlighting that solving several issues is not overly complex despite the generally low accessibility of municipal websites. (Kesswani & Kumar, 2022) compared the accessibility of government websites' home pages among G7 and BRICS countries, identifying significant compliance flaws related to robustness.

3. RESEARCH OBJECTIVE AND MOTIVATION

This study is motivated by the relatively limited exploration of website accessibility in Serbia. The objective of the research is to assess the accessibility of the Serbian e-government websites for users with visual impairments. The research delves into the fundamental principles essential for ensuring comprehension among blind individuals and those with severe visual impairments. Subsequently, an evaluation of how these principles are implemented on the Serbian e-government website is conducted. By exploring the regulations and guidelines outlined by standards and comparing them with the actual state of the website in the case study, this paper provides an analysis and critique of the applied (or lacking) accessibility principles. Where

violations or misinterpretations of accessibility principles are identified, corresponding advice or commentary will be provided based on the guidelines.

4. TECHNIQUES AND GUIDELINES

The World Wide Web primarily caters to visual interaction, leaving visually impaired users relying on audio methods for accessing content at a disadvantage. While tools exist to assist, they often prioritize adapting content for devices rather than addressing user-specific needs, underscoring the importance of understanding users' behavioral strategies to enhance web accessibility (Lunn et al., 2011). The accessibility point of view should be considered from the start of the analysis and the development process, but it is also possible to upgrade an existing website by adding certain features. As Brown (2024) indicates, content compatibility with screen readers depends on clarity and simplicity, adhering to standard language conventions, and avoiding complex formatting. Additionally, it highlights the intricacies of the English language, where identical spellings can yield different pronunciations.

Designing visual elements with alternative text and descriptive labels is a convenient way of communicating the structure and content of the website to people with visual impairments. As a part of Web Content Accessibility Guidelines, the main principles for ensuring web accessibility are (Kirkpatrick et al., 2023):

- Perceptible - users should perceive information without effort and interface components are supposed to be designed in such a way.
- Operable - the interface should be usable by all users without requiring interactions beyond their abilities.
- Understandable - users need to understand both the information displayed and the functionality of the user interface.
- Robust - content should be reliably interpretable by various user agents, including assistive technologies, ensuring consistent accessibility despite technological advancements.

The guidelines, situated under the principles, offer fundamental objectives for authors to enhance content accessibility for users with diverse disabilities. While not directly testable, they furnish a framework to grasp success criteria and improve technique implementation. There is also a testable success criterion for each guideline in WCAG 2.1 to enable its application in various scenarios, including design specifications, procurement, regulations, and contracts. The defined conformance levels—A, AA, and AAA—cater to diverse needs. The three levels of conformance signify escalating accessibility standards, each tackling more advanced requirements to ensure web content accessibility for users with disabilities. However, enforcing Level AAA conformance for entire sites is discouraged due to practical constraints.

Techniques provide precise instructions for authors and evaluators to meet WCAG success criteria, offering code samples, references, and assessments. According to Kirkpatrick et al. (2023), these techniques are divided into three categories: sufficient techniques, advisory techniques, and failures. Sufficient techniques provide reliable methods to meet success criteria. By correctly implementing these techniques, authors can ensure compliance, contingent upon accessibility support for their audience. Advisory techniques offer recommended approaches to enhance accessibility, catering to various users' needs and providing alternative access methods for certain content types. Authors are encouraged to implement these techniques to ensure inclusivity across diverse user requirements. Failures represent accessibility barriers that cause content to not meet specific success criteria. They serve as valuable guidance for authors, helping them understand what to avoid, and for evaluators, aiding in checking content compliance with WCAG success criteria.

In addition to this, common methods for accessing and interacting with the web include assistive and adaptive technologies. Assistive technologies encompass software and hardware solutions utilized by individuals with disabilities to enhance their web interaction. Examples include screen readers, which audibly relay webpage content, screen magnifiers, and voice recognition software. Adaptive technologies are utilized by individuals with disabilities to enhance their experience on the web. They range from simple adjustments like increasing text size to more complex tactics such as enabling captions. Adaptive strategies may involve standard software, mainstream web browsers, or specialized assistive technologies.

During crises like COVID-19, integrating intelligent personal assistants (IPAs) can notably benefit individuals with intellectual disabilities. Technological advancements and increased affordability have made IPAs more accessible, potentially enhancing overall well-being. Popular options like Amazon Alexa and Google Nest/Home offer diverse input methods and employ machine-learning techniques to improve functionalities such as speech comprehension and usability (Van Wingerden et al., 2023).

WAVE is a suite of evaluation tools aimed at enhancing web content accessibility for individuals with disabilities. It identifies a wide array of accessibility errors while adhering to the WCAG, emphasizing human evaluation to directly address issues affecting end users. Prioritizing user impact and fostering education on web accessibility principles are central to their approach.

Advancements in technology allow us to cater to all users visiting websites or applications. Platforms like Frontend Masters offer comprehensive resources for developers to learn how to address disabilities and create inclusive digital products. Developers find numerous courses on website accessibility, covering topics like color contrast and integration tactics. UX and Product Designers face challenges with vast accessibility guidelines, including clear link text and minimizing color reliance, sometimes lacking clarity on balancing accessibility with aesthetics. The Perkins School for the Blind is committed to ensuring website accessibility for all visitors, including those with visual impairments, by adhering to the WCAG, level AA criteria. Their ongoing efforts focus on enhancing website accessibility for individuals of all ages, abilities, and means of access.

5. CASE STUDY OF E-ADMINISTRATION OF THE REPUBLIC OF SERBIA

Many countries have devoted considerable effort to enhancing accessibility in the IT industry and e-business, reflected in the proliferation of directives and legislation. Detailed guidelines for website accessibility, regularly updated to incorporate technological advancements, are outlined in (Kirkpatrick et al., 2023). Furthermore, the World Wide Web Consortium's Web Accessibility Initiative provides standards and support materials to aid developers in crafting inclusive websites (World Wide Web Consortium, n.d.).

As highlighted, web accessibility is essential for enabling effective internet interaction for individuals with disabilities, yet numerous sites remain inaccessible due to design deficiencies. Despite these challenges, individuals with visual impairments rely on the web daily (Van Deursen & Van Dijk, 2016). For web designers, this implies that approximately 10% of site visitors may encounter difficulties in perceiving colors normally. People with low vision can perceive colors but face challenges such as poor acuity, tunnel vision, central field loss, or clouded vision (Byun & Finnie, 2011). In UX design, catering to users with visual impairments is paramount, with a set of standards derived from WCAG guidelines offering actionable strategies for designers to prioritize assistance and ease of use for them (DeWitt, 2010).

Serbia's e-government website for administrative and governmental activities was approved for development towards the end of 2006 (Vidas-Bubanja, 2011). Since its inception, numerous functionalities have been incorporated, such as scheduling appointments for passports, and ID cards, requesting certificates, electronic signatures, school and kindergarten applications, and tax information, among others. Adhering to the standards delineated in (Kirkpatrick et al., 2023), several measures were undertaken to assess the website's accessibility for all users, including a comprehensive examination of their implementation in Serbian sites to ascertain their effectiveness and applicability within the context. Kirkpatrick et al. (2023) emphasize the importance of catering to individuals with visual impairments, which is particularly relevant to enhancing online government services in Serbia. Within the case study, certain aspects, such as text color and fonts, are consolidated into a single category, mirroring the presentation referenced research.

5.1. Logging into the platform

Information such as legal process descriptions, important dates, or contact numbers can be accessed on the website without requiring users to create an account or sign in. However, most actions are restricted to logged-in users, as they involve private data. The registration process is straightforward and comprehensive. A potential accessibility challenge arises during the account creation process, where users are required to upload a photograph of their identity card or passport, posing difficulties for blind or visually impaired individuals. An alternative solution and suggestion for improvement could involve a secure video call, wherein an agent verifies the user's identity based on system data and information provided during the call, along with video footage of the user displaying their ID.

5.2. Text-to-speech option

Inclusive web design is essential for accessibility, particularly for visually impaired users who rely on screen readers. Clear labeling of links and buttons facilitates easy navigation, and understanding how screen readers convert web content into audio is crucial for compatibility.

While the e-government website has implemented text-to-speech software in Serbian on most pages, it's not consistently available across all of them. For instance, the landing page lacks a text-to-speech button, making it challenging for users to access pages that offer this option. The voice reading of the website's content is

comprehensive, but pronunciation may not always adhere to Serbian grammar rules, and duplicate readings of lines can confuse. Moreover, there's no differentiation between English and Serbian words in pronunciation, leading to comprehension issues, especially for words like "ConsentID." Skipping certain parts of the content without using a mouse is not feasible, posing difficulties for visually impaired users, particularly when navigating lengthy pages with extensive lists of services. Similarly, adjusting playback speed requires accessing a sub-menu, which is only accessible with a mouse, further hindering accessibility. Text-to-voice choices correspond with WCAG success standards connected to offering substitutes for non-textual elements (Success Standard 1.1.1) guaranteeing harmony with assistive tools (for example Success Standard 4.1.2) and aiding in navigation and direction (Success Standard 2.4.5).

5.3. Contrast and font adaptability

In digital design, it's crucial to avoid relying solely on color, as this can pose challenges for colorblind users. Including underlining for alerts, links, and buttons aids in accessibility. Ensuring adequate contrast through careful color and texture selection is vital, particularly for individuals with visual impairments. Integrating textures or patterns into graphs can help distinguish data points, aiding those with color blindness. Limiting the number of colors in the interface improves usability, as an excess of colors can be confusing for users. Adjusting the contrast intensity on a webpage can assist people with partial visual impairments in viewing the content more clearly. Success Criterion 1.4.6 (Enhanced Contrast) mandates a higher contrast ratio of at least 7:1 for most text and images of text, compared to the 4.5:1 requirement in Success Criterion 1.4.3 (Minimum Contrast), which is more stringent for ensuring readability. However, the current version of the website does not support this option, providing the same view for all users.

High contrast intensity may feel unnatural for those with regular vision, so offering an option to adjust this setting in a dedicated place on the page could enhance the experience for people with partial visual impairments. Similarly, font size adjustment is missing from the website, with the only option being to use the browser's zoom feature. Enabling manual font size adjustments, such as through a slider or button, is essential for visually impaired accessibility. This provides a more welcoming experience, especially for older users with declining vision who may not use specialized tools. Offering manual font size adjustments is crucial for enhancing website accessibility on content-heavy pages.

5.4. Keyboard as a navigation tool

Keyboard accessibility, including shortcuts, is essential for facilitating easier navigation, particularly for visually impaired users relying on screen readers. This enhances browsing without necessitating hand-eye coordination. Effective content scanning relies on screen reader support for navigating between headings to access key information, underscoring the importance of descriptive headings to facilitate accurate navigation. Clear page titles benefit all users, as screen readers announce them upon loading, aiding visually impaired users in quickly understanding the page's topic or purpose and saving valuable time typically spent scanning for content details.

It's worth noting that the website enables keyboard navigation, allowing users to select all options on the landing page. However, drop-down menus are inaccessible for selection via keyboard, as the page refreshes when the drop-down menu is chosen. Additionally, the presence of a slider—featuring sliding images with associated buttons, links, or text—is not conducive to keyboard navigation, as users may not have enough time to read the content before it transitions to the next slide, potentially confusing. Keyboard navigation aligns with WCAG Success Criterion 2.1, ensuring that users can access all content functions using only the keyboard without needing to press keys within specific timeframes.

5.5. Alternative text for images

Including alternative text for images is crucial, as screen readers announce them, skipping those without it. Concise descriptions should be used for video and audio content, using clear language in both text and alternative text to effectively convey the message. Describing images in alternative text is essential for communicating the information they represent to individuals who cannot see them clearly or at all and ensuring accessibility.

6. CONCLUSION

Significant progress has been made in the field of human-computer interaction, particularly concerning accessibility, but there's a need for a more thorough application of developed tools and techniques, especially within governmental administration websites. Innovative methods should be mandated by laws and regulations to ensure that accessible design becomes a standard requirement rather than an option. The key principles outlined in accessibility guidelines have been shown to elevate website accessibility levels.

The software solution implemented on the e-government website in Serbia has greatly impacted the daily lives of visually impaired individuals, streamlining administrative tasks that can now be completed from home. While the website developers have adhered to certain accessibility principles during its design, there are still instances where obtaining desired information comprehensively, or at all, remains challenging. The implemented improvements are still not fully utilized. Although the text-to-speech option is available to assist visually impaired users, it is not accessible on all pages. The same applies to keyboard navigation. Additionally, the speech option could be enhanced to include clearer language and better-suited pronunciation for the Serbian language. Introducing color and font size adjustments would benefit not only visually impaired users but also regular users, particularly elderly people with declining vision.

This paper has identified both positive and negative practices on the website and has proposed actionable solutions to enhance its accessibility for users with visual impairments. The research has several crucial implications for enhancing the accessibility of online government services in Serbia. Identifying and addressing existing accessibility issues can create a more inclusive and user-friendly experience for visually impaired users, allowing them to access essential government services without unnecessary barriers. The findings can also inform policymakers about the current gaps in accessibility and the need for stricter regulations and guidelines to ensure all government websites meet accessibility standards. Evaluating the Serbian e-government website provides a benchmark for future improvements of other Serbian websites. The suggested improvements will benefit not only visually impaired users but also the elderly and others with declining vision or reading difficulties. Aligning with international accessibility standards, such as the WCAG, the research helps Serbia move towards global best practices and ensures compliance with potential future European Union directives. Ultimately, the research supports the broader goal of social inclusion, ensuring that all citizens, regardless of their physical abilities, have equal access to government services and information.

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