

PLUG-N-TALK

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BACKGROUND

- **The hearing loss problem**
 - About **20%** of Americans (48 million) report some degree of hearing loss.^[1]
 - At age 65, **1 out of 3** people has a hearing loss.^[2]
- **Current hearing aids**
 - More than **2/3** of adults over 50 who might benefit from hearing aids **don't use them** ^[3]
 - Range from just shy of \$1,000 on up to more than \$4,000 for each device
 - **More than \$8,000** if buying a pair, which is almost equivalent of up to 2 months of average American household income.
 - The hearing aid costs are **not covered** by most insurance providers

[1][2] Hearing Loss Association of America
[3] American Association of Retired Persons

NEEDS

During our interaction with seniors, we heard a lot of complains regarding problems associated with their hearing aids. Therefore, we concluded three major needs of hearing aids users:

- **The need of a cheaper alternative:** Existing hearing aids cost a lot of money, so not everyone can afford them. Since hearing problems are very common across the senior population from every social class, a cheaper alternative to pricy hearing aids is needed.
- **The need to reduce background noises:** Many hearing aids users still have problem hearing clearly in a noisy environment because the hearing aids amplify the target sounds as well as the background noises. Users need a device that can filter out the background noises while enhance sounds from the target people.
- **The need of easily adjustable enhancement of sound in certain frequency bands:** Aging related hearing loss often causes hearing deficits in high frequency sounds, and on top of that, different people are associated to losses in hearing different frequencies. The hearing aids parameters associated with sound frequencies can only be adjusted by audiologists and this process takes time and money. Some seniors complained that due to the mistake in the frequency parameters, their pricy hearing aids do not help with their hearing problems at all. They need a device that provides customizing hearing enhancement in certain sound frequencies achievable by the users themselves.

DEVELOPING PROCESS

With a better understanding of user needs, we went through a three-stage developing process:

- Stage 1: "Wizard of oz"
 - Conducted "fake" conversations with seniors: seniors listened to voice recorded through microphone in noise background
 - Recorded voices appeared to be more "clear" than voices through hearing aids
 - Proved that microphone could effectively reduce background noises
- Stage 2: Testing with existing cell phone application "Megaphone"
 - Megaphone transmits sounds collected from microphone to earphones in real time
 - Proved that device with realtime noise reduction function could bring better conversation quality compared to existing hearing aids

	Conversations with background noises
Phonak Hearing Aid	Background noise was intervening More "Say that again"
EarPod + App	Satisfactory quality of sound from not only the young speakers but also themselves Much fewer "Say that again"

- Stage 3: Building our own application
 - Adopted the feature of realtime noise reduction
 - Integrated the feature of frequency adjustment

PRODUCT

Our product Plug-N-Talk is a smartphone application that serves as an affordable solution to the pricey hearing aids market. By using our app, a pair of earphones and a microphone, users can enjoy a realtime in person conversation with background noises effectively reduced. Users can also easily adjust the enhancement of specific frequencies according to their hearing needs.



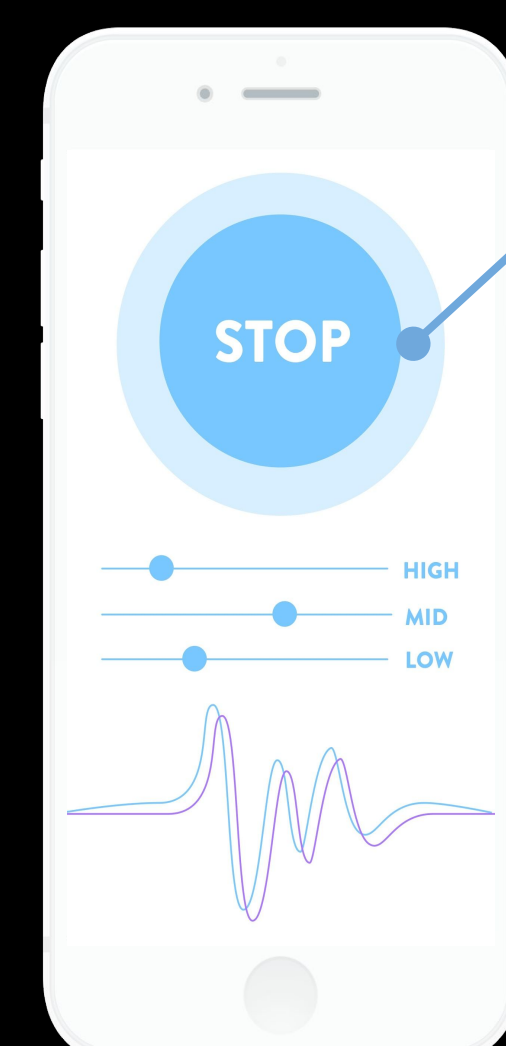
● The landing screen:

- Two icons indicate if earphones/microphone are plugged in properly
- When both accessories are properly plugged in, two icons will turn into a "START" button and the starting function screen (bottom left) will show up.

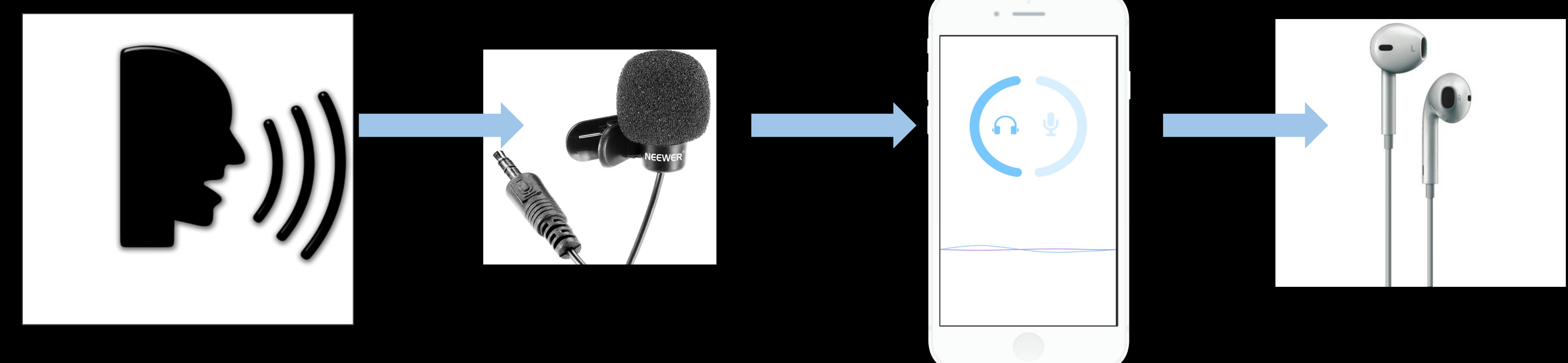


● The function screens:

- "START" button shows up, indicating the app is ready for use
- Three slide bars available for users to trim the gain for high/mid/low frequencies
- When "START" is pressed, the app starts transmitting audio from microphone to earphones with desired frequency setup



- "STOP" button is available for users to indicate if they no longer want the app to transmit sounds.
- Either pressing "STOP" or unplugging microphone/earphones would make app stop transmitting audio and jump back to the landing screen



- The conversation audio is picked up by the microphone, processed by the Plug-N-Talk app, and then brought to the user through the earphones
- Our solution is this Plug-N-Talk app combined with a microphone, a pair of earphones, and an audio splitter, everyday accessories whose combined total cost totally beats a pair of hearing aids.

TECHNOLOGY

AVAudioUnitEQ class of Apple's **AVFoundation** library is utilized in our app to build an equalizer for the user to tune the gains of 3 frequency ranges, each with 1 octave bandwidth, of the speech for better clarity.

CONCLUSION & FUTURE PLAN

Our application brings up the concept of building an almost zero-cost alternative to hearing aids with existing commonly seen accessories. By using our app, seniors can enjoy an evidently improved conversation quality.

Our future plans include

- Achieve the similar result through wireless airphones so that our product can be used in conversation among three or more people
- Develop the function of recording. Specifically, audio record and subtitles will be stored in the history and can be played back if necessary.
- Pitch our prototype to large corporations