

Development of a Ultra Low-Cost Integrated Audiometer and Hearing Aid

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Background 360 million people have mild to severe sensorineural hearing loss (SHL) worldwide, most in developing countries and cannot afford a hearing test or hearing aid. Since hearing tests are conducted separately from the fitting of hearing aids, a doctor is required to program the hearing aid, limiting access. Hence, SHL often goes undiagnosed and untreated.

Methodology A low-cost, automated audiogram solution was created on a Raspberry Pi (\$45). An algorithm was created to play clinical audiogram files and record user input through external buttons. A clinical test (n=15 patients) was conducted to compare the results of the RPi audiogram to the clinical audiogram at frequencies of 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz. A viable hardware platform for the hearing aid was identified as well. **Results and Conclusions** The RPi audiogram matched the corresponding results of a standard audiogram within 10 dB with a 96% accuracy in a controlled environment (ambient noise < 50 dB). These results demonstrate that the RPi audiogram may be a cost effective solution (< \$60) to diagnose SHL in developing countries. A low-cost hearing aid is currently being developed in conjunction with the low-cost audiogram with the hearing aid automatically self programming based on the results of the audiogram.