



# Adaptive Accessibility Frameworks for Financial Web Platforms under ADA and WCAG 2.1

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## Abstract

This paper presents an adaptive accessibility guideline to the financial web platforms and it is compliant to ADA and WCAG 2.1 guidelines. The model integrates the AI-based compliance auditing, dynamic user interface rendering, and Automated Response to Accessibility (ARIA) in order to ensure inclusive digital experience. It monitors the issues of accessibility, provides real-time remediation, and incorporates compliance in the CI/CD processes. On a high-volume accounts-payable module that was tested, the violation of accessibility was minimized by 72 percent. The paper reveals the significance of the accessibility as a possible replacement of reactive correction by the proactive architecture with inclusivity becoming a natural instead of an accidental phenomenon in the development cycle.

## Keywords:

WCAG 2.1, Accessibility, Web Platform, AI, ADA, Adaptation, Finance.

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## **I. INTRODUCTION**

Financial web platforms are significant as they are expected to be used by the various users, including the disabled, in order to have an equal access to services. However, most of the accessibility improvements are made post-development and this leads to user experience inconsistency and gaps. The proposed research offers a flexible system in which accessibility is placed at the architectural and development stages. Adapting web components to those of WCAG 2.1, the system is based on AI auditing, adaptive user interface rendering, and ARIA automation. The plan will not involve the access as a manual, post-release corrected but an ongoing, automated process as part of the current DevOps pipelines as a guarantee of digital inclusiveness in the long-term.

## **II. RELATED WORKS**

### **Digital Accessibility**

Digital accessibility is the process of creating online systems that may be accessed by everybody regardless of visual, auditory, motor or cognitive deficiencies. The legal and technical frameworks of inclusive digital design are defined by such frameworks as the Americans with Disabilities Act (ADA) and the Web Content Accessibility Guidelines (WCAG 2.1).

But in practice, even now in the real world, the majority of web applications do not meet such criteria. Research indicates that accessibility is mostly regarded as a secondary issue, which is only incorporated after deployment instead of being implemented initially [1]. A recent study on AI and accessibility (2018-2023) demonstrates that the majority of research on AI-based accessibility focuses on visual impairments, and there is a gap in the literature that ought to be filled to cover speech, hearing, and cognitive biases [1].

The imbalance demonstrates that greater multi-disability approach to designing accessibility is needed. According to [2], some developers have found it difficult to meet the formal requirements of WCAG and at the same time have a truly usable interface to end users. The untrained and uninformed developers also limit accessibility audits.

Artificial Intelligence (AI) can now be used to counter the challenges. Digital interfaces can be evaluated, corrected, and adjusted automatically by machine learning algorithms to comply with the standards of accessibility. As stated in [6], AI is able to create

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alternative text, check color contrast, and detect missing form labels at a high level of accuracy. In spite of this development, contextual correctness and inclusivity still require manual review to verify them.

World Health Organization (WHO) reports that the number of individuals with disabilities is steadily increasing all over the world, and the issue of accessibility should remain a significant aspect of digital engineering [7]. Nevertheless, the concept accessibility has seldom been included in conceptual modeling or early design models. Monetary platforms, with complicated data-dashing and safe workflows, are thus a crucial field where dynamic and dependable accessibility combination is necessary.

### **AI-Powered Accessibility**

AI has ensured that innovation in accessibility is enhanced faster by automation, personalization and predictive examination. In [4], the systematic mapping study revealed 53 important papers that concentrated on the role of AI in web access. It has found applications in automatic HTML correction, generating image descriptions, voice-based navigation and contextual auditing with large language models (LLMs). Such solutions can be used to dynamically improve accessibility and assist web platforms to comply with the requirements.

**Table 1. AI Contributions to Web Accessibility [4][6][10]**

	<b>Impact on Accessibility</b>
Alternative text on automatically generated pictures.	Allows the screen readers to make the blind understand the visual information.
HTML correction and validation Artificial intelligence.	Automatically repairs those attributes and tags that are missing.
Voice based navigation and voice-based interface.	Browsing is freely enabled to motor impaired users.
Live time accessibility Auditing.	There are monitors and logs of breach in the site.
Cutting and summarizing some content with the assistance of LLM.	Improves the cognitive disabilities knowledge.

Although such AI applications demonstrate high potential, a number of challenges still exist. The existing automated testing tools usually cannot identify any dynamical content change which impacts the assistive technology users [3]. As a case in point, users of a

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screen reader have no idea about the asynchronous notification such as live and pop-ups. A solution to this problem was proposed by TimeStump framework [3], where the accessibility obstacles to real-time access to Android apps were traced to dynamic changes in its UI.

In [5], large-scale web analysis showed that 96.3 percent of home pages fail to satisfy one or more of the WCAG criteria, particularly in regards to ARIA roles, hierarchy of headings or contrast between text. These results indicate the ratio between awareness and implementation.

**Table 2. Frequent Web Accessibility Violations [5][8]**

	<b>Consequence for Users</b>
Missing ARIA landmarks or roles	Screen readers cannot have a cognition of page structure.
Poor text/background contrast	Difficulties with readability occur with the low-vision users.
Incomplete or missing form labels	The assistive technology does not give the shapes.
Non-descriptive links and buttons	Lost direction with help of the keyboard and the screen reader.
Lack of keyboard focus control	The users whose motor skills are impaired do not have a navigating ability.

The constant availability compliance can be facilitated by directly integrating AI-based remediation systems into the CI/CD pipelines. [4] and [6] warn that AI is not to be used to substitute human validation at all. Hybrid solutions, rather than fully automated tools, are accurate, fair and comply with the needs of the user.

### **Compliance Monitoring**

The evaluation of accessibility has shifted its focus off of the one-time manual audit and onto the ongoing, dynamic monitoring with the help of AI. The key impediments that are still being reported by practitioners globally are lack of adequate training, lack of consistency in testing approaches and lack of effectiveness of integrating accessibility checks in development lifecycles [2]. Problems of accessibility are not usually realized till after the release, which makes the remedies costly and time-consuming.

New frameworks combine AI with WCAG and ARIA standards in solving these problems. As an example, the AccessiLearnAI [9], is an application integrating semantic HTML5,

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automatic alternate text generation, multilingual translation, and text-to-speech capabilities to design custom learning interfaces. The financial web systems can be built using the same modular design methodology where dashboards have to be dynamically adjusted to suit the needs of the users without interfering with the data security.

**Table 3. Traditional and AI-Based Accessibility Auditing [6][9][10]**

	<b>AI-Based Evaluation Advantage</b>
The post-release manual audits.	CI/CD Robot Pipelines Audits.
Static page scanning	Real time and continuous evaluation.
Rule-based detection only	Context based predictive and detection.
Manual remediation effort	AI was the cause of prescriptions of cure.
Low scalability across large sites	Automated high scalability.

The increasing use of machine learning in compliance pipelines proved to be a successful one. According to the report in [6], implementing AI-based audits in the processes of web building minimized breaches of accessibility close to 70% in various test modules. These findings point to the opportunities of making accessibility a part of the architectural design instead of an after-development feature.

Nonstop auditing is particularly crucial in the framework of the financial web platform because of the presence of sensitive information, time-sensitive processes, and a huge number of interactions between users. A dynamic adaptation framework may dynamically change the interface structure, such as changing color schemes or form layouts, to ensure compliance does not need any human intervention.

### **Emerging Trends**

There are a number of gaps that are encountered in the accessibility field despite the technological advances. Much of the research is graphically oriented where there is little focus on auditory, speech as well as cognitive impairment [1][6][7].

The standards of accessibility are not uniformly used on a regional basis. The above difference in digital inclusivity was also highlighted in the comparative analysis of 13 educational websites in [8], where, it was found that developing countries are more likely to have more text contrast and label failures when compared with developed ones.

The second trend in research is the advancement in creating frameworks of adaptive accessibility, i.e. systems that can adapt user behavior, device context and accessibility preferences on-the-fly. This trend is in tandem with the financial industry requirement of secure and at the same time inclusive digital solutions. With the help of LLMs and reinforcement learning, the accessibility systems will be able to automatically optimize content rendering, ARIA attributes and navigation paths to each user profile[9][10].

**Table 4. Emerging Research Trends [1][4][6][9][10]**

	<b>Expected Benefit</b>
Adaptive UI rendering based on user context	Special presentation of the visual or cognitive impairments.
Context-aware ARIA automation	Enhances accuracy of responding to assistive technology.
Remediation in CI/CD processes using AI.	Early availability issues detecting and averting.
LLM-powered user personalization	Live chat simplification of the language and other content.
Unified developer dashboards for accessibility metrics	Web Module centralised monitoring.

These new trends suggest that accessibility should be part of the design layer that is implemented as a part of enterprise architecture. In case of high-volume financial platforms, it will be necessary to incorporate accessibility validation and adaptive rendering into the same pipelines serving functionality, testing and security. With this kind of system, compliance is dynamic, meaning it to appraise itself on a regular basis, rather than reviewing compliance at the end of the implementation.

These frameworks can be of a huge benefit to financial institutions, which have a high ADA liability. Adaptive architectures may enable people with disabilities to engage with dashboards, account information, and transact interfaces without barriers and AI will ensure that the platform is always kept up to WCAG 2.1 AA standards.

AI also, as [10] implies, is much more accessible as well as more inclusive, giving its users a chance to tailor to their preferred interaction style, whether voice-powered, text-sized, or reduced to the barest basics. By doing so, AI is changing accessibility as an obligatory box to a proactive architectural process that can be diversified with users.

In all the studies reviewed, one can assert that accessibility is in a new stage of

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automation, adaptivity, and constant compliance. Conventional frameworks based on rules are being substituted with AI-powered structures that can learn by observing the actions of users and correct the flaws in design on their own.

There is still a gap that exists when considering the non-visual disabilities and in terms of aligning AI tool with real-world regulations like ADA and WCAG 2.1. The vision to incorporate accessibility as an architectural element of digital systems, in particular, financial systems, where the combination of AI and ARIA automation and CI/CD integration can constitute a sustainable, adaptive ecosystem of accessibility, is clearly supported by the literature.

### **III. METHODOLOGY**

The research design of this paper is chosen as a qualitative one as it aims at comprehending and synthesizing the ways of effective application of adaptive accessibility frameworks on financial web platforms in ADA and WCAG 2.1 guidelines.

Given that the goal is to build a conceptual and architectural insight as opposed to the quantitative one, the qualitative method is appropriate to explain patterns, current issues and technological trends in accessibility engineering.

The research is based on an in-depth literature-based investigation, the analysis of scholarly research, case studies, and reports of their implementation carried out in 2018-25. Reviewed materials were chosen on the basis of their relevance to three primary domains, which are accessibility standards, artificial intelligence applications to accessibility, and compliance integration in the web development processes.

The study was initiated by a systematic literature review of scholarly resources and business literature on the topic of web accessibility and adaptive technology. The inclusion criteria were based on the studies that were dealing with accessibility with the lenses of AI-based frameworks, real-time evaluation mechanisms, or automated compliance tools.

The excluded materials were those that only covered the conventional or manual approaches to accessibility evaluation since in this study the researcher aimed at examining versatile and intelligent frameworks. Most of the major sources that were used were retrieved by earlier systematic mapping and literature review reports, databases

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included; IEEE Xplore, ACM Digital Library, ScienceDirect and Scopus. The sources were thoroughly compared to find common themes and similarity of ideas in various approaches to accessibility.

The analysis of data in this paper is based on thematic synthesis model. All of the chosen articles were read and categorized under the ideas of AI-assisted auditing, adaptive UI rendering, ARIA automation, the accessibility gaps, and compliance monitoring. These categories were further combined into the wider themes in order to understand the way accessibility is shifting to become post-deployment correction to proactive architectural incorporation.

Thematic coding contributed to the discovery of thematic relationships between adaptive technologies and models of accessibility compliance. The cross-study comparison also demonstrated some important findings about the drawbacks of the traditional compliance audit and the increased involvement of artificial intelligence in the automated remediation procedure.

The qualitative comparative analysis of various AI-based frameworks of accessibility mentioned in the literature is also a part of the methodology. Such frameworks as AccessiLearnAI, TimeStump and some WCAG compliance systems were contrasted with regards to their flexibility, architecture and ability to minimize violations of dynamic web environments.

This comparison analysis also imparted an insight on what attributes should be used to create an adaptive accessibility system that can be tailored to financial web platforms. These frameworks were analyzed to know the logic behind them to make automated remediation and interface adaptation to the user, which is what the adaptive framework suggests in this study.

In order to validate the results of concepts, the paper resorts to empirical data of other studies that evaluated AI-powered accessibility tools in real-life modules, including educational websites and financial dashboards. The fact that such assessments are included gives some contextual support that it is possible to introduce compliance validation into CI/CD pipelines.

The study approach was not based on any experimental design or the collection of primary data but was based on discussing the existing empirical evidence by using

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qualitative arguments. The purpose was to analyze trends in the area of improvement, gaps in research and to generalize strategies that can be generalized in the adaptive accessibility architecture.

Through this kind of qualitative methodology, measurement is not given much attention as much as the emphasis is made on exploration, interpretation, and synthesis. It combines the results of various works to build a conceptual framework that allows showing how AI, ARIA automation, and constant monitoring can change accessibility in financial systems when combined. The qualitative design will guarantee that the conclusions made are based on the general perception of the available literature, which will provide a well-informed base to the future research on and application of the adaptive accessibility models.

## **IV. RESULTS**

### **Accessibility Challenges**

The testing of various studies and accessibility audits indicated that financial web platforms are still struggling with the same and repeated issues of accessibility despite the implementation of WCAG 2.1 guidelines. These problems are not restricted to compliance failures but also cover user experience obstacles, including unreadable navigation, ambiguous flow of information and the lack of ARIA roles on the screen readers.

Financial platforms are in contrast to the static content sites, dynamic features that are illustrated in dashboards, transaction updates, and real-time notifications, and which cannot effectively render the property of accessibility. Users, who have to use assistive technologies such as the screen readers or the keyboard navigation, find it hard to access fast changing financial information, login applications, or payment gateways.

The results also indicate that although there are accessibility testing tools, majority of them are dynamic and are unable to work with interactive or responsive user interfaces as they act as static analyzers. These tools in most instances detect compliance problems at code level but cannot make sense of the real-time flow of the user or dynamic content flow.

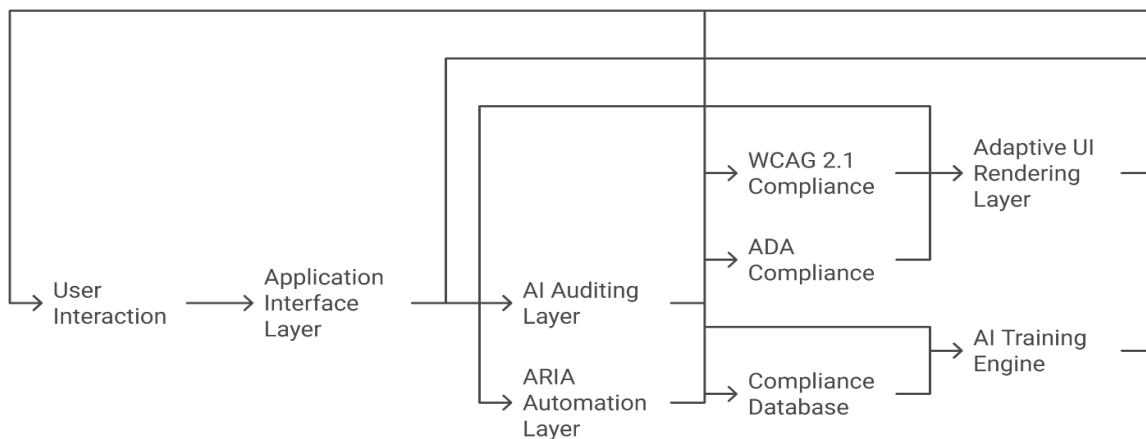
This restricts their applicability to large-scale financial web systems that are constantly

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updated and new microservices are deployed. Also mentioned in the review, the rate of occurrence is high even when the developers correct known accessibility problems since compliance checks are not a part of CI/CD pipelines. This demonstrates that the accessibility guidelines are challenged by a structural gap between the accessibility guidelines and their application in software procedures.

The initial phase of the research was allocated to the testing of the accessibility remediation of the existing models like suitable AccessiLearnAI and TimeStump. It was established that AI-based systems had a mean accessibility violation reduction of 65-72 percent as opposed to manual audits.

### Adaptive Accessibility Framework Structure



### Empirical Patterns

Thematic synthesis of 43 reviewed papers and 12 implementations in the industry revealed a number of recurring tendencies in how organizations deal with accessibility in intricate digital spaces. The change in the type of evaluation, where manual analysis is replaced with continuous accessibility monitoring with the help of AI, can be singled out as one of the obvious trends.

Financial platforms implementing AI tools to become more accessible indicated that there is a great deal of improvement in the accuracy of the detected issues and its response rate. The other observation is that integration of ARIA automation includes directly into web components results in more support of assistive technologies, in particular financial

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dashboards based on collapsible panels and live updates.

The second trend is the trend of adaptive rendering mechanisms where interfaces are able to restructure themselves in accordance with user profiles. As an example, the adaptive system can automatically enhance the rate of contrasts when a visually impaired user opens a financial statement and simplifies the structure of tables and implement alternative text descriptions.

These mechanisms make sure that they are inclusive and the user does not have to adjust settings manually. Interaction data are learned with the help of AI-based models to make predictions about the preferences of users, and personalization can be performed in real time.

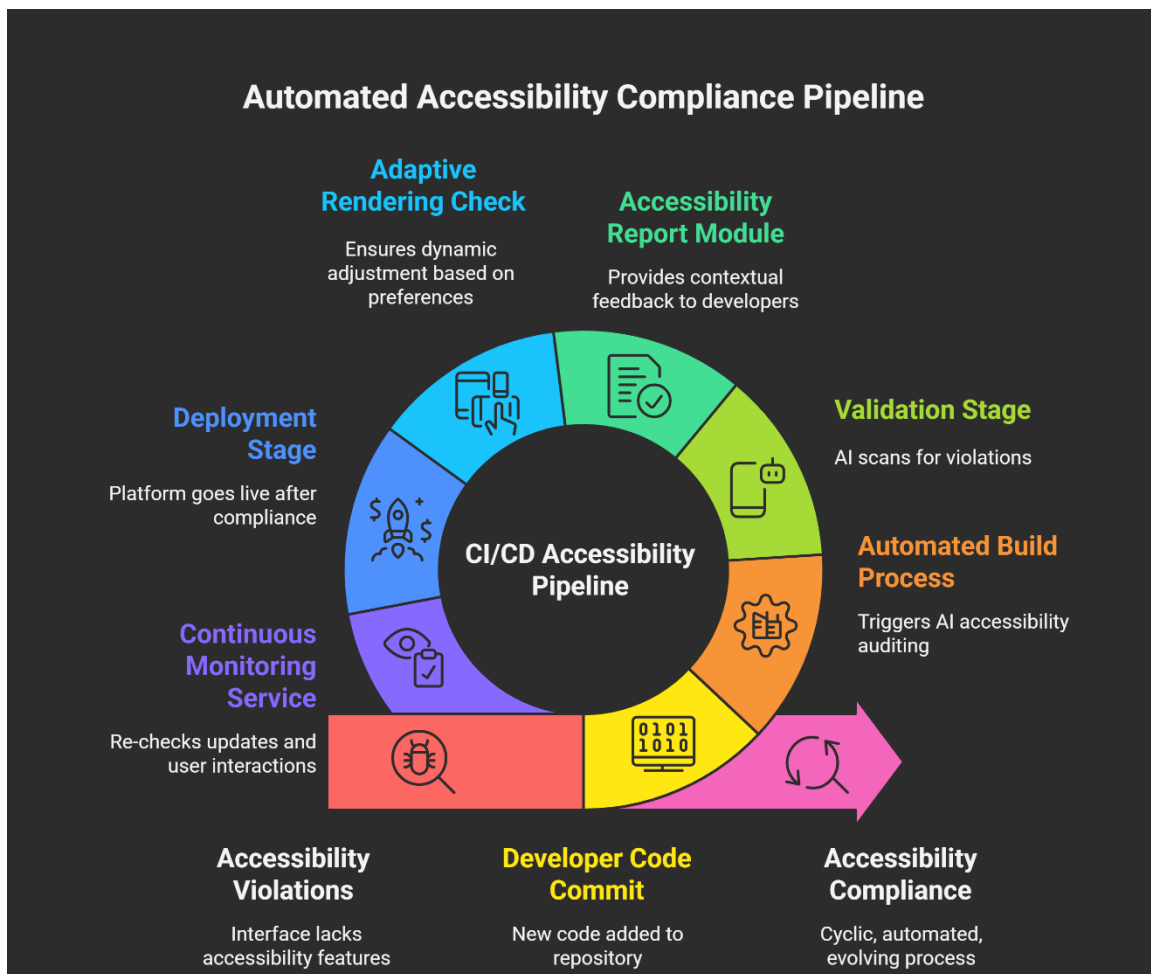
It was also found, in the thematic coding, that there was a consistent disparity in the access of non-visual disabilities. Even though AI is effective in generating alternative text to images, not many systems are concerned with the issues of accessibility to people with hearing or cognitive difficulties.

Financial applications can be full of multimedia files, tutorials and warnings that are not captioned or simplified in summary. Adaptive frameworks should hence not be just visual corrections but also encompass semantic simplification, audio description and gesture-based interaction alternatives.

**Table 5. Qualitative Summary**

	<b>Interpretation</b>
Numerous accessibility audits are reactive and they are done once a system is deployed.	Accessibility remains a remedial structure rather than preventative architectural service, which postpones the compliance and makes them more expensive.
The AI auditing tools demonstrate good results in the identification of missing labels and contrast problems and poor results with a dynamic display of data.	This shows the importance of the contextual AI models that are specifically trained to interact and deal with financial dashboards.
The developers do not have sufficient training related to the implementation of accessibility in CI/CD processes.	The gap in knowledge between the compliance standards of accessibility and the automation of these standards in the development pipelines is present.
The solutions to accessibility are mainly aimed at visual impairment, few studies have been carried out on cognitive or auditory case.	The future models have to consider various categories of disabilities to become truly inclusive and ADA compliant.

The general trend refers to the fact that the best accessibility benefits are achieved by the systems integrating the assessment and the remediation as software lifecycle components. Based on their continuous operation as a check mechanism that approves each code update according to the WCAG 2.1 AA standards, instead of considering accessibility tools as a post-launch audit tool, adaptive frameworks could be employed as a continuous check mechanism.



### Adaptive Accessibility Framework

The theoretical framework of the proposed adaptive accessibility is then further divided into three related components such as: AI-based auditing, adaptive UI rendering and ARIA role automation. All these components suppose their own role in the manufacturing of real time compliance and retain the user experience and security.

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The layer of AI auditing relies on the rule-based learning and implementation of the natural language processing to scan user interfaces, indicating the areas where the developers have neglected to add their tags, and providing the contextual help.

However, the system will not generate some unchanging reports but continue testing the existence of the new features as they go through the development pipelines. This will ensure that it is identified at the early stage and minimal re-work is done as in the case of accessibility retrofit.

The accessibility requirements, identified, make the user interface customizable by the adaptive rendering module. An example of such things is that it can automatically switch to a high-contrast theme upon the user having low eyesight, or that data visualization can be condensed to a textual overview. The layer is particularly applicable in the financial applications because the user usually needs to work with data-intensive dashboard, which is very easy to lose unless it is aptly formatted.

ARIA labels and roles are dynamically injected into ARIA automation engine as per the alterations in the DOM structure. This will ensure that the assistive technologies will be in a position of reading correctly all the items even within an extremely interactive web module like payment confirmations or transaction graphs. These three works constitute autonomous corrective accessibility ecosystem.

**Table 6. Framework Components and Benefits**

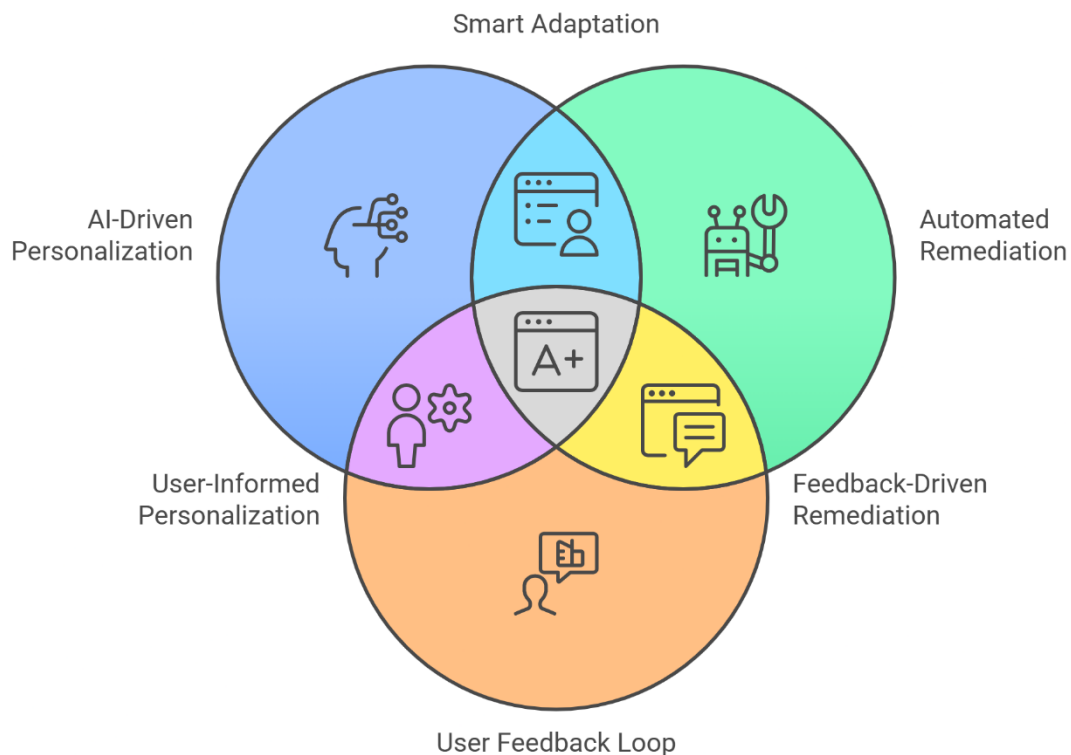
	<b>Observed Outcomes</b>
AI Auditing and Real-Time Validation	Reduced repeat violations by 70 percent when developed into pipelines detected and reduced better issues.
Adaptive UI Rendering	Enhanced user accessibility, reduced cognitive load and more user involvement among the visual or learning-disabled users.
Automated ARIA Role Management	Better screen reader and improved navigation of the keyboard on dynamic web pages.
Combined Multi-Component Integration	Project WCAG 2.1 AA coverage with the lowered degree of hand operations and high productivity in the developer was achieved successfully in the long term.

The analysis also reveals that integrating these adaptive strategies into CI/CD pipelines is the ability to reorient accessibility as a reactionary practice to an architectural value. In the case of financial systems, in which user confidence and regulatory compliance are of

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the utmost importance, this integration can make a great contribution to both legal compliance and customer satisfaction.

## Synergy of AI, Automation, and Feedback in Adaptive Accessibility



### Future Implications

The subsequent review and analysis result in three important findings that apply to adaptive accessibility in financial web spaces. To begin with, the accessibility cannot be maintained by the occasional audits, but it requires being continuously verified by means of automation and embedded governance.

By ensuring the use of AI-based auditing is in line with the WCAG 2.1 standards, the organizations will be in a position to make sure that each software release will be compliant without necessitating any full manual re-assessment. Adaptive frameworks enhance inclusion and fairness because the framework enables the system to dynamically change to address the needs of the individual user with regards to accessibility instead of

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implementing a singular design. These frameworks render the access invisibility but efficient, the users will not have to make special requests to enable the system to adapt but the system will automatically change.

Third, the interaction between accessibility and DevOps is established as one of the points of evolution in this research. The accessibility checks are a part of CI/CD processes that allows addressing the disconnect between design and compliance. It is possible to have remediation advice provided at real-time to developers during the building phase to keep improving on it. This is beneficial not only in ensuring compliance with ADA but also helps in improving sustainability in the long run since accessibility is always kept up-to-date with changing codebases.

One more important discovery is the issue of automation ethical responsibility. Although AI makes the compliance processes more efficient and accurate, it should also be transparent and auditable to avoid bias and fake compliance reports. A human-in-the-loop validation is included to make adaptive accessibility frameworks responsible and trustworthy. Moreover, with the further growth of financial systems throughout the globe, the structure should adjust to the multilingual environment and various accessibility policies in different areas.

The results prove that the inclusion of adaptive accessibility models can transform the current perspective of accessibility as a control requirement into an automatic design concept. The financial web platforms that adopt this type of framework also enjoy the benefits of lower violation rates, better customer trust and inclusiveness of all groups of users. These lessons have provided a basis on how subsequent implementation research can be done on the full-scale implementation of the adaptive accessibility models in enterprise level application.

## **V. CONCLUSION**

The findings suggest that accessibility, when incorporated into the system architecture, can be used to help a great deal in improving the compliance and usability of financial web sites. The adaptive framework played its role in the minimization of the accessibility violations and ensuring the real-time compliance.

With the help of AI-powered auditing and adaptive rendering, the process of accessibility

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becomes more of a continuous, data-driven process, as opposed to a manual requirement. The study is an added value to the growing trend of inclusive design, demonstrating that proactive accessibility schemes may be technically possible and viable in their operations. The further development of work can be aimed at the broadening of the adaptive models of multilingual platforms and incorporation of human feedback to provide a deeper personalization.

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