ELECTRONICS TO THE AID OF HEARING IMPAIRED

Take a look at some of the electronic aids that strive to hear every little piece of sound and then put the pieces together to help the hearing impaired hear better.

Hearing loss interferes with a person’s ability to process linguistic information through auditory channels with or without amplification. Any device that is used to enhance the residual hearing is referred to as an assistive listening device (ALD). Beyond ALDs, telecommunication devices have been created to assist students with severe hearing impairments by making use of their other abilities such as sight and touch. ALDs have been in use since the 1800s. At that time, horns were held to the ear to collect and focus sound waves. Certain pitch ranges were amplified depending on the dimensions of the horn, and no external power supply was used.

One of the first high-tech devices designed for persons with hearing impairments is something we take for granted—the telephone. Alexander Graham Bell originally invented the telephone for helping his sister, who had a hearing disability. Today, advances in electronics technology and medicine have led to the development of a wide range of high-tech ALDs and telecom devices that assist students with severe hearing impairments, enabling them to participate more effectively in the classroom.

Devices to assist hearing impaired students

Audio loops. The audio loop is a type of amplification system. It was introduced in an attempt to control the sound level of the teacher’s voice, to maintain consistency in auditory cues between home and school, to deal more effectively with background noise and to provide maximum mobility within a classroom. An adaptation of the FM device, it directs sound from its source directly to the listener’s ear through a specially equipped hearing aid. Sound may be transmitted through a wire connection or radio waves. Audio loops can be built into the walls of a room or created to surround only a certain section of seats in a room.

FM systems. Many paediatric audiologists now recommend that frequency-modulated (FM) systems be used at home. FM systems, also known as auditory trainers, are often used in school classrooms to help children hear the teacher better. The teacher wears a small microphone and radio transmitter and the child wears hearing aids connected to radio receivers. Sound is sent directly between the teacher and the child using wireless radio frequency signals.

FM systems improve listening in situations where a hearing aid alone may not help enough. The most difficult situations are noisy backgrounds, large distances between the speaker and hearing aid user, and...
rooms with a lot of reverberation or echo. FM auditory enhancement systems are now widely used in schools because of their versatility and portability for use in or out of the school building.

**Infrared systems.** Infrared systems transmit clean, clear sound invisibly to hearing impaired listeners. These provide better hearing in public places without the hassle of wires and cords, and suffer less from interference emanating from pagers and other outside radio signals. But, they may have limited accessibility because of issues related to line-of-sight or distance between the emitter and the transceiver. Nevertheless, as costs come down, the popularity of infrared systems is increasing.

**Captioned television and live speech captioning.** Captioning refers to the addition of text to a visual display, where the words that are spoken are seen as text. The early form of captioning was seen primarily as subtitles for translating foreign films.

Live speech captioning is another variation of this technology that allows individuals with hearing impairments to access words as they are being spoken. This technology works much like steno keyboards that are used to record judicial proceedings. When captioning is used in educational settings, a stenographer typically enters information as the teacher talks and the text is displayed on a computer monitor. This technology has proven to be very helpful for students with hearing disabilities who are enrolled in college courses or who attend public lectures.

**Telecom devices for the deaf**

Telecommunication devices for the deaf (TDD) are widely known. These enable persons with no hearing to make or receive telephone calls. The device is attached to a telephone and resembles a small keyboard with a screen to display the incoming or outgoing messages. Some TDDs have a paper printout to record a permanent copy of the conversation.

To use a TDD, the user types a message on the keyboard that is automatically converted into tones and transmitted over the phone line to another TDD, which converts the message back into text form. In this system, both the sender and the receiver of the message must have access to the technology.

Although these technologies are not typically used in the classroom environment, they enable students with disabilities to interact with each other outside of the school environment for both academic and social reasons, just as their non-disabled peers do.

**Cochlear implants.** A cochlear implant is a relatively new device designed to provide sound information for people with profound hearing impairments. While hearing aids and other assistive devices amplify sound, an implant can actually enable the wearer to hear sounds that were previously indistinguishable. The implant, which is surgically placed beneath the skin, bypasses the damaged parts of the inner ear and stimulates nerves that have not been stimulated before. Signals are sent continuously when sound is present in the environment.

**An advanced remote control that offers one-touch binaural program and volume control**
Hearing aids. The hearing aid is a miniature public address system worn by the listener. It works best in quiet, structured settings, where the speaker is no more than a few metres away and extraneous noise is minimised.

Hearing aids are generally available in four styles: body-worn, behind-the-ear, eyeglass and in-the-ear. School-age children most often use postauricular hearing aids, which are designed to fit unobtrusively behind the ear. Almost all people with hearing loss, including ‘nerve loss,’ can benefit to some extent from hearing aids.

More about hearing aids

Hearing aid technology is constantly getting better. Many hearing aids today have special microphones and amplifiers. Many have small digital circuits inside. This technology affects how the hearing aid amplifies sounds. Many hearing aid manufacturers use their own trade names to label circuits, but some generic terms that apply to hearing instrument circuits are analogue, digital and programmable.

Analogue, digital and programmable. Analogue hearing aids amplify the sound wave by simply making it louder. These use simple components like transistors in a circuit to amplify and modify the incoming sound. Any change to the sound of the hearing aid is made with the volume control, small trimmers to adjust the response, or by sending the instrument back to the manufacturer to have components changed.

Due to constant improvements in microcontrollers, most of the new hearing aids have digital circuits. This lets the audiologist make computerised adjustments to many different features. The audiologist uses a computer connection to the hearing aid to adjust the hearing aid response, listening programmes and type of processing in the hearing aid.

A true digital hearing aid, based on a digital signal processor, takes the incoming signal from the microphone, converts it into a digital format and then processes the signal using digital technology before converting it back into an analogue sound to be delivered to your ear. Digital hearing aids are normally much more flexible and can be used to process sound more selectively than analogue ones.

Programmable (analogue/digital) hearing aids can have their response (sound) changed in the dispensers office, so one need not send it back to the factory. If the user needs more power—a change in frequency—the hearing aid fitter can plug a cord into his hearing aid and modify it on the field.

Analogue types are sometimes more powerful than digital gadgets. Besides, their batteries usually last longer and these cost much less than digital. Some digital hearing aids can have multiple memories for different listening situations and certain noise-reduction algorithms can be programmed into the circuit to help reduce background noise. Built-in digital feedback reduction circuits make more gain available without any whistling. Programmable types are less expensive than digital instruments. The listener can adjust the sound to better fit his own likes and dislikes.

Hearing and amplification

Dynamic range compression. When a hearing aid uses compression, the circuit amplifies softer sounds more than louder sounds. If a hearing aid circuit has a wide dynamic range of compression, it automatically adjusts the amount of gain so that soft sounds are made louder and loud sounds are not distorted or too loud. This kind of circuit may help one hear conversations at different listening distances.

Directional microphones. Some hearing aids have microphone settings that change between omni-directional and directional. Omni-directional microphones pick up sounds coming from all around. Directional microphones pick up sounds from a narrow listening direction, just like a camera that has a wide-angle and zoom lens.

Multiple memories. Many ‘true digital’ hearing instruments can keep more than one listening program stored in the hearing aid circuit. Multiple programs let the hearing aid user choose different microphone or hearing aid settings by using a remote control or program button on the hearing aid. Adults often use different programs for listening in noisy situations or when listening to TV or music. Having the choice of different programs can be good for children, especially if their hearing fluctuates or changes. This can allow a fast change in the hearing aid settings.

Availability

There are a variety of electronic devices in the market to support or enhance the hearing capability. These could range from very low-technology to very high-technology, with price ranging from a few hundred rupees to several thousand rupees. Some devices are dedicated, meaning that these only provide a means of communication. Others are designed to work in conjunction with computer systems that play multiple roles.