Building for Digital Accessibility at Scale

AudioEye's research and approach

April 2022

Contents

Legal disclaimer

The content contained in this white paper is correct as of April 2022, and represents the status quo as of the time it was written. As we continue to improve our digital accessibility solution, our product and services may change.

Introduction

We live in the digital age, where access to the internet plays a critical role in our daily lives and livelihoods. As our reliance on the internet grows in every aspect of our lives—from healthcare to employment to shopping, and beyond—it's exposing gaps in digital accessibility and vulnerabilities these gaps create for people with disabilities, businesses, and the society at large.

3%

of the internet is accessible for people with disabilities

There are 1.9 billion websites worldwide,[1] with more than 250,000 new sites going live every day.[2] But only 3% of the internet is accessible to people with disabilities.[3] As the urgency to solve digital accessibility continues to grow, it's becoming clear we need an approach that can solve for the scale of the internet and the speed of content creation, while creating inclusive experiences for every user today.

This is no small task, and we believe that the only way to provide equal access for all—to billions of people on billions of websites—is through responsible implementation of technology backed by true subject matter experts, and to do so in a transparent way.

Accessibility solutions on the market today range from simple automation-only tools to labor-intensive, expensive manual audits. AudioEye's recent research, which consisted of assistive technology user and business surveys as well as website analyses across industries, shows that neither solution can deliver ongoing accessibility, inclusive experiences, or legal compliance on its own and in an affordable and sustainable way.

The internet is simply too big and fast-changing for a manual-only approach (see the table below). And while automation helps provide rapid improvements at scale, it cannot fix issues that depend on deeper contextual understanding.

Can we manually solve digital accessibility at scale? This is what it would take:

16 hours manual audit + **72 hours** remediation & retest = **88 hours** total for one site	**88 hours** to make one site accessible x **1.9 billion sites** worldwide = **167 billion hours** to fix every site	**167 billion hours** to fix every site ÷ **2,080 hours** per year = **80.3 million people** needed to implement

Using these estimates and assuming the websites are of average complexity, it would take 167 billion hours for a person to fix every website worldwide, or 80.3 million implementers working for a whole year. If we were to assume that only half of the world's websites needed to be made accessible, it would still take 83.5 billion hours. If the average implementer is able to make source code fixes and works 40 hours a week (40 x 52 = 2,080 hours in a year) at an annual wage of $100k,[4] you would still need 40 million implementers working for an entire year at the cost of $4 trillion USD to fix half the websites on the internet. That's not even accounting for the 22 million hours needed each day to fix newly created websites.

AudioEye has developed a hybrid approach that pairs technology with certified accessibility experts to help website owners and content creators solve every aspect of digital accessibility in the most effective, scalable, and affordable way.

2 billion

estimated assistive technology (AT) users by 2030[5]

Through our continuous investment in research and development and our unwavering focus on the end user, we have created an automated test suite with 400+ test outcomes and 70+ automated fixes that allow us to solve the majority of common accessibility issues in real-time, thus instantly improving access to digital content and tools for millions of users. We work with people with disabilities and use their feedback in our product development and quality assurance to ensure our solution continues to deliver the best experience for the end user.

Founded as a research and development firm in 2005, AudioEye has evolved into a technology company to better support businesses and organizations around the world in building accessible and inclusive experiences for their users. With every accessibility problem we solved—and we've been solving billions of them every day for the past decade—we learned something new and used that knowledge to improve our technology and custom solutions.

15%

of the world's population live with some type of disability[6]

As we work to eradicate every barrier to digital access, we recognize that accessibility is an ongoing effort. We also believe that accessibility is an inherently collaborative undertaking, where different stakeholders—members of the disability community and their advocates, government entities, businesses, web professionals and content creators, accessibility solutions providers, and experts—all contribute to bridging the digital accessibility gap and making sure that people of all abilities can enjoy the same access to the internet and all its benefits. And the only way we can succeed is if we bring more transparency into our work and create opportunities for sharing our unique perspectives, research, and insights.

It is in this spirit that we are sharing our research and insights on the state of digital accessibility today and AudioEye's unique approach to bridging the accessibility gap.

When the COVID-19 pandemic struck, in many cases making digital the only channel through which customers could interact with brands, Forrester saw a significant uptick in inquiries related to accessibility, mostly from companies getting serious about accessibility for the first time. The pandemic served as a wake-up call not just about the importance of digital accessibility but also about its benefits..."

Digital Accessibility Enters The Spotlight As A Business Priority,
Gina Bhawalkar, Principal Analyst, Forrester, April 2021

The state of digital accessibility

One of the paradoxes in web accessibility today is that while the general awareness for it is growing—fueled by the rise of accessibility lawsuits and diversity and inclusion investments—there is still a tremendous lack of practical information and transparency on how to implement accessibility best practices. This has created a vacuum leading to misguided assumptions and poor decision-making.

Common misconceptions among business owners and web professionals

A 2021 AudioEye online survey of 500 business leaders, website designers, and developers revealed a number of misconceptions and challenges that impede efforts to comply with accessibility guidelines.

52%

of business leaders, designers, and developers said they believe that they have to rebuild their entire website to be accessible

Over 65% of all respondents said they believe that just using accessibility toolbars can make websites “almost completely accessible,” while 52% maintained that creating an accessible website means redesigning and redeveloping the entire website. Neither of these beliefs is true. Simple and cheap accessibility toolbars are not a complete solution. But rebuilding an entire website, which is costly and time-consuming, is not the answer either. Considering that 70% of all survey respondents cited “cost” as the most important concern in addressing website accessibility, these misconceptions are likely to influence accessibility decisions, to the detriment of users with disabilities.[7]

Common accessibility issues and their impact on user experience

According to WebAIM's most recent accessibility analysis of the top one million home pages, almost 97% of websites have accessibility errors, failing to meet some of the basic Website Content Accessibility Guidelines (WCAG)—only a slight improvement from 2020, when 98% of home pages were inaccessible. Almost all accessibility failures on these sites fall into six common issue types, such as low contrast text and missing alternative text for images, which can be easily fixed with the right tools.[3]

In a 2021 AudioEye digital accessibility survey of 73 assistive technology users, survey participants selected keyboard navigation, missing or unhelpful headings, and empty or missing form labels as the top three accessibility problems that need to be addressed.[8] These issues persist across retail, healthcare, finance/banking, education, and other websites that play an essential role in everyday life. Some of these issues, such as missing or unhelpful headings, are straightforward to fix in both HTML and drag-and-drop website builders, even for non-code websites and don't require technical expertise. Other issues, such as keyboard navigation, can be tricky and require an extra effort. All of these issues can be fixed and prevented with proper accessible design practices and planning.

Accessibility issues across different industry sites

79%

of websites analyzed have three or more types of severe accessibility issues

At AudioEye, we analyzed more than 3,500 randomly selected websites across 22 industries based on top search results, including those highly impacted during the pandemic—healthcare, e-commerce, and employment. Across the sample set, we found that 79% of the websites contained three or more types of severe accessibility issues, and 49% of the websites contained at least five.[9]

9% vs 4%

The unemployment rate for people with disabilities is more than twice as high as for those without disabilities[10]

In addition to home pages, we scanned 2-3 pages that contained key information and/or were necessary for completing certain tasks, such as viewing product descriptions, booking an appointment, or completing a purchase. We included these additional pages in our scan to better understand the sites' overall usability for persons with disabilities.

A severe accessibility issue is a potential barrier to users that prevents some individuals from completing the goal of a site visit. For example, when an assistive technology user can't submit a form because the form field label is empty or the button can't be reached.

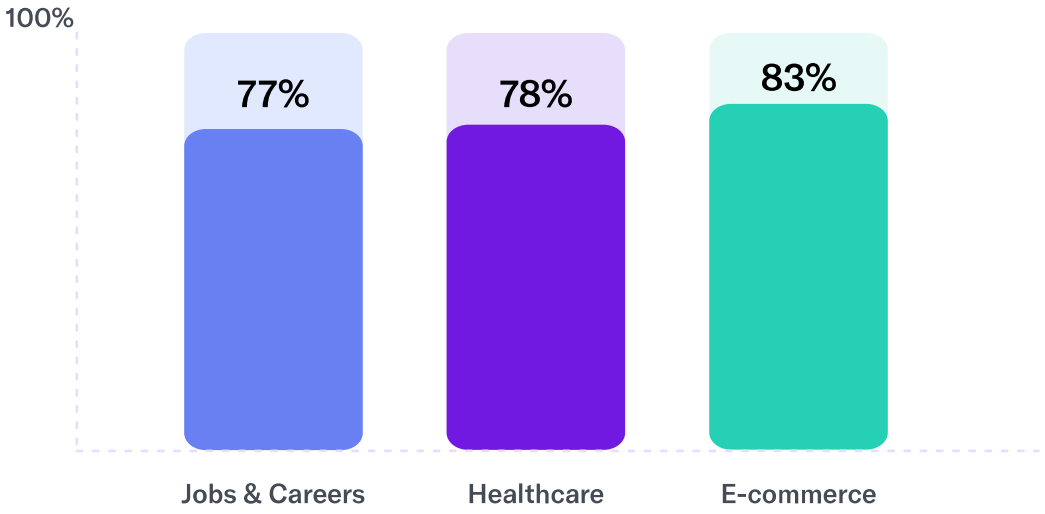
The frequency of issues was also high, with an average of 84 issues per page on career and job sites, 109 issues per page on healthcare sites, and 203 on e-commerce sites. On average, 20% of these issues were severe, and likely to impact a user's ability to complete certain tasks, such as viewing product descriptions, completing a purchase, filling out an application, or booking an appointment.

More findings from our website analysis:

For nearly half of the industries analyzed, three or more types of severe accessibility issues—i.e., issues that can potentially block an assistive technology user from interacting with the content and/or completing the goal of a site visit—were found at least 80% of the time.

Industries that were highly impacted during COVID-19 also had significant accessibility issues: 77% of jobs and career websites, 78% of healthcare websites, and 83% of e-commerce websites containing at least three types of severe accessibility issues.

Sites with at least three severe accessibility issues



The most common severe accessibility issues found across all sites were: small font size in content and hyperlinks and non-text content that was not labeled according to WCAG 1.1.1, such as empty form field labels and images not tagged. These issues could affect experiences for a broad range of people with disabilities, including those with vision, motor, and cognitive impairments.

Top accessibility issues found per URL

Accessibility issue	Severity	Sites that have this
Small font size	High	100% of sites
Empty field labels	High	72% of sites
Missing SVG text equivalents	High	44% of sites

When we expanded our analysis to 20,000 websites across the same industries:[9]

5.8% of websites were using some form of automated digital accessibility solution, with the highest prevalence in the law & government (10%), automotive (10%), and travel & tourism (9%) sectors.

Notably, only 1% of e-commerce websites were using some form of automated digital accessibility solution.

54%

of assistive technology users say they feel that e-commerce companies don't care about earning their business[11]

We found that despite running simple, automation-only accessibility solutions, most sites still had accessibility errors with significant impact on the user experience. Looking specifically at our customers' websites, we found that the majority of accessibility issues (up to 95%) can be fixed and prevented using a mix of automated and manual remediations leveraging JavaScript, without the need to modify the original source code.

In addition to site scans, we conducted manual audits on 61 randomly selected websites that were using competitors' traditional manual audit and remediation services and associated accessibility solutions. We found significant accessibility issues, such as non-functional site navigation, unlabeled graphics, inaccessible video controls, and many more. In total, we found hundreds of issues across the audited sites that have either not been fixed at the source code yet, or have been missed.[12]

Key challenges

There are a number of reasons why despite the growing awareness of digital accessibility in the private sector, expectations of inclusivity, and renewed efforts by governments worldwide, we are still lagging behind. Among those reasons are:

- Ambiguity between legal and technical frameworks,
- Misleading discourse and lack of transparency,
- Current limits of technology, and
- Dynamic nature of websites and speed of content creation.

Ambiguity between legal and technical frameworks

The Americans with Disabilities Act (ADA) is one of the key legislations that prohibits discrimination based on disability. In order for websites to be compliant with the ADA, they have to be accessible to people who browse the internet using assistive devices. Based on the way the courts and the Department of Justice have interpreted the law so far, ADA compliance is clearly mandatory for government and business websites. On March 18th, 2022, the Justice Department published guidance reaffirming that web accessibility is a legal requirement under the ADA. While it still doesn't provide any legal standard for businesses to follow, the guidance lists a number of recent settlements that show the Justice Department's approach and decision-making in ADA lawsuits.

400%

increase in ADA-related lawsuits between 2017 and 2021[13]

Between 2017 and 2021, the number of ADA-related lawsuits went up 400%. Most ADA website lawsuits are filed against businesses that are considered “places of public accommodation” under the law. But the ADA, which was signed into law in 1990, doesn’t provide technical guidance or specific legal criteria for implementing digital accessibility. Instead, the courts and the Department of Justice rely on WCAG, which are used as a web accessibility standard. Under the ADA, WCAG is almost universally cited in lawsuits and ADA settlements. In fact, legal precedents show that adhering to WCAG is key to ADA compliance.

But a lot is left to interpretation, including how many and which WCAG criteria a website needs to conform with in order to be considered ADA compliant. What’s more, as companies grow in size and web traffic, they are being held to higher standards, facing a bigger risk of getting sued for non-compliance.

The recent focus on legal compliance has also diverted the attention from creating great experiences for people with disabilities to worrying about lawsuits. For businesses of any size, legal threat is often the main driver for action, which coupled with the lack of technical knowledge, makes them vulnerable to accessibility vendors that sell inadequate solutions and create self-serving, false narratives around compliance. These vendors span cheap automation-only solutions and expensive manual audits, neither of which can deliver ongoing accessibility and compliance. And while differences in opinion and approach are part of a healthy competition in business and technology, in this case, they have a damaging effect.

Misleading discourse and lack of transparency

94%+

of active websites are using some form of third-party resource, most common being JavaScript, images, and HTML[14]

At the moment, overlays are one of the most contentious topics in digital accessibility discussions. Overlays can be defined as snippets of JavaScript code that add functionality to a website, typically offered by a third party. Many online software solutions with rich feature sets, such as chatbots, A/B testing platforms, and site analytics and tracking tools fit that description, even though they are not commonly referred to as "overlays." As of 2021, the most popular example is Google Analytics, which can be found on over 62% of websites. Over 94% of active websites are using some form of third-party resource, most common being JavaScript-enabled content and images, ad tracking, and social media plugins.

In the context of accessibility, the term "overlay" is typically used to describe toolbars and/or automation that help detect and resolve accessibility issues, such as text size or color contrast, as the page loads for the user.

The problem with overlays lies in their implementation and discourse. There are vendors who sell and promote overlays as reliable and complete accessibility solutions.[15] This is misleading for a number of reasons.

Firstly, there are content types, such as video, audio, and PDF, that an overlay cannot fix. Secondly, there are issues that need human intervention. And, finally, some overlays interfere with the work of assistive technology, such as screen readers. The misleading discourse and false promises made by some vendors cause a reductive attitude towards technology in general, falsely generalizing all solutions as simply "overlays."

Considering that accessibility technology is still new, the majority of businesses don't have the expertise or tools to distinguish the nuances of each solution. The lack of transparency makes it even harder to make an informed decision when comparing accessibility vendors.

Current limits of technology

Many of the common barriers to digital accessibility are simple to identify and resolve. Even relatively basic, rules-based software can quickly detect and resolve errors, such as incorrectly ordered HTML header tags. An AI-enabled solution may even be able to fill in missing image alt text. By and large, where an accessibility concern can be described in terms of a simple pass/fail test, it's often possible for software to automatically find and fix it. This can happen on the fly with automated solutions that interpret a website's code to remediate problems in a way that is indistinguishable from at-source fixes from the perspective of a user or assistive technology.

~2/3

of common digital accessibility issues that AudioEye detects can be resolved with automation today

AudioEye's recent study, conducted on more than a thousand websites across popular content management systems, showed that automation can potentially detect up to 70% of common web accessibility issues today, and resolve about two-thirds of them.[16] The research compared AudioEye's automated test suite and automated remediation software to manual testing and remediation conducted by experienced assistive technology QA testers.

For the remaining issues, however, automated technology is in its infancy. Detecting more subtle errors often requires an understanding of context that is beyond even the most sophisticated AI today. Even with human judgment, if you ask two people to describe an image, their descriptions may be similar, but it is unlikely they would be exactly the same. Determining which description is the better one is also subjective, and AI is not yet able to make those types of judgments.

Considering that web content, WCAG, browser technology, and development techniques are constantly changing, new and more subtle accessibility concerns will continue to arise. Without human support, it's hard to know for sure when web content meets the needs of users in the real world.

Dynamic nature of websites and speed of content creation

There are more than 1.9 billion websites on the internet, with new sites going live every second and millions of blog posts, videos, and images added every day.[1] The speed of new content creation is only matched by the dynamic nature of content, or continuous changes based on user behavior, preferences, and other data.

Every change comes with a risk of making content inaccessible for users with disabilities. Yet, consumers today expect personalized content, instant access, interactive features, and intuitive interfaces to find information, get entertainment, shop, and do myriad other things online.

For businesses and content creators who want to reach the widest audiences possible and meet the expectations of all users, including those with disabilities, the dynamic nature of content poses an ongoing challenge. In a more global context, how do we scale accessibility to almost two billion websites? Considering that most websites were not created with accessibility in mind in the first place, we are now trying to both catch up and keep up. At the beginning of the paper, we provided a rough estimate that it would take 80 million implementers an entire year to help fix accessibility for all of the websites worldwide, and another 22 million implementer hours each day to keep up with new websites being created.

500

hours of content uploaded to YouTube every minute as of February 2020

Another example is video content. As of February 2020, there were 500 hours of content being uploaded to YouTube every minute.[17] Without automation, machine learning/AI, and other technology solutions, there is no chance at captioning that much video content by hand. At the same time, technology today cannot solve every accessibility issue that prevents users with disabilities from consuming and interacting with digital content. So, notably, the most widely used video accessibility solution today, 3Play Media, is a hybrid solution: they pair the most advanced automation with human oversight to validate last mile accessibility issues and ensure maximum accuracy.

The reality is that technology is necessary to scale accessibility efforts. While it can't repair all the problems, it helps to get the work done and provides an ongoing and scalable solution to accommodate for the dynamic nature of websites.

The role of technology in solving digital accessibility

1996

Bobby, the first digital accessibility assessment tool, is released

We've come a long way from the first accessibility tools that emerged in the late 1990s and early aughts. These were free site scanning tools—Cynthia Says, Bobby, and a number of others—that evaluated online content against the standards at the time—WCAG 1.0, the W3C Web Accessibility Initiative (WAI) standards, and Section 508 of the Rehabilitation Act of 1973.[18] One of these tools, the Web Accessibility Evaluation Tool (WAVE) is still in use today. These scanners exposed the complexity of accessibility issues and paved the way for solutions on the market today.

The use of automated solutions for detecting and remediating accessibility issues is a controversial topic, often framed in the context of two extremes. On one hand, there are cheap, automation-only solutions that can sufficiently monitor and identify some issues, but can't fix the majority of issues or provide custom solutions. On the other, we have expensive, manual services that provide scheduled site audits, labor-intensive reporting, and guidance for source code fixes. Neither approach meets the current challenges in digital accessibility, which require a sustainable and scalable solution that businesses of all sizes can afford to implement on an ongoing basis, with full visibility into its performance.

AUTOMATION-ONLY

- monitors and identifies some issues
- can't fix the majority of complex issues
- don't provide custom solutions

MANUAL SERVICES

- provides scheduled site audits
- labor-intensive static reporting
- guidance-only for source code fixes

$** **$$$$

Today, technology is what allows us to remove roadblocks on the path to a more accessible and inclusive internet. This means addressing the scale, speed, and cost of an accessibility solution, so we can fix more issues faster, and in a way that's affordable and sustainable for content creators and businesses of all sizes. Automation is helping us fix billions of issues every day and identify patterns we can use to learn and build new technology, pushing us forward on a path to solving more issues of different complexities.

More specifically, technology enables us to:

- Solve accessibility issues across a wide range of disabilities.
- Solve accessibility issues as they happen on site load, before they are experienced by users.
- Help companies operationalize accessibility and shift away from treating it as an added expense or technical burden.
- Create accessibility tools that are easy to find and use and provide instant help for end users.
- Streamline feedback from people with disabilities and act on it in a timely manner.
- Provide transparency throughout the entire accessibility process.

We can't discuss the role of technology without bringing up the culture and ethics of operating in the accessibility space. At the 2021 M-Enabling Summit, AudioEye COO Dominic Varacalli and Anil Lewis, the Executive Director of Blindness Initiatives for the National Federation of the Blind, discussed three conditions necessary for a successful use of technology:[19]

1. **Transparency.** Accessibility vendors must be transparent about what their technology can and cannot remediate, and, ideally, provide customers with options to fix the remaining issues. Transparency is the key to starting a conversation and creating a more collaborative environment, focused on continuous improvement of accessibility solutions.

2. **Collaboration with people with disabilities.** Providing a way for end users to give feedback throughout the product development process, not just at the end, is important in fostering more collaboration and helping to develop solutions that actually serve their intended users.

3. **Manual audits and remediation.** We know that automation has its shortcomings and will fail when faced with certain types of accessibility issues. And when it does, we need human experts to step in and provide manual support, ensuring the highest level of accessibility.

Accessibility is a journey, not a destination."

Anil Lewis, Executive Director of Blindness Initiatives, Jernigan Institute, National Federation of the Blind

Accessibility technology timeline[20]

1986

IBM Screen Reader, the first screen reader (for DOS), is created by Jim Thatcher.

1990

The Americans with Disabilities Act (ADA), a major legislation on the rights of people with disabilities, is signed into law.

1994

The World Wide Web Consortium (W3C), a standards organization that publishes guidelines and recommendations for web technologies, is founded by Tim Berners-Lee

A Synthetic Speech Newspaper is created by the NFB.

1995

Microsoft Windows 95 is the first OS by Microsoft issued with built-in basic accessibility features vs. as an add-on.

JavaScript is built by Brendan Eich at Netscape to provide developers with an easy way to access the DOM (Document Object Model) and add interactivity to websites.

1996

Web Accessibility Initiative (WAI), an effort by the W3C to improve web accessibility, officially kicks off. The WAI is responsible for publishing WCAG.

Bobby, one of the first accessibility testing tools on the web, is released by the Center for Applied Special Technology (CAST). After going through several versions, Bobby was discontinued in 2005.

pwWebSpeak, a browser that translates text into speech, is created by The Productivity Works.

1998

US Rehabilitation Act of 1973 Section 508 is expanded to include the World Wide Web. It requires government or federal agencies to make their websites accessible to people with disabilities.

Synchronized Accessible Media Exchange (SAMI) is released by Microsoft. It simplifies the process of adding closed captions and audio descriptions.

1999 **Web Content Accessibility Guidelines (WCAG)** are published by W3C. The 14 original guidelines help developers create accessible websites. The WCAG has revised over the years.

2000 **Microsoft Windows 2000** is released with a number of accessibility features.

2001 **Web Accessibility Evaluation Tool (WAVE)** is released by Dr. Len Kasday at Temple University. Unlike other accessibility tools, it's released as a browser extension. In 2003, WebAIM took over the project and continues to develop it.

2003 **Cynthia Says** is released by HiSoftware. Named after accessibility expert Cynthia Waddell, Cynthiasays.com performs website accessibility scans.

2005 **The Accessibility for Ontarians with Disabilities Act (AODA)** is passed to require all public sites and business and nonprofit organizations with 50+ employees to meet WCAG 2.0 compliance Level AA by 2025.

2008 **WCAG 2.0** presents four guiding principles for web accessibility.

2009 **The World Wide Web Foundation** is founded by Tim Berners-Lee and Steve Bratt "to advance the Web as a medium that empowers people to bring positive change."

2010 **The 21st Century Communications & Video Accessibility Act** is signed into law.

2016 **The European Union issues the Web Accessibility Directive**, also known as EN 301 549, which requires all EU Member States' public sector websites and mobile apps to meet WCAG 2.0.

2019 **The Accessible Canada Act** is passed "to make Canada barrier-free by January 1, 2040." The law requires all organizations under federal jurisdiction to have accessible websites.

The European Union adopts the European Accessibility Act, which provides EU Member States with common accessibility rules and requires businesses to make their products and services accessible to people with disabilities.

AudioEye's hybrid approach

93%

of AudioEye's revenue comes from customers who receive both automated and manual services to meet their web accessibility needs[21]

At AudioEye, we believe that everyone, regardless of ability, should have equal access to the internet and the opportunities and conveniences it affords. We also believe that our approach to accessibility—which pairs automation with human expertise—is the most effective way to break barriers to an accessible, usable, and inclusive internet for people with disabilities.

We need automation to tackle the dynamic nature of websites and the fast pace of digital transformation, which create a colossal accessibility challenge for businesses and content creators. Even the websites that have accessibility included in the development process are still vulnerable to accessibility errors. Every change or addition on a site—whether it's a new sign-up form, an image, or a plugin—can compromise its accessibility. Every time someone makes an update, however small, there's a chance that they'll create an accessibility problem without even realizing it.

If we also consider that the majority of existing websites were built without accessibility in mind (which explains why 97% of the internet is inaccessible),[3] then we are faced with a systemic problem that requires a solution that can both fix existing errors at scale and provide ongoing monitoring and remediation to ensure continuous accessibility. And that solution needs to be affordable and workable for every website owner who is, ultimately, the one implementing accessibility solutions and held responsible in the court of law. If they can't adopt and use an accessibility solution on a consistent basis, we can't make progress and the internet will remain in a perpetual state of inaccessibility.

Today, there are technology solutions that use automation, mainly overlays, to provide minimum accessibility to the largest number of sites.

While affordable, these solutions are not nearly sufficient in addressing the many and complex accessibility issues that prevent people with disabilities from navigating websites and using digital tools. Relying on them also poses a risk for business owners who are concerned with legal compliance, as these solutions repeatedly fail to provide protection from ADA lawsuits. Other accessibility providers insist on solving every problem at the source or in some cases, rebuilding websites from ground-up—which requires a lot of time and developer resources, putting an immense financial strain on businesses. While more robust and reliable, these solutions are not sustainable, nor are they accessible to many small businesses that don't have the resources or developers. As such, many business owners are unable to ensure ongoing accessibility or ADA compliance.

In contrast with the solutions described above, AudioEye's technology was built and improved over time to first and foremost address the needs of the end user. This meant equipping website owners with the tools they need to fix the majority of accessibility errors in real-time and to monitor and remediate issues on an ongoing basis. Our technology detects up to 70% of most common accessibility issues (low contrast text, empty links, missing alt text for images, etc.), delivering an immediate improvement through the Visual Toolkit and suite of automated remediations, without the cost and delay of making changes to source code.[17]

According to Gartner, "While legislation puts a "stake in the ground" for digital accessibility practices within a country or region, accessibility clauses in major contracts make digital accessibility a fundamental requirement to do business with leading brands. As awareness about digital accessibility grows, Gartner also expects small and midsize businesses to adopt digital accessibility as a standard contractual requirement."[22] (Gartner®,* *Market Guide for Digital Accessibility,* Brent Stewart, Bill Finnerty, Arun Batchu, Grace Farrell, October 2021).

AudioEye's Active Monitoring and Issue Reporting provide ongoing monitoring, remediation, and reporting that even non-technical users can manage and use to deliver accessible and inclusive experience to all customers, regardless of ability. Critically, automation enables us to lower the cost of accessibility, thus helping businesses of all sizes make their websites accessible, moving us closer to our goal of a fully accessible and inclusive internet.

Unlike automation-only providers, we recognize that there's still a large number of issues that technology cannot solve today. We also understand that without human contribution, automation will not improve on its own and will not serve its purpose. This is why we rely on human expertise to ensure that our solution consistently delivers the highest level of accessibility to people with different disabilities. To that end, we provide manual testing and remediation services and use the insights from manual audits—run by certified testers and members of the disability community—to develop new automated fixes and solve issues proactively.

AudioEye's hybrid approach is not just about offering automation and human support, but it is also about the internal organization that capitalizes on the strengths and benefits of both automation and human expertise, creating opportunities for continuous collaboration and innovation.

This is where we differ from traditional accessibility service providers who maintain that manual audits and remediation are the only way to ensure accessible and usable internet, ignoring the enormity of the task ahead and the urgency to close the accessibility gap.

It's impossible to keep up with the pace of new content creation and website changes with a manual process alone. It is also not economically feasible for the majority of website owners, including small businesses. But even for large enterprises that can afford manual accessibility consultants, relying only on manual testing and remediation creates a risk of leaving accessibility issues undetected and unresolved in between audits. In our recent accessibility audit of sites that use traditional manual testing and remediation services, we found that 41 out of 61 websites had one or more significant issues, such as non-functional site navigation, unlabeled graphics, and/or inaccessible video controls.[12] *(See page 11 for more details.)*

Despite the fact that the conversation about digital accessibility today is so polarized that it ignores the challenges of the moment, sometimes even creating new barriers to accessibility, we are making progress. Historically, every new technology had to undergo scrutiny—and rightly so. In the 1990s, the first accessibility scanners drew criticism and resistance. Now, the new and improved versions of them are commonplace. Over the last 15 years, we've collected feedback from our customers and end users to continuously improve our solution. We know that even the best automated tools are not perfect and we choose to be transparent about it. Today, we are confident that our hybrid model will allow us to facilitate a more collaborative approach and make the most progress.

AudioEye's customer-driven innovation

2012

Customer feedback: The browser-based AT solution is not ideal for people relying on assistive technologies.

Follow-up action: *Worked with advocacy groups and AT users to rebuild the solution and introduced testing and remediation technology.*

2013

Customer feedback: Service lacks a grievance procedure that would allow people with disabilities to report site issues they encounter.

Follow-up action: *Created a dedicated digital accessibility 24/7 Help Desk.*

2014

Customer feedback: Businesses need developer tools to understand their WCAG conformance issues.

Follow-up action: *Built a customer-facing developer portal that opened up testing interfaces to clients.*

2015

Customer feedback: It's hard to use automated testing results alone to encourage action. Include manual testing results.

Follow-up action: *Built source feedback reports detailing the results of automated and manual tests to provide clear and concise instruction for clients making updates to their designs and code base.*

2016

Customer feedback: Issue reporting nomenclature is not clear.

Follow-up action: *Simplified client-facing reporting to clarify ambiguous issue classifications.*

2017

Customer feedback: Need platform-level reporting for CMS partners.

Follow-up action: *Launched platform-level insights, training, and instruction for product stakeholders.*

2018

Customer feedback: Partners who manage large numbers of sites need accessibility solutions as well.

Follow-up action: *Fortified our partnership capabilities, allowing web agencies and platforms to bring our solutions to their clients at scale.*

2019

Customer feedback: We need to take the stress off our internal developers to continuously implement solutions.

Follow-up action: *Significant investments in automatically remediating common access barriers.*

2020

Customer feedback: There needs to be more visibility into the work automation is completing.

Follow-up action: *Next Gen Portal launched, giving the first reporting insights into accessibility trends on customer sites.*

2021

Customer feedback: Lacking engagement from the disability community.

Follow-up action: *Launched AudioEye A11iance, bringing people with disabilities to the forefront of the product development and quality assurance process.*

Customer feedback: Need more detailed reporting and visibility.

Follow-up action: *Built Issue Reporting dashboard to provide detailed, real-time updates and insights on accessibility issues and how to solve them, with full visibility into AudioEye's work.*

2022 & beyond

Customer feedback: Continue to develop solutions that work for the end user while being transparent in the process.

Follow-up action: *Continued advancements in testing, monitoring, and remediation to further scale the impact of technology solutions that work for digital accessibility.*

Technology

2005

AudioEye founded as an R&D firm in the digital accessibility space

AudioEye started as a research and development firm in the digital accessibility space over 15 years ago, shifting focus to tech investments in 2012. Working over the years with the American Foundation for the Blind (AFB), the National Foundation of the Blind (NFB), the Southern Arizona Association of the Visually Impaired (SAAVI), the Amputee Coalition, and a number of other organizations and end users, AudioEye developed a unique approach to accessibility that reflects user feedback and addresses the challenges that keep the internet from being accessible and usable to people of all abilities.

AudioEye's hybrid approach to website accessibility takes advantage of both automated and manual remediation techniques. We want our auto-remediation tools to fix as many issues as possible, because automated fixes are faster and more affordable than manual options, making it possible for businesses of all sizes to implement accessibility on an ongoing basis. But we also recognize that automation cannot solve every website accessibility problem today, so we are continuously investing in research and development to improve our capabilities. Every time we solve an issue with automation on one website, we become capable of fixing millions of instances of the same issue across the internet.

An overview of AudioEye's automation capabilities and human-led services:

Automation

AudioEye's automation provides support at every step of the process: detection, remediation, ongoing monitoring, and reporting.

Testing and remediation

400+

test outcomes for accessibility issues ran by AudioEye

AudioEye's patented JavaScript-enabled automation solution is capable of detecting about 70% of common accessibility issues on a website, using 400+ test outcomes and resolving about two-thirds of them with a suite of 70+ automated fixes.[23] AudioEye's technology delivers more than a billion remediations daily, and is able to identify patterns as they emerge. Identifying these patterns allows us to continue to learn and build new technology, pushing us forward on a path to solving more issues and complex problems as digital content and tools continue to evolve.

70+

automated fixes by AudioEye

By loading natively on websites, AudioEye fixes immediately improve the experience for site visitors. Prior to this innovation, websites needed to make changes at the source code, which was costly and sometimes months passed between the moment of discovery and the fix date, leaving site visitors with inaccessible experiences as they waited.

AudioEye's team of accessibility experts, web developers and engineers, data scientists, and members of the disability community (as part of the AudioEye A11iance) work together to build and improve auto remediations. The A11iance members, who use assistive technology in their daily lives, provide invaluable insights and perspective in product development and processes. Through their QA testing, the A11iance helps us detect issues with current auto remediations and identifies the need for new ones.

I know my feedback is valuable to the team. I enjoy making web experiences inclusive and accessible to all. AudioEye is accessibility through a different mindset."

Justin, an AudioEye A11iance member who uses NVDA screen reading technology

Active Monitoring

The most common way to monitor accessibility is to manually review each page and painstakingly fix every problem in the source code. Naturally, this provides only a point-in-time snapshot of the page, and it doesn't replicate the actual way in which users experience a website.

1 billion+

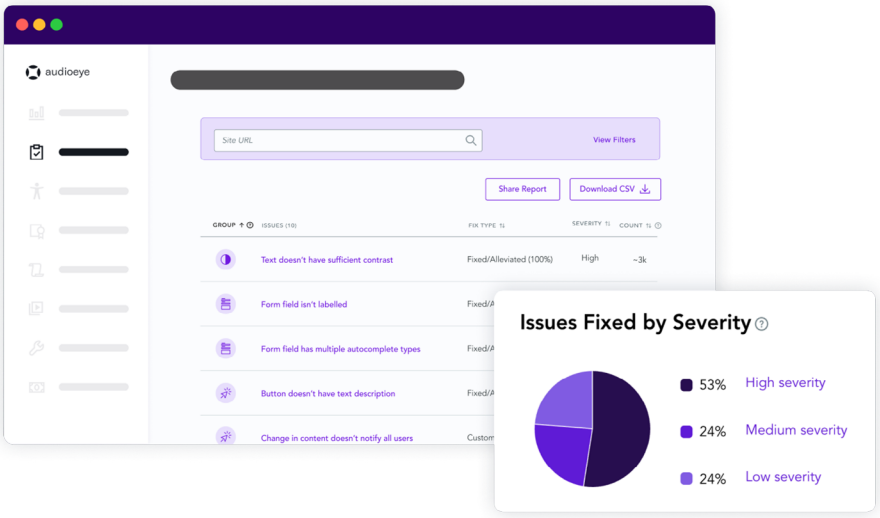
remediations applied daily by AudioEye[24]

Content behind a login or paywall may not be visible on traditional site scanners, and will not appear in accessibility reports. A site with dynamic content that looks different for each visitor, such as a social media platform, won't necessarily have those differences accounted for.

AudioEye Active Monitoring checks sites for new accessibility issues with every visitor, maintaining a real-time representation of a site's accessibility. Unlike other "scanner" based solutions, AudioEye helps find and resolve accessibility issues that appear within new, dynamically-generated, and personalized content—including post-login pages—that is often the most critical for a user's overall experience. As site content changes, AudioEye's technology continues to find and fix issues automatically.

AudioEye's patent-pending monitoring:

- Is guided by real-life users as they navigate your site.
- Securely monitors behind logins and paywalls.
- Reviews dynamic content as your visitors experience it.
- Naturally focuses on the pages that are most visited by your users.
- Tracks and reports on issues that auto remediation fixes in real time.
- Indicates complex issues for manual review and remediation.
- Respects privacy by only collecting test results, not user data.



AudioEye has been our key partner in helping local governments engage with their constituents through accessible and inclusive digital experiences. We are excited about Issue Reporting because it'll allow us to identify and solve the most critical accessibility issues faster than ever, take a more proactive and efficient approach, and report on our work in greater detail."

Don Torrez, Partner Manager at CivicPlus, a web design and integrated technology platform for local governments

Issue Reporting

By combining Active Monitoring with real-time reporting, AudioEye's Issue Reporting allows even non-technical users to continuously detect and monitor most accessibility issues on their websites. With its user-friendly interface and custom views, Issue Reporting dashboard provides detailed information on issues, including the impact these issues have on site visitor experiences and where exactly to solve these issues on the site. These insights help to prioritize high impact issues, cut down developer time and cost to fix them, and provide full visibility into AudioEye's work.

AudioEye's automated scanning gathers rich information across all users and all pages—the kind of data that's impossible to get from a one-time full scan of a site, even if done on a cadence. The monitoring data sent back to AudioEye as end users navigate a site includes detailed information gained from more than 400 test outcomes designed to determine whether or not the site's content meets WCAG. That data is displayed in a dashboard view, providing a current, granular understanding of the accessibility issues that were found, fixed or alleviated, or flagged for human review and intervention. This level of visibility and transparency allows website owners to make data-driven decisions and measure the return on investment of their digital accessibility efforts.

Issue Reporting dashboard

- **Issue description:** A full description, including its impact on end users, severity, and frequency.
- **Pages affected:** A list of pages where issues were found.
- **User groups affected:** Insights on which specific accessibility issue most impacts abilities (visual, auditory, motor, and cognitive).
- **Compliance:** The WCAG compliance category that any given issue falls under, with a link to the WCAG documentation for that category.
- **Impact:** The issue's impact on end users, the severity of the issue, and what that severity means.
- **Issue resolution:** A full report on issues that have been fixed entirely, partially, or require a custom/source fix.
- **Instructions on fixing at source:** Details on how to repair the most commonly found issues in the source code.

Visual Toolkit with 24/7 Help Desk

AudioEye's Visual Toolkit puts the power of instant personalization in the hands of website visitors and provides them with a way to submit feedback, including grievances. We review all submissions and either build new remediations to help resolve them, or contact the customer with recommendations if we're unable to do so on our own. While the Visual Toolkit alone doesn't solve accessibility in general, it does help many visitors improve their experience instantly.

Solving accessibility for small businesses

AudioEye has done a great job at keeping it all very seamless. It was easy to integrate. There was good documentation, and we got good support. AudioEye provides an elegant solution to a pretty complicated problem."

Mark Hellweg, Founder, Ratio Coffee

Customer story

Creating inclusive online customer experiences has always been important to Mark Hellweg, the founder of Ratio Coffee, an automatic coffee maker based in Portland, Oregon. After all, the majority of Ratio Coffee's customers come through its website.

Yet, in 2021, Ratio Coffee received a demand letter, stating that their website was not compliant with the ADA. According to Mark, the letter listed a number of accessibility issues that neither his team, nor the web agency they worked with, could have known about. Mark understood that a lawsuit would cost Ratio Coffee exponentially more than the demanded settlement amount of $20,000. And, as a small business, Ratio Coffee couldn't afford to go to court. This is when Mark turned to AudioEye.

AudioEye guided Ratio Coffee through the entire process, resolved outstanding accessibility issues on their site, and provided tools and human support to ensure ongoing compliance. Ratio Coffee was able to reduce the amount of settlement by over 60%.[25]

Considering that accessibility guidelines are constantly changing and difficult to either learn or keep up with, finding an affordable and effective ongoing solution was game-changing for Mark, who can now focus on growing his business.

"Having a partner like AudioEye, that's steeped in this work, is very valuable to us. It's not a difficult thing to do and it saves a lot of headaches. The subscription fee relative to the value we get, is very reasonable," says Mark.

Human expertise

While automation helps provide rapid improvements at scale, it cannot fix issues that depend on deeper contextual understanding and direct human experience. Artificial intelligence, which has altered our world in amazing ways, but does not have empathy, cannot make decisions about accessibility on its own. Nearly one in five accessibility issues remains invisible to automated technology as it exists today, and catching the remainder requires the skill, experience, and judgment of human testers conducting manual reviews to maintain compliance.

People with disabilities use different assistive technologies to interact with digital content. These technologies vary in their performance, which often depends on whether or not a website's code conforms to WCAG. Considering that the majority of websites do not conform to WCAG, we need human experts to test web content using a variety of common tools, making sure that assistive technology users can access and navigate it. And when those experts find the subtle accessibility errors that automated scanning inevitably misses, we need smart, tailor-made remediation to eliminate them.

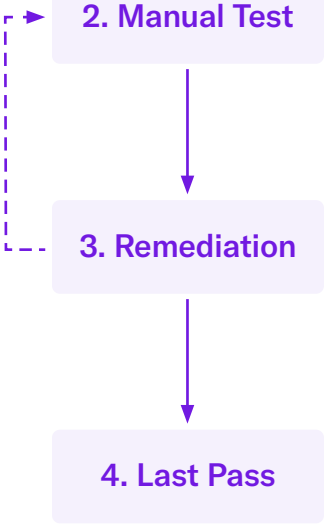
Manual testing and remediation

AudioEye's dedicated team of accredited members of the International Association of Accessibility Professionals (IAAP) has deep expertise in accessibility guidelines and assistive technologies most commonly used by people with disabilities. They manually test content across a variety of browsers and assistive technologies to help diagnose subtle hindrances to accessibility. This can include code that is technically conformant with WCAG but will cause unexpected problems for some or all users with disabilities.

AudioEye developers who specialize in accessibility work in close partnership with the manual testing team. Developers fix issues that are uncovered and accessibility testers verify that those remediations sufficiently resolve the issues. Our services team regularly builds custom remediations for AudioEye customers when automated tests or manual audits find issues that can't be resolved with automation. They also fix all issues that come through our 24/7 Help Desk, directly from end users.

AudioEye's 4-Step Manual Testing & Remediation Process:

Using native software, we are able to code custom remediations into the automation layer, adding custom fixes for websites that need it, without affecting the source code. Old methods require developer resources and costly consulting hours billed on top.



In the first pass through a website, a developer remediates issues found in the initial scan. They set landmarks, enable accessible carousels, and more.

An accessibility tester, using a screen reader and keyboard navigation, goes through a testing workflow and tests patterns, or common website elements for accessibility.

A developer then remediates further issues found by the accessibility tester, then returns the issues to the tester to be re-tested. Steps two and three are repeated each time a remediation round is completed.

Before changes are published, a developer spot-checks the site to confirm the remediations are working as expected. The source feedback is compiled throughout and shared with the team, who may pass it along to the site owner.

Periodic manual audits

AudioEye offers Advanced Remediation services and conducts periodic manual audits of websites that are considered at higher risk of non-compliance, based on Active Monitoring data. Using our large dataset of tests and remediations conducted across thousands of websites, we're able to find recurring, high-impact issues that help focus our manual audit efforts on the sites that need it most. This also passes the cost savings of periodic manual audits back to customers as we analyze at scale.

AudioEye A11iance Community

The AudioEye A11iance is a community-based initiative that brings people with disabilities to the forefront of the product development and quality assurance process and ensures a systematic way of incorporating their critical perspective in our work.

The A11iance members work with our QA team to conduct manual audits and test manual remediations in development, providing feedback and insights for continuous improvement in our product and services.

It's crucial to ensure that the products we are developing work for the community that we are here to serve. AudioEye A11iance provides income opportunities to people with disabilities and a systematic way for them to make key contributions to our product roadmap, so that we can continue to deliver top experiences to our clients."

Dominic Varacalli, COO of AudioEye

Training and collaboration

Through continuous reporting, training, and collaboration with a team of subject matter experts, AudioEye shares accessibility and usability insights as they are gained. These timely insights allow businesses to take proactive action, integrate accessibility into their processes, and ensure compliant and equitable user experiences, as they add new content and update websites.

AudioEye offers educational videos for all subscribers with access to the portal, and we provide foundational training for all enterprise clients. AudioEye's Foundations of Accessibility course is taught by trainers certified by the International Association of Accessibility Professionals (IAAP), and is suitable for both technical and non-technical audiences. The course provides cross-disciplinary, conceptual knowledge about disability, accessibility, universal design, global laws, and international standards.

Conclusion

The internet is the world's most significant public space, connecting and affecting more people than anything that has existed in human history. But unless we ensure that everyone, regardless of ability, can access the internet, it will not live up to its original vision and promise of universality.

At AudioEye, we believe that the only way to provide equal access for all—to billions of people on billions of websites—is through responsible implementation of technology backed by true subject matter experts, and to do so in a transparent way. Over the last decade, we have made significant strides in automation technology, improving our ability to find and resolve more and more issues through automation. As we work on breaking every barrier to digital access, we continue to invest in research and development and keep our focus on the end user.

Accessibility is a journey, not a destination, and we intend to bring every person along for the ride.

The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect."

Tim Berners-Lee, W3C Director and Inventor of the World Wide Web

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Appendices

Definitions of terms used in the paper

ADA: Signed into law in 1990, the Americans with Disabilities Act (ADA) prohibits discrimination based on disability in “places of public accommodations,” which include “businesses that are generally open to the public.” For a website to be compliant with the ADA, it must be accessible to people who browse the web with assistive devices.

ARIA: Accessible Rich Internet Applications (ARIA), or WAI-ARIA, is a technical specification that provides a framework to improve accessibility, especially when it comes to dynamic content and user interface controls developed with HTML, JavaScript, and related technologies. Incorporating WAI-ARIA helps to ensure that people with disabilities can use assistive technologies, such as screen readers, to navigate content and access and use different functionalities.

Assistive technologies: Assistive technologies include any device, software, or equipment used to increase, maintain, or improve the functional capabilities of people with disabilities. Screen readers, voice recognition software, reading assistants, and switch devices that replace the need to use a keyboard or mouse are examples of assistive technologies.

Auto testing and remediation: Auto testing and remediation in accessibility refer to using automated technology to find and fix accessibility errors, adding improvements to a digital ICT.

Closed captioning: Closed captioning is a display of spoken content, song lyrics, sound effects, and noise as text on a screen. Closed captions are synchronized with the audio, meaning they are time coded to match the audio.

Digital accessibility: See ‘*web accessibility*.’

IAAP Certification: The International Association of Accessibility Professionals (IAAP) Certified Professional in Accessibility Core Competencies (CPACC) credential is IAAP's foundational certification, representing broad, cross-disciplinary conceptual knowledge about 1) disabilities, 2) accessibility and universal design, and 3) accessibility-related standards, laws, and management strategies

ICT: Information and communication technology (ICT), a broad term that encompasses telephone, radio, television, and internet.

Image alternative text: Image alternative text, or alt text, is a written description of an image that screen-reading tools can read out loud to people with visual impairments, sensory processing disorders, or learning disabilities. Missing alt text is one of the most common image accessibility complaints.

Manual testing and auditing: Manual testing and auditing is carried out by certified accessibility experts who assess a digital technology's accessibility and usability for people with disabilities. Accessibility experts complete a series of tasks using a variety of techniques and tools, including assistive technology.

Overlays: Overlay tools work by modifying the code of a web page with a snippet of JavaScript and usually come in the form of a toolbar, plugin, app, or widget. Overlays do not typically make any changes to the website's source code.

Remediation: There are four types of accessibility remediations:

1. **Auto Remediations:** Completely automatic code-based tools capable of alleviating website accessibility problems in a fraction of a second.
2. **Guided Remediations:** Combine the speed of code with the power of human judgment. Especially useful because they do not require an expert's skill set.
3. **Manual Remediations:** Human interventions—the gold standard for remediation, but not as fast or cost-effective as automated solutions.
4. **User-controlled Remediations:** Let users implement certain fixes and adjustments with AudioEye's Visual Toolkit.

Screen reader: A screen reader is a software application that uses text-to-speech technology to read out loud digital content for people who are blind or visually impaired.

WAI: The Web Accessibility Initiative (WAI) is a W3C group responsible for developing and publishing strategies, standards, and resources for making the web accessible.

WCAG: Published by the W3C, the Web Content Accessibility Guidelines (WCAG) provide a set of accessibility standards and instructions on making digital content more accessible to people with disabilities.

Web accessibility: Web accessibility refers to designing and developing websites, tools, and technologies in a way that people with disabilities can use them. The term is often used interchangeably with “digital accessibility,” which also covers non-web technologies, such as software and documents.

W3C: Founded in 1994, the World Wide Web Consortium (W3C), is an international governing body responsible for web standards. W3C publishes the Web Content Accessibility Guidelines (WCAG). AudioEye is a member of W3C.

Appendices

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AudioEye

Our mission is to eradicate every barrier to digital access.

By combining easy-to-use technology and subject matter expertise, AudioEye helps companies and content creators solve every aspect of digital accessibility—from finding and resolving issues to navigating legal compliance, to ongoing monitoring and upkeep.

Trusted by more than 75K companies and organizations, including the FCC, WebMD, Calvin Klein, NP Digital, and others, AudioEye delivers automated remediations and continuous monitoring for accessibility issues without making fundamental changes to website architecture, source code, or browser-based tools.

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