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Accessibility Challenges in Current Mobile Applications: A Comprehensive Overview

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ABSTRACT: In the digital era, mobile applications are important tools for daily activities. Yet many of these apps remain inaccessible to individuals with disabilities. This article synthesizes findings from past research papers to provide a comprehensive overview of common accessibility issues in current mobile applications. Key issues include missing labels, poor color contrast, small touch targets, inaccessible navigation, and inadequate support for assistive technologies. These barriers significantly impact usability, independence, and quality of life for users with disabilities, often leading to exclusion from essential digital services and negative psychological effects. To address these challenges, the article outlines strategies for developers, emphasizing the importance of implementing comprehensive accessibility guidelines. Key recommendations include adopting user-centered design, conducting regular accessibility audits, providing education and training, fostering enhanced collaboration, and leveraging emerging technologies such as AI and machine learning. By following these guidelines, developers can create more inclusive mobile apps, ensuring equal access to digital technologies for all users.

KEYWORDS: Mobile applications, accessibility, disabilities, usability, user-centered design, accessibility audits, assistive technologies, digital inclusion

I. INTRODUCTION

In today's digital age, mobile applications have become an integral part of daily life. It offers unprecedented convenience, connectivity, and productivity by serving us with a myriad of functions, from social networking and online shopping to navigation and health monitoring. However, as the reliance on mobile technology grows, so does the necessity to ensure that these digital tools are accessible to all users, including those with disabilities. Globally, about 15-16% of the world's population, or roughly one billion to 1.3 billion people, experience some form of disability. [1] Therefore, accessibility in mobile apps is not just a matter of convenience but an important factor in enabling independence and full participation in society for individuals with disabilities.

Despite the advancements in technology and the growing awareness of the importance of inclusivity, many mobile applications still fall short in providing an accessible user experience and various research studies as well have highlighted a high prevalence of accessibility issues that hinder the usability of apps for people with various impairments. These issues range from but not limited to missing labels and descriptions to poor color contrast and small touch targets, each presenting significant barriers to effective use.

This article aims to synthesize findings from past research papers to provide a comprehensive overview of common accessibility issues found in current mobile apps. By examining the prevalence, types, and impacts of these accessibility barriers, we hope to shed light on the challenges faced by users with disabilities and suggest pathways for improvement. Additionally, we aim to guide developers by offering recommendations to address these issues. Addressing these barriers is crucial for ensuring that the benefits of mobile technology are accessible to everyone, promoting inclusivity and enhancing the quality of life for all users.

II. PREVALENCE OF ACCESSIBILITY ISSUES

Accessibility issues in mobile applications are alarmingly widespread, affecting a significant portion of the app market. Several studies have highlighted the extensive prevalence of these issues, revealing that many mobile apps fall short in providing an accessible user experience. A comprehensive large-scale analysis conducted by Xia et al. [2] found that over 89% of Android apps contain severe accessibility problems. These issues significantly hinder the usability for individuals with disabilities and this high prevalence indicates a systemic problem in the development processes of many mobile applications.

In another study, Almeida et al. [3] examined the accessibility of mobile apps developed by Brazilian federal agencies. The findings were similarly concerning, with widespread accessibility shortcomings identified across the apps where many of these applications lacked any formal accessibility requirements during their development, resulting in numerous barriers for users with disabilities. This study underscores the need for more stringent accessibility standards and enforcement, especially in the public sector. Furthermore, Nayebi et al. [4] provided user feedback on the usefulness and accessibility features of mobile applications, specifically focusing on visually impaired users. The study revealed that a significant number of apps do not meet the basic accessibility needs of this user group. The study also highlighted some of common issues included unlabeled buttons, inadequate text descriptions, and interfaces that are not compatible with screen readers.

These findings collectively highlight the pervasive nature of accessibility issues in mobile applications. The prevalence of such barriers underscores the importance of incorporating accessibility from the initial stages of app development and regularly auditing apps to ensure compliance with accessibility standards. By addressing these issues, developers can significantly improve the usability of their apps for all users, particularly those with disabilities.

III. TYPES OF ACCESSIBILITY ISSUES

Mobile applications frequently present various accessibility challenges that impede their usability for individuals with disabilities. Those most likely to encounter significant difficulties include users with visual impairments, motor impairments, hearing disabilities, cognitive impairments and elders. Each accessibility issue impacts a unique audience, as every impairment presents distinct needs. Based on findings from multiple studies, these issues can be categorized into several types, each affecting user experience differently:

A. Missing Labels and Descriptions

Many apps lack proper labeling of buttons and images, making them inaccessible to screen readers used by visually impaired users. For instance, the absence of textual descriptions for image-based buttons is a recurrent problem. Image based buttons are interactive elements in mobile applications and websites that use images or icons. This issue significantly impedes the ability of visually impaired users to navigate and interact with the app effectively [4]

B. Insufficient Color Contrast

Poor color contrast between text and background is also a common issue that affects readability for users with visual impairments. This problem was highlighted in the study by Ahmed et al. [5], which found that many apps fail to meet the recommended contrast ratios which makes it difficult for users with low vision to read text and other visual elements. For example, using light gray text on a white background can make the text difficult to read for users with low vision or color blindness. Similarly, dark blue text on a black background can cause readability issues.

C. Small Touch Targets

Many apps feature touch targets that are too small for users with motor impairments to interact with effectively. The study by Apostolidou and Fokaidis [7] identified undersized buttons and interactive elements as a significant barrier to accessibility. This issue makes it challenging for users with limited dexterity to use the app accurately and comfortably. For example, checkboxes that are too small can be hard to select and can affect the accessibility of the app as accuracy will be important in this case.

D. Inaccessible Navigation

Navigation issues, such as the inability to use apps with a keyboard or other assistive technologies, are widespread. For instance, users often rely on the enter key to move to the next text field when filling out forms, but this functionality is frequently unsupported. Xia et al. [2] and Ahmed et al. [3] noted that many apps are incompatible with screen readers and other assistive tools, making it difficult for users with disabilities to navigate through the app's interface effectively.

E. Lack of Feedback for Actions

Applications often lack auditory feedback for user actions, which is essential for individuals with visual or hearing impairments. Feedback mechanisms are crucial in enhancing app accessibility. The absence of such feedback can lead to confusion and significantly reduced usability. Studies by Almeida et al. [3] and Buzzi et al. [6] emphasize the importance of implementing effective feedback systems to improve the overall user experience for people with disabilities.

F. Complex or Confusing User Interfaces

Complex and non-intuitive user interfaces can hinder accessibility. Buzzi et al. [6] highlighted the need for user-centered design practices to create more accessible interfaces. When interfaces are cluttered, users with cognitive impairments may struggle to navigate and use the app effectively.

G. Lack of Support for Assistive Technologies

Many apps do not adequately support assistive technologies like screen readers, which are essential for visually impaired users. The study by Xia et al. [2] found that many apps lack the necessary compatibility features, making them inaccessible to users who rely on these technologies.

H. Poorly Implemented Accessibility Features

Another very important issue is that even when accessibility features are implemented, they are often not properly tested or maintained, leading to degraded functionality over time. Ahmed et al. [5] highlighted that many apps do not maintain their accessibility features hence it results in a poor user experience for individuals with disabilities.

I. Insufficient Customization Options

Current apps lack customization options that allow users to adjust the interface according to their needs, such as font size adjustments and color schemes. Buzzi et al. [6] identified the lack of customization options as a significant issue that limits the usability of apps for users with specific accessibility needs.

These are some of the most commonly found accessibility issues that are prevalent across many mobile applications and significantly impact the user experience for individuals with disabilities. Addressing these issues requires a concerted effort from developers to incorporate accessibility best practices and continuously test and refine their apps to ensure inclusivity.

IV. IMPACT OF ACCESSIBILITY ISSUES

It is also important to understand the impact of these accessibility issues. These issues in mobile applications significantly impact the independence, usability, and overall quality of life for individuals with disabilities. These barriers prevent users from effectively interacting with apps, limiting their access to essential services and information. The following are key impacts of accessibility issues:

A. Reduced Usability and User Experience

The presence of accessibility barriers such as missing labels, poor color contrast, and small touch targets can make mobile apps difficult or impossible to use for individuals with disabilities. These barriers lead to frustration and decreased user satisfaction. For example, Xia et al. [2] found that visually impaired users often struggle with apps that lack proper labeling, resulting in a negative user experience and reduced usability.

B. Decreased Independence

Accessibility issues can undermine the independence of users with disabilities by making it challenging to perform everyday tasks that others might take for granted. Almeida et al. [3] highlighted that users with motor impairments face significant difficulties when apps have small touch targets or complex navigation paths, forcing them to rely on assistance from others.

C. Exclusion from Digital Services

When mobile apps are not accessible, individuals with disabilities may be excluded from important digital services such as online banking, health management, and social networking. Nayebi et al. [4] noted that the lack of accessibility features in many apps prevents visually impaired users from accessing crucial services, thereby exacerbating the digital divide.

D. Negative Psychological Effects

The frustration and difficulty encountered when using inaccessible apps can lead to negative psychological effects, including feelings of helplessness and decreased self-esteem. Ahmed et al. [5] reported that repeated exposure to inaccessible interfaces can lead to a sense of exclusion and diminished confidence in using technology.

E. Economic Disadvantages

Inaccessible apps can also have economic implications. Users with disabilities may incur additional costs when they need to purchase specialized assistive technologies or services to use standard apps. Furthermore, businesses that do not make their apps accessible risk losing a significant customer base, as highlighted by Buzzi et al. [6].

F. Limited Participation in Smart Environments

Accessibility issues in apps designed for smart environments, such as smart homes, can limit the participation of individuals with disabilities in these advanced settings. Apostolidou and Fokaides [7] noted that navigation challenges and insufficient real-time assistance in smart environment apps prevent users with disabilities from fully benefiting from these innovations.

G. Health and Safety Risks

For mHealth apps, accessibility issues can pose serious health and safety risks. Radcliffe et al. [8] found that inaccessible health management apps could prevent users from effectively managing their health conditions, potentially leading to adverse health outcomes.

E. Increased Reliance

Users with disabilities may have to rely more on caregivers or family members to navigate inaccessible apps, which can increase dependency and reduce personal autonomy. This increased reliance can also place additional burdens on caregivers.

Addressing these accessibility issues is crucial for promoting inclusivity and ensuring that individuals with disabilities can fully participate in the digital world. By improving accessibility, developers can enhance the quality of life for users with disabilities, foster independence, and ensure equal access to digital services.

V. RECOMMENDATIONS FOR IMPROVEMENT

This section outlines potential improvements that developers or development teams can adopt to ensure compliance with accessibility guidelines. Each recommendation provides a brief overview of the proposed improvement, followed by a summary of key points for implementation.

A. Implement Comprehensive Accessibility Guidelines

Adopting established standards such as the Web Content Accessibility Guidelines (WCAG) is essential to ensure all app components are accessible. The WCAG documents explain how to make web content more accessible to people with disabilities. [12] The comprehensive guidelines from those documents will help in systematically addressing accessibility issues, providing clear criteria for developers to follow.

- Adopt WCAG Standards: Use WCAG 2.1 or higher as a baseline for accessibility features.
- Detailed Documentation: Create detailed documentation for developers on how to implement and test each accessibility requirement. [12]

B. Practice User-Centered Design

Involving users with disabilities in the design and testing phases is crucial to ensure the app meets their needs and is usable. Training quality assurance professionals to focus on accessibility-friendly features can also help identify and resolve issues early in the development process.

- Empathy and Inclusion: Engage diverse user groups, including individuals with various disabilities, to gather insights and feedback. [3]
- Prototyping and Testing: Develop prototypes and conduct usability testing sessions with users who have disabilities to identify potential issues and areas for improvement.
- Iterative Design: Continuously refine the app based on user feedback, ensuring that the design evolves to meet accessibility standards and user expectations.

C. Practice Regular Accessibility Audits

One of the most crucial checklists would be to have regular audits. Audits will help maintain and improve app accessibility over time. These audits should include both automated tools and manual inspections to identify and rectify accessibility issues.

- Automated Testing: Use tools to quickly scan the app for common accessibility issues, such as missing alt text or poor color contrast. [5]

- Manual Testing: Complement automated tests with manual inspections to catch issues that automated tools might miss, such as the usability of navigation or the clarity of instructions.
- User Testing: Regularly involve users with disabilities in the testing process to gain real-world insights into the app's accessibility.

D. Education and Training

Education and training are critical for raising awareness and equipping developers and QAs with the skills needed to implement accessible features effectively. Training programs should cover accessibility best practices and the importance of inclusivity.

- Workshops and Seminars: Organize workshops and seminars to educate developers about accessibility guidelines and best practices.
- Online Courses and Resources: Provide access to online courses, webinars, and resources on accessibility to ensure continuous learning and skill development.
- Accessibility Champions: Identify and support accessibility champions within the development team who can advocate for accessibility and mentor others. [6]

E. Enhance Collaboration

Collaboration between developers, designers, and disability organizations is essential for creating comprehensive and up-to-date accessibility features. Enhance collaboration to foster a shared understanding of accessibility needs and encourage the development of inclusive solutions.

- Cross-Functional Teams: Create cross-functional teams that include developers, designers, accessibility experts, and end-users to work together on accessibility initiatives. [7]
- Partnerships: Establish partnerships with disability organizations to gain insights and validate accessibility features.
- Feedback Loops: Implement feedback loops that allow continuous input from users with disabilities, ensuring that their needs are consistently met.

F. Leverage Emerging Technologies

Emerging technologies such as AI, machine learning, and augmented reality can be leveraged to significantly enhance app functionalities and address specific accessibility needs as well. These technologies offer innovative solutions to complex accessibility challenges, making apps more usable for individuals with disabilities. Here are some of the ideas on how we can use these emerging technologies:

- Artificial Intelligence: Use AI to automate and enhance accessibility features like voice recognition, text-to-speech, and real-time translation. [8]
- Machine Learning: Implement machine learning algorithms to personalize and adapt the user interface based on individual accessibility needs and preferences.
- Augmented Reality: Utilize AR to provide interactive and immersive experiences that can assist users with navigation and information retrieval in real-time.

VI. CONCLUSION

Addressing accessibility issues in mobile applications is critical to ensuring that all users, including those with disabilities, can benefit from the advancements in digital technology. The widespread prevalence of accessibility barriers, such as missing labels, poor color contrast, small touch targets, and inadequate support for assistive technologies, underscores the urgent need for developers to prioritize accessibility in their design and development processes.

By implementing comprehensive accessibility guidelines, adopting user-centered design practices, and conducting regular accessibility audits, developers can create more inclusive and user-friendly mobile applications. Education and training programs can raise awareness and equip developers with the necessary skills, while enhanced collaboration with disability organizations can ensure that accessibility features are both comprehensive and up-to-date.

Furthermore, leveraging emerging technologies like AI and machine learning can provide innovative solutions to complex accessibility challenges, making apps more adaptable and personalized for users with diverse needs. By following these strategies, developers can significantly improve the usability and accessibility of mobile apps, promoting digital inclusion and enhancing the quality of life for all users.

Ultimately, creating accessible mobile applications is not just a technical challenge but a moral imperative. Ensuring that digital technologies are accessible to everyone fosters independence, reduces social exclusion, and promotes equal participation in the digital world. By committing to accessibility, developers can help build a more inclusive society where everyone, regardless of their abilities, can thrive in the digital age.

REFERENCES

1. United Nations Office for Disaster Risk Reduction (UNDRR), "2023 Global Survey Report on Persons with Disabilities and Disasters," 2023. Available: <https://www.undrr.org/report/2023-gobal-survey-report-on-persons-with-disabilities-and-disasters>.
2. H. Xia et al., "Accessible or Not? An Empirical Investigation of Android App Accessibility," *Proc. ACM Hum.-Comput. Interact.*, vol. 4, no. CSCW, pp. 1-25, 2020.
3. G. Almeida, T. P. Sales, and K. Gama, "Accessibility in Mobile Apps of Brazilian Federal Agencies," *J. Accessibility Des.*, vol. 15, no. 3, pp. 345-360, 2020.
4. F. Nayebi, J. Desharnais, and A. Abran, "User Feedback on Usefulness and Accessibility Features of Mobile Applications by People with Visual Impairment," *J. Usability Stud.*, vol. 15, no. 2, pp. 89-103, 2020.
5. T. Ahmed, M. Mathur, and A. Venkatesh, "A Systematic Mapping of Accessibility Problems Encountered on Websites and Mobile Apps: A Comparison Between Automated Tests, Manual Inspections, and User Evaluations," *Int. J. Hum.-Comput. Stud.*, vol. 145, pp. 102-123, 2021.
6. M. C. Buzzi, M. Buzzi, and B. Leporini, "Integrating Accessibility in a Mobile App Development Course," *Comput. Educ. J.*, vol. 31, no. 4, pp. 12-25, 2021.
7. E. Apostolidou and P. A. Fokaides, "Enhancing Accessibility: A Comprehensive Study of Current Apps for Enabling Accessibility of Disabled Individuals in Buildings," *Buildings*, vol. 13, no. 2085, 2023, doi: 10.3390/buildings13082085.
8. E. Radcliffe, B. Lippincott, R. Anderson, and M. Jones, "A Pilot Evaluation of mHealth App Accessibility for Three Top-Rated Weight Management Apps by People with Disabilities," *Int. J. Environ. Res. Public Health*, vol. 18, no. 3669, 2021, doi: 10.3390/ijerph18073669.
9. M. Ballantyne, J. Archit, and A. Anna, "Study of Accessibility Guidelines of Mobile Applications," *Proc. 17th Int. Conf. Mobile Ubiquitous Multimedia (MUM 2018)*, pp. 305-315.
10. R. J. P. Damaceno, J. C. Braga, and J. P. Mena-Chalco, "Mobile Device Accessibility for the Visually Impaired: Problems Mapping and Recommendations," *Univ. Access Inf. Soc.*, vol. 17, pp. 421-435, 2018.
11. F. DeRuyter, M. Jones, and J. Morris, "Mobile Healthcare and People with Disabilities: Current State and Future Needs," *Int. J. Environ. Res. Public Health*, vol. 15, no. 515, 2018, doi: 10.3390/ijerph15030515.
12. World Wide Web Consortium (W3C), "Web Content Accessibility Guidelines (WCAG) Overview," [Online]. Available: <https://www.w3.org/WAI/standards-guidelines/wcag/>. [Accessed: 01-Jun-2024]



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