Capstone Design Expo Posters   College of Engineering

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Portable Pure-Tone Audiometer

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CAPSTONE DESIGN EXPO 2017

ECE 407 | **Team members:** Zachary Conner, Zachary Clute, Min Su Ju, James Le | **Faculty adviser:** Michael Cabral, Ph.D. |
Sponsor: MCV | **Sponsor adviser:** Daniel H. Coelho, M.D., F.A.C.S.

360 Million
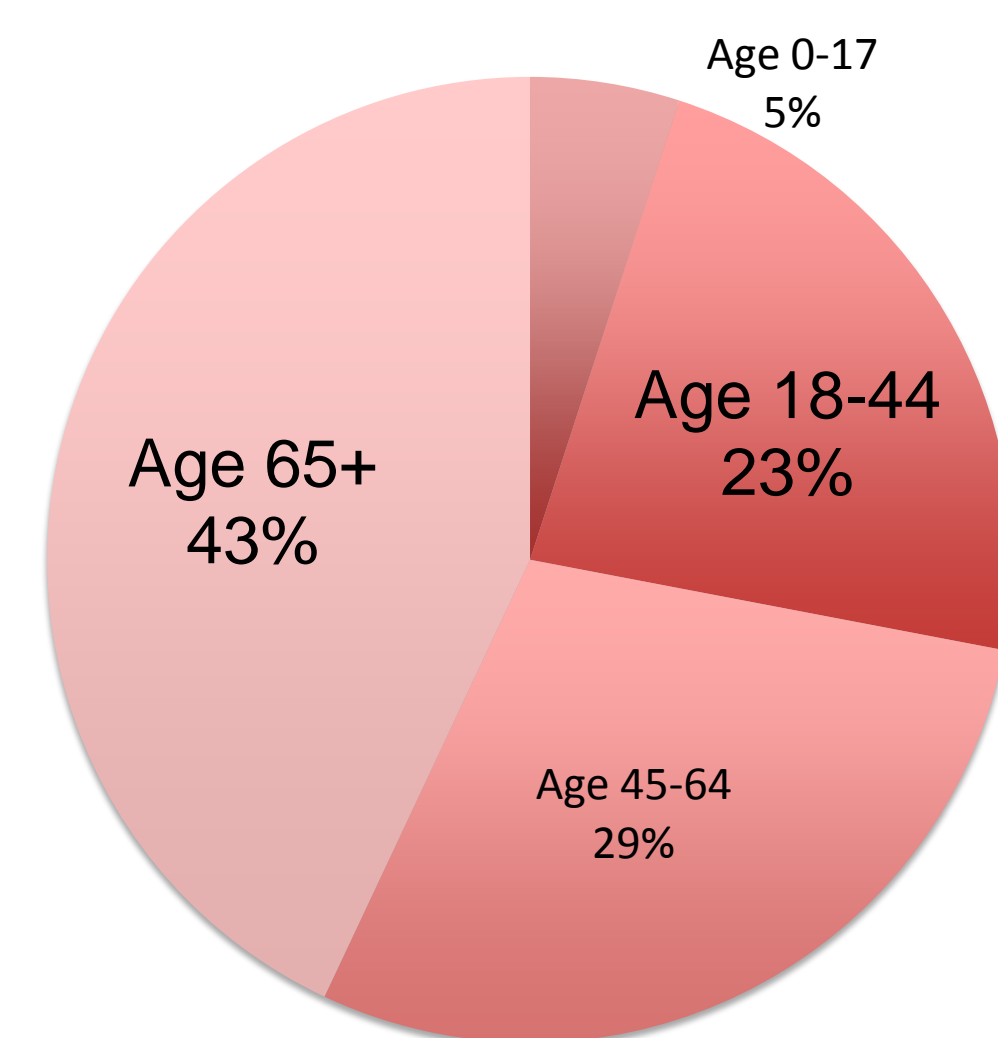people have disabling hearing loss worldwide

2nd most common health deficiency in the world.

Mostly found in low and medium income countries.

Testing is not readily available in low and medium income countries.

Poses annual societal cost of over **one trillion USD**.

Hearing Loss: Age Distribution

- Age 0-17: 5%
- Age 18-44: 23%
- Age 45-64: 29%
- Age 65+: 43%

Solution

Complete Feature Set
- Air and Bone Conduction Audiometry
- Fully Automated Test Procedure
- Masking Support
- Touchscreen Interface

Portable
- Noise Cancelling
- Battery Powered
- Small Form Factor
- Lightweight

Inexpensive
- Typical audiometer start up cost: **$51,000**
- Target cost of our product: **$1,000**
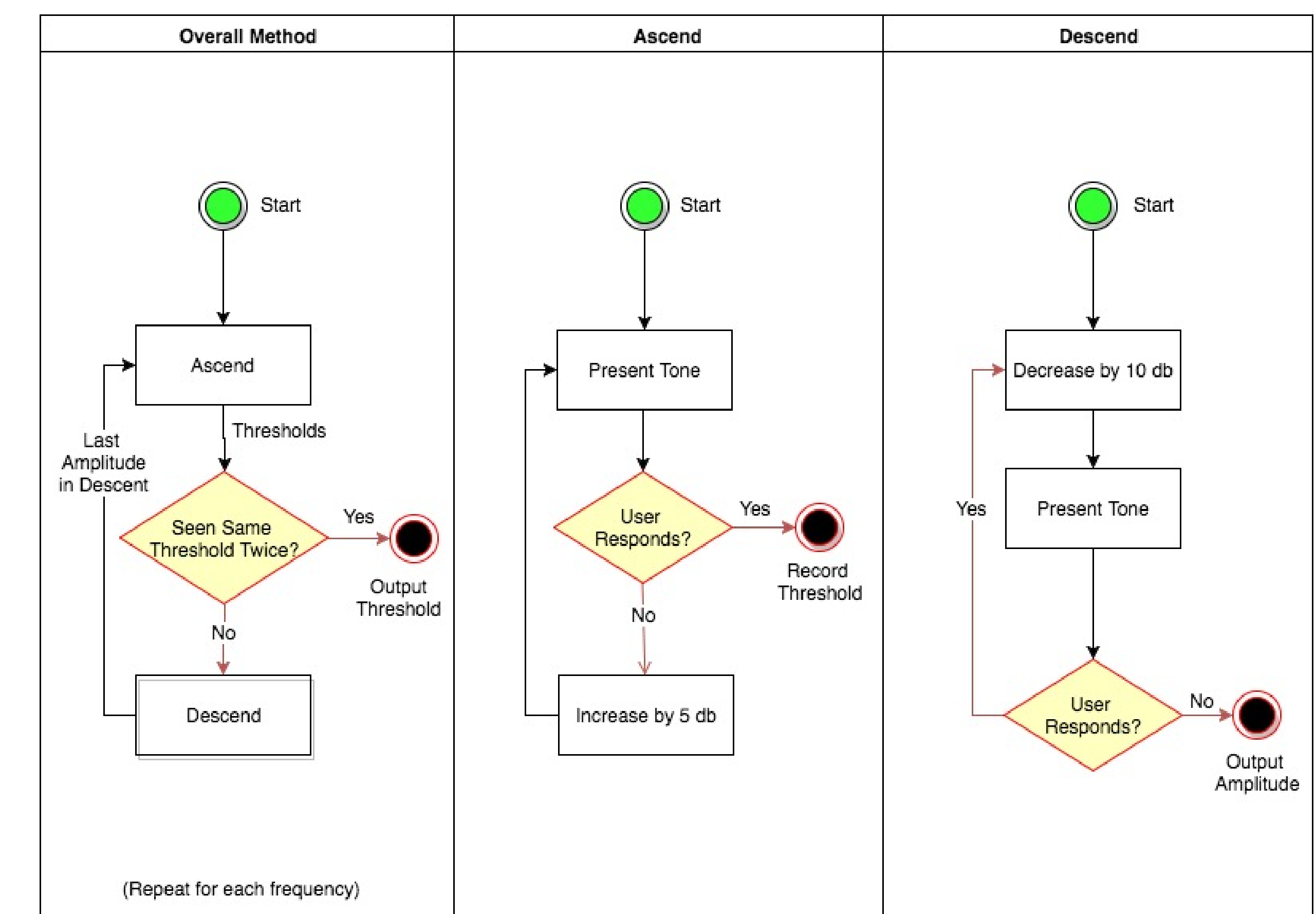- No need for sound-proof room.
- No need for large/expensive equipment

Raspberry Pi

Noise Cancelling Headphones

Bone Transducers
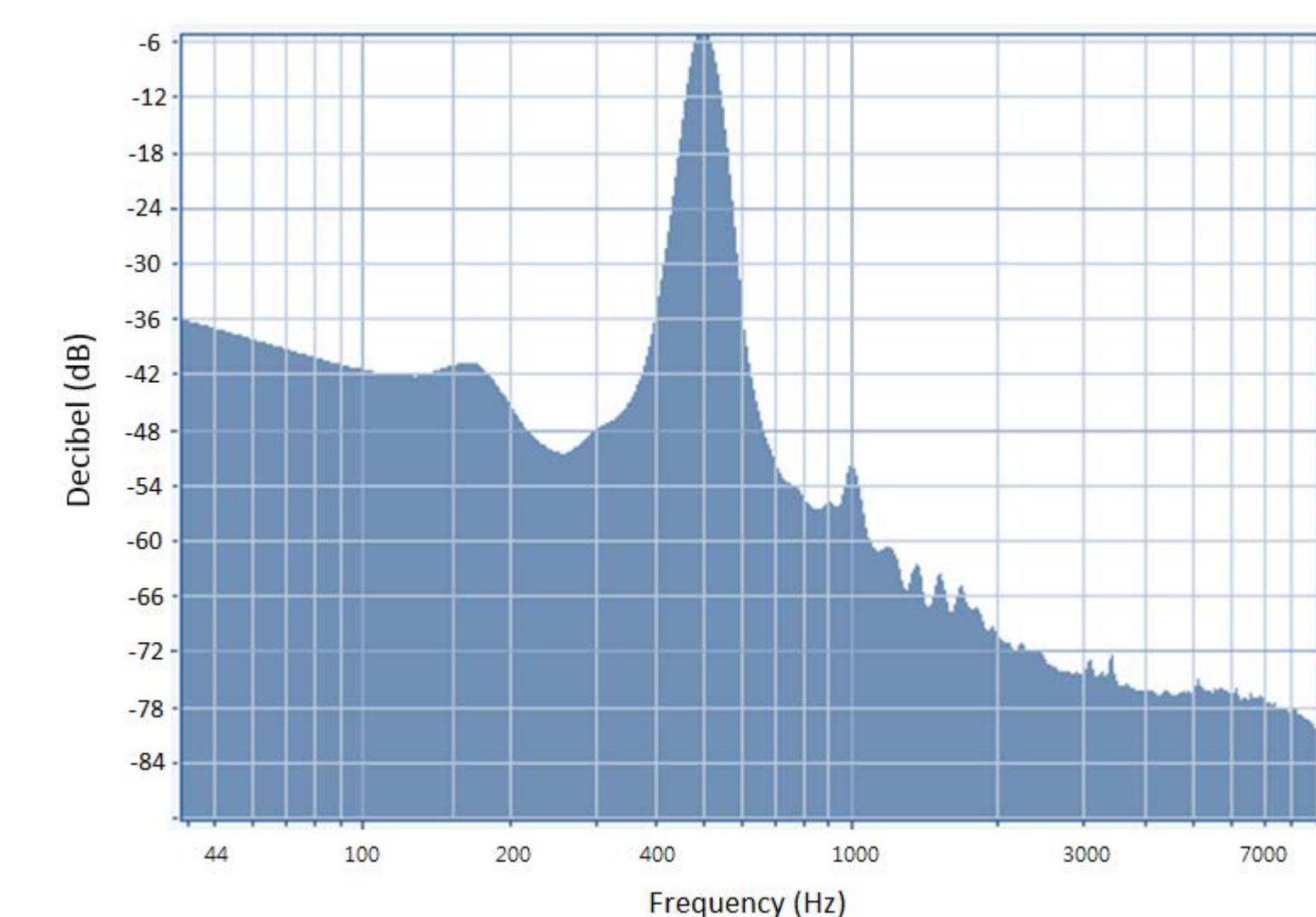
Finding the Hearing Threshold

The algorithm that was implemented to determine the patient's hearing threshold at a particular frequency is known as the "ascending method." It mimics the standard method used with manual audiometers.

Overall Method	Ascend	Descend
Start → Ascend → Thresholds → Seen Same Threshold Twice? (Yes → Output Threshold) (No → Descend → Last Amplitude in Descent) (Repeat for each frequency)	Start → Present Tone → User Responds? (Yes → Record Threshold) (No → Increase by 5 db)	Start → Decrease by 10 db → Present Tone → (Yes) User Responds? (No → Output Amplitude)

Does it Work?

The following graphs show the frequency content of the the sounds a patient would hear in a typical testing environment with the device generating a 500Hz tone via air conduction and bone conduction.

Air Conduction

Bone Conduction

Mark A. Sternheimer Senior Design Award