

ECE 540 FINAL PROJECT PROPOSAL

Project Name: FFT Audio Visualizer

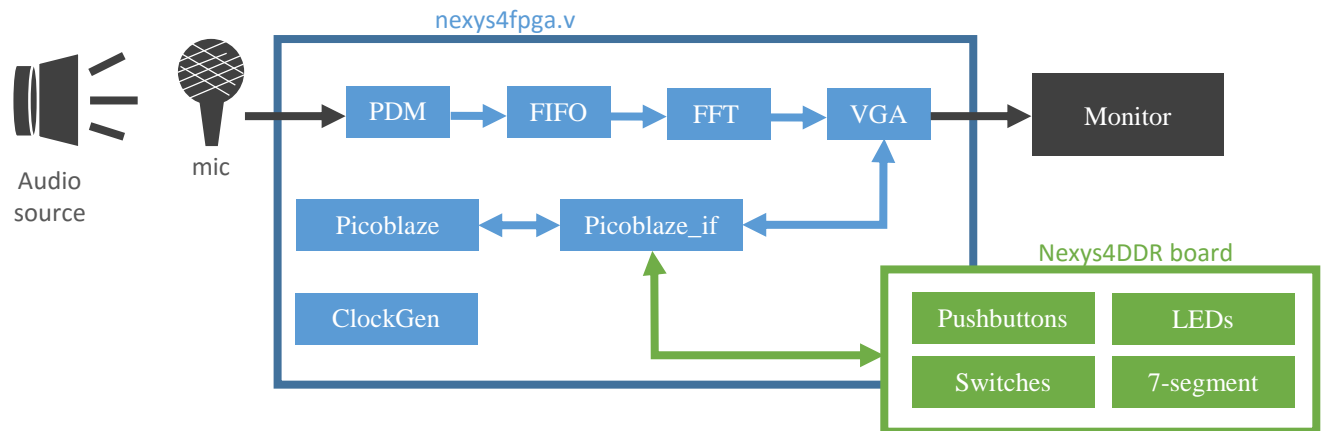
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Project Description [WHAT ARE YOU GOING TO BUILD? WHAT COMPONENT(S) WILL YOU USE? **INCLUDE A BLOCK DIAGRAM OF YOUR DESIGN AS YOU ENVISION IT**]:

We are building an audio visualizer to display on-screen. We will sample an audio source from the Nexsy4 on-board microphone, which outputs a PDM signal. We will (optionally) store this in a FIFO buffer and then pass to a Fast-Fourier Transform (FFT) module for processing. This module will be optimized to take advantage of the DSP modules in the Artix 7. With the results of the FFT, we will pass this to a VGA controller which will determine whether to draw the background or the spectral bins. The VGA controller will provide the appropriate RGB values for outputting on a monitor connected to the Nexys4 board. The Picoblaze will be used to handle the pushbutton inputs and update the on-board LEDs and 7-segment display.



Design Approach HOW ARE YOU GOING TO BUILD IT? HOW WILL YOU DEMONSTRATE SUCCESS ON THE FPGA DEVELOPMENT BOARD? WHAT ARE YOUR OPTIONS IF YOU START RUNNING OUT OF TIME?]:

1) We are using Github (<https://github.com/rsi7/finalproject.git>) to manage code and push incremental development. We will establish the architecture and the IO's required for each block, then assign each module to a team member to develop, debug, and complete. No outside hardware should be required save for the monitor. A number of resources are available for FFT algorithms and HDL implementations, so that piece should be fairly straightforward. We will test this functionality on the Nexys4 LEDs to make sure the spectrum is operating as expected. The biggest challenge will probably be the VGA controller block, which will need some pixel detection scheme similar to the 'icon' module in Project 2.

2) We will demonstrate success by having an 8-bin audio spectrum displayed on a monitor connected to the board. The spectrum should be responsive to the audio and refresh at a reasonable rate.

3) We have intentionally kept the feature set very basic to guarantee deliverables. However, if time runs out we will replace the VGA output with a simpler display (e.g. 8x8 LED array). This should be considerably simpler to implement. If we are running ahead of schedule, we may implement additional features such as: RGB color cycling of the spectrum, a live waveform viewer, a connected RGB LED strip, better microphone connection through USB, DSP modification of the audio input (e.g. delay, rever, etc.), additional FFT bins.

Milestones/Deliverables [HOW ARE YOU GOING TO DEMONSTRATE THAT YOU'RE MAKING PROGRESS]:

Week of 11/15: Have detailed architecture and IOs listed; divide work, research FFT, start top-level 'nexys4fpga' module.

Week of 11/22 : Audio input into buffer working; Picoblaze code for board IO running. Testing/debugging FFT module.

Week of 11/29 : FFT fully functional and displaying on Nexys4 LEDs; VGA controller in development.

Week of 12/6 : Demonstration and Final Report
