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Hearing Aid with Bluetooth Technology

G.Venkatesan[1], P.Jagan[2], S.Kaviya[3], R.Arunachalam[4],

Assistant Professor, Civil Department, Priyadarshini Engineering Colleg Vaniyambadi, Vellore India[1]

Student, Civil Department, Priyadarshini Engineering College Vellore India[2 3 4]

***Abstract*— Hearing impaired people, and particularly hearing aid users, often have difficulty communicating over the telephone. The intelligibility of telephone considerably lower than the intelligibility of face - to - face speech. This is partly because of lack of communication, limited telephone bandwidth, and background noise. In addition, cell phones may cause interference with the hearing aid. To address these problems hearing impaired people experience with telephone, this paper proposes a wireless phone adapter that can be used to route the audio signal directly to the hearing aid. This adapter is Bluetooth technology. In old hearing machine only we can hear the atmospheric noise only, by this new device we can hear mobile calls , voice messages, music , audio, Google navigation etc.**

I INTRODUCTION

In India 26,810,557 peoples are having disable problems. In this 14.9crore peoples are male and 11.8crore peoples are female. Nearly 5crore peoples are having hearing disability, 5crore peoples are having visual disability, 2crore peoples are having speech disability, 5.4crore peoples are having moment disability, 1.5crore peoples are having mental disability, 2.1crore peoples are having multiple disability.

In percentage wise in total disable people 18.8% peoples are having seeing disability, 18.9%peoples are having hearing disability, 7.5% peoples are having speech disability, 20.3% peoples are having movement disability & 7.9% peoples are having multiple disability.

In general terms, there are two types of hearing loss, conductive and sensor neural. A combination of both is also seen as a mixed hearing loss. Each is discussed below. Conductive hearing loss is caused by any condition or disease that impedes the conveyance of sound in its mechanical form through the middle ear cavity to the inner ear. A conductive hearing loss can be the result of a blockage in the external ear canal or can be caused by any disorder that unfavourably effects the middle ear's ability to transmit the mechanical energy to the stapes footplate. These results in reduction of one of the physical attributes of sound called intensity (loudness), so the energy reaching the inner ear is lower or less intense than that in the original stimulus. Therefore, more energy is needed for the individual with a conductive hearing loss to hear sound, but once it's loud enough and the mechanical impediment is overcome, that ear works in a normal way. Generally, the cause of conductive hearing loss can be identified and treated resulting in a complete or partial improvement in hearing. Following the completion of medical treatment for cause of the conductive hearing loss, hearing aids are effective in correcting the remaining hearing loss. The audiometric profile that indicates a conductive hearing loss is the presence of air-bone gaps (better hearing by bone conduction than by air conduction), excellent word recognition at a comfortable listening level, and evidence of a middle ear dysfunction on admittance. For situations where a blockage is noted in the external ear canal, hearing testing is deferred until the canal is cleared. The second type of hearing loss is called sensorineural hearing loss. This word can be divided into its two components - sensory and neural - to allow us more clarity in specifying the type of hearing loss. The comprehensive audiometric assessment and supplemental tests can yield the information needed to differentiate between a sensory and a neural hearing loss, although they can co-exist in the same ear. Neural hearing loss is another name for retro cochlear hearing loss. Sensorineural hearing loss results from inner ear or auditory nerve dysfunction. The sensory component may be from damage to the organ of Corti or an inability of the hair cells to stimulate the nerves of hearing or a metabolic problem in the fluids of the inner ear. The neural or retrocochlear component can be the result of severe damage to the organ of Corti that causes the nerves of hearing to degenerate or it can be an inability of the hearing nerves themselves to convey neurochemical information through the central auditory pathways. The reason for sensorineural hearing loss sometimes cannot be determined, it does not typically respond favorably to medical treatment, and it is typically described as an irreversible, permanent condition. Like conductive hearing loss, sensorineural hearing loss reduces the intensity of sound, but it might also introduce an element of distortion into what is heard resulting in sounds being unclear even when they are loud enough. Once any medically treatable conditions have been ruled out, the treatment for sensorineural hearing loss is amplification through hearing aids. A mixed hearing loss can be thought of as a sensorineural hearing loss with a conductive component overlaying all or part of the audiometric range tested. So, in addition to some irreversible hearing loss caused by an inner ear or auditory nerve disorder, there is also a dysfunction of the middle ear mechanism that makes the hearing worse than the sensorineural loss alone. The conductive component may be amenable to medical treatment and reversal

of the associated hearing loss, but the sensorineural component will most likely be permanent. Hearing aids can be beneficial for persons with a mixed hearing loss, but caution must be exercised by the hearing care professional and patient if the conductive component is due to an active ear infection.

II EXISTING TECHNOLOGY FOR HEARING IMPAIRED PEOPLES

[1]A hearing aid is a small electronic device that you wear in or behind your ear. It makes some sounds louder so that a person with hearing loss can listen, communicate, and participate more fully in daily activities. A hearing aid can help people hear more in both quiet and noisy situations. However, only about one out of five people who would benefit from a hearing aid actually uses one.

A hearing aid has three basic parts: a microphone, amplifier, and speaker. The hearing aid receives sound through a microphone, which converts the sound waves to electrical signals and sends them to an amplifier. The amplifier increases the power of the signals and then sends them to the ear through a speaker.

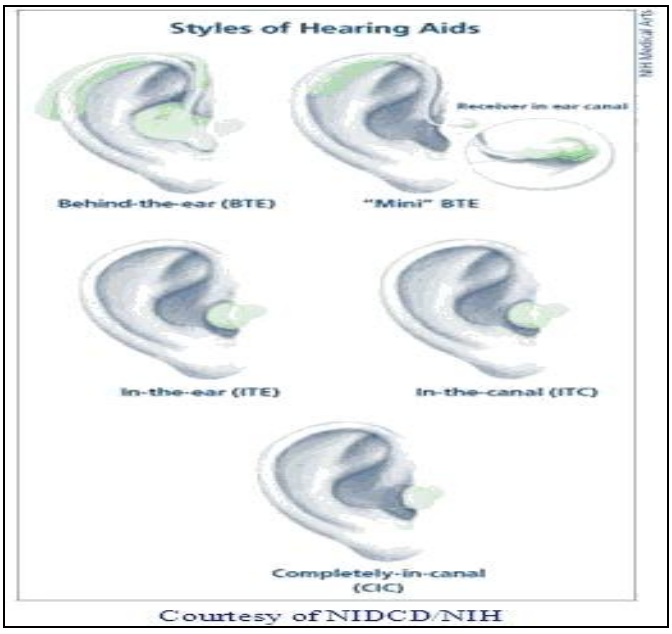
Hearing aids are primarily useful in improving the hearing and speech comprehension of people who have hearing loss that results from damage to the small sensory cells in the inner ear, called hair cells. This type of hearing loss is called sensorineural hearing loss. The damage can occur as a result of disease, aging, or injury from noise or certain medicines.

A hearing aid magnifies sound vibrations entering the ear. Surviving hair cells detect the larger vibrations and convert them into neural signals that are passed along to the brain. The greater the damage to a person's hair cells, the more severe the hearing loss, and the greater the hearing aid amplification needed to make up the difference. However, there are practical limits to the amount of amplification a hearing aid can provide. In addition, if the inner ear is too damaged, even large vibrations will not be converted into neural signals.

In this situation, a hearing aid would be ineffective. There are three basic styles of hearing aids. The styles differ by size, their placement on or inside the ear, and the degree to which they amplify sound. Behind-the-ear (BTE) hearing aids consist of a hard plastic case worn behind the ear and connected to a plastic ear mold that fits inside the outer ear. The electronic parts are held in the case behind the ear. Sound travels from the hearing aid through the ear mold and into the ear. BTE aids are used by people of all ages for mild to profound hearing loss. A new kind of BTE aid is an open-fit hearing aid. Small, open-fit aids fit behind the ear completely, with only a Narrow tube inserted into the ear canal, enabling the canal to remain open. For this reason, open-fit hearing aids may be a good choice for people who experience a buildup of earwax, since this type of aid is less likely to be damaged by such substances. In addition, some people may prefer the open-fit hearing aid because their perception of their voisound "plugged up."

In-the-ear (ITE) hearing aids fit completely inside the outer ear and are used for mild to severe hearing loss. The case holding the electronic components is made of hard plastic. Some ITE aids may have certain added features installed, such as a telecoil. A telecoil is a small magnetic coil that allows users to receive sound through the circuitry of the hearing aid, rather than through its microphone. This makes it easier to hear conversations over the telephone. A telecoil also helps people hear in public facilities that have installed special sound systems, called induction loop systems. Induction loop systems can be found in many churches, schools, airports, and auditoriums. ITE aids usually are not worn by young children because the casings need to be replaced often as the ear grows.

Canal aids fit into the ear canal and are available in two styles. The in-the-canal (ITC) hearing aid is made to fit the size and shape of a person's ear canal. A completely-in canal (CIC) hearing aid is nearly hidden in the ear canal. Both types are used for mild to moderately severe hearing loss. Because they are small, canal aids may be difficult for a person to adjust and remove. In addition, canal aids have less space available for batteries and additional devices, such as a telecoil. They usually are not recommended for young children or for people with severe to profound hearing loss because their reduced size limits their power and volume. Hearing aids work differently depending on the electronics used. The two main types of electronics are analog and digital.



Analog aids convert sound waves into electrical signals, which are amplified. Analog/adjustable hearing aids are custom built to meet the needs of each user. The aid is programmed by the manufacturer according to the specifications recommended by your audiologist. Analog/programmable hearing aids have more than one program or setting. An audiologist can program the aid using a computer, and you can change the program for different listening environments—from a small, quiet room to a crowded restaurant to large, open areas, such as a theater or stadium. Analog/programmable circuitry can be used in all types of hearing aids. Analog aids usually are less expensive than digital aids.

Digital aids convert sound waves into numerical codes, similar to the binary code of a computer, before amplifying them. Because the code also includes information about a sound's pitch or loudness, the aid can be specially programmed to amplify some frequencies more than others. Digital circuitry gives an audiologist more flexibility in adjusting the aid to a user's needs and to certain listening environments. These aids also can be programmed to focus on sounds coming from a specific direction. Digital circuitry can be used in all types of hearing aids.

Here are some helpful tips about good hearing aid battery care: Store hearing aid batteries at normal room temperatures. Do not refrigerate. Wash your hands thoroughly before changing batteries. Grease and dirt on the batteries may damage the hearing aid. Leave the battery compartment of your hearing device open at night so moisture can escape. Doing so will keep the battery from corroding and damaging the hearing aid. Remove dead batteries immediately. A completely discharged battery may swell and become difficult to remove. When you're not wearing your hearing aid, turn it off or open the battery door to minimize battery drain. If you won't be using the hearing aid for an extended period of time, remove the battery entirely. Avoid storing in extreme temperatures to keep from draining battery power and shortening battery life. Leave the stickers on your batteries until you are ready to use them, because removing them will activate the battery. Keep your batteries in their packaging they come in. When batteries touch each other they activate one another. When preparing to change your battery, remove the sticker and let the battery sit for 60 seconds to allow the batter to reach its full energy. Hearing Aid Care and Maintenance Here are some helpful tips about how to care for you hearing aids. Maintaining your hearing aid through daily cleaning and regular service is extremely important. Proper care helps retain optimum hearing conditions, extends the life of your hearing aid, and ensures proper hygiene. Handle your hearing aid with care. Store your hearing aid in a safe place that's dry and cool. Change hearing aid batteries often so they don't suddenly run out of power. Switch off your hearing aid when you're not using it. If you don't use it for a long period of time, remove the battery. Battery contacts should be cleaned regularly. Use a cotton swab, taking care not to bend the contacts. Dirty battery contacts can cause improper device function. Remove earwax from your hearing aid to prevent temporary malfunction or permanent damage. Clean your hearing aid using the small brush or the soft cloth that came with it. Never insert tools into the sound outlet. Doing so could damage the receiver. If you can't clean the hearing aid completely, ask your hearing professional for help. Change filters often so they don't collect wax or dirt. Accumulated earwax may prevent sounds from traveling from the hearing aid into the middle ear. Contact your doctor regularly to have your ear canals cleaned. Never remove the earwax from the ear yourself. Doing so could damage your ear. Don't wear your hearing aid

• In the shower •swimming • When using a hair dryer, hair spray or other types of spray

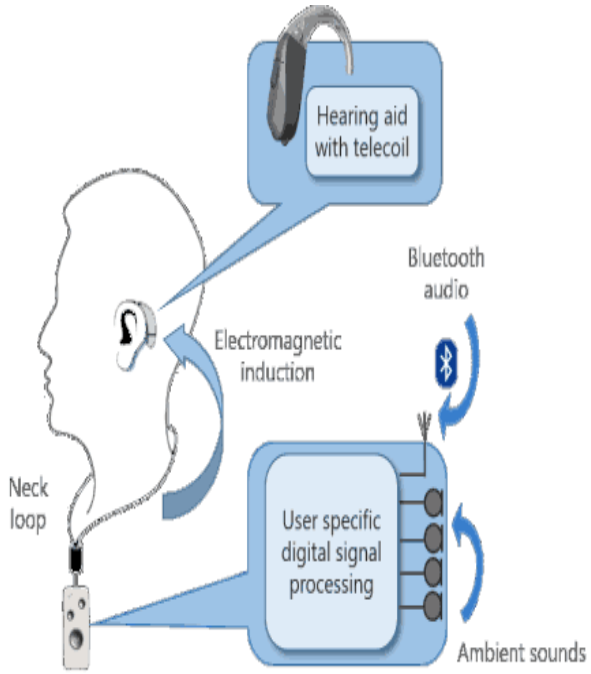
III BLUETOOTH AND ITS TYPES

[2] Bluetooth is one of the most efficient short distance wireless communication devices in our daily lives. With its stability and convenience in communication, this has allowed Bluetooth technology to become a valuable asset for both computers and electronic communication.

Every device will have to be equipped with a microchip (transceiver) that transmits and receives in the frequency of 2.4 GHz that is available in the whole world (with some variations of bandwidth in different countries). Besides the information, there are three channels of voice available. The information can be exchanged to speeds of up to 1 megabit for second (2megabits for second in the Second Generation of this Technology). Blue tooth mainly have 3 versions they are

1.Version 3.0(covers 100m area)
2.Version 4.0(covers 200m area)
3.Version 5.0(covers 800m area)

transmitter are used to transmit the data and the reviser are used to receive the the both transmitter and receiver collect and send the data of bandwidth about 2.45GHz .the speaker peasant in the Bluetooth is use to increase the intensity of sound. Voice controller are used to control the sound on/off switch is also provided ,micro phones are used to increase the intensity of sound .USB charger is provided for charging of the device. It consume very small amount of power to run the device about 3v



only Bluetooth technology has enabled wireless communication between various electronics and has been expanding every day and more and more electronics come with the Bluetooth device. By using this newer hardware and smarter software algorithms to direct network data we can achieve more efficient, flexible wireless communications. However, the rapid development of Bluetooth, there has been a noticeable correlation burden on the existing security protocols, security systems always have their weakness, and there are still security issues that must be addressed. The connections have a maximum range of 10 meters, though using amplifiers it is possible to come up to 100 meters, but creating some distortion interferes. Maybe it doesn't look too much, but it is necessary to remember that these devices were created by the intention of using them in closed environments and little distances.

This technology Bluetooth provides short range wireless capabilities so that two devices can transfer data with eachother. Over the years various versions of Bluetooth have been evolved which include v1.2, v2.0, v2.1, v3.0,v4.0 and v4.1.It operates at 2.4 GHz ISM frequency band. The technology is based on IEEE 802.15.1 standard. Both PHY and MAC layers of the Bluetooth is defined in this Wireless Personal Area Network(WPAN) standard.All the bluetooth versions have different speed and data rate requirements. They are compatible with their previous versions so that device with one version can interoperate with the other version. Bluetooth network is composed of piconets. Each piconet will have one master and one to seven slaveswhich communicate to one another.Bluetooth RF and baseband specifications

IV BLUETOOTH RF AND BASEBAND SPECIFICATION

- Modulation type is GFSK
- Peak data rate is about 1Mbps
- RF Bandwidth is 220KHz and 1MHz
- RF frequency band is 2.4 GHz
- No. of RF carriers are 23/79
- RF carrier spacing is 1 MHz
- 1600 hops/sec frequency hopping
- Time Division Duplex mode
- Transmit power is about 0.1 watt
- distance coverage of up to 10m to 100m
- 7 simultaneous links possible in a star configuration[3]

Bluetooth v1.2Speed or data rate: 720 kbps
Backward compatibility: v1.1
Bluetoothv2.0
Speed: 2.1 Mbps.Backward compatibility: Bluetooth v1.2
Bluetooth v2.1
Speed: 2 Mbit/s. Backward compatibility: Bluetooth v1.2
Bluetooth version v3.0
Speed: 24 Mbps. Backward compatibility: Bluetooth v2.1
Bluetooth v4.0
Speed:24 Mbps.Backward compatibility: Bluetooth v3.0
Bluetooth v4.1Designed to work seamlessly with LTE cellular technology.Backward compatible with previous versions.

Bluetooth devices to connect to each other so they can work together, they need to be paired. Pairing or bonding means that the two devices are exchanging their passwords or passkeys. Once paired, all of the data that is sent between the two devices isencrypted, meaning that any device that is not pairedwith the other two is unable to translate the data. However, there are occasions when pairing is not necessary, such as exchanging business cards. Fortunately, there is a setting on most devices to lower the security for these lower grade transfers.

V THE DROWBACKS OF EXISTING HEARING AID

Maintaining your hearing aids through daily cleaning and regular service is extremely important. The environment for in-the-ear hearing aids is moist and warm with relative humidity between 40-70% and a constant temperature of 98 degrees. Earwax, which is a combination of salt and corrosive body acid, can accumulate in the ears and on the hearing instrument .Not surprisingly, these conditions can be harmful to electronics. Proper hearing aid care helps retain optimum hearing conditions, extends the life of your hearing aid, and ensures healthy ear hygiene. In existing techniques we are us in a hearing aid \ hearing machine. It is very use full for hearing disability peoples. But, the hearing disable people not able to able to hear the mobile calls, voice messages, songs, Google navigation purpose etc., and also it not able to easy communication using mobile phone . For rectify these kind of problems we proposed a new technology in this technique we are introducing blue tooth with hearing aid.[4]

VI THE ADVANTAGES IN OUR PROJECT

Bluetooth compatible hearing aids allow you to wirelessly connect to televisions, cell phones, landline phones, and mp3 players. This provides better speech comprehension and sound clarity because the sound is delivered wirelessly to the hearing aids with no issue of sound decay or reverberation.

Bluetooth technology advances permit you to listen on the telephone through the hearing aids in both ears simultaneously. This allows the hearing aid wearer to talk on the phone hands-free. With the push of a button, the phone is answered. In addition, the hearing aids automatically shut off the microphones to enable you to hear on the phone in comfort and without distraction.

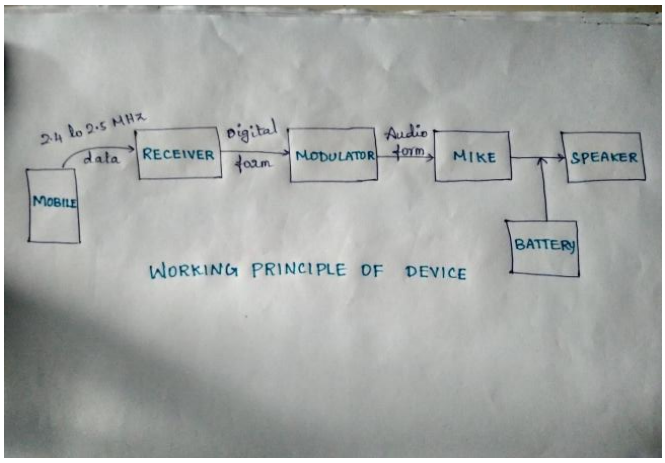
You may have "discussions" at your home about the volume of the television. This can result in the family watching the same show on different televisions. Most manufacturers of hearing aids now provide a plug-in accessory for your television which wirelessly sends a comfortable sound to the hearing aid wearer and also permits a comfortable sound for friends and family.

The hearing aids can receive music and other signals from an iPod or mp3 player making those uncomfortable ear buds unnecessary!

VII CONCLUCION AND METHODOLOGY

Now a Day's hearing aid or ci device are easily available. And also Indian government and some NGO's offering the hearing freely. But they not effectively use to the hearing disable peoples. Because they only use to hear the atmospheric noise only and not able to hear the mobile calls, voice messages, television, music, video songs, Google navigation and some other facility. That's why we are introducing the hearing aid with accessible of mobile phone using the Bluetooth technology. Project is introducing the hearing aid with Bluetooth technology. In this device there is following parts are there

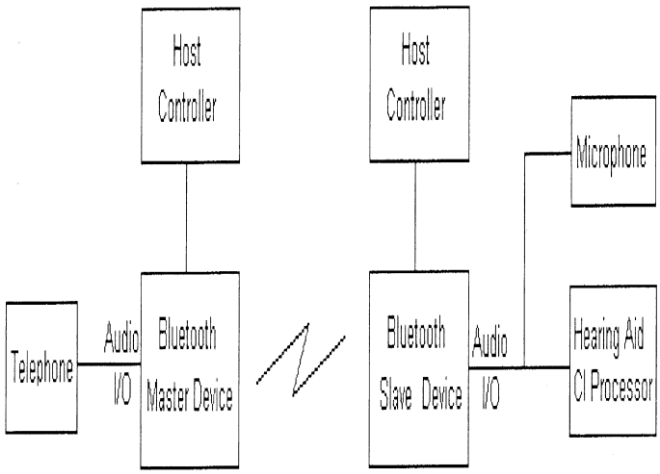
1. Receiver.
2. Transmitter
3. Modulator
4. Mike
5. Battery
6. Speaker



[5]Transmitter present in the mobile phone is transmitting the data in the waves form. The frequency of the transmitting data is 2.45Hz. Receiver is used to receive the data about 2.45Hz frequency data only, and the received data is in the form digital data .we want to convert the digital data into audio form. for the conversion we are using modulators . The modulators are converting the digital data to audio form. The intensity of the sound is very less. So, we are using mike to increase the sound. Battery is used to provide power. The power consumption is more than the hearing machine .because the transmitter and receiver peasant in the device is also consumes the power. So, the battery capacity is increased. Speaker peasant in the hearing aid is giving the output.

To evaluate the effectiveness of the wireless transmission with regard to the quality of the audio signal, three CI users were invited to use the phone-adapter prototype. All users were previously fitted with the Med-El/CIS-LINK processor. The three CI subjects were using their daily Med-El implant processor and were fitted with the CIS strategy operating at a rate of 1000–2000 pulses/s/channel. The audio I/O of the portable device was split to two monojacks, one leading to the audio input of the CI processor and the other leading to a Microphone. The users listened through the CI processor and talked to the microphone. Good quality was

reported by the CI users when both parties stayed within a reasonable distance inside our lab (within a 7 6 m area). The CI users reported that the quality was as good as the quality obtained using a direct connection with a commercial phone adapter. The present study evaluated the performance, at least qualitatively, of the Bluetooth device. Further studies are needed to quantify the performance, in terms of speech intelligibility, of The Bluetooth device. There are several factors that may affect the quality (and perhaps intelligibility) of speech transmitted via A Bluetooth link. One potential factor is the accumulation of processing Delays in the cellular telephone network and in the Bluetooth Link. Another factor is the potential loss or damage of data Packets. The speech signal is coded in the Bluetooth link using A 64 kb/s continuous variable slope delta modulation (CSVD) Scheme, and is, therefore, unlikely that it gets impaired since it is not compressed. Packet losses or damages, however, May impair the received signal and therefore need to be considered and possibly accounted for. The individual assessment of these factors on speech intelligibility/quality needs further investigation



VIII ESTIMATED COST OF OUR PROJECT

The cost of the existing hearing aid is around Rs650 to 900. We are introducing the new technology that have Bluetooth technology in the hearing aid. There is many industries are there for the production of Bluetooth and hearing aid. The cost of the Bluetooth is increase about Rs150 to 300 only. Hence the cost of the new device is around Rs950 to 1100 only.

The work in this paper addressed the problem of assisting Hearing-impaired people (CI users and normal hearing aid users in this study) to use telephones. A wireless assistive phone adapter was designed based on Bluetooth technology. The proposed phone adapter routes the Telephone audio signal to the CI processor or hearing aid via a wireless Bluetooth Connection, thereby disabling environmental noise. Bluetooth technology is the easy technology to transfer the data over the short distance. Using the technology of Bluetooth in the hearing aid or CI device hearing disable peoples can use mobile phones mobile phones easily.

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