Project Title: Compact re-configurable Hearing Aid using sensors and sophisticated signal processing techniques

Project Number: IMURA0278

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Research Academy Themes:

Highlight which of the Academy’s Theme(s) this project will address? (1)
(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Hearing impairment is a common problem occurring in humans. More than 3 million people in Australia have hearing impairment. A hearing impairment may happen suddenly or gradually but it differs from most other disabilities in one important respect — it is invisible. This means that it often isn’t obvious, and it often isn’t understood. Hearing loss can be described as congenital or acquired. A congenital hearing loss is one that is present at, or soon after, birth. An acquired loss is one that occurs later on. Hearing is also affected as a person ages.

Considering that hearing impairment is a major problem, it is important to design and develop a compact, low cost, re-configurable hearing aid which will allow subjects to hear properly as per their hearing loss.
Project aims

Define the aims of the project

This project aims to develop signal processing algorithms in order to mitigate hearing loss, for instance the loss of amplitude sensitivity at certain frequencies, abnormal variations in spectral detail and a hearing frequency reduction. These signal processing techniques will be evaluated using a suitable hardware platform such as an FPGA board, Motorola DSP chip, etc. The research may involve developing an architecture well suited for implementing some of the established signal processing for programmable hearing aid (filtering, compression, and one or two user selectable add-ons, with online setting of parameters) and meeting the low power requirements.

Expected outcomes

Highlight the expected outcomes of the project

This multidisciplinary research project will lead to the following outcomes:

1. Developing signal processing algorithms targeted at mitigating hearing loss at certain frequencies, and/or at certain amplitudes.
2. Implementing the derived algorithm(s) on a DSP or an FPGA board.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

The theme relevant to this project is “Advanced computational engineering, simulation and manufacture”.

This research project targets a signal processing algorithm mitigating hearing loss at certain frequencies and/or amplitudes, as well as the design of an ultra low-power digital programmable IC processing the algorithm in question real time.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Candidates should have a MEng or BEng, and have taken FPGA / microcontroller design courses. Expertise in Matlab and C, C++ is essential. Experience with EDA design tools like Cadence, Synopsys or Tanner is a definite bonus.