Nafath

by Mada

Issue no. 22
April 2023

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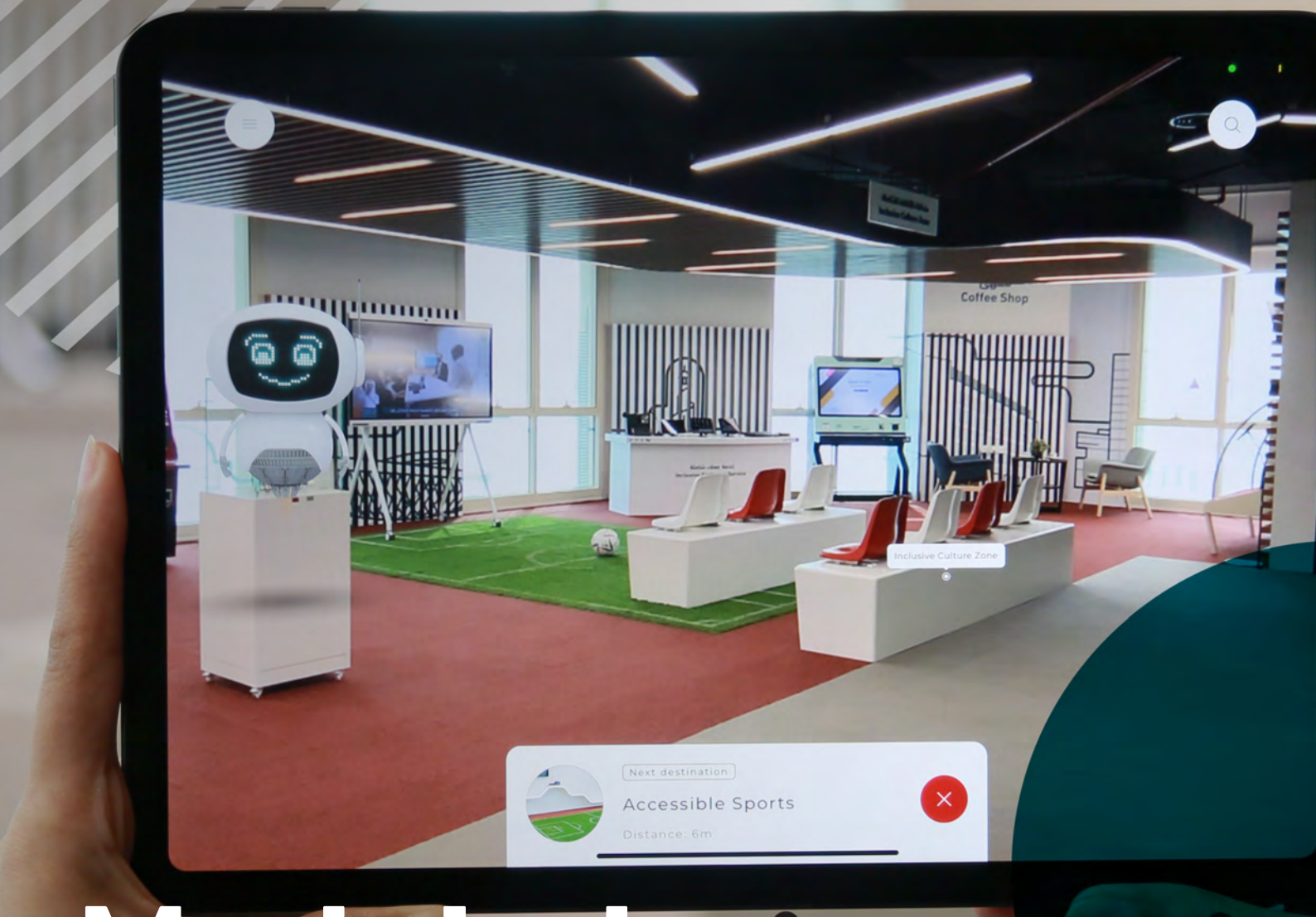

MadaLab

A Global Innovation Hub for Arabic ICT Accessibility and Assistive Technologies Empowering Digital Inclusion

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About Mada

Mada – Assistive Technology Center Qatar is a private institution for public benefit, which was founded in 2010 as an initiative that aims at promoting digital inclusion and building a technology-based community that meets the needs of persons with functional limitations (PFLs) – persons with disabilities (PWDs) and the elderly in Qatar. Mada today is the world's Center of Excellence in digital access in Arabic. The Center works through smart strategic partnerships to enable the education sector to ensure inclusive education, the culture and community sector through ICTs to become more inclusive, and the employment sector to enhance employment opportunities, professional development and entrepreneurship for persons with disabilities. The Center achieves its goals by building partners' capabilities and supporting the development and accreditation of digital platforms in accordance with international standards of digital access. Mada also raises awareness, provides consulting services, and increases the number of assistive technology solutions in Arabic through the Mada Innovation Program to ensure equal opportunities for the participation of persons with disabilities in the digital society.

Mission
Empowering PWDs to participate and live independently through fostering the ecosystem of ICT Accessibility.

Vision
Enhancing ICT Accessibility for Persons with Disabilities in Qatar and beyond.

About Nafath

Nafath aims to be a key information resource for disseminating the facts about latest trends and innovation in the field of ICT Accessibility. It is published in English and Arabic languages on a quarterly basis and intends to be a window of information to the world, highlighting the pioneering work done in our field to meet the growing demands of ICT Accessibility and Assistive Technology products and services in Qatar and the Arab region.

Content Page

Open call for papers

Nafath, an open access journal, solicits original research contributions addressing the accessibility, usability, and key information resource for disseminating the facts about latest trends and innovation in the field of ICT Accessibility to enable persons with disabilities and the elderly. Nafath is focusing on theoretical, methodological, and empirical research, of both technological nature, that addresses equitable access and active participation of potentially all citizens in the Information Society.

Topics of specific interest

Important aspects and topics to be discussed evolve around (but are not limited to):

- Accessibility guidelines
- Accessible games
- Adaptable and adaptive interfaces
- Alternative and augmented Input /Output techniques
- Applications of assistive technologies in the mainstream
- Architectures, development methods and tools for ICT Accessibility
- Design for All accessibility education and training
- Evaluation of Accessibility, Usability, and User Experience
- Innovative Assistive applications and environments and ICT Accessibility solutions
- Localization
- Novel designs for the very young, the elderly, and people with different types of disabilities
- Novel interaction techniques, platforms, metaphors, and devices
- Personalization techniques and personalized products and services
- Smart artifacts, smart cities and smart environments
- Web accessibility

In addition to the above, Nafath can host special issues, book reviews and letters to the editor, announcements (e.g. conferences, seminars, presentations, exhibitions, education and curricula, awards, new research programs), and commentaries (e.g. about new policies or legislation).

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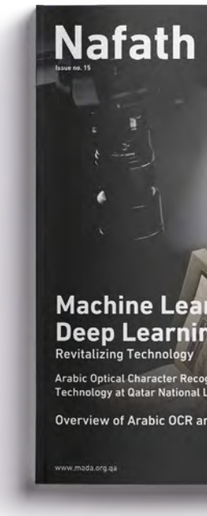

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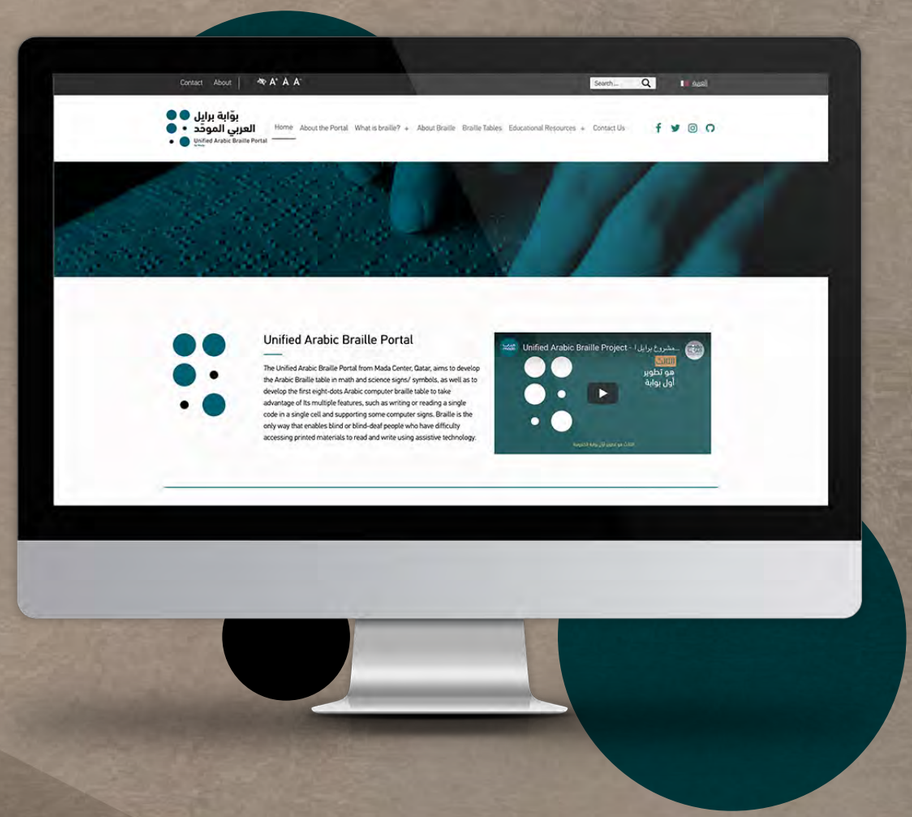

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How is an Electronic Kiosk Accessible?

Mike Park
Mada Center

Abstract
This short article introduces the accessibility of electronic kiosks. It presents the requirements that make electronic kiosks accessible, and the challenges faced by People with Disabilities (PWD) when they use them. The present article will also describe the key international best practices, standards and guidelines around making kiosks accessible.

Keywords
Electronic Kiosk, Digital accessibility, Web Content Accessibility Guidelines.

1. Electronic Kiosk Accessibility

Digital accessibility initiatives should include the accessibility of electronic Kiosk terminals which offer many different types of applications and services in the public domain (Lahiri et al., 2020). The electronic Kiosk is a device; that is a combination of hardware and software connected to the internet. The compact self-service machine is designed to sell products and/ or provide services in any location. As an example, the Bank ATM (Automated Teller Machines) is a self-serving machine that provides basic banking services. The ATM has set the international standards for accessibility of electronic kiosks and has paved the way to best practice guidelines.

To make electronic kiosks accessible, international best practices, standards, and guidelines must be fully implemented. The most popular and comprehensive guidelines are ; (The Americans with Disabilities Act, n.d.) (ADA) which references the physical accessibility aspects of the machine. (Web Content Accessibility Guidelines (WCAG) 2.1, n.d.) which references the software application that drives the hardware kiosk terminals. The (EN 301 549: European Standard for Digital Accessibility | Deque, n.d., p. 549) is the most complete to include both; physical and software accessibility guidelines (Al Jabor et al., 2021).

The objective is to ensure the electronic kiosk is accessible and usable to people with all types of disabilities including elderly people who may face similar challenges. We refer to elderly people as they develop disabilities over time as part of the natural aging process (Chalghoumi et al., 2022). The most common type of accessibility requirements for people with disabilities are visual impairment, hearing loss and physical. The methods and tools used for testing the accessibility of kiosks are a checklist based on international guidelines and using the assistive technologies built into the machines for testing the software application. Physical testing entails actual measurements of the hardware and the built environment according to ADA best practice standards and guidelines. It is essential that the entire journey should be assessed leading to the location of the physical kiosk machine. The logic is, if you make the machine itself accessible, physically getting to the actual machine should also be accessible. This primarily applies to people who are blind and are wheelchair users.

A checklist should be compiled incorporating all the best accessibility practices guideline points into a list for field testing and review. When using an accessibility checklist, all points in the list must comply with a check, otherwise it can affect some people with a specific disability such as screen reader users who in most cases are blind. Mada accessibility specialists use a strict checklist for accreditation requirements. Mada accessibility consultants do not accept partial accessibility, only full compliance according to the checklist is accepted for accreditation consideration (Al Jabor et al., 2021).

2. Some Accessibility Requirements

ATM kiosk Case study

Using Automated Teller Machine (ATM) kiosk as an example. Here are some of the most common, important accessibility requirements for people with disabilities:

2.1 How to make a kiosk accessible to a blind person?

The first parts to check in this case are: does the kiosk have a braille or tactile interface with headphone jack? Does the numeric keypad comply to standards with the raised dot feature on the "5" key so a blind person may orient themselves on the numeric keypad? After the earphone is plugged in, does the screen go blank for a blind person's privacy, and does the screen reader work properly and usable with the kiosk software application interface? For a person with low vision (limited with some vision); Are accessible fonts used? Is the text large enough with high color contrast? Is there a screen glare? This can affect people with low vision; use anti-glare film over the monitor.

Braille technology can improve the accessibility of Automated Teller Machines (ATMs) for individuals who are blind or have low vision by providing a way for them to read and interpret information displayed on the ATM (El Ghoul et al., 2020). One way this can be achieved is through the use of braille overlays or braille labels, which can be placed on top of the keypad, buttons, and display screen of the ATM. These overlays or labels allow users to read the information displayed on the ATM by running their fingers over the braille characters. Alternatively, braille displays can be integrated into the ATM itself, providing users with a dedicated braille output device that allows them to read information displayed on the ATM in braille. In addition to providing braille output, it may also be helpful to include features such as audio prompts and large print options to make the ATM more accessible for users with visual impairments. Overall, incorporating braille technology into the design of ATMs can greatly improve the accessibility and usability of these devices for individuals who are blind or have low vision (Othman & El Ghoul, 2022b).

Automatic speech recognition (ASR) technology can improve the accessibility of automatic teller machines (ATMs) in several ways (Dhouib et al., 2022). One of the main benefits is that it allows users to interact with the ATM using their voice, rather than needing to input commands through a keypad or touch screen. This can be particularly helpful for individuals with motor impairments or disabilities that make it difficult to use traditional input methods. Additionally, ASR technology can be used to provide users with audio prompts and instructions, allowing individuals with vision impairments or low vision to use the ATM more easily. In some cases, ASR technology can also be integrated with text-to-speech or other assistive technologies to provide additional support for users with cognitive or learning difficulties. By enabling users to interact with the ATM through voice commands, ASR technology can help to make ATMs more accessible and user-friendly for a wide range of individuals.

2.2 How to make a kiosk accessible to people with physical disabilities?

Accessibility for persons with physical disabilities include, primarily wheelchair users. Physical accessibility measurements from the ADA guidelines are universal and should be used to ensure compliance of the machine and the space around it. Using wheelchair users as an example, here are some ways to make the electronic kiosk experience accessible to them: ensure all curb cuts and doorways leading to the kiosk are at-least 36 inches wide and all doors open automatically or with push button along the way. Ensure there is enough space around the kiosk for wheelchair users to operate the machine. Physical forward reach for wheelchair users must be within 48 inches from the floor to reach all operable parts of the kiosk; various input controls, buttons, card readers and receipt dispensers where applicable. If the kiosk is in an enclosed space, ensure there is sufficient space for wheelchair users to turn their wheelchairs around, the measurement is a minimum of 60 inches by 60 inches. The challenge for physical accessibility is whether the built environment is accessible to begin with, if it is not, it is impossible to remediate, or with very high cost to correct. Kiosk owners should choose physical locations very carefully using the accessibility checklist as a guideline.

2.3 How to make a kiosk accessible to people with cognitive, learning and language difficulties?

For people with cognitive, learning and language difficulties, we recommend simplifying and providing help with all the tasks where possible. Use simple and multiple languages. Use accessible type face with large high color contrast text on all screens.

There are several ways to make a kiosk accessible to people with cognitive, learning and language difficulties. One approach is to design the kiosk interface with clear and simple language, with instructions and prompts that are easy to understand and follow. Additionally, the kiosk interface should be visually appealing and easy to navigate, with large buttons and simple graphics that are easy to interpret. It is also important to provide users with the option to adjust the font size and contrast, as well as to choose from multiple languages if applicable. Other options include providing audio guidance or using symbol-based navigation for individuals who may have difficulty reading or understanding written instructions. It may also be helpful to provide a physical assistive device, such as a stylus or a keyboard with large keys, to allow individuals with motor impairments to easily interact with the kiosk.

2.4 How to make a kiosk accessible to deaf people and hard of hearing?

It is recommended in this case to not provide audio only instructions and information or provide videos of any kind without subtitles. One option is to use visual displays, such as text or graphics, to convey information. This can be done through the use of on-screen captions, subtitles, or text-based menus. It is also important to ensure that the kiosk is equipped with a high-quality visual display that is easily visible to users with low vision. Additionally, it may be helpful to provide a telecommunication device for the deaf (TDD) or a text telephone (TTY) for users to communicate with the kiosk through written text.

Sign language can improve the accessibility of automatic teller machines (ATMs) for individuals who are deaf or hard of hearing by providing a way for them to communicate with the ATM and access information. One way this can be achieved is through the use of sign language interpretation software or video relay services, which allow users to communicate with the ATM through sign language. These technologies can be integrated into the ATM itself or accessed through a separate device, such as a smartphone or tablet. Additionally, it may be helpful to include features such as audio prompts and visual displays to make the ATM more accessible for users who are deaf or hard of hearing. For example, the ATM could display text or graphics on the screen to provide information and instructions, or it could provide audio prompts through a headphone jack or built-in speaker. Overall, incorporating sign language support into the design of ATMs can greatly improve the accessibility and usability of these devices for individuals who are deaf or hard of hearing.

Sign language avatars can improve the accessibility of automatic teller machines (ATMs) for individuals who are deaf or hard of hearing by providing a visual representation of sign language that can be displayed on the ATM's screen (Othman & El Ghoul, 2022a). These avatars, which are typically computer-generated, can be programmed to interpret and display sign language in real-time as a user communicates with the ATM through sign language. This can be helpful for individuals who may not be familiar with written language or who may have difficulty understanding spoken language, as it provides a more intuitive and visual method of communication. Sign language avatars can also be used to provide information and instructions to users, allowing them to easily access and understand the information displayed on the ATM. Overall, the use of sign language avatars can greatly improve the accessibility and usability of ATMs for individuals who are deaf or hard of hearing by providing a more intuitive and visual means of communication.

3. Mada center commitments

Mada Center is committed to advocating for the implementation of accessible digital kiosks in the state of Qatar to enable persons with disabilities to ICT. Mada work with strategic partners to raise awareness about the importance of accessible kiosk design and to advocate for the adoption of best practices and guidelines. Mada is engaged in collecting efforts and running advocacy campaigns to encourage the government and private businesses to adopt accessible kiosk technology. Additionally, Mada is providing training and resources to businesses and organizations to help them understand the benefits of accessible kiosk design and the steps they can take to make their kiosks more accessible. Mada is playing a key role in advocating for the implementation of accessible digital kiosks in Qatar and promoting a more inclusive society for all individuals. Moreover, through the Mada Innovation Program, Mada is showcasing the latest accessible kiosks to raise awareness about the importance of digital inclusion through their sponsors at MadaLab (Thani et al., 2019).

4. Conclusion

In conclusion, the aim of this article is to implement the accessibility best practices and standards before development and procurement of electronic kiosk devices. Once the hardware is delivered, it is impossible to change any physical aspects of the device. Electronic Kiosk owners must get this right the first time. Software applications embedded in these devices are more flexible as they can be changed and enhanced at any time to make it more accessible and usable.

One direction for designing accessible digital kiosks in the future may involve the use of artificial intelligence (AI) and machine learning algorithms to create more personalized and intuitive interfaces. For example, an AI-powered kiosk may be able to adapt to the needs of each individual user, providing assistance or accommodations based on their specific abilities and needs. This could include providing alternative forms of communication, such as sign language interpretation or text-to-speech, or adjusting the interface to meet the needs of users with vision or motor impairments. Additionally, the use of natural language processing and voice recognition technology could allow users to interact with the kiosk through spoken commands, making it easier for individuals with cognitive or language impairments to use the kiosk. In the future, it may also be possible to incorporate virtual reality or augmented reality technologies into kiosk design, allowing users to interact with the kiosk in a more immersive and interactive way.

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The Potential of using Virtual Reality for People with Disabilities

Amira Dhouib
Mada Center

Abstract
Virtual Reality (VR) technologies have become a popular area of study in recent years. These technologies were found to be effective in various useful applications to support People with Disabilities (PWD). The present article explores the current trends addressing the role and applications of VR in supporting individuals with disabilities. It presents the advantages of VR, and how they can be used as assistive technologies to minimize the effects of disabilities and increase the independency of PWD. It also explores a range of successful VR applications for PWD and an example of an assistive VR application in Mada Center to support people with disabilities.

Keywords
Virtual environment, accessibility, virtual reality, assistive technology.

1. Introduction

Over the past decades, VR has emerged as an innovative technology in different fields like healthcare area for rehabilitation and treatment (Bird et al., 2017). Since their emergence, various researchers have argued the advantages of applying VR to people with disabilities. Through such technology, PWD can benefit from accessible applications and services that increase their degree of independence and enhance technology for life. In this context, the use of VR technology for PWD has become essential for Information and Communication Technologies (ICT) developers (Kamieth et al., 2011). Over time, several initiatives have been conducted to use VR for a wide range of accessibility topics, targeting different disabilities like people with physical disabilities and those with cognitive disabilities.

In this article, we provide a summary of relevant studies investigating a range of applications of virtual reality for individuals with disabilities. We also present the role and advantages of VR technologies along with some assistive VR projects used in Mada Center.

2. Role and Advantages of VR Technology

Virtual Reality (VR) technologies describe the process of creating a synthetic and realistic Virtual Environment (VE) using computers and other technologies (Kamieth et al., 2011). Through the experience of feeling immersed in a VE, an inexpensive and efficient means of practicing social skills and daily functioning can be provided to users (Zhang et al., 2022). Another advantage of VR is the possibility to control the type, number, and order of stimulus presented in the virtual scenario for users. In this context, specialists can adapt their interventions by adapting the VE according to the specific conditions of each user (Kamieth et al., 2011). An additional important benefit of VR is the capability to create a realistic environment. Through the use of VR, users are allowed to experience a virtual space that is similar to reality although a controlled environment (Kamieth et al., 2011). At present, the most important areas of VR applications to PWD concerns teleoperation, learning, therapy, and training. Most of these applications are proposed to create a flexible and useful environment between users and specialists. This environment may enable specialists to set and customize scenarios, activities, and measurements to meet the needs of users and assess their progress. The next section describes some of the most significant VR applications for PWD.

3. VR as a Powerful Assistive Technology

Over the past few decades, VR has emerged as an effective technology in a range of health fields such as mental health therapy, and diagnosis (Zhang et al., 2022) (Jeffs, 2009). The widespread use of VR has encouraged many researchers to think about the potential of implementing VR technology to support the diagnosis and rehabilitation of different disabilities. Examples of these disabilities include physical, cognitive, and sensory disabilities (Jeffs, 2009).

3.1 Applications of VR for Individuals with Autism Spectrum Disorder (ASD)

The American psychiatric association defines ASD as a category of neurodevelopmental disorders characterized by a delay in the acquisition of several fundamental abilities and capacities (Frey, 2018). Previous existing research and experiments showed that the use of VR may be a useful technology in supporting and interfering with individuals with ASD (Almazaydeh et al., 2022). These benefits are related to different social aspects like social functioning, emotion processing, and speech. In terms of emotion recognition, for example, different studies have integrated VR with dynamic psychophysiological signals to enhance intervention approaches. In the study of (Modugumudi et al., 2013), an electrophysiological study was performed to test whether children with ASD could recognize effectively the basic emotions with, and without Collaborative Virtual Environment (CVE). The results indicated that CVE-based intervention significantly improved emotion recognition in children with ASD. One more study (Almazaydeh et al., 2022) was conducted to evaluate the effectiveness of a VR-based learning environment for children with ASD to safely practice and rehearse daily tasks related to the school environment. The main idea of the study was to simulate safely the real-life situations of autistic children in the world of outer school.

3.2 Applications of VR for Individuals with Cognitive Disabilities

Individuals with cognitive disabilities may often face challenges with attention, memory, and knowledge acquisition. The use of VR technology for individuals with cognitive disabilities represents an important research objective for VR researchers. It has been explored in the treatment of various cognitive disorders. Through VR, varied and motivating opportunities can be offered for the educational inclusion of people with moderate or severe cognitive disabilities. The purpose of virtual learning environments is to encourage and improve interactive learning (Jeffs, 2009). They also offer several opportunities for learners to have control over the learning process. Through VR, people with cognitive disabilities can carefully examine their strengths and preferred methods of learning concerning the necessary learning task and desired learning outcome. In this way, virtual environments can be customized to fit different learning styles through, for example, auditory or visual information.

3.3 Applications of VR for Individuals with Sensory Disabilities

Individuals with a sensory impairment encounter problems with one or more of their senses, including hearing, vision, and touch. VR technology can play a significant role in assisting those individuals to experience what would normally be challenging or impossible for them. It transforms information from the affected sensory modality into information that can be recognized by the undamaged senses. Through VR, it is possible to create simulations for individuals with sensory impairments like blind, deaf, and hard-of-hearing people. The main purpose of these applications is to assist them in learning how to use new tools (e.g., a walking stick, and sign language) (Teófilo et al., 2018). In the study of (Ghoul & Othman, 2022), for instance, a novel approach based on VR was proposed to assist parents and teachers in learning the basics of the Qatari sign language. In another project (Torres-Gil et al., 2010), a VR application for visually impaired individuals was developed. The main goal is to propose an auditory representation of VE, making the virtual world totally across the hearing sense.

4. The use of VR as an Assistive Technology in Mada Center

Recently, some projects have been proposed by Mada Center to support PWD using VR technologies. For instance, a new research project called “Flight Journey Simulation Lab” had launched to support parents and children with ASD during their flight journey. The research project, proposed as part of the Mada Innovation Program, implements a simulation lab based on the best aspects of VR and augmented reality to simulate the full flight journey for children with ASD in immersive environments. One of the common features of children with ASD is the inclination to recognize unknown situations and environments as a source of anxiety. It is common for them to tend to avoid novel experiences, including traveling to new destinations, and therefore an environment like an airline trip can be overwhelming. The simulation lab provides children with ASD along with their parents the opportunity to experience air travel without the anxiety of leaving on a trip. The solution will target the key aspects of flying and all the main norms related to it. Both parents of ASD children and therapists will have control over what should be shown and heard on the VE.

5. Conclusion

The use of VR technologies for people with disabilities is as diverse as the individuals it serves. Over the years, these technologies have proven their utility and benefits for people with disabilities through various research projects and experimentations. The purpose of this article is to present a summary of relevant studies investigating a range of VR applications for people with disabilities. It describes the role and advantages of VR technologies along with a successful assistive VR application used in Mada Center.

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The proposed innovation
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The proposed innovation and ICT accessibility solutions

- **Smart Lighting**
  are remotely controllable devices. Many types of smart lighting systems are connected to motion sensors which makes it simple for people with restricted mobility to turn lights on and off.

- **Smart Curtains and Blinds**
  physically operating curtains and blinds for physically disabled or visually impaired patients can be inconvenient. Smart curtains enable you to control them remotely with the help of applications through your smartphones.

- **Smart Thermostats & IR controller**
  help to control the temperature of homes remotely. They are cost-effective and energy-efficient. For patients who need to keep their rooms warm, smart thermostats are a great alternative to traditional thermostats as they are controllable from a smartphone.

- **Smart thermostats**
  can be very useful for patients suffering from cerebral palsy, as they tend to have lower body temperatures than other people. They are also beneficial for patients who are confined to wheelchairs, enabling them to easily control the temperatures of their homes without having to do so manually.

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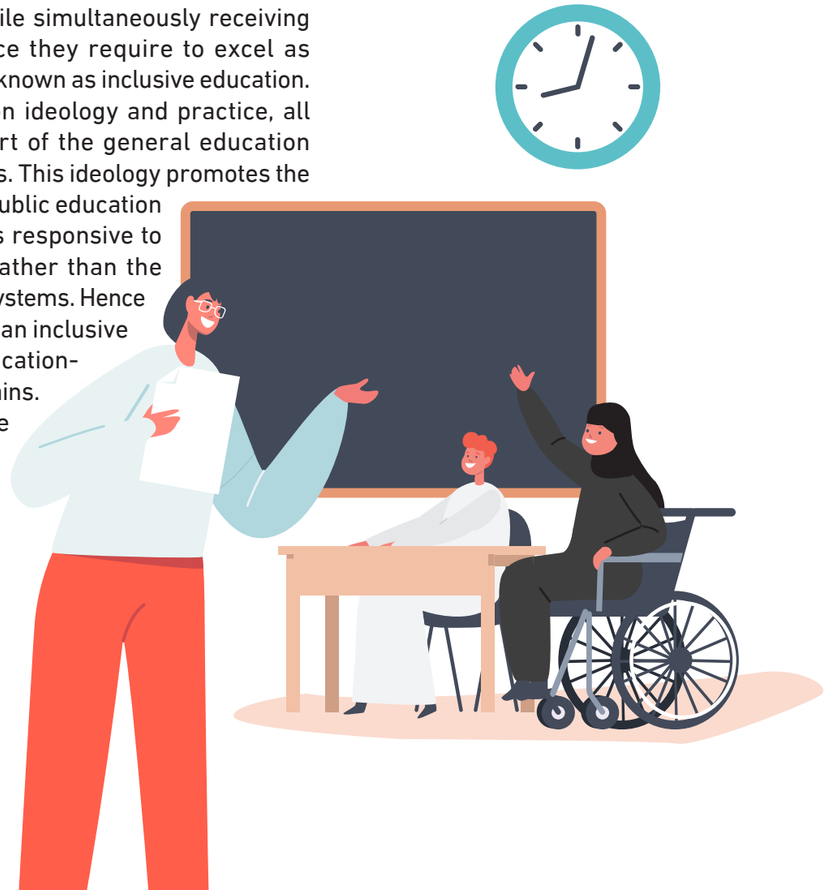
Explaining Inclusive Classrooms Concept

a review

Ahmed Elsheikh
Mada Center

Abstract Ensuring children with disabilities attend school alongside their classmates and neighbors while simultaneously receiving the extra education and assistance they require to excel as students and meet high standards is known as inclusive education. According to the inclusive education ideology and practice, all students should be considered part of the general education community, regardless of their labels. This ideology promotes the fusion of the special education and public education systems into a single system that is responsive to the requirements of all learners rather than the continued existence of two separate systems. Hence in inclusive classrooms, by adopting an inclusive pedagogy approach and use of education-assistive technology, every student gains. Inclusive classrooms improve the capacity of all children to cooperate, comprehend and appreciate various points of view, think critically, and be effective learners.

Keywords Inclusive education, accessibility, inclusive classrooms, students with disabilities.



1. Introduction

The number of disabled children globally is projected to be 240 million. Children with impairments have aspirations and plans for the future, just like any child. To develop their abilities and reach their full potential, like all children, they require access to high-quality education (UNICEF, 2022). All students, particularly those with differing talents, needs, and impairments, have the right to equitable learning experiences. According to the comprehensive definition provided by UNESCO (2009), inclusive education comprises improving the educational system's ability to reach all learners in a way that promotes fairness for all learners, particularly those with disabilities (Khribi, 2021).

The education of learners with disabilities in inclusive classrooms becomes more of a shared responsibility between the various stakeholders when all learners' capabilities or "differential abilities" are acknowledged (Ahmad, 2015a; Praisner, 2003). This requires a change in attitude; the classrooms infrastructure, pedagogy, need-based approaches, and materials for delivering education, assessing students' progress, and evaluating teachers are all readily available and accessible, as well as the much more apparent issue of acceptance (Ahmad, 2014; 2015b; Stainback & Stainback, 1984). A general education classroom that welcomes students with and without learning difficulties or disabilities is called an inclusive classroom. Inclusive classrooms are friendly and meet all children's academic, social, emotional, and communication requirements. Therefore, inclusion must be practiced successfully at all levels of education, including in the community, the school, the classroom, and the lesson (Eredics, 2022).

Teachers in inclusive classrooms support students' access to and understanding course material by implementing inclusive instructional practices, including Universal Design for Learning (UDL), lesson adjustments, and even curriculum adaptations. Students who are different in various ways and those with impairments face this difficulty regarding inclusion. Education professionals must accommodate students with varied learning styles, languages, homes, family situations, and hobbies.

2. Benefits of Inclusive Classroom

Both people with impairments and those without gain more knowledge. Over the past three decades, several studies have revealed that inclusive education benefits students with disabilities and their classmates without difficulties, with students with disabilities achieving higher accomplishments and developing better skills (Alquraini & Gut, 2012). This includes academic progress in literacy, (i.e., reading and writing, arithmetic, and social studies, both in class and on standardized exams, as well as enhanced communication, social skills, and friendships). Fewer absences and referrals for disruptive conduct are also linked to more time for students with disabilities in the regular classroom. Generally, students have a greater self-concept, like schools and their instructors, and are more driven to study and learn. These discoveries concerning attitude may have something to do with this.

Moreover, finding new instructional approaches is another aspect of the benefit of inclusion that enables classrooms to incorporate all students actively. It also entails figuring out how to foster connections, friendships, and respect for one another among all students and between students and instructors in the classroom. Also, inclusive classes offer better learning chances when students with disabilities learn in classrooms alongside other children; children of all levels are frequently more motivated to learn. Finally, inclusive classrooms can promote parental engagement in their children's education and the goings-on at their neighborhood schools.

3. Inclusive Classrooms Strategies

The key to successful inclusive education in classrooms has been recognizing and comprehending student diversity, including cognitive, academic, social, and emotional traits (Rosmiati et al., 2019). Below we are going to explore some of the strategies that are adopted around the world for creating inclusive classrooms:

- Least restrictive environment: The assumption underlying how the school and classroom function is that kids with disabilities are equally capable to students without impairments. Because of this, every student may actively participate in their classes and the wider school community. The legislation and strategies in many countries, including Qatar, requiring that people get their education in the least restrictive environment is a significant component of the movement (LRE). This indicates they are as integrated as possible with their typically developing classmates, with general education being the setting of choice for all people (Alquraini & Gut, 2012). However, this is not to argue that students never need to take time away from their usual studies; they occasionally do for specific reasons, such as speech or occupational therapy. The objective is for this to be the exception, however.

- Pedagogical and teaching strategies: to create inclusive classrooms, pedagogical training methods investigate learning obstacles such as unconscious bias, microaggressions, stereotype threat, and fixed mindsets, as well as the social identities of students and instructors. Therefore, we need competent and trained teachers who are knowledgeable and confident about educating students with disabilities and are familiar with inclusive classrooms' pedagogy, as shown in Figure 1.

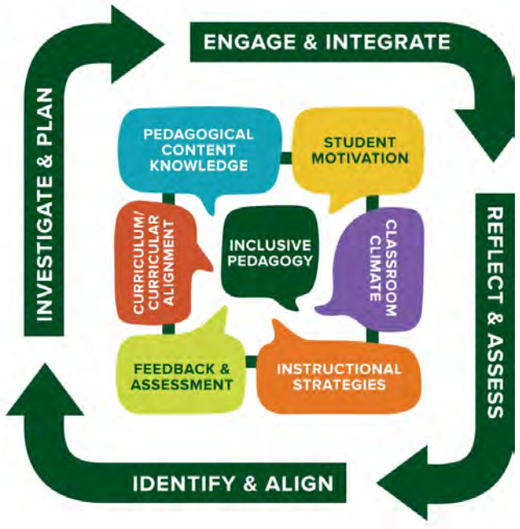


Figure 1: Inclusive Pedagogical Process (Inclusive Pedagogy 2022)

- Use A Variety of Instructional Formats: Transition from whole-group teaching to flexible groupings, such as small groups, stations or centers, and partnered learning, starting with whole-group instruction. Using technology, such as interactive whiteboards, is associated with high student involvement across the board. Flexible groups can be student-led with teacher oversight for older students but are frequently teacher-led for younger children. Peer tutoring, cooperative learning groups, pair work, and student-led presentations are all examples of peer-supported learning that may be highly successful and interesting. Diversity in the teaching methods and accessible resources is seen in Figure 2.

- Accessible Academic Curriculum: All students must be allowed to engage in learning activities with the same learning objectives. Although this will need considering the specific assistance that each student with a disability requires, general tactics include ensuring that all students hear instructions, that they really begin tasks, that they take part in large-group education, and that they exit the classroom simultaneously. Regarding the latter, it would keep people on duty with the teachings and prevent their non-disabled peers from observing them leaving or arriving during class, which can significantly highlight their differences.

- Use of Universal Design: These techniques are diverse and meet the demands of several learners. They contain a variety of mediums, such as models, pictures, objectives and manipulatives, visual organizers, oral and written replies, and technology, for both providing knowledge to students and enabling students to present learning back (Figure 3). These can also be modified to accommodate students with disabilities who use giant print and headphones, can have a peer transcribe their dictation, draw a picture in place of writing, use calculators, or have more time.

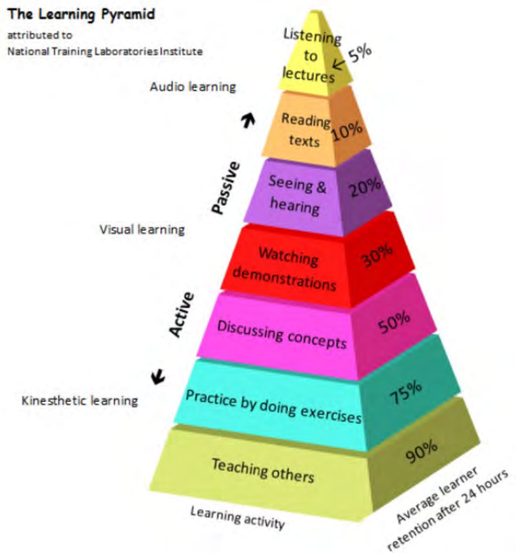


Figure 2: Learning Pyramid National Training Laboratories

Figure 3: Inclusive Classrooms Quality Approaches

Consider the effectiveness of project-based and inquiry-based learning, in which students research an experience independently or in groups.

4. Assistive Technology & Disability

The World Health Organization (WHO) developed the International Classification of Functioning, Disability and Health (ICF), which recognizes the numerous obstacles faced by children with disabilities in their educational experience and uses the term "participation" rather than "inclusion" (ICF, 2001; Simeonsson et al., 2003). It turns the conversation away from typically being very child-focused and toward environmental elements that impact and may even help children participate more fully in their daily lives (ICF, 2001; Simeonsson et al., 2003; Gal et al., 2010). Therefore, "functioning" and "disability" are understood as "multi-dimensional" terms linked to people's bodily structures and functions, their activities and regions of participation in life, and the environmental circumstances that influence these experiences, as seen in Figure 4.

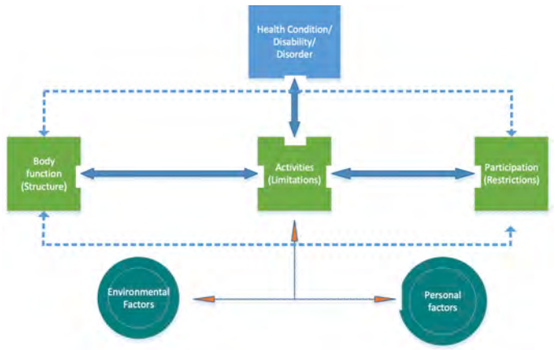


Figure 4: ICF Model of Disabilities (ICF, 2001)

Assistive technology can certainly help close the gap between non-disabled and students with disabilities by "assisting" in the practice of teaching students with physical, mental, and developmental disabilities in the same classroom (Smith et al., 2005); by removing obstacles that had been preventing them from learning on the same level as their peers, they are better able to understand the material. Assistive technology can be described as any piece of equipment or device in the market or modified that improves the lives of persons with special needs, disabilities, or impairments is considered assistive technology (AT). While assistive technology might be low-tech or completely non-tech, integrating assistive technology can make classrooms more accessible. "The real miracle of technology may be the capacity it has to remove previously insurmountable barriers faced by persons with disabilities" (Simon, 1991). Since many of these technologies serve as supplements for students with particular requirements, using educational assistive technology can make accommodating and involving learners more straightforward. For instance, text-to-speech for deaf and hard-of-hearing people is a simple approach to involve those learners in general education classes.

5. Conclusion

Numerous factors make inclusive classrooms necessary. However, they are also a part of a broad range of methods that instructors may employ to improve not just the education of all students but also the opportunity for each student to use technology (ViewSonic, 2022). Inclusive classrooms are incredibly beneficial for students who receive special education. A large number of students with special needs, disabilities, or impairments are capable of participating in regular classrooms.

While some studies demonstrate the advantages of inclusive classrooms, detractors claim that this methodology is flawed because the students who spend more time in inclusive classrooms tend to be better suited to those environments and perform better than their less-suited ones peers outside of these classrooms.

The argument made by those opposed to inclusive education is that while inclusion for all students is prioritized, people with disabilities are not recognized as unique individuals with complex needs that might not be satisfied in a big classroom. Additionally, detractors cite data that shows that peers of kids with disabilities in inclusive classes frequently suffer disadvantages (Bruno, J. R, 2019).

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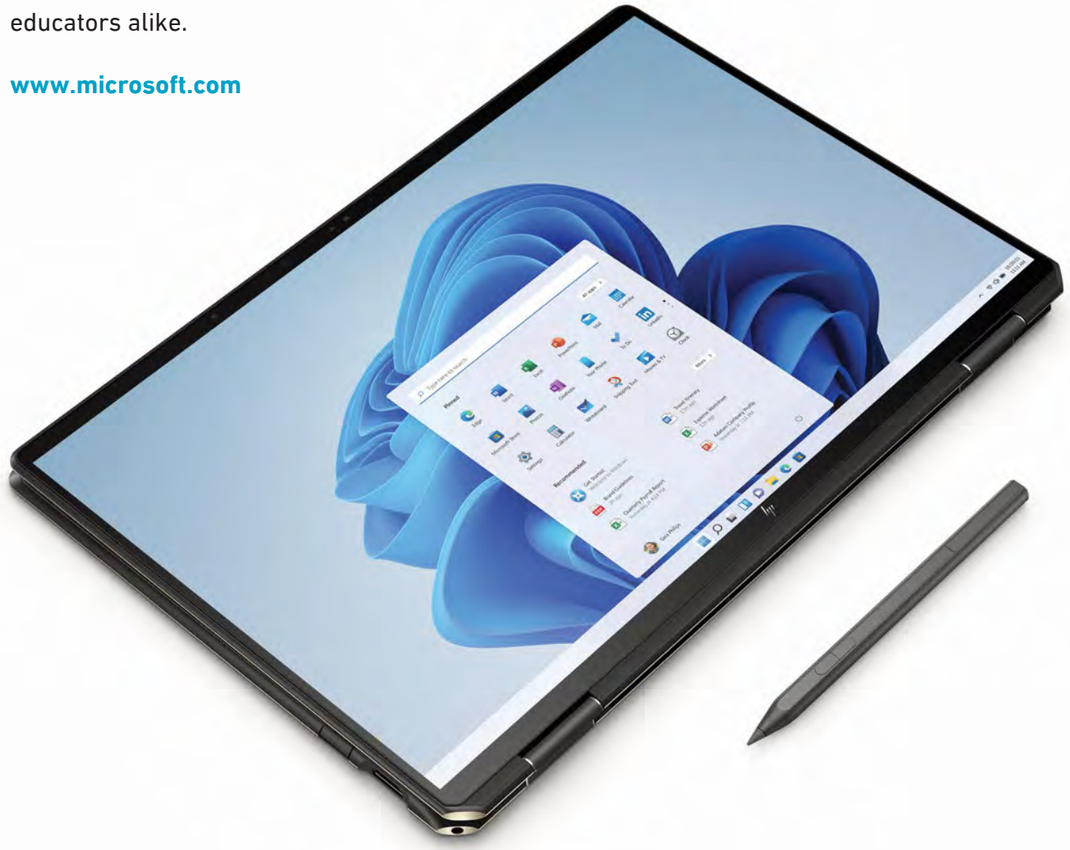
The proposed innovation

Mada inclusive classrooms Microsoft recommended the surface devices as they offer versatile input options such as voice and face recognition, allowing students to log in hands-free using Windows Hello or type with voice. The devices offer various accessibility features that are easily activated through function keys, all of which are made to meet the needs of students and educators alike.



Demystifying GPT and GPT-3

How they can support innovators to develop new digital accessibility solutions and assistive technologies?

Achraf Othman
Mada Center

Abstract
GPT (Generative Pre-trained Transformer) is a neural network-based language model, developed by OpenAI that has demonstrated impressive capabilities in generating human-like text and performing a wide range of natural language processing (NLP) tasks. GPT-3 is the latest version of the model, it is currently the largest and most advanced language model available, with 175 billion parameters. GPT and GPT-3 have the potential to support the development of digital accessibility solutions and assistive technologies, including text-to-speech synthesis, language translation, text summarization, and intelligent virtual assistants. In addition to its capabilities as a language model, GPT-3 has also been used as a tool for generating synthetic data and training other machine learning models. Some possible future directions for GPT include increased scale and performance, greater flexibility and adaptability, improved capabilities for unsupervised learning, and integration into more applications and industries.

Keywords
GPT, Generative Pre-trained Transformer, GTP-3, AI, digital accessibility, NLP.

1. Introduction

GPT, or Generative Pre-trained Transformer, is a state-of-the-art language model developed by OpenAI. It is a neural network-based model that has been trained on a large dataset of human-generated text, in order to learn the patterns and structure of language. GPT has demonstrated impressive capabilities in generating human-like text and has been used for a wide range of natural language processing (NLP) tasks, including language translation, text summarization, and question answering. As the use of digital technologies continues to grow and evolve, there is an increasing need for solutions that support accessibility and assistive technologies for individuals with disabilities. GPT has the potential to support innovators in developing new digital accessibility solutions and assistive technologies by providing a robust and flexible platform for natural language processing (Zong & Krishnamachari, 2022, p. 3).

One key aspect of GPT that makes it particularly useful for developing digital accessibility solutions is its ability to generate human-like text. This allows GPT to be used for tasks such as text-to-speech synthesis, which can be a valuable tool for individuals who are deaf or hard of hearing. GPT can also be used to generate descriptive text for images and videos, which can be useful for individuals with visual impairments. In addition to its text generation capabilities, GPT can also be used to support the development of assistive technologies that rely on natural language processing. For example, GPT could be used to build intelligent virtual assistants that can understand and respond to the needs and requests of individuals with disabilities. These assistants could be integrated into a variety of devices and platforms, such as smartphones, smart home systems, and wearable technologies.

2. History of GPT

The history of GPT (Generative Pre-trained Transformer) dates back to the early 2010s, when the field of natural language processing (NLP) was undergoing a major shift towards the use of deep learning methods. At this time, researchers at OpenAI began developing a series of language models based on the Transformer architecture, which was introduced in a paper published in 2017. The first version of GPT, GPT-1, was released in 2018 and was trained on a dataset of 8 million web pages. It was notable for its ability to generate human-like text and perform a variety of NLP tasks, including language translation and text summarization. However, it was limited in scale and was not able to perform some tasks as well as more specialized models.

In 2019, OpenAI released GPT-2, a significantly larger and more powerful version of the model with 1.5 billion parameters. GPT-2 was trained on a dataset of 8 million web pages and was able to generate coherent and coherent-sounding text. It was also able to perform a variety of NLP tasks, including question answering and language translation, and was able to outperform other models on some benchmarks.

In 2021, OpenAI released GPT-3, the latest version of the model, which has 175 billion parameters and is trained on a dataset of billions of web pages. GPT-3 has demonstrated impressive capabilities in generating human-like text and performing a wide range of NLP tasks, and has received widespread attention and acclaim in the research community **(Dale, 2021, p. 3).**

Since its release, GPT has continued to evolve and improve, with new versions being released periodically. As the field of NLP continues to advance and the demand for natural language processing capabilities grows, GPT is likely to remain a key player in the development of language models and NLP technologies.

3. Generative Pre-trained Transformer 3 (GPT-3)

GPT-3 (Generative Pre-trained Transformer 3) is the latest version of the GPT language model developed by OpenAI. It is currently the largest and most advanced language model available, with 175 billion parameters, and has been widely praised for its ability to generate coherent and coherent-sounding text. One of the key features of GPT-3 is its ability to perform a wide range of natural language processing (NLP) tasks without any additional fine-tuning. This is made possible by the model's massive scale and the fact that it has been trained on a dataset of billions of web pages. As a result, GPT-3 is able to understand and generate text that is similar in style and content to the text it has been trained on. GPT-3 has demonstrated impressive performance on a variety of NLP tasks, including language translation, text summarization, and question answering. It has also been used for tasks such as language translation and text-to-speech synthesis, and has been integrated into a number of commercial applications, including chatbots and virtual assistants.
In addition to its capabilities as a language model, GPT-3 has also been used as a tool for generating synthetic data and training other machine learning models. This has led to the development of a number of applications and tools that rely on GPT-3, including tools for data augmentation, code generation, and machine learning model fine-tuning **(Floridi & Chiriatti, 2020, p. 3).**

4. Example of applications using GPT-3

GPT-3 (Generative Pre-trained Transformer 3) has a wide range of applications. Some examples of applications that use GPT-3 include:

- **Text-to-speech synthesis**
  GPT-3 can be used to generate human-like speech from text, which can be a valuable tool for individuals who are deaf or hard of hearing. It can also be used to improve the quality of text-to-speech synthesis systems in general (Zheng et al., 2021).
- **Language translation**
  GPT-3 can be used to translate text from one language to another, which can be useful for a variety of applications, including language learning, content localization, and document translation (J. Yang et al., 2020).
- **Text summarization**
  GPT-3 can be used to automatically summarize long pieces of text, which can be useful for a variety of applications, including news aggregators, content curation, and information management (Nikolich & Puchkova, 2021).
- **Question answering**
  GPT-3 can be used to build intelligent virtual assistants that are able to understand and respond to questions and requests in natural language. These assistants can be integrated into a variety of devices and platforms, such as smartphones, smart home systems, and wearable technologies (Z. Yang et al., 2022).

- **Code generation**
  GPT-3 has been used to generate synthetic code, which can be useful for tasks such as code completion, code style correction, and code testing (Paik & Wang, 2021, p. 2) (Khan & Uddin, 2022, p. 3).
- **Data augmentation**
  GPT-3 has been used to generate synthetic data, which can be used to augment and improve the performance of machine learning models (Kumar et al., 2021).

5. GPT-3 and assistive technologies and digital accessibility

Assistive technologies are designed to support individuals with disabilities in performing tasks and activities that may otherwise be difficult or impossible. GPT-3 has the potential to be a valuable tool for the development of assistive technologies. Some ways in which GPT-3 could be used to benefit assistive technologies include:

- **Text-to-speech synthesis**
  GPT-3 can be used to generate human-like speech from text, which can be a valuable tool for individuals who are deaf or hard of hearing. It can also be used to improve the quality of text-to-speech synthesis systems in general.
- **Language translation**
  GPT-3 can be used to translate text from one language to another, which can be useful for a variety of assistive technologies, including language learning tools and translation devices.
- **Text summarization**
  GPT-3 can be used to automatically summarize long pieces of text, which can be useful for a variety of assistive technologies, including text-to-speech systems and information management tools.
- **Question answering**
  GPT-3 can be used to build intelligent virtual assistants that are able to understand and respond to questions and requests in natural language. These assistants can be integrated into a variety of devices and platforms, such as smartphones, smart home systems, and wearable technologies.
- **Descriptive text generation:**
  GPT-3 can be used to generate descriptive text for images and videos, which can be useful for assistive technologies that support individuals with visual impairments.

Overall, GPT-3 has the potential to be a valuable tool for the development of assistive technologies, as it can provide a robust and flexible platform for natural language processing. As GPT-3 continues to evolve and improve, it is likely to have even more significant and wide-reaching impacts on the development of assistive technologies in the future.

6. Conclusion and future directions

Overall, GPT is a powerful and versatile tool that has the potential to support the development of innovative digital accessibility solutions and assistive technologies. Its ability to generate human-like text and perform natural language processing tasks makes it a valuable asset for innovators working in this field. As GPT continues to advance and evolve, we can expect to see even more exciting and impactful applications of this technology in the future. Some possible future directions for GPT include:

- **Increased scale and performance:** As computational power and data availability continue to increase, it is likely that GPT will continue to get larger and more powerful, with the potential to achieve even higher levels of performance on NLP tasks.
- **Greater flexibility and adaptability** GPT is currently trained on a large dataset of human-generated text, which means that it is able to generate text that is similar in style and content to the text it has been trained on. In the future, it is possible that GPT could be adapted to generate text in a wider variety of styles and for different purposes, such as generating code or generating content for specific domains or industries.
- **Improved capabilities for unsupervised learning** GPT is currently trained using unsupervised learning, which means that it is not given explicit labels or categories to predict, but rather is fed a large amount of text and left to learn on its own. In the future, it is possible that GPT could be adapted to perform better on unsupervised learning tasks, such as generating coherent and coherent-sounding text without the need for large amounts of training data.
- **Integration into more applications and industries** GPT has already been integrated into a number of applications and industries, including chatbots, virtual assistants, and machine learning model fine-tuning. In the future, it is likely that GPT will be integrated into even more applications and industries, as the demand for natural language processing capabilities continues to grow.

Overall, the future of GPT is likely to be exciting and impactful, as this technology continues to evolve and improve.

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Wayfinding and indoor navigation for persons with visual impairment

an overview of support innovations by Mada

Abstract Technology has become an essential part of our lives, and many of our daily tasks have become entirely dependent on it. For example, routine chores such as shopping for household necessities, booking travel tickets, going to places using all different kinds of transportation, etc., are quickly done through mobile phones. And because how it is easy to use mobile phones, we may forget that others, such as the visually impaired, may face many difficulties when using them. The task of navigating through new spaces can often be challenging for people with disabilities, especially for people with visual disabilities and the elderly unless they were already acquainted with the pathways and key landmarks. This applies to both indoor and outdoor spaces. People with Disabilities (PWD) typically rely on published information, experience, other people's expertise, and/or technology to navigate through unknown outdoor and interior areas to attain safe and independent movement. Wayfinding technology has made it possible for accessible and inclusive mobility for persons with visual impairment, and independent travel is a crucial component of this.

Keywords persons with visual Impairments, digital accessibility, wayfinding technology, indoor navigation

1. Introduction

Technology is changing the way we interact with the world and access services and products. Companies are eager to use technology to reach as many clients as possible. Although many companies are missing digital accessibility, leaving a growing population out without them knowing. Wayfinding was critical for independent mobility, and it is still a complicated ability that is linked to the quality of life, mental health, and economic wealth today (Allen, 2007; Golledge, 2003). Wayfinding for those who are blind, have low vision, or are deafblind may also be known as "orientation and mobility" (O&M), "orienteering," "travel," and "visually impaired mobility." The term "wayfinding" is used to describe orientation and navigation through an environment. Travelers can know where they are and where they are going by understanding where they have already been. It is described by Wiener et al. (2010) as "moving purposefully through the environment toward a destination" while using all the cognitive, motor, and perceptual skills that the traveler has already learned.

The task of navigating through new spaces can often be challenging for people with disabilities, especially for people with visual disabilities and the elderly unless they were already acquainted with the pathways and key landmarks. This applies to both indoor and outdoor spaces. To achieve safe and independent mobility, PWDs usually depend on published information, prior experience, the knowledge of others, and/or technology to navigate through unfamiliar outdoor and indoor environments. Today, due to advances in various technologies, wayfinding, navigation systems and services are more common and accessible on all platforms for end-users.

2. Accessible Wayfinding for Visually Impaired

The use of accessible wayfinding technology can provide excellent indoor and outdoor directions for the blind and more generally for individuals with disabilities. By depending on interior and outdoor navigation solutions, public spaces such as metro stations, airports, bus stops, entertainment centres, malls, tourist attractions, and many more are now adapting to inclusive design (van der Bie et al., 2019a).

Among the many functions that smart cities offer, the safe and comfortable movement of pedestrians within the built environment is of particular importance. Safe and comfortable mobility requires that the smart city-built environment considers different mobility needs and preferences and is accessible to all pedestrians, people with mobility impairments, and people with mobility disabilities. Through this, coupled with advanced technologies such as wayfinding applications, pedestrians can get assistance in finding the best pathways to use at different locations and times. Wayfinding applications are usually comprised of two components, accessibility data, and appropriate algorithms that can utilize that data to meet the mobility needs and preferences of all individuals (Al-Khalifa & Albatati, 2022).

3. Key highlights of accessible wayfinding solutions

3.1 Seamless Indoor and Outdoor experience

The wayfinding application must be able to provide seamless routing and navigation between rooms, floors, buildings, and remote areas. A seamless indoor and outdoor experience refers to the smooth transition between the inside and outside of a building or space. This can be achieved through the use of large windows or doors that allow natural light to flow into the interior, as well as through the use of outdoor features such as patios, decks, and gardens that are incorporated into the design of the space. When the indoor and outdoor areas are connected in a cohesive way, it can create a sense of unity and continuity that enhances the overall experience of being in the space. Additionally, a seamless indoor and outdoor experience can provide a connection to nature and the outdoors, which has been shown to have numerous benefits for mental and physical health.

3.2 Indoor positioning with Bluetooth Low Energy beacons

The easiest, most cost-effective method with the smallest interference with other IT networks is to use commercial matchbox-sized BLE beacons. These beacons are usually attached with double-sided tape, to crucial locations inside buildings, to deliver location services for mobile phones.

Indoor positioning with Bluetooth Low Energy (BLE) beacons involves the use of small, low-power devices that transmit a Bluetooth signal to enable location tracking within a confined space, such as a building or shopping mall. BLE beacons can be placed strategically throughout a space to create a network that allows for the accurate tracking of a user's location in real-time. This technology is often used in conjunction with a mobile app or other software to provide information about the user's location and any nearby points of interest. For example, a shopping mall might use BLE beacons to help customers find their way to specific stores or restaurants, or a museum might use them to provide interactive exhibits or audio tours. BLE beacon-based indoor positioning systems offer a number of benefits, including high accuracy, low cost, and the ability to work with a wide range of devices.

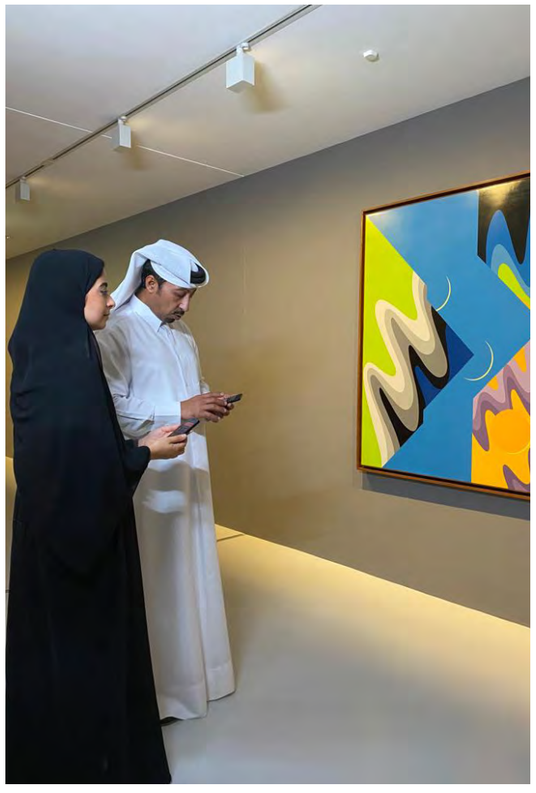
3.3 Easy Map Editor tools

It should be easy for novice users with IT skills to update digital maps to accommodate small changes and create points of interest, using simple drag-and-drop gestures. Map editor tools are important for indoor navigation systems because they allow for the creation and maintenance of accurate and up-to-date maps of the space being navigated. These tools allow users to input data about the layout and features of the space, including the location and size of rooms, corridors, and other features such as stairs, elevators, and restrooms. This information is then used to create a digital map that can be accessed by the navigation system to provide users with directions and other information.

Map editor tools are important because they allow for the creation of maps that are as accurate and detailed as possible. This is especially important in large or complex spaces, where it can be challenging to navigate without a clear map. In addition, map editor tools allow users to update and maintain the map as the space changes over time. For example, if a new store is added to a shopping mall, the map can be updated to reflect this change.

Overall, map editor tools are an essential component of indoor navigation systems because they enable the creation and maintenance of accurate and up-to-date maps that are essential for providing users with reliable navigation and other information.

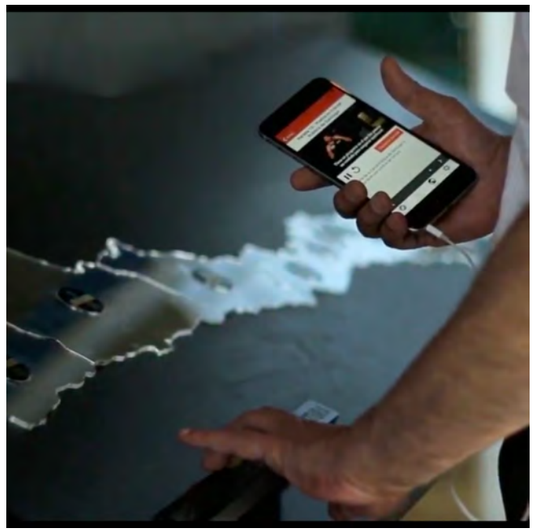
4. Lazarillo app supported by Mada Innovation Program



Out of its commitment to perform its role as an ICT Accessibility strategic enabler, and in line with its efforts to enable independent equal basis for PwDs and the elderly to take part in cultural life via ICT, Mada developed an innovative project together with the Mada strategic partners to implement Lazarillo at Mathaf, Metro Station and Galleria Mall (Thani et al., 2019). The initiative seeks to allow visually impaired people to visit a wide range of facilities, using an internal navigation system that is currently live at the locations. Such an initiative is about making art more accessible for everyone, the Lazarillo audible guide and map will help users experience independent mobility and find their way around the locations (Arditi and Tian, 2013). Lazarillo with its free mobile app helps persons with disabilities navigate the physical and digital world of companies and public institutions services, reducing anxiety and saving time for customers with audible assistance that expertly guides them through their physical space and connects them to services while being at home too. Companies Improve the experience of their customers with disabilities in an easy, simple, and secure way. Lazarillo is a tool used every day by persons with disabilities to help them navigate their world. It can be also used as a communication platform by uploading content and services to further inform customers about various services and benefits. Lazarillo is designed for people with disabilities who use smartphones with Android or IOS systems. Accessible for visually impaired users using Talkback and Narration screen readers. Persons with visual impairments receive audible directions with information to guide them through their surroundings. For persons with a physical disability, it provides information on accessible routes, showing the best way to manoeuvre

without problems.

Of the many features that smart cities offer, the safe and comfortable mobility of pedestrians within the built environment is of particular importance. Safe and comfortable mobility requires that the built environments of smart cities be accessible to all pedestrians, mobility abled and mobility impaired, given their various mobility needs and preferences. Through this, coupled with advanced technologies such as wayfinding applications, pedestrians can get assistance in finding the best pathways to use at various locations and times. Wayfinding applications are usually comprised of two components, accessibility data, and appropriate algorithms that can utilize that data to meet the mobility needs and preferences of all individuals. Accessible wayfinding technology offers great solutions to guide the blind and more generally people with disabilities indoors and outdoors. Public places like metro stations, airports, bus stations, entertainment centres, malls, tourist spots, and much more are now adapting to inclusive design by relying on indoor and outdoor wayfinding solutions.



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The Autism-Friendly Sensory Pods

An Overview

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Abstract
Sensory integration plays a key role in child development because he/she explores the environment through their senses (i.e., smell or hearing). While typically developed children gain sensory development automatically, children with Autism Spectrum Disorder (ASD) have difficulty with receiving and responding to sensory information, affecting their behavior and social skills. Sensory processing therapy has been widely used to intervene in the sensory stimuli appropriately for children with ASD. To provide an inclusive and accessible environment for autistic individuals, sensory pods have been introduced as an autism-friendly closed space to help them escape from the overstimulating environment and manage their moods to adapt to the atmosphere. Currently, research is needed to examine the empirical evidence of the best practices with the use of sensory pods.

Keywords
Autism Spectrum Disorder, Sensory Pods, autism-friendly closed space.

1. Introduction

Sensory Integration (SI) refers to the process that a human receives information from the body's sensory systems, then our brain organizes the information in order to respond appropriately (i.e., safe or not, pleasurable or painful, or to engage or to avoid) (Guardado & Sergent, 2022). As a child grows, they develop skills from their sensory demands to engage their senses to learn about the world and to interact with the environment (Ramirez, 1998). An example of sensory integration of a typically developed child, he/she would hold the egg delicately to avoid crushing it. Some children have difficulty integrating sensory information to process and respond, which is called "sensory processing disorder" or "sensory integration dysfunction" (Weitlauf et al., 2017). The sensory processing disorder can impact a child's development in motor, emotional, cognitive, physiological, and regulatory functions, thereby negatively affecting their social relationships and participation in their daily activities (Ikonen, 2001).

Children with autism spectrum disorder (ASD) are individuals who have a developmental disorder that affects their communication and social skills. ASD is a spectrum disorder, which means that it can range from mild to severe and can manifest in a variety of ways in different individuals. Children with ASD may have difficulty with social interactions and communication, such as making eye contact, initiating or maintaining conversations, or understanding social cues and body language. They may also have repetitive behaviors or limited interests, and may be sensitive to certain stimuli, such as certain noises or textures. They may also have difficulty with sensory processing, meaning that they may be oversensitive to certain stimuli or under-sensitive to others. It is important to note that every child with ASD is unique and may experience the symptoms of the disorder differently (Lahiri et al., 2020).

2. Sensory processing difficulties and children with ASD

Research shows that approximately 90% to 95% of children with ASD have sensory processing disorder, which impacts their behaviors and social skills negatively (Camarata et al., 2020). The typical signs of a sensory processing disorder from autistic include (a) being overly sensitive or under-responsive to touch, movement, sights, or sounds, (b) having a typical high or low activity level, (c) being easily distracted, (d) delays in motor, speech, or academic skills, (d) poor body awareness, (e) difficulty with unfamiliar location, toys, or new tasks, and (f) difficulty in coping with self-regulation, such as calming themselves (Ikonen, 2001). For example, a child with ASD may present severe discomfort when he/she is at a noisy shopping mall.

Sensory Integration treatment is the intervention to help children with sensory processing disorders by stimulating their sensory process. Typical sensory integration treatments used for children with ASD not only calm their anxiety but also for them to tolerate a sensory-rich environment, thereby improving their challenging behaviors or social functions and skills. Some examples of devices for sensory integration therapy are deep pressure, sensory brusher, and weighted vests. Also, therapy sessions provide activities for vestibular, proprioceptive, auditory, and tactile stimuli by utilizing play-oriented materials, such as trampolines, balls, swings or slides. Sensory integration therapy is applied in various environments such as homes, communities, schools, and clinics.

Although sensory integration treatment in ASD has been widely used as a behavioral intervention framework in schools and clinical settings, there is limited and emerging evidence on the effectiveness and efficacy of sensory integration therapy [1]. While (Schoen et al., 2019) address that an increasing number of studies have provided positive results of sensory integrating interventions, (Weitlauf et al., 2017) pointed out the empirical limitations of sensory integration therapy as the conditions of the target population, interventions, and outcomes varied. However, the literature suggests that large-scale clinical trials are needed for clearer and more consistent outcomes (Camarata et al., 2020).

3. Closed Space for Children with ASD

Children with ASD frequently receive and interpret sounds or sights differently. Many of them demonstrate a different reaction to bright-colored, large open space, constant noise, or crowds which triggers high levels of anxiety and becoming overwhelmed (Guardado & Sergent, 2022). In recent years, sensory deprivation pods have been used to help individuals with sensory processing disorders, most commonly autistic individuals, feel more relaxed and calmer. When a child with autism spectrum disorder (ASD) needs to escape the overstimulating environment, the sensory pod provides that child with a personal safe space, providing various features such as a sliding door, soft blankets, multicolored lights, and speakers. (see Figure 1).

Figure 1.
An example of a Sensory pod in a classroom

For instance, Dublin City University (DCU) in Ireland launched the Autism-friendly university initiatives and research project focused on better understanding the challenges and difficulties of their students with ASD to settle in and adapt to university life. The autism-friendly university design guide revealed the sensory stressors to prevent effective accessibility for autistic students in the university environment (Mostafa, 2021). Some examples of sensory stressors include smells from the cafeteria, red walls, projector sounds, or cluttered furniture. In order to help autistic students manage their overwhelmed feelings and destress from the campus environments, three sensory pods were placed in libraries across the university's three campuses to offer them a

designated quiet and closed space (see Figure 2). From the efforts of the Autism-friendly university initiatives, the university revealed that students with ASD handle their college life better by accessing the sensory pods to reduce sensory overloads (Ryan, 2019).
Also, the Sensory Pod was provided at Mada Center as part of the sponsorship agreement between Mada and SensoryPod to provide a full inclusive localized experience in the region as part of the Mada Innovation Program (Thani et al., 2019).

4. Integration of virtual reality in closed spaces

One of the key elements of sensory pods is the integration of VR technology. VR headsets and other VR hardware are used to create a fully immersive visual experience for the user (Othman & Mohsin, 2017). This can be combined with other sensory elements, such as sound and touch, to create a truly multisensory experience. There are several ways that VR is being used in sensory pods. For example, some pods are being used to provide relaxation and stress relief through guided meditation and visualization exercises. These exercises can be enhanced with VR technology, allowing users to visualize themselves in a peaceful, calming environment such as a beach or a forest. Other sensory pods are being used for entertainment purposes, such as virtual reality games or movies. These pods can provide an immersive gaming or movie-watching experience that takes the user out of the real world and into a virtual one. Therapy is another area where VR is being used in sensory pods. For example, VR can be used to help people with phobias or other anxiety disorders to confront their fears in a controlled, virtual environment. It can also be used to help people with physical disabilities to regain movement or strength through virtual rehabilitation exercises.

There are a number of benefits to using VR in sensory pods. One of the main benefits is the ability to create a fully immersive experience that can be customized to the needs of the user. This allows for a highly personalized experience that can be tailored to the specific goals of the user, whether it be relaxation, entertainment, or therapy. Another benefit is the ability to create virtual environments that might be difficult or impossible to experience in the real world. This can include things like simulated space travel or exploring exotic locations.

Overall, the integration of VR in sensory pods is a promising development that is helping to enhance the sensory experience in a variety of settings. From relaxation and stress relief to entertainment and therapy, VR is being used to create immersive and personalized sensory experiences that can have a positive impact on people's lives.

5. PECS in sensory pods

Integrating pictograms, such as those used in the Picture Exchange Communication System (PECS), into sensory pods can be a helpful way to enhance the user experience for individuals with communication difficulties, such as those with autism spectrum disorder (ASD) (Othman & Al-Sinani, 2021). PECS is a communication system that uses visual symbols or pictures to help individuals express their needs and wants. By incorporating PECS into sensory pods, individuals with ASD or other communication challenges can more easily interact with and control their sensory environment. For example, a sensory pod could have a display with a series of pictograms representing different sensory experiences, such as music, lights, or smells, and the user could select the desired sensory experience by pointing to the corresponding pictogram. This can help make the sensory experience more interactive and engaging and can also provide a useful tool for individuals with ASD to communicate their preferences and needs.

Figure 2.
Sensory Pod in
Dublin City University

Figure 3.
Sensory Pod at Mada Center

6. Conclusion

Most autistic children have some kind of sensory processing issues. The architectural designs (i.e., the color of walls) and environments (i.e., noisy crowds) can be barriers for them to be fully included in the school or community. However, it is not an easy solution to modify or redesign the existing buildings and the environment. Instead, the sensory pod can be an alternative option, which is an affordable, calming and safe space to be easily installed in a place such as schools, universities, hospitals, libraries, and airports. Yet, there is currently no empirical evidence of the effectiveness of the sensory pod as a sensory therapeutic solution. In order to develop best practices with the use of sensory pods, experimental studies are needed to evaluate the effects for children with ASD and sensory integration intervention in various settings.

One potential future direction for research on sensory pods could be to focus on improving the overall user experience by enhancing the realism and immersion of the sensory stimuli provided by the pods. This could involve using more advanced technologies, such as virtual reality or haptic feedback, to create a more convincing and lifelike sensory environment for the user. Another area of research could be to explore the therapeutic potential of sensory pods, by studying the effects of different sensory stimuli on various mental health conditions such as anxiety, stress, and depression. Additionally, research could focus on developing sensory pods that are more portable and accessible, potentially using mobile or wearable technology, to allow for more convenient and widespread use in various settings.

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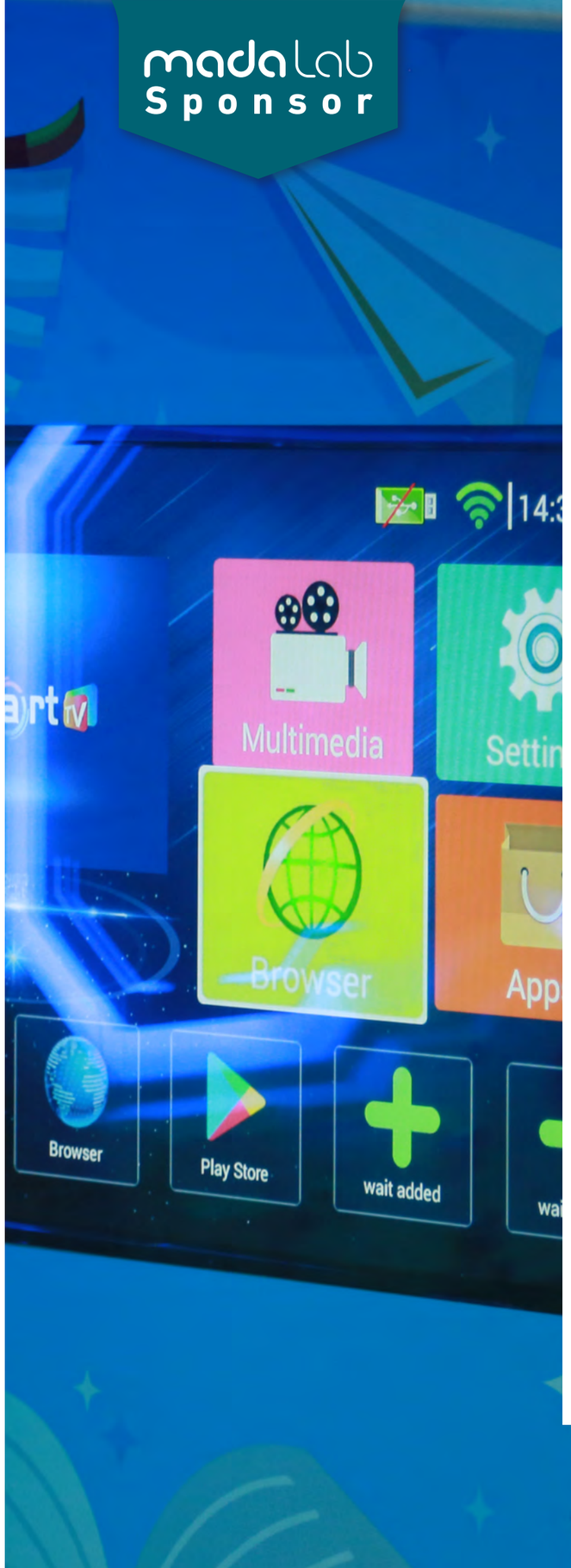

The Sensory Pod
a safe space for you

Sensory Souk has been brought to market by Murray's Medical Equipment, Ireland. Designed to calm, regulate, and relax for children and adults. It used in educational, healthcare, public and residential settings.

The proposed innovation and ICT accessibility solutions

The Sensory Pod is proposed to provide a calming space for children with autism as an alternative to more expensive Sensory Rooms. Its compact size works in sites without free rooms as it can be situated in a corridor or under a stairwell. Measuring 8' long x 4' deep. Supplied with changeable LED mood lighting, speakers for calming music and a 32" screen to mirror SEND teachers tablet/computer.

The door slides over to provide a relaxing cocoon for the child. It can be left open and there is a viewing window for child protection.

www.murrays.ie/the-sensory-pod

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SENSORY SOUK
Supporting Development and Learning

Sensory Souk is the first company based in Qatar that offers professional therapy products, developmental toys, and specialist educational and therapy. It provides tools to support kids' learning and development and their parents, educators, and therapy professionals.

The proposed ICT accessibility solutions

- **Reading Assistant Plus TM**
  is an innovative online guided reading tool and component of the Fast ForWord program that provides intensive reading practice.
- **Learn Autism**
  As a leading digital autism resource, Learn Autism provides the skills and confidence parents, educators and health care professionals need to help autistic individuals thrive.
- **Floreo**
  Virtual Reality (VR) lessons offer immersive experiences in simulated real-world settings that are engaging, accessible, and motivating to address social, communication, daily living, safety, and emotional regulation skills.

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SuperWire

SuperWire assistive is an educational consultancy that serves people with special needs in Qatar. SuperWire works with the leading assistive technology and special educational needs brands to bring equal accessibility in the education and workplace for their clients.

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Consort World

Consort World offers a complete range of Assistive Technology (AT) products and solutions for special needs. Since its start in 2006, Consort World has grown to become renowned in the field of AT and Eye Tracking. It represents more than 30 international companies serving the demand of the Arab-speaking world & throughout the MENA region. Consort World strongly believes in making a difference by helping people with various impairments live a more independent life. It provides educational and technical solutions that assist children and adults alike to lead a productive life.

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