Name(s)	Project Number
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Project Title

Sound Localization and Noise Cancellation to Assist the Hearing Impaired

Abstract

Objectives

Hearing loss can be caused by multiple factors, such as genetics, aging, or exposure to noise or infections, rendering it a difficult medical disorder to remedy with a cure-all solution. Deficits in hearing can contribute to onset of depression and anxiety and were identified in 2005 as an area of emerging research, particularly in its application to children. However, expensive rehabilitative services remain a high barrier to entry for many in the developing world.

Our purpose is to identify a cost-effective solution. The goal is to create a smartphone-based device that visualizes real-time locations of environmental sounds on a 3D-grid interface. The aim of this study is to determine accuracy and viability of our sound localization method.

Methods

An audio sample was played from a fixed position and recorded using 4 microphones. Recordings were compared by cross-correlation and yielded the calculated position of the sound source. This calculation was compared to known origin of sound. Noise cancellation was performed by removing wall-reflected and background noise. FFT-IFFT technique was used to further remove high-frequency noise.

Results

Analysis of calculations revealed that most origins were found within a 40-degree angle of error without performing noise cancellation. Analysis of noise-cancelled data indicated that error decreased by half.

Conclusions

This proof-of-concept study yielded promising rates of accuracy of the sound source position detection with pure signal analysis only. The result can provide a cause to begin prototyping a visualization device.

Summary Statement

By recording the sound with 4 different mikes and analyzing it with matlab, we could accurately find the exact sound source position.

Help Received

Dr. Young Kim in Northrop Grumman reviewed the noise cancelling equation derivation