

Thesis Project Portfolio

Pitch Shifting Audio Sampling Instrument
(Technical Report)

The Ethics of True Environmental Sustainability in Engineering
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

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Introduction

In my group's capstone project, we designed and built a musical instrument called "The Samplisizer". The name is a portmanteau of sampler and synthesizer. The Samplisizer, as the name suggests, is a combined audio sampler and synthesizer. It allows users to record any audio with a microphone and play it back at the corresponding pitch on a keyboard. The Samplisizer is MIDI compatible meaning that any MIDI controller can be plugged into the device to control the audio output. Our group was composed of musicians and fans of sampled music, which was our primary motivation for this project. My STS research paper is about sustainable engineering. I chose this topic because I am very passionate about environmentalism and green activism.

Project Summaries

In my technical capstone, we wanted to create an instrument that could sound like anything. In order to actualize this, we determined that the best way to do this was by allowing users to use a microphone to record audio. The Samplisizer contains a RaspberryPi that would then run the PSOLA algorithm on the raw audio to create a set of pitch shifted copies of the original audio. Then, when the Samplisizer receives an input from the MIDI controller, it will play the corresponding audio out of the speakers. Some distinguishing features of the Samplisizer are the modularity of the design as well as the ability to play multiple samples at the same time.

My STS paper explored what true sustainability in what engineering looks like. I provide a more rigorous definition of sustainability and show that essentially nothing that is commonly considered ecofriendly is truly sustainable. I then explore specific examples of sustainable technology and their short comings by this new definition of sustainability with a specific emphasis on E-waste recycling. I chose to do this because of its relevance to electrical

engineering. Finally, I discuss greenwashing and how it has negatively contributed to our current view of sustainability.

Conclusion

My capstone project was a great opportunity to use the skills I learned in my time in undergrad to design something with limited guidance. It gave a broad range of technical challenges including PCB design, digital signal processing, communication protocol, and operating systems. Additionally, it provided a glimpse into collaborating in a team setting where each member can leverage their own strengths. I gained a greater understanding for what it takes to turn an idea into an actualized design. Through my technical thesis, I obtained a deeper appreciation for the ethical challenges within engineering and how to apply these more broadly in my day-to-day life.

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