# Sound Bite Hearing System for Hearing Impairment

Deepika S , Jefcy Treesa Jef, Kokilapriya P ,Valliammai C ,Hemalatha Karnan M.E,(Ph.D)
Final year Students /Assistant Professor ,
Department of Biomedical Engineering
Dhanalakshmi Srinivasan Engineering College,
Perambalur.

***Abstract* :- Human ear is an organ of hearing in which the environmental sound is channeled to auditory meatus. Any obstruction in this mechanism results in hearing impairments. This may occur at birth or by the dysfunction of auditory nerve which cannot be improved surgically. This project aims to develop a non-invasive bone conduction device for those with problems in their various parts of ear. It transfers sound at the frequency of 20HZ-20kHZ by bone vibration directly to the cochlea thus bypassing the outer or middle ear and used for some hearing losses. The "SoundBite Hearing System" is developed for people with hearing disabilities like unilateral deafness and CHL. A simulation of hearing sound has been done through the LabVIEW. Bone conduction included provide a hearing support to the patient. In addition the system has a facility for mobile communication which is focused on coherent hearing. Here the signal processing strategy is adopted for restoration of cross-channel suppression in hearing impaired listeners. The input voice from the microphone is given simultaneously to the speaker and motor. Thereupon the sound travel to input mic tool which pick up the sound, converge the waves and convert them to useful data. This data is used in a wave form generator to plot the graph with respect to amplitude and time with a frequency of 1kHZ. This project concentrates on various emotions like anger, joy etc. This device is sure to help the people to communicate effectively both in direct conversation and mobile communication.**

***Keywords-: Bone-Conduction, SoundBite , LabVIEW , prosthetic device.***

## I.INTRODUCTION

**Sound Bite Hearing System** is a non-surgical bone conduction prosthetic device that transmits sound via the teeth. It is an alternative to surgical bone conduction prosthetic devices, which require surgical implantation into the skull to conduct sound. Bone-Conduction Devices (BCDs) are used in a wide range of applications such as communication systems, language development approaches, mitigation of stuttering, audiometric investigations and finally and most importantly, in hearing rehabilitation. This review is focused on BCDs for hearing rehabilitation, where the common indications are conductive and mixed hearing loss and also single-sided deafness. These BCD devices can be non-implantable (conventional BCDs) and semi-implantable, where some part of the device is implanted

Sound bite uses the tooth instead of the implanted component and eliminates the need for surgery. It is therefore typically lower in complications and in cost than the prevalent surgical treatments. Sound bite Hearing System has two principal components: a behind-the-ear (BTE) microphone unit that is worn on the impaired ear and a removable, custom-made in-the-mouth (ITM) device worn on the upper, left or right back teeth. Both components have rechargeable batteries and a charger is included with the system.

## CURRENT PRACTICE

Hearing aids most commonly used for moderate to profound conductive hearing loss or single side deafness SSD are the bone conduction hearing aid and more recently, the bone anchored hearing aid (BAHA). These work by transmitting sound signals to the inner ear via bone, bypassing the outer and middle ear. In SSD, the systems rely on signals being transmitted from the hearing impaired side through the skull to the working inner ear. The bone conduction hearing aid may be a relatively large device worn on a band around the head or a smaller device attached with a custom ear mould. The newer BAHA is more discreet and is reversibly clipped onto an implant in the skull (for direct bone conduction), behind the ear. Although the surgical procedure for the BAHA implant is relatively minor and the implant is small, the requirement for a skin penetrating surgical implant may be unacceptable, unsuitable or impossible for some patients, particularly as outcomes may vary widely.

## SOUNDBITE HEARING AID

A unique technological approach for the treatment of unilateral sensorineural hearing loss is the use of a removable oral device called the Sound Bite hearing system . The Sound Bite hearing system also makes use of the sound conduction properties of bone; yet, unlike the BAHA system, does not require the use of surgery. The Sound Bite hearing system uses a microphone unit housing a receiver and wireless transmitter to receive sound. The microphone portion of the unit is in the affected ear canal to take advantage of the ability of the ear's pinna and external ear canal to capture and direct sound into the microphone, while the receiver and the transmitter situated in a unit behind the affected ear. The unit then transmits the captured sound wirelessly to a removable oral device similar to a retainer that sits over the maxillary molars in the mouth. The oral device touches several structures in the mouth including the gingiva, teeth and the inner cheek. The electrical signal from the behind the ear transmitter is captured by the oral device and transducer is used to capture sound transmitted into vibrational energy using a piezoelectric transducer. The vibrations are conducted by way of the teeth to the bone and trans-cranially to the cochlea of the ear. One of the advantages of the piezoelectric transducer is that it allows a much wider frequency range to be conducted through the teeth than the traditional electrodynamic transducers used in the BAHA systems.

The Sound bite hearing system is designed to aid hearing in adults affected by conductive hearing loss or SSD. The system consists of two devices, one behind-the-ear (BTE) and one in-the-mouth (ITM). The BTE device is similarly designed to an "open-fit" hearing aid and picks up sound from a microphone placed in the ear canal. This is wirelessly sent to the ITM device which processes the sound digitally and transmits it through the upper back teeth to the single working inner ear. The ITM device resembles a small retainer and contains a piezoelectric transducer. It requires the person to have two sound upper molars or premolars to be attached to. A dental impression is required prior to fitting, which the company states can be performed by any dentist after half an hour of training. The system may be switched off either by removal of the ITM device or via a remote control. Insertion and removal of the devices can be carried out simply by the patient at any time. The company state that the ITM device will usually not need to be removed for eating and that cleaning of the device at the end of each day is likely to be sufficient. Additionally, the strength of the vibrations produced by the ITM device for different levels of noise, and the maximum tolerated level of vibration can be calibrated to the individual.

LABVIEW – Laboratory Virtual Instrument Engineering Workbench is a system design platform &development environment for a visual programming language from national instruments . It integrates the creation of user interfaces into the development cycle. The graphical language is named "G",LabVIEW is commonly used for data acquisition ,instrumentational control &Operating Systems(OSs)including Microsoftwindows.

## II. EXISTING SYSTEM

BCDs were developed in the beginning of the 20th century, with a sound processor attached with spectacles, steel spring headbands, or soft headbands. The vibrations that are produced are transmitted through the skin to the skull bone, and further to the cochlea in the inner ear, bypassing a conductive impairment in the external or middle ear. The development of the conventional BCD was a big step forward in the rehabilitation of these patients .In existing system ,in ear outer drum disabilities are using hearing machine it is to used to hear the sound signal. But inner drum disabilities persons cant able to hear the voice . The hearing machine only amplify input signal.

**DISADVANTAGES**

Devices have some drawbacks.

- Static pressure on the skin needs to be high enough to transmit the vibrations to the cochlea, leaving the skin compressed, which might lead to discomfort and skin problems in the attachment area.
- BCD with a headband as well as with frames of a pair of glasses is related to the static pressure of approximately 2 N towards the skin and the soft tissues.
- Outer drum disability person can't be use
- Less distance

## III. PROPOSED SYSTEM

In this project we implemented the voice input given to microphone after that we use some filters to compress the voice & Cleared voice stored in storage device of controller, after processing of controller give another section depends upon the channel selection. In decompress section retrieve the given input voice but it has less amplitude so we have to amplify the signal. After amplification we use transducer for converting sound signal into vibrating signal.

Sound vibrations travel through a medium, and sound is heard when sound waves travel through the medium of air or bones/teeth to arrive at the inner ears. The Sound Bite Hearing System uses sound waves travelling through bone, known as bone conduction to transmit subtle vibrations through bones to the inner ears. It is a removable bone conduction hearing prosthetic device that re-routes sound through the teeth and skull bone directly to the functioning inner ear or cochlea. By-passing problems in the outer and middle ears entirely. For patients suffering from single-sided deafness, Sound Bite re-routes sound from the deaf side, to the functioning cochlea, by-passing the non-hearing side.

Sound Bite uses the same mechanism of action as BAHA devices (bone conduction), however it places a transducer on the tooth —a "naturally osseointegrated" post — and thereby eliminates the need for a surgical implant.

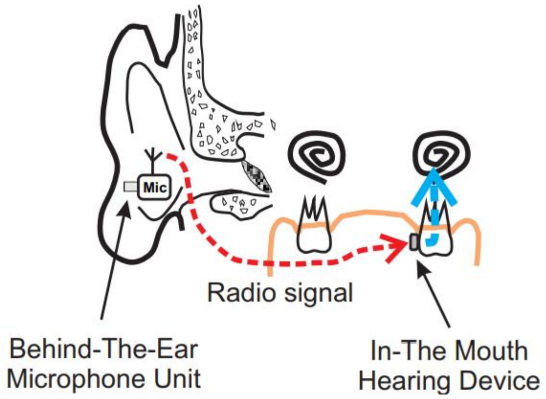
Sound Bite relies on two primary components to deliver sound:

- The behind-the-ear (BTE) microphone unit is worn on the patient's deaf ear. Using the natural acoustic benefits of the outer ear, sound is collected and channeled into the ear canal. A tiny microphone is placed within the canal of the impaired ear and is connected by a small tube to the BTE. The BTE uses a digital signal processor to process the sound and a wireless chip to transmit the sound signals to the in-the-mouth (ITM) device.

- The ITM device is customized for each patient to fit around the upper, left or right, back teeth. The ITM picks up the signals from the BTE and converts them into subtle vibrations that travel via the teeth, through bone, and to the cochlea. Once these sound vibrations reach the inner ear, they are converted into auditory signals which are sent to the brain and are interpreted as sound.

The BTE unit has a 12-to-15-hour operational life when fully charged. Each ITM hearing device has a 6-to-8 hour operational life when fully charged. The Sound Bite Hearing System includes 1 BTE, 2 ITMs, and a system charger.

The BTE unit delivers a broader frequency bandwidth (up to 18,000 Hz) as compared to existing devices for single-sided deafness. This broader bandwidth enhances spatial hearing ability, which is a key limitation for SSD patients




SoundBite device. The sound is picked up by an external microphone, worn behind the ear and then is transmitted wirelessly to the (In-The Mouth) hearing device attached to the teeth. The piezoelectric transducer converts the sound to vibrations that travel via the teeth, through the bone to the cochlea.

The simulation of hearing sound through a LabVIEW through bone conduction principle provide emotional based monitoring sound to single side deafness patients.

ADVANTAGES

1. Avoidance of surgery and surgical complications.
2. Delivers high fidelity sound with wide frequency range.
3. Removable device.

DISADVANTAGES

1. Cannot drink alcohol while wearing the oral device
2. Health teeth are needed to fit the device properly and good oral anatomy for full benefit the last 3 teeth in the maxillary arch are usually the abutment teeth and must be free of active caries periodontal and endodontic condition .

## IV.HARDWARE REQUIREMENTS

- PIC controller 16F877A
- Voice Board
- Driver
- Relay
- Vibrator motor
- LCD Display
- Call attend switch
- Amplifier

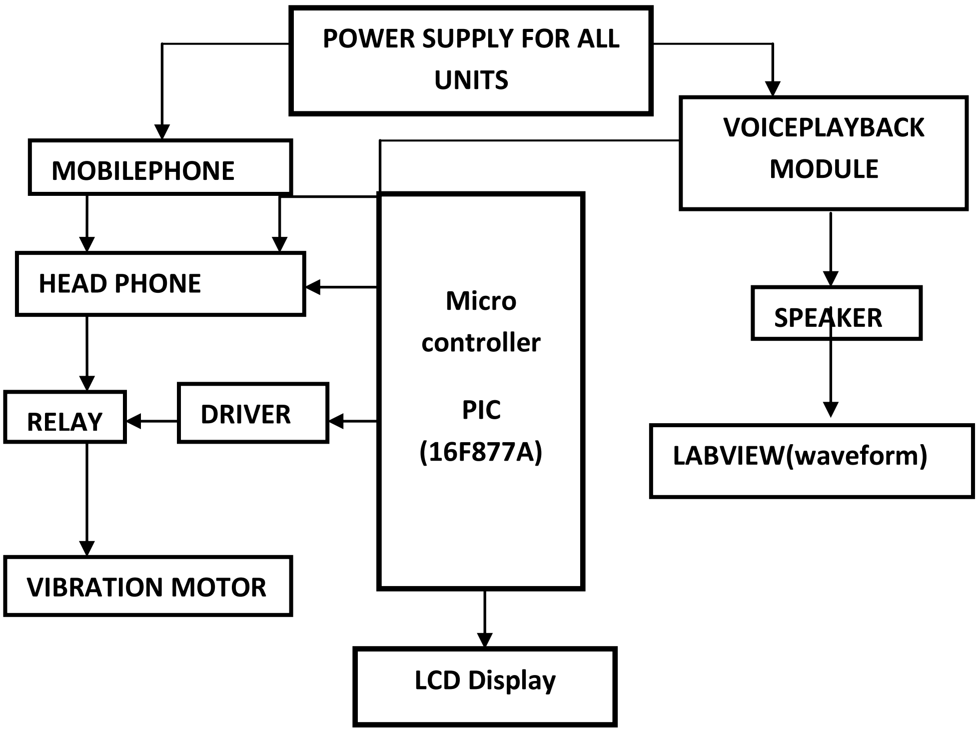
## V. WORKING

The microphone present in the voice board picks the sound created in the exerted environment /voice of the person. It has play &record switch for the purpose of recording the voice for the duration of 20 seconds &can play the voice whenever there is a necessity .Voice board controlled by PIC controller ,the motor operates at 9 Volt for the regulation of voltage ,the driver & relay is used. LabVIEW software is used to implement the graphical representation of emotional based sounds. The direct mobile communication is used when the far away.

## VI. SOFTWARE TOOL USED

The necessary program regarding private PC that comprises configuration as specified as follows:-

- Windows 10 (64-bit) operating system.



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*BLOCK DIAGRAM OF SOUND BITE HEARING SYSTEM*

- LabVIEW:

Sound captured by microphone & it given to continuous floe block for real time sound transmission. While loop is used for continuous process and sound signal is given to data conversion block where this sound signal is converted to data's, these data's are displayed by using graph & array unit.

Graph produce graphical waveform and array produce values of data & the present wave form displayed in the PC. It includes extensive support for interfacing to devices,instruments,camera etc. User interfaces to hardware by either writing direct bus commands(USB,Serial)or using high-level,drivers that provide function nodes for controlling device.

## VII. RESULTS & DISCUSSION

*GRAPHICAL REPRESENTATION OF DIFFERENTS SOUNDS BASED ON VARIOUS EMOTION*

Here we used the different types of emotions like anger, joy, sad, laugh and normal sounds of 3 persons or characters under two conditions like direct and indirect conversation which are graphically represented in the following figures**.**

*(i) GRAPH MODEL OF DIFFERENT CHARACTER FOR DIRECT CONDITIONS BASED ON EMOTIONS*

It shows the details view of different characters in face to face conversation with different emotions like angry, joy, sad, laugh and normal conditions.

| EMOTIONS | CHARACTER (d) |
|---|---|
| FIG 1 Angry | d0 |
| FIG 2 Joy | d1 |
| FIG 3 Sad | d2 |
| FIG 4 Laugh | d3 |
| FIG 5 Normal | d4 |

DIRECT CONDITION OF CHARACTER(d )

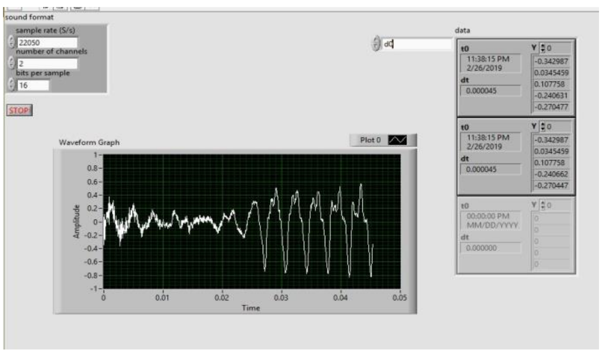


FIG 1 Representation of anger (d0)

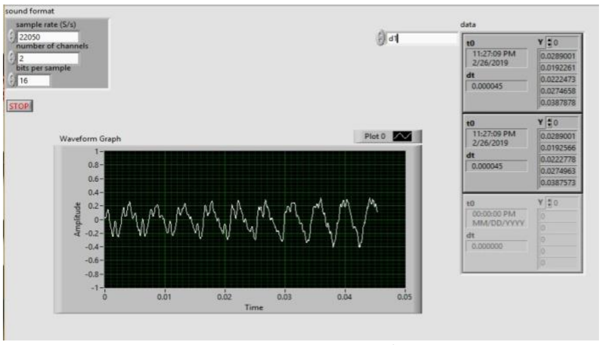


FIG 2 Representation of joy (d1)

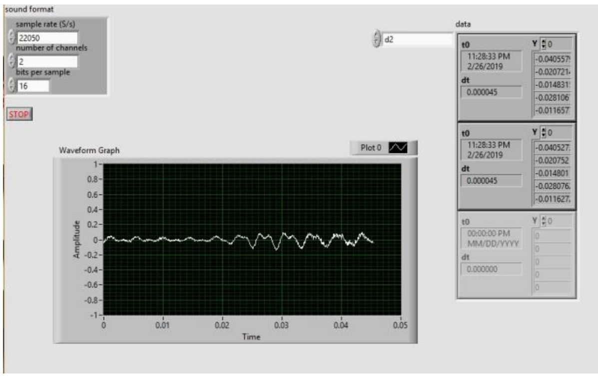


FIG 3 Representation of Sad (d2)

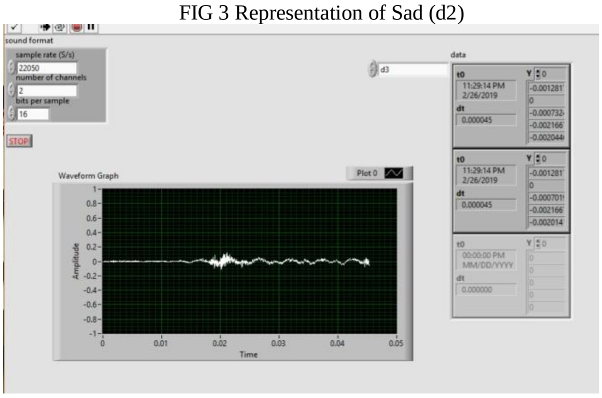


FIG 4 Representation of laugh (d3)

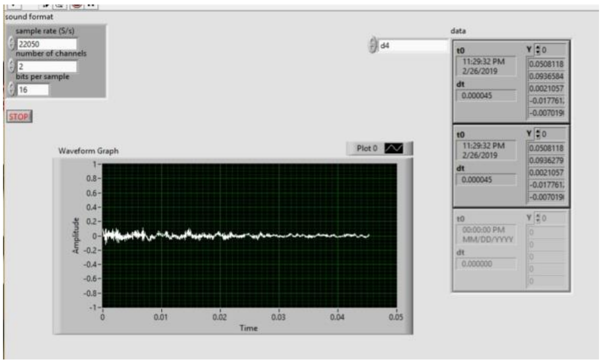


FIG 5 Representation of normal speaking(d4)

*(ii)GRAPH MODEL OF DIFFERENT CHARACTER FOR INDIRECT CONDITION BASED ON EMOTIONS*

It shows the details view of different characters in far away or mobile conversation with different emotions like angry, joy, sad, laugh and normal conditions in following figures:

*INDIRECT CONDITION OF CHARACTER  (dp)*

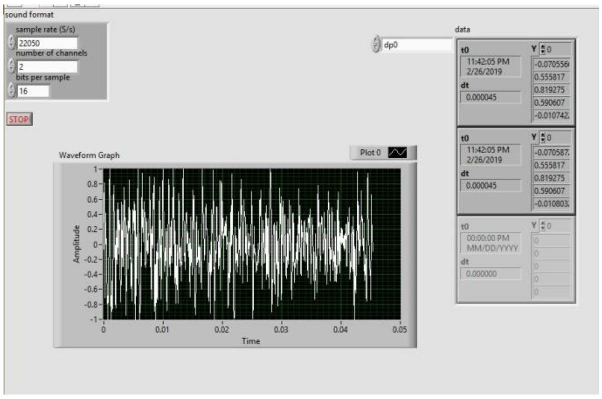


FIG 6 Representation of angry (dp0)

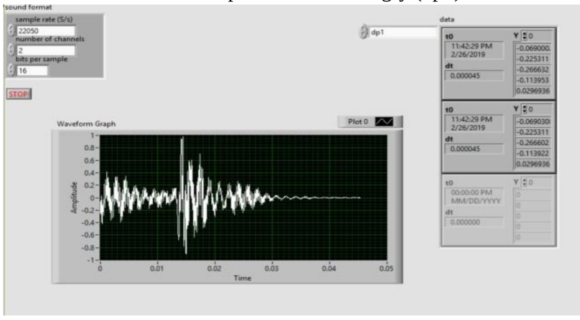


FIG  7 Representationof joy(dp1)

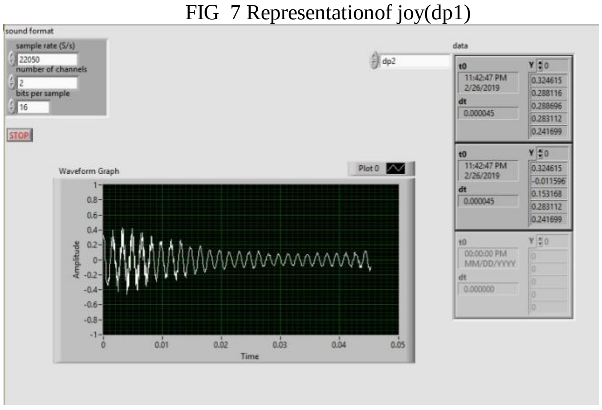


FIG 8 Representation of Sad (dp2)

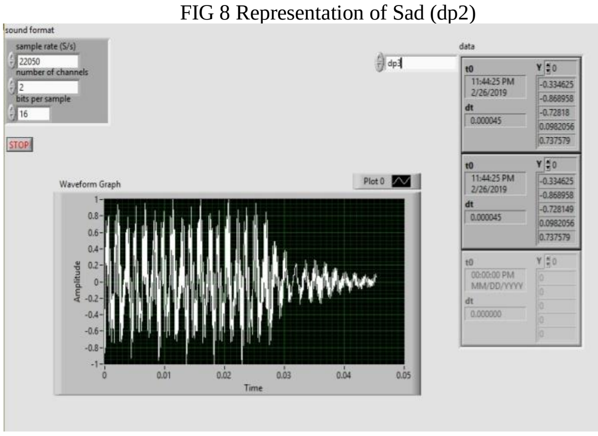


FIG 9 Representation of  Laugh  while speaking(dp3)

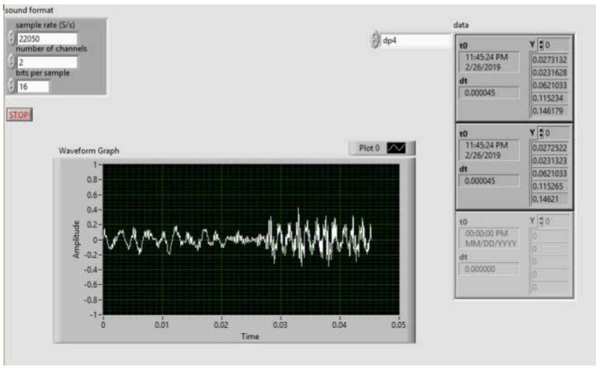


FIG 10 Representation of  normal speaking (dp4)

| EMOTIONS | CHARACTER(dp) |
|---|---|
| FIG 6 Angry | dp0 |
| FIG 7 Joy | dp1 |
| FIG 8 Sad | dp2 |
| FIG 9 Laugh | dp3 |
| FIG 10  Normal | dp4 |

## VIII.CONCLUSION

In this project we developed a soundbite hearing system for hearing impairment person. We used the bone conduction principle which provide hearing support to the patients and can provide emotional based monitoring sound by LabVIEW. It has a direct mobile communication system for enhanced hearing. We implemented signal processing strategy for restoration of cross-channel suppression in hearing impaired listeners. Sound bite hearing system is a non-surgical bone conduction prosthetic device that transmits sound via the teeth. It is very useful for hearing disability person. This device is sure to help the deaf people to communicate effectively in both direct and mobile communication.

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