The Sound Pixel Project

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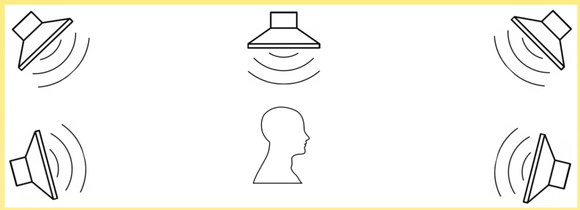
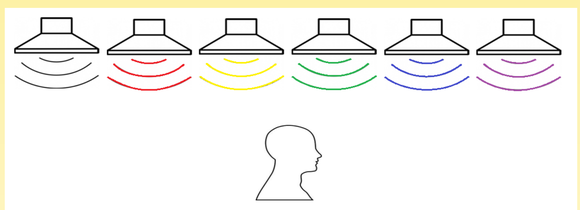
Introduction

Traditional surround sound speaker systems are based on arranging 2 to 8 speakers around a listener. To create a general location of particular sounds the same audio stream is played at different volumes in each speaker. This method of surround sound creates a false sense of thee dimensional positioning. The Sound Pixel Project moves from the conventional use of a small collection of speakers to a large array of sound emitters allowing for unique positional audio effects. Look at a television, for example, it is a system of light emitting pixels that function independently but come together to form a unique picture. Building off this concept, each sound emitter becomes a sound pixel that is capable of creating a unique sound at its location. The result is the formation of a “sound image” creating a true positional effect for the listener.

Surround Sound: single audio file played through different locations



Sound Pixel: multiple audio flies played through independent sound emitters



Objectives

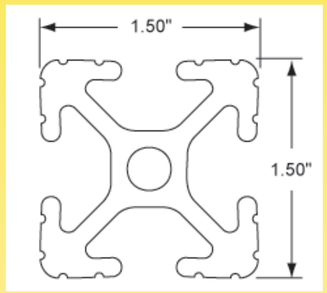
- Construct a sturdy frame to mount speakers in a two dimensional grid
- Develop programs to mix audio files that prevent clipping
- Develop a network where a server pushes configuration data to the client
- Install and configure an audio card to control multiple ports of audio

Methods

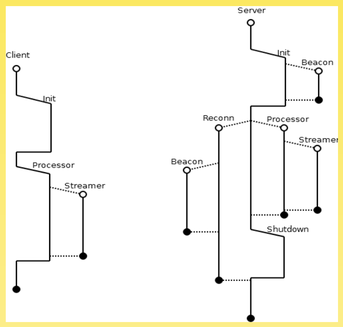
Building a Frame

The frame’s general concept is to be transportable, sturdy, and easily constructed. We chose the material 80/20 due to it’s lightweight aluminum alloy composite and T-slot capability. 80/20 also came in 4’ segments allowing the frame to be adjustable for future projects. Currently the frame is 4’x4’ but is capable of 16’x12’. To mount the speakers eight gauge cable wire extends vertically at cross sections of the frame.

Cross section of 80/20 material displaying T-slots



Network process diagram



Network to Control the Emitters

To get the audio from the computer to the speakers, a client and a server had to be created. The server broadcasts its location to the clients, they connect, download configuration data, and the server begins processing and streaming audio to the clients. If clients get disconnected for any reason, the server is immediately notified and begins trying to reconnect while still streaming to the other clients. The server currently supports approximately 65535 total clients and is easily modified to support more

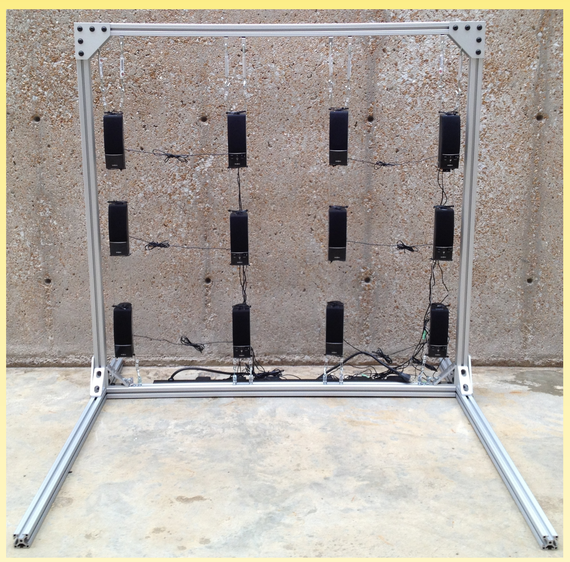
Mixing Audio Files

For future projects, an audio mixing program was developed to enable audio files to “flow” between sound emitters. All audio files are broken down into samples that are determined by the tracks sampling rate and bit depth. We chose to create a standard audio format of signed 16-bit audio at a 44100 bits per second sampling rate. If two or more audio files are mixed together and the combination of samples surpasses the threshold clipping occurs, the distortion of audio. The program prevents clipping by searching through the mixed track to find the peak sample value to use as a dividing ratio for the rest of the track. This makes sure the max value is never clipped and all over mixed samples are reduced by the same ratio.

Results and Future Projects

The Sound Pixel Project is currently functioning but with limited capabilities. Each sound emitter must be loaded with an individual audio file before being sent by the server. Meaning, all audio mixing is forced to be completed before any audio plays. Although this project is at a basic state it creates a platform to be built upon with future projects. New undergraduate studies could start implementing real-time mixing where audio can move between sound emitters while playing. Applications can be developed to show a layout of the speaker grid with the capabilities of “dragging” music to the particular sound emitter. Further into the future plans when the grid is much larger, Xbox Kinects can be used to track the motion of a person walking by the grid allowing the sound to follow the listener.

The Completed Sound Pixel Project



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