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Electronic Music Instrument Design
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EMID Final Project: The Windstrument

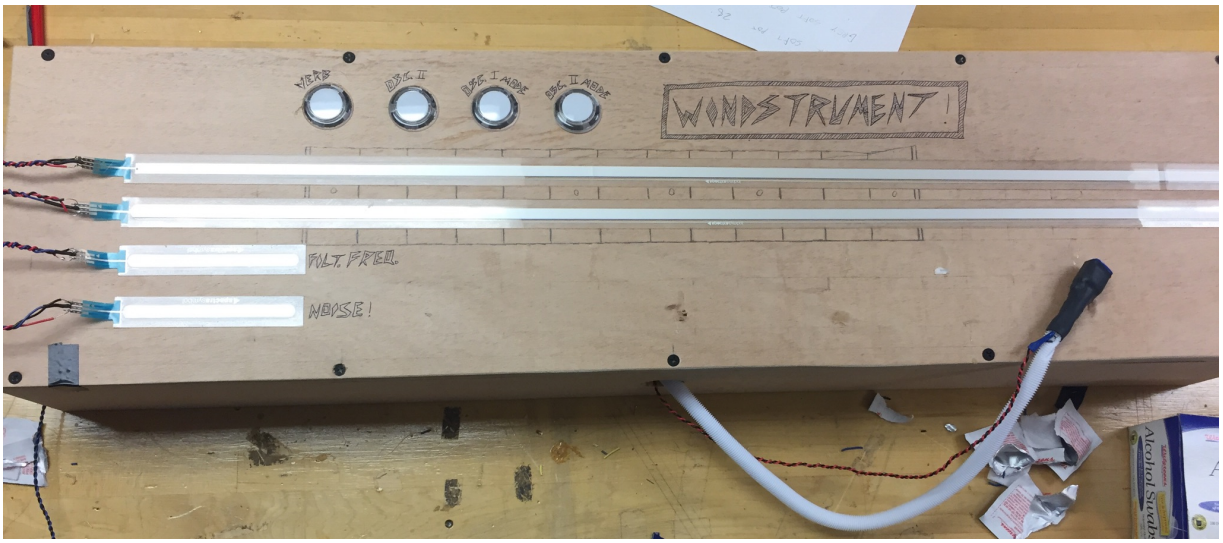
Concept:

The concept for the Windstrument was based on the LinnStrument, a MIDI controller developed by Roger Linn that emulates a stringed instrument. We wanted to continue using the breath sensing technology from the MIDI Melodica, but move away from the keyboard setup of selecting pitches, so our idea was to once again use the breath sensor we developed to control volume and have four linear softpots arranged in parallel on a surface, each representing a 'string' of the instrument.

Design:

The Windstrument design was to have a simple playing surface four linear sensing strips arranged in parallel along the bottom of the surface, four arcade pushbuttons in a line along the top left of the surface, and two shorter softpots parallel to the strings and to the right of the pushbuttons. The breath sensor would then be attached to the middle of the body of the instrument. The strings would be arranged each with 13 distinct regions corresponding to a chromatic scale, so that each string had a full octave range. There would then be an interval of a perfect fourth between strings. The buttons and short softpots would control effects in the Reason patch that generates the main synth sound for the instrument. Given this design, the player would select pitches by pressing and sliding on the 'strings' and cause the pitches to sound by blowing into the breath sensor.

Since two of the sensor strips we planned to use for strings stopped functioning properly, the final setup of the instrument can be seen below with two strips acting as strings, two smaller softpots below it controlling filter frequency and noise, and four buttons above controlling reverb on/off, oscillator 2 on/off, oscillator 1 mode, and oscillator 2 mode.



Wiring:

The wiring for the Windstrument was not extremely extensive. Ultimately, the things that were wired into the Arduino were four linear softpots, four two-pin pushbuttons on the playing surface, another pushbutton mounted in a wood block on the floor for sustain, and a mouthpiece with a breath pressure sensor and an FSR sensing bite pressure. The wires for all the components were twisted so as to attenuate electrical noise, and the specific wiring for each component was done according to the wiring diagram on the data sheet for that specific part. The softpots, breath, and bite sensors were fed into analog pins on the Arduino, while the pushbuttons went to digital pins.

Software:

All of the software processing for the Windstrument is done in Max. The main Max patch receives data from the Arduino and has subpatches out to separate modules for breath control, bite sensor, button controls, short softpot controls, sustain pedal, and separate modules for both of the strings. The values for the strings were scaled to have 13 zones, each sending note out information for a corresponding to a pitch in a chromatic scale. The upper string on the playing surface starts on a C and the lower string starts on the F above it. Other processes are occurring in Max that keep track of when a string is touched and released and the change in position along the softpot once it has been touched, so that pitch bend information can be sent to Reason to simulate sliding up or down on a stringed instrument. Each string operates on a separate MIDI channel so that they can slide independent of each other.

The Windstrument's Reason patch is a fairly simple Subtractor synth with two oscillators. Filter frequency is set at full by default, but values from the upper short softpot are scaled and reversed to correspond to filter frequency (sliding to the left along the softpot brings the filter frequency down and once you lift off the softpot the filter frequency goes back to full). The second short softpot's values are scaled and sent to the 'Noise amount' control in the Reason patch. The four pushbuttons were set up in the Max patch as toggle switches and sent out to their corresponding MIDI controls for the Reason patch: reverb on/off, oscillator 2 on/off, oscillator 1 mode, oscillator 2 mode (oscillator modes change the tone of the oscillator). Finally, the pushbutton used as a sustain pedal sent a toggle command to a Max operation called 'sustain' that holds notes until told to release them.

Construction:

A 34-inch by 9-inch plank of wood—the playing surface—and two 34-inch by 4-inch planks of wood—the legs—comprised the body of the instrument. The legs were attached with 5 wood screws each. Our four linear softpots were glued in parallel on the bottom section of the playing surface and the four arcade buttons were mounted in a line along the top left section of the surface in 1*18* inch holes drilled straight through the plank. Our Arduino and protoboards used in wiring were glued to the inside of the legs of the instrument, and wires for the softpots wrapped around the left edge of the board. A 1*18* inch hole was drilled in the middle of the front leg for the breath sensor wires to run through to the Arduino. Finally, another 1*18* inch hole was drilled through a small block of a 2X4 and a pushbutton with extra long wires was mounted in it

to construct the sustain pedal. A small section of a wood dowel was sawed and hot glued to one side of the bottom of the pedal to tilt it and make it easier to press with a foot.

Problems/Solutions:

The main problems we came across in developing the Windstrument came in the last day or two before the project was due. The first two Kurzweil sensor strips we intended to use along with the Adafruit linear softpots stopped working, as did a second batch of Kurzweil strips found in the lab that we hoped to use as replacements. Since getting the instrument fully functional and not too simplistic was more important that having all four of the strings we intended to have, we decided we would leave the instrument with just two strings. Though we lost time fiddling with the Kurzweil strips, it may have worked out in our favor only having two strings on the instrument; four might have been too difficult to play well.