M57: ANDROID-BASED RESEARCH PLATFORM FOR COCHLEAR IMPLANTS

Feng Hong[1], Hussnain Ali[1], John H.L. Hansen[1], Emily A. Tobey[2]
[1]Department of Electrical Engineering, The University of Texas at Dallas, Richardson, TX, USA
[2]Department of Behavioral and Brain Sciences, The University of Texas at Dallas, Richardson, TX, USA

The current work presents the design and features of an Android-based research platform for cochlear implants. The platform is based on existing and emerging hand-held Android smartphones/tablets and is an extension of the PDA-based research platform developed by the Loizou Cochlear Implant Laboratory at The University of Texas at Dallas. This highly versatile and portable research platform allows researchers to design and perform complex experiments with cochlear implants manufactured by Cochlear Corporation with great ease and flexibility. The platform consists of a smartphone/tablet for implementing and evaluating novel sound processing algorithms and a custom-developed interface board to stimulate Cochlear Corporation's CI24 implants. The interface board houses a high quality stereo audio codec, an FPGA, a Wi-Fi module, and a set of input/output ports for connection with clinical Behind-The-Ear (BTE) microphone units and Freedom headpiece coils.

The acoustic signal is acquired from the BTEs and is sampled digitally by the on-board stereo codec and sent to the smartphone wirelessly over Wi-Fi for subsequent processing. The smartphone receives packets of stereo acoustic signal every 8 ms and processes them through a sound coding strategy. As a proof-of-concept, we have implemented Advanced Combination Encoder (ACE) strategy using a combination of JAVA and C languages. The processing generates a set of stimulation data which consists of electrode, mode, amplitude (EMA), and timing of each biphasic pulse. The stimulation data is sent back to the interface board where it is encoded in the Embedded Protocol by the FPGA and finally streamed to the Freedom coils for stimulation.

The platform can be used for unilateral or time-synchronized bilateral stimulation. It can be used in both real-time and bench-top modes. In the bench-top mode, the processing can be carried out in MATLAB in offline mode and the stimulation data can optionally be sent to the interface board via a USB cable. The bench-top mode can also be used to design and conduct psychophysical experiments. In addition, the platform can be configured to provide both electric and acoustic stimulation (EAS). The graphical controls on the smartphone provide an interactive user-interface for modifying processing parameters on the go. The platform will need FDA approval before it can be used for experimentation with human participants and made available to the research community.