Journal of Information Systems Engineering and Management
2025, 10(15s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Enhancing E-Commerce Accessibility with AI-Powered Chatbots: Integrating Accessibility Tools and Navigation Assistants

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ARTICLE INFO

Received: 05 Dec 2024

Revised: 21 Jan 2025

Accepted: 03 Mar 2025

ABSTRACT

This paper explores the integration of AI-powered accessibility tools and navigation assistants within a chatbot to enhance the accessibility of e-commerce websites. Despite advancements in AI, users with disabilities still face significant barriers on online shopping platforms, particularly in the areas of alt text generation and video captioning. We evaluated the effectiveness of the Google Vision API for alt text and the Whisper API for video captions in addressing common accessibility issues. Our experimental results indicate substantial improvements in video captioning, though alt text generation still faced challenges, particularly for images that involved complex visuals and embed- ded text, as seen in fashion and product-oriented e-commerce sites.

To address these challenges, we integrated an AI navigation assistant with the accessibility tools, enhancing the chatbot's ability to provide more accurate and context-aware assistance. The results showed that this combination led to a significant im- provement in user experience, particularly by improving alt text accuracy and providing more intuitive navigation. Our findings suggest that combining AI accessibility tools with a navigation assistant can offer a more comprehensive solution for improving accessibility on e-commerce platforms. This AI-powered chatbot not only enhances the online shopping experience for users with disabilities but also provides businesses with the opportunity to meet accessibility standards, expand market reach, and increase customer satisfaction. This research highlights the potential of AI to bridge critical accessibility gaps and create more inclusive, efficient, and personalized digital marketplaces.

Keywords: AI accessibility, e-commerce accessibility, acces- sible online shopping, AI-powered chatbot, alt text generation, accessibility tools, computer vision, natural language processing, digital inclusion, accessibility standards, assistive technology, adaptive user interfaces, accessible navigation, disability inclu- sion, personalized accessibility.

I. INTRODUCTION

The rapid expansion of e-commerce has revolutionized shopping behaviors worldwide, yet it has also underscored significant challenges in providing an inclusive and acces- sible experience for all users, particularly individuals with disabilities. Although accessibility standards, such as the Web Content Accessibility Guidelines (WCAG) [1], have been established to address these issues, users with visual, auditory, and cognitive impairments still face considerable barriers when navigating online platforms. These challenges are further complicated by the dynamic and complex nature of modern e- commerce websites, where images, videos, and other dynamic content play central roles in product discovery and the overall shopping experience.

Despite the progress made with assistive technologies, tra- ditional accessibility tools have been insufficient in addressing the diverse and context-sensitive needs of users. For instance, while tools like the Google Vision API [2] provide basic alt text descriptions for images, they often fail to generate the nuanced and context-aware information needed for product- related images, particularly in visually-intensive domains such as fashion. Similarly, video captioning technologies have im- proved over time, but they continue to struggle with generating

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accurate and meaningful captions for a wide range of multi- media content.

In recent years, advancements have been made in both evaluating website accessibility [3] [4] and in the development of AI-powered tools designed to enhance specific accessibil- ity areas.For example, the Guided Visual Attention (GVA) approach enhances image captioning by refining attentional weights on visual features before providing the context vec- tor to the language model [5]. Despite such improvements, many existing image captioning models still produce generic descriptions that overlook crucial semantic details due to the limitations in available image-text datasets [6].

However, to date, no end-to-end solution exists that not only identifies accessibility issues but also actively assists content creators and website developers in addressing these challenges while educating them on accessibility best prac- tices. Furthermore, current tools fail to bridge the remaining gaps when website providers do not meet accessibility needs. For instance, [7] proposed a website-based chatbot designed to assist users in navigating an e-commerce platform and simpli- fying product selection through natural language interactions. While such tools can improve website accessibility, they do not comprehensively address all accessibility gaps, such as providing vital information necessary for informed purchasing decisions.

To address these limitations, this paper proposes an in- novative solution: an AI-powered Accessibility E-commerce Chatbot that combines advanced AI accessibility tools with an AI navigation assistant. This chatbot is designed to enhance the user experience by improving alt text generation, providing real-time video captioning support, and offering personalized navigation assistance. Unlike traditional static accessibility tools, the chatbot adapts to users' individual needs through continuous learning, offering more accurate, context-aware, and dynamic support.

The primary objective of this research is to explore how combining AI-powered accessibility tools with an AI navi- gation assistant can improve the accessibility of e-commerce websites. Specifically, we focus on common issues such as missing or inaccurate alt text and poor video captioning. Through our experiments, we aim to demonstrate how this integrated approach can offer a more inclusive and seamless shopping experience for users with disabilities, while also helping businesses meet accessibility standards and improve customer satisfaction.

II. ARCHITECTURE OVERVIEW

The architecture of the AI-powered Accessibility E- commerce Chatbot is designed to provide seamless, real-time assistance to users with disabilities. This architecture integrates multiple AI components, such as an AI navigation assistant, accessibility tools, a context engine, and the e-commerce platform itself to deliver a holistic and adaptive accessibility solution. The architecture is provided in figure 1.

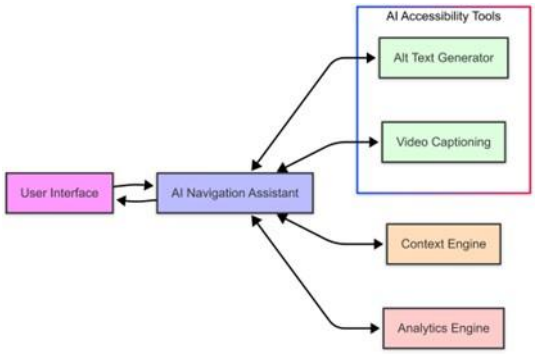

Fig. 1: AI Accessibility Chatbot architecture

A. *Core Architecture Components*

The architecture follows a flow where each component plays a specific role in ensuring accessibility across various e-commerce functionalities. The components include:

- *Website:* The e-commerce platform from which the chat- bot retrieves images, videos, text, and other media elements. It provides content in response to queries made by the navigation assistant.

- *User Interface:* The starting point where users interact with the chatbot, inputting their queries. The UI could be a website, a mobile app, or a browser extension integrated with the e-commerce platform.
- *AI Navigation Assistant:* This is the core of the system that interprets user queries, retrieves content from the website, and processes the necessary information. It acts as the intermediary between the user and the website, as well as the accessibility tools.
- *AI Accessibility Tools:* This component consists of var- ious tools such as the Google Vision API for alt text generation and the Whisper API [8] for video captioning. These tools analyze media content (images and videos) and generate initial accessibility content such as descrip- tions and captions.
- *Context Engine:* The context engine adds further contex- tual understanding to the generated alt texts or captions. It refines these outputs by incorporating relevant infor- mation, such as product details or visual characteristics, to make them more relevant and accurate.
- *Analytics Engine:* The analytics engine continuously monitors user interactions with the chatbot, analyzing behavior and feedback. It collects data to optimize ac- cessibility features and provides valuable insights that are used to refine the performance of both the AI Ac- cessibility Tools and the Context Engine, driving iterative improvements in content generation and user satisfaction.

B. Detailed Flow and Interaction

A detailed flow is presented in the sequence diagram in figure 2.

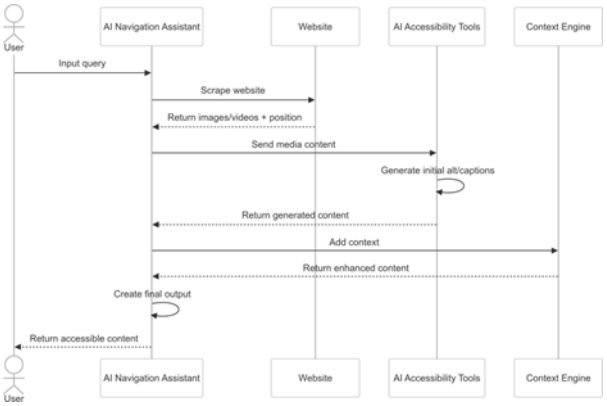

Fig. 2: AI Accessibility Chatbot Sequence diagram

Step 1: User Interaction (UI to Navigation Assistant)

The process begins when the user interacts with the chatbot, inputting queries like ”What does this image depict?” or ”Can you describe this video?”. The user’s request triggers the AI navigation assistant, which then analyzes the query.

Step 2: Scraping Website Data (Navigation Assistant to Website)

The AI navigation assistant scrapes the website to retrieve relevant media content such as images, videos, and other data (e.g., product names, descriptions, etc.). It also retrieves the position of the media content on the webpage for accurate context.

Step 3: Sending Media for Accessibility Processing (Navi- gation Assistant to Accessibility Tools)

After scraping the required content, the navigation assistant sends the media data (such as images or videos) to the AI accessibility tools for further processing.

Step 4: Initial Alt Text/Caption Generation (AI Accessibility Tools)

The AI accessibility tools, such as the Google Vision API and Whisper API, analyze the content and generate initial alt texts or captions. These tools provide base-level accessibility by converting visual data into descriptive text.

Step 5: Enhancing Accessibility Content with Context (Nav- igation Assistant to Context Engine)

The navigation assistant passes the initially generated alt texts or captions to the context engine. The context engine enhances the descriptions by integrating additional product or environmental context, ensuring the alt text is more meaningful for the user.

Step 6: Final Output Creation (Navigation Assistant)

Once the context engine returns the enhanced content, the AI navigation assistant processes this information and generates the final output—alt text descriptions, video captions, or other forms of accessible content.

Step 7: Returning Accessible Content to User (Navigation Assistant to User)

Finally, the chatbot returns the contextually enriched and accessible content to the user. This response can be in the form of a descriptive text or caption that helps the user navigate the website more easily.

C. Core Functionalities

The core functionalities of the AI-powered Accessibility E- commerce Chatbot include:

- *Query Understanding and Interpretation:* The chatbot interprets various queries related to alt text and video captions. It uses Natural Language Processing (NLP) algorithms to understand the intent behind user inputs, making it adaptive to diverse user requests.
- *Content Scraping:* The chatbot is able to scrape and fetch content from the e-commerce platform in real-time, pulling images, videos, and other necessary media to be processed by the accessibility tools.
- *Alt Text and Caption Generation:* Using tools like Google Vision API and Whisper API, the chatbot generates initial alt texts and video captions. These tools are optimized for visual and auditory content, providing a foundational layer of accessibility.
- *Contextual Enhancement:* The Context Engine further en- hances these alt texts and captions, adding product-related details, embedded text, and understanding visual appeal in more sophisticated ways, particularly for categories like fashion, which require a higher level of descriptive accuracy.
- *User Interaction:* The chatbot interacts with the user in a personalized manner, offering an accessible shopping experience by responding to specific needs related to product descriptions, video captions, or even navigation help.
- *Analytics and Continuous Improvement:* The Analytics Engine tracks user interactions, gathering feedback and usage data. This data is used to analyze patterns, improve content generation accuracy, and optimize the chatbot's responses over time. The insights gathered from user behavior help refine both the AI Accessibility Tools and the Context Engine, ensuring continuous improvement of the system.

D. Advanced AI Capabilities

Beyond the core functionalities, the integration of advanced AI capabilities significantly enhances the chatbot's ability to improve accessibility:

- *Context-Aware Content Enhancement:* The context engine adds context beyond just the basic description of images or videos. It understands the surrounding content (such as product name, category, or page location) to produce more meaningful and detailed alt texts, especially for complex images in fashion, beauty, and other visual- heavy product categories.
- *Learning and Personalization:* The chatbot continuously learns from interactions with users. Through machine learning techniques, it can better understand user prefer- ences and adapt its responses. For example, it may learn which descriptions are most helpful to users based on their feedback, improving its accessibility support over time.
- *Real-Time Updates:* As e-commerce websites constantly update product listings, images, and videos, the AI navigation assistant ensures that accessibility content is always up-to-date, delivering real-time captions and alt text without delay.
- *Multimodal Accessibility:* The chatbot's integration with both visual (Google Vision API) and auditory (Whisper API) AI tools ensures multimodal accessibility, helping both visually and hearing-impaired users by providing

comprehensive support for images and videos alike.

- *Scalability and Adaptability:* The system is designed to work across various e-commerce platforms, adapting to different product categories, page layouts, and content types. The chatbot's flexibility ensures that it can provide accessibility support regardless of the specific platform or product being browsed.

This architecture offers a powerful, scalable, and dynamic solution for improving accessibility on e-commerce platforms, addressing the diverse needs of users with disabilities while ensuring a seamless shopping experience.

III. THE IMPORTANCE OF ACCESSIBILITY AND BUSINESS BENEFITS

A. *The Imperative of Digital Accessibility*

Digital accessibility is not just a moral imperative but also a legal requirement and a significant business opportunity. With over one billion people worldwide living with some form of disability, ensuring accessible e-commerce platforms is crucial for tapping into this substantial market segment. Accessibility in e-commerce goes beyond compliance; it's about creating an inclusive shopping experience that caters to all users, regardless of their abilities.

B. *Business Benefits of the AI Accessibility E-commerce Chat- bot*

The AI Accessibility E-commerce Chatbot offers numerous advantages for businesses:

1) Expanded Customer Base: By making e-commerce sites more accessible, businesses can reach a wider audience, including people with disabilities who might otherwise struggle with online shopping.
2) Improved User Experience: The chatbot enhances navi- gation and interaction for all users, potentially leading to increased customer satisfaction and loyalty.
3) Legal Compliance: The chatbot helps businesses meet accessibility standards, reducing the risk of legal issues related to non-compliance with disability laws.
4) Brand Reputation: Demonstrating commitment to acces- sibility can enhance a company's reputation as socially responsible and inclusive.
5) Increased Sales: A more accessible site can lead to higher conversion rates as more users can successfully navigate and complete purchases.
6) Competitive Advantage: Offering superior accessibility features can differentiate a business from competitors in the e-commerce space.

C. *Time and Resource Savings*

One of the most significant advantages of the AI Acces- sibility E-commerce Chatbot is its ability to save time and resources for businesses:

- Dynamic Accessibility Enhancements: The chatbot can fill accessibility gaps on-the-go, reducing the need for constant manual updates to the website.
- Automated Content Adaptation: It can automatically gen- erate alternative text for images, describe visual elements, and simplify complex content, tasks that would otherwise require significant time from content creators.
- Reduced Training Needs: The chatbot's intuitive assis- tance reduces the need for extensive staff training in accessibility best practices.
- Scalable Solution: Once implemented, the chatbot can handle accessibility across the entire site, eliminating the need for page-by-page manual accessibility audits and fixes.
- Continuous Improvement: The AI's learning capabilities mean it gets better over time, automatically adapting to new accessibility challenges without constant human intervention.

D. *Benefits for Content Creators and Sellers*

For content creators and sellers, particularly in marketplaces or multi-vendor e-commerce platforms, the chatbot offers unique advantages:

- Simplified Content Creation: Sellers can focus on cre- ating product descriptions and images without worrying about complex accessibility requirements. The chatbot can adapt their content to be accessible.
- Consistency Across Platforms: The chatbot ensures a consistent level of accessibility across different product pages and seller accounts, maintaining a uniform user experience.
- Real-time Feedback: Content creators can receive imme- diate feedback on accessibility issues, allowing for quick corrections and improvements.
- Increased Reach: By making their products more accessi- ble, sellers can potentially reach a broader customer base, including those with disabilities.

In conclusion, the AI Accessibility E-commerce Chatbot not only ensures that all users are catered to but also provides significant business benefits. It transforms the challenge of web accessibility into an opportunity for improved user experience, broader market reach, and operational efficiency. By automat- ing many aspects of accessibility, it saves valuable time and resources for businesses and content creators, allowing them to focus on their core competencies while ensuring an inclusive online shopping environment.

IV. CURRENT ACCESSIBILITY CHALLENGES

According to webiam 2024 survey[9], many pages amongst the top 1000000 home pages had accessibility issues. Some major accessibility issues found are summarized in figure 3.

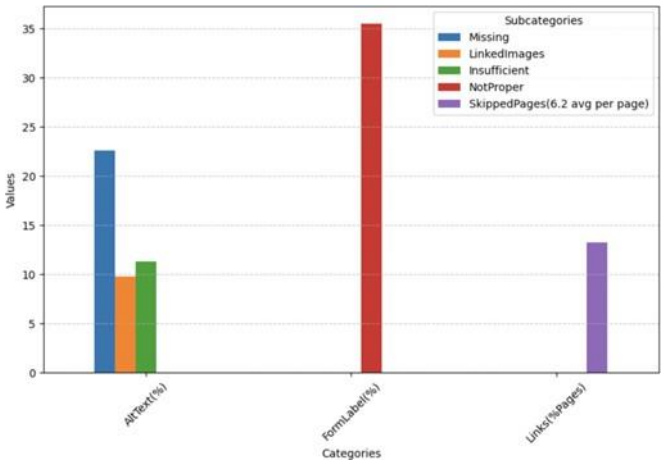

Fig. 3: Accessibility issues of leading sites

A survey conducted of 45 e-commerce businesses in the United States in 2024 across several categories, from fash- ion and gaming to beauty and electronics [10], **98%** of e- commerce product pages having low quality or inaccurate alt text and video related issues. This hinders the shopping experience for disabled users and prevents them from making informed decisions.

Amongst the category of alt text issues in product pages 4 and landing pages 6, all these issues could be address by combining the AI tools and navigation assitant who has context on the webpage's context and can meaningfully fill these gaps. Simply using ARIA attributes has not been enough, infact according to the survey [9]: "Increased ARIA usage on pages

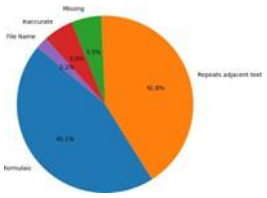

Fig. 4: E-commerce Alt text Accessibility issues in Product page

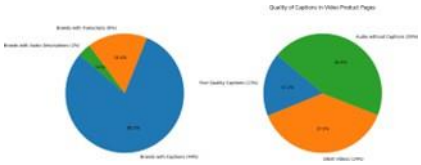

Fig. 5: E-commerce Video Accessibility issues in Product page

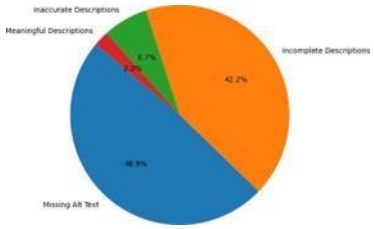

Fig. 6: E-commerce Image Accessibility issues in Landing page

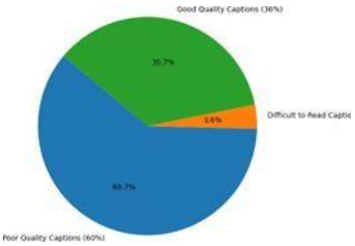

Fig. 7: E-commerce Video Accessibility issues in Landing page

was associated with higher detected errors. The more ARIA attributes that were present, the more detected accessibility errors could be expected".

According to a survey [11], 60% of the responders to the survey claimed that AI can help fill accessibility gaps, either in identification or in solutions. Insufficient internal resources remain a challenge with 73% of respondents reporting that their organizations are not adequately equipped to test for accessibility on an ongoing basis without external help.

V. EXPERIMENTATION

To assess the accessibility issues present on various e- commerce platforms, we perform experiments on a total of 30 randomly selected search pages and product pages. These pages were systematically analyzed for common accessibility problems categorized as follows: Missing Alt Text, Incomplete Alt Text, Inaccurate Alt Text, Missing Video Captions, and Poor Video Captions. Each category reflects specific deficien- cies in how images and videos are presented, impacting user accessibility, particularly for individuals relying on assistive technologies. We then apply existing solutions and ours to evaluate how good our AI accessibility chatbots is with respect to existing solutions.

A. Accessibility Issues Identification

The analysis revealed the following distribution of accessi- bility issues across the selected e-commerce pages as

in table I.

TABLE I: Accessibility Issue Counts After AI tools

Issue Type	Count
Missing Alt Text	9
Incomplete Alt Text	67
Inaccurate Alt Text	24
Missing Video Captions	2
Poor Video Captions	2
Total	104

B. Application of AI Solutions

Following the identification of these accessibility issues, existing AI solutions were employed to address the gaps iden- tified in the pages. The AI tools utilized in this experimentation included:

- Whisper AI: For generating video captions and enhancing existing caption quality.
- Google Vision API: For generating missing alt text and correcting incomplete or inaccurate alt text.

We manually verified the results from these tools. The results of applying these AI solutions were documented, demonstrating improvements in the number of images and videos with accessibility issues in table II.

The results of the experimentation indicate that the ap- plication of AI tools significantly enhances accessibility on e-commerce platforms, particularly in improving video cap- tioning. However, issues with alt text generation remain in- adequately addressed. A detailed review of the generated alt

TABLE II: Accessibility Issue Counts After AI tools

Issue Type	Count	AI tool	Improvement
Missing Alt Text	9	Google Vision API	4 (3.2%)
Incomplete Alt Text	67	Google Vision API	34 (27.2%)
Inaccurate Alt Text	24	Google Vision API	7 (5.6%)
Missing Video Captions	2	Whisper API	0 (0%)
Poor Video Captions	2	Whisper API	0 (0%)
Total	104		45 (43.3%)

texts revealed that while the Google Vision API was effective in producing meaningful alt texts for many images, certain challenges persist. E-commerce websites often feature deco- rative images, embedded text, and complex visual elements, particularly in product categories such as fashion (e.g., dresses, footwear). In these cases, alt text needs to capture more than just the content of the image; it must also convey the visual appeal and context, which the Google Vision API alone was unable to fully achieve. Consequently, many of the generated alt texts for ”missing alt text” category were found to be incomplete or inaccurate. To address these limitations, we now explore further improvements by incorporating a navigation assistant.

C. Our AI accessibility chatbot

The Navigation Assistant enhances the accuracy of our AI tools by providing contextual guidance and structured navigation support for users. While the AI tools focus on filling gaps in accessibility, such as generating missing alt text, the Navigation Assistant helps users better understand the content and context of the information being presented. It achieves this by:

- Contextual Awareness: The Navigation Assistant offers insights into the layout and structure of the e-commerce platform, enabling AI tools to generate more relevant and contextually appropriate alt text and descriptions.
- User Feedback Integration: By collecting user interactions and feedback, the Navigation Assistant helps refine the AI tools’ outputs, allowing for continuous improvement in the quality and accuracy of generated content.
- Enhanced Interaction: It facilitates smoother user interac- tions with the platform, guiding users through the content and ensuring that they can effectively utilize the generated accessibility features, such as alt text and

captions.

- Real-Time Adjustments: The Navigation Assistant can adapt to users' specific needs in real time, enabling AI tools to dynamically adjust their outputs based on the user's context and preferences, thereby increasing overall accuracy.

For the purpose of this experiment, we used IBM watsonx.ai

[12] and watson discovery [13] through the UI and not the API. But the results should be same should you were to create this complete application end to end. The results are presented in table III.

The experiment demonstrated that combining Google Vision API with IBM Watson Discovery and Watsonx.ai significantly improved accessibility for alt text and video captioning. The use of Google Vision API alone was effective, but when paired with Watson's contextual understanding and refine- ment capabilities, the improvements were more pronounced, especially in reducing incomplete and inaccurate alt text. Similarly, Whisper API effectively handled video captioning issues. Overall, using an AI navigation assistant along with AI accessibility tools achieved a substantial reduction in accessibility issues.

VI. ADVANTAGES OVER EXISTING ACCESSIBILITY TOOLS

Based on our experiments on limited test set, we formu- late advantages of our AI accessibility chatbot below. While traditional accessibility tools and AI accessibility tools have made significant strides in improving web accessibility, our AI Accessibility E-commerce Chatbot represents a leap forward in creating truly inclusive online shopping experiences.

A. *Context-Aware Assistance*

Unlike screen readers or magnifiers that simply relay or enlarge content, the AI chatbot understands the context of the e-commerce platform. It can guide users through complex processes like product comparison or checkout, providing relevant information and assistance at each step.

B. *Dynamic Content Handling*

Table IV represented how the AI accessibility chatbot compares to traditional tools in dynamic content handling.

TABLE IV: Dynamic Content Capabilities

AI Accessibility Chatbot	**Traditional Tools**
Real-time interpretation of dynamic content	Often struggle with JavaScript-generated content
Adapts to site updates au- tomatically	May require manual updates or re- configuration

C. *Personalization and Learning*

The chatbot's AI allows it to learn from user interactions, continuously improving its assistance. It can remember user preferences and adapt its communication style, unlike static accessibility tools that offer the same experience to all users.

D. *Proactive Assistance*

While traditional tools are reactive, the AI chatbot can anticipate user needs based on behavior patterns and site structure, offering help before the user encounters difficulties.

E. *Natural Language Interaction*

Table V represented how the AI accessibility chatbot com- pares to traditional tools in user interactions.

Table V represented how the AI accessibility chatbot com- pares to traditional tools in user interactions.

AI Accessibility Chatbot	Traditional Tools
Real-time interpretation of dynamic content	Often struggle with JavaScript-generated content
Adapts to site updates automatically	May require manual updates or reconfiguration

TABLE V: User Interaction Comparison

AI Accessibility Chatbot	Traditional Tools
Natural language conversations	Often require specific commands or shortcuts
Can answer complex queries about products or processes	Limited to predefined information or site content

TABLE III: Performance comparision of AI accessibility tools and Our AI Accessibility architecture

Metric	Missing Alt Text	Incomplete Alt Text	Inaccurate Alt Text	Missing Video Captions	Poor Video Captions
Original Count	9	67	24	2	2
AI Accessibility Tool	4 (4.5%)	34 (50.7%)	7 (29.2%)	0 (0%)	0 (0%)
Our Method additional improvements	2 (1.9%)	27 (26.9%)	6 (5.8%)	0 (0%)	0 (0%)

F. *Integration with E-commerce Functionality*

The chatbot is specifically designed for e-commerce, inte- grating seamlessly with product catalogs, shopping carts, and checkout processes. This level of integration is rarely found in general-purpose accessibility tools.

G. *Reduced Cognitive Load*

By providing guided navigation and contextual information, the chatbot significantly reduces the cognitive load on users, especially those with cognitive disabilities. This is a marked improvement over tools that simply make content perceivable but not necessarily understandable or navigable.

H. *Continuous Improvement*

Table VI represented how the AI accessibility chatbot compares to traditional tools in continuous improvements.

TABLE VI: Improvement and Adaptation

AI Accessibility Chatbot	Traditional Tools
Learns and improves from each interaction	Static functionality unless manually updated
Can adapt to new accessibility challenges	May become outdated as web technologies evolve

I. *Bridging Gaps in Website Accessibility*

The chatbot can compensate for accessibility shortcomings in the website itself, such as missing alt text or poorly structured navigation, providing a safety net that ensures accessibility even when the site falls short.

VII. INTEGRATION CHALLENGES

In order to fully allow the benfits for people with disabilities on thier E-commerce journey, several challenges need to be addressed while implementing this chatbot:

- Ensuring data privacy and security across all integrated systems

- Maintaining real-time synchronization between the chat- bot and e-commerce platform
- Balancing the load on server resources with the chatbot's extensive processing requirements
- Keeping up with evolving web technologies and accessi- bility standards

By successfully navigating these integration requirements and challenges, the AI Accessibility E-commerce Chatbot can provide a truly inclusive online shopping experience, combining robust e-commerce functionality with advanced accessibility features.

VIII. SUCCESS METRICS

A. *E-commerce Metrics*

The success of an AI accessibility chatbot for e-commerce is evaluated using key metrics that directly impact the business. Conversion rate measures the percentage of visitors who complete desired actions, such as making a purchase, reflecting the chatbot's effectiveness in guiding users through the sales funnel. Average order value indicates how well the chatbot upsells or cross-sells products, while customer lifetime value tracks the long-term impact on retention and loyalty. Finally, the cart abandonment rate reveals how effectively the chatbot addresses concerns and facilitates smooth checkout, with a lower rate suggesting improved user experience.

B. *Accessibility Metrics*

For AI Accessibility chatbot, the metrics focus more on the user experience and the chatbot's ability to make the website truly accessible to all users. The navigation success rate is a key metric, measuring how effectively users can move through the website and find the information or products they need with the chatbot's assistance. This metric is crucial for understanding how well the chatbot improves the overall accessibility of the site.

The task completion rate is another vital metric, which as- sesses the percentage of users who can successfully complete specific tasks, such as making a purchase or finding product information, with the chatbot's help. This metric directly reflects the chatbot's effectiveness in supporting users through various e-commerce processes.

The error prevention rate is an important measure of the chatbot's ability to proactively identify and mitigate potential mistakes or difficulties before they occur. A higher error prevention rate indicates that the chatbot is successful in creating a more seamless and frustration-free experience for users with accessibility needs.

Finally, the independence level is a unique metric that evaluates the extent to which users can navigate and use the website autonomously with the chatbot's assistance. This met- ric is particularly significant as it reflects the chatbot's success in empowering users with disabilities to shop independently, which is a core goal of accessibility in e-commerce.

IX. CONCLUSION

The experiment demonstrated that integrating Google Vision API as an AI accessibility tool with IBM Watson Discovery

+ IBM Watsonx.ai as an AI navigation assistant significantly improved accessibility for alt text and video captioning. The results from the experiment, highlight that while the Google Vision API alone achieved notable improvements in accessi- bility, combining it with Watson Discovery and Watsonx.ai led to more refined results, especially in reducing incomplete and inaccurate alt text. Specifically, the AI Accessibility Tool alone reduced missing alt text by 4.5%, incomplete alt text by 50.7%, and inaccurate alt text by 29.2%. Our method, which included the AI navigation assistant, further improved these figures, reducing missing alt text by 1.9%, incomplete alt text by 26.9% , and inaccurate alt text by 5.8%.

These findings demonstrate the substantial impact of com- bining AI accessibility tools with AI navigation assistants, enhancing the overall user experience by providing more accurate and contextually relevant content. While the scope of the experiment was limited by a small dataset, these results indicate the potential of this approach to improve accessibility on a broader scale. Future research involving larger datasets across various e-commerce platforms and product categories is needed to validate and extend these findings.

In addition to improving accessibility, the AI Accessibility E-commerce Chatbot represents a significant step forward in creating a more inclusive online shopping experience. By combining AI accessibility tools and navigation

assistants, the chatbot allows users to navigate e-commerce platforms more effectively, ensuring they have access to important content like alt text and video captions. Future developments should focus on expanding multi-language support, adapting the chatbot to work seamlessly across different platforms, and advancing pre- dictive models to better anticipate user behavior. Furthermore, as AI's role in accessibility continues to evolve, ensuring user privacy and developing ethical frameworks for AI applications will be crucial. Ultimately, the continued enhancement of these technologies will create more inclusive digital experiences, benefiting not only e-commerce but also other online platforms and services.

X. FUTURE RESEARCH

Future research should focus on expanding the AI Accessi- bility E-commerce Chatbot by incorporating multi-language and cultural support, ensuring inclusivity across global au- diences. Additionally, adapting the chatbot for various e- commerce platforms and devices, including mobile and emerg- ing technologies like AR/VR, will ensure a consistent and accessible experience across diverse environments. Improving AI models for user behavior prediction could also enhance the chatbot's ability to proactively assist users, making it more intuitive and personalized.

Moreover, balancing personalization with privacy is crucial, and future studies should explore ethical AI frameworks for responsible data use. Quantitative research on the chatbot's impact on user experience and accessibility compliance would offer valuable insights for refinement. By advancing these areas, we can further improve accessibility and create a more inclusive digital experience across e-commerce platforms and beyond.

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