Self-Assessment of Hearing System for Impaired People with Fast Audiometric Method

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Abstract- Ear is an important part of our body since it is one among the sense organs, without which it is difficult to lead a life as a normal human being. Audiometric system is a system where a person can examine themselves at their convenience. Audiometric system is efficient, less time consuming, accurate, involves multiple types of testing, has Standard sound recognition and Pure tone frequencies. Experimental results show Frequency and Decibel range, simplified Audiometric graph and Pictorial representation.

Keywords – Audiometric system, Hearing impaired, Hearing loss, Self-assessment, Standard sound recognition, Audiometric graph,

I. INTRODUCTION

As there are different causes for hearing loss, it can be due to hereditary, aging factor, excessive noise, effects of ototoxic medications, injuries, infection and there are people who are suffering right from their birth. They can examine themselves using the Audiometric system. This introduces the Self-assessment system for hearing impaired, where impaired can test themselves to know their degree of hearing loss. Usually, hearing impaired has to go through several medical procedures, one of the major procedures is Audiology. Thus, this system helps to analyze themselves and further proceed accordingly with obtained Audiometric graph.
The rest of the paper is organized as follows. Proposed Hardware system and developed software are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

II. PROPOSED METHOD

2.1 Audiometric system-

To generate pure tone signals at particular frequencies that range from 250Hz to 8000 kHz, the Audiometer is used. To every frequency level, the amount of volume is incremented from soft to loud. During this phase, the patient is requested to retort at a degree where the patient starts hearing the tone, which represents the patient's hearing level at that frequency. The corresponding result is designed as an audiogram that will be illuminated by health experts to come to a decision of what appropriate actions to be taken. The weakest tone heard at a particular frequency is that the audible range in decibels dB for that specific frequency. This is considered as a relevant rate, the intensity reference is audiometric 0, which correlate with average hearing response of a group of 18-25 years old with no otologic pathology. Together with frequencies, the sensitivity of normal ear varies. Thus, the different frequencies of different levels of sound pressure are represented.

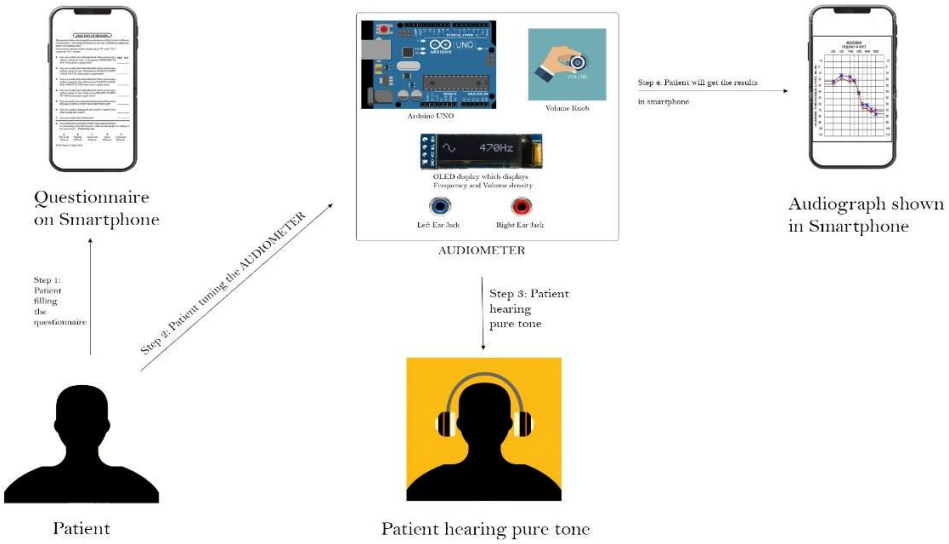


Figure 1. Block diagram of Audiometric System

2.2. Hardware Section –

The components used in this project model include Arduino UNO Atmega-32, Node MCU, Knob (potential divider), Female Jack, well-equipped earphones with a good amount of noise cancellation, LCD, Power Supply, Resistor. Software is fed to Arduino to increase the value if the volume is too high. LCD displays the necessary frequency range. And here we use two potentiometers, one for setting the frequency and another to increase the volume or sound. And sending the data to a server by using a WIFI module which is Node MCU and displaying the graph in the Android application.

The hardware section comprises an Arduino where sound frequencies of a certain range are fed to it. The knob is used to tune the volume. Then earphones are connected to the jack, where the sound can be heard by a person. LCD displays the frequencies and decibels where the person can monitor the sound levels. Then by using the WIFI module the frequency is sent to the server to display the graph.

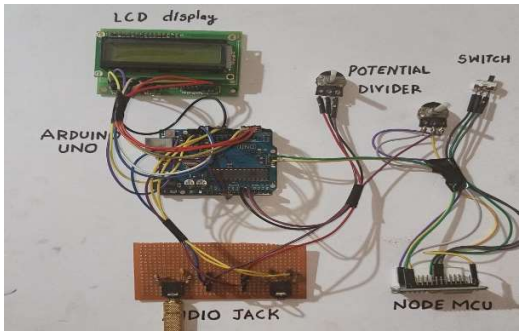


Figure 2. Components used in hardware section

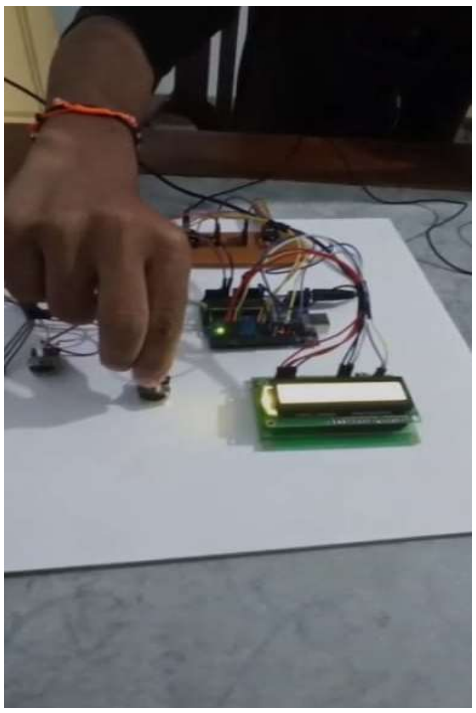
2.3. Software Section –

The software section comprises of smartphone which has an application that displays questionnaire, user-friendly audio graph, and frequency range.

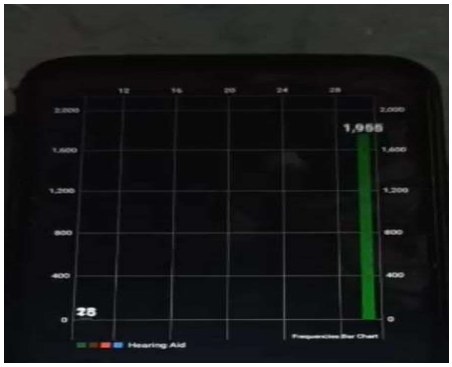
III. Experiment and Result

The patient needs to fill the questionnaire in the android application where the person will be listing out their previous hearing problem and they'll also be filling their personal details like Name, Contact number, Address, and E-mail ID. Decibel and frequency ranges are displayed in LCD which allows the patient to monitor themselves. When the patient switches on the patient response button, they will be able to see the audiometric graph in the smartphone (android application). After obtaining the audiometric graph, the patient analyses themselves while looking at the pictorial representation. The patient analyses whether hearing capability is normal or is the patient experiencing as light, mild, moderate, moderately severe, severe, or profound hearing loss while looking at the simplified pictorial representation. The patient's information and the problem will be stored on the server for further analysis. The patient is examined to each ear to ensure correctness for the reason that one ear may be worse than the other ear. The pure-tone frequency testing and therefore the bone conduction testing stand almost similar kind of tests. Here, pure-tone testing is being conducted and pure tones are presented to the patient's ear through earphones and therefore the patient responds once they hear the pure-tone frequencies. There remains an oscillator which is employed to tune the frequencies which is how the sound is presented to patient's ear. The oscillator vibrates and directs the pure tone frequencies on to the Cochlea, evading to the outer and the middle ear. In air-conduction testing, an auditory sensation of pure tone is presented via an earphone. In typical audiometric testing, pure tones that range from 250 to 8000 Hz are presented to the listener by headphones or in-ear earphones. Audiometric levels are measured in decibels relative to population normative values (0 dB hearing level (HL). Hearing levels that fall within the 0–20-dB range are considered normal. Hearing loss may be termed as mild hearing loss ranges from 20–40 dB, moderate ranges from 40–60 dB, severe ranges from 60–90 dB, and profound ranges above 90 db. If the patient is suffering from any of the above-mentioned hearing loss except if the result is Normal, we suggest the patient to opt hearing aid or any other alternative method to treat their hearing loss.

(a)



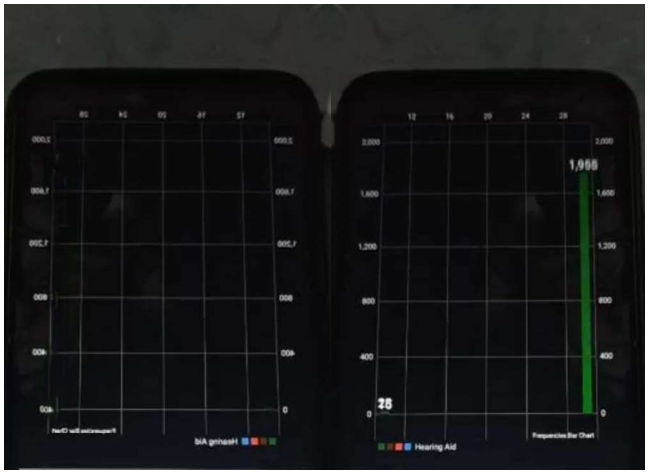
(b)



(c) (d)

Figure 3. (a) Questionnarie(Patients personal details) (b) Adjusting frequencies and decibels (c) LCD showing the adjusted values (d) Final obtained audiometric graph

(a) (b)



(c) (d)

Figure 4. (a) LCD display before adjusting the frequency and decibel (b) LCD display after adjusting the frequency and decibel (c) Graph befpre obtaining the output (d) Graph after obtaining the otput

Table -1 Table explaining different types of hearing loss

Frequency	Decibels	Type of hearing loss	Color representation
250	0- 15	Normal	Green
500	15- 25	Slight	Brown
1000	25- 40	Mild	Yellow
2000	40- 55	Moderate	Red
3000	55- 70	Moderately-Severe	Blue
4000	70- 90	Severe	Violet
8000	90-110	Profound	Pink

Table 1 shows the different ranges of frequencies and decibels which results the type of hearing loss accordingly as mentioned above. The color representation shows the type of hearing loss a person is suffering which is displayed in the android application which is only for an individual reference.

IV.CONCLUSION

The proposed audiometric system is a portable, low cost and efficient device which will make the hearing impaired understand how to assess the system on their own. The major outcome of this project is to assist the patient in identifying their hearing capability. This system mainly focuses on elderly and physically challenged people, in the meantime they are the one who are suffering from hearing loss due to several reasons. This technological solution can be implemented for their own comfort for the real time performance.

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