



# Role of Electronics in the development of Hearing aids

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**Abstract:** The technology has changed a lot in the last many years. The electronics has a significance in development of health care products. The size of hearing aid was bulky when it was initially introduced. Due to inventions in the field of electronics, the size of electronic components reduced. These new components were used in the manufacturing of hearing aid and thus the size of hearing aid was reduced. Initially the clarity and efficiency of hearing aids was low. But later the integrated chips helped the users to hear without any noise. Hearing aid manufactures are trying to improve the aesthetics of hearing aids. The knowledge of electronic is essential for every audiologist and they are having it as a subject in their curriculum.

**Keywords:** hearing aid, amplification, electronics, hearing loss, technology

## I. INTRODUCTION

The field of electronics has contributed to the society. Each day the life of human becomes easy due to the development in the field of electronics. These new technologies were implemented in the field of medical science. As a result the treatment of diseases became easy and convenient for doctors and other health workers. Similarly in the field of audiology the electronics has made a significant development in the hearing aids. Hearing aid is an electronics devices which is used by people with hearing disability. It can amplify sound and it helps them to hear clearly without strain. It is very clear from the evolution of hearing aids. The size of hearing aid has reduced significantly due to the invention of integrated chips. We can also consider hearing aids as a small amplifier. Hearing aids are usually programmed by the audiologist. Audiologists are the people who treat issues due to the hearing loss. Even the audiologist has Electronics as core paper in the first year during their bachelors course to have basic knowledge in the field of electronics.

## II. OBJECTIVE

To study the role of electronics in development of hearing aids and to study about major electronics components used in each type of hearing aid.

## III. EVOLUTION

The hearing aids has undergone a drastic change in terms of technology , size.. In this century we are lucky even if we have hearing loss, due to development in technology the hearing aids are efficient. But our ancestors and forefathers did not have kind of technologies or methods for treating the hearing loss.

We can see in detail about the evolution of hearing aid.



Fig. 1 Evolution of hearing aid



### A. Ear Trumpet

Ear Trumpets were having funnel shaped structure . It is the most primitive hearing aid or technique. It was used around 17<sup>th</sup> century. It was popular treatment method at that time. One of it was narrow and other side was wide. The narrow end was to transmit the sound into the person's ear and wider end was to collect the sound. It was made from horns of animals. The sound was straight away sent to ear canals. Initially it was only affordable to rich people but later ear trumpets were manufactured and used widely. Famous composer Ludwig Van Beethoven has used ear trumpet for many years.



Fig. 2 Ear Trumpet

### B. Carbon Transmitter Era

The invention of telephone by Alexander Graham bell as brought a great innovation to hearing aid. The telephone was a device which captured sound and it was transmitted electronically. The same mechanism or technology was used and it could be attached to human ears. The Miller Reese Hutchison, founder of Akouphone was the first to use this technology. It was a revolutionary invention. It was invented in the year 1895. It is the first hearing aid that is close to our modern standard of hearing aid, even though it has a great difference. It works on electric current, it was the time where electricity was becoming popular among people. The carbon transmitter was used to amplify the weak signals. But the major issue was it was too bulky so the people could not carry easily.



Fig. 3 Akouphone

### C. The Era of Vacuum tubes

It was the era, in which a new advanced technology was implemented in hearing aid. The advanced technology of vacuum tubes were used in hearing aids. It helped in reducing the size compared to carbon transmitter era and also became more efficient. It was from the era of vacuum tubes the size of hearing aid reduced significantly. In 1920s the Vactophone was invented. It was controlled using vacuum tube. It was expensive ,bulky, old fashioned product. These kind of hearing aid was not portable in the initial stage. It also used telephone technology for its functioning. The transmitter converted the input speech signal into electrical signal. By 1930s the hearing aids were getting popularised due to the decrease in size. Idea of miniaturization helped in development of hearing aids.

### D. Transistor Hearing Aids

The invention of transistors has helped in reducing size of hearing aid. Transistors hearing aids were introduced in the year of 1948. Transistors were replaced in the position of vacuum tube. The vacuum hearing aids were replaced by transistor hearing aid. The vacuum tube had an issue of becoming hot when it is used. When compared to vacuum tubes, the transistors were small and more efficient. The hearing aid started to have better battery efficiency. In the initial phase transistor hearing aids were not effectively tested. The transistor got damp, but the later it was modified by putting a coating in transistor to protect from dampness. It was the first time when the listening device could be worn completely. It was not bulky to carry. It was the first time where the hearing aids were able to keep near or behind ears easily.

### E. Analog hearing aids



The microprocessor was invented in the 1970s. So the microprocessors were used in hearing aids. It replaced the transistor. These microprocessors helped in amplifying the signals. The analog hearing aids used combination of analog and digital circuit. The analog hearing aids were cheaper when compared to digital hearing aids. The analog hearing aid cannot distinguish when there is multiple sound. Generally a analog hearing aid consist of microphone, processor, receiver and also a power source. The input is taken by microphone that pick the sound and then it is transformed into current. This current is amplified which is done by the processor. The power source – battery used in analog hearing aids were small.

#### F. Digital hearing aids

The analog hearing aids don't have a capability to distinguish between sounds. The digital hearing aids has a capability to reduce unwanted noise. It uses a digital signal processor in amplifying. It is the microprocessor which acts heart of the digital hearing aid. These kind of hearing aids are reliable and adjustable. These hearing aids are programmable as per the requirement of the client based on their hearing loss. When compared to analog hearing aid , digital hearing aid are smaller and convenient for people using it. The users can hear with good clarity. There are millions of people using this technology now a days. The new technologies not only allow them to hear the noise from surroundings but also helps to connect with their computers and mobile. The Bluetooth technology is used for this purpose. The modern hearing aid are designed in wide varieties such a way it can be worn over ear, deep into ear canal and even behind the ears. The people find it easy to wear as the size of the hearing aid is small so others may not notice it easily.

#### IV. RESULT

We have understood how the development of hearing aid took place with the help of invention of each new electronic component. The bulky hearing device has transformed into a very small device with the contribution of electronics.

#### V. CONCLUSION

We can see a drastic change in the development. In coming years also we can expect new technologies for hearing aids. The artificial intelligence can contribute a lot to this by making the hearing aids more efficient and user friendly. The hearing aid manufacture are trying their best to

develop the aesthetics of hearing aid. So people will hearing disability can use it like a fashionable accessory. The fully digital hearing aids adjust the sound itself without the user's action by using the sensors.

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