

# ECE 385

Spring 2022

Final Project Proposal

## FPGA Sound Board

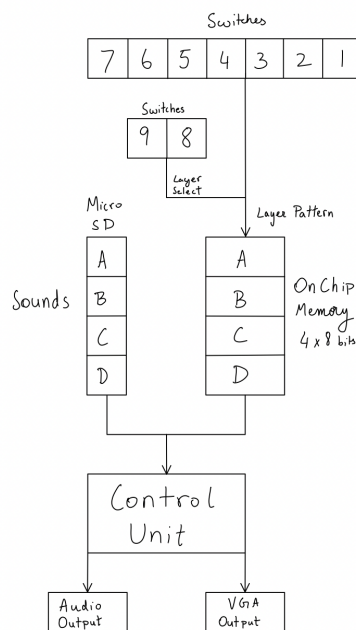
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## Idea and Overview

We propose to design and implement a GarageBand-type digital audio sequencer on the FPGA. Our System-on-chip will be based around the SystemVerilog 6502 CPU chip. This will be implemented using SystemVerilog essential components, like System Bus, RAM, and Video Display. Our design will also include the NIOS II/e CPU chip in order to read from the MicroSD card, and output to the headphone jack. To show the success of this project, we will demonstrate the selection of 4 audio patterns and play them in real-time.

## Block Diagram



## List of Features

### Base Features:

- A pattern of sounds should be able to play based on the patterns created from the switches
- Represent the currently saved pattern for each sound on the LEDs
  - This would help us see the current state of the pattern for a selected sound.
- Save/overwrite pattern for each sound to On-Chip memory
- Properly layer the audio patterns with Digital Signal Processing in the Control Unit

### Additional Features:

- Represent the final produced beat on a VGA monitor.

- This could include just representing the pattern or also adding a waveform for each sound block.

## Expected Difficulty

Upon speaking to Professor Cheng, we have come to believe that we can place the difficulty of this as a 9. 8 Points of difficulty can be attributed to just reading data off of the MicroSD card, and then utilizing Digital Signal Processing to manipulate and clip and sew the audio files, and then outputting it in a usable format to the audio jack. Another point of difficulty comes from connecting all the units together and potentially using the VGA.

## Proposed Timeline

### Week 1

- Since we want to wait for the proposal to be approved before we start getting into the thick of this project, we want to set up the structure of the project with different modules by the end of this week.
- Start working on pattern creation, saving, and resetting with the switches and LEDs.
- Start working on the on-chip memory component.

### Week 2

- Finish the pattern creation and the on-chip memory component.
- Start working on reading MicroSD data.
- Mid-Project Checkpoint
  - Show the setting and clearing of the patterns based on the switches onto the LEDs.
  - Show some progress on the MicroSD component.

### Week 3

- Finish MicroSD component
- Start and finish outputting to audio jack
  - Be able to output an unmanipulated audio file
- Start DSP/audio layering component

### Week 4

- Finish DSP/audio layering component
- Implement VGA if time permits