SONIC FUSION:ADVANCED HEARING AID WITH A PIEZOELECTRIC TRANSDUCER FOR BONE CONDUCTION

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Keywords:

Bone conduction hearing aids, Skin erosion, non-surgical device, Piezoelectric element modification.

Introduction:

The invention presents a bone conduction device that translates received acoustic signals into mechanical force for the recipient's skull. It comprises a multilayer piezoelectric element with two stacked layers separated by a flexible passive layer. The piezoelectric layers, polarized oppositely, deflect in a unified direction upon receiving electric signals from sound. A mass component attached to the piezoelectric element responds to its deformation. A coupling connects the device to the recipient, facilitating the transfer of mechanical forces to the skull. The device's key components include the multilayer piezoelectric element, the attached mass component, and the coupling mechanism. Through these elements, the device efficiently converts acoustic signals into mechanical vibrations, enabling bone conduction for auditory perception.

Objectives:

Development of an innovative non-surgical bone conduction hearing device that eliminates the need for close contact with the skull skin, addressing issues of skin erosion and discomfort associated with traditional bone conduction hearing aids.

The goal is to provide a comfortable and effective alternative for individuals with conductive hearing loss, without the necessity for surgical intervention, ultimately enhancing the quality of life for users.

Cartilage implantation is not a standard term in the context of hearing aids, and it's more likely associated with reconstructive surgery. On the other hand, Fusion Sonic in hearing aids is a recognized technology designed to help individuals with specific types of hearing loss by transmitting sound through bone vibrations

Methodology:

The methodology employed in this study involved investigating the functionality of bone conduction hearing aids as an alternative when the traditional pathway of sound transmission to the eardrum is compromised. Specifically, we harnessed the inherent conductive properties of bone to directly stimulate cochlear sensory cells, bypassing the damaged outer and middle ear components. Our experimental device integrated a single-module system comprising a microphone, processor, and piezoelectric transducer. The microphone captured ambient sound, converting it into an electric signal transmitted to the processor. Subsequently, the processed and amplified sound activated the piezoelectric transducer, strategically placed against the mastoid bone. This essentially emulates a speaker, with its membrane substituted by a plate that responds to variations in electric current. Through this comprehensive approach, we aimed to evaluate the efficacy of this bone conduction methodology in transmitting sound directly to the cochlea, thereby providing insights into its potential as a viable hearing aid solution.

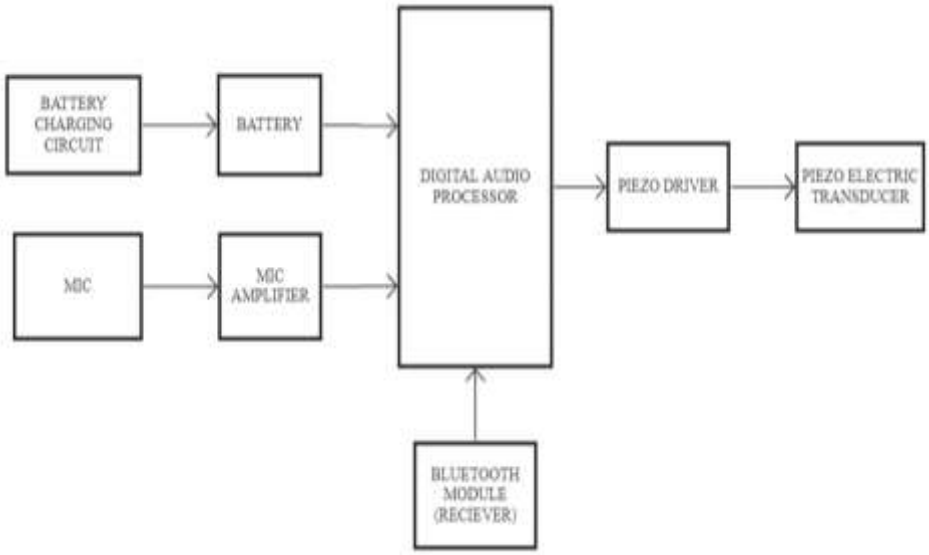

Fig 1:Block Diagram of Sonic Fusion

Conclusion:

The anticipated outcomes of this project involve the implementation of a novel bone-conduction system in headband to enhance noise reduction and speech signal magnification. the study aims to analyze the frequency responses of the proposed system and model a combinatorial approach for sound transfer. The expected results include effective neutralization of ambient noise through anti-phase cancellation and amplification of incoming speech signals using in-phase signals.

The efficacy of the devices is expected to be influenced by factors such as the quality of contact with the bone, the thickness of overlying skin, and the pressure exerted by the device on the bone.

The outcomes may pave the way for the integration of such technology into mainstream mobile devices, addressing a significant need in the communication technology industry.

Scope for future work:

- Improve durability for long-term reliability
- Optimize frequency response for clearer sound quality.
- Enhance battery life through energy-efficient piezoelectric materials