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HEARING IMPAIRED ALERTER

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I. ABSTRACT

Deafness is the inability to detect sounds .Total deafness is a condition when a person cannot detect any of the audible sound frequencies between 20 Hz to 20,000 Hz. Normal Hearing aids won't work efficiently for them. It also leads to body imbalance. Traditional analog hearing aids are similar to a simple radio. They can tune and adjusted for volume, bass etc. But hearing loss is not a technical loss of volume. The traditional hearing aid amplifies the sound signal. But it is not efficient for the totally deaf persons. A complete deaf person needs a new way for alerting him apart from the existing hearing aid devices .The present work deals with a way to overcome the conductive to senso-neural forms of hearing loss. This project aims at converting sound waves to light. This device works by picking up sound waves using a condenser microphone. Condenser microphone acts as the sensing device. Eight LED lights are used to indicate different range of sound frequencies. This could be the one of the easiest, low cost and simplest way to alert a person who is completely deaf.

Keywords: Alerter, Deafness, Hearing Impaired, Hearing Lose, LED.

II. INTRODUCTION

The awareness about the fact that the early treatment for hearing loss can help them to overcome it to a great extent. Hearing loss people delay in decision making due to the above reason. From the research study conducted by National Council on the Aging, It is estimated that more than 2000 people have hearing impairment which could be improved by using a hearing aid so that they can improve socially emotionally and even psychologically. There are different forms of hearing loss, they are mainly due to body aging process or long term cumulative exposure of the ear to sound energy. As a person gets older it becomes more difficult to hear ,the ears will become less sensitive to sound ,less precise and even less effective as a speech processor. For different individuals loss of hearing varies greatly. Gradually over time there will be changes happening in the ear and it is estimated that approximately 30 to 50 sensory cells present in the inner ear suffer from irreparable structural damage or they are found missing. So, during these conditions there is only one choice for the individuals that are to wear a hearing aid. Hearing aids which are available locally consume more battery power continuously and they have a very complex circuit and design. Hearing aids are available mainly in four styles. Behind The Ear (BTE), In the Ear (ITE), body, eyeglass. In The Canal (ITC), completely in the Canal (CIC), are the categories of the ITE hearing aids. Whereas Eyeglass and body style hearing aids were used ago 50 years .Now only one percentage of the market promote eyeglass and body. Presently most of the individuals go for ITE or BTE style hearing aid. The reason is that it is transition in style, use, small size of the component and even cosmetic concerns. From the part of the consumer all the above mentioned hearing aids are applicable only for deaf person. Hearing Impaired Alerter is specially

developed for a person who is completely deaf. This hearing impaired alerter works by converting acoustic signals to light signals. Sound signals are picked up by a transducer. The transducer used here is condenser microphone which converts sound signals to electrical signals. The first signal amplification is done with the help of a preamplifier, which amplifies weak signals from the condenser mike. Signal from the amplifier is passed to a comparator from which signals are transferred to respective LED.

The human ear consists of three portions, internal ear, external ear and middle ear. Outer ear is called pinna it is a rigid cartilage covered with skin. Sound funnels are extended from the pinna into the external auditory canal which short tube at the ear drum. The ear drum and the tiny bones present in the middle portions of the ear vibrate due to sound. Cochlea conducts vibrations. Cochlea is a spiral shaped part of inner ear that transforms sound into nerve impulses which will travel to the brain. The information is send by a semi-circular canal (labyrinth). If there is any sudden change in pressure that is if the middle ear pressure is not same as that of the outside pressure. This will cause eardrum to bulge and make it less able for transmitting vibrations resulting temporary hearing problem. This condition can be reversed or equalized during the time of swallowing.

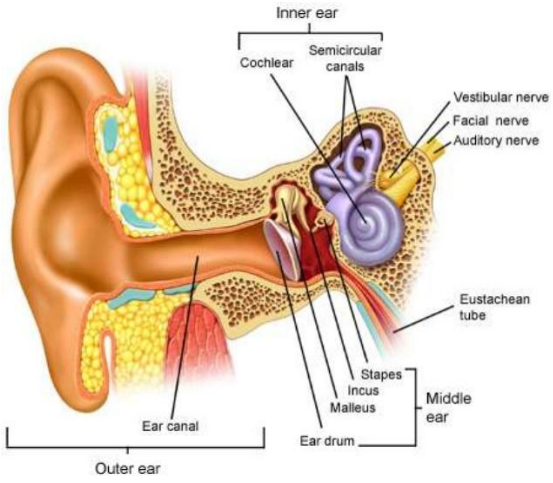

Fig 2.1 Structure of the ear

Hearing impairment or difficulty in hearing is a condition when individuals are partially or impartially unable to perceive sound when the members of their same species can. Conductive hearing impairment is a result from dysfunction in the conduction of sound waves to the outer ear, bones of the middle ear and ear drum. Conductive hearing loss is a non-permanent one that affect only outer and middle ear. Some causes of conductive hearing loss include impacted ear wax, foreign objects in the ear canal, ear infections or a break in the ossicular chain in the middle ear. Most conductive hearing losses can be treated by a medical doctor. A lesion can occur in the inner ear or on the VIII nerve resulting in a sensorineural hearing loss. This type of hearing loss is permanent and irreversible. In a true sensorineural impairment, the outer and middle ears remain unaffected; therefore, sound is transferred through these areas. When sound reaches the inner ear that the hearing loss starts. Damage to the structures involved in a sensorineural hearing loss can be due to the exposure to very loud sounds, congenital abnormalities, tumors, and infectious diseases. Eighty percent of individuals, who have hearing loss, have this type of non-treatable hearing loss. A hearing loss can occur that has two

component which are conductive component and a sensorineural component. A permanent hearing impairment in the inner ear is present in conjunction with some blockage in the transmission of sound in the outer or in the middle ear. A good example of a mixed hearing loss is a child who has a congenital sensorineural hearing loss with an infection in the middle ear. In this case the middle ear infection can be treated but the congenital component remains is permanent. A person with a profound hearing loss is typically described as deaf. Many individuals with profound hearing loss will not be benefited from hearing aid use for the purpose of hearing speech. Some individuals may use hearing aids to hear loud and environmental sounds. Some individuals with profound hearing loss may have cochlear implants. That device is implanted into the head. A signal processor is worn generally on the body and transmits electrical pulses to the internal device. The internal device stimulates the nerve for hearing. The individual no longer hears sound like a person with normal hearing or a person with a hearing aid. Many hearing impaired people become very good at understanding speech using cochlear implants. Cochlear implants can be coupled to assistive listening devices just as hearing aids work. Some individuals with profound hearing impairment will use sign language as their primary mode of communication and will not be needed sound anymore. A person with a profound hearing loss is typically described as deaf. Many individuals with profound hearing loss will not be benefited from hearing aid use for the purpose of hearing speech. Some individuals may use hearing aids to hear loud and environmental sounds. Some individuals with profound hearing loss may have cochlear implants. That device is implanted into the head. A signal processor is worn generally on the body and transmits electrical pulses to the internal device. The internal device stimulates the nerve for hearing. The individual no longer hears sound like a person with normal hearing or a person with a hearing aid. Many hearing impaired people become very good at understanding speech using cochlear implants. Cochlear implants can be coupled to assistive listening devices just as hearing aids work. Some individuals with profound hearing impairment will use sign language as their primary mode of communication and will not be needed sound anymore.

III. LITERATURE RIVIEW

In the year 2013 M.A.A. Mashud, Monika Bishwas et.al designed a low power consumption smart hearing aid in which the battery run continuously once they are switched on. A ‘C’ program was developed for the working of the microcontroller [2]. In 2014 Sudip et al. developed a low cost hearing aid with additional features. Compared to other types it has two modules one is for the hearing aid with receiver circuit for wireless doorbell vibrator system. As well as torch light facility and low battery indication. Second is the transmitting module which is used for doorbell vibrator system [3].In 2012 Ankit et. Al did a study about how a digitized counterpart scores over the obsolete ones and also how measures can be incorporated to effectively utilize the frequency spectrum in order to curb the hearing impairment density across the world. Several simulations were carried out over a cochlear prosthesis simulator and results on a comparative basis were also tabulated. This adaptive digitization in the implementation of cochlear hearing-aids possesses good future potential [4].In 2017 Navin Ghamry et.al this paper presents a PIC based microcontroller automatic gain system which uses a wavelet transform digital processing unit, according to the noise it can the microcontroller can send control signal to the digital volume controller to adjust the volume level in real time. [10].In 2014 S B Shrote, et .al did study about communication between deaf and normal persons. It facilitate impaired people by means of a glove based deaf- mute communication interpreter system. Hand gestures are used here as the

medium of communication [5], and in 2013 Yusuf M.A et.al , developed a small gadget to wear behind the ear by which acoustic signals are picked up using condenser microphone. TDA 2822M IC is used here for audio amplification that converts audio signal to headphone.[6].In 2014 Domtau D.L, et.al designed and constructed a device that amplify people with hearing loss. This device was realized with environment considerations so that it will be cost-effective and could be made readily available and with easy maintenance [7].

VI. PROPOSED WORK

Acoustic signals are picked up using a condenser microphone. Condenser microphone converts sound to electrical signals. The electrical signals are passed to a preamplifier .First level amplification is done in preamplifier. Preamplifier removes the noise and interference from the signal. It also provides voltage gain for the signal. This signal is fed onto an operational amplifier for further amplification as they are weak. Op-amp amplifies weak electrical current to a common level. Comparators rectify any variations in signals to a fixed level. Analog to digital conversion of the signals is done using a comparator. Comparator is connected to an LED array. The output of the device is shown as a visual indication in the form of light. Reference is used for different voltages. It's obtained by using a voltage divider. It ideally produces a fixed voltage irrespective of the loading on the device, power supply variations. The device uses a power supply of 9 volt .Power supply is given to the preamplifier, operational amplifier and comparator of the device.

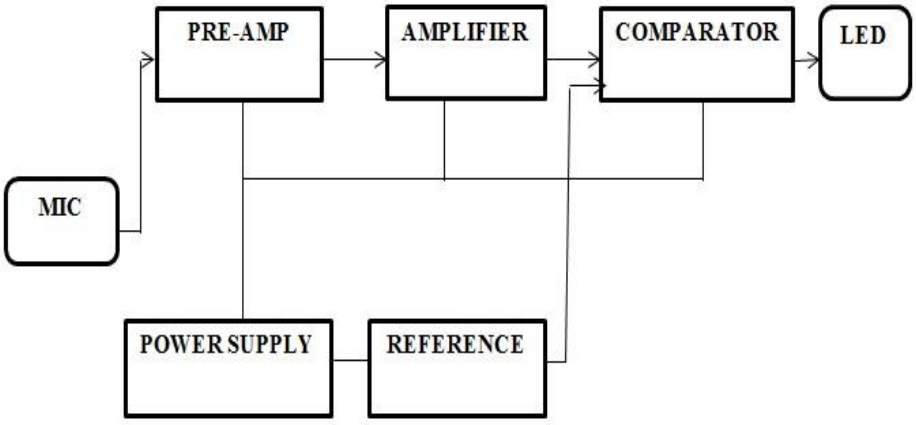

Fig 4.1 Block diagram of hearing impaired alerter

The sound signals are captured using a condenser microphone. The condenser microphone works as the transducer. It converts the sound energy into the form of electrical signals. Signal conversion is the function a condenser mike. These signals will be weak and full of noise and distortions. So, they have to be amplified for removing noise. First level amplification is done at the preamplifier.QN3904 is the transistor used in this device. It is a bipolar Junction npn Transistor. It has three terminals which are base, emitter and collector respectively. The base of the transistor is connected to a capacitor value of 1uf.The emitter is connected to a 1k resistor and finally the collector shows joint connection with a capacitor and resistor. It is given with a power supply of 9 volt battery. But this signals lack the signal strength. As a result we have to further amplify them.

The weak signals are converted to a common level using the preamplifier. At the preamplifier lower signals are being converted to a higher one. The output of the preamplifier circuit is grounded. The signals from this circuit needs to be amplified further for increasing the strength of the signals. This amplification is done using LM741 IC. It is an operational amplifier. The main connections are taken from the second, third, fourth pin of the I.e. use two 1k resistors for this in which, it shares the connection with the second, third and sixth pin of the IC.

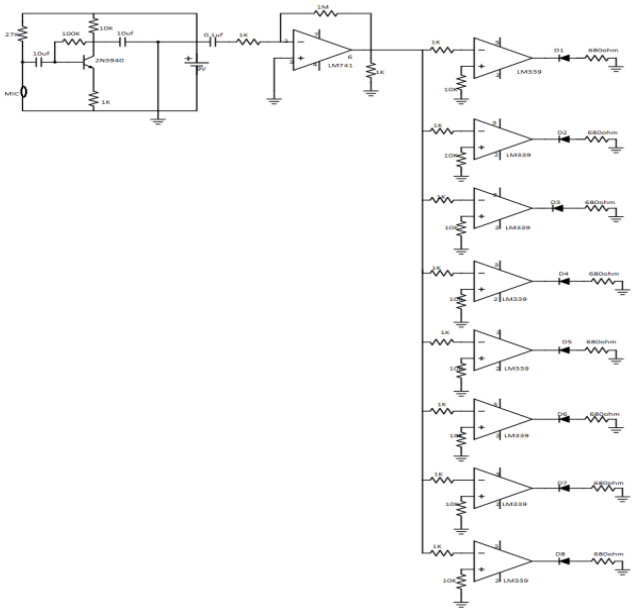

Fig 4.2 Circuit diagram of Hearing impaired alerter

The sixth pin is having a joint connection, with 1M resistor and 1k resistor. Here the output is generated from the seventh pin. The whole level of amplification is done in this amplifier part. This amplifier also provides overload protection for the both input and the output. The output signals are again fed on to the comparator. Comparator used here is Quad comparator. Quad comparators are generally single channel comparators. LM 339 is the comparator that is used here. This circuit uses 2 LM339 IC. One IC will be holding four comparators with it On account to the additional IC we are using eight comparators here. This 8 comparator have a specific function of detecting different range of the sound frequencies. Every eight comparators are having connection with the LED lights .This LED light measures the amount of current that is flowing through them. It therefore produces the light according to the different range of frequencies. Comparator is connected with a 9 volt battery. Both the preamplifier and comparator is using 9 volt IC. The whole circuit obtains the power from 9 volt battery.

IV. RESULT AND DISCUSSION

We have developed a hearing impaired alerter for the complete deaf people. This device alerts in the form of visual indications. The presently used or commonly existing hearing aid system has wide range of forms ranging from cochlear implant to normal hearing aid. They all lack the feature for alerting a totally deaf person.

Adding to this fact, they have enormous drawback like, they have to be surgically implanted or replaced frequently and are not suitable for all forms of hearing loss. So, emphasizing on this problem, we have developed a low cost hearing aid alert device which works by converting acoustical form of energy to light energy. With the help of this device a profound deaf can receive better assistance at a very low cost rate. The main advantage of using this system is that anybody could afford to use and enjoy the benefit. The device uses eight LED light, which shows light on detecting the various frequencies of sound.

When a complete deaf use a normal hearing aid he will be unable to hear any of the sound. This is because normal hearing aids have only the function of amplifying the low signals to higher signals. A hundred percent deaf needs a way different from this. We have developed a device that could convert sound in the form of light, which is shown by the LED. Visual indications are easiest way of alerting the profound deaf. This light now varies according to different intensity of sound. This is just an initial step. We are adding advanced feature like voice recognition module along with the feature of vibration. This hearing impaired alerter will ease the burden of the deaf, and supports them.

FREQUENCY IN (dB)	LIGHT INDICATION
20 dB to 40 dB	Green
41dB to 55dB	Yellow
56 dB to 57 dB	Blue
71db to 90 dB	Red

Table 5.1 Different frequencies and light indication

Different range of sound frequencies is shown by the green, red, yellow and blue lights. Normal audible sound frequencies are from 20 Hz to 20000 Hz. This range is shown by using LED lights. Mild frequencies between 20 dB to 40 dB are indicated by green light .The comparator used, measures the frequency of sound coming and that is passed to the green LED .The 41dB to 55dB of sound is shown by a yellow light. Moderately severe sound between 56 dB to 57 dB is shown as blue a light. For severe sound of 71db to 90 dB red light will be on. Comparator used in the device measures the amount of frequencies of sound and pass them on to the respective LED .This is how different ranges of the sound intensities are shown as visual indication on this device. The developed hearing impaired alerter system is used for complete deaf persons. This device uses LED indication for alerting. With numerous forms of hearing impairment appearing in human beings, at some stage of life or the other, there is an indispensable need for hearing aids. Demand is for smaller, cheaper, robust and user-friendly too .Most systems that have been developed so far lack the feature for alerting the total deaf person. For further improvement, it is recommended that a Voice Recognition module is designed and integrated along with this device. They are hardware device with the ability to decode the human voice and have the ability to receive and interpret dictation, or to understand and carry out spoken commands. This could

be the work that is going to be implemented on this hearing impaired alerter. This developed device could be an easiest and low cost way that can be used. It could help people with profound deafness or complete hearing impairment. Hearing impaired alerter works for the person who is completely deaf person. The profound persons are the one who cannot detect any of the sound frequency between 20 to 2000 Hz. The normal hearing aid won't efficiently work for the person who is completely deaf or profound deaf. The voice are detected by the conductor microphone .They haven't detect any sound. so we are developed a low cost hearing impaired alerter . The microphone that convert the acoustic signal to the electrical signal. The electrical signal is amplified by using an amplifier. Hearing aid won't efficiently for them.

VI. CONCLUSION

The developed hearing impaired alerter system is used for complete deaf persons. This device uses LED indication for alerting. With numerous forms of hearing impairment appearing in human beings, at some stage of life or the other, there is an indispensable need for hearing aids. Demand is for smaller, cheaper, robust and user-friendly too .Most systems that have been developed so far lack the feature for alerting the total deaf person. For further improvement, it is recommended that a Voice Recognition module is designed and integrated along with this device. They are hardware device with the ability to decode the human voice and have the ability to receive and interpret dictation, or to understand and carry out spoken commands. This could be the work that is going to be implemented on this hearing impaired alerter. This developed device could be an easiest and low cost way that can be used. It could help people with profound deafness or complete hearing impairment.

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