Can Innovation be inclusive? A view from Qatar

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As a researcher, I have always enjoyed developing new technologies especially when it comes to supporting people with disabilities. Over the years, our group at the College of Science and Engineering at Hamad Bin Khalifa University has invented, experimented and developed several new technologies that enabled accessibility and supported people with disabilities in several ways. In this article, I would like to shed light on two promising research projects:

- **Interact SE: A Search Engine for the Blind**

The Internet is the main source of information nowadays, we use search engines numerous times a day. Blind users access the web using a screen reader. There are several research evidence, stating that blind web searchers tend to spend more than double the time sighted web searcher spends on a search results page. This, in turn, affects their performance and inclusion. Therefore, we aim to provide different and alternative ways to represent the search results to facilitate the search process, enhance their experience and support their efficacy,

The work in this project leads to the design of an interactive tool (Interact SE) that represents an overview of the search results page using audio components. The tool has been evaluated by blind users in cooperation with Mada Centre and Qatar Social and Cultural Center for the Blind. The result of this study is a functional prototype that summarizes the search results, where the main ideas are identified as concepts and represented to the users first. The user then can dig to more information and explore more search results in details. We have adopted the use of Formal Concept Analysis (FCA), to produce the outcome of the summarization concepts. The aim is to allow the final product (Interact SE) to be released as an open-source product and to publish the outcome of our research in both academic and practitioner communities.

- **Detecting and Monitoring Attention in Children with Autism Spectrum Disorder During Learning**

Autism Spectrum Disorder (ASD) is a neurodevelopment disorder characterized by a deficit in social communication and repetitive pattern of behaviour. They are also known with exhibiting an unusual pattern of attentional behaviours such as difficulty in shifting attention, inability to pay attention to over or under-stimulated audiovisual stimuli and pay little or no attention to social stimuli. The prevalence of this disorder is relatively high and there has not been any known cure for it. Hence, a series of

educational and behavioural interventions have been developed by leveraging existing technologies to support their attention deficits which invariably supports their social communication and academic skills.

These interventions work differently for the children with ASD as some may require over-stimulating effect and others prefer the opposite. Therefore, it is imperative to detect and monitor the attention level of these children in real-time during a learning intervention to identify which intervention suits them while learning. This will create the opportunity of changing attentional cues as required by each child. Studies have identified sustained attention out of other types of attention as a critical element in learning intervention and maintaining the level of sustained attention varies across different technologies used and learning environments such as Computer Based Intervention (CBI), Human-Robot Intervention (HRI) and Virtual Reality (VR) and Normal Classroom Setting. The aim of this study is to design and develop an assistive technology to monitor the level of attention of children with ASD during learning in a VR-based environment due its possibility of mimicking real-life scenario such as road crossing or shopping that is safe for children with ASD as well as providing a uniform class scenario across the participants.

We have been able to identify from existing studies on VR-based interventions to have majorly focused on subjective measures as compared to objective methods in detecting and monitoring sustained attention in children with ASD. Although the subjective measures have been successful in determining the level of attention, it requires vast experience in autism domain and it is time-consuming. Hence, we intend to apply objective measures in detecting and monitoring the attention of children with ASD in a VR-based intervention by leveraging today's sensing technology which is reliable and requires little or no expertise.