

User Experience Design for Data Analytics in Business Intelligence
(Technical Project)

**An Analysis of User Experience and Web Accessibility of Government Websites in
Developing Countries and United States for the Disabled People**
(STS Project)

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On my honor as a University student, I have neither given nor received unauthorized aid
on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Research Problem: Enhancing User Experience, Web Effectiveness, and Web Inclusivity in Interface Designs

How can website interfaces be designed to ensure a user experience that accommodates the diverse needs and capabilities of individuals across various industries and tools, including, but not limited to, business intelligence tools or government websites?

An estimated 16% of the global population, or over 1.3 billion people, live with some form of disability (World Health Organization, 2023). Disability is a broad and multifaceted concept that refers to physical, sensory, cognitive, or psychological impairments that may limit an individual's ability to engage in typical daily activities. And, in an increasingly digital world where rapid advances are being made each day, the accessibility of websites for people with disabilities has emerged as a pivotal and often overlooked facet of inclusive design.

The use of information and communication technology (ICT) such as the World Wide Web (WWW) has become embedded in our everyday life and has rapidly transformed the world during the past decades. These changes are providing unprecedented opportunities for people to communicate and exchange information around the world. But, from another perspective, those without the abilities to access these tools are at a severe disadvantage in educational and employment situations. This division is currently enlarging the existing economic and cultural gaps between the “haves” and “have nots” in our society and is threatening to create major difficulties for people with disabilities (Chiang et al., 2006). 90% of websites are inaccessible to people with disabilities and do not comply with Web Content Accessibility Guidelines (WCAG) (Wang et.al, 2005). Therefore, it is essential that everyone, regardless of their physical or

cognitive abilities can access and navigate online content with ease and web interfaces are designed keeping the needs of different social groups in mind (La Porte et al., 2001).

To improve web accessibility and user experience, I propose two projects. My technical project would focus on redesigning user experience and decision-support to improve analytics, security, and observability for a data analytics company while considering the needs and use cases of different users with varying level of expertise. My proposed STS Research would focus on understanding and analyzing how user interfaces of government websites accommodate people with disabilities across developing countries and the United States. The overarching problem connecting both the projects together revolves around the intersection of user experience, inclusivity, and effective information access, acknowledging that diverse user needs must be considered in the design of interfaces, whether for business intelligence tools or government websites.

User Experience Design for Data Analytics in Business Intelligence

How can user experience design principles be effectively employed to revolutionize data analytics in the field of business intelligence, all while prioritizing and addressing the specific needs of users?

In the 21st century, every company aims to be the next defining company in terms of brand, customer loyalty, revenue, customer service, market value, customer experience, and more (Vijayakumar, 2023). Customers now expect not just exceptional product interactions but a holistic experience that includes exemplary support, service, execution, and a steadfast commitment at every stage of their journey. A prime example of such customer-centric design is evident in Apple, Inc.'s approach. The company's use of animated elements, white backgrounds,

negative space, simple colors, typefaces, graphics, and sleek designs has set a modern and professional standard, significantly influencing today's UI/UX trends. User Experience (UX) design refers to the “entire user journey of interacting with a digital product, from initial discovery to post-purchase support.” On the other hand, User Interface (UI) design refers to the “visual and interactive elements of a digital product that users can see and interact with” (Hamidli, 2023). Both UX/UI refer to different aspects of product development and design disciplines but are interrelated concepts playing a crucial role in the development of digital products, as seen in the case of Apple products.

Adding more excitement to this dynamic landscape is AI: Artificial Intelligence, which has taken over the steering wheel in the 21st century. Every organization aspires to create AI-driven products and technologies to streamline human processes. For instance, ChatGPT (AI-Powered Search Interface by OpenAI) has taken the center stage with companies eager to incorporate it into their business to address the constant evolution of customer needs. These emerging trends are particularly significant for my capstone client as they actively pursue expansion in the AI space while focusing on the best customer-centric design practices for displaying their log data, to improve customer experience and company performance over time. Logs refer to log data or log files, recording events, activities, and transactions that occur with a software application, system, or network, allowing businesses to gain valuable insights into the performance, security, and usability of their business intelligence systems.

Keeping these different trends in mind, my technical project revolves around redesigning user experience using UX/UI design principles and decision-support to improve analytics, security, and observability for this client’s logs, by harnessing the power of artificial intelligence (AI) natural language processing models. The client is a cloud-based machine data analytics

company focusing on business intelligence (BI) use cases. Business intelligence (BI) refers to computer-based techniques used in detecting and analyzing business data to provide historical, current, and future perspectives of business activities (Elena, 2013).

Our focus in this project is centered around redesigning log query module, specifically the search conducted on log data. Our client currently employs its own version of SQL across various modules, including Search, Cloud Security, Metrics, etc. However, this language poses a challenge for first-time users due to its complexity, resulting in a steep learning curve as many processes are manual and require proficiency in the language. To address this issue, my project aims to integrate AI into their existing systems to simplify the query searching process for users. In this technical project, our team is tasked with developing a comprehensive workflow through high-fidelity prototypes using Figma, a collaborative interface design tool. An interface encompasses both visual and functional elements within a digital product, including screens, buttons, toggles, icons, and other interactive components. The objective is to enable the move beyond query-based processes towards a more conversational interface aligned with modern AI capabilities. For instance, users could input questions about metrics for their company, and the interface might guide them to a specific instance of data or provide a tailored response based on their intent. This shift aims to make the user experience more intuitive and user-friendly, reducing the learning curve associated with log query processes.

To achieve this goal, we are actively creating design concepts and developing Figma mock-ups. This collaborative effort involves working closely with the client's design team to introduce new components and features that enhance log analysis. Throughout the iterative process, we have incorporated a plethora of design ideas, incorporating feedback from both the client and our instructor. Our progress took a significant step forward with the solidification of

key design features, marking the completion of the first draft wireframe, which was presented before Thanksgiving. As we move forward into the remainder of the semester, our team is dedicated to refining our designs and advancing towards high-fidelity prototypes, with the aim of completing this phase before the end of the fall semester. The next phase involves testing and usability evaluations, where we will assess how effectively users can learn and navigate the product to achieve their goals. This phase will be the focus of our project for the spring semester, with work starting on it in early February. Final design ideas with our entire progress during the capstone will be presented at Systems and Information Engineering Design Symposium (SIEDS), “a student focused international forum for applied research, development, and design in Systems and Information Engineering” (IEEE SIEDS, 2023).

Our technical project is geared towards enhancing users' decision support by providing features such as autocompletion, context-aware suggestions, documentation assistance, adaptive learning, and more. The goal is to improve the efficiency, productivity, and user-friendliness of data analysis. This initiative holds particular significance as the shift towards online platforms is rapidly increasing, yet the diverse needs of users remain unmet. Many websites currently lack accessibility, presenting a challenge to users. The implementation of AI has the potential to accelerate this issue. This project aims to bridge the gap by applying design principles that account for different user needs, creating inclusive and effective designs. The primary objective is to ensure that the move to online platforms doesn't inadvertently exclude certain user groups. To achieve this, extensive research will be conducted to identify the features and design principles necessary to meet the diverse needs of various social groups. By doing so, the project aims to contribute to a more inclusive and accessible online experience for all users.

Comparing User Experience and Web Accessibility of Government Websites in the United States and Developing Countries for the Disabled

What insights can we gain into the accessibility challenges faced by individuals with disabilities when accessing government websites in developing countries and the United States?

Background & Literature Review

Government websites today serve as the electronic face of governance, playing a pivotal role in enhancing cost efficiency and minimizing direct interactions with citizens. These multifunctional platforms support activities such as e-voting, e-procurement, data management and analysis, inter-agency collaboration, e-learning, and more. Given the diverse functions they serve, it becomes imperative for government agencies to not only encourage but also enhance the usage and user experiences of e-Government websites.

However, this positive intent faces a significant challenge in ensuring inclusivity. In the United States, Section 508 of the Rehabilitation Act mandates that federal agencies make their electronic and information technology (EIT) accessible to individuals with disabilities (Jaegar, 2006). This legislation, complemented by amendments from the Workforce Investment Act of 1998, establishes specific accessibility standards and guidelines based on the Web Content Accessibility Guidelines (WCAG). These standards cover various aspects including digital content, websites, software, and hardware. Accessibility, in this context, is defined as the practice of designing and developing information and communication technologies (ICTs) to ensure effective perception, understanding, navigation, and interaction for people with disabilities (Henry, 2006). Despite these regulations outlined in Section 508, federal e-Government websites continue to pose accessibility challenges for individuals with disabilities,

highlighting the ongoing need for concerted efforts to address and rectify accessibility gaps in government digital platforms (Jaeger, 2006).

In my proposed STS project, I aim to study the current state of user experience and web accessibility through a comparative analysis of government websites catering to disabled individuals in the United States and developing countries like Pakistan, Bangladesh, and Turkey. The primary objective is to pinpoint disparities across these nations and assess ongoing efforts to address accessibility issues. This research is motivated by the overarching goal of identifying actionable steps to enhance the online experience for those at a disadvantage, advocating for equity in both web accessibility and user experience. In an era where our daily activities increasingly rely on online platforms, understanding and rectifying the challenges faced by certain social groups is crucial.

Despite the United States creating largest e-Government network globally, a stark reality persists— “92% of the most popular federal websites” fail to meet basic WCAG standards (Cudd, 2023). A study conducted on 66 government websites in the United States, based on W3C accessibility guidelines using automatic evaluation tools and criteria such as font size, navigation, and general usability, revealed that 86% of the websites fail to pass the accessibility standards. This indicates a substantial gap in addressing the needs of people with disabilities on U.S. e-government websites. This situation is exacerbated in developing countries like Pakistan, Bangladesh, and Turkey, where disabled individuals are often the most neglected segment of society. Widespread discrimination and their isolation from the broader community have led to significant financial hardships and a loss of creative abilities, further exacerbating the challenges of web inaccessibility (Baowaly, 2012).

A specific case in point is Pakistan, where a study of 45 different government websites revealed significant shortcomings in adhering to WCAG standards 1.0 and 2.0. Before this specific study, no evaluation had been done. The findings revealed that 100% of central government websites failed to achieve complete implementation, with only "2.63% having almost complete implementation" and "93.37% having partial implementation" (Bakhsh, 2012). Notably, all government websites failed to meet the Web Accessibility Framework for the disabled, including criteria such as content accessibility, navigation accessibility, user interface accessibility, and adherence to scripting & HTML standards for web applications (Figure 1).

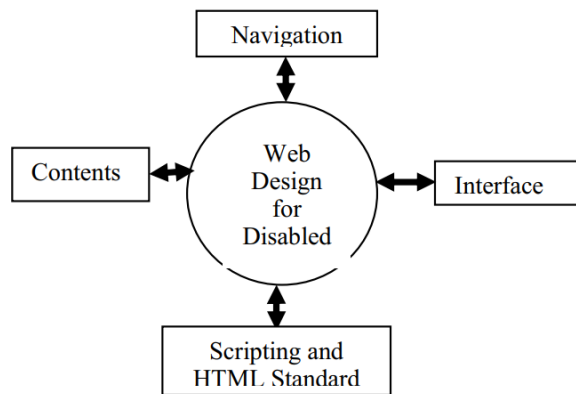


Figure 1. Web Accessibility Framework

Similar studies conducted in Turkey and Bangladesh echoed these concerns. In Turkey, the analysis of the homepages of 25 government websites revealed issues in HTML and CSS validity, web accessibility, and the current use of HTML5 and ARIA. The clear conclusion was that "all Turkish e-government websites do not meet the minimum levels of web accessibility requirements" (Akgul, 2016). Bangladesh faced similar challenges, with none of the ten websites of different ministries passing any conformance level A, AA, or AAA (Figure 2) (Baowaly, 2012).

<i>Category</i>	<i>Description</i>	<i>Symbol</i>
1	The developer must follow these guidelines in order to make all the information on a website accessible for all users including the persons with disabilities.	A
2	The developer should follow these guidelines to remove the important accessibility barriers in accessing the information on a website.	AA
3	The developer may follow these guidelines as these are not so important but make the website more comfortable for the use of disable person.	AAA

Figure 2. WCAG Priority with Conformance Level

A comprehensive examination by Baowaly of the accessibility of e-Government websites across 12 countries, encompassing both developing and developed nations, revealed significant challenges. Even governments claiming adherence to W3C accessibility standards and UN legislations exhibited serious accessibility issues in their tested e-Government sites. The scope broadened with additional studies conducting a global analysis of web accessibility for e-Government websites across United Nations member states. The conclusive findings pointed towards a consistent trend: government websites in developed countries generally surpass their counterparts in developing nations in terms of accessibility. This disparity underscores the critical importance of delving into accessibility concerns specific to developing countries, emphasizing the need to bring attention to this gap and implement effective measures to address the issue comprehensively. These insights highlight the imperative for comprehensive research and intervention to enhance web accessibility, particularly for marginalized communities across diverse nations. It is evident from these studies that the websites assessed universally failed to address disability-accessibility concerns, indicating an immediate need for targeted interventions and strategies for improvement.

Theoretical Frameworks & Methods

To better understand this topic, my exploration will be grounded in understanding the sociotechnical system at play. This dynamic interaction between technology and society forms the backdrop, presenting a significant hindrance for disabled individuals when navigating government websites. My interest extends to understanding the diverse needs of the public and the disabled population in different countries, dissecting the similarities and differences between the two. Additionally, I aim to explore the role of social norms, advocacy groups, and their collective efforts in advocating equal rights for all. Further layers of investigation involve scrutinizing various government agencies, their online operations, and the hurdles they pose for users. I am keen on unraveling the current standard development practices employed by user experience designers and teams to ensure equal accessibility. Recognizing the importance of collaboration among these groups and organizations is crucial for fostering inclusivity and providing equal access to information and services.

Expanding the analytical framework, I will explore the theories of Appropriate Design & Technology. These theories will guide an exploration into how social power influences technological design and, consequently, social and cultural outcomes. I am particularly interested in understanding how the principles of appropriate technology and inclusive design can converge to create accessible solutions for individuals with disabilities. This exploration will venture into the broader question of whether technology propels the course of human history, and if societal change is a consequence of technological advancements or vice versa. Given the government's ample resources for planning website interfaces, a strategic aim should be to drive technological advancements while conscientiously addressing the needs of all social groups.

To gather evidence for my STS research, I plan on conducting a comparative analysis of the accessibility standards met by government websites across different countries – Pakistan, Bangladesh, Turkey, and the United States. My focus will be on unraveling the intricacies of the accessibility issue, understanding existing debates, and offering suggestions on how this situation could be improved. A spotlight will be cast on the social processes and practices that underpin these differences, examining prevailing social norms concerning disabled individuals. Delving into policies and standards for disadvantaged populations, I aim to trace the historical roots of isolation and discrimination against the disabled. This journey will involve understanding the evolution of these policies and standards over time and their role in shaping the current conditions of inaccessibility. Additionally, I plan to establish connections with my family members residing in Bangladesh and Pakistan. By doing so, I aim to identify a few individuals who directly experience challenges in their daily lives due to the inaccessibility of government websites. Conducting interviews with these individuals will provide me with a firsthand perspective, enriching my research and contributing valuable insights to enhance its overall quality.

A critical aspect of my investigation involves evaluating the credibility of various assessment tools (e.g., Eval Access, AChecker, NVDA) and assistive technologies widely used to ensure accessibility effectiveness. The significance of this evaluation stems from the common issue of some tools not supporting the latest WCAG versions, leading to inflated results that may misrepresent website adherence to standards. This approach will aim to deepen my understanding of the needs of the disabled population, contributing valuable insights to both my STS paper and Technical Project.

Conclusion

In numerous government sectors across various countries, a pronounced gap in interface usability persists, particularly where most websites remain inaccessible for impaired users. This issue stems from a widespread lack of awareness regarding accessibility resources and guidelines, including standards set by W3C. Governments in these countries have yet to fully grasp the imperative of providing services that cater to the needs of individuals with disabilities. Addressing this pressing gap requires immediate action. Consequently, my STS research aims to comprehensively understand the user experience and web accessibility landscape of government websites in developing countries and the United States, specifically focusing on the needs of disabled individuals. Parallely, my technical project will concentrate on the design of user experience interfaces for a business analytics company, leveraging the capabilities of AI. Both projects will delve into best practices for designing user experiences, emphasizing UX/UI principles that account for the diverse needs of various user groups. Through these two projects, I intend to contribute to bridging the accessibility gap in government websites and enhancing the overall user experience for individuals with disabilities.

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