

Affordable Infant Hearing Screening Device for Under-Resourced Communities

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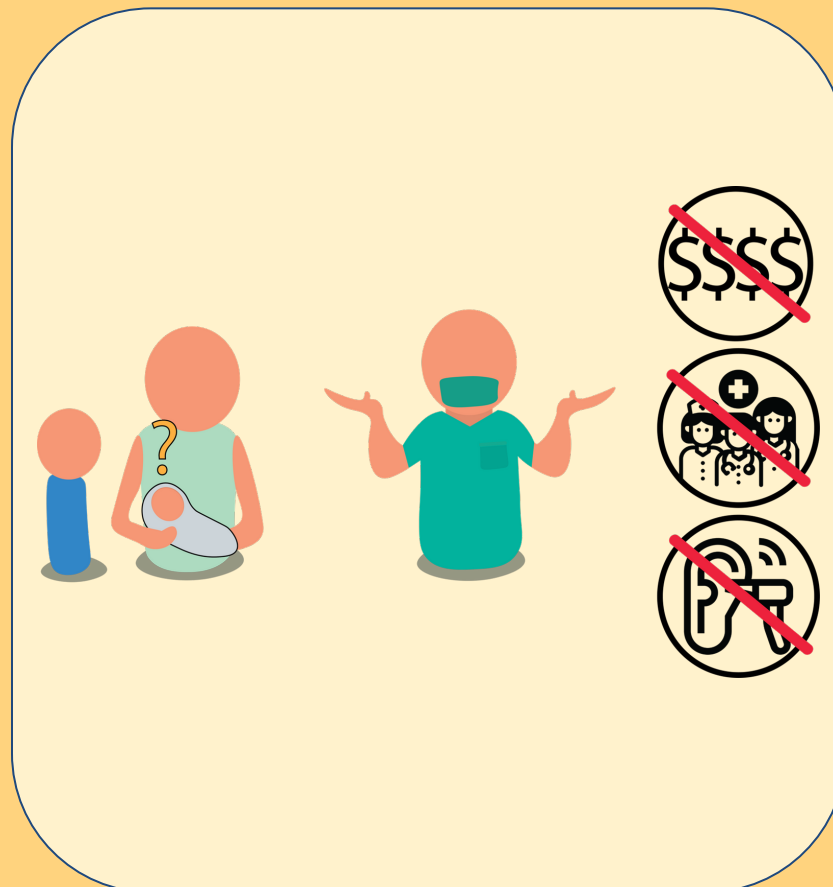
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Affordable Design and Entrepreneurship



Introduction

Worldwide, 34 million children have hearing loss. With the proper screening equipment, 57% of these hearing losses are detectable at birth.¹ However, this detection rate drastically decreases in developing countries where citizens and healthcare workers have low access to hearing test devices.² Dra. Patricia Castellanos de Muñoz, the only audiologist in Guatemala, put it this way:

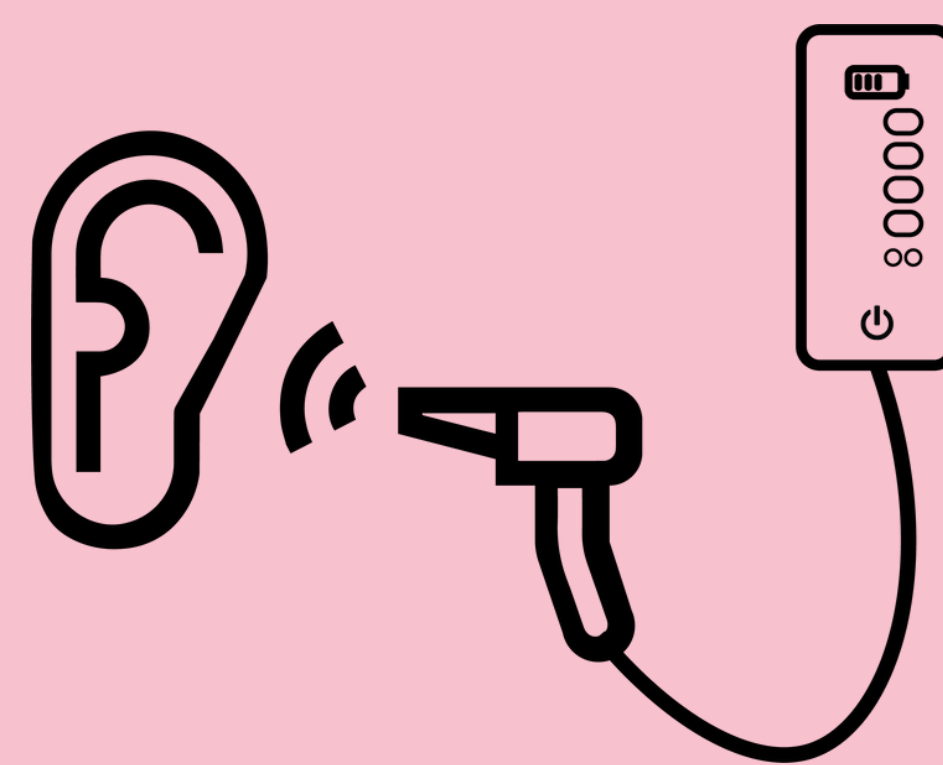


"Many countries do not have any technology for newborn hearing screening. OAE is a great starting technology for countries in Latin America, Africa, and Asia."

An Affordable DPOAE Device

Distortion Product Otoacoustic Emissions Screening

How it Works:



An OAE device sends a sound into the recipient's ear canal and measures the distortion products. The amplitude of the distortion products can be used to determine if the recipient of the test has hearing loss.

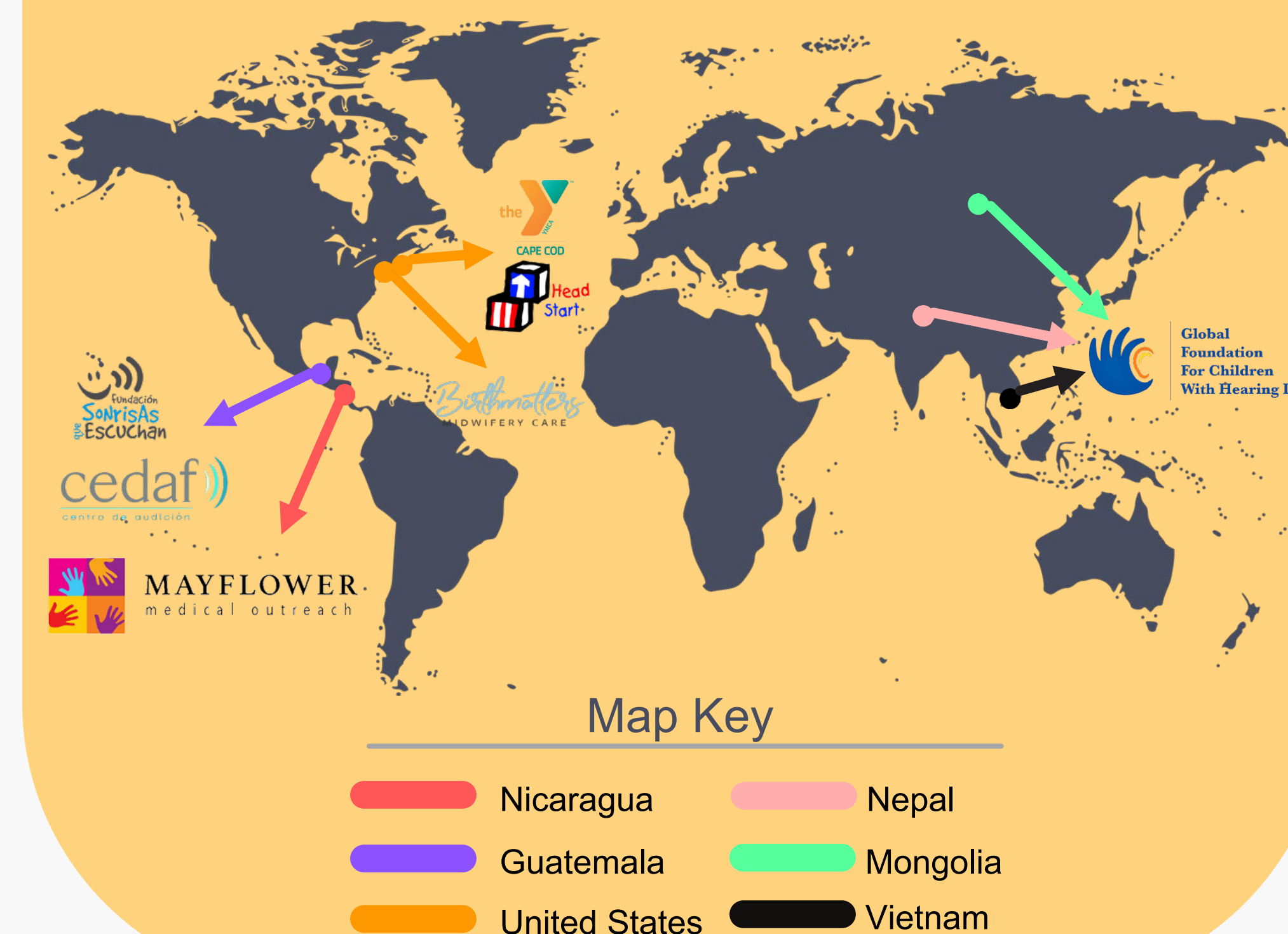
Benefits:

- Significantly lower costs compared to current devices on the market
- Ease of use and universal format
- Device plays a safe, quiet tone in a baby's ear
- The baby/child does not need to interact or respond

Outcome:

- Improves access for screening
- Families can be informed about their child's hearing health
- Improve quality of life for deaf/hard of hearing children
- Ensure equitable access to education

Current Codesign Collaborators



Methods

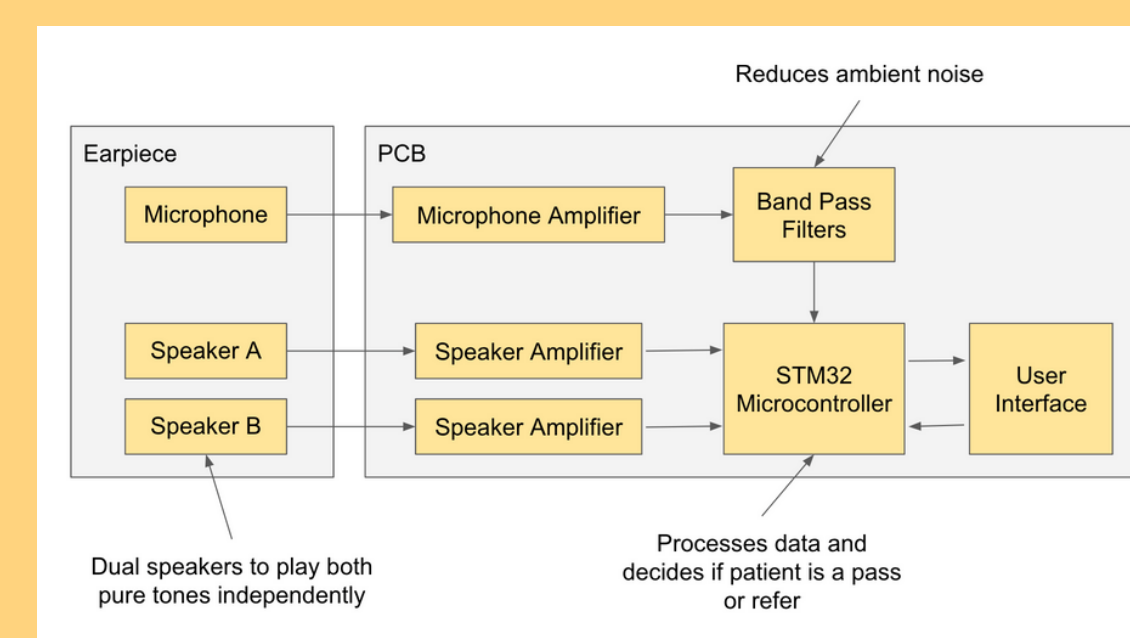
- Building off of existing, expired OAE patents to reduce R&D costs
- Working with a commercialization partner who is committed to keeping pricing low
- Using a participatory design approach to ensure a user interface uniquely easy to use for local community members without any audiology background

Table 1: Expired IP for Use in System Design

| Category | Patent Number | Title | Subsystem used On |
|--------------------------|--------------------|---|-------------------|
| Expired, relevant | US 5792073 A | System and Method for Acoustic Resonance Measurement in the Ear Canal | Circuit Design |
| Expired, relevant | US 6110126 | Audiological Screening Method and Apparatus | System |
| Expired, relevant | US 6258043 B1 | Ear Probe Tip | Probe |
| Expired, relevant | US 2004/0171966 A1 | Hand-Held Hearing Screener Apparatus | System |
| Expired, relevant | US 4122841 | Probe Tip | Probe |
| Abandoned, relevant | US 2005/0015018 A1 | Ear Probe and Disposable Ear Tip System | Probe |
| Soon-to-expire, relevant | EP 1 187 550 B1 | Handheld Audiometric Device and Method of Testing Hearing | System |

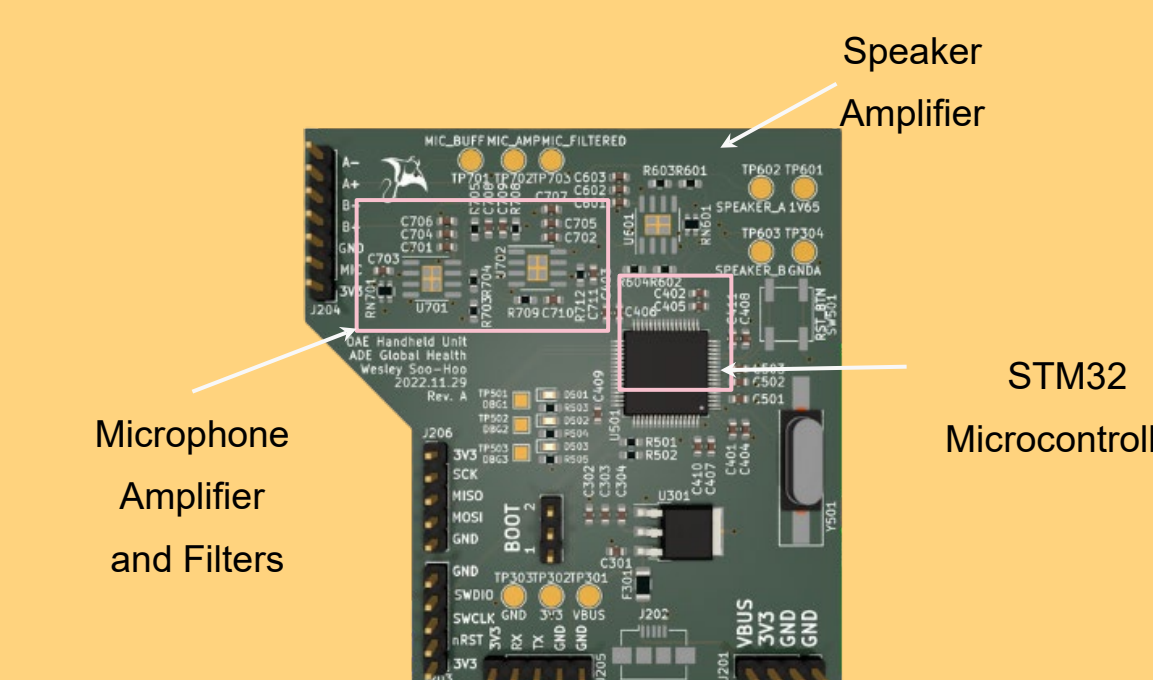
Working Prototype From Expired IP

Electrical Systems Diagram

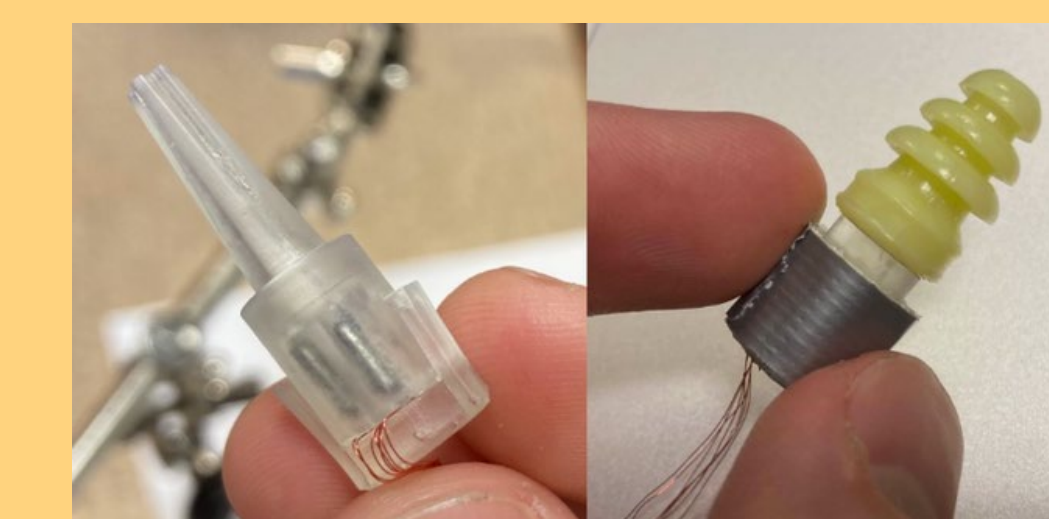


Combination of off-the-shelf (OTS) components to keep costs low

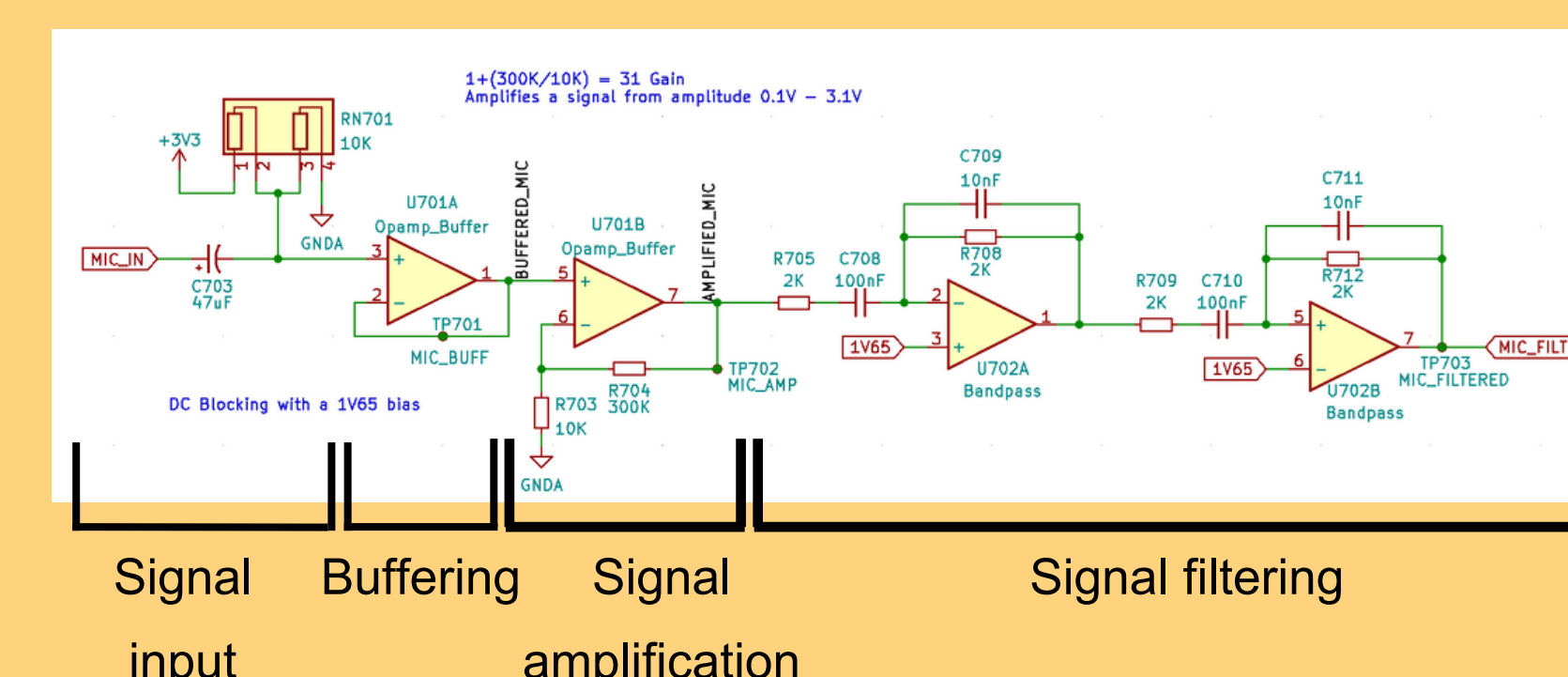
Printed Circuit Board Design



Probe Tip Housing

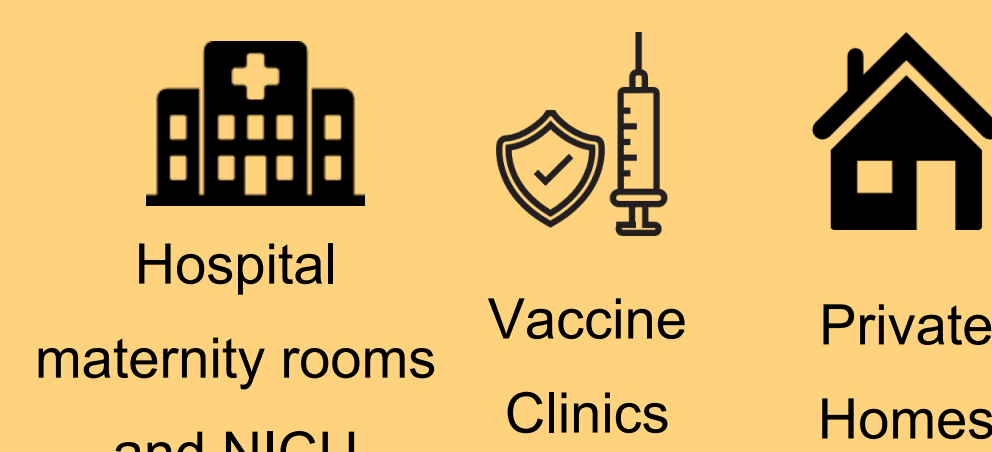


Compatible with reusable, washable, off-the-shelf, silicone ear tips



Background Noise Muffling

Screening Contexts



Ear Muffs for OAE Screening

Research shows ear muffs can reduce noise and lead to more accurate OAE screening in adults.³

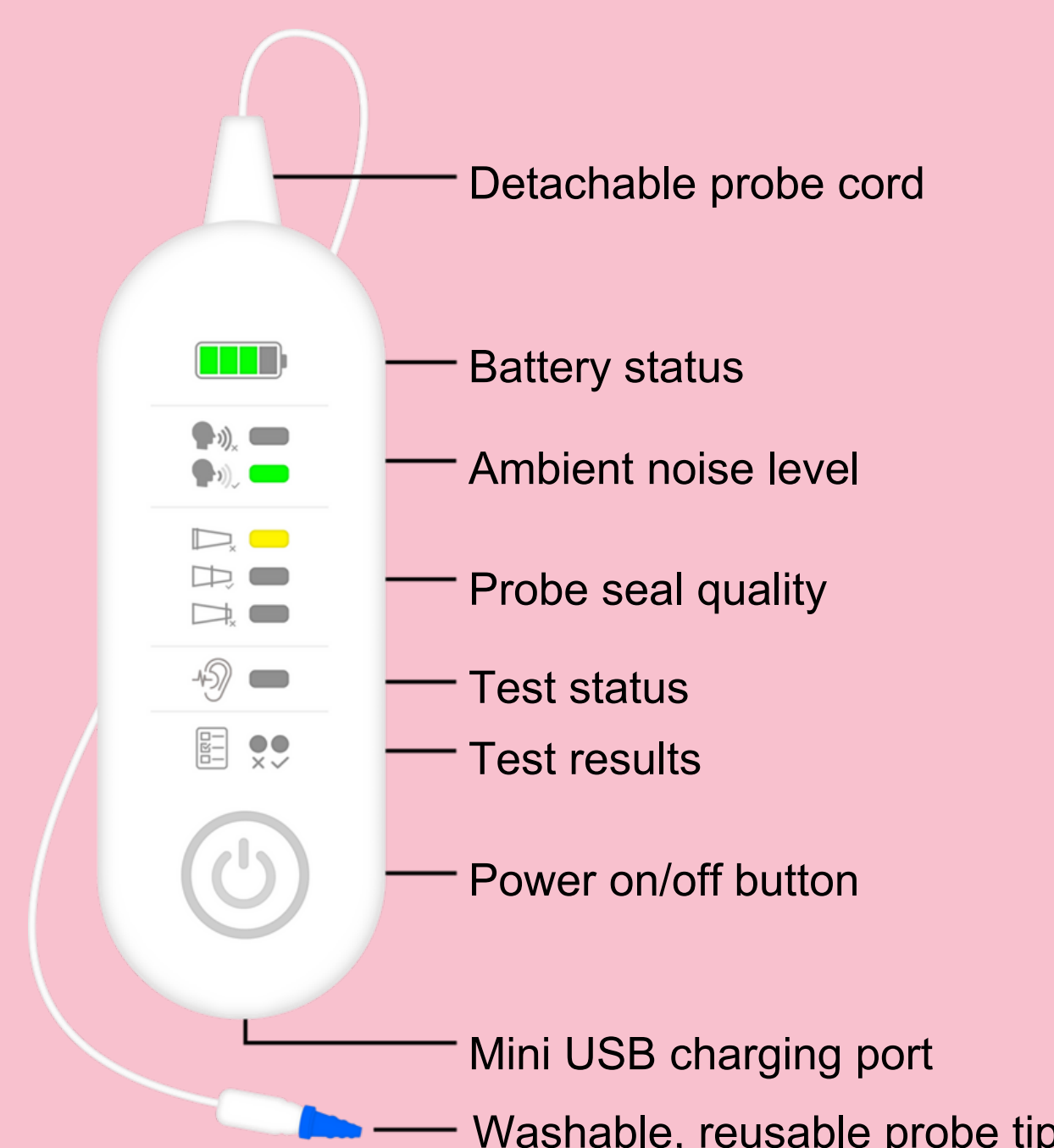


Our Current Work

Would using an earmuff over the OAE probe be feasible for infants and children? Will it make screening easier or more challenging for technicians?

User Interface Concept for Global Audio Technicians

Developed through codesigns with international Audiologist collaboration



- Benefits of our UI
- Graphical icons for non-language specifics
 - Easy to use for Audiology technicians
 - Easy to learn and train so community members can be trained to perform screenings

Acknowledgements



Conclusion

Our goal is to create an affordable OAE device that is 20-50% the price of a typical DPOAE device. We plan to achieve the target low price goal by partnering with a manufacturing/distribution company that focuses on keeping retail price low by saving costs on R&D while ensuring we are building a high-quality device. With our end user in mind (under-resourced international communities), the material of our OAE device is made from high-quality materials and can also endure rugged environments.

Connect with us!

You can connect with us by contacting our advisor Elizabeth Johansen (elizabeth.johansen@olin.edu) or scanning the QR code.



³ Nielsen, Kelsey, Brian M Kreisman, Stephen Palletti, and Nicole V Kreisman. "Effects of Noise Attenuation Devices on Screening Distortion Product Otoacoustic Emissions in Different Levels of Background Noise". 17 (2011). 9