Geomixer: A Creative Audio Mixer

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY OF MICHIGAN

EECS 452: Digital Signal Processing Design Lab – Fall 2022
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Introduction

- Geomixer is a creative approach on a traditional audio mixer.
- It implements a user-friendly, tactile approach to audio mixing by using shapes to represent combinations of effects.
- Four different real time audio effects were implemented from scratch in C++.
- The GUI serves as an innovative approach to elementary audio mixing.

Overall System Architecture

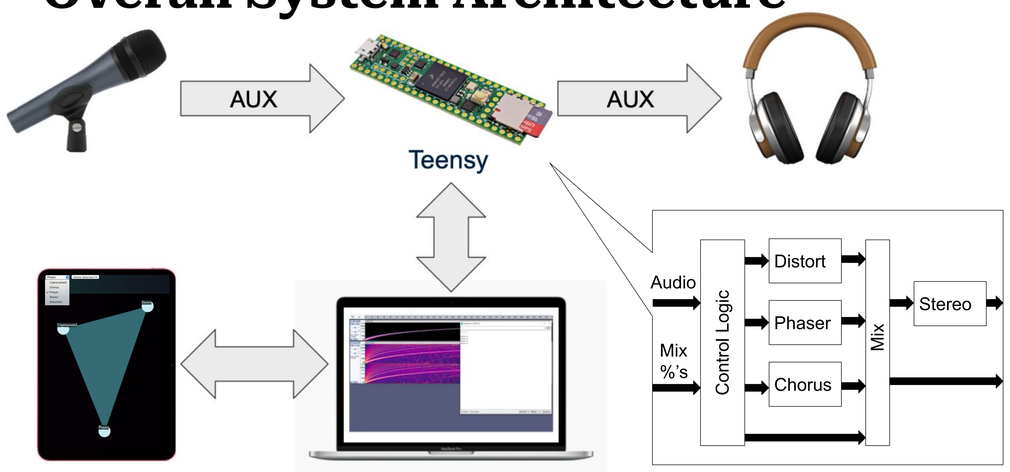
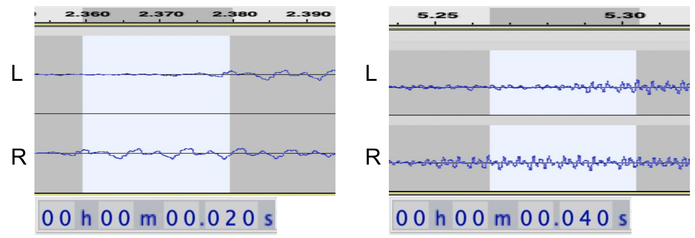
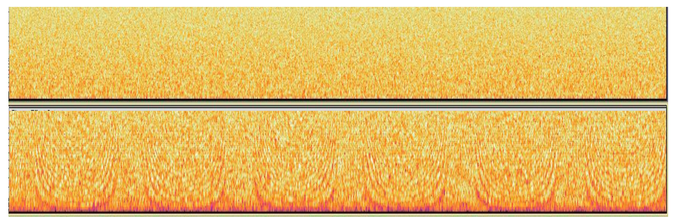


Diagram of the overall system with components and connections

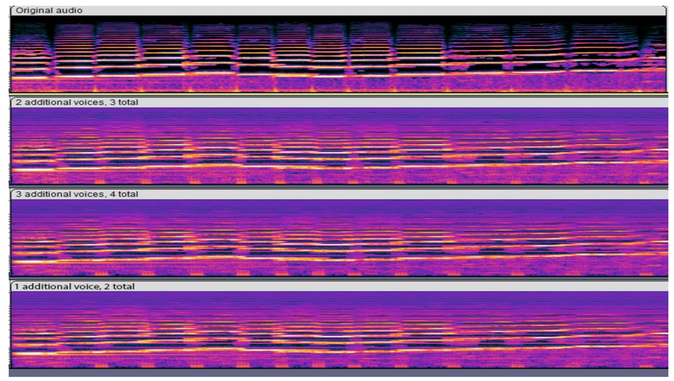
Testing Results



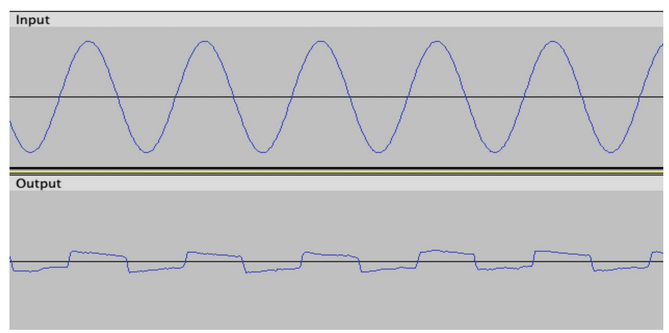
Stereo Delay Validation Tests



Phaser Effect Oscillations on White Noise



Chorus Effect on Violin Sample



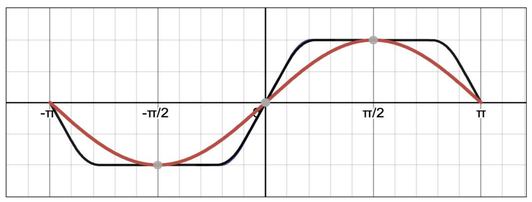
Distortion on 500 Hz Sine Wave

Challenges & Future Improvements

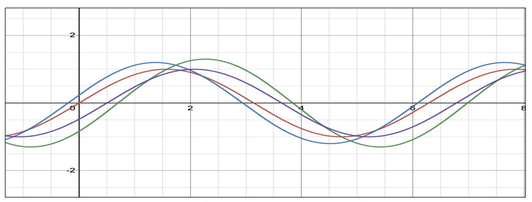
- Challenges with Reverb
  - Simulation reverb sounded like chorus
  - Convolution reverb required too much processing power
- Future Improvements
  - Add more audio effect options
  - Add features to GUI for more creative expression
    - Multiple shapes at once
    - Larger shapes than triangles

Algorithms & Techniques

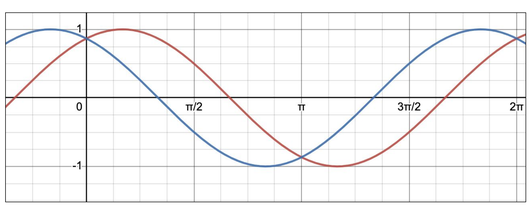
The audio effects are applied to the input sound at different levels based on user input through the GUI's geometric coordinate system.



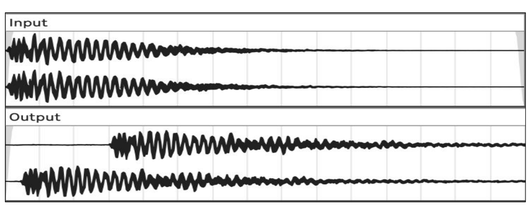
The **distortion** effect changes the shape of an input sound wave by inputting sample values into a piecewise function that clips the signal beyond an adjustable threshold.



The **chorus** effect uses a circular buffer to store previous audio samples and, depending on the desired effect intensity, past samples are added back into the current block to give the input sound multiplicity.



The **phaser** effect adds back in a delayed version of the signal where the delay is modulated by a sine wave to produce a sweeping sound.



The **stereo** effect delays the output of the channel in one ear up to 40ms, taking advantage of the Haas effect.

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