A Review on Roles of Next Generation User Interface to Support People with Disabilities

Dr. Sheily Verma(Panwar) [1], Dr. Aboubakr Aqle[2]
[1]Assistan professor (Department of computer science/Cyber Securit), CUC-Ulster University, Doha, Qatar
[2]Assistant professor (Department of computer Engineering), CUC-Ulster University, Doha, Qatar
[1]sheily.verma@cuc-ulster.edu.qa
[2]aboubakr.aqle@cuc-ulster.edu.qa

Abstract- User interfaces of the next generation are a significant step forward in technological development. They bring potential that have never been seen before for boosting accessibility and inclusivity, particularly for people who have disabilities. These interfaces, driven by state-of-the-art technology like AI, NLP, and gesture detection, enable users to overcome limitations in their physical abilities. These interfaces provide individualized solutions to several requirements. They empower those with visual impairments by providing them with superior screen readers, and they empower individuals with motor disabilities by providing them with intuitive gesture-based interactions. This can be accomplished by democratising access to information and communication. The principles of inclusive design that are included into these interfaces give accessibility the highest priority from the very beginning, thereby creating environments in which dignity and autonomy are prioritised. The influence extends beyond the realm of convenience, permeating social inclusion and empowerment through the provision of tools for communication, cooperation, and engagement. The revolutionary potential of next-generation user interfaces promises a future in which disability is associated with infinite potential. This is because innovation is continuing to meet unmet requirements, such as brain-computer interfaces and devices that use augmented reality. The purpose of this abstract is to investigate the substantial consequences of next-generation user interfaces in the process of making society more accessible and inclusive. This will ensure that everyone, regardless of their ability, has the opportunity to flourish and make meaningful contributions.

Keywords- Disabilities, Generation, Interface, Environments and Empowerment.

1. Introduction

In the ever-evolving landscape of technology, the advent of next-generation user interfaces

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heralds a transformative era, promising not only heightened user experiences but also revolutionary opportunities for inclusivity and accessibility. Amidst this progression, the pivotal question arises: How can these advancements empower and support individuals grappling with disabilities? This introduction delves into the profound impact of next-generation user interfaces on enhancing the lives of people with disabilities, elucidating how technology can serve as a beacon of hope and change. Living with a disability presents multifaceted challenges, ranging from physical limitations to barriers in communication and access. On the other hand, cutting-edge user interfaces have opened up a world of possibilities by connecting people's abilities with their limitations. By leveraging cutting-edge technologies such as artificial intelligence, natural language processing, and gesture recognition, next-generation user interfaces offer tailored solutions that cater to the diverse needs of individuals with disabilities. One of the most compelling aspects of these advancements lies in their ability to democratize access to information and communication. For individuals with visual impairments, screen readers powered by advanced algorithms now render digital content into speech or Braille, unlocking a wealth of knowledge and opportunities that were previously inaccessible. Those with motor impairments find newfound independence through intuitive gesture-based interfaces, enabling seamless interaction with digital devices and the virtual world. the significance of inclusive design cannot be overstated in the realm of next-generation user interfaces.[1]

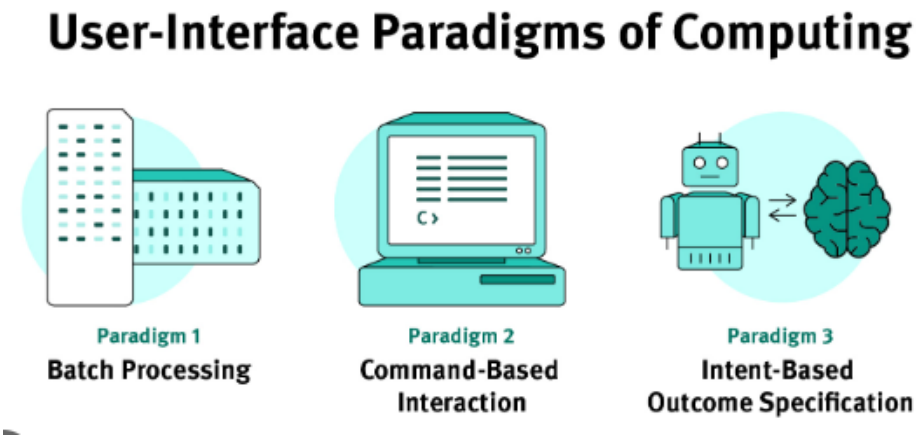

Figure 1 UI Paradigms of computing

By prioritizing accessibility from the inception of product development, designers and engineers can create solutions that cater to a diverse range of abilities, fostering an environment where no one is left behind. Whether it's through customizable interfaces, voice commands, or haptic feedback, these inclusive designs empower individuals to navigate the digital landscape with dignity and autonomy. Beyond mere convenience, the impact of next-generation user interfaces transcends into the realm of social inclusion and empowerment[2]–[6]. By providing individuals with disabilities the tools to communicate, collaborate, and engage with their surroundings, technology becomes a catalyst for breaking down societal barriers and fostering a more inclusive society. From facilitating employment opportunities to enabling active participation in social

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activities, these interfaces pave the way for a future where disability is not synonymous with limitation but rather with endless potential, the roles of next-generation user interfaces in supporting people with disabilities are multifaceted and profound. Through innovation, inclusivity, and empowerment, technology has the power to make a tangible difference in the lives of millions worldwide. As we embark on this journey towards a more accessible future, let us harness the transformative potential of next-generation user interfaces to create a world where everyone, regardless of ability, can thrive and contribute to society. In the ever-evolving realm of technology, the emergence of next-generation user interfaces stands as a beacon of hope and change, particularly for individuals navigating life with disabilities. By democratizing access to information and communication, they bridge the chasm between ability and limitation, offering tailored solutions to cater to diverse needs. For those with visual impairments, advanced screen readers transform digital content into speech or Braille, unlocking previously inaccessible realms of knowledge and opportunity. Similarly, individuals with motor impairments find newfound independence through intuitive gesture-based interfaces, enabling seamless interaction with digital devices and the virtual world. Moreover, inclusive design principles embedded within these interfaces ensure that accessibility is prioritized from inception, fostering environments where dignity and autonomy reign supreme. Customizable interfaces, voice commands, and haptic feedback mechanisms empower individuals to navigate the digital landscape with ease and confidence. Yet, the impact extends far beyond convenience, permeating the fabric of social inclusion and empowerment. By equipping individuals with disabilities with tools to communicate, collaborate, and engage, technology becomes a powerful catalyst for dismantling societal barriers and fostering a more inclusive society. From enhancing employment opportunities to facilitating active participation in social activities, these interfaces pave the way for a future where disability is synonymous not with limitation, but with boundless potential. Moreover, the relentless march of innovation continues to address previously unmet needs, with advancements such as brain-computer interfaces offering unprecedented control over digital devices through neural signals. Technologies like virtual reality (VR) and augmented reality (AR) help people with sensory impairments navigate more effectively and have a better sense of space [6]. As we journey towards a more accessible future, the transformative potential of next-generation user interfaces holds the key to unlocking a world where everyone, regardless of ability, can thrive and contribute meaningfully to society, ensuring that no one is left behind in the march of progress[7]–[13].

2. Literature Review

Vanpuymbrouck 2024 et al. This study aimed to qualitatively examine healthcare access barriers' impact on Persons With Mobility Disabilities (PWMD), focusing on self-advocacy experiences and accommodation request decision-making factors. Qualitative semistructured interviews were conducted with 6 purposively sampled PWMD. Interpretative phenomenological analysis revealed a shared process of recognizing and combating disability discrimination normalization,

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fostering self-advocacy agency. Results underscore the importance of supporting individual advocacy and combating disability discrimination in healthcare systems[14].

Xie 2023 et al. This retrospective study evaluated the clinical utility of metagenomic next-generation sequencing (mNGS) in bronchoalveolar lavage fluid (BALF) for HIV-infected patients with suspected multi-pathogenic pneumonia. Among 57 patients who underwent bronchoscopy, mNGS demonstrated higher accuracy in fungal detection compared to conventional microbiological tests (CMTs). Sensitivity of mNGS for pneumonia diagnosis was significantly higher than CMTs (79.6% vs. 61.1%). Patients with mixed infections had lower CD4 T-cell counts and longer symptom duration. mNGS detected more co-pathogens, with fungi-virus being the most common mixed infection pattern. Early bronchoscopy and mNGS are recommended for HIV-infected patients with low CD4 T-cell counts and prolonged symptoms[15].

Namoun 2023 et al. Integrating diverse technologies for new functionalities is highly researched, yet overlooked for individuals with special needs. This study reviews recent advancements in service-oriented composition techniques for disabled individuals, identifying key challenges. A systematic literature review identified 38 relevant articles from major databases. Findings reveal gaps in datasets, accessibility specifications, design practices, testing with disabled users, and techniques. The study concludes with guidelines to enhance assistive service composition, highlighting AI/ML utilization and addressing research gaps[1].

Li 2023 et al. Uterine adenosarcoma (UA) is a rare tumor characterized by benign epithelial and sarcoma-like stromal components, often low-grade. Its etiology remains unclear. Next-generation sequencing (NGS) analysis was conducted to explore gene mutations in UA. Two low-grade UAs with heterologous components exhibited ATRX gene frameshift mutations, one had a MED12 missense mutation. Copy number amplifications were observed on chromosome 12q13-15. PIK3/AKT/PTEN pathway mutations were common, alongside a rare BCORL1-PRR14L fusion mutation. These findings shed light on UA molecular changes for future targeted therapy research [16].

Park 2022 et al. This study investigates the impact of parental stress on depression among 164 mothers of children with disabilities in Gwangju and Jeollanamdo, South Korea. Parental stress predicts depression, with social support buffering this relationship. High social support levels correlate with lower depression likelihood. Findings underscore the critical role of social support in mitigating depression risk among mothers facing parental stress. Implementing supportive techniques, such as counseling and support groups, could enhance mental well-being in this demographic [17].

Aqle 2022 et al. Experiment conducted to explore whether search result summaries can enhance web search efficiency and experiences for visually impaired (VI) users. Their research introduces an interactive search engine interface called InteractSE, which utilizes unsupervised machine learning to organize search results into a hierarchical tree structure. This approach aims to

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improve the efficiency and interaction experience of VI users by enabling easier navigation through clustered concepts summarizing relevant information. The evaluation, involving 16 legally blind users comparing InteractSE with traditional Google search methods, indicates that providing search result summaries significantly enhances search efficiency and user experience by reducing cognitive load, suggesting potential improvements for search engine interfaces to better support VI users [45, 46].

Table 1. Summary of Research Studies with Methodologies, Advantages, and Future Intentions

Authors/year	Methodology	Advantages	Future intentions
[18] 2023	Conducted research on the experiences of unpaid careers, using phenomenological investigation, and presented significant findings.	Gaining understanding of the requirements of careers to develop impactful assistance initiatives for individuals with dementia.	Improve assistance programmers by incorporating insights and expectations from careers.
[9] 2021	Implemented Device-to-Device (D2D) communication into the IEEE 802.11ax standard, enhancing resource allocation for improved efficiency.	Enhanced spectrum efficiency, improved resource allocation, minimized interference, and optimized performance.	Further refine D2D integration for enhanced WLAN spectrum efficiency.
[10] 2021	Introduced efficient decoding algorithm for LDPC codes in IoT networks.	Improved hardware efficiency, reduced complexity, and enhanced error-correction performance for LDPC.	Enhance LDPC decoding efficiency and error correction for IoT networks.
[19] 2020	Compilation of Nano fluid research: preparation, performance, limitations, for transformer insulation.	Compilation elucidates Nano fluid advantages, aiding transformer insulation development.	Address concerns, resolve inconsistencies, and advance high heat dissipation insulation.
[20] 2019	Reviewed clinical trials to assess ECLS effectiveness in ARDS management.	Highlighted limitations prompt cautious consideration of ECLS in ARDS.	Improve ECLS efficacy through high-quality evidence and focused studies.

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3. Research Methodology

This research undertakes a comprehensive review of the roles of next-generation user interfaces (UIs) in supporting individuals with disabilities. Through systematic searches of databases including PubMed, IEEE Xplore, ACM Digital Library, Scopus, and Google Scholar, employing keywords such as "next generation user interface," "disabilities," "accessibility," and "usability," peer-reviewed articles, conference papers, and relevant reports published in English from 2010 onwards were selected based on strict inclusion criteria. Thematic analysis of the selected literature was conducted to identify recurring themes related to UI technologies, disability types, usability challenges, technological innovations, and user experiences. Critical appraisal of the literature ensured the reliability and validity of findings. The synthesis of results provides insights into the implications of next-generation UIs for individuals with disabilities, addressing both opportunities and challenges, thereby contributing to the academic discourse and guiding future research and development efforts in this field[19], [21]–[24].

3.1 Database on Next-Generation User Interfaces for Disability Support

This review on the roles of next-generation user interfaces (UIs) in supporting individuals with disabilities encompasses a systematic examination of literature sourced from databases including PubMed, IEEE Xplore, ACM Digital Library, Scopus, and Google Scholar. Utilizing keywords such as "next generation user interface," "disabilities," "accessibility," and "usability," the search was restricted to peer-reviewed articles, conference papers, and relevant reports published in English from 2010 onwards. A stringent inclusion criteria ensured selection of studies primarily focusing on UI technologies and their implications for disability support. Thematic analysis of the literature enabled the identification of recurring themes, encompassing UI technologies, disability types, usability challenges, technological innovations, and user experiences. Through critical appraisal, the reliability and validity of findings were ensured. The synthesis of results provides comprehensive insights into the impact of next-generation UIs on individuals with disabilities, addressing both opportunities and challenges. This database serves as a valuable resource for researchers, developers, and practitioners in the field, facilitating informed decision-making and guiding future endeavors aimed at enhancing accessibility and usability for people with disabilities through innovative UI solutions[25]–[29].

3.2 Analysis Methods

Analysis methods encompassed thematic analysis to identify recurring themes, critical appraisal to assess study quality, comparative analysis to evaluate UI technologies, quantitative synthesis for statistical aggregation, user experience evaluation for subjective feedback, and emergent theme identification for comprehensive exploration. These methods ensured rigorous examination of next-generation UI roles in disability support[20], [30], [31].

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1. Thematic Analysis: Thematic analysis was employed to identify recurring themes across the selected literature, including UI technologies, disability types, usability challenges, technological innovations, and user experiences. This method involved systematically coding and categorizing data to extract meaningful patterns and insights related to the roles of next-generation UIs in supporting people with disabilities.

2. Critical Appraisal: A critical appraisal of the literature was conducted to evaluate the quality of evidence and potential biases. This involved assessing the methodological rigor of included studies, considering factors such as sample size, study design, and data analysis techniques. By critically appraising the literature, the reliability and validity of the review findings were ensured, enhancing the credibility of the synthesized results.

3. Comparative Analysis: Comparative analysis was utilized to examine the similarities and differences between various UI technologies in terms of their effectiveness in supporting individuals with disabilities. This involved comparing features, functionalities, and performance metrics across different UI platforms to identify strengths, weaknesses, and areas for improvement.

4. Quantitative Synthesis: Quantitative synthesis methods, such as meta-analysis or statistical aggregation, were employed where applicable to quantitatively summarize findings from multiple studies. This involved pooling data from individual studies to calculate effect sizes, confidence intervals, or other statistical measures, providing a more robust and precise estimate of the overall impact of next-generation UIs on disability support.

5. User Experience Evaluation: User experience evaluation methods, including surveys, interviews, or usability testing, were utilized to gather insights into the subjective experiences and preferences of individuals with disabilities using next-generation UIs. This involved collecting qualitative feedback on factors such as ease of use, satisfaction, and perceived accessibility barriers, informing recommendations for improving UI design and implementation.

6. Emergent Theme Identification: In addition to predefined themes, emergent themes were identified through iterative analysis of the literature. This involved remaining open to new ideas and concepts that may not have been initially anticipated, allowing for a more comprehensive exploration of the roles of next-generation UIs in supporting people with disabilities.

4. Empowering Accessibility: Next Gen UI Impact

In the realm of technology, the emergence of next-generation user interfaces (UIs) stands as a beacon of hope and change, particularly for individuals navigating life with disabilities. This article delves into the profound impact of next-generation UIs on enhancing accessibility and empowering individuals with disabilities, elucidating how technology can serve as a transformative force in their lives.Traditional user interfaces often posed significant challenges

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for individuals with disabilities, ranging from physical barriers to limitations in communication and access. However, the advent of nextgeneration UIs heralds a new era of possibilities, offering tailored solutions that cater to diverse needs. Utilising state-ofthe-art technology like AI, NLP, and gesture recognition, these interfaces bridge the gap between ability and limitation, empowering users to interact with digital devices and the virtual world with greater ease and independence. One of the key advantages of next-generation UIs lies in their ability to enhance interaction for individuals with disabilities. Intuitive gesture-based interfaces allow people with motor impairments to easily browse digital devices by simply moving their hands. This eliminates the need for traditional input techniques. Similarly, voice recognition technology enables hands-free interaction, allowing individuals with mobility issues to control devices and access information effortlessly. These advancements not only promote independence but also foster a sense of empowerment and inclusion in the digital realm. Communication barriers are often a significant challenge for individuals with disabilities, but next-generation UIs are changing the landscape by providing innovative solutions. Speech-to-text and text-to-speech technologies enable seamless communication for individuals with hearing or speech impairments, allowing them to engage in conversations, access information, and participate in social interactions with greater ease. Real-time translation features break down language barriers, facilitating communication across diverse linguistic backgrounds and promoting inclusivity on a global scale. Inclusive design principles are at the core of next-generation UIs, ensuring that accessibility is prioritized from the inception of product development. Customizable interfaces allow users to adapt settings and features to suit their specific needs, whether it's adjusting font sizes for better readability or configuring input methods for enhanced usability. Moreover, built-in accessibility features such as screen readers, magnifiers, and alternative input methods cater to a wide range of disabilities, empowering users to personalize their digital experience and navigate the digital landscape with dignity and autonomy. For individuals with disabilities, independence is not merely a goal but a fundamental aspect of quality of life. Next-generation UIs play a crucial role in promoting independence by providing tools and resources that empower users to perform daily tasks, access information, and engage with their surroundings autonomously. From smart home devices that enable remote control of appliances to navigation apps that provide step-bystep directions with audio cues, technology offers a lifeline of support for individuals striving to live independently despite physical or cognitive challenges. Despite the remarkable advancements in next-generation UIs, challenges remain in ensuring equitable access and usability for individuals with disabilities. Issues such as compatibility with assistive technologies, consistency in design standards, and affordability of accessible devices pose significant barriers to adoption and inclusion. Moreover, digital accessibility regulations and standards vary across regions, creating inconsistencies in the implementation of accessibility features and hindering progress towards universal design. Looking ahead, the future of nextgeneration UIs holds immense promise for advancing accessibility and inclusion for individuals with disabilities. Continued innovation in areas such as artificial intelligence, augmented reality, and wearable technology will further enhance the

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capabilities of UIs to cater to diverse needs. Moreover, collaboration between technology developers, disability advocates, and policymakers is essential to ensure that accessibility remains a priority in the design and implementation of digital solutions. By harnessing the transformative potential of next-generation UIs, The roles of next-generation UIs in supporting people with disabilities are multifaceted and profound. From enhancing interaction and communication to promoting independence and addressing challenges, technology has the power to make a tangible difference in the lives of millions worldwide. As we continue to innovate and advance accessibility, let us strive to create a future where technology serves as a tool for empowerment, inclusion, and equality for all[32]–[35].

5. Transforming Disability Support: Next Gen

The advent of next-generation technology, especially in the domain of user interfaces (UIs), is causing a revolutionary change in the disability support scene. This article explores the technical aspects and implications of next-generation UIs in revolutionizing disability support, examining their potential to enhance accessibility, promote independence, and foster inclusion for individuals with disabilities. Next-generation UIs encompass a diverse range of technologies and innovations aimed at improving user interaction and experience across digital platforms. Interfaces like this are made possible by cutting-edge tech like AI, NLP, gesture detection, and AR to make them user-friendly, flexible, and accessible to everyone. By prioritizing accessibility and usability, next-gen UIs aim to break down barriers and empower individuals with disabilities to fully participate in the digital world. One of the primary objectives of next-gen UIs is to enhance accessibility for individuals with disabilities. Through customizable interfaces, adaptive features, and assistive technologies, these UIs cater to diverse needs and preferences. Users with mobility disabilities can benefit from speech recognition technology's hands-free interaction, while those with visual impairments can access digital information with the help of screen readers and magnifiers. By providing multiple input modalities and personalization options, next-gen UIs ensure that users can interact with digital devices and services in a manner that best suits their abilities and preferences. Nextgen UIs play a crucial role in promoting independence for individuals with disabilities by providing tools and resources that empower self-reliance and autonomy. Smart home devices, wearable technologies, and mobile applications equipped with accessibility features enable users to perform daily tasks, access information, and navigate their environments with greater ease and confidence. By harnessing the power of AI and IoT, nextgen UIs can anticipate user needs, provide contextually relevant assistance, and adapt to changing preferences, thereby enhancing users' sense of control and agency over their lives. Figure 2 Social model of disability To make sure that digital goods and services are available to everyone, regardless of their ability or disability, next-gen user interfaces are built around inclusive design principles. In order to foster inclusivity and diversity in the digital realm, next-gen user interfaces take varied user demands and views into account from the very beginning of the design process. For example, alternative input methods, such as gesture-based interaction or switch control, enable users with physical disabilities to navigate digital interfaces effectively.

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Similarly, captioning, audio descriptions, and language translation features ensure that digital content is accessible to users with sensory impairments or language barriers. Despite their potential benefits, next-gen UIs also present challenges and considerations in their design, development, and implementation. Ensuring compatibility with assistive technologies, addressing privacy and security concerns, and complying with accessibility standards and regulations are critical aspects that require careful attention. Moreover, the digital divide and disparities in access to technology among individuals with disabilities must be addressed to ensure equitable access and participation for all. Looking ahead, the future of next-gen UIs in disability support holds immense promise for advancing accessibility, independence, and inclusion. Continued innovation in AI, IoT, and humancomputer interaction will drive the development of more intuitive, adaptive, and inclusive interfaces. Moreover, collaboration between technology developers, disability advocates, and policymakers is essential to ensure that next-gen UIs meet the diverse needs of individuals with disabilities and promote equal access and opportunity for all. Next-generation UIs have the potential to transform disability support by enhancing accessibility, promoting independence, and fostering inclusion for individuals with disabilities. By leveraging advanced technologies and inclusive design principles, nextgen UIs can empower users to fully participate in the digital world and lead more independent and fulfilling lives. As we continue to innovate and advance next-gen UIs, let us strive to create a future where technology serves as a powerful tool for empowerment, equality, and inclusion for all individuals, regardless of their abilities or limitations[36]–[40].

6. Next Generation User Interface: Architecture, Advantages, And Disadvantages

The Next Generation User Interface (UI) represents a significant evolution in the way users interact with digital devices and services. This article explores the architecture of Next Generation UI, its advantages, and disadvantages, shedding light on its impact on user experience and technology advancement[41]–[43].

6.1 Architecture of Next Generation UI

The architecture of Next Generation UI is characterized by several key components and principles:

1. Advanced Technologies: Next Generation UI represents a culmination of cutting-edge technological advancements, incorporating sophisticated tools like artificial intelligence (AI), natural language processing (NLP), gesture recognition, and augmented reality (AR). These technologies work in tandem to revolutionize user experiences, providing an intuitive, adaptive, and immersive interface that transcends traditional boundaries. By harnessing the power of AI, Next Generation UIs can learn from user interactions, predict preferences, and tailor experiences accordingly. NLP enables seamless communication, allowing users to interact with devices

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using natural language commands. Gesture recognition and AR further enhance user engagement by enabling intuitive and interactive interactions, blurring the lines between the physical and digital worlds.

2. Adaptive Interface: At the core of Next Generation UI is its adaptability to the user's preferences, behavior, and context. By dynamically adjusting to user inputs, past interactions, and environmental factors, Next Generation UIs offer a highly personalized and tailored experience. Through continuous learning algorithms, these interfaces evolve over time, finetuning themselves to better serve the user's needs and preferences. Whether it's customizing layout, content, or functionality, Next Generation UIs prioritize user-centric design, ensuring that each interaction is optimized for maximum efficiency and satisfaction.

3. Multi-Modal Interaction: Next Generation UIs embrace a multi-modal approach to interaction, accommodating a diverse range of user inputs and preferences. By supporting voice, touch, gesture, and gaze inputs, these interfaces cater to users with varying abilities and limitations, fostering natural and intuitive interactions. Voice commands enable hands-free operation, while touch and gesture inputs provide tactile feedback and precise control. Additionally, gaze-based interaction offers a novel way for users to navigate interfaces, particularly beneficial for individuals with mobility impairments or visual impairments. By offering multiple interaction modalities, Next Generation UIs promote inclusivity and accessibility, ensuring that all users can engage with digital devices and services effectively.

4. Context Awareness: Next Generation UIs are imbued with context-aware capabilities, enabling them to understand the user's surroundings, location, and activities. By leveraging sensors, geolocation data, and environmental cues, these interfaces can adapt their behavior and presentation to suit the user's current context. For example, a Next Generation UI on a smartphone may adjust its display brightness based on ambient lighting conditions or suggest relevant information based on the user's location. This contextual awareness enhances the relevance and usefulness of the UI, providing users with timely and pertinent information and services tailored to their specific circumstances.

5. Seamless Integration: Next Generation UIs excel in their ability to seamlessly integrate with a wide range of devices, services, and platforms. Through standardized protocols and APIs, these interfaces facilitate interoperability and continuity across different contexts and environments. For example, a Next Generation UI on a smart home device may seamlessly communicate with other connected devices in the home, allowing users to control various aspects of their environment through a single interface. Similarly, Next Generation UIs on mobile devices may integrate with third-party apps and services, enabling users to access a wide range of functionalities without switching between multiple apps. This seamless integration enhances the user experience by providing a cohesive and unified interface across diverse digital ecosystems.

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6.2 Advantages of Next Generation UI

1. Enhanced User Experience: Next Generation UI elevates the user experience to new heights, surpassing traditional interfaces through its seamless blend of intuitiveness, adaptability, and personalization. By intuitively anticipating user needs, adapting to individual preferences, and delivering personalized interactions, Next Generation UIs foster a deeper and more satisfying user experience that resonates with users on a personal level.

2. Improved Accessibility: Next Generation UI takes significant strides in enhancing accessibility, particularly for users with disabilities or limitations. By embracing multi-modal interaction and context-awareness, these interfaces break down barriers and empower users of all abilities to engage with digital content and services. Whether it's through voice commands, touch gestures, or context-sensitive prompts, Next Generation UIs prioritize inclusivity and accessibility, ensuring that every user can participate fully in the digital experience.

3. Increased Efficiency: Next Generation UI revolutionizes efficiency by optimizing tasks and workflows, streamlining processes, and reducing cognitive load. Through intelligent automation, proactive assistance, and seamless integration with user workflows, these interfaces empower users to accomplish tasks more efficiently and effectively across various domains, from productivity and education to entertainment and leisure. By minimizing friction and maximizing productivity, Next Generation UIs enhance user efficiency and effectiveness in accomplishing their goals.

4. Better Engagement: Next Generation UI captivates users with immersive and interactive experiences that go beyond mere functionality to evoke genuine engagement and emotional connection. Through rich multimedia content, dynamic visualizations, and interactive elements, these interfaces create captivating and memorable experiences that hold users' attention and foster deeper engagement. By stimulating curiosity, creativity, and exploration, Next Generation UIs transform passive users into active participants, driving higher levels of engagement and interaction.

5. Future-Proofing: Next Generation UI ensures the longevity and relevance of digital products and services by embracing advanced technologies and design principles that are adaptable, scalable, and resilient to change. By leveraging cutting-edge technologies such as AI, machine learning, and adaptive algorithms, these interfaces anticipate and adapt to evolving user needs and preferences, ensuring that they remain relevant and effective in a rapidly changing technological landscape. By future-proofing digital products and services, Next Generation UIs empower organizations to stay ahead of the curve and deliver value to users over the long term.

6.3 Disadvantages of Next Generation UI

1. Complexity: Implementing Next Generation UIs can introduce complexity in various aspects,

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including design, development, and implementation. These interfaces often require specialized skills and expertise to create and maintain, as they may involve intricate algorithms, advanced technologies, and novel interaction paradigms. Designing intuitive and user-friendly interfaces amidst this complexity requires careful consideration of user needs, preferences, and usability principles, adding another layer of complexity to the development process.

2. Privacy Concerns: Next Generation UIs raise significant privacy concerns due to their capability to collect, analyze, and potentially exploit vast amounts of user data. With features like personalized recommendations, context-aware assistance, and behavioral analysis, these interfaces may inadvertently compromise user privacy and security by accessing sensitive information without explicit consent. Furthermore, the aggregation and analysis of user data for targeted advertising or profiling purposes can raise ethical and legal questions regarding user privacy and data protection.

3. Accessibility Challenges: While Next Generation UIs aim to enhance user experience and inclusivity, they may inadvertently introduce accessibility challenges for users with disabilities or limitations. Interfaces heavily reliant on specific input modalities or sensory cues, such as voice commands or gesture recognition, may pose barriers for individuals with certain disabilities, such as motor impairments or visual impairments. Ensuring that Next Generation UIs are accessible to all users requires careful consideration of accessibility standards, guidelines, and best practices throughout the design and development process.

4. Dependency on Technology: Next Generation UIs are inherently dependent on advanced technologies such as artificial intelligence (AI), natural language processing (NLP), and augmented reality (AR). While these technologies enable innovative and immersive user experiences, they may not be accessible or affordable for all users, leading to disparities in access and adoption. Additionally, reliance on proprietary or closed-source technologies may limit interoperability and hinder the development of open and inclusive digital ecosystems.

5. Resistance to Change: Next Generation UIs may encounter resistance from users accustomed to traditional interfaces, who may find the transition to new interaction paradigms challenging or disruptive. Users may be hesitant to adopt unfamiliar technologies or change ingrained habits and workflows, particularly if they perceive the learning curve as steep or the benefits as uncertain. Overcoming resistance to change requires effective communication, user education, and support mechanisms to help users navigate the transition and realize the potential benefits of Next Generation UIs. Among the many advantages offered by Next Generation UI— a giant leap forward in user interface design—are an improved user experience, accessibility, efficiency, engagement, and future-proofing. But there are other obstacles, such as complexity, privacy worries, accessibility issues, reliance on technology, and aversion to change. Designers, developers, and stakeholders may make better judgements and build interfaces that satisfy users' requirements and expectations in the digital age if they grasp the architecture, pros, and cons of

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Next Generation UI.

6. Conclusion

In conclusion, the review illuminates the profound impact of Next Generation User Interfaces (UIs) in revolutionizing disability support through advanced technologies. Through the utilisation of state-of-the-art advancements such as AI, NLP, and gesture recognition, Next Generation UIs deliver personalized, adaptive, and immersive experiences tailored to the unique needs of individuals with disabilities. These interfaces not only facilitate seamless interaction and communication but also empower users to navigate digital devices and services with newfound ease and autonomy. The architectural framework of Next Generation UIs, characterized by its integration of advanced technologies, adaptive interfaces, multi-modal interaction, context awareness, and seamless integration, lays a solid foundation for a more inclusive and accessible digital ecosystem. There are many benefits to Next Generation UIs, such as an improved user experience, accessibility, efficiency, engagement, and future-proofing. However, there are also many drawbacks, such as complexity, privacy issues, accessibility barriers, technological dependencies, and opposition to change. The review underscores the imperative of continued innovation and collaboration in designing, developing, and implementing Next Generation UIs to ensure they authentically address the needs and expectations of individuals with disabilities. By confronting challenges head-on and seizing opportunities, Next Generation UIs possess the potential to redefine disability support, empowering individuals to fully embrace digital participation and lead lives marked by independence and fulfillment. As we press forward in advancing technology and accessibility, let us remain committed to forging a future where Next Generation UIs serve as catalysts for empowerment, equality, and inclusion, transcending barriers and embracing the diversity of all individuals, regardless of their abilities or limitations.

References

[1] Namoun, A., Tufail, A., Nawaz, W., BenRhouma, O., & Alshanqiti, A. (2023). A Systematic Literature Review on Service Composition for People with Disabilities: Taxonomies, Solutions, and Open Research Challenges. *Computational Intelligence and Neuroscience*, *2023*(3), 1–40. https://doi.org/10.1155/2023/5934548

[2] Al-Sa'Di, A., & Al-Samarraie, H. (2022). A Delphi Evaluation of User Interface Design Guidelines: The Case of Arabic. *Advances in Human-Computer Interaction*, *2022*. https://doi.org/10.1155/2022/5492230

[3] Dianat, F., Khodakarami, V., Shakouri Ganjavi, H., & Hosseini, S. H. (2022). Sustainability Assessment of Electricity Generation Development under the Implementation of Support Policies with Endogenous Financial Resources Using a Hybrid Decision Support Model. *Mathematical Problems in Engineering*, *2022*. https://doi.org/10.1155/2022/7436749

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[4] Gu, J., Chen, L., Zeng, C., Yang, X., Pan, D., Cao, H., & Qian, Q. (2022). A Retrospective Analysis of Metagenomic Next Generation Sequencing (mNGS) of Cerebrospinal Fluid from Patients with Suspected Encephalitis or Meningitis Infections. *Journal of Healthcare Engineering*, *2022*. https://doi.org/10.1155/2022/5641609

[5] Son, J. H., Kim, D. G., Lee, E., & Choi, H. (2022). Investigating the Spatiotemporal Imbalance of Accessibility to Demand Responsive Transit (DRT) Service for People with Disabilities: Explanatory Case Study in South Korea. *Journal of Advanced Transportation*, *2022*. https://doi.org/10.1155/2022/6806947

[6] Zhang, H., Duan, Y., Cai, F., Cao, D., Wang, L., Qiao, Z., Hong, Q., Li, N., Zheng, Y., Su, M., Liu, Z., & Zhu, B. (2022). Next-Generation Probiotics: Microflora Intervention to Human Diseases. *BioMed Research International*, *2022*. https://doi.org/10.1155/2022/5633403

[7] Ali, M. I., & Kaur, S. (2021). Next-generation digital forensic readiness BYoD framework. *Security and Communication Networks*, *2021*. https://doi.org/10.1155/2021/6664426

[8] Asif, M., Khan, W. U., Afzal, H. M. R., Nebhen, J., Ullah, I., Rehman, A. U., & Kaabar, M. K. A. (2021). Reduced-Complexity LDPC Decoding for Next-Generation IoT Networks. *Wireless Communications and Mobile Computing*, *2021*. https://doi.org/10.1155/2021/2029560

[9] Mohd Zaki, Z., Ishak, S. F., & Mohamad, K. A. (2021). User Interface Designs of an Educational Mobile Application: A Study of Qiraat Teaching and Learning. *Advances in Human-Computer Interaction*, *2021*. https://doi.org/10.1155/2021/6648550

[10] Thompson, B. A. D., & Broome, K. (2021). Social Circus for People with Disabilities: A Video Analysis through the Lens of the MOHO. *Occupational Therapy International*, *2021*. https://doi.org/10.1155/2021/6628482

[11] Wang, Y., Lei, J., & Shang, F. (2021). Enabling Device-to-Device (D2D) Communication for the Next Generation WLAN. *Wireless Communications and Mobile Computing*, *2021*. https://doi.org/10.1155/2021/1949352

[12] Lavín-Pérez, A. M., Collado-Mateo, D., Caña-Pino, A., Villafaina, S., Parraca, J. A., & Apolo-Arenas, M. D. (2022). Benefits of Equine-Assisted Therapies in People with Multiple Sclerosis: A Systematic Review. *Evidence-Based Complementary and Alternative Medicine*, *2022*. https://doi.org/10.1155/2022/9656503

[13] Nour, R. (2022). An Assessment of Accessibility and Usability of Saudi Online FinTech Services for People with Disabilities. *Computational and Mathematical Methods in Medicine*, *2022*. https://doi.org/10.1155/2022/8610844

[14] Vanpuymbrouck, L., & Magasi, S. (2024). Confronting Barriers to Equitable Care: A Qualitative Analysis of Factors That Inform People with Mobility Disabilities' Decisions to Self-Advocate in the Context of Healthcare. *Health and Social Care in the Community*, *2024*. https://doi.org/10.1155/2024/9975084

Nafath © 2024 by Mada Center, Qatar is licensed under CC BY-NC-4.0

[15] Xie, Y., Dai, B., Zhou, X., Liu, H., Wu, W., Yu, F., & Zhu, B. (2023). Diagnostic Value of Metagenomic Next-Generation Sequencing for Multi-Pathogenic Pneumonia in HIV-Infected Patients. *Infection and Drug Resistance*, *16*, 607–618. https://doi.org/10.2147/IDR.S394265

[16] Li, Y., Meng, X., Luo, Y., Huang, X., Luo, S., & Wang, J. (2023). Next-Generation Sequencing Analysis of 3 Uterine Adenosarcomas with Heterogeneously Differentiated Genomic Mutations. *International Journal of Analytical Chemistry*, *2023*. https://doi.org/10.1155/2023/7436368

[17] Park, G. A., & Lee, O. N. (2022). The Moderating Effect of Social Support on Parental Stress and Depression in Mothers of Children with Disabilities. *Occupational Therapy International*, *2022*. https://doi.org/10.1155/2022/5162954

[18] Gümüşkaya, O., Şen, S., Işik, I., Ayaz, V., Arslan Özkan, H., & Wilson, R. L. (2023). Urban Share of the "burden": Impact of a Support Organisation on Caregiver Burden of People Affected by Dementia. *Perspectives in Psychiatric Care*, *2023*. https://doi.org/10.1155/2023/2706698

[19] Suhaimi, S. N., Rahman, A. R. A., Din, M. F. M., Hassan, M. Z., Ishak, M. T., & Jusoh, M. T. Bin. (2020). A Review on Oil-Based Nanofluid as Next-Generation Insulation for Transformer Application. *Journal of Nanomaterials*, *2020*. https://doi.org/10.1155/2020/2061343

[20] Aretha, D., Fligou, F., Kiekkas, P., Karamouzos, V., & Voyagis, G. (2019). Extracorporeal Life Support: The Next Step in Moderate to Severe ARDS - A Review and Meta-Analysis of the Literature. *BioMed Research International*, *2019*. https://doi.org/10.1155/2019/1035730

[21] Helton, M., Abu-Rmaileh, M., Thomas, K., Gokden, M., Kanaan, A., & Rodriguez, A. (2020). Pituitary Metastatic Composite Tumors: A Case Report with Next-Generation Sequencing and Review of the Literature. *Case Reports in Oncological Medicine*, *2020*, 1–8. https://doi.org/10.1155/2020/5073236

[22] Bizimungu, T., Harelimana, D., & Marie Ntaganda, J. (2021). A Client-Server and Web-Based Graphical User Interface Design for the Mathematical Model of Cardiovascular-Respiratory System. *Applied Computational Intelligence and Soft Computing*, *2021*, 9783162. https://doi.org/10.1155/2021/5581937

[23] He, X., Zhao, S., & Li, Y. (2021). Faecalibacterium prausnitzii: A Next-Generation Probiotic in Gut Disease Improvement. *Canadian Journal of Infectious Diseases and Medical Microbiology*, *2021*. https://doi.org/10.1155/2021/6666114

[24] Manzoor, S., Bajwa, K. B., Sajid, M., Manzoor, H., Manzoor, M., Ali, N., & Menhas, M. I. (2021). Modeling of Wireless Traffic Load in Next Generation Wireless Networks. *Mathematical Problems in Engineering*, *2021*. https://doi.org/10.1155/2021/7293093

[25] Chen, X., Ding, S., Lei, C., Qin, J., Guo, T., Yang, D., Yang, M., Qing, J., He, W., Song,

Nafath © 2024 by Mada Center, Qatar is licensed under CC BY-NC-4.0

M., Zhang, Y., Zeng, H., Qin, Q., Yang, L., Long, Y., Chen, Y., Ma, B., Ouyang, R., Chen, P., & Luo, H. (2020). Blood and Bronchoalveolar Lavage Fluid Metagenomic Next-Generation Sequencing in Pneumonia. *Canadian Journal of Infectious Diseases and Medical Microbiology*, *2020*. https://doi.org/10.1155/2020/6839103

[26] Da Rosa, S. V., Moysés, S. J., Theis, L. C., Soares, R. C., Moysés, S. T., Werneck, R. I., & Rocha, J. S. (2020). Barriers in Access to Dental Services Hindering the Treatment of People with Disabilities: A Systematic Review. *International Journal of Dentistry*, *2020*. https://doi.org/10.1155/2020/9074618

[27] Lanza, G., Calì, F., Vinci, M., Cosentino, F. I. I., Tripodi, M., Spada, R. S., Cantone, M., Bella, R., Mattina, T., & Ferri, R. (2020). A Customized Next-Generation Sequencing-Based Panel to Identify Novel Genetic Variants in Dementing Disorders: A Pilot Study. *Neural Plasticity*, *2020*, 1–10. https://doi.org/10.1155/2020/8078103

[28] Lersilp, S., Putthinoi, S., Lerttrakarnnon, P., & Silsupadol, P. (2020). Development and Usability Testing of an Emergency Alert Device for Elderly People and People with Disabilities. *Scientific World Journal*, *2020*. https://doi.org/10.1155/2020/5102849

[29] Smaradottir, B. F., Berntsen, G. K. R., & Fensli, R. W. (2020). How to Enhance Digital Support for Cross-Organisational Health Care Teams? A User-Based Explorative Study. *Journal of Healthcare Engineering*, *2020*. https://doi.org/10.1155/2020/8824882

[30] Blumenstein, T., Turova, V., Alves-Pinto, A., & Lampe, R. (2016). Sensorimotor Piano System for People with Disabilities. *Journal of Sensors*, *2016*. https://doi.org/10.1155/2016/9825905

[31] Ravn, M. B., Petersen, K. S., & Thuesen, J. (2019). Rehabilitation for People Living with Dementia: A Scoping Review of Processes and Outcomes. *Journal of Aging Research*, *2019*, 12–16. https://doi.org/10.1155/2019/4141050

[32] Heldak, M., Stacherzak, A., & Przybyla, K. (2018). Demand and financial constraints in eliminating architectural and technical barriers for people with disabilities in Poland. *Journal of Healthcare Engineering*, *2018*. https://doi.org/10.1155/2018/1297396

[33] Li, W., Mei, L., Chen, H., Cai, X., Liu, Y., Men, M., Liu, X. Z., Yan, D., Ling, J., Feng, Y., & Dorszewska, J. (2019). New Genotypes and Phenotypes in Patients with 3 Subtypes of Waardenburg Syndrome Identified by Diagnostic Next-Generation Sequencing. *Neural Plasticity*, *2019*(endothelin 3). https://doi.org/10.1155/2019/7143458

[34] Sautto, G. A., Kirchenbaum, G. A., Diotti, R. A., Criscuolo, E., & Ferrara, F. (2019). Next Generation Vaccines for Infectious Diseases. *Journal of Immunology Research*, *2019*. https://doi.org/10.1155/2019/5890962

[35] Yousaf, K., Mehmood, Z., Saba, T., Rehman, A., Munshi, A. M., Alharbey, R., & Rashid, M. (2019). Mobile-health applications for the efficient delivery of health care facility to people with dementia (PwD) and support to their carers: A survey. *BioMed Research International*, *2019*. https://doi.org/10.1155/2019/7151475

Nafath © 2024 by Mada Center, Qatar is licensed under CC BY-NC-4.0

[36] Chiu, A., Garvey, J., & Abdelrahman, T. S. (2017). A language and preprocessor for user-controlled generation of synthetic programs. *Scientific Programming*, *2017*. https://doi.org/10.1155/2017/1046161

[37] Awoyemi, B. S., Alfa, A. S., & Maharaj, B. T. (2018). Network Restoration for Next-Generation Communication and Computing Networks. *Journal of Computer Networks and Communications*, *2018*. https://doi.org/10.1155/2018/4134878

[38] Bong, W. K., Chen, W., & Bergland, A. (2018). Tangible User Interface for Social Interactions for the Elderly: A Review of Literature. *Advances in Human-Computer Interaction*, *2018*. https://doi.org/10.1155/2018/7249378

[39] Gelšvartas, J., Simutis, R., & Maskeliunas, R. (2018). Projection mapping user interface for disabled people. *Journal of Healthcare Engineering*, *2018*.

[40] Iannone, A., Ruospo, M., Wong, G., Barone, M., Principi, M., Di Leo, A., & Strippoli, G. F. M. (2018). Mesalazine for people with diverticular disease: A systematic review of randomized controlled trials. *Canadian Journal of Gastroenterology and Hepatology*, *2018*. https://doi.org/10.1155/2018/5437135

[41] Navarro, R. F., Rodríguez, M. D., & Favela, J. (2016). Use and Adoption of an Assisted Cognition System to Support Therapies for People with Dementia. *Computational and Mathematical Methods in Medicine*, *2016*(1), 1–11. https://doi.org/10.1155/2016/1075191

[42] Boessen, A. B. C. G., Verwey, R., Duymelinck, S., & Van Rossum, E. (2017). An Online Platform to Support the Network of Caregivers of People with Dementia. *Journal of Aging Research*, *2017*. https://doi.org/10.1155/2017/3076859

[43] Punchoojit, L., & Hongwarittorrn, N. (2017). Usability Studies on Mobile User Interface Design Patterns: A Systematic Literature Review. *Advances in Human-Computer Interaction*, *2017*. https://doi.org/10.1155/2017/6787504

[44] Aqle, A., Al-Thani, D. & Jaoua, A. Can search result summaries enhance the web search efficiency and experiences of the visually impaired users?. *Univ Access Inf Soc* 21, 171–192 (2022). https://doi.org/10.1007/s10209-020-00777-w

[45] Dena Al-Thani and Aboubakr Aqle. 2023. Evaluating Search Results Overviews and Previews with Visually Impaired Users. In Proceedings of the 16th *International Conference on PErvasive Technologies Related to Assistive Environments (PETRA '23).* Association for Computing Machinery, New York, NY, USA, 680–685.

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