T39b: INTERNET-OF-THINGS AND SMART ASSISTIVE HEARING DEVICES

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Ubiquity of smart technology, (e.g., smartphones, sensors, and devices integrated with Internet-of-Things (IoT)), has created unique opportunities to reinvent traditional stand-alone human-assist computing devices. The number of connected devices today is approximately 20B, and it is projected to surpass ~50B+ by the year 2020. Traditional devices, such as PCs, tablets, and smartphones will represent only a small fraction of the devices connected to the internet. IoT is rapidly evolving with inroads into our daily lifestyle, including home, office, automotive, healthcare, energy, agriculture, security, etc. Mundane objects such as a trash-bin are becoming smart. Home-automation is a perfect example of how smart-technology is integrating with our daily lives. The growth in smarter consumer electronics is driven by both high demand and expanding market potential. Healthcare/medical devices present some additional challenges, such as privacy and security; but it is only a matter of time as to when IoT will permeate to the healthcare and medical device market as well.

Assistive hearing devices can be revolutionized, both technically and scientifically, in countless ways with the adaption of IoT, big data, and smart concepts. Our center has recently been involved in the development of portable mobile research platforms/tools that can be used for both laboratory and take-home field experiments with cochlear implants (CIs). We have successfully integrated Personal Digital Assistant (PDA) devices, PCs, tablets, and Android smartphones with CIs and hearing aids (HAs). Such a setup has evolved into a highly versatile and portable research platform, which enables researchers to design and perform complex experiments with CIs with great ease and flexibility. One of the unexplored opportunities this platform presents is its ability to leverage the versatility of a smartphone that houses state-of-the art computing infrastructure, broad-range of sensors, and most importantly internet connectivity with location knowledge. Consider a scenario where audio sensors in a smartphone and microphones in Behind-the-ear (BTE) processors are able to form a synergy and transform into a microphone array system. Such a system could be configured for applications like beam-forming, noise cancellation, and speech enhancement strategies. Another example is the use of geo-location to automatically configure sound processors according to the environment type (i.e., a “smart room” which links with the HA/CI to share noise and speaker profiles for that room and time). As our homes and public/work environments become smarter, smart-rooms could potentially connect and relay memory based room acoustics profiles to an individual’s processor, to reconfigure the sound processing parameters for optimal hearing. As a proof-of-concept, we conducted a simple experiment using the CCi-MOBILE platform. By using Wi-Fi tagging, the sound processor was able to switch between different noise suppression strategies which were optimized for the specific room scenario.

There are countless possibilities and opportunities in ways hearing assistive devices can leverage emerging sensors, computing and networking technology to impact a change. Sound processors will soon join the emerging IoT ecosystem and re-invent themselves as connected, data-driven, smarter devices, which will hopefully lead to better hearing solutions for the users.

This work was supported by the grant R01 DC010494-01A from the National Institute on Deafness and Other Communication Disorders, National Institutes of Health.