Kareoketron 9000

A simple sound player and listener I created for Physics Lab Fall Sophomore year.

Functionality

Video

The kareoketron 9000 tests users pitch by playing them a note then listening for the note they sing back. If the note they sing back is within one percent of the desired frequency the green led light is turned on to show they hit the correct pitch. Over the course of two seconds the Teensy 4.0 microcontroller averages together what it hears. I used the notefrequency() function from the Audio library that came with the Teensy. After the Teensy determines the average note sung, it flashes a light to show how close you were to the note overall. As you hopefully can tell from the video green is within one percent of the original note, orange is within twenty-five percent, and red is for when you completely miss the note. This process is repeated for five notes and the result of the test is printed out to the serial monitor of the computer the teensy is connected to.

Components

Wiring diagram

At the heart of the kareoketron 9000 is a teensy 4.0 microcontroller which I chose because it came with an adc and the processing power to perform the fast fourier transforms needed to pick out a note in real time. My lab also let us borrow a speaker and a microphone. I used a simple voltage divider to cut the signal in half because the adc of the teensy could only take a signal with an offset of .6V with a VPP of 1.2V while the microphone outputted a signal with an offset of 1.25V and a VPP of 2V. The slick 3D printed housing was designed and printed by my lab partner Aiden.

Some Caveats

One interesting thing about the human voice is that there are a lot of overtones. Sometimes the teensy would pick up on these overtones and record them into the notefrequency() function. Since I was taking the average of sound over time these miss readings of overtones would throw off the results. I ended up throwing away any datapoints that were not within 25 percent of the original note to get rid of them. This means that even if you sing the correct note an octave up or down the kareoketron 9000 will consider the note you sang incorrect. Unfortunately, we disassembled the kareoketron 9000 to return all the parts before winter break but if we were to continue development we would definitely add octave jump detection and the ability to actually sing along to music.