Navigating the Digital Divide: A Comprehensive Exploration of Accessibility Challenges in Mobile and Video Game Development

By

Mustafa Sibai

Abstract

This literature review's main focus and aim is to investigate the challenges, costs, and resources it takes to add accessibility features to mobile and video game applications. Furthermore, it showcases some inventive systems (both hardware and software) that allow people with physical disabilities to play video games. Furthermore, this literature review is aimed towards mobile application and video game developers to gain insight into what it takes to create a fully accessible application and spread awareness of the importance of adding accessibility features to today's modern devices and software. The main findings of this literature review are it highlights the challenges in including accessibility-friendly features in mobile applications and games and the ongoing efforts to create an accessible-friendly world for those who need it. Many of the sources in this literature review are cited from academic literature, such as SpringerLink, ResearchGate, and IEEExplore. Regarding the structure of this literature, it is split into multiple sections, including the introduction, accessibility challenges, accessibility in video games, accessibility in Mobile Applications, conduction, and finally, references. The strength of this literature review consists of a comprehensive overview of the challenges in mobile application development, citations to academic papers that add credibility to the literature review, and structured sections with clear headings and subheadings. The limitations faced were the depth of analysis and challenges in mobile application and video game development for people with disabilities.

Introduction

People with disabilities make up a significant portion of the world's population. 16% to be exact, according to the World Health Organization. 1 of 6 people are considered disabled. (Who reference) In recent years phones and mobile applications have exploded in popularity and have taken over our daily lives. As a society, we rely increasingly on our smart devices to do everything from payments to grocery shopping and ordering a taxi to monitor our daily health. Therefore it is not surprising that smart devices and mobile applications have been used as a powerful tool for addressing the needs of this demographic. This literature review aims to explore and gain insight into the current state of these applications and their usefulness for people with disabilities.

Despite the importance of developing mobile applications and video games for people with disabilities, a shortage of individuals with disabilities available for testing/providing feedback on the applications still persists. Identifying issues that may not be apparent to developers is crucial, which poses an obstacle for startups and individual developers. This literature review sets on a journey that shows the impact of technology on society by creating an inclusive world.

Mobile App Development Challenges for people with disabilities

Developing a mobile application for people with disabilities presents unique challenges for developers. One of these challenges includes the diverse needs of people with disabilities. Not every person has the same needs; therefore, developers must cater to the needs of multiple types of disabilities, such as visual, hearing, cognitive, and speech impairment. Another challenge for developers is they must understand and comply with accessibility guidelines such as the WCAG (Web Content Accessibility Guidelines) (WAI, 2005) when developing their application that targets people with disabilities. Not to mention creating a proper user interface that is both accessible and user-friendly is no easy task. This issue is compounded by the wide variety of smartphone screen sizes and operating systems, which reduces the developers' ability to have one consistent experience for their application across these devices. Furthermore, while people with disabilities make up 16% of the global population (WHO, 2023), sometimes it can be challenging to find enough people to test the application and give proper feedback to address any issues that are not obvious to the developers. On top of that, there is the added cost and resources required to comply with all of these guidelines and to do proper testing. (Park et al., 2014) Only some teams are capable of that, especially one-man teams, small teams, or startups.

Despite all of these challenges, developing an accessible app is critical for creating an inclusive digital environment inclusive of everyone. Therefore, many resources and tools have been developed for developers to use and overcome some of these challenges. Some of these tools include testing tools (Alshayban et al., 2020), documentation, and guidelines.

Accessibility in Video Games

Mobile applications are not the only type of applications that should comply with accessibility guidelines and rules. Video games are a large part of the entertainment industry. In fact, according to (Marchand & Hennig-Thurau, 2013), video game revenue was estimated to have reached $67 billion dollars, including both software and hardware. In addition to video game sales, “Sales of so-called virtual goods within games generated an additional $14.8 billion in 2012. These totals are about five times higher than global music revenues ($16.5 billion in 2011), higher than consumer book sales ($69.4 billion in 2011), and similar to movie revenues ($85 billion in 2011)”. (Marchand & Hennig-Thurau, 2013)

Keeping that in mind, according to (Babb et al., 2013), “Sixty-eight percent of American households now play video games, and many of these are online players”. Therefore it is more important now than ever to make sure that everyone, including people with physical disabilities, can enjoy playing video games.

Video game developers have developed both hardware and software for people with disabilities to use to play video games. From the hardware side of things, there is the eyeCan, a system that provides precision eye gestures that can be used to control video games. Another is EPOC,

a brain-computer interface that allows the user to control the game through an electroencephalograph and a gyroscope. Finally, the Microsoft Kinect is a device that allows the player to control the game through body gestures utilizing a natural user interface (NUI). (Aguado-Delgado et al., 2018)

From the software side, many developers have added accessibility options in their games to aid people who need them. Some of these accessibility options are

- Use of simple language
- Voice or text repetition
- Subtitles
- Colour blind modes
- High contrast
- Text to speech

And much more. (Jaramillo-Alcázar et al., 2020)

Accessibility in Mobile Applications

Mobile applications have significantly transformed the lives of people with disabilities in different sectors, such as healthcare and education sectors. These applications included features such as text-to-speech and speech-to-text, which allowed their users to easily use them. Furthermore, these applications became an instrument for managing chronic conditions, medical reminders, and facilitating online consultations.

Healthcare

Regarding the healthcare sector, applications like “WheelMate” helped locate accessible entry points such as restrooms and parking spaces. Moreover, “MyChart” allows its users to book appointments and obtain/manage their medical records and enhances accessibility to people with mobility limitations.

Education

The education landscape has been transformed with the assistance of mobile apps for people with disabilities, “BARD Mobile” provides access to audiobooks for those with visual impairment, whereas applications such as “NaturalReader” and “Voice Dream Reader” assist people who have been diagnosed with dyslexia by converting text into speech. These educational applications have been tailored towards people with disabilities.

Below are examples of mobile applications which assist people with disabilities:

Speech Impairments

Mobile applications such as “Proloquo” provide alternative and augmentative communication (ACC) for individuals with speech impairments, allowing them to establish communication via text and symbols. The key benefit of using “Proloquo” is empowering users to express their thoughts and feelings effectively. The app allows for customizable vocabularies and communication boards, which the caregivers or therapists could adjust to suit the individual needs. Users could also benefit from applications such as voice output, which offers text-to-speech, allowing users to use words or phrases that the application could speak aloud. Hence this feature aids in improving the user's expression and thoughts.

Visual Impairments

“Be My Eyes” is a mobile application developed to assist and aid individuals with visual impairments throughout their daily lives. They are connected with sighted agents/volunteers through live video calls. This kind of support provides people with visual impairment assistance and support in their day-to-day lives. It also provides immediate visual assistance in which people with visual impairments get immediate assistance by identifying objects, checking expiration dates, reading labels, and more. This application provides a human connection that fosters a sense of community, creating a supportive and positive environment for its users.

Mobility Impairments

“Wheelmap” is a web and mobile application that serves various benefits to individuals with mobility impairments. One of its many features includes providing access points to public places such as shops, hospitals, and so on. The application keeps up-to-date data on the accessibility status of public places and facilities. The application features community-generated data, which means the application users can add and modify information about public locations' accessibility status, including wheelchair ramps, elevators, and accessible restrooms. Wheelmap is a valuable tool for people with mobility impairments, offering a wide range of services and benefits such as navigation assistance, supportive community, and accessibility information, which helps to empower individuals to make decisions about their destinations and activities.

Conclusion

In Conclusion, this literature review has shed light on the challenges, costs, and resources needed for developers to develop either a mobile application or video game to include accessibility-friendly features for people with disabilities. With the smartphone and smart devices revolution, our lives have completely transformed to depend on these devices. Alongside 16% of the world's population facing different types of disabilities, making sure an inclusive digital world for everyone is more important than ever. Furthermore, this literature review has also shown the different types of applications and hardware systems that 16% of the world's population relies on to go about their daily lives and how important it is for developers to keep in mind the world's 16%.

Recommendations

Based on the findings of this review, several recommendations can be made to further improve the development of accessibility features in mobile applications and video games.

1. **Increase collaboration with people with disabilities**. No one knows the needs of people with disabilities more than them. So collaborating with them and getting their feedback on features relevant to them is essential and can ease the development of both the software and hardware.
2. **Education and awareness campaign.** More developers should be educated on the needs of people with disabilities, and further training in regard to the (WCAG) guidelines should be conducted.
3. **Accessibility Testing.** Developers should widen their target audience to include people with disabilities and allow them to test the developer software and hardware to give them feedback on how to improve the product.
4. **Recognition and awards.** Developers who put more effort into adding accessibility features to their products should be recognized and awarded. One of the awards that developers can get is to be put into a special category in their respective app stores, recognizing their effort in implementing accessible-friendly features. Furthermore, a badge could be given to those developers on their respective app stores.
5. **Regular Updates and Maintenance.** Accessibility features should not be a one-time implementation to be added to the app and forgotten about. Developers must put their 100% effort into updating and maintaining those features for the application's lifetime.

References:

(WAI), W.W.A.I. (2005) *WCAG 2 Overview*, *Web Accessibility Initiative (WAI)*. Available at: https://www.w3.org/WAI/standards-guidelines/wcag/ (Accessed: 20 September 2023).

World Health Organization (2023) *Disability*, *World Health Organization*. Available at: https://www.who.int/news-room/fact-sheets/detail/disability-and-health#:~:text=Key%20facts,1%20in%206%20of%20us. (Accessed: 20 September 2023).

Park, K., Goh, T. and So, H.-J. (2014) *Toward accessible mobile application design: Proceedings of HCI Korea*, *ACM Other conferences*. Available at: https://dl.acm.org/doi/10.5555/2729485.2729491 (Accessed: 26 September 2023).

Alshayban, A., Ahmed, I. and Malek, S. (2020) 'Accessibility issues in Android apps', *Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering* [Preprint]. doi:10.1145/3377811.3380392.

Marchand, A. and Hennig-Thurau, T. (2013) 'Value creation in the video game industry: Industry Economics, consumer benefits, and research opportunities', *Journal of Interactive Marketing*, 27(3), pp. 141–157. doi:10.1016/j.intmar.2013.05.001.

Babb, J., Terry, N. and Dana, K. (2013) 'The impact of platform on Global Video Game Sales', *International Business & Economics Research Journal (IBER)*, 12(10), p. 1273. doi:10.19030/iber.v12i10.8136.

Aguado-Delgado, J. *et al.* (2018) 'Accessibility in video games: A systematic review', *Universal Access in the Information Society*, 19(1), pp. 169–193. doi:10.1007/s10209-018-0628-2.

Jaramillo-Alcázar, A. *et al.* (2020) 'A method to develop accessible online serious games for people with disabilities: A case study', *Sustainability*, 12(22), p. 9584. doi:10.3390/su12229584.

Leporini, Barbara & Buzzi, Maria Claudia & Buzzi, Marina. (2012). Interacting with mobile devices via VoiceOver: Usability and accessibility issues. 339-348. 10.1145/2414536.2414591.

Avila, Mauro & Wolf, Katrin & Brock, Anke & Henze, Niels. (2016). Remote Assistance for Blind Users in Daily Life: A Survey about Be My Eyes. 1-2. 10.1145/2910674.2935839.

Sennott, Samuel & Bowker, Adam. (2009). Autism, AAC, and Proloquo2Go. Perspectives on Augmentative and Alternative Communication. 18. 137-145. 10.1044/aac18.4.137.

Mobasheri, Amin & Deister, Jonas & Dieterich, Holger. (2017). Wheelmap: the wheelchair accessibility crowdsourcing platform. Open Geospatial Data, Software and Standards. 2. 10.1186/s40965-017-0040-5.

Leporini, Barbara & Buzzi, Maria Claudia & Buzzi, Marina. (2012). Interacting with mobile devices via VoiceOver: Usability and accessibility issues. 339-348. 10.1145/2414536.2414591.

Avila, Mauro & Wolf, Katrin & Brock, Anke & Henze, Niels. (2016). Remote Assistance for Blind Users in Daily Life: A Survey about Be My Eyes. 1-2. 10.1145/2910674.2935839.

Sennott, Samuel & Bowker, Adam. (2009). Autism, AAC, and Proloquo2Go. Perspectives on Augmentative and Alternative Communication. 18. 137-145. 10.1044/aac18.4.137.

Mobasheri, Amin & Deister, Jonas & Dieterich, Holger. (2017). Wheelmap: the wheelchair accessibility crowdsourcing platform. Open Geospatial Data, Software and Standards. 2. 10.1186/s40965-017-0040-5.

World Wide Web Consortium (W3C). (2018). Web Content Accessibility Guidelines (WCAG) 2.1. Retrieved from https://www.w3.org/TR/WCAG21/

Apple Inc. (2020). Accessibility - iOS - Apple. Retrieved from https://www.apple.com/accessibility/ios/

Android Developers. (2020). Creating Accessible Apps. Retrieved from https://developer.android.com/guide/topics/ui/accessibility