Nafath

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Artificial Intelligence & Accessibility

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Mada Center

Creating accessible sports broadcasts for the visually and hearing impaired

Mada Center

In the world today, there are 1 billion people with disabilities – about 15 percent of the world's population – and their proportion and number are increasing as humanity lives longer. In developing countries, a disproportionately high number of people with disabilities are present. Television, radio, and the Internet are an integral part of society's fabric, and without them we cannot imagine a "full life". Having a disability may deny normal media access, which may limit life choices, personal independence, personal fulfillment, sense of identity, enjoyment, and social cohesion.

In shaping our society, television plays an important role. It is a primary source of news, entertainment, and sports programming, and plays a critical role in making us aware of the vast array of ideas and perspectives that make up our society's rich fabric. As a result, ensuring that everyone can take advantage of what TV has to offer is important.

For the visually impaired:

Fans of sports love watching a good game. But if you're visually impaired, following the action on the TV screen is much harder.

The main way to make sports broadcasts accessible to people with visual impairments is to use "audio descriptions" in details. These are audio passages that explain what's going on in the picture visually. Audio descriptions can also be useful for those with aging disabilities to bring the things they need to notice in the picture to their attention in order to fully follow the broadcast.

For the hearing impaired:

The main way to make sports broadcasts accessible for people with hearing impairments is by providing subtitles. Hearing impaired people prefer, broadcast, stream or download television programs that include optional subtitles in the intended audience's language. Digital TV systems enabled the subtitles to be cut into the picture through a simple remote-control procedure. The secondary way to make broadcasts accessible for television viewing is by having a "in-screen" signer providing a sign language version of the audio.

Close captioning allows people who are deaf or hard of hearing to benefit from television. It has the added advantages of being useful to people learning to read or speak a second language and enabling people to enjoy television programming in restaurants, gyms and other places where the sound is often turned off.

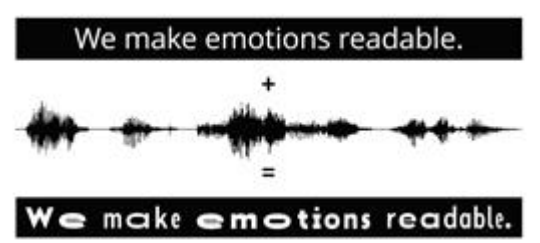
Closed captioning makes broadcasts accessible by translating audio into text captions displayed on the screen for people who are deaf or hard of hearing. Also, the captions identify who is speaking and the emotions they feel and include icons for elements like music.

WaveFont – Visualization of information and emotions from the voice in captions

Tim Schlippe

Innovation

While traditional captions only reflect what is spoken in an utterance, the innovative technology WaveFont additionally visualizes information of **how** it is spoken. WaveFont has been invented by Prof. Dr. Matthias Wölfel, Angelo Stitz and Dr. Tim Schlippe in an art research project. Due to the very positive feedback, Dr. Tim Schlippe decided to make it available for a broader audience by commercializing and developing WaveFont further as the founder and CEO of Silicon Surfer. Particularly, hearing-impaired people receive for the first time information and emotions from the voice (stresses, pauses, length) which they were excluded from. The WaveFont visualization is very intuitive: For example, when someone speaks louder, the font gets bolder, when some speaks slower, it gets wider:



WaveFont generation.

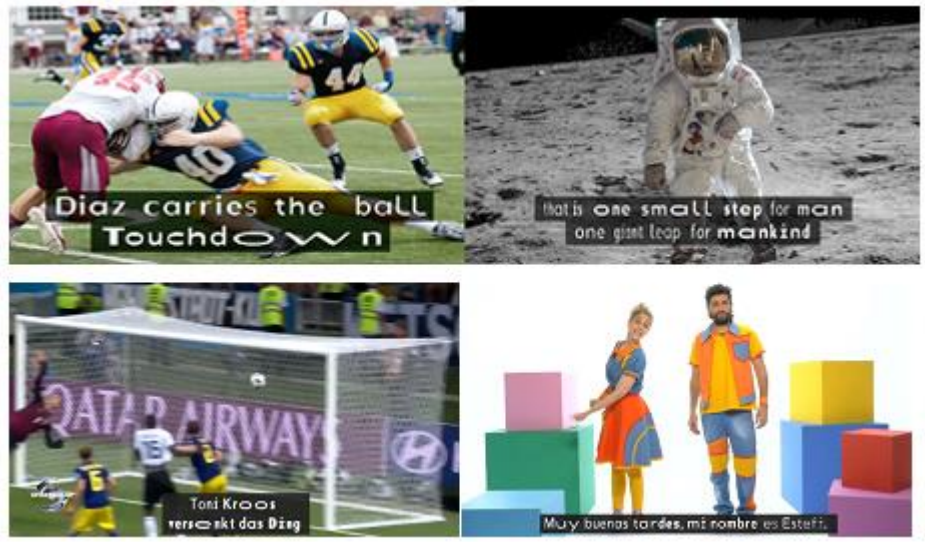
After a short time information and emotions are much better transported than with conventional captions supporting accessibility, integration and inclusion.

Service

In order to enable hearing-impaired people to receive the voice characteristics, Silicon Surfer offers a service to automatically produce WaveFont captions. To generate WaveFont captions, Silicon Surfer processes traditional subtitle files or the transcriptions together with the sound file.

Applications

WaveFont is universally applicable for different genres and can be ported to new languages and writing systems. So far it is available in English, Spanish and German and first actions have been taken to port it to Arabic.



WaveFont captions.

Potential in the world

A huge number of people would benefit from additional information in captions: According to the World Health Organization, 466 million people worldwide have disabling hearing loss. This is 5% of world's population. Due to the demographic change it is estimated that by 2050, over 900 million people will have hearing impairments. However, this new technology and visualization is not only interesting for hearing impaired people: For example, there are 244 million migrants living in a country other than where they were born. Many of them need to learn a new language. WaveFont captions would help them since Silicon Surfer's analyses have demonstrated that the WaveFont visualization is much more intuitive than phonetic transcriptions such as the International Phonetic Alphabet. According to Amazon Prime Video, 30% of the users watch with captions but only 20% of those are hearing impaired. But by far the largest number of people who would benefit from WaveFont captions are on social media: 85% of the active Facebook users watch videos without sound. These are 2 billion people. WaveFont supports the UN sustainable development goals 3 (good health and well-being) and 4 (quality education) of the agenda 2030.

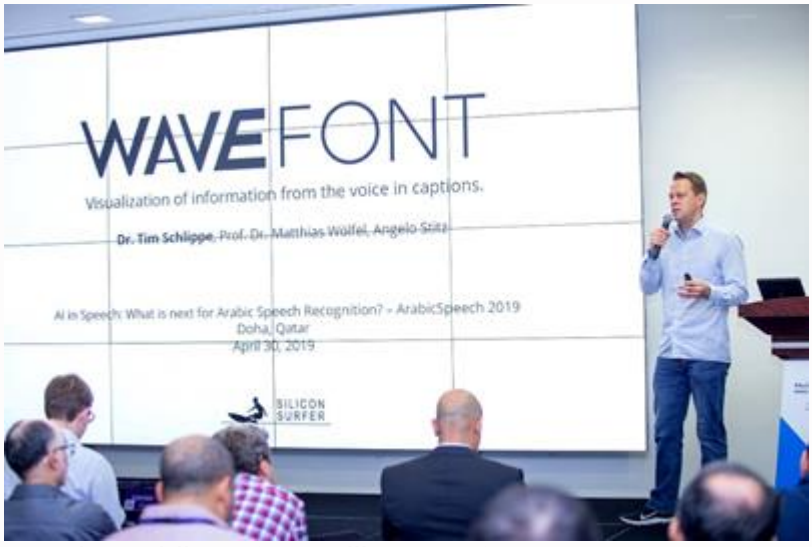
Potential in Qatar

5.2% of the population in Qatar suffers from hearing loss (Girotto et al., 2014). WaveFont can improve their TV, video and cinema experience since they receive information they were excluded from and are able to imagine better how their favorite actors speak.

A very interesting application for the WaveFont technology in Qatar is also during the FIFA World Cup. WaveFont is particularly suitable for visualizing emotional scenes. Such emotional scenes can be found in the sportscasts of the matches, but also in the commercials and explanatory videos about the event. Further application areas

are information systems, display boards, and media libraries with videos. With WaveFont, Qatar can be a pioneer and offer a much more accessible and inclusive event.

At the conference ArabicSpeech 2019 at Qatar Computing Research Institute, Dr. Tim Schlippe, CEO of Silicon Surfer, presented the WaveFont technology and his first steps to port it to Arabic.



Dr. Tim Schlippe from Silicon Surfer at QCRI.

Next steps

To make WaveFont available in Qatar, Silicon Surfer plans to participate in Mada's Innovation Program. This includes to port the technology to Arabic, to analyze its impact and benefit in Qatar, to evaluate application areas, especially for the FIFA World Cup 2022, to integrate and use it in information systems, display boards, media libraries with videos and to port it to further Arabic dialects and languages.

Self Driving Cars: An Exciting Proposition for People with Disabilities

Mada Center

Self-driving cars have almost become a staple of everyday conversation. They are set to be one of the significant innovations of the 21st century, once they become broadly available to the public. Self-driving cars present radically new ways to consider transportation and accessibility. These are cars in which human drivers are never more required to operate the car securely. Also known as autonomous or driver-less cars, these are combined solution integrated with sensors and software to control, manage, and drive the vehicle.

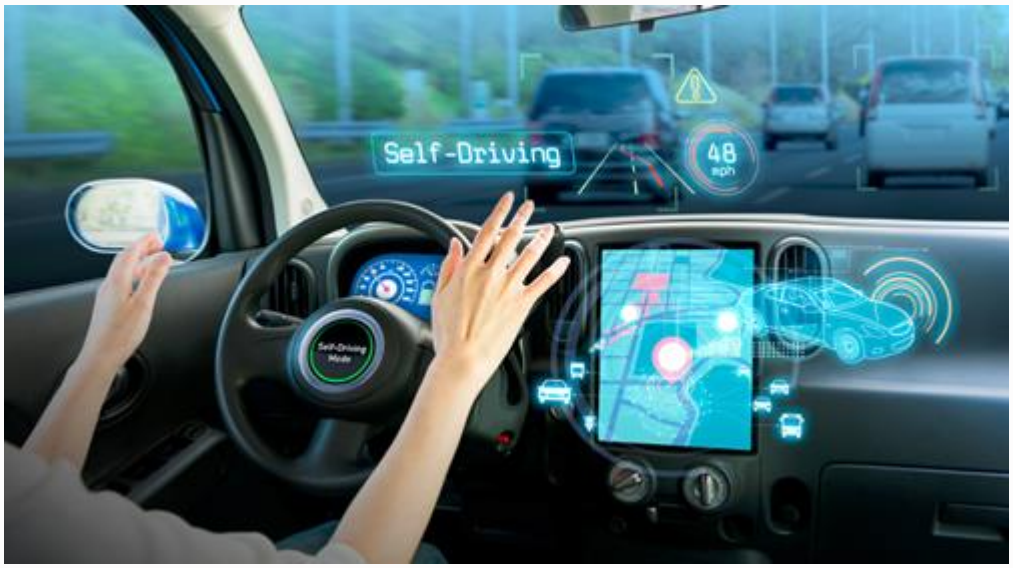


Figure 1: A dashboard display of a self-driving car

Currently, there are no authorized operating, fully autonomous vehicles in the world and partially autonomous cars and trucks with varying amounts of self-automation, from conventional cars with brake and lane assistance to highly-independent, self-driving prototypes. Various types of self-driving technologies have been developed by Google, Uber, Tesla, Nissan, and other major automakers, researchers and technology corporates. While design details differ from each manufacturer, most self-driving systems create and support an internal map of their surroundings, based on a wide array of sensors, like radar.

It is well-documented that transportation remains a significant obstacle for people with disabilities, whether it be public transportation, para transit or private transportation. This has been a long-standing challenge despite many government reforms and legislative advances. Mobility is a serious factor that is hindering many people with various functional limitations and elderly to work and being trapped at home.

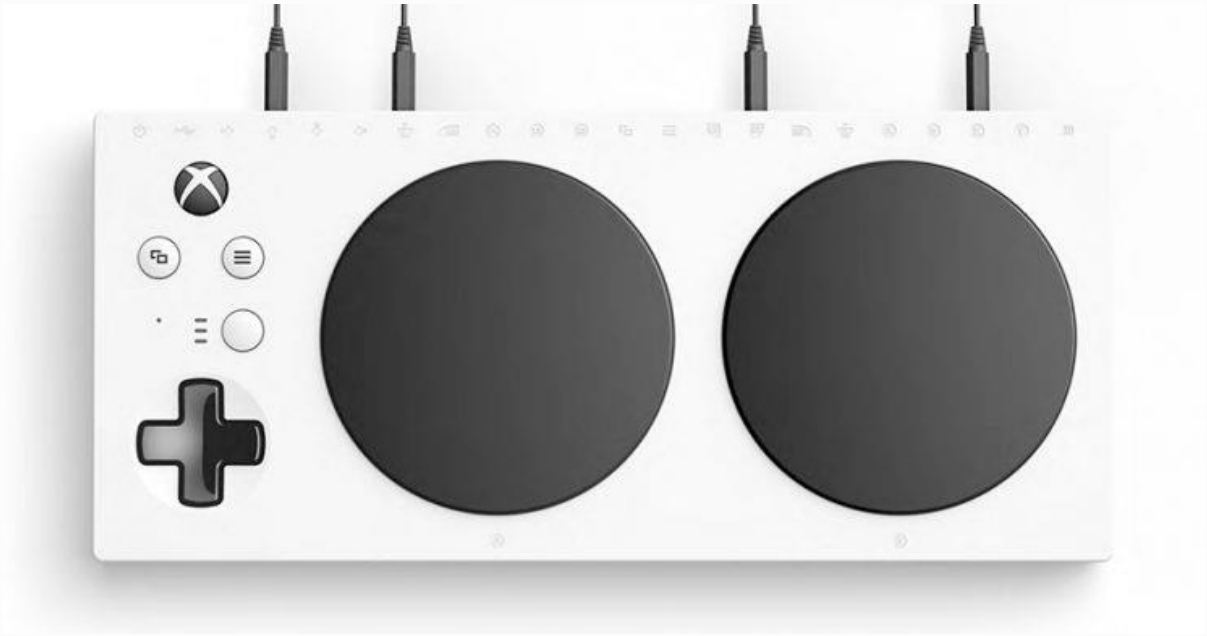
Self-driving cars could revolutionize how people with functional limitation get around their neighborhoods and even commute far from home. Autonomous vehicle technology on its own is not sufficient to assist people with functional limitation to become more independent, but simultaneous advances in machine learning and artificial intelligence can allow these cars to understand delivered instructions, examine nearby surroundings and relate with people. Combining these technologies could provide autonomous mobility with practical assistance that is specialized for a user's abilities and needs. Elderly and physically disabled people are the most to adopt self-driving cars as it will increase their independence and access to work or other locations. Self-driving cars may also be helpful for people with mental health issues; for example, some people with anxiety disorders or depression may have days when driving is only too much for them. This will help people get out of the house to work or for leisure, which can help the management of or recovery from mental health disorders.

There are many wrinkles to be ironed out before we can rely entirely upon this technology, but the general excitement (particularly among the disabled community) is palpable. Accessibility, Safety, Insurance and legislative laws are the major factors which need to be resolved and secured before the autonomous cars can be seen on mainstream use. Once these issues are resolved, it will not be long to see such cars on daily use. They have the potential to transform neighborhoods and people' lives including people with functional limitations and often both literally and figuratively left behind. With precise planning and study, autonomous vehicles can accommodate even more people with significantly enhanced independence and confidence in their lives.

Accessible Gaming – Xbox Adaptive Controller

Mada Center

Game accessibility refers to the accessibility of video games in the field of human-computer interaction. More broadly, game accessibility refers to all gaming products, including tabletop RPGs and board games being accessible.



Accessibility to video games is considered a computer accessibility sub-field that studies how to make software and computers accessible to users with different types of impairments. With an increasing number of people interested in playing video games and video games being increasingly used for purposes other than entertainment, such as education, rehabilitation or health, game accessibility has become an emerging field of research, especially as disabled players could benefit most from the opportunities offered by video games.

When technology empowers each of us, it empowers all of us. Imagine you love video games, but you can't play them easily because your body works differently than others. Maybe you are deaf, have partial sight, limited mobility, or perhaps quadriplegia. But there is no prerequisite for joy, no physical requirements to have fun. The main thing standing in your way is the interface or the design of the game itself.

As the industry expands accessibility, it creates newfound confidence for those with different disabilities. The video game industry has been offering new equipment for people with disabilities in recent years, with Microsoft's Xbox Adapter Controller just one example of new hardware options. Game makers, too, are adding features to

make their products more accessible to those with disabilities. In the latest version of Electronic Arts' blockbuster Madden football franchise, for instance, audio cues and vibration patterns on controllers have been included for the first time to help people who are blind play the game.

The Xbox Adaptive Controller is a Microsoft video game controller designed for Windows PCs and the Video Game Console of Xbox One. The controller was designed to make the input of users for video games more accessible for people with disabilities.

the Xbox Adaptive Controller is a controller unit lined with 3.5mm sockets that supports a range of switches and buttons, allowing users who cannot use a standard Xbox controller to effectively build a custom setup for their unique personal needs.

Designed primarily to meet the needs of gamers with limited mobility, the Xbox Adaptive Controller is a unified hub for devices that helps make gaming more accessible.

Use the Xbox Accessories app on Xbox One or Windows 10 to customize your experience further with the button remapping and profiles. Create multiple controller profiles in the app and switch instantly to the built-in Profile button between three of them.

In general, modern video game control schemes have become increasingly complex each console generation, with a myriad of functions, buttons, triggers, touch pads, and analog sticks all crammed into a small handheld gamepad.

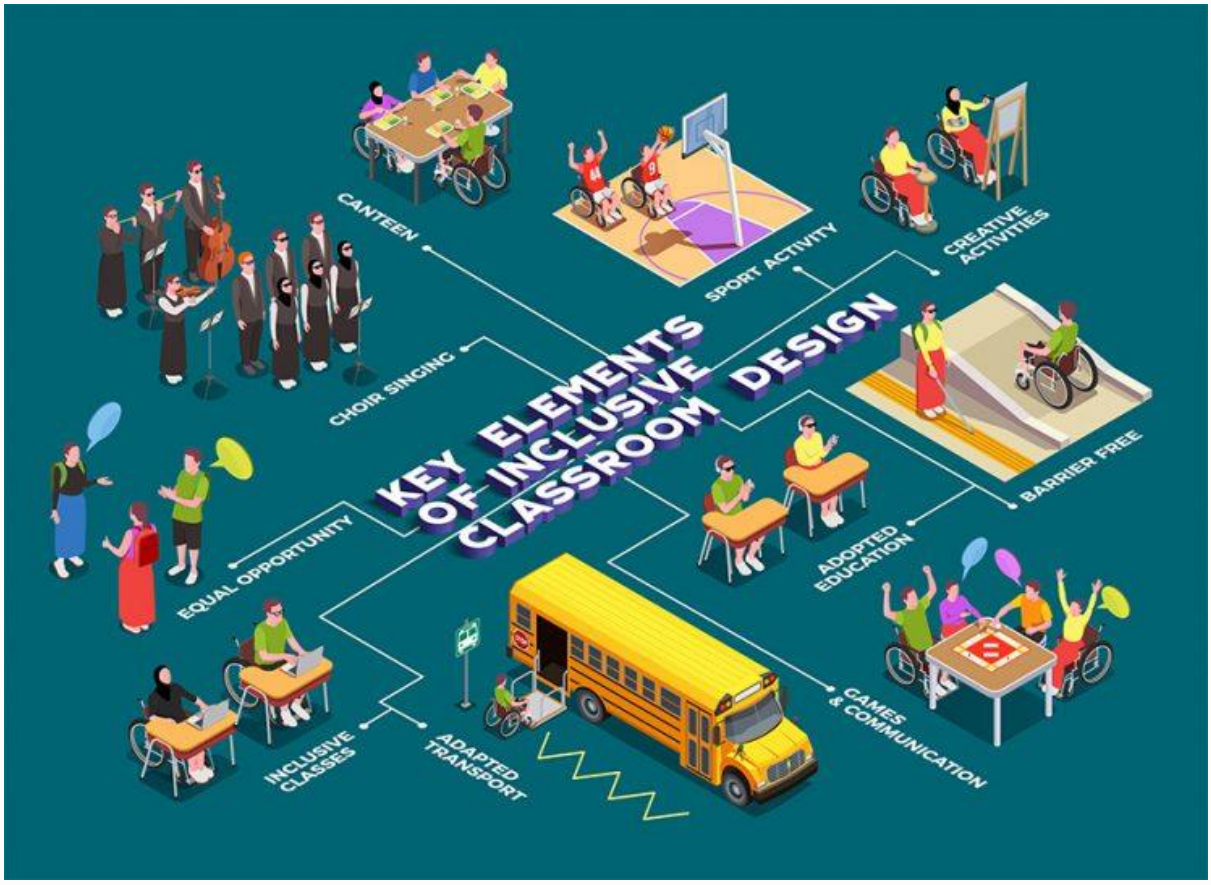
With the technology available to us today, there's no reason why we can't all share the love of this creative medium.

Key Elements of Inclusive Classroom Design

Mada Center

Our understanding of how people learn and how we can teach to better support learning and acquisition of skills has developed significantly in recent times. Our appreciation of the value of creative thinking and self-directed activity in creating innovative and motivated students and employees for the future has also grown and steered education services and development.

Inclusive design for our schools today encompasses physical design of education settings, curriculum design and delivery, use of technology and trained motivated staff. Moreover, it must recognize and embrace diversity and uniqueness and enable every person to engage and develop their skills to achieve their optimum role in society.



Physical spaces need to be accessible to all with flexible furniture to facilitate a variety of learning sessions, from individual to group or practical sessions. Spaces should be clear and uncluttered with good lighting and minimal sudden loud noises.

A good understanding of Universal Design for Learning is required. This is an approach to the curriculum that is accessible to all and engages the learner, this means it supports students to express themselves and learn in their own individual way and works with students of all strengths and needs. It is particularly important for students with disability to enable them to access the same content as other students whether they have any physical limitations, visual or hearing impairments, communication or learning difficulties. Learning resources must be presented in various accessible formats.

New technologies allow teachers to communicate seamlessly with individuals or groups of students. Information on goals of learning sessions, assignments, extra resources and grades can be accessed by the click of a button and stored for easy access by all. Assignments can be completed in a variety of ways, not just the traditional essay or worksheet, for instance, students may be able to create a presentation, a podcast or a video to show what they know. They may even be allowed to draw a comic strip or incorporate a virtual model.

Likewise lesson plans can incorporate written, audio or visual information and use interactive virtual reality to bring learning alive for all students. This provides equal access and is highly motivating.

Staff need to be adequately trained in new technologies and their use. The pace of development can at times be difficult to keep up with and daunting for some educators. Students however seem able and willing to jump in.

Educators need to work with specialist in the fields of Technology and Assistive Technology to best understand how to implement these in the classroom. They should also work with people and organizations who possess the perspective and knowledge required to ensure this design is truly accessible to all, i.e. experts in the field of disability, and people with disabilities, their parents and teachers.

Children with specific needs should have clear plans in place with required resources clearly documented for all staff to be aware of and understand.

We have a great opportunity now to design and utilize inclusive connected classrooms that engage and motivate educators and students alike through the use of new technologies to support development of creative and innovative students and adults.

We must allow that this requires a complex system that needs to have an easy to use intuitive interface for users and must adapt as needs demand.

INDUSTRY 4.0 – IOT FOR DISABILITY

Mada Center

Mada Center works with its various partners and innovators to develop an ecosystem that is supportive of innovating technological solutions that promote digital access for PWDs and the elderly. That trend is compatible with the goals of Industry 4.0, that is generally attributed to as the fourth industrial revolution and is set to alter the life, work and usability fundamentally, and its implementation will mean radically changing the existing tools, information framework and business processes of the entire operation.

Industry 4.0 sees the foundation of disruptive cutting-edge technologies, the current courses of automation and data transfer that is starting to occur in manufacturing technologies. This covers Cyber-physical System, Internet of Things (IoT), Data Analysis, Cloud computing systems, Cognitive Computing, 3D printing and Artificial Intelligence (AI).

The Internet of Things (IoT) was always known for its unique properties, the enabling of advanced services by interconnecting both physical and virtual things based on existing and evolving interoperable information and communication technologies. However, there is no denying that the importance of technical underpinnings of IoT is that it is less about the technical and more about how it impacts the life of the users regardless of their ability level.

As IoT continues to grow in its consumer acceptance, for people with disabilities IoT offers far more than its parts. Much of the potential power of IoT for people with disabilities is in its always-on, real-time connectivity, which can ensure that people

can quickly and easily obtain assistance and support. Although the potential benefits of connected things are limitless, the primary application IOT for people with functional limitations are:

– Mobility: The development of the self-driving car, with thousands of different sensors reporting millions of times only on a short journey. It will offer those with disabilities an incredible level of mobility like never before.

– Home automation: Wireless Home Automation system using IoT creates a system that applies computers or mobile devices to establish a vital connection with the home functions and features automatically through internet from anywhere around the world. Such automated homes give access to the elderly and people with functional limitations to control the home units by voice command or on one touch at ease.

– Monitoring: The use of IoT devices to monitor hundreds of people in the healthcare sector. The idea of this is to accumulate millions of different data points that may hold a hint to identifying and resolving the illness. Such mode of data collection can be used not only for those suffering from diseases with potential cures but for helping people with disability via sensors in prosthetics that could identify the means that people are using them and develop innovative models which will cater them to the best. It could also distinguish how people move about their home and which factors could be altered to make it more convenient.

– Communication: IoT encourages communication between devices. Because of this, the physical devices can stay connected and hence the total transparency is available with lesser inefficiencies and more exceptional quality.

IoT devices and services enable people with disabilities to engage more fully and autonomously in daily life by overcoming some needs for human agents or accommodations. In addition to the potential advantages of IoT devices and assistance for people with functional limitations, unique privacy risks and objections are raised by the collection, use, and distribution of user data.

9 Ways to Make a Waiting Area Accessible

Mada Center

1. **General Information Provision**
   Technologies that help People with Disabilities (PWD) locate, identify, and navigate the space must be integrated within arrival and waiting areas as part of providing the general information. This can be done through solutions like digital kiosks, virtual assistants, robots, beacons and QR codes.

2. **Shift & Specific Information Management**
   Resources, human or automated must be implemented effectively, within a service setting to display information and efficiently process service related tasks to ensure proficient customer flow management. Essentially, this means managing queues through technologies like digital queuing & ticketing systems, and assigning of service staff trained to accommodate PWD customers as they arrive.

3. **Complementary Elements**
   Complementary ICT elements that can contribute to making the experience of PWD as inclusive and rewarding as possible must be taken into account. This can include Wi-Fi zones equipped with accessible devices for web consultation, as well as accessible automatic teller machines and other services.

4. **Equitable Use**
   The design of digital resources that may be accessed from the waiting area must be useful and marketable to people with diverse abilities. For example, a website that is designed to be accessible to everyone, including people who are blind and use screen reader technology, employs this principle.

5. **Usage Flexibility**
   The design should accommodate a wide range of individual preferences based on the users' abilities. An example is a museum that allows visitors to choose to read or listen to the description of the contents of a display case.

6. **Perceptible information**
   Information must be communicated effectively to the user, regardless of ambient conditions or the user's sensory abilities. An example of this principle is captioned television programming projected in a noisy coffee shop.

7. **Low Physical Effort**
   The design of the waiting area space and its facilities must be implemented for efficient and comfortable use causing minimum level of fatigue to PWD users. For instance, relevant kiosk must be integrated with doors that open automatically for people with a wide variety of physical characteristics demonstrate the application of this principle.

8. **Size and Space for Approach and Use**
   Appropriate size and space must be provided for approach, reach, manipulation, and use of customer services throughout the waiting area (including entry and exit points) regardless of the user's body size, posture, or mobility. For example the waiting area must be adequate spaces and pathways to allow wheelchair users to navigate and use the area facilities effectively.

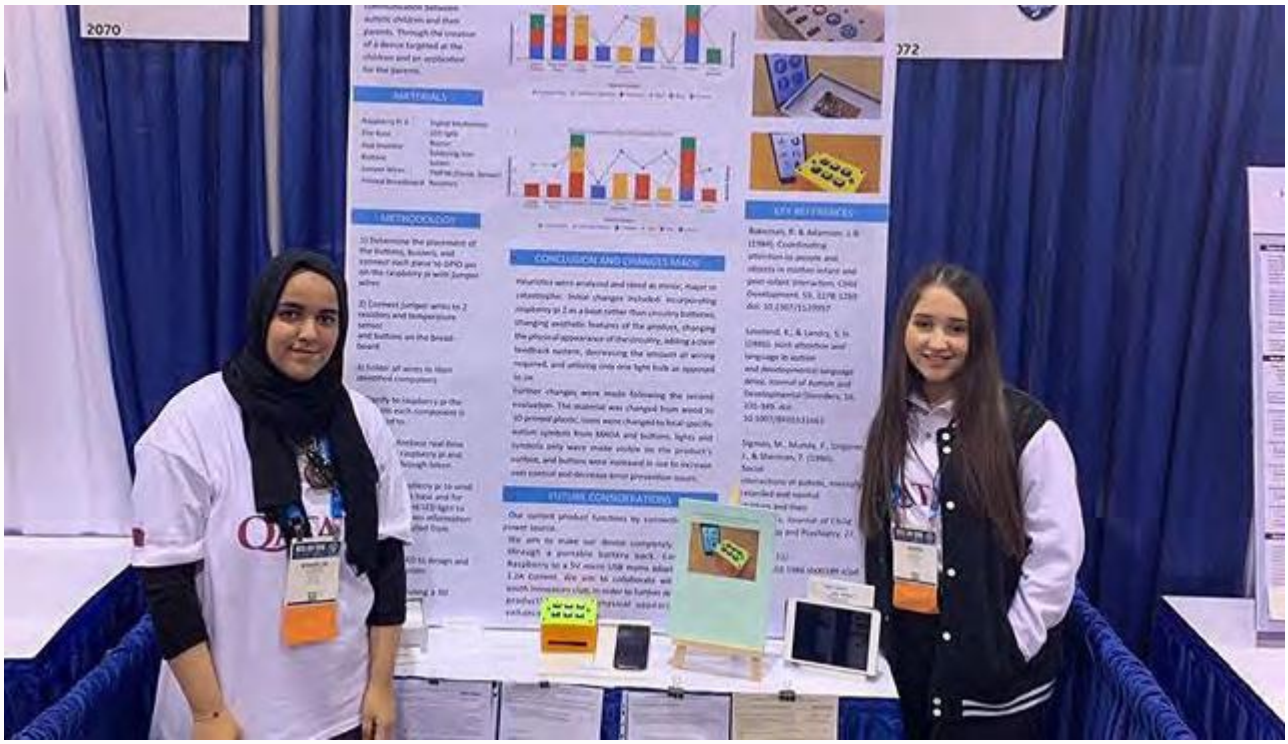
9. **Universal Usability**
   The waiting area must be designed such that it is suitable for all users without restricting PWD from using the space effectively. The use of Universal Design principles must be considered while setting up the space with attention towards the adaptability and purpose of the area.

Mada Innovation Club

Mada Center

Mada Center works with its various partners and innovators to develop an ecosystem that is supportive of innovating technological solutions that promote digital access for PWDs and the elderly.

The Center has launched its Innovation Club for youth and juniors. The goal of such initiative is to support and promote innovation and empower young innovators in Qatar to develop AT and ICT Digital access solutions to improve the quality of life of PFLs.



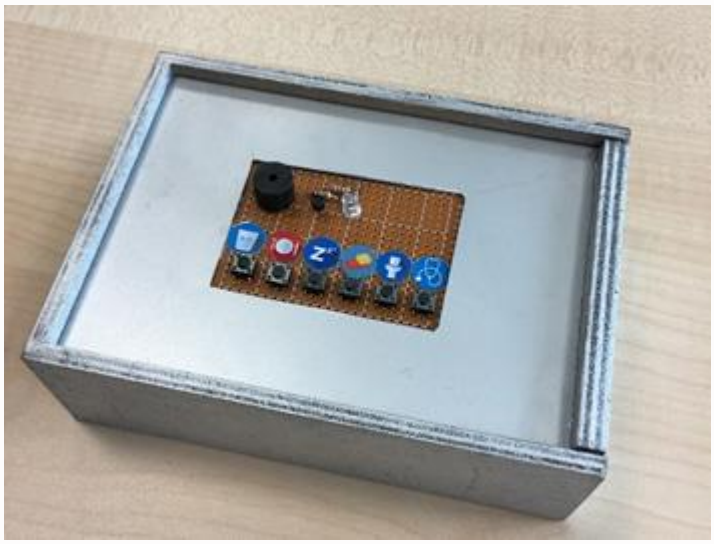
Mada has previously worked with youth innovators providing mentorship and facilitating presentation of ideas and solutions at conferences. Through the establishment of this club Mada aims to consolidate our efforts and provide a more cohesive and collaborative approach bringing like minded youth together in an informative and supportive manner.

This Innovation Club will offer members individual sessions as required and focus group meetings to:

- Provide a forum to generate and develop ideas.
- Promote discussion and development of ideas to address needs.

- Enable members to forge connections and develop peer support structures.
- Provide subject matter expertise and mentoring.
- Help evaluate usefulness of ideas/projects and the potential impact on PFLs.
- Foster self-development and improvement through group discussions, presentation of ideas and creativity in work.
- Highlight positive impact of innovations on the lives of PFLs.
- Acknowledgment of and recognition for work and developments.

In the inauguration session in April 2019, Mada Innovation and Research staff provided subject matter expertise to a student from Qatar Academy, Sama Ayoub. After their visit to Mada, Sama and Khadija developed their prototype by adopting Tawasol symbols. This developed prototype took part in the ISEF and received two awards.



Sama and her partner Khadija Elmagarmid won the first place in the National Science competition for their project to help children with Autism communicate their needs In Intel ISEF (International Science and Engineering Fair) Phoenix, USA in May 2019 they won two awards. The first award is a special category award from oracle and the second award was the 4th place in the global category among all 1800participants worldwide.