Project Title - Happy Hands: An Instrument for Talentless Folks
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GitHub repository: https://github.com/henry-muller/eecs149-proj

Project Goal
Our goal is to create a pair of gloves that can be used to make music. A glove-wearer will be able to move their hands through the air according to predefined patterns in order to create different musical notes.

Project Approach
The gloves will track the movements of their wearer through several different types of sensors. In order to make music, the wearer will use their right hand as if they were playing a piano, flexing different fingers or combinations of fingers to activate flex sensors and select different notes or chords. The left hand will be rotated back and forth as if on a dial, activating an accelerometer to create slight changes in pitch (up to one half step in either direction). The sensor data will be processed in real time on a microcontroller attached to the left glove, which will produce corresponding, electronic musical tones that emanate from an attached speaker. If time permits, we may add haptic actuators to the fingertips of the right hand to simulate interaction with a physical instrument.

Resources
We plan to use the nRF52DK with attached Berkeley Buckler as the brain of our virtual instrument. The nRF52DK will have wired connections to each flex sensor, or to any filtering circuitry we place in between the sensors and the board. It may also have wired connections to haptic actuators. By mounting the nRF52DK on the back of the wearer's left hand, we can take advantage of the attached accelerometer on the Buckler as well. The flex sensors will likely be FS-L-0055-253-ST sensors from Spectra Symbol, since these match our target form factor and price point. Standard passives will be used for any filtering circuitry we decide to implement based on initial testing. LM731 op-amps may be used for buffering. We plan on getting an Arduino shield to use as an audio adapter, or alternatively, we will do the audio processing on a computer if the shield does not give us the output that we want.

Schedule
- October 19 - Project Proposal Due (this document)
- October 30 - hook up sensors and calibrate them, be able to read from sensors, determine our gestures.
- November 13 - flex sensors integrated and producing output for different finger positions.
- November 26 - sound properly outputting for each hand gesture
- December 5 - add haptic feedback (maybe)
- December 11 - Project Presentations and Final Demos
- December 14 - Project Report Due

Risk and Feasibility

The idea of controlling a device using flex sensors on a glove is not a new one, so in a sense there are already some proofs of concept of our project in existence. However, we would like to improve on these existing designs by implementing a higher degree of finger positioning certainty via the flex sensors, perhaps by combining two sensors for each finger and applying some kind of algorithm to their outputs. This approach is largely untested by us and would involve a lot of trial and error and sensor calibration. Implementing haptic feedback in the fingertips of the right hand would require very specialized electronics to obtain vibrations in such a small area. Finally, actually outputting sound through a speaker may prove somewhat difficult. We would also like to play pure electronic tones rather than pre recorded sound clips, which will require us to do something like manually create square or triangle waves using our microcontroller's output pins and feed them into a speaker, which might require extra amplification.