MUSICAL INSTRUMENT ACCESSABILITY

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Motivation

For some, playing music is one of life's singular enjoyments. Losing the ability to do so can be devastating to such an individual. For those born without this ability, gaining it could be a form of therapy and a source of happiness.

Goal

Design a device for physically impaired individuals that will:

1. Accomodate restricted arm movement by only requiring two octaves of playing.
2. Correct for incorrect key presses due to dissability, like tremors.
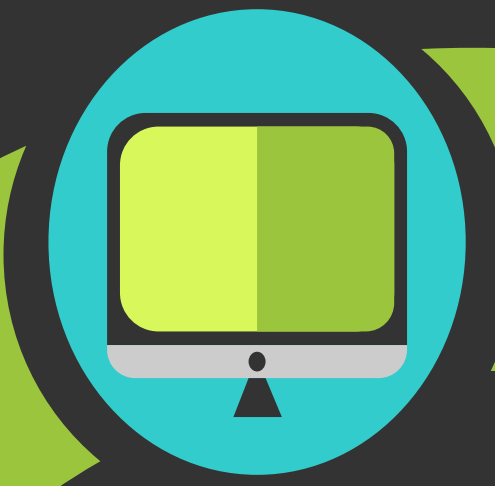3. Actuate the music on an acoustic piano.

System

Sensor Subsystem
Use distance sensors under keys to determine the note pressed and the intesity, or volume of the key. Debouncing is used clean the input signal.

MIDI Pre-Processing
Inspect the MIDI song the user intends to play to extract the necessary information to be used for signal processing.

Signal Processing
Make decisions to fix disability -caused mistakes. Account for tremor frequencies, and iregular volume.
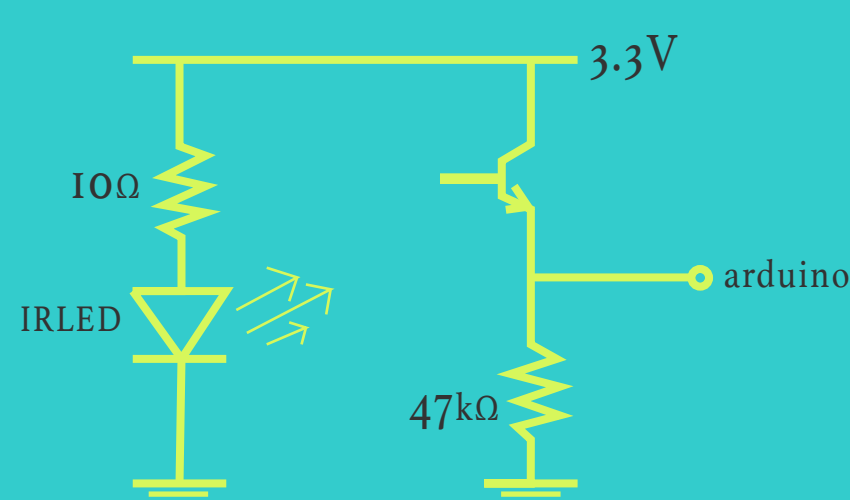
Musical Output
Play the song via MIDI or actuating on an acoustic piano.

Results

1

Infrared distance sensors are placed beneath each piano key. The velocity of the key is determined by the slope of the distance readings. Stabilization is achieved using a digital filter.

2

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62
key on
adding stalled note 1.55536408891e+15
1.55536408901e+15
key off
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The signal processing system has a record of how long a note should be played. If it detects a user has stopped playing the key early it searches for another down stroke within the period of the tremor's frequency, else the note is turned off. The volume values are also passed through a moving average filter to prevents accidental sharp changes in volume.
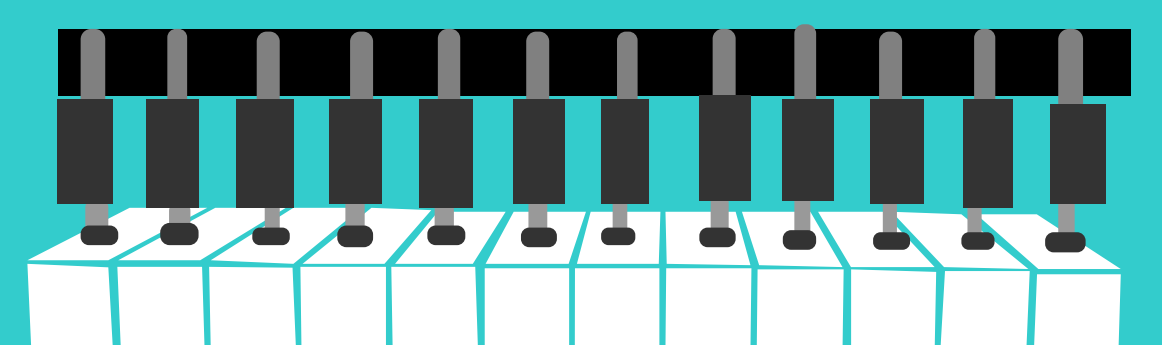
3

The piano actuation takes MIDI input data (on/off, note number, velocity) and sends I2C protocol data to PWM controller. The Power Transistors pass variables to the solenoids based on PWM duty cycle, and the solenoids strike the piano keys with a force relative to the amount of current flowing.