

Summer 2018

Short Range Imaging Using Ultrasonic Signals

Liam Gildehaus
Montana Tech

Bryce Hill
Montana Tech

Follow this and additional works at: https://digitalcommons.mtech.edu/urp_aug_2018

Recommended Citation

Gildehaus, Liam and Hill, Bryce, "Short Range Imaging Using Ultrasonic Signals" (2018). *2018 Undergraduate Research*. 6.
https://digitalcommons.mtech.edu/urp_aug_2018/6

This Book is brought to you for free and open access by the Other Undergraduate Research at Digital Commons @ Montana Tech. It has been accepted for inclusion in 2018 Undergraduate Research by an authorized administrator of Digital Commons @ Montana Tech. For more information, please contact sjuskiewicz@mtech.edu.



MontanaTech

Short Range Imaging Using Ultrasonic Signals

Liam Gildehaus and Bryce Hill

Project Overview

Develop hardware and software to make distance measurements using ultrasonic signals. The main goal is to use the signals to create 2D and 3D images at short ranges and in confined spaces.

Hardware

- Teensy 3.6 Microcontroller and Audio Shield
- Microphones and Speakers
- Microphone amplifier PCB (Printed Circuit Board)

Software

- Arduino
- Ultiboard
- Multisim
- Matlab
- Audacity

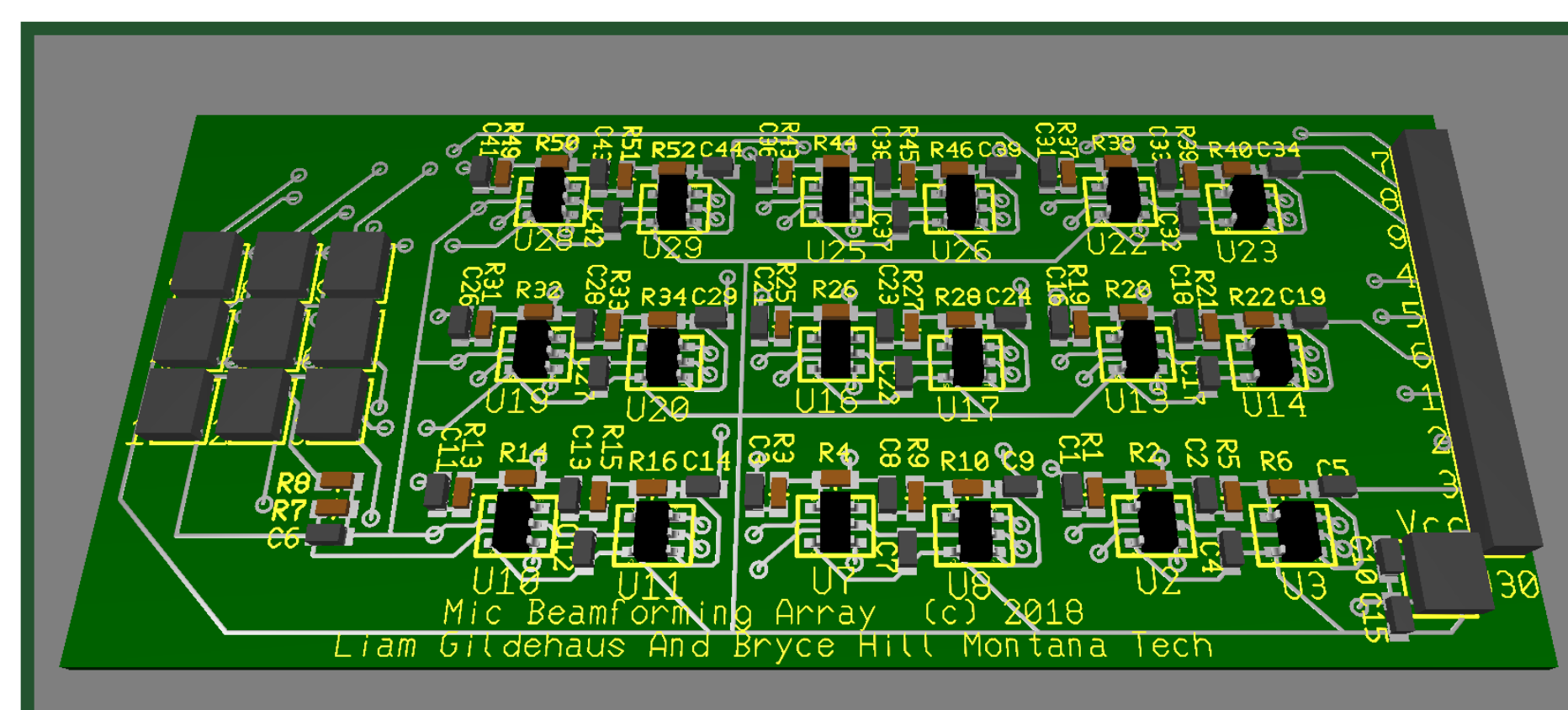


Figure 1. Microphone Amplifier PCB

Methods

- Tested microcontroller's ability to play audio
- Developed code to play and record audio simultaneously
- Tested different microphones and speakers between 5 kHz and 42 kHz
- Designed hardware setup and performed distance measurements
- Compared results and determined ideal frequency range
- Cross-correlated input and output signals

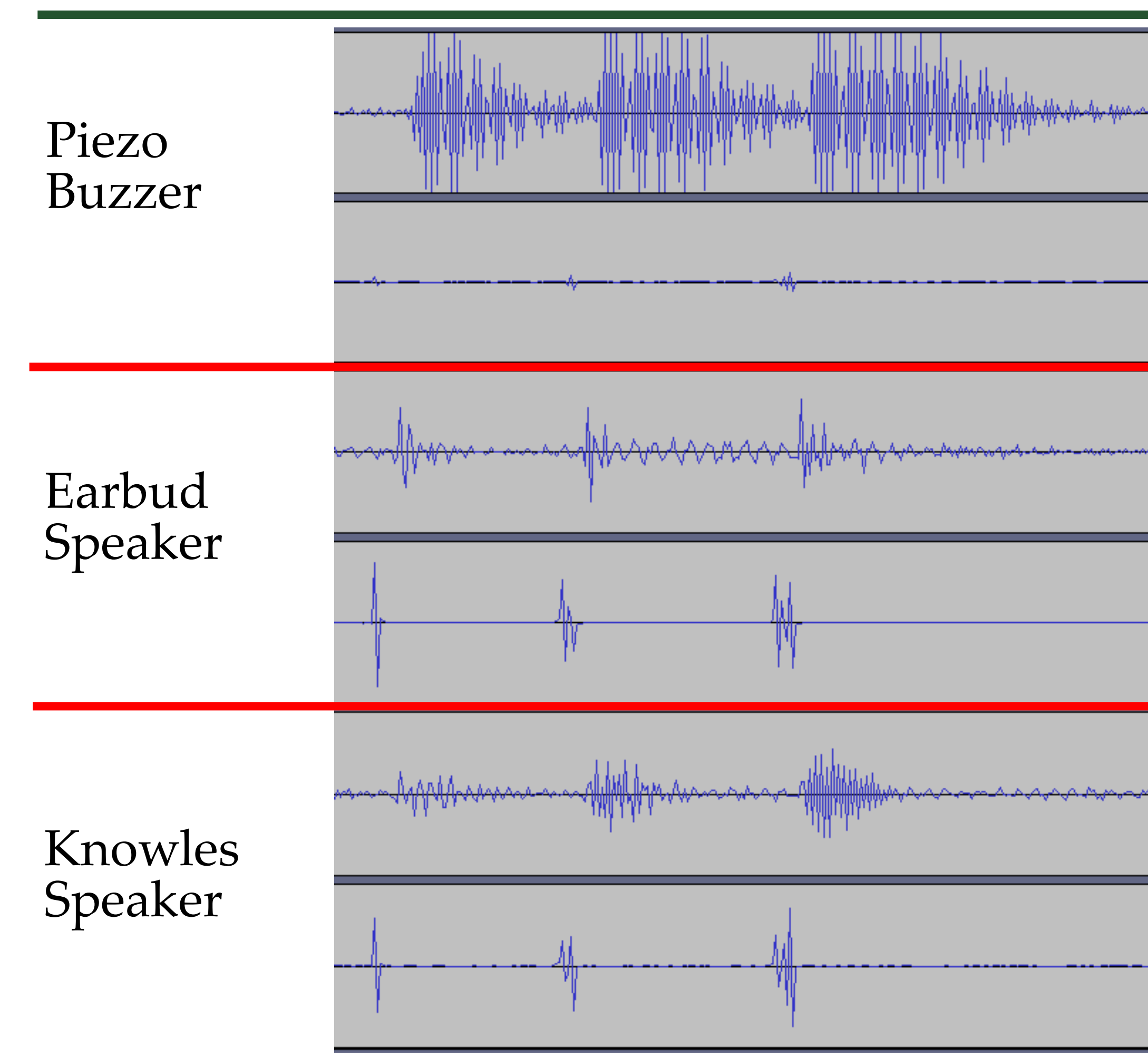


Figure 2. Speaker Comparison

Results

- Evaluated three speakers with similar input signals
- Lowered the signal frequency from 40 kHz down to 25 kHz
- Increased I2S sample rate from 44.1 kHz to 176 kHz
- Maximum resolution for distance measurements is to nearest 2 mm

Conclusions

- The piezo buzzer exhibited undesired ringing
- Identified signal frequency range
- Future work
 - Find a more suitable speaker
 - Obtain accurate distance measurements
 - Expand to an array of 2 microphones and speakers

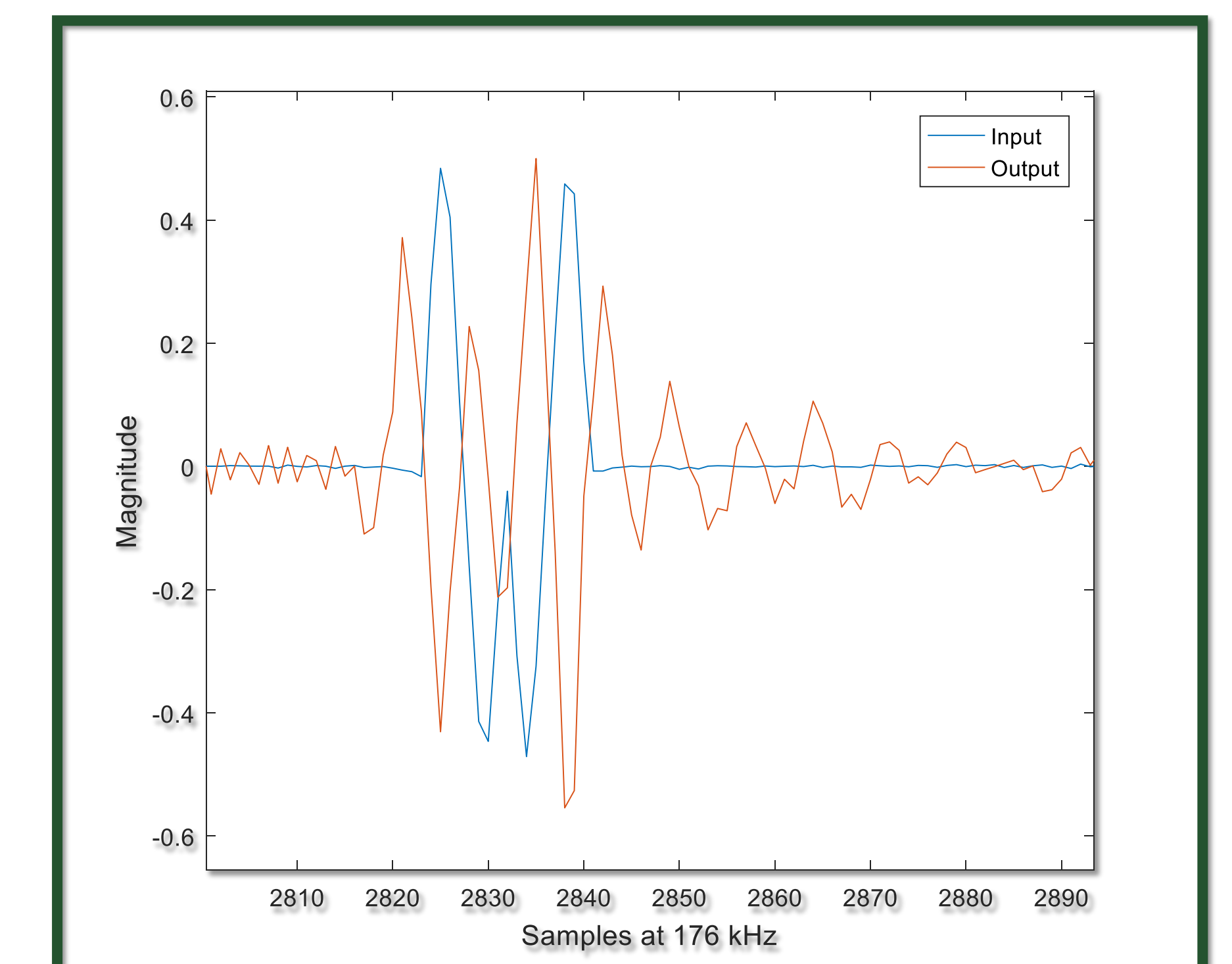


Figure 3. Cross Correlation of output and input

Acknowledgments

This work was supported by Montana Tech's Summer undergraduate Research Fellowship (SURF).