HEARING AID BASED ON OP-AMP

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Abstract: Many people lose their hearing power because of old age or due to hearing loud music or because of any another reason. In order to amplify the weak signals they can use this circuit which is used to enhance the weak signals as similar to common audio amplifier. In the early 17th century ear trumpets were designed and was further modified in the 18th century but drastically changed after the invention of the telephone. In this project, we developed noise reduction, frequency, and amplitude filters for a configurable super hearing aid. The circuit consists of resistors, capacitors, op amp and a headphone. The circuit begins with a mike connected to a resistor which leads the signal to the op amp through the capacitor. The output can be obtained through the headphone.

Keywords: Hearing Aids, OP-Amp.

I. INTRODUCTION
Hearing aid refers to the relative change in performance on a particular measure between the aided and non-aided listening. A number of studies in the recent years has shown that the hearing aid benefits increases over the time after the initial fitting.[1-3] About 10% of the world’s population suffers from hearing loss. For these individuals, the most common amplification choice is hearing aids. The first hearing aid was created in the 17th century. The movement toward modern hearing aids began with the creation of the telephone as people can alter the various features of the acoustic signal which were later applied in the hearing aid. Moreover it was further developed after the development of the transmitter, carbon microphone and the computer technology. At present digital hearing aids is the preferred intervention when a patient has a hearing loss with the various exceptions. With the advances in digital chip designs and the reduction in current consumption, many of the historically unachievable concepts have now been put into practice.[4-10]

II. MATERIAL AND METHODOLOGY

In the conventional analog hearing aids, the acoustic signal is picked up by the microphone and converted to an electric signal. The level and the frequency response of the microphone output is then altered by a set of analog filters and the signal sent to the receiver.[11-14] The signal of the analog hearing aids remains continuous throughout the signal processing path. Various electrical components along with headphone and microphone are used.[15-19]

(i) Resistors
Various resistors of value 2.7m, 1k and 5.6k are used. The resistors here are used to determine the amplification of op-amp and also act as a voltage divider when connected to the op-amp to give a reference to the half the voltage as two same valued resistors are connected at a node from positive and negative charge. The difference in values between the resistors must not be high as it affects the output of the circuit.[20-26]

![Fig. 1: Resistors](image)

(ii) Capacitors
Capacitors are one of the most fundamental passive components in the electric circuit. The
most common use of the capacitors are to store the charges but the connection in the circuit is made in order to filter the electric signal from dc to ac.[27]

Fig. 2: Capacitors

(iii) Op-Amp

The TL072 operational amplifier family is designed to offer a wider selection than any previously developed operational amplifier family.

Some of the general characteristics of the op-amp are:

- Low Power Consumption
- Common-Mode Input Voltage Range Includes VCC.
- High Slew Rate: 13 V/µs Typical.
- Low Input Bias and Offset Currents.
- Output Short-Circuit Protection.
- Wide Common-Mode and Differential Voltage Ranges.

Fig. 3: TL072 Op-Amp

(iv) Electrode Microphone

Several different types of microphone are in use, which employ different methods to convert the air pressure variations of a sound wave to an electrical signal. [28-32] The most common are the dynamic microphone, which uses a coil of wire suspended in a magnetic field; the condenser microphone, which uses the vibrating diaphragm as a capacitor plate. The microphone used in the circuit is of dynamic type where a small movable induction coil is positioned in the magnetic field of a permanent magnet attached to the diaphragm. When sound enters through the windscreens of the microphone, the sound wave moves the diaphragm. When the diaphragm vibrates, the coil moves in the magnetic field, producing a varying current in the coil through electromagnetic induction.

Fig. 4: Electrode Microphone

(v) Headphone

Headphones were originated from the earpiece and were the only way to listen to electrical audio signals before amplifiers were developed. The headphone was used to hear the amplified output signal.[33-39]

Fig. 5: Headphone

III. DISCUSSION

This project emphasizes on the features of the op-amps and also provides basic knowledge on the resistors, capacitors, microphone and headphones. Op-amp are mostly preferred for the mathematical operations. The op-amp is one type of differential amplifier. Other types of differential amplifier include the fully differential amplifier (similar to the op-amp, but with two outputs). The TL072 is a pretty well-behaved op-amp for most audio circuits (filters, gain control circuits, summers...). It's pretty stable, drives a reasonable load and doesn't have any bad habits. The input common-mode voltage is pretty good and the gain bandwidth is useable. [40-45]
It is a FET-input op-amp, so the input bias current is low, but the input offset voltage isn't particularly low.

IV. CONCLUSION
There has been tremendous improvement in the ability to amplify sounds since the ear trumpet, but hearing aids are still not regarded with much enthusiasm by the general public. A microcontroller PIC12F675 may be used along with the signal processing program to assist the hearing aid. In order to make it simpler and easier op-amp was selected. Various types of op-amp are available in the market with different features. op-amps TL072, TL084 can be applied as the features of the selected op-amp sounds similar and only difference between them is the number of input and output channels in the op-amp. The difference between the resistors was kept within a certain ratio in order to control the amplification and also helps in the voltage divider.

V. FUTURE SCOPE
The circuit can be applied on a device and may be useful in reducing the hearing aids. It is highly useful to the patients of sensorineural hearing. Furthermore advancement in the project can be done by applying the Bluetooth technology.

VI. REFERENCES


