

## **ENHANCING DIGITAL INCLUSION: A DUAL APPROACH TO ASSESSING HOMINERE AND SMART BREAK APP**

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### **ABSTRACT**

This study presents a methodology for assessing the accessibility of two mobile apps, Hominere and Smart Break, using guidelines, automatic validation tools, and manual analysis. Using automated evaluation tools, including WAVE, Access Monitor, SortSite Accessibility Checker and Validator revealed common accessibility issues such as missing or incorrectly labeled buttons, non-descriptive links, and inaccessible images. Supplementing the automated assessment, manual evaluation with TalkBack unveiled specific accessibility challenges that automated tools may overlook, including intricate user interactions and issues related to visual design and layout. This evaluation and subsequent analysis identified viable solutions to enhance inclusivity and accessibility within the application. Furthermore, the study affirms that the chosen accessibility evaluation strategy is not only effective but also transferable, offering a valuable framework for assessing accessibility in a wide range of mobile applications.

### **KEYWORDS**

Accessibility Assessment, Accessibility Principles, Guidelines, Mobile Application, Screen Readers, Web Accessibility

## **1. INTRODUCTION**

With the increasing number of people with disabilities, accessibility has become a critical issue for designers and developers of digital products and services. Mobile applications have become an integral part of people's daily lives, and their usage has increased significantly in recent years. These applications serve as a medium for individuals to access information, communicate, and complete various tasks. However, people with disabilities often face significant barriers when using mobile applications due to accessibility issues. Therefore,

evaluating the accessibility of mobile applications is critical to ensure everyone, including those with disabilities, can use them easily.

The accessibility evaluation strategies can be classified into two categories: manual evaluation and automated evaluation. Manual evaluation involves expert evaluators who manually inspect the product or service for accessibility issues, and automated evaluation comprises software tools that can automatically check the accessibility of digital products. Manual evaluation can identify accessibility issues that are difficult to detect using automated tools; however, it can be time-consuming and expensive. On the other hand, automated evaluation is faster and less expensive, but it may miss certain accessibility issues that only human evaluators can detect.

This article focuses on developing a hybrid evaluation strategy that combines both manual and automated evaluation. This approach can help developers and designers improve the accessibility of mobile applications and provide a better user experience for everyone.

In the context of Challenge Based Learning (CBL), during the 2022/2023 school year, as part of the Master Communication and Web Technologies program at Aveiro's University, the company BOSCH proposed the development of digital platforms to reduce energy waste. One of the projects developed was Hominere, a mobile application that aims to solve the lack of motivation regarding energy and water saving and the lack of energy efficiency in people's daily lives, such as food, transportation, and recycling. Furthermore, the application also aims to change users' behavior in these areas by presenting motivating and re-educating content through information-sharing publications. There is also the presentation of challenges that aim to help and guide individuals to change bad habits according to their needs. This application serves as a Business-to-Consumer (B2C) solution.

Another project developed during this initiative was Smart Break, a mobile application operating as a tracker format, enabling work teams to configure their devices and log their work breaks while measuring the energy saved during these break periods, thus promoting energy awareness. The platform records user consumption patterns, generates statistical reports on energy usage, converts energy data into more easily understandable metrics, and gamifies the impact through visual representations of a battery. This second project functions as a Business-to-Business (B2B) solution.

It's important to remember that B2B models pertain to companies that primarily sell products and services to business customers rather than directly to consumers. In contrast, B2C models refer to companies that market their goods or services directly to consumers (Kim et al. 2023).

Although these two apps have different objectives, they are both driven by the goal of increasing energy efficiency in buildings (homes or businesses). This objective has been emphasized in the Paris Agreement on climate change and the Montreal Protocol on ozone depletion, as part of broader environmental protection goals (IEA EEfD, 2017). These digital solutions can potentially promote savings in heating, cooling, and lighting while also improving the comfort of workers/colleagues and reducing maintenance costs, risks, production time, and waste.

According to Kotsopoulos et al. (2018), promoting people's altruistic motives for energy and monetary savings in their homes is crucial as a means of contributing to environmental protection. It is also essential to involve company employees in energy conservation efforts in the workplace, as personal monetary gains are not typically expected. Therefore, these two applications could serve as promising ways to educate employees/household members about energy conservation, utilizing their feedback to raise awareness of their behavior and its

consequences.

In the scope of the Curricular Unit of Digital Accessibility and Compliance, of the mentioned master's degree, the evaluation and analysis of the Hominere and the Smart Break applications were carried out to detect possible accessibility problems and, through the results obtained, elaborate and present possible solutions to improve the final product, and also to understand if the selected accessibility strategy evaluation is effective and appropriated and can be replicated in other mobile apps assessments.

This work is part of a larger research effort, part of it presented at the 2023 edition of the Multi Conference on Computer Science and Information Systems, article entitled "Accessibility assessment of mobile applications: the case of the Hominere app" (Alves et al., 2023)). This work extends the previous one by adding information about results obtained after analyzing the accessibility parameter of another mobile application developed in the same context named Smart Break, with the point of interest being the comparison between two applications with different approaches, Hominere having a B2C approach and Smart Break having a B2B approach.

## **2. THEORETICAL BACKGROUND**

Web accessibility is the degree to which a website/mobile app is usable by the most significant number of people to promote their digital and social inclusion (Kalbag, 2017). Therefore, web accessibility refers to the ability of people with disabilities to access and use digital content, including websites, mobile applications, electronic documents, and other digital resources. This means designing and developing digital content to be easily accessed and used by people with disabilities/incapacities, including those with visual, hearing, physical, cognitive, neurological or some temporary impairment (Cooper et al. 2016; Oliveira et al. 2021).

Digital accessibility is essential because it ensures that people with disabilities have equal access to information, services, and opportunities online. It also helps European organizations comply with legal requirements, such as the Directive (EU) 2019/882 on the accessibility requirements for products and services, also known as the European Accessibility Act.

The World Wide Web Consortium (W3C) defines web accessibility as "essential for developers and organizations that want to create high-quality websites and web tools, and not exclude people from using their products and services" (W3C WAI 2018). Digital accessibility involves ensuring that digital content is perceivable, operable, understandable, and robust for all users, including those who use assistive technologies like screen readers, magnifiers, and alternative input devices (WCAG 2.1). Digital accessibility also includes considerations for usability, such as providing clear and consistent navigation, labelling of form fields, and ensuring that content is easy to read and understand.

The compliance levels of a mobile platform/application depend on the priority check. Thus, the application is assigned conformance level 'A' if all priority one checkpoint is satisfied, conformance level 'AA' if all priority 1 and 2 checkpoints are satisfied, and conformance level 'AAA' if all priority 1, 2 and 3 checkpoints are satisfied (W3C WAI 2018). Accessibility assessment should be a process that combines automatic tools (software) and human assessment (Rutter et al. 2007). Following this line of thought, Slatin & Rush (2002) refer that no automatic tool detects all accessibility problems. However, in combination with a manual check, they are the starting point for problem detection and correction.

### **3. RELATED WORK**

Developing an accessible app is still challenging due to several particularities of mobile phones requiring technical expertise in creating applications that meet the needs of people with disabilities (Ballantyne et al. 2018). Recent studies show that developers need to consider different specialties of mobile phones, e.g., versions of the same mobile operating system, different screen sizes, and the features of assistive tools such as screen readers like Voice Over (VO) and TalkBack (Oliveira et al. 2021; Silva Neto et al. 2021; Tymoshchuk et al. 2021).

In this context, several studies highlight the importance of accessibility testing in the prototyping phase is crucial for ensuring that mobile applications are accessible to everyone (Nilsson 2018; Silva Neto et al. 2021; Vieritz et al. 2016). Dias et al. (2022) conducted a literature review of automated evaluation tools for web and mobile accessibility and despite the existence of various tools either for web or mobile apps, they are not completely effective, covering less than 40% of all the problems encountered. Also, no tool was found to adapt the application interfaces according to the type of disabilities that users may present. Ismailova and Inal (2018) compared online accessibility evaluation tools to perceive their effectiveness. The authors observed that each tool generated different evaluation data for the same websites and some of the tools are complementary to each other, meaning the highest coverage and completeness can be possible with the right combination of evaluation tools. Therefore, the authors suggest that different tools should be utilized to provide consistency and obtain reliable data from online evaluation tools, improving tool effectiveness.

Accessibility evaluation requires a deep understanding of accessibility guidelines, specialized knowledge and expertise, and adequate time and resources to conduct the testing properly. In this context, web development courses should offer future developers the opportunity to learn and apply in practice the accessibility guidelines that should be considered in the mobile app development process. Recent studies report that students of web/application development have a low level of familiarity with accessibility guidelines and their practical application (Kearney-Volpe et al. 2021; Cao and Loiacono 2022). These studies underline the importance of educating future developers about accessibility guidelines, promoting their personal connection with disabled people in the educational process, including universal design principles in the development of accessible websites/apps, as well as the business values of an accessible web/app. Clearly indicate advantages, limitations, and possible applications.

### **4. METHODOLOGY**

This study presents a work of accessibility assessment of two mobile app prototypes. Hominere, developed by five students of the master's degree in communication and Web Technologies, focuses on informing and motivating users for energy efficiency and water saving through challenges and a forum (Figure 1) that helps and guides them to save more and change bad habits, depending on their needs.

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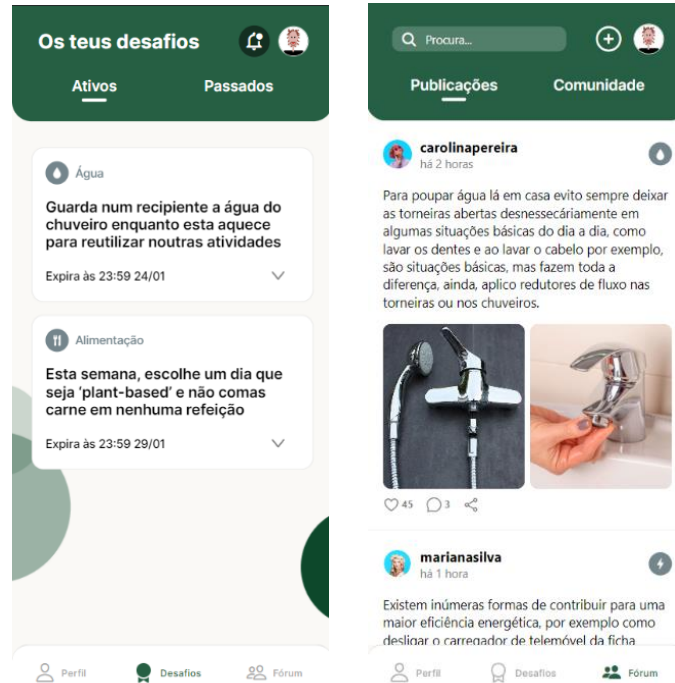


Figure 1. Challenges and Forum areas

On the other hand, it is also designed to assess the accessibility of a second prototype. Smart Break is a mobile application focusing on improving workers behavior and mentality and reducing energy waste in the workplace through energy breaks, which has been developed by the authors of this paper (Figure 2).

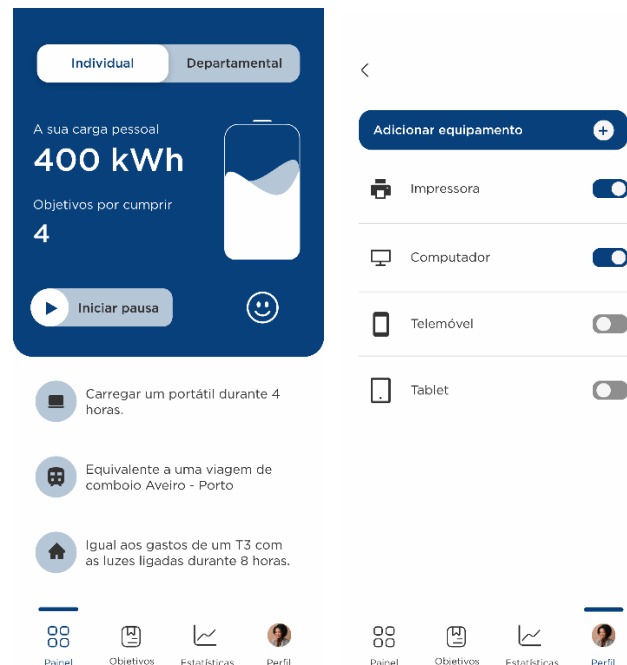


Figure 2. Dashboard and Devices areas

Throughout its development, the Smart Break application underwent a series of design changes to the initial prototype, as well as the logo, due to a lack of alignment with the preferences and brand identity concerning the target audience. Notably, the development team proactively addressed certain accessibility issues during this redesign phase, which ended up streamlining the evaluation process in the current phase for this factor.

In any case, to improve both apps' accessibility, the authors evaluated it by applying the following guidelines and automatic and manual evaluation platforms/tools:

### 1. Web Content Accessibility (2.1) and Mobile Accessibility (2.0) Guidelines

The analysis was conducted based on a set of recommendations defined by the Web Content Accessibility Guidelines 2.0 (W3C WAI 2018), following its principles, guidelines and criteria applied to the content of the mobile application, together with some standards presented by the Mobile Accessibility Guidelines (W3C WAI 2021). This way, it was weighted for evaluating and analyzing the four main principles: perceivable, operable, understandable, and robust (POUR). Following these guidelines and standards, the analysis aimed to comprehensively evaluate and analyze mobile applications based on four main principles: perceivable, operable, understandable, and robust (POUR). This comprehensive approach ensured that all aspects of accessibility were thoroughly examined and considered during the analysis process of two mobile applications (Hominere and Smart Break).

### 2. Automatic Validation

To assess accessibility, the project team selected three automatic validation tools for their suitability to the context: WAVE – Web Accessibility Evaluation Tool, Access Monitor and SortSite Accessibility Checker and Validator. These tools helped identify accessibility issues and provided valuable insights for improving the applications' accessibility.

### 3. Manual Analysis through TalkBack

In addition to automatic validation, a manual analysis was conducted using TalkBack, a screen reader tool widely used by visually impaired users on Android mobile devices. The analysis simulated the experience of a visually impaired user, allowing for a more realistic evaluation of the applications' accessibility.

## 5. METHODOLOGY

Using all the tools mentioned in the previous topic made it possible to analyse Hominere and Smart Break applications, identify aspects that are unsuccessful in accessibility and define possible solutions to correct these aspects. Next, the results are presented according to POUR principles.

As anticipated, neither mobile platforms nor websites successfully achieved a perfect score during the accessibility testing phase. It is worth mentioning that the websites of both projects function mainly as a management platform, not being the central focus of either project. In the case of Smart Break, the decision was made to use a management platform template for the website, resulting in a comparatively limited allocation of time and resources towards its development. Furthermore, the website's usage is expected to be minimal, with a projected user base of less than 2%.

### 5.1 First principle – Perceivable

The principle Perceivable states that content should be perceivable to all users (W3C WAI 2018), so the authors identified several critical aspects:

#### 5.1.1 Small Screen Size - Criterion 1.1 (WCAG 2.0)

The Hominere application analysis showed that the application does not guarantee the provision of acceptable sizes on some buttons in terms of their proportions and the spacing around them. Considering that the minimum size a button should have been 44px - 44px, several application screens are found buttons with smaller dimensions. In the most severe case, the button to return to the previous page with a proportion of 8px -14px (Figure 3). Smart Break met the requirements for approval of the criterion.

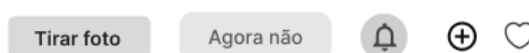


Figure 3. Examples of buttons that do not reach 44px in height in Hominere application

#### 5.1.2 Contrast - Criterion 1.4.3 (WCAG 2.1)

The authors conducted contrast testing for the app's elements utilizing various tools, including Stark, a comprehensive suite of integrated accessibility tools offering a Figma-compatible plugin designed to access and enhance contrast accessibility. Considering that the minimum desired contrast value is 4.5:1 for standard text, it was concluded that the Hominere app presents contrast problems in the chosen color palette (Figure 4).



Figure 4. Example of lack of contrast between colors - Hominere

Similar challenges are encountered in the case of Smart Break, where noteworthy issues pertaining to contrast arise, with discernible difficulties arising from the juxtaposition of orange and a light gray, almost white, palette (Figure 5).

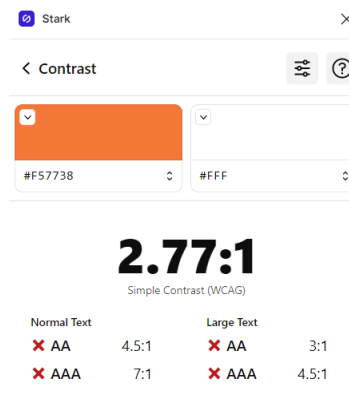


Figure 5. Example of lack of contrast between colors - Smart Break

### 5.1.3 Visual Presentation - Criterion 1.4.8 (WCAG 2.1)

Regarding visual information presentation, the authors identified shortcomings restricting user customization of the Hominere background and foreground colors. Additionally, on certain screens, the minimum required line spacing is not met (this aspect will also be discussed in criterion 1.4.12).

Smart Break met the requirements for approval of the criterion.

### 5.1.4 Text Spacing - Criterion 1.4.12 (WCAG 2.1)

The authors observed that the Hominere app falls short of several success criteria concerning text spacing. Specifically, the line spacing, ideally set at 1.5 times the font size, registers as zero (0). Moreover, the app does not meet the recommended spacing between characters and words, which should ideally be 0.12 and 0.16 times the font size, respectively.

Smart Break met the requirements for approval of the criterion.



## **5.2 Second Principle – Operable**

According to WCAG 2.1, the operability principle is related to the navigation and interface being operational, so the authors assessed the following aspect: Placing buttons where they are easy to access - Criterion 3.5 in WCAG 2.0. In the Hominere app, in some situations, the buttons are only positioned for easy access by right-handed users. Furthermore, certain buttons are positioned too high on the page without adequate margins, potentially impeding their touch accessibility. This issue may be exacerbated on devices with features like a front camera located in the upper right corner, as observed in some mobile devices.

On the other hand, the Smart Break application displayed a centered design with significant margins, not exhibiting the same issue.

## **5.3 Third Principle - Understandable**

The principle of comprehensibility asserts that users should be able to understand the presented content (W3C WAI 2018). In accordance with this definition, the authors identified the following aspects:

### **5.3.1 Consistent Layout/Consistent Navigation - Criterion 4.2 (WCAG 2.0) and Criterion 3.2.3 (WCAG 2.1)**

Regarding layout consistency, the authors noted a lack of uniformity on the forum page compared to the rest of the platform. This discrepancy creates the impression that this section is somewhat detached from the overall interface. This can be attributed to the limited use of the color palette, which is typically more prevalent, and the distinctive background color and aesthetic elements characteristic of the Hominere app (Figure 6).

Smart Break met the requirements for approval of the criterion.

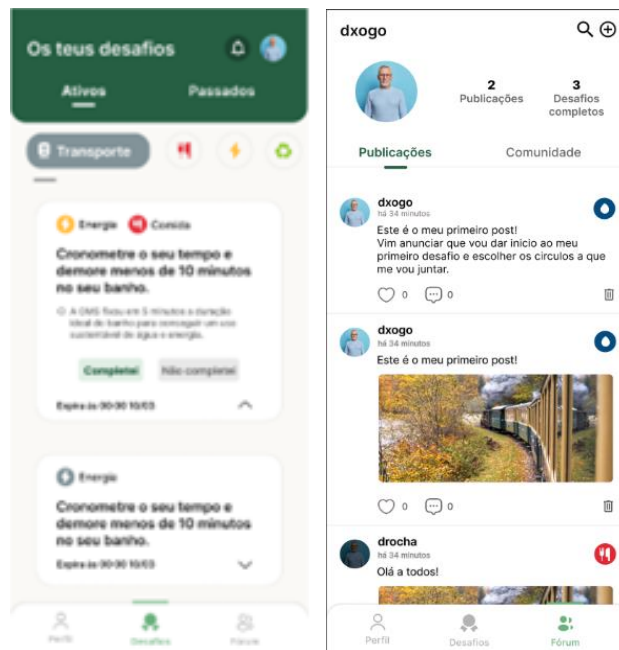


Figure 6. Challenge and forum pages

### 5.3.2 Error Identification - Criterion 3.3.1 (WCAG 2.1)

This criterion states that if an input error is automatically detected, the error element should be identified and described to the user in text. The authors have detected some problems with this criterion in the Hominere app. Users may enter invalid values on the registration page, e.g., fake or incomplete cell phone numbers and e-mails that have not been correctly validated (e.g., aaa@aaa) without being informed of this. In this sense, false accounts can be created very quickly, which may not only impair the use of the application but also complicate accessibility for people with motor disabilities who may be mistaken in their credentials.

In the case of the Smart Break application, all fields were correctly validated, preventing the insertion of incorrect data.

### 5.3.3 Positioning Essential Page Elements before the Page Scroll - Criterion 4.3 (WCAG 2.0)

Regarding the strategic positioning of essential page elements before the page scroll, the authors found in the Hominere app that on the registration pages, the progress bar has an element that is at the top, and this is not the most relevant concerning the element that is next (question and options for setting the user profile and its forward button).

Smart Break met the requirements for approval of the criterion.

### 5.3.4 Provide a Clear Indication that Elements are Actionable - Criterion 4.4 (WCAG 2.0)

Another aspect at fault in the design is related to touchable elements. The Hominere app generally includes a box with rounded edges, a dark green background, and text or icons that

are buttons. However, it is possible to see that there are other elements of quite similar structures, but they are not touchable. Furthermore, the aesthetics of the transport, food, energy, and recycle buttons (in a set) differ from the presented aesthetics of the symbols present within each publication, which could create difficulties concerning understanding and association.

In the Smart Break application, it was possible to observe that the touchable elements had distinct borders compared to the non-touchable ones, thus fulfilling the requirement.

## 5.4 Fourth Principle - Robust

Lastly, the robustness principle stipulates that content should be resilient enough to be interpreted by diverse agents (W3C WAI 2018). In this context, the authors did not uncover any inconsistencies within either the Hominere or Smart Break applications.

## 5.5 Other Results

With automated tools, it was possible to find other relevant aspects regarding accessibility and obtain results that meet the problems previously found in the guidelines.

### 5.5.1 Access Monitor Plus

The authors used the Access Monitor Plus tool to evaluate the most relevant pages in Hominere application automatically and the scores (0-10 points) obtained are shown in Table 1.

Table 1. Scores obtained with the Access Monitor Plus tool - Hominere

Page	Classification
Challenges	6,9
Profile	6,9
Forum	6,7
Notifications	6,3
Personal information	7,1

The authors identified recurring color contrast issues across various pages, as highlighted in the manual analysis following the established guidelines. During this assessment, several discrepancies were noted in the CSS file, such as instances with null alt attributes, which do not adhere to the WCAG 2.1 standards. This represents a significant accessibility shortfall in the app, as providing alternative descriptive text for images mitigates potential misinterpretations and enhances the overall user experience.

### 5.5.2 WAVE – Web Accessibility Evaluation Tools

With the WAVE extension, the authors evaluated the developed project regarding the structure and organization of the code and visual accessibility with a focus on the contrast of the colors used. In the case of Hominere application, the page that reported more accessibility problems

was the Forum, with one (1) error, three (3) alerts, forty-seven (47) contrast errors and a total of twenty-four (24) features without alternative text (Figure 7).

Using this tool, the authors found that the forum search bar does not have a corresponding label, which configures as an error, and that the color palette used by the Hominere app is inadequate, something that the authors had already concluded before.

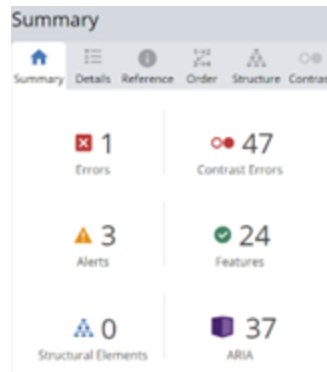


Figure 7. Results obtained on the Forum page in Hominere application using the WAVE extension

### 5.5.3 Accessibility Checker - PowerMapper

In general, the Hominere application did not present many problems when evaluated by the PowerMapper tool (Figure 8), presenting only two grave errors: in search - the application does not respect the Google, Bing and Yahoo guidelines, and in standards - there are validation flaws at the W3C HTML/XHTML level. However, it should be noted that since it is a Single Page Application (SPA), this type of tool cannot evaluate the entire application extension and only evaluates its homepage.

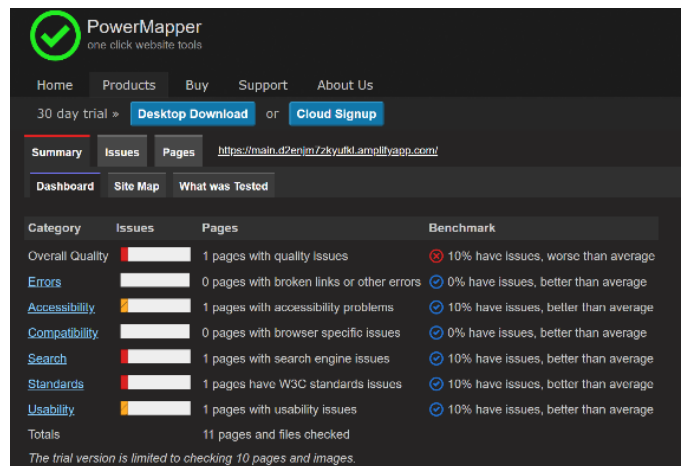


Figure 8. Overview of the PowerMapper evaluation results - Hominere

#### **5.5.4 NVDA**

To obtain a more precise assessment of the Smart Break application, the NVDA Tool was employed, with the evaluation results underscoring unaddressed gaps in the alt attribute, which unveils the absence of alternative text for certain elements. This deficiency, however, was identified solely in select elements of the application, likely due to inadvertence on the part of the development team during its creation. Consequently, the aspects lacking alternative text encompassed: the entirety of icons, which lacked descriptions; the profile picture and the "Log Out" button on the website, both devoid of descriptions and therefore inaccessible to screen readers.

#### **5.5.5 Contrast Checker**

In addition to the comprehensive Smart Break analysis, we conducted further assessments focusing on the suitability of the color palette using the Contrast Checker platform. The results revealed a common non-compliance issue across both the web and mobile platforms, specifically concerning the "Soon Available" page. As indicated by the platform, the contrast score between the background and the text on this page, was measured at 2.77, falling significantly below the minimum acceptable threshold of 4.5. As previously mentioned, this deficiency stems from the insufficient contrast between the shades of orange and light gray, bordering on white, a challenge that was recognized by our team in advance. Furthermore, additional contrast-related issues were identified on the website side. Specifically, when the buttons in the sidebar change their state to "hover," they undergo a shift in background color from #07407b to #ffffff14. This transition results in a loss of contrast. Nonetheless, it's important to highlight that the remaining aspects of the validation yielded positive outcomes, with an impressive score of 18.56, aligning with the guidelines outlined in WCAG 2.1, specifically addressing 1.4.3 – Contrast (Minimum) and 1.4.6 – Contrast (Enhanced).

#### **5.5.6 TalkBack**

To finish the results acquisition stage, the authors used the tool provided by Android mobile devices - TalkBack, to verify accessibility in a scenario where the user presents visual limitations. Regarding the evaluation of the Hominere application, the evaluation process showed the need to improve several aspects since, in several situations, the user was confused about his progress and could not complete the tasks assigned to him without the help of a second person. Thus, the results revealed that using the Hominere app by people who need screen readers is practically impossible.

Conversely, the implementation of Smart Break during the development phase following the redesign incorporated all designated accessibility fields, ensuring compatibility with screen readers. As a result, it encountered no issues related to redundancy or the absence of fields.

## **6. POSSIBLE SOLUTIONS**

As evident from the comprehensive analysis conducted, the authors have pinpointed various areas that require enhancement to augment the app's accessibility and provide an enhanced user experience.

The potential strategic solution for the Hominere app is enhancing the buttons' proportions. Currently, they tend to have smaller dimensions than recommended, so increasing their size to a minimum of 44px is imperative. Incorporating a background for buttons with critical functions is also an option to enhance visibility and provide a larger touch area. Additionally, it is crucial to refine the placement of certain buttons and contemplate implementing features that cater to left-handed users, ensuring seamless application usage. Currently, buttons are positioned for optimal access with the right hand, potentially causing inconvenience for left-handed users.

The Hominere palette would need a revamp, as most of the colors failed the contrast test, and a definition to ensure consistency because several shades of green do not differ much from each other. In the Stark tool, it is possible to see some color suggestions within the same color spectrum, which would solve this problem.

Regarding the visual presentation of information, the application could include in the settings page an area dedicated to accessibility, where the user can customize the background and foreground colors. In addition, this accessibility area could include other options, namely text spacing, allowing users to adjust it to their needs, as well as a night mode option.

The Hominere application also presented flaws regarding the comprehension principle. The authors used the design guidelines to assess the consistency of layouts/navigation to follow logic and coherence. For example, the main buttons should all have the same color scheme, or the background should have a constant color instead of varying between shades of white and beige. Besides helping the application's consistency, these guides would also solve the problem regarding touchable elements since all these elements would be designed in the same way or with similar logic (depending on the cases).

Regarding positioning the essential elements of the page before the scroll, the suggestion is to invert the order of the elements. The progress bar would be presented at the end of the page, ensuring that the relevant information appears first. As for positioning elements too close to the edges, it is only necessary to set fixed margin values. This way, there is no failure to display information because it is in a position that coincides with the physical elements of the device.

Concerning the null alternative texts, it is necessary to provide descriptive texts to the images that appear throughout the application so that all users can capture them in the best way and have the best experience that the Hominere app can give. This way, add the `alt="[description]"` field in the code referring to the images so that users can access this information. In the case of the forum, it would be interesting to allow each user to define their descriptive text for the image post they have published. This is especially important for blind users, as they can hear the description through tools such as TalkBack and understand what images are on the pages and what they represent. However, images are not the only ones that need extra care for reading by the screen reader; buttons and text must be configured to read correctly.

Concerning search engines, the application has several flaws that violate Google Search, Bing Search and Yahoo Search guidelines, which can negatively affect its positioning in search results. One of the leading solutions to improve search engine accessibility would be offering users an HTML site map with links pointing to the critical parts of the site. Links embedded in menus, lists and similar elements are not accessible to search engines unless they are in the site map.

Smart Break's case, some potential solutions have been implemented beforehand, primarily focusing on perceptibility and comprehensibility principles. Relating to the contrast,

the concept of "high contrast" was introduced to ensure that users more sensitive to the combination of orange and light gray could enjoy the application by activating this mode. This involves replacing the light gray color with a darker gray on pages where orange is used, thereby ensuring an adequate level of contrast. Furthermore, a dark mode version was developed to adhere to criterion 1.4.8 in WCAG 2.1 - visual presentation. Consequently, an accessibility section was incorporated into the application's settings, allowing users to choose between the high-contrast mode and dark modes, thus enhancing the overall accessibility and visual experience.

To ensure product coherence, a set of guidelines was established. Primary buttons are consistently filled with blue, while secondary buttons always feature an orange border; primary buttons have a 16px border, whereas secondary buttons feature an 8px border; all switches are colored in a shade of blue; screens containing individual information are presented in blue, while screens displaying data related to the individual's department are shown in orange; all icons within the application are in a non-bold style, and boxes present in the application have shading for emphasis, among other specifications. These guidelines were implemented to maintain a uniform and user-friendly design throughout the application.

## 7. CONCLUSION

This study has shown the effectiveness and appropriateness of the selected accessibility strategy evaluation, which combines manual evaluation of WCAG and using a mobile screen reader with automated evaluation through specific tools. This approach can be replicated in the accessibility evaluation of other mobile apps.

The mobile application Hominere presents accessibility problems beyond visualization and aesthetics, necessitating correctly structuring the code that composes it. Accessibility elements should be placed in all necessary parts to make it possible for a user with limitations to enjoy the platform without discomfort, which is now impossible, even using tools such as screen readers. However, without restructuring the color palette and the proportions of some elements, achieving a satisfactory result will not be possible either.

Regarding the Smart Break application, most of the accessibility issues had already been identified during the redesign phase, and solutions had been developed in advance. However, the team adjusted certain aspects related to layout consistency and color palette contrasts.

Accessibility is a broad value that often gets overlooked in the early stages of development. It's important to consider that there are millions of people with various types of disabilities or impairments, whether they are visual, motor, or auditory, temporary or permanent. These conditions can significantly impact the user experience of an application that hasn't been developed with accessibility in mind.

Among the study limitations, the authors can mention the time constraints, which did not allow testing the applications with people with different types of disabilities. At the moment, the suggested improvements are being made. In the next stage, the applications are expected to be tested with end users, including people with some disability/disability.

In conclusion, incorporating accessibility assessment into the development process of this application will allow the development authors to correct the shortcomings identified and create an accessible product for the most significant number of people. This study reinforces the importance of learning and applying accessibility guidelines in platform/mobile

application development, which is crucial to create inclusive and accessible digital products that meet legal requirements and provide a better experience for all users. Nonetheless, evaluating and ensuring digital accessibility remains a significant challenge, and more research is needed to develop effective evaluation strategies. The authors believe that associating a protocol of evaluation by users is the key to a more complete strategy, and that it will be this field of research that they will investigate in the future and take this study to a higher level.

This study has shown the significance of educating future programmers about accessibility guidelines and fostering personal connections with individuals with disabilities during the educational process. The study also highlights the importance of incorporating universal design principles into website development and creating accessible digital tools.

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