Abstract

Around 650 million people across the world live with some form of disability, which inadvertently prevents them from being able to fully utilize conventionally designed software and tools.¹

For software developers, this poses a unique challenge not just from a technological perspective but also as a social gap that needs to be filled. Over the years, government agencies and the corporate sector have worked toward enhancing accessibility to ensure that a historically marginalized segment of society is finally brought into the mainstream.

This paper discusses the various nuances that must be considered when we are designing software for the differently-abled. Organizations should not only make their workspace more inclusive, but also their enterprise software increasingly accessible to people from all walks of life.
Introduction

Disability is extremely diverse, both in terms of its demographic reach and the sheer spectrum of conditions associated with it. Approximately 15% of the global population live with some form of disability and 110-190 million adults face significant difficulty performing daily tasks. Unsurprisingly, they have an extremely hard time integrating with the society at large. They have trouble finding employment to such an extent that they need to apply for 60% more jobs than an average person.¹

It is apparent that even with the technological progress we have made over the last decade, we have done little to accommodate the differently abled. The 217 million visually impaired people², for example, cannot read any of the content on a simple website and the 360 million who experience hearing loss³ face a completely different set of challenges altogether.

Exercising Social Responsibility

Keeping the socio-economic and cultural needs in mind, many countries have passed legislations to drive public and private entities into making their business software accessible to users with disabilities. These include:

- Section 508 of the U.S. Rehabilitation Act of 1973
- Barrierefreiheit in Germany
- Web Content Accessibility Guidelines 2.0 (ISO/IEC 40500)
- Accessibility requirements suitable for public procurement of ICT products and services in Europe (EN-301-549)

In response, global organizations including software product developers are working toward enabling people with diverse accessibility needs to be included in the main stream. In addition to making their workspace accessible for the physically challenged, they are also aiming to make their software usable for people with visual and hearing impairment. Microsoft’s Narrator and Google’s Project Eyes-Free serve as examples of innovation in this regard.
Designing for Inclusivity

Regulatory bodies across nations have defined accessibility standards to ensure that software is usable globally. However, companies will need to translate these statutory requirements into organization-specific standards and processes in order to inform the various stages of a product’s development lifecycle.

Software and the overall digital experience of interacting with different information and communication technologies (ICT) must be designed for the differently abled. Not only does this convey a degree of social sensitivity, but in turn addresses a largely untapped section of the market.

Let’s begin by looking at the solution elements we can explore at various product development phases (see Figure 1).

**Phase 1 – Requirement Capture and Analysis**

In order to enhance usability for the differently abled, the UI needs to be modified in such a way that every event and function can be performed with just a keyboard. This will require the overall navigation to be simplified to a point that it is possible to see and/or hear what each onscreen item is.

To enable this:

- The page tab sequence must be laid out logically from the left to the right and from the top to the bottom.
- Users should also be able to directly access the main content by omitting any redundant navigational links and pop-ups.
Every checkbox must have a label directly to its right for quick visual comprehension. The software should support alternative pointing devices and voice recognition technology. Screen readers should be able to discern context from the content of a page. Software must be designed to be compatible with external hardware such as braille displays. Using Flash programs should be avoided because they do not support keyboard shortcuts.

**Phase 2 – Design**

At the very onset of this phase, developers must acutely consider what visual, aural, and physical disability entails in terms of how it affects interaction with the human-machine interface (HMI).

In this regard, the software must be able to:

- Provide textual information for images since screen readers cannot read and interpret pixels.
- Include label column and row headings in tables.
- Provide colour-coded captions for video as an alternative to audio for the aurally challenged.
- Use sound adapters to translate audio into visual signals.
- Support unique software control keys that are compatible with assistive technologies such as screen readers.
- Use proper colours and modifiable fonts for users with colour blindness.
- Support full keyboard access.

**Phase 3 – Development and Testing**

Since government mandates have already laid out a set of guidelines for developers to follow, it has become significantly simpler to define technology-specific coding standards and checklist.

The focus, therefore, must be on:

- User Interface (UI) programing models
- Operating systems
- Testing different form factors

Besides the standard automated bench testing, accessibility testers should be brought in to cover vision, speech, hearing, mobility, and learning aspects of the software.
Phases 4 and 5 – Deployment and Product Support

Once the software is designed and rendered ready for the market, companies must focus on developing an extensive repository of user manuals and web-based training modules to familiarize the differently-abled with its functionalities. As part of after-sales services, there should be a dedicated help desk to support customers with accessibility challenges.

What Lies Ahead

Apart from addressing the basic requirements, the primary value necessary for developing software for the differently-abled is empathy. Without it, organizations will not be able to adequately provide equal opportunities – something that is part of their corporate social responsibility (CSR) manifesto.

In the coming times, augmented reality (AR) and virtual reality (VR) may become the human-machine interface between the differently abled and the real world. Using head mounted displays (HMDs) hosting AR/VR, available senses can be guided through an artificial intelligence (AI) system to help meet these needs and offer perspectives that can change. Here, AI could be deployed as a self-managed system that learns through training and continual feedback.

Use cases include:

- **For the hearing impaired**: Interactions over an HMD, with a virtual character can monitor where the user is looking on the screen and enable written interaction or interaction using sign languages
- **For those with autism**: Focused programs that create an environment of virtual world to work on specific senses in the person
- **For the visually impaired**: Voice-based interaction using an HMD that can guide the person to walk through a room by providing real-time insights into obstructions, objects, people, and so on, as well as help them gain access to relevant information

With these emerging technologies offering game-changing software development approaches, we are sure to realize the goals of inclusivity with regard to the differently abled population.
References


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Rajesh Kumar Sakri is the Client Partner for a large software account within the HiTech business unit at Tata Consultancy Services (TCS). He has a rich experience of over 20 years at TCS across multiple industry solution units and has performed roles of business development, relationship management, and delivery management in his earlier engagements. Sakri possesses an excellent blend of cross-functional and multinational experience in customer relationship, business development, people and delivery management.

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