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DIY tools TalkBox and SenseBox help people with disabilities to communicate

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Researchers at the University of Maryland, Baltimore County (UMBC) have developed do-it-yourself (DIY) assistive technology prototypes that are revolutionizing how people with disabilities can access tools that will help them interact with the world.

Foad Hamidi, assistant professor of information systems, and his collaborators at York University in Canada and the Pamoja Community Based Organization in Kenya have created research-based assistive technology platforms for people with different abilities and in different cultural contexts to learn how to use simple computers to communicate. Importantly, the development of platform prototypes has been grounded in close collaboration among researchers and community members in Kenya and the U.S. The Institute of Electrical and Electronics Engineers (IEEE) has published the results in *IEEE Pervasive Computing*.

In the field of assistive technology, costs often prohibit many people with disabilities and their families from accessing useful communication technologies. Existing tools that facilitate communication are especially hard to individualize and can be costly, explains Hamidi. However, computers have steadily become less expensive to distribute and easier to use. This makes computer-based assistive technologies more accessible to people with disabilities, both inside and outside of the U.S.

Hamidi and his team have worked to develop and test two platforms: SenseBox and TalkBox. These platforms are open source and only require a Raspberry Pi (an inexpensive microcomputer), low-cost

sensors, and a speaker to operate.

TalkBox allows users to communicate by touching images on an attached surface to play audio files stored within the system. The images and sounds can be customized during assembly, depending on an individual's unique needs. For example, TalkBox can be adapted to fit on a wheelchair, and it can include individualized visual elements. The TalkBox could display illustrations of faces showing different expressions, which a student could use to express an emotion. Numerous adjustments are available to the user, making the technology extremely customizable.

SenseBox relies on a similar model of stimuli being translated into audio, but it operates using tactile objects, which are recognized by sensors. These tactile objects are embedded with radio frequency identification (RFID) tags, similar to how objects are tagged in stores. The objects can be 3-D printed, which permits extensive customization.

TalkBox was successfully used in Kenya by a special education teacher who was able to input the names of all of his students onto the device to be used in class. This application of the device led to a noticeable increase in participation and inclusion. The success of the tool within that classroom has already led to an increased interest in the technology for other potential stakeholders in Kenya. The researchers hope to work with community members in Kenyan universities and healthcare facilities to expand the availability of this tool, and help stakeholders learn how to use it.

In the U.S., SenseBox was used by a speech-language pathologist and a nonverbal client with low vision and autism spectrum disorder. The client was able to play his favorite music by holding the desired CD case to the device, which was a major stepping stone in his communication. Previously, he had difficulty using other devices to achieve this same

goal of playing his favorite artist.

The success of these DIY devices rests on the fact that people with limited experience using technology can quickly learn how to use the tools and teach others how to use them. Hamidi and his research partners see their close collaboration with those who will be using TalkBox and SenseBox as essential to ensuring the tools are tailored to meet their needs.

The researchers continue to explore how best they can scale up the use of these new tools to support people with disabilities who are seeking new ways to communicate in a broad range of cultural contexts.

More information: Foad Hamidi et al, DIY Assistive Technology Prototyping Platforms: An International Perspective, *IEEE Pervasive Computing* (2020). DOI: 10.1109/MPRV.2019.2947749

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