

# Comprehensive Regarding Hearing Impairment using Smart Android Phone

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**Abstract:** This paper shows that the android phone can be used as the new educational tool for learning and also be used by hearing aid person. Android application has been developed using Android Studio where the user would get information regarding the hearing impairment, there are some feature of the application like generating spectrogram, spectrum analyser and time domain also additional feature like text to speech conversion and speech to text conversion for the hearing impaired person.

**Keywords:** Spectrogram, spectrum analyser, time domain, Android.

## I. INTRODUCTION

Hearing impairment or hearing loss is defined as partial or total inability to hear. It may occur by many factors such as genetics, age, exposure to noise, illness, chemicals and physical trauma. Hear test are conducted by doctor to determine the severity of hearing loss. Hearing loss is usually described as mild, mild-moderate, moderate, moderately severe, severe or profound. The severity of the hearing impairment is basically categorized based on the minimum sound that the person could hear with better ear. Higher the decibel the louder the sound[7].

- Mild hearing impairment: Sound ranging between 25 and 40 dB. In this the person cannot hear soft noises.
- Moderate hearing impairment: Sound ranging between 40 and 70 dB. In this the person face hearing problem for soft or moderate loud noises unless they use hearing aid.
- Severe hearing impairment: Sound ranging between 70 and 95dB. In this the person face problem for hearing most of the noises.
- Profound hearing impairment: Sound ranging between 90 dB and above. In the person may hear only very loud noises.

A spectrogram is defined as visual representation of the spectrum of frequencies in a sound with variation of time. They are also called as spectral waterfalls, voiceprints or voicegrams. They are extensively used in development in the fields of music, speech processing, sonar, etc. Spectrogram are usually formatted in two geometric dimensions where the horizontal axis represents time and the vertical axis represents frequency. In digital signal processing, spectrograms are generated where the calculation for the time signal is done using FFT. Time domain is known as the analysis of mathematical functions, physical signals or time series of environmental data with respect to time. Spectrum analysers are used for analysing frequency spectrum of audio signals. The FFT uses digital signal processing techniques for analysing a waveform with the help of Fourier transforms.

Android phones are used by most of people around the world[1], so with the help of it new devices would be created for hearing impaired people. It is continuously

pushing the boundaries of hardware and software forward to bring new capabilities to users. It also gives us everything, needed to build best-in-class app experiences. It gives a single application model that deploys your apps. The objective of this paper is to demonstrate that the smart phone are used to share information and is also used as an educational tool. The software supporting the above platform is android studio. Android Studio is new software developed by Google to generate android app. Java language is basic platform for app creation. This app is only created for android smartphones. The main advantage of using Android Studio instead of Eclipse is that it have Maven-based build dependencies, Build variants and multiple-APK generation and advance android code completion and refactoring.

## II. LITERATURE SURVEY

*A. An educational platform to demonstrate speech processing techniques on Android based smart phones and tablets[1].*

In this paper, there the use of integrating theory and practically applying it on smart phone. The application which is presented in this paper is called as "Speech Enhancement for Android" allowing to interact with surrounding environment which is done by recording and processing the speech of the user.

*B. Phoneme-Based Self Hearing Assessment on a Smartphone[4].*

In this paper, it shows that self-hearing assessment could be done using new smart phone. The author conducted test on different subject having different hearing loss. It was found to be sufficiently reliable to determine hearing threshold of the subject.

*C. Implementation and verification of a Platform for Bluetooth Linked Hearing Aids System with Smart Phone and Multimedia Devices[3].*

In this paper, the author designed and implemented a hearing aids using open platform which combines smart phone and other devices using Bluetooth for binaural hearing aids. Author also developed GUI using android for

controlling volume and different parameters for hearing aid.

**D. A Sliding-band Dynamic Range Compression for use in Hearing Aids[5].**

In this paper, the author discuss about the sensorineural hearing loss. In this paper dynamic range compression technique is used to reduce the hearing loss. For applying the technique frequency dependent gain function was calculated based on different parameters like compression ratios, attack time, and release time. The technique was successfully implemented and tested with satisfactory real time operation.

**E. Android based sound detection application for hearing impaired using ADABOOSTM1 classifier with REPTree Weaklearner[6].**

In this paper, the author developed an application named AudiTion which helped the hearing impaired person for detecting sound and recognizing the surrounding sound. AdaBoostM1 is an algorithm for boosting method. Testing were done on four environment condition to determine the sound predication accuracy level. It has two sound database, first was for indoor sound and the second one was for outdoor.

**III.TYPES OF HEARING LOSS**

**Conductive hearing loss:** The problems occurs in the outer ear, middle ear, ear canal, eardrum, because of tiny bones in the middle ear. Conductive hearing loss occurs if sound is not being conducted properly through the ear. It can be corrected by medically or surgically.

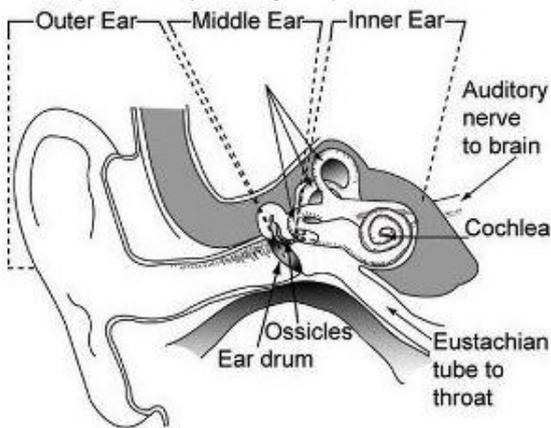


Figure 1: Outer, Middle and inner ear

**Sensorineural hearing loss (SNHL):** Also known as nerve hearing loss, which occurs if there is damage in the auditory nerve or the cochlea, which is the inner ear. The hearing loss is permanent, although it might be possible to treat it with hearing aids[7].

**Mixed hearing loss:** If person is having both conductive hearing loss and SNHL at the same time, that hearing loss is known as mixed hearing loss. It occurs if there is damage both to the outer or middle ear and damage to the inner ear.

When there are problems within the brain that interfere with the ability to interpret or understand sounds that is

known as Central hearing loss. This type of hearing impairment are rare and the hard to treat.

**IV.SYSTEM DESIGN**

The Figure 2 shows the block diagram illustrating the functionality of the interactive elements. Different blocks have different function. Based upon the user block is been executed. When the user selects the spectrum analyser function, there would be real time display of the speech spectrum on android phone display.

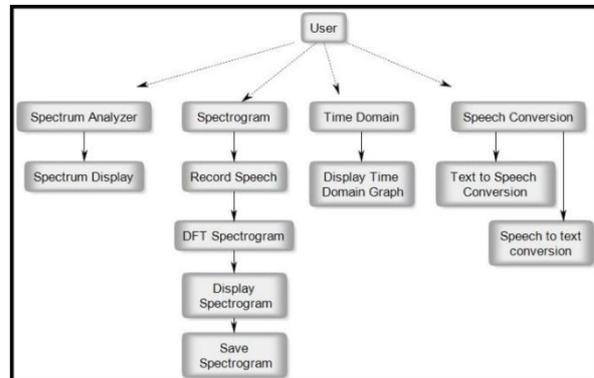


Figure 2: Block diagram illustrating the functionality of the interactive elements.

If the spectrogram function is selected, the speech of the user would be recorded, processed using digital signal processing and the later on spectrogram is generated and shown on android phone display. The spectrogram generated could also be saved if the user want to use latter on. When the time domain function is been selected, the speech of the user would be processed and there would be real time display of time domain on the android phone display. If the user has selected the speech conversion function, this function would also be used by the person who is having hearing impairment. There are two features in speech conversion, first is text to speech conversion. In this the user could write which would be played through their android phone. The second feature is speech to text conversion, in this the recorded speech would be converted in the text format and the text is displayed on the android phone screen.

**V. HARDWARE AND SOFTWARE SYSTEM DESIGN**

The hardware required for this system is android smart phone and the software required for this system is android studio

**A. Android smart phone**

Android is most widely used smartphone OS. It is user friendly, easy to use, open source to create any application as per requirement.

**B. Android studio**

Android Studio is new software developed by ‘Google’ to generate android app. Java language is basic platform for app creation. This app is only created for android smartphones. The main advantage of using Android Studio instead of Eclipse is that it have Maven-based build dependencies, Build variants and multiple-APK generation and advance android code completion and refactoring.

## VI. RESULTS AND DISCUSSION

We develop an android application using android studio. Figure 3 shows the screen shot of the android application.



Figure 3.A



Figure 3.B

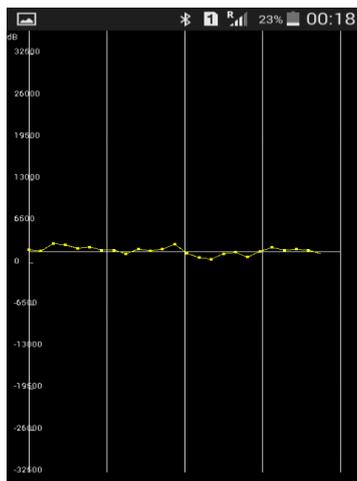


Figure 3.C

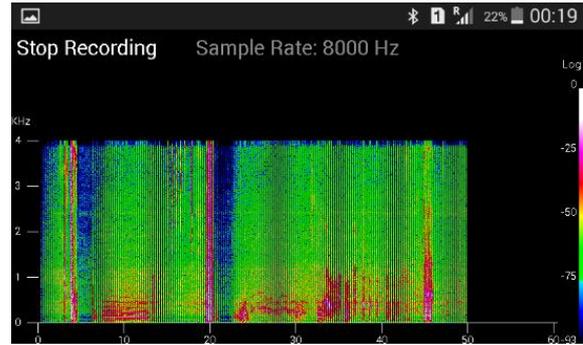


Figure 3.D

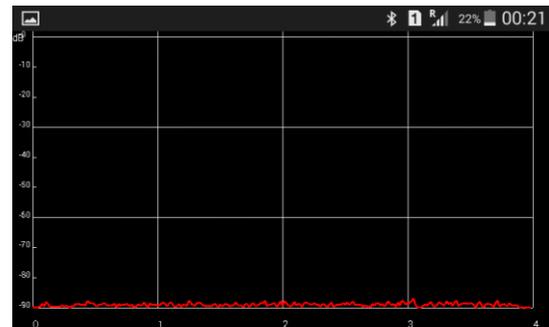


Figure 3.E

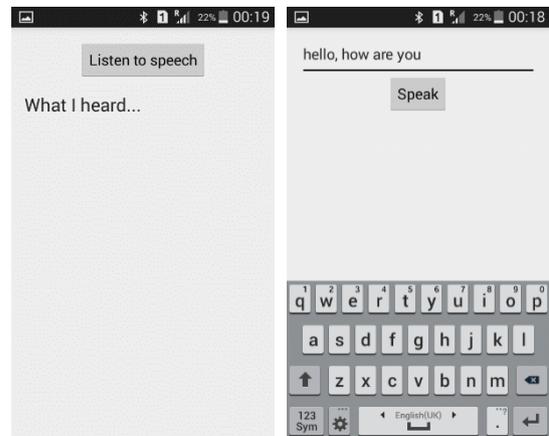


Figure 3.F

Figure 3.G

Figure 3.A home page, 3.B different function of application, 3.C time domain, 3.D spectrogram, 3.E spectrum analyser, 3.F speech to text, 3.G text to speech

## VII. CONCLUSION

The system is implemented using android studio. Smart phone devices are becoming readily available to most of the people. This paper has suggested the use of smart phone as educational tool for the hearing impairment. And it also shows that the android phone could be used as hearing aid for the hearing impaired person. The spectrogram, time domain and spectrum analyser is generated in real time using FFT. There is no need of extra hardware for the signal processing

## REFERENCES

1. R.Chappel , K.Paliwal, "An educational platform to dem onstrate speech processing techniques on Android based smart phones and tablets" Speech Communication, pp.13-38, August 2013.

2. Yeou-Jiunn Chen, Chia-Jui Chang, Jiunn-Liang Wu, Yi-Hui Lin, Hui-Mei Yang, " *Handheld Device Based Personal Auditory Training System to Hearing loss*" IEEE Symposium on Computational Intelligence in Rehabilitation and assistive Technologies(CIRAT), pp.19-23, 2013.
3. Dong-Wook Kim, Eui-Sung Jung, Ki-Woong Seong, Jyung-Hyun Lee, Jin-Ho Cho " *Implementation and Verification of a platform for Bluetooth Linked Hearing Aids System with Smart Phone and Multimedia Devices*" IEEE International Conference on Consumer Electronics(ICCE), pp. 354-355, 2013.
4. Jong Min Choi, Junil Sohn, Yunseo Ku, Dongwook Kim, Junghal Lee, " *Phoneme- Based Self Hearing Assessment on a Smartphone*" IEEE Journal of Biomedical and health informatics, vol. 17, NO. 3, May 2013
5. Nitya Tiwari, Prem C. Pandey, " *A Sliding- band Dynamic Range Compression for Use in Hearing Aids*" IEEE National Program on Perception Engineering, 2014
6. Ayu Indah Shekar Melati, Kanisius Karyono, " *Android based Sound detection application for hearing- impaired using ADABOOSTM1 classifier with REPTree weaklearner*" IEEE Asia-Pacific Conference on computer aided system engineering, 2014
7. <http://study.com/academy/lesson/what-is-hearing-impairment-definition-causes-treatment.html>

### BIOGRAPHIES



Miralkumar Surati received the B.Tech. degree in Electronics and Telecommunication Engineering from U.V.Patel College of Engineering, Mehsana, India in 2013 and is currently pursuing the M.E. degree in VLSI and Embedded systems from MIT College of Engineering, Pune, completing project based on FPGA.



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