John Westbrook

5 December 2023

System on Chip

Dr. Keith Schubert

Final Project Report

Summary

Having a background in music, my idea for this project was to use the on-board mic of the NEXYS4 and display an audio input as a note on the seven-segment display. I did not expect it to be so difficult, but it was. Taking data from the microphone, which thankfully was in digital format, and determining the frequency from it was the biggest challenge.

Process

Coming into this project with a minimal understanding of the process of converting audio required a lot of research just to understand what needed to be done. After many hours of scouring Google and help forums, I came to the understanding that a Fast Fourier Transform would be needed. The next issue was that I had almost no idea how an FFT worked. Thankfully Xilinx has an IP built in to Vivado which enabled me to just plug in the variables and obtain the transformed data.

The microphone outputs Pulse Density Modulated data, which streams a one-bit output as 1s and 0s, with the density of the bits carrying the data. To make it easier to use the FFT, I first converted the PDM data to Pulse Code Modulated data, which was able to store a data size greater than one.

 