ECE 153A, Friday @ 4:00pm
Lab #3A

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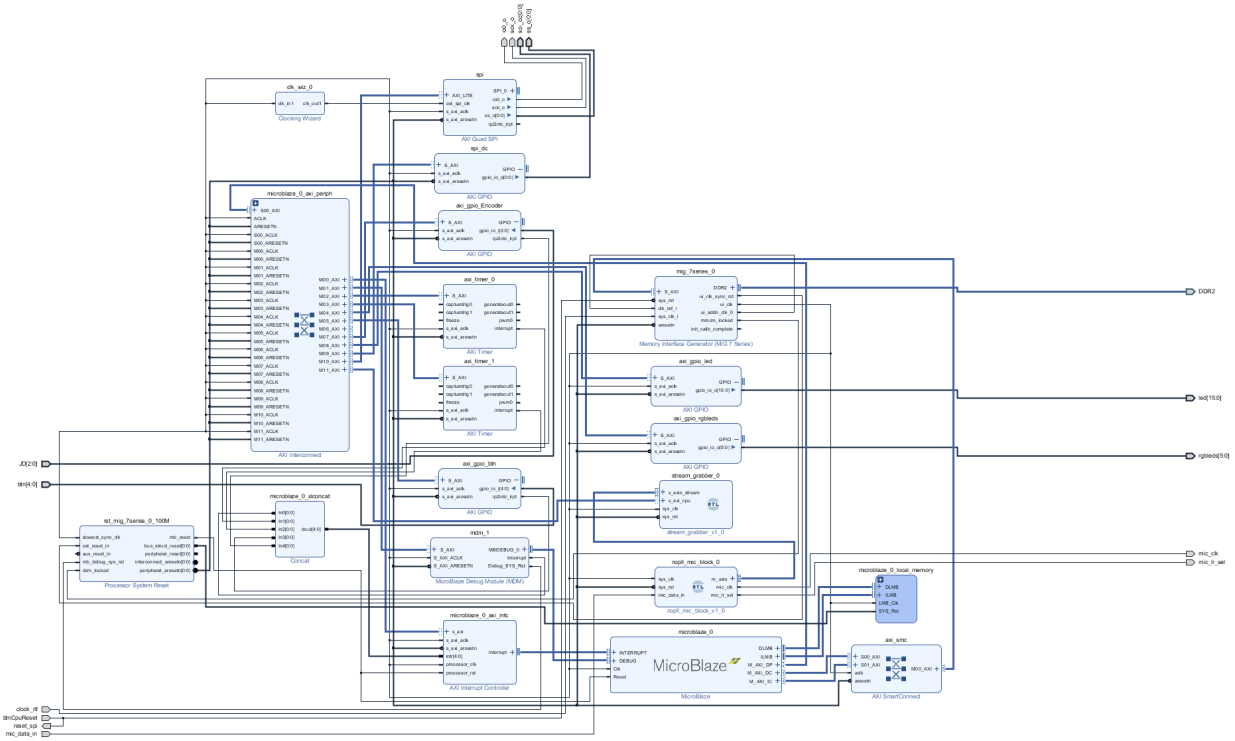
Lab Partners: Joshua Thomas

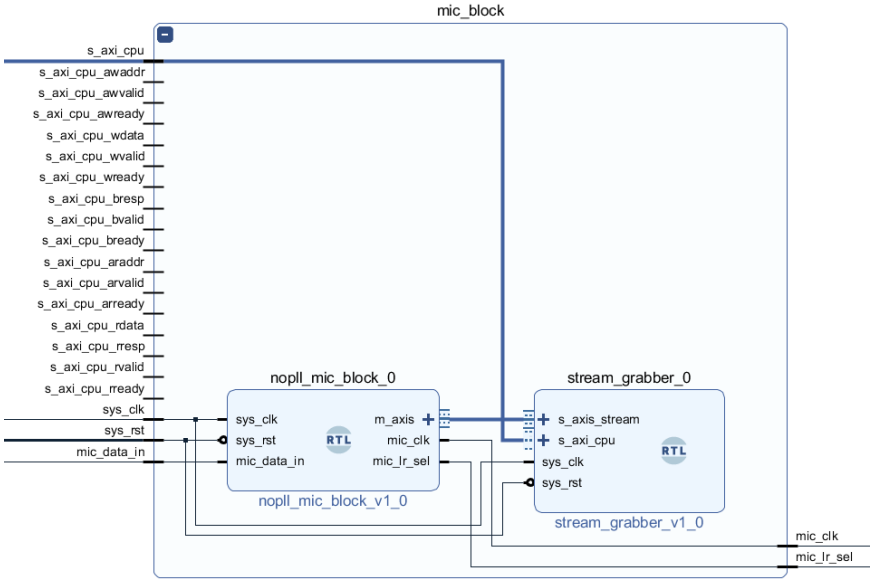
PART 1

Here's a picture of our entire block design schematic from Vivado.



PART 2

Here's a picture of the internal wiring for the Mic_Block.



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PART 3

The first thing we noticed was that in the FFT function, there were two calls to sine and cosine functions that were taking a lot of time. Since these sine and cosine values were being calculated at runtime, it led to a lot of runtime delay in the program. We solved this problem by creating a 2D array of all the sine and cosine values computed ahead of time. This way, during the actual execution of the FFT function, it can just lookup the necessary value in this array in linear time. We also decreased the sample rate from 512 to 128. This further help reduce the runtime delay.

PART 4

We noticed that for lower frequencies (less than 5 kHz), the computed frequency value was within 20 Hz. For frequencies between 5 and 6 kHz, the computed value was very close (within 1-5 Hz). For any frequency above 6 kHz, the program did not seem to function well at all.

PART 5

Our new FFT code operates significantly faster than before. We noticed that the computation time decreased from around 1300 ms with the original function to just 90 ms with our new function. Throughout all our changes the accuracy remained very similar.

PART 6

Before we made any modifications to the original code, we found that around 75% of the time was spent in the actual FFT part of the code, 2% of the time was in the read_fsl_values function, and the other 23% was spent in other various parts of the program.

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Once we made our optimizations to fft.c and trig.c, we found that only 11% of the time spent was in the FFT part of the code, 2% spent in the read_fsl_values function, and the other 87% was spent in other various parts of the program.

PART 7

Here's a link to our demo video:

https://drive.google.com/file/d/1Q6-pLa0_WhlvAhOFhg3uU2CNaNrTrjTV/view?usp=sharing