ECE 153B Final Project Proposal

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Background

Originally, I was planning to do a auto guitar tuner, which listens to the pitch of my guitar string as I pluck it, and while the string is still ringing, a motor adjusted the knob on the guitar at the corresponding string until the pitch is correct. It is something that I actually need because I played the guitar, so it means a lot to me. However, I later realized that the it is very tricky to measure the continuously changing frequency as the knob turns, and the utility of the project depends solely on the accuracy of the tuner, and high accuracy is hard to achieve. So I switched to another music related project in the last minute.

Goal

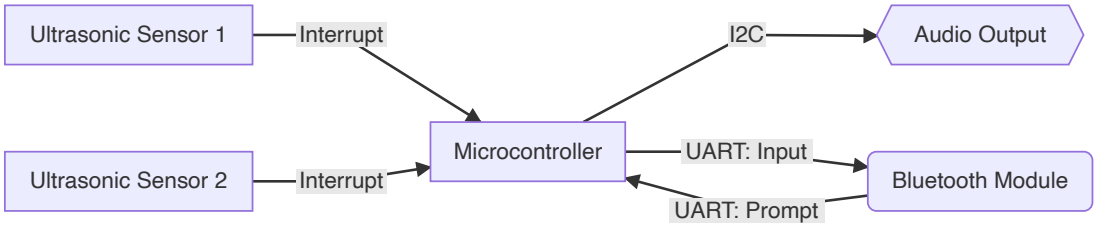
The goal of the project is to build a electronic musical instrument that can play notes according to the distance of my hands to the sensors (, inspired by a video that I saw a few years ago). Specifically, one hand will be in charge of the pitch, and the other will be in charge of the loudness. In addition, there will be a menu which offers further configurations. For instance, one can allow the pitch to move 'continuously' as the hand moves continuously, or one can let the pitch to be rounded to the nearest chromatic semitone, or some other common scales (major/minor). In addition, there can be some preconfigured timbres of sound made from adding different harmonics and overtones to a fundamental frequency. The user will be able to interact with the settings configuration through a Bluetooth Module.

Purpose

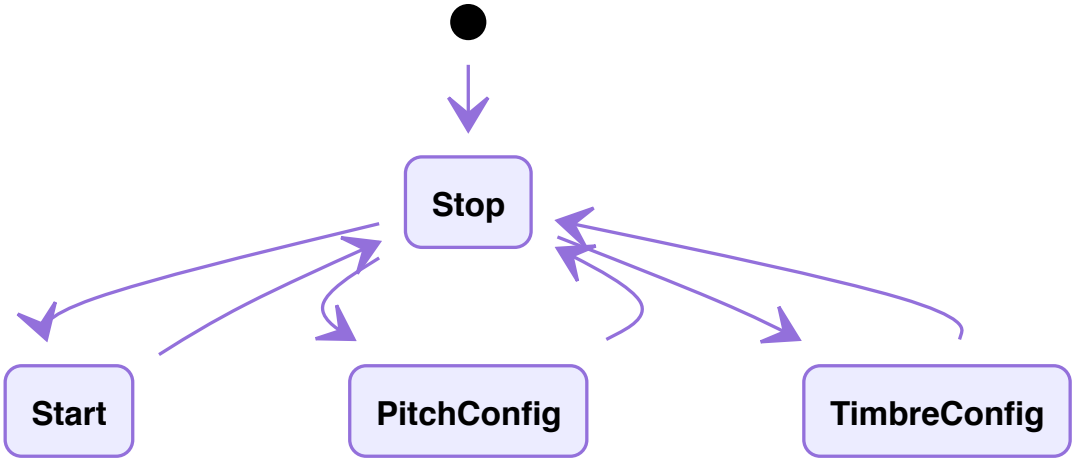
The purpose of this project is that it not only allows me to play music through this simple apparatus, if I can control this instrument accurately, I can play a note (e.g. E), listen to the note, and tune the E-string of my guitar as a way to train my ear.

Peripherals

1. Ultrasonic Distance Sensors x 2
2. Bluetooth Module (UART) x 1
3. On Board Audio Output (I^2C) x 1
4. (On Board LCD for debugging)



State Machine (Tentative)



Software Structure

- UART communication with bluetooth
- Convert ultrasonic sensors to distance using PWM and interrupts
- State machine for different configurations and ON/OFF
- Convert the distance from ultrasonic sensors into frequencies and amplitudes
- I2C communication with audio output