Building a Low Cost Hearing Device with User Customized Frequency Response for the Hearing Impaired

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Currently, 1.5 billion people worldwide suffer from some level of hearing loss. However, only 17% of those who would benefit greatly from using a hearing aid use one. Hearing aids can cost anywhere from $1000 to $6000 per device, presenting a significant barrier to adoption. On the other hand, personal sound amplification devices are lower in cost, but are often not extensively customizable. The aim of this project is to make a customizable and low cost hearing device that allows hearing impaired users to adjust and reprogram at different frequencies. The prototype was designed and built using a microphone, digital signal processor (DSP), amplifier, audio jack, LiPo battery, and voltage regulator. It was tested using an oscilloscope and a tone generator to measure output-to-input versus frequency characteristics in decibels (dB). A python-based Graphical User Interface (GUI) was developed to allow users to upload their hearing loss profiles into the DSP. In addition, the GUI also allows users to perform additional +/-5 dB adjustments in 3 frequency bands if needed. Testing showed that the device was capable of accurately modifying signals in a range of 30 dB, for frequencies from 100 Hz to 20 kHz, making this device suitable for users with mild hearing loss. At a cost of only $70 per device, this prototype has the potential to make customizable hearing devices much more accessible to the many who need it.

Awards Won:
Fourth Award of $500
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category