

Active Noise Cancellation System

Project

Active noise cancellation systems are implemented in a wide range of applications. They are interesting examples of signal processing, and most users overlook the methods used to achieve such satisfying results.

Objectives

- Create an active noise cancellation system capable of 20 dB of noise cancellation
- Make the system modular in nature to be used in any sort of unidirectional enclosed environment
- Make a product that is capable of teaching others about noise cancellation in an intuitive manner
- Improve our abilities in signal processing and FPGA development

System

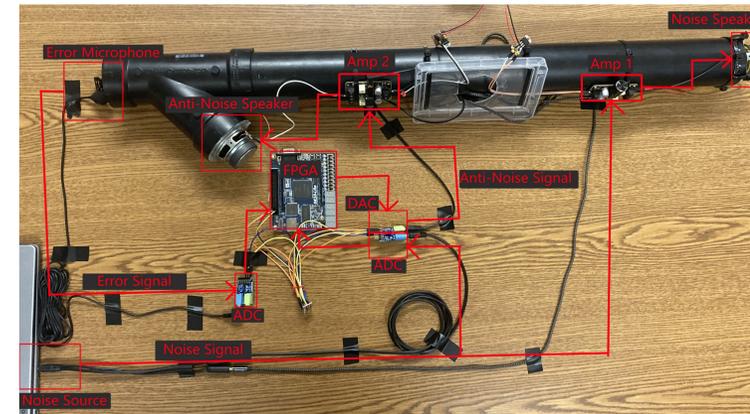


Figure 1. Photo of System with Block Diagram Overlay

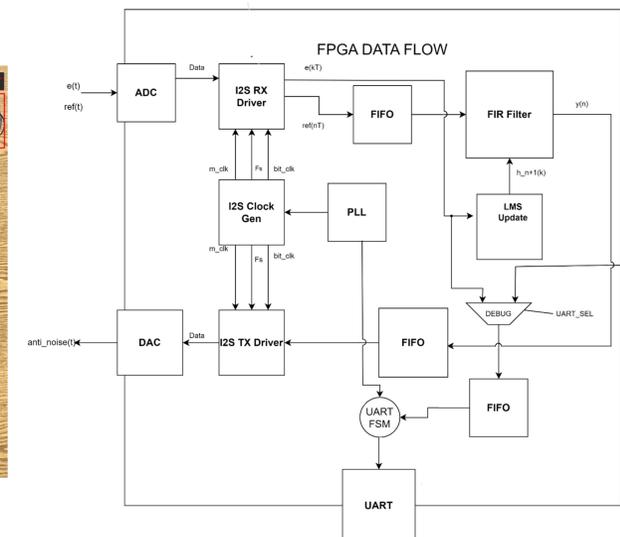


Figure 2. Block Diagram of FPGA Module Connections

Methods

- Develop a system-level design of components and methods required to process audio signals and compute an anti-noise signal
- Develop a MATLAB model to focus on the filtering algorithm without analog signals creating additional variables
- Write HDL to implement the filtering algorithm from the MATLAB model
- Write HDL to interface with ADC/DAC peripheral boards using I2S2 communication protocol
- Simulate filter HDL and verify results with MATLAB model values
- Integrate HDL and hardware into a cohesive system
- Test the complete system, find bugs, and optimize the processing

Conclusion

- Continued testing needs to be done with more types of sound before it can be considered a viable product for consumers
- We learned to perform real time DSP on audio signals and had to consider factors we had not originally thought of or considered
- We would like to test with even higher input noise sources, use different filter algorithms, and develop a PCB to refine the hardware connections

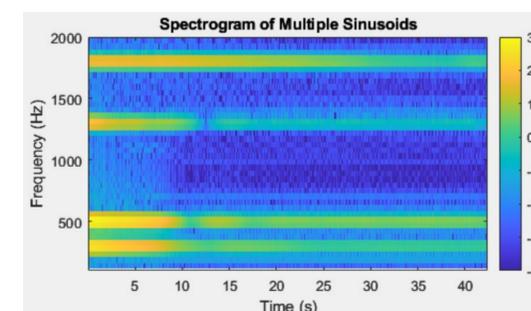


Figure 3. Spectrogram of Multi-Frequency Noise Cancellation

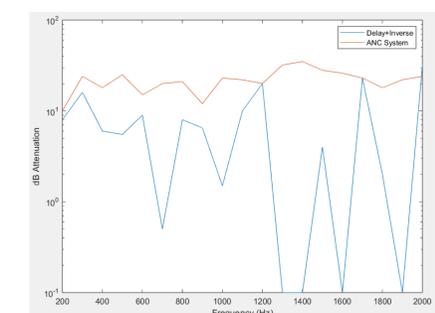


Figure 4. Measured Attenuation of ANC System Versus Delay and Inverse