

# **Application of WCAG Standards as a Basis for Visual Design Assessment in Running Applications**

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## **ABSTRACT**

This research studied how accessible running apps are visually, utilizing the Web Content Accessibility Guidelines (WCAG). The purpose of this study was to test four UI elements, buttons, icons, text, and labels and provide recommendations for their visual accessibility. This study was of a quantitative audience, looking at color contrast ratios for moving text over backgrounds while at the same time looking at compliance with the WCAG AAA and AA standards when testing UI elements from all three apps. Data was collected from the Strava, Nike Run, and Adidas Running apps in the Home, Activity Tracking, and Result/Summary screens. The results indicated that the primary UI elements, primary buttons and any numeric displays, were found to mostly pass the AAA and AA WCAG billing standards, while secondary UI elements, unit labels, routes map lines, and subtexts, were often found to not pass the AAA standards, and in some cases did not even pass the AA standards. This study provides designer resources, such as heat maps and tables that show pass/fail ratios for each UI element. This study demonstrates that WCAG was an effective basis for developing an accessible visual design that supported readable text which engaged all users. This study also helped by blending accessible visual design evaluation within WCAG framework for running app interfaces.

Keywords: Running app, WCAG 2.1, Visual accessibility, Color contrast, User Interface, Readability

## **ABSTRAK**

*Penelitian ini mengkaji tingkat aksesibilitas visual pada aplikasi lari dengan menggunakan pedoman Web Content Accessibility Guidelines (WCAG). Tujuan dari penelitian ini adalah untuk menguji empat elemen antarmuka pengguna (UI), yaitu tombol, ikon, teks, dan label, serta memberikan rekomendasi terkait aksesibilitas visualnya. Penelitian ini menggunakan pendekatan kuantitatif dengan menganalisis rasio kontras warna pada teks yang bergerak di atas latar belakang, sekaligus mengevaluasi kesesuaian terhadap standar WCAG tingkat AA dan AAA pada elemen UI dari ketiga aplikasi yang diuji.*

*Data dikumpulkan dari aplikasi Strava, Nike Run, dan Adidas Running pada layar Beranda (Home), Pelacakan Aktivitas (Activity Tracking), serta Hasil/Ringkasan (Result/Summary). Hasil penelitian menunjukkan bahwa elemen UI utama, seperti tombol utama dan tampilan angka, umumnya memenuhi standar WCAG tingkat AA dan AAA. Namun, elemen UI sekunder, seperti label satuan, garis peta rute, dan subteks, sering kali tidak memenuhi standar AAA, bahkan dalam beberapa kasus tidak memenuhi standar AA.*

*Penelitian ini juga menyediakan sumber daya bagi desainer, seperti heat map dan tabel yang menunjukkan rasio kelulusan/gagal untuk setiap elemen UI. Secara keseluruhan, penelitian ini menunjukkan bahwa WCAG merupakan dasar yang efektif dalam mengembangkan desain visual yang aksesibel, mendukung keterbacaan teks, dan dapat digunakan oleh berbagai kalangan pengguna. Selain itu, penelitian ini mengintegrasikan evaluasi desain visual yang aksesibel dalam kerangka WCAG untuk antarmuka aplikasi lari.*

*Kata kunci: Aplikasi lari, WCAG 2.1, Aksesibilitas visual, Kontras warna, antarmuka pengguna, Keterbacaan*

## **INTRODUCTION**

In contemporary society, mobile devices do not only have a role of providing communication with others, but also a valuable resource for education, entertainment, health or sports related activities. With readily available access, mobile devices now allow people to monitor their physical state, track their athletic performance, and track their daily activities more efficiently as these devices can now also provide a host of additional features (Pires et al., 2020). An example of this application is through running applications such as, "Strava," "Nike Run Club," and "Adidas Running" where activities can be

visually represented in form of distances run, pace, mapped routes, and their individual performance stats.

Visual readability of the application interface is a key consideration in these applications as to whether or not UI features that are difficult to read or decipher labour to impede the user experience and diminish the application as a fitness monitor (Del Aguila Dominguez et al., 2023). Although the multiple running apps provide a high level of interactive features and sophistication, preliminary research indicates that several of the interface features, for example, unit text, subtitles, and icons, and even line colors for mapped route, do not have much color contrast, thus reducing its readability. In that case it may be challenging for users to retrieve the information quickly and accurately, for those with visual impairments, as well as in bright outdoor lighting.

As outdoor fitness activities grow more popular, this readability issue becomes increasingly applicable. In the use context of sunlight, glare on screens and diminished visual contrast can impede readability and become difficult for users to access key information, such as speed, distance, or time, during activities (Qian et al., 2024a). These are closely aligned with the principles of visual legibility and luminance contrast, two essential components of information perception under variations in lighting conditions (Qian et al., 2024b). Readability and contrast are fundamental components of user interface design in design (Zhang et al., 2024). The Web Content Accessibility Guidelines (WCAG) have also highlighted the importance of minimum contrast ratios for text and graphic elements to ensure visibility in various visual conditions. Although some studies have explored the impacts of color and spatial formats on visual search efficiency in mobile navigation systems (M.Zhang et al., 2022), the number of studies focused on readability of outdoor sports applications and user interfaces is limited.

This research study will analyze the visual readability of common running apps based on WCAG specifications. The analysis consists of text elements as well as icons, buttons, and labels that will be measured based on color contrast ratios, and the overall pass/fail rate calculated for WCAG AA and AAA levels of accessibility. The outcomes of the current research are expected to inform practical design suggestions to assist developers and UI/UX designers in developing more accessible application interfaces that are readable in outdoor settings and enhance the user's experience of fitness activities.

## **RESEARCH METHOD**

This research utilized a quantitative descriptive approach complemented by visual qualitative analysis which focused on the readability and visual accessibility (Rajendran & Othman, 2023). of running app interfaces in bright daylight. A quantitative descriptive approach was adopted to objectively assess visual contrast ratios and to view user experience (Weichbroth, 2024). Contrast ratios measured per the recommendations to determine if text, icons, and buttons were visually accessible. The study aimed to examine how interface design elements including color, typography, layout, and contrast affected accessibility for users reading information presented to them under conditions of high-luminance (Zhu & Yang, 2023). The quantitative descriptive approach permitted the researchers to quantify both objective findings by measuring functional visual contrast ratios and perceptual findings through the researchers observations while reading and drawing on studies from the literature that relates to readability and digital (Weichbroth, 2024).

The research sample consists of three popular and widely used running apps, specifically Strava, Nike Run Club (NRC), and Adidas Running (Runtastic). These three applications were selected because they all have extensive user communities and comprehensive features (Moghaddam-Banaem et al., 2022). plus visual elements that showcase user interface design practices of running applications in comparison to one another. For each application, the review

examines three general application screens that provide similar visual functions:

- Home / Dashboard
- Activity Tracking (real-time data)
- Results/Summary (post-run visualization)

The research procedure was carried out in several stages:

1. **Identify UI Elements.** Identification is performed on essential elements like text (headings, labels, numbers), icons (such as navigation or status indicators), buttons (Start, Pause, Stop, Share), and additional markers or labels on graphs or maps. This step determines the visual elements that most impact user Readability while outdoors (Sunkara et al., 2022).
2. **Color Contrast Ratio Measurement.** Assessing color is done by comparing the foreground color (text, icons, or buttons) to the background color using the HEX color format. Each element is measured against the Web Content Accessibility Guidelines (WCAG) 2.1 level AA and AAA standards to measure the minimum contrast ratio that can be viewed by people with low vision or during intense lighting circumstances (Osman & Hwang, 2021). The classification will be either Pass if the measurement meets the thresholds or Fail if the measurement does not meet the thresholds. Comparison measurements are collected using measurement software and direct visual assessment under daylight (simulation of outdoors).
3. **Data Analysis and Visualisation.** Results of measurements are organized in a systematic presentation through tables, graphs, and heat maps to represent the distribution of elements that pass and/or fail to meet the standard (Radley & Dart, 2024). Pass/Fail ratios are calculated for each application, and in each screen category to identify patterns of visual readability. The analysis confirms the following generalization: primary elements (title text, navigation buttons) pass AA/AAA standards, while secondary elements (unit labels, subtitles,

map route lines) often do not pass AAA standards and sometimes do not even pass AA standards.

4. **Visual Descriptive Analysis.** This reserach also carried out visual observation and user perception review to understand the effects of color contrast, typography, and layout on reading in high lighting conditions, which gives an interpretive frame to quantitative outcomes and provides additional supporting user interface design that in relation to improving the reading process and also help designer to understand it (Handriyantini & Salem, 2025). By deploying this method we are able to systematically and measurably evaluate visual readability through practical suggestions to improve interface design to be more inclusive, readable in outdoor contexts, and more user friendly.

Technique	Description	Output
<b>Visual Observation</b>	Frame-by-frame analysis of screenshots of each application interface using a standard observation template that refers to WCAG 2.1.	Qualitative notes & observation tables
<b>Outdoor simulation</b>	Observation of interface readability under simulated lighting levels (10,000, 30,000, 50,000 Lux).	Readability score (1–5) by researcher
<b>Contrast Ratio Measurement</b>	Using <i>the WebAIM Contrast Checker</i> to calculate the contrast ratio between text/icon elements and their backgrounds.	Quantitative contrast ratio table
<b>User Readability Test</b>	5–10 participants assess readability outdoors using the same rubric (1–5) and provide qualitative comments.	Readability scores per application & per screen

Table 1 . Data collection techniques  
 source : author's documentation

## RESULT AND DISCUSSION

After reviewing the major user interface (UI) aspects of Strava, Nike Run, and Adidas Running, each UI aspect was evaluated based on the Web Content Accessibility Guidelines (WCAG) implementation as a method of evaluation. The evaluation was focused on the color contrast ratio of the foreground text or icons, and the color of the background that the text or icon was situated. Resolution was to bring upon the measurement via an online contrast checker, where each color pairing (in HEX) was measured and evaluated against the WCAG AA and AAA contrast ratios.

### Visual Observation Analysis

This section discusses visual readability detected in three apps, Strava, Nike Run Club, and Adidas Running, through qualitative observations of visual elements (Dashboard, Activity Tracking, Result/Summary) per WCAG 2.1 guidelines. The WCAG (Web Content Accessibility Guidelines) advocates for minimum contrast ratios to achieve the best readability and to identify text or elements. Evidence from prior studies, confirmed the significance of visual hierarchy and selection of color combinations on visual search efficiency (M. Zhang et al., 2022). It also examine if these conclusions also apply to running app interfaces. This observation also calls attention to small elements that are often inadequate when applied (e.g., secondary labels, thin icons).

Application	Screen	Observation	Assessment
Strava	Dashboard	The main elements are legible, but the gray text and small icons are unclear. Main data is clear, subtext on the map and main status icons have sufficient contrast and are clear. Main data is clear, routes on the map have strong contrast, but sub-data and gray sub-text may appear less clear.	Good/Moderate
	Tracking		
	Summary		

<b>Nike Run Club</b>	Overall average	<p>Improvements are still needed for the subtext and some small icons. The main "Start Run" button is clearly visible for Text vs Button Fill &amp; Background, text, gray subtext, and thin bottom bar icons that are easy to miss.</p> <p>The main data and figures are very clear and dominant, while the subtext has minimal contrast, making it difficult to read.</p>	Moderate
	Dashboard		
	Tracking		
<b>Adidas Running</b>	Summary	<p>Key data is good, but small text and icons lack contrast.</p> <p>Good use of a clean layout with dominant key data, but the use of color and secondary elements needs more contrast.</p> <p>Key data such as text and small numbers are visually overwhelmed by the map, and the small (thin) text is difficult to read.</p>	Poor
	Overall average		
	Dashboard		

Table 2. Visual observation test results  
 source : author's documentation

In general, visual observation results show that there are variations in readability influenced by contrast, text size, and visual hierarchy, where the main elements (large numbers, titles) generally meet the contrast criteria, while secondary elements (gray text, line icons) often fail. Applications that maintain a higher contrast ratio show better readability, in line with the findings of (Perrig et al., 2023), who state that aesthetic aspects with contrast that complies with WCAG guidelines (at least level AA) significantly support the user experience.

### Outdoor Simulation

The purpose of this simulation is to evaluate the screen of the running app for readability in lighting of 10,000 – 30,000 – 50,000 lux, to verify the conclusion of the earlier observations made under extreme lighting conditions. The WCAG guidelines state, "readability of the interface, based on the contrast ratio principle, must be maintained for all lighting conditions," therefore, contrasting was utilized in this study as an extension of their findings in extreme lighting conditions (Lewandowska et al., 2021). The measurement of the readings was made with a mobile lux meter (with an approximate deviation of 10%) and recorded using an iPhone 13 version with brightness at 100%.

Application	Screen	Readability Rating	Notes
<b>Strava</b>	Dashboard	3.3	Strava does well at ensuring readability for primary elements, but secondary elements see a reduced readability as lux increases in brighter situations. The decreased visibility is primarily due to insufficient contrast ratios and the application of small icons in some areas.
	Tracking		
	Summary		
<b>Nike Run Club</b>	Dashboard	2.2	Nike Run Club shows good usability because it does an excellent job displaying good readability for the primary text elements, as the dominant and bold text is used for important data. Unfortunately, the readability of secondary elements (smaller text/captions, sub-data, small icons) has a dramatic fall off in readability outdoors due to low contrast ratios.
	Tracking		
	Summary		
<b>Adidas Running</b>	Dashboard	1.9	The clean look of Adidas Running comes from easy color combinations on their main elements that meet the minimum contrast ratio requirements for all of the essential data. However, their light design (light gray base, and light lines/icons) means that secondary elements, map labels, and thin graphics are often not satisfactorily legible in bright outdoor lighting.
	Tracking		
	Summary		

Table 4. Readability ratings

source: author's documentation

The simulation results here reflect a decrease in readability for the applications with low contrast, particularly for secondary elements with small text or thin icons. These simulation results are similar to previous findings and demonstrate how color combinations and visual hierarchy is beneficial to improving interface readability for users.

### User Readability Test

Additionally, this test is designed to evaluate users' subjective perceptions of the readability of the three running applications (dashboard, activity tracking, results/summary) main screen interface in outdoor lighting conditions. The sample size was N = 5 participants, who were tasked to perform several in-app tasks (identify buttons, read, pace & distance travelled) to make their evaluations. The evaluation utilizes a 1–5 scale and a short questionnaire for qualitative comments. Following the test, participants who trialled the applications had exposure to lighting conditions while running activities of 10,000 - 30,000 - 50,000 lux to validate the earlier test evaluations.

Application	Lux Level	Readability Rating	Feedback
Strava	10,000	3.5	Readability generally holds up to 30k lux, it decreases at 50k lux. The only minus is locating the "Start Run" button, which is the smallest component against the other two apps. On the other hand, the bottom bar icons are the most distinguishable and contrasting, remaining legible at bright light.
	30,000	3.1	
	50,000	2.8	
<b>Overall Rating</b>		3.1	
Nike Run Club	10,000	3.8	Shows the best readability regardless of the environment, strong contrast and a sharp visual hierarchy. A marked decrease in secondary gray text occurs at 50-k lux, otherwise the main elements are still easy to read.
	30,000	3.3	
	50,000	2.7	
<b>Overall Rating</b>		3.2	

Adidas Running	10,000	3.2	The readability is the lowest out of all devices especially at a light level of 50k lux. The thin black/white colors and small text size make for difficult reading of important data, suggesting the contrast does not meet WCAG 2.1 standards.
	30,000	2.6	
	50,000	2.2	
<b>Overall Rating</b>		2.6	

Table 5. Interface readability for users  
source: author's documentation

Tests conducted on users of running apps indicate differences in user perception of applications with higher rated interfaces (i.e. perceived quality of the visual hierarchy). However, with increases in lux (i.e. light), the implications of contrast grow more significant. This data confirms the effect contrast has on readability in outdoor space. The WCAG 2.1 guidelines specifically note appropriate contrast applied to interface elements (e.g. text, icons, and buttons) will improve reading, and cognitive load on the user. To the user experience this can relate positively to a better experience, which further informs the context of running apps, as previously discussed by (Acosta-Vargas et al., 2021).

### **Color Contrast Testing Results (WCAG)**

The assessment of color contrast explains that three running applications based on the principles of visual accessibility, Strava, Nike Run Club, and Adidas Running, do not fully adhere to the recommended WCAG (Web Content Accessibility Guidelines 2.1) practices. Regardless of the presence of a modern minimalist visual design approach, where all interfaces have light backgrounds and dark text in some way, they do not all follow the WCAG specifications consistently. Differences in the WCAG specifications across the applications might also suggest differences in design philosophy. Consistent color application following WCAG contrast ratios ensures an inclusive and readable design.

With the highest contrast ratio success rate (75% achieving AAA level and 90% achieving AA level), the best performance can be seen in the Strava app, which shows strong visual readability of text and main labels on various main screens (*Home/Dashboard, Activity Tracking, Results/Summary*). The application of a black color combination (#000000) on a white background (#FFFFFF) produces an ideal ratio of up to 21:1, which fully meets the AAA Level standards. However, some visual elements, such as the orange map route lines (#FC5200) on a light gray background (#EBCF4), still do not meet the minimum Level AA requirement (2.81:1), indicating that non-text graphic elements still need to be evaluated.

Furthermore, testing results on the Nike Run Club (NRC) application show a success rate that sufficiently meets the minimum requirements of the WCAG guidelines (50% reaching level AAA and 70% reaching level AA), with main text and interactive buttons such as "Start Run" as elements that demonstrate the best performance. However, some secondary elements such as distance and time labels still do not meet the AA or AAA criteria, with a light gray color (#7B7B7B) on a white background (#FFFFFF) that has a low contrast ratio (4.23:1, where the minimum contrast ratio standard is 4.5:1). The design style prioritizes a clean look, but the aspect of readability tends to be sacrificed in this application.

In addition, Adidas Running has a quite similar success level compared to Nike Run Club, but ranks lowest among the three apps (45% at AAA and 65% at AA) due to inactive icons navigation (#C8C9C7 over #FFFFFF) and map route lines (#009FA3 over #F6F2E7). Adidas takes a simpler approach to visual design by adopting a minimalist, monochromatic visual style that looks clean, but appears to fail in visibility under high-light contexts.

In conclusion, this study has illustrated how, while all apps utilize the same, modern design brand approaches, visual accessibility, because it involves a level of color contrast, is still something that has relevance in running app interface design. The insights from this project will help facilitate discussions

around new app design relating to useable application, visual ergonomics, and universal readability on apps, especially for users that have interpretation bias issues.

### **Comparative Analysis Between Applications**

By comparing the applications, it was observed that visual principles have been applied differently component to component, in aid of reading circumstances in outdoor contexts. For outdoor conditions of reasonable visibility, Strava employs high-contrast colors to signal significant sections of the app. Nike Run Club and Adidas Running rely on a more modern, minimalist design, layering low-contrast designs and soft gray-color for secondary components in either application. This attention to aesthetics is visually appealing but is contrary to reading standard in high-light.

It appears in our observations that the secondary components (text, labels, icons) are typically total failure points across each application with primary text and call-to-actions points meeting AA and AAA success criteria consistently. This would suggest developers write for the readability of essential components and fail to consider the contribution of second-tier information to support reading in outdoor contexts.

From a quantitative position, Strava's outcomes measures wellness results stand alone against Nike Run Club and Adidas Running outcomes measures. Strava's visual contrast rated highest with optimal visual contrast, while Adidas Running (Barisch-Fritz et al., 2023). visual contrast was minimalist, visual contrast readings appeared to hinder readability. This shows that space within mobile applications needs to balance in its design decisions aesthetics and purpose.

### **Interface Display Readability Simulation**

The findings of the indoor-situation interface display-text readability simulations designed to simulate, at least as best permitted, outdoor lighting conditions at intensities of 10,000, 30,000, and 50,000 lux are described in

this section. The intent was to evaluate how well the primary components of the interface text, icons, and labels are able to be read under high light exposure situating outdoor lighting conditions that refers to the WCAG 2.1 principle of perceptible contrast ratio.

The findings show that Strava had the most stable readability across all lux levels of all applications because of the high contrast of navigation icons and bold shapes. Nike Run Club was found to demonstrate the clearest items and order of information through text, icons, and hierarchy that remained at least legible at middle lux levels and its colors and typography were described to indicate readable in association to information hierarchy. Adidas Running had the greatest impairment in this area of readability, particularly around small text and gray icons that seemed to lose functionality altogether at the 50 K lux simulation exposure.

In most cases, elevations of lux light intensities declined readability across all apps, and were of note in particularly in secondary elements that are made of low contrast ratios. The simulation again demonstrated decline of readability when surfaces light intensity is increased when using low contrast surfaces, source light intensity and reflectance can affect low contrast elements (Bano et al., 2024). Designs should take into account a surface adaptable to the lighting conditions, to improve visual consistency.

### **Testing Visibility for Users**

Three main tasks were included in the visibility test for test participants: reading the speed label, locating the distance label, and looking for the Start Run button. This task was utilized to evaluate the users' evaluations of actual readability under three conditions, with lighting levels of 10,000, 30,000, and 50,000 lux. The five participants were assigned scores for their ability to read from a 1-5 scale for readability.

The results indicate that Nike Run Club had the highest visibility score consistently because of its effective contrast and hierarchy in design. Strava fell in the middle with some clearly legible elements, like the pace numbers, but smaller, less evident elements of design, like the "Start Run" button, were more difficult for participants to see in all lighting conditions. This design follows the brand identity guidelines of Strava, which insists upon high contrast, and bold forms of the elements to ensure readability in any level of light (Strava Branding Style Guides, 2023). Overall, Adidas Running scored the worst, because the light gray was harder to read the smaller text in the bright light.

In sum, the user results later corroborate and mirror findings from the previous simulation studies in that low contrast and thickness of vision, resulting in less overall readability. In practical tasks, it might be easier for users to recognize the larger contrast items sooner. Overall, the findings converge with the usability principle offered by (Rangeswan et al., 2023), that visual accessibility enhance not only efficiency of users decisions, but also the delivery of those decisions back to the top of this page.

### **Implications for Future Application Concept**

The results of the analysis show that designing outdoor activity-based applications needs to take into account considerations about visual readability, accessibility, and user comfort. This research made available some effective concept guidelines aimed at developers and designers of digital interfaces, grounded in the specific context of outdoor activity-based applications requiring high readability in bright light. This discovery can even be further built upon for research and in evaluating designs and interfaces.

The basic WCAG guidelines that develop into concept development and work framework for designer and programmer are:

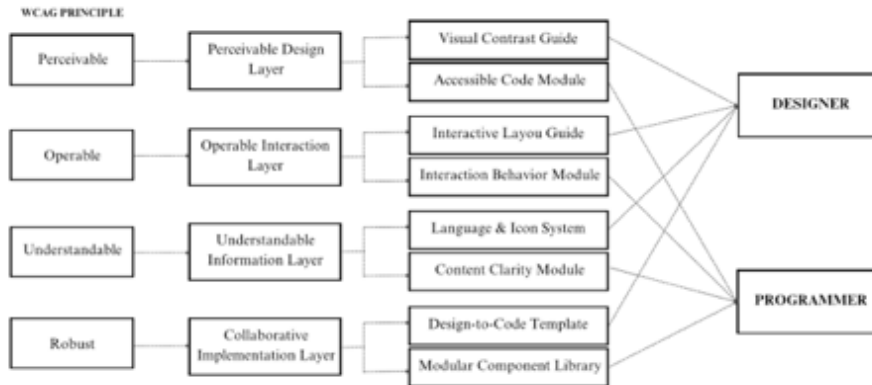


Figure 1. Framework Based on WCAG  
 source: author's documentation

To translate accessibility principles into a practical creative workflow, this study proposes a structured framework that integrates the Web Content Accessibility Guidelines (WCAG) within the context of collaborative design and development. The goal is to create a shared reference system that bridges the gap between designers and programmers, ensuring both aesthetic and functional accessibility are achieved in harmony. This framework positions accessibility not merely as a compliance requirement but as a creative foundation for inclusive user experience design.

By dividing the framework into four interconnected layers: Perceivable Design, Operable Interaction, Understandable Information, and Collaborative Implementation, it establishes a systematic workflow that guides how visual, interactive, and technical decisions can align seamlessly. The following table outlines the adapted structure, describing each layer's focus, relevant WCAG principles, and the corresponding deliverables for both designers and programmers.

<b>Pillar</b>	<b>Focus</b>	<b>Adapted WCAG Principle</b>	<b>Output for Designers</b>	<b>Output for Programmers</b>
<b>Perceivable Design Layer</b>	Information and visual elements must be clearly seen, heard, or otherwise perceived	<i>Perceivable</i>	Guidelines for color contrast, typography, and visual hierarchy (14–16px body text, contrast ratio $\geq 4.5:1$ , use of symbols beyond color)	Implementation of CSS/HTML supporting <i>high contrast mode</i> , <i>alt text</i> , and <i>responsive scaling</i>
<b>Operable Interaction Layer</b>	Interactive elements must be easily usable in various conditions (indoor/outdoor)	<i>Operable</i>	Layout guidelines for buttons (minimum 44×44px), consistent navigation placement, non-distracting animation	Implementation of <i>keyboard navigation</i> , <i>touch target optimization</i> , and <i>consistent UI mapping</i>
<b>Understandable Information Layer</b>	Information must be clear and easy to understand across different ages and levels of digital experience	<i>Understandable</i>	Guidelines for labels, icons, microcopy, and simple navigation structure	Implementation of <i>natural language processing</i> , text validation, and <i>help tooltip functions</i>
<b>Collaborative Implementation Layer</b>	Bridging communication between designers and programmers	<i>Cross-functional integration</i>	Visual documentation templates technical specification	Modular design components (e.g., <i>design tokens</i> , <i>component library</i> )

Table 6. Framework details for further application  
source: author's documentation

This study highlights the value of adapting typography principles and color contrast principles in designing visually accessible running applications. Font sizes that respond to lighting and pixel density establish the potential for

readability considering varying conditions of use 22. Therefore, a context-based, dynamic color system is also recommended. Studies examining color contrast adaptations with screen brightness have shown improvements in visual comfort and user efficiency. Icon design should consider the stroke and line thickness present to ensure readability in outdoor conditions.

## **CONCLUSION**

This study shows that the Web Content Accessibility Guidelines (WCAG 2.1) could be effectively used as a way to assess visual readability of mobile application interfaces, primarily in an outdoor context. The testing involved WCAG analytical components, visual inspection, simulating outdoor lighting and user testing for readability, suggesting that factors of contrast ratio, text size and visual hierarchy of interactive elements can affect the level of readability presented within the app interface.

With a strong emphasis on points of focus, and overall legibility in varying light, the running app, Strava demonstrated the strongest contrast ratio standards. The Adidas Running app does have a very cost-effective layout which is hindered by the muted colours in the text/information area that made it unreadable in bright light. The Nike Run Club app had a fairly good visual hierarchy, the downside being that when the text was secondary readability decreased in brighter light.

In summary, the research showed a strong rationale for taking the Web Content Accessibility Guide (WCAG 2.1) guidelines into consideration during the development of running apps. Though, the way higher legibility and user comfort could be obtained through regular use of contrast colour combinations, text sizing, and reinforcement of established hierarchy elements.

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