

HEARING AID ANDROID APPLICATION

A Report for the Evaluation 3 of Project2

Submitted by

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ABSTRACT

Growth in technology has resulted in smartphones being available to the masses. Such a wide scale use had encouraged development of a variety of applications These applications can be easily found thanks to services like Google play store and apple app store. Over time these applications have diversified and are now also available for scientific and medical field. On finding these smartphones as an opportunity to help people having mild hearing impairment.

INTRODUCTION

The ability to perceive sound by detecting modulations in the air known as sound waves. These sound waves are regions of compression and rarefaction that travel the space as longitudinal waves.

With the evolution of humans the ability to differentiate among various sounds has been greatly enhanced. The Homo sapiens have a hearing range of 20 Hz to 20 KHz i.e 20,000 Hz. Though this is comparatively less than other mammals [1], it has proven to be sufficient for the human survival.

Recently this ability has been under threat by the changes that have occurred in the lifestyle of many people. The ever increasing demand placed by this fast paced lifestyle on the auditory system of people has resulted in severe degradation of hearing ability. People of old age have been the main victims of this disability.

There has been extensive research done in the field of hearing aid design. Mostly these hearing aids are specific set of hardware that amplify the sound they receive from the environment and output the amplified sound to some earpiece. Yet there are events when people find themselves not carrying their hearing aids. In such conditions the use of a mobile app that can mimic the functions of a legacy hearing aid would be helpful.

There are various hearing aid mimicking apps present on various app stores that can be used. In this review the aim is to understand the need for hearing apps, along with the requirements that a typical hearing app must satisfy to be acceptable by the customers.

Hearing Loss:

The World Health Organization (WHO) defines disabling hearing impairment in adults as a permanent unaided hearing threshold level (average for frequencies 0.5, 1, 2, 4 kHz (kiloHertz)) for the better ear of 41 dB or greater (WHO, 2001).² In children under 15 years of age, disabling hearing impairment is defined as permanent unaided hearing threshold level (average for frequencies 0.5, 1, 2, 4 kHz) for the better ear of 31 dB or greater. The WHO classifies hearing impairment into five grades, as shown in Table below. Categories of hearing impairment range from “no impairment” to “profound impairment” according to the threshold.

Table:

Grade of Impairment	Audiometric ISO value (average of 500, 1000, 2000, 4000 Hz)	Impairment description
0 (no impairment)	25 dBHL or less (better ear)	No or very slight hearing problems. Able to hear whispers
1 (Slight impairment)	26-40 dBHL (better ear)	Able to hear and repeat words spoken in normal voice at 1 metre
2 (Moderate impairment)	41-60 dBHL (better ear)	Able to hear and repeat words using raised voice at 1 metre
3 (severe impairment)	61-80 dBHL (better ear)	Able to hear some words when shouted into better ear
4 (Profound impairment including deafness)	81 dBHL or greater (better ear)	Unable to hear and understand even a shouted voice

Source: WHO Report of the Informal Working Group On Prevention Of Deafness And Hearing Impairment Programme Planning. Geneva, 1991 and Global burden of hearing loss in the year 2000 World Health Organization.¹

There are two basic types of hearing loss: conductive hearing loss, sensorineural hearing loss

and mixed hearing loss based on which part of the auditory system is damaged.

1- Conductive hearing loss occurs when sound is not conducted efficiently through the external

ear canal to the eardrum and the ossicles of the middle ear. This type of hearing loss usually

involves a reduction in sound level or the ability to hear faint sounds and can be corrected

medically or surgically.

2- Sensorineural hearing loss (SNHL) occurs when there is damage to the inner ear(cochlea), or

to the nerve pathways from the inner ear to the brain. Sensorineural hearing loss is the most

common type of hearing loss and cannot be medically treated so far. Persons affected have

difficulties in hearing faint sounds even when the speech is loud enough.

Cause

1. Heredity - Some inherit this from their parents.

2. Congenital conditions- There are cases where people are born with a loss of hearing, this

mostly occurs in children born prematurely or those that are exposed to hazardous

environment while they are developing in the womb.

3. Presbycusis- This natural hearing loss due to aging, people gradually lose the ability to

hear high pitched sounds.

4. Acquired

a. Noise-induced hearing loss- Exposure to high levels of noise can cause this impairment.

b. Ototoxic drugs and chemicals- Reactions due to drugs and chemicals causes hearing loss in some.

c. Infection- infection in the ear due to bacteria or other reasons causes hearing loss.

Motivation

The main motivation to carry on with this project was due to the advantages that smart phones had as hearing aid.

The wide availability of smart phones was also a very strong motivation for success of the project.

Scope

The application is developed for people with hearing loss. The application is designed to be used on a temporary basis, and should not be considered a substitute for traditional hearing apps.

With this application we aim to provide its users with an improvement in their hearing ability.

Purpose

“Clip Handle”. This application works as a hearing aid. The application is intended for people with mild hearing impairment. This is the document for the first version of the application.

EXISTING SYSTEM

The figure below shows the findings of a research conducted by Paglialonga et al [4]. In this research there were five domains selected to classify the apps available on various application stores.

The domains chosen were:

- 1- Assistive Tools
- 2- Education and Information
- 3- Sound Enhancement
- 4- Rehabilitation
- 5- Hearing Testing

The results of their findings is shown in the figure below.

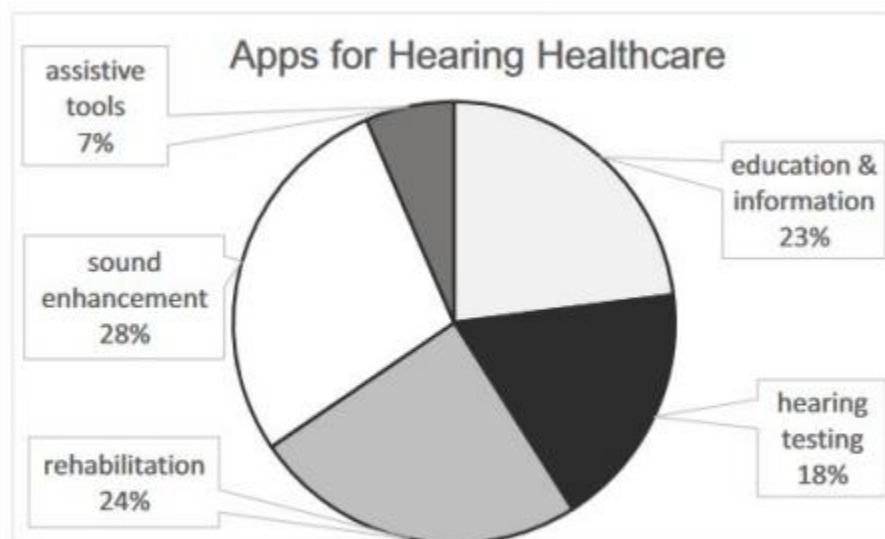


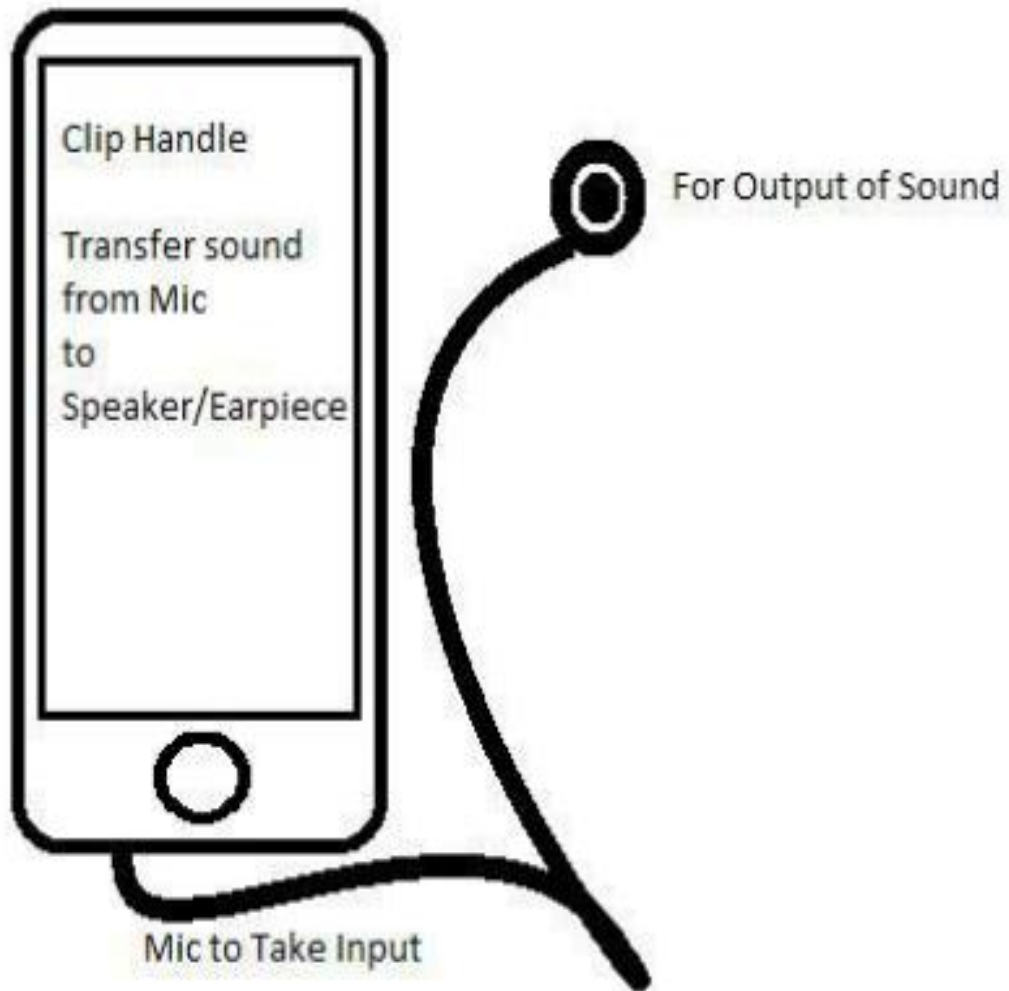
Figure 1. Distribution of the available apps for hearing healthcare (N = 200. As for Nov 5, 2014).

PROPOSED MODEL

The model we propose can be used on a temporary basis to mimic the functionality of a traditional hearing aid.

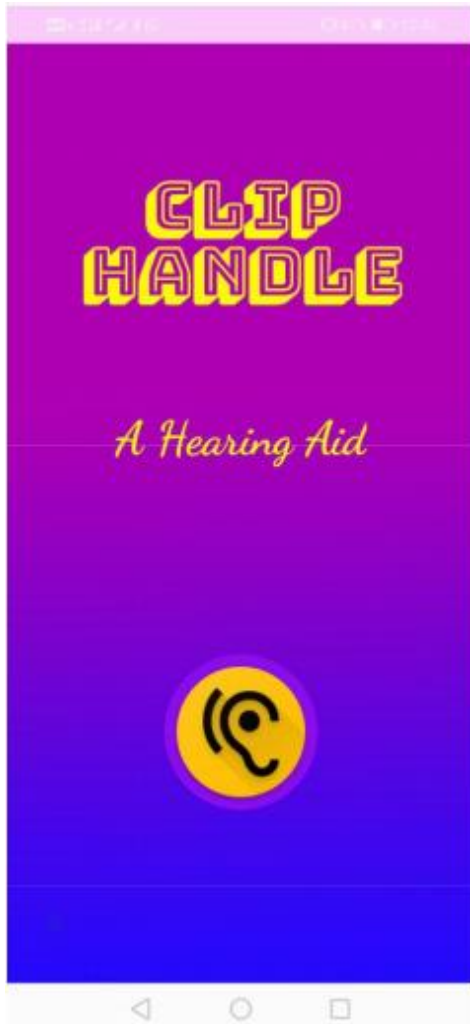
- The app would connect the mic to the speaker of the smart phone creating an audio loopback.
- The volume of the output can be controlled using the seek bar provided in the application or using the volume buttons.
- The user will receive the output through speaker or the output can be received through a earpiece.

Architectural Diagram

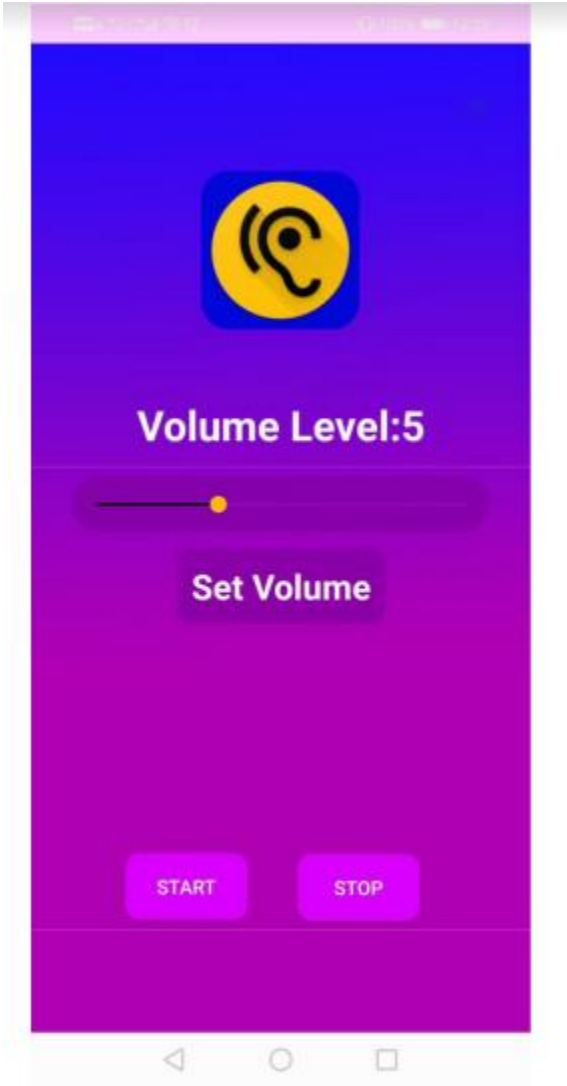


SCREENSHOTS

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RESULT

Emmy. M. Amlani et al[5] conducted a research to compare the workings of two mobile apps and a hearing aid. They used the apps and the hearing aid under various conditions and came to the following conclusion:

Results from this study indicate that the intended use of smartphone based hearing aid applications is to provide *temporary assistance* to individuals with hearing deficits.

It also pointed out that traditional hearing aids do not provide the user with the flexibility that apps have the ability to provide. It further went on to suggest that if traditional hearing aids are to improve such flexibility as volume control, pitch control need to be provided.

CONCLUSION

Further work can be done on this app to improve calibration.

Some other functionality that can be added are:

- Adjusting volume based on user hearing result.
- Calibrating app to match different user needs.
- Amplifying volume to be greater than the hardware support provided.
- Applying ML to improve app performance.

REFERENCES

[1]-Hearing in Mammals: The Least Weasel Rickye S. Heffner, Henry E. Heffner

Journal of Mammalogy, Volume 66, Issue 4, 29 November 1985, Pages 745–755

[2]-

https://www.who.int/medicines/areas/priority_medicines/BP6_21Hearing.pdf

[3]-<http://www.hearingreview.com/2014/01/utility-of-smartphone-based-hearing-aid-applications-as-a-substitute-to-traditional-hearing-aids/>

[4]- <https://person.hst.aau.dk/ska/MIE2015/Papers/SHTI210-0666.pdf>

[5]- Utility of Smartphone-based Hearing Aid Applications as a Substitute to Traditional Hearing Aids

Study suggests that a smartphone app provides adequate temporary/starter solution By Aryn M. Amlani, PhD; Brian Taylor, AuD; Charla Levy; and Rachel Robbins