A Portable Research Platform for Cochlear Implants

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Introduction

- Having access to a flexible research platform is critical for the advancement of cochlear implants or neural interface devices in general.
- Aims of a recent contract from NIDCD/NIH are to develop a research processor that is:
  - Portable - to allow for realistic assessment of new algorithms after long-term use
  - Flexible - to allow for quick development and evaluation of new research ideas
  - Easy to use - accessible to all researchers interested in critical and animal studies
- To achieve the above aims, we sought for a research platform which requires minimal investment in hardware development.

Research processors: Then …

Existing research processors: Now

Project Overview

PDA hardware capabilities

- Capabilities suitable for several interfaces:
  - Input ports (single & multiple channel) suited for multi-channel recordings
  - Output ports suitable for sending data for stimulation
  - Wireless connectivity
  - Graphical user interfaces for patient control (e.g., via input)
  - Portability for chronic studies
  - Powerful computing capability

Patient controls and interface

Cochlear Implant Research Interface

Real-time implementation on the PDA using LabVIEW

- 16-channel CIS implementation runs in real-time on the PDA
- Used Intel’s IPP routines optimized for PXA270
- Digital signal processing library for CIs (ongoing)

Work done so far

1. Implemented a 16-channel CIS and ACE strategies in real-time on the PDA
   - Used Intel’s IPP routines optimized for PXA270
   - Digital signal processing library for CIs (ongoing)

2. Implemented a 16-channel noise vocoder in real-time on the PDA (audio demo)
   - Useful for studies investigating learning effects following changes to processor (e.g., frequency maps)

3. Implemented a 16-channel noise vocoder in real-time on the PC using LabVIEW

4. PDA stimulation of the Freedom implant via Secure Digital IO interface (see demo)

Evoked Potentials

Evoked Potentials Set Up

- 1. headstage or pre-amplifiers
- 2. amplifier unit
- 3a. trigger pulse connection
- 3b. presentation of electrical stimuli
- 4. presentation of electrical stimuli

- Easy and flexible to program
- Critical for the advancement of cochlear implants or neural interface devices in general.

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- The PDAs can provide for a portable, flexible and easy-to-use research platform for cochlear implant research.
- The PDAs can possibly be used in other neural prostheses.
- Other applications will require a different input and a perhaps different output neural interface.
- In retinal implants, for instance, the input will come from a small camera rather than a microphone.

Summary

Research supported by NIDCD/NIH