Real-time spatial sound rendering system using LiDAR sensor for auditory augmented reality application
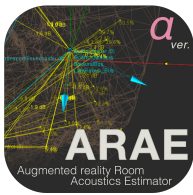
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Platform Overview

Augmented reality Room Acoustic Estimator (ARAE) is the iOS platform to compute variable characteristics of room acoustics for AR and produce spatialized sounds instantaneously using Unity and audio middleware, Wwise. This platform needs LiDAR-equipped iPhone and AirPods with gyrosensor. Participants' movements and transmission of sounds can be stored at an external strage. Any sound attributes are controllable from both inside and outside. This research platform provides a practical experimental environment that supports a variety of studies on cognition in AAR.

Background

The basic idea of **Audio Augmented Reality (AAR)** is to superimpose sounds on top of the real world as its user moves through it. The plausible spatial sound impression is essential to create a high-immersive experience in AAR: particularly, spatial matching between the physical room and virtual sound is crucial. However, due to the nature of AR, differences in spatial impressions in real and virtual spaces can be easily detected, and the mismatch can inhibit the immersive experience.

Currently, AR applications cannot acquire the room information needed for spatial acoustics in advance; hence, there are few research platforms to conduct perceptual studies on spacial matching.
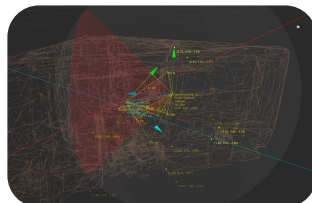
## ◆ Features

Capture and store room shape

Capture a 3D room model by meshing function in ARKit and save it as a 3D geometry format (.obj).

### Acoustical attribute caltucation and visualization

Real-time calculation of various kinds of room acoustic attributes, early reflection, late reverberation, diffraction, room coupling, and transmission. Visualize room acoustics and listener/sound source positions through the Wwise profiler.

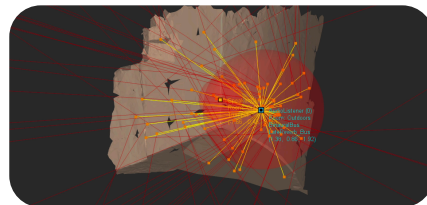### Spatial audio input and output support
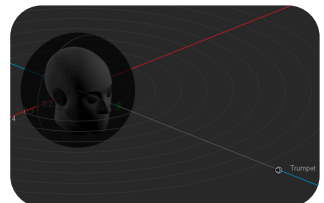
Support multichannel sound format, high order Ambisonics, and binaural decodes with HRTF convolution / head tracking.
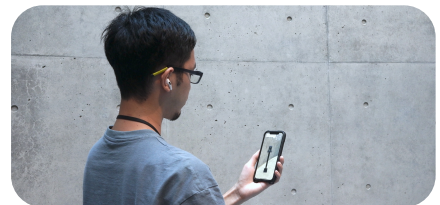
◆ Procedure

Scanning
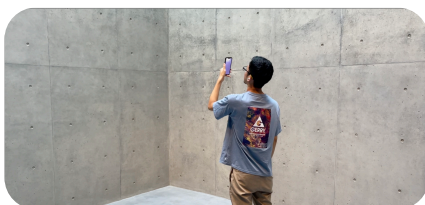
Capture room shape and registor its mesh data to the calculate senction.

Real-time calculation

Calculate acoustical parameters according to each sound and user position/direction.

Representation

You can listen to spatialized sounds in binaural format through ARAE!

This platform should enable AR and acoustic researchers to achieve and evaluate plausible spatial acoustics in AAR applications.

Scientific research with ARAE will contribute to future immersive perception research, including auditory perception in the metaverse.

Acknowledgements

OKINAWA INSTITUTE OF SCIENCE AND TECHNOLOGY

GATARI Inc.

RIT | Rochester Institute of Technology