Game Board Assembly

14 April 2018, Chad Dudzek

Test Assembly

On 14 April I assembled the game board for testing on a temporary panel. It included four of the eight target buttons, the two menu buttons, one of the two custom circuit boards, the Arduino Mega controller, and the RGB LCD panel.

See the videos in the repository for the first power-on and the button test. The select/start buttons were attached to the wrong Arduino pins, so the yellow Select button did not light up on the first power-up.

Please note that in the video the 100mm buttons are not very bright because I was only pushing 5V from the Arduino through the LEDs, which are rated to 12V. On the final board assembly I will pull 9V directly from the power supply for those lights instead of powering them through the Arduino pins; this will also reduce the power draw through the Arduino board.
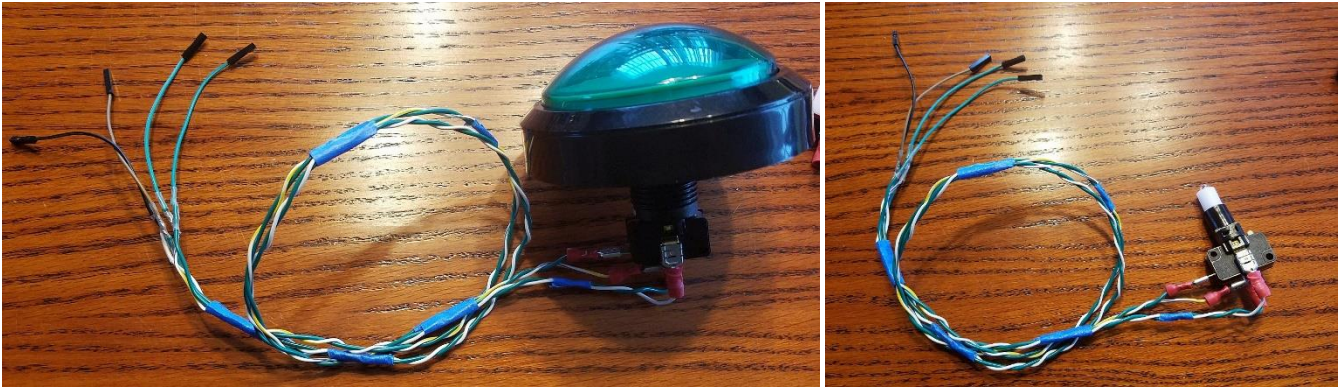

Parts List

Arduino Mega 2560 Rev 3

One of the 100mm target buttons with a switch and light attached and wired

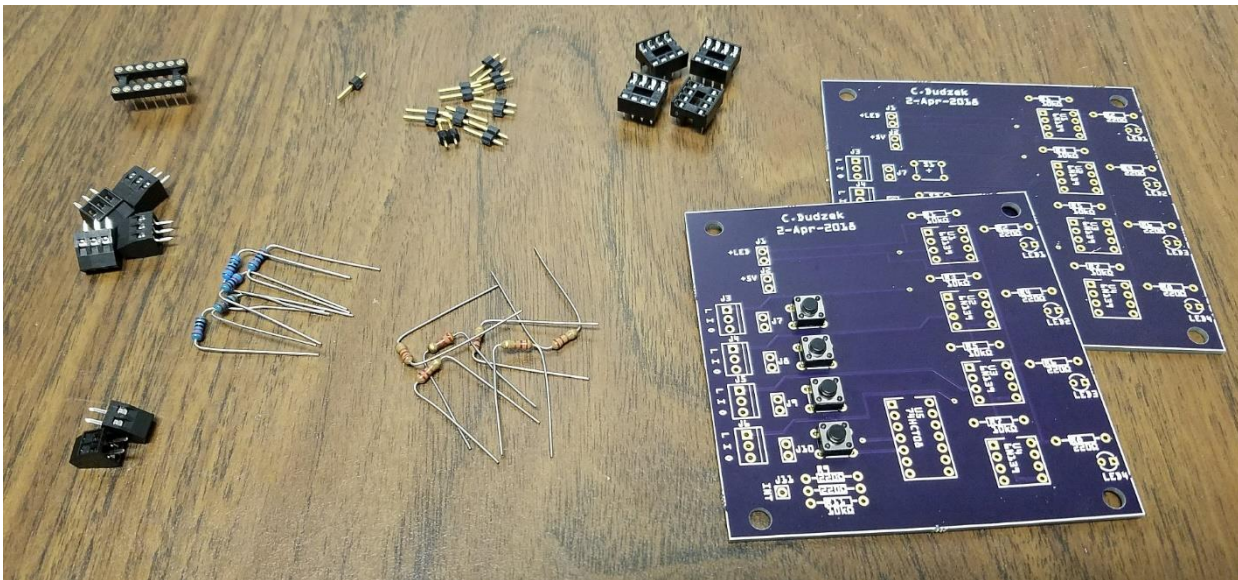Four buttons with switches and color-coded wiring harnesses

30mm Arcade Buttons are used for Select / Start menu controls

The components to assemble the custom circuit board. The bare boards were ordered from OSHPark.com and had to be assembled by hand. One board was assembled and tested before assembling the second board.

The assembled board, and with the cables attached which connect to the Arduino. For the test build I used a 74HCT21 (4-input AND gate) in U5 instead of the 74HCT08 (2x 2-input AND gate). The rest of the circuit is the same, but the 74HCT21 combines all 4 inputs into a single output, and can be used as a drop-in replacement in this board with no other changes.
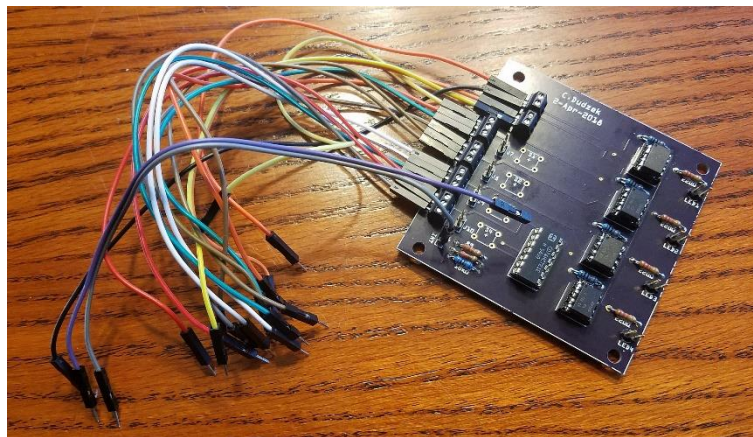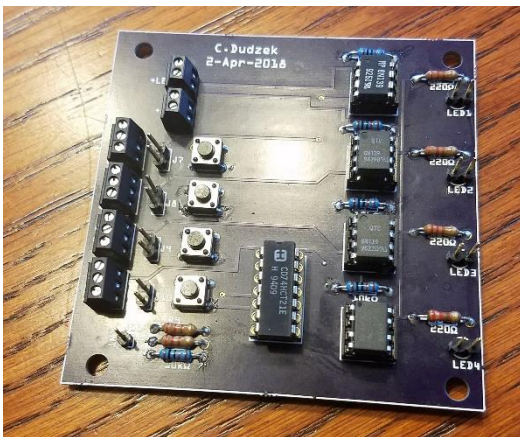
After soldering up the first board and testing it, I discovered I had a trace on the wrong side and it shorted to a 5V input. The trace for U4 Pin 3 (grounds to enable LED4) crossed the trace to U5 Pin 14, which is the +5V supply. Whoops! The trace had to be cut on the bottom of the board where the traces intersected, and a jumper wire soldered from J6 Pin 1 to U4 Pin 3.
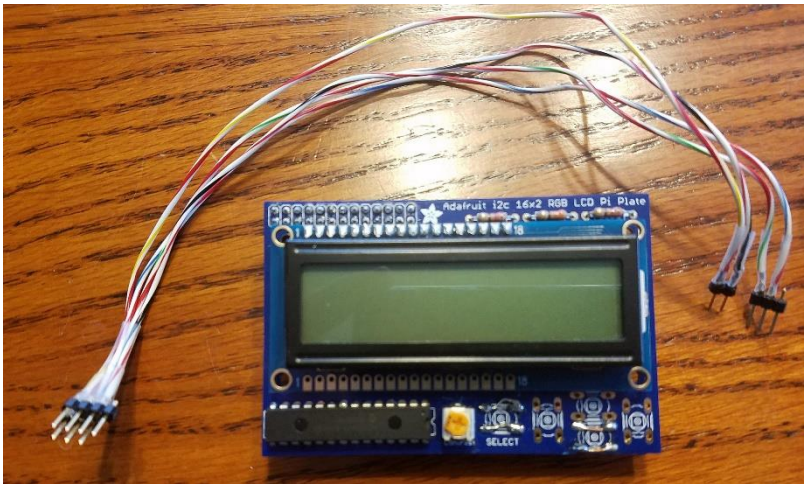
TODO: Add photo of jumper wire

A 9V/1A power supply and switch from Adafruit are used to power the whole game board.

The Adafruit RGB LCD Pi Plate. This is designed to attach to the top of a Raspberry Pi, but a wiring harness was created to attach to the Arduino. Only the 5VDC, Ground, and I2C wires are needed.
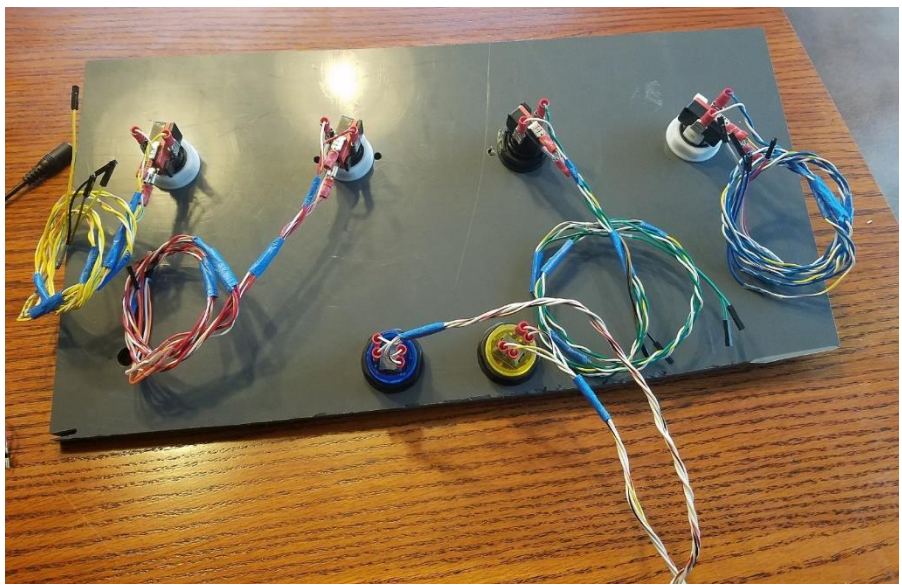

A test panel was used to mount all of the control and target buttons for initial testing. One inch holes were drilled for the four target buttons and 1-1/8" holes were drilled for the 30mm control buttons. The LCD, Arduino, and circuit boards were not mounted for testing.
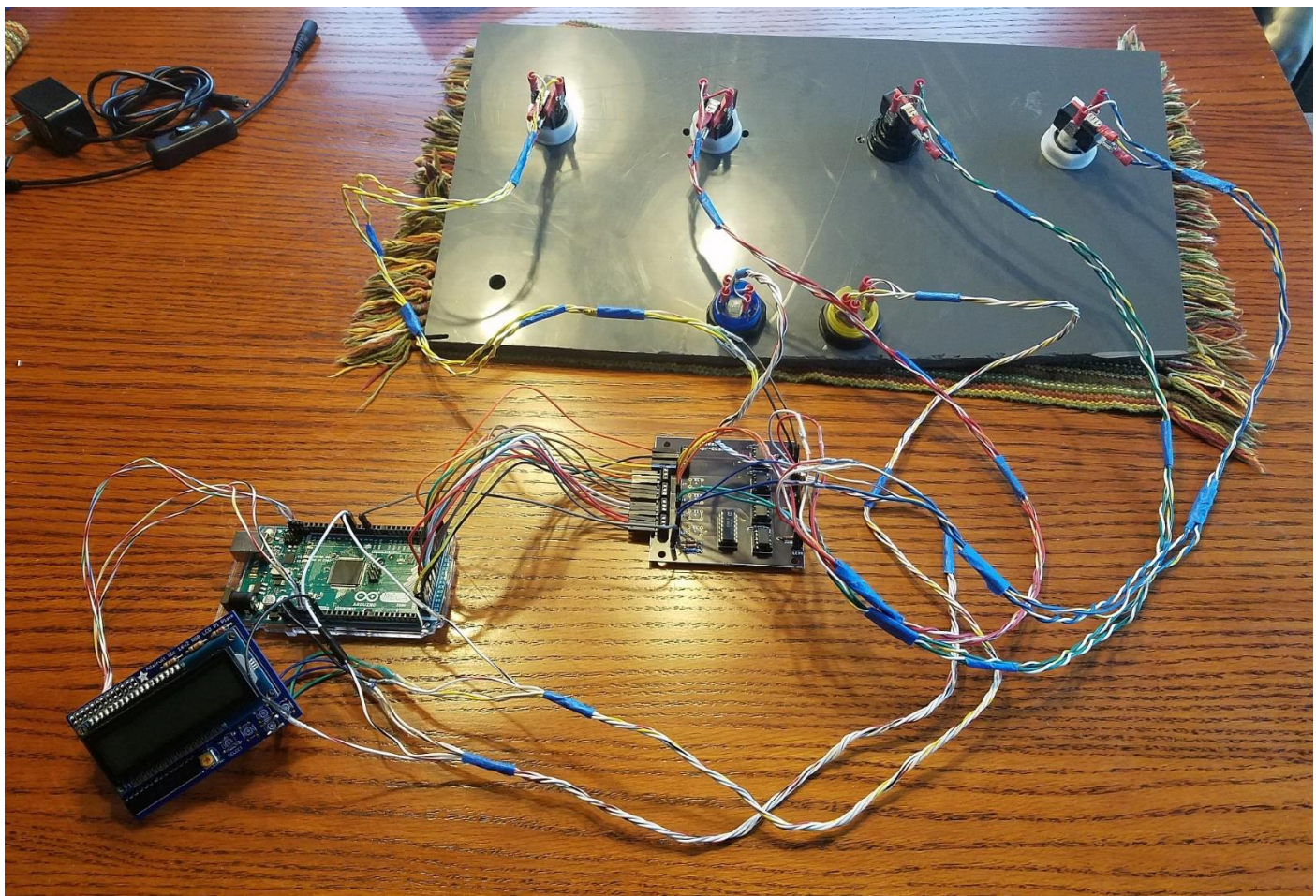

With the buttons mounted

With all components wired

After the functional test was done, the real wooden board was cut and drilled, and the other four target buttons were wired up. This photo does not have the LCD area cut out yet (I didn't have the right Dremel bit at the time).

The board is a ½" (12.5mm) layered birch wood. I bought the green 100mm target buttons from Adafruit, and I was able to mount the button on the board with the extra backing disc to have a solid-looking body. However, the other colored buttons were bought on Amazon (only because they were out of stock at Adafruit) and were not long enough to fit with the backing disc so they had to be mounted without it. The product images and dimension drawing on Amazon were IDENTICAL to the ones on Adafruit, but the buttons were indeed not the same product. The shaft length was not specified on either site, so I do not know which one was technically correct.

TODO: Side view of board with button threads

Wiring

This is the top view of the PC Board (with the corrected trace). All components are labeled, including the resistor values. Yellow lines are traces on the top of the board, and orange lines are traces on the bottom of the board.
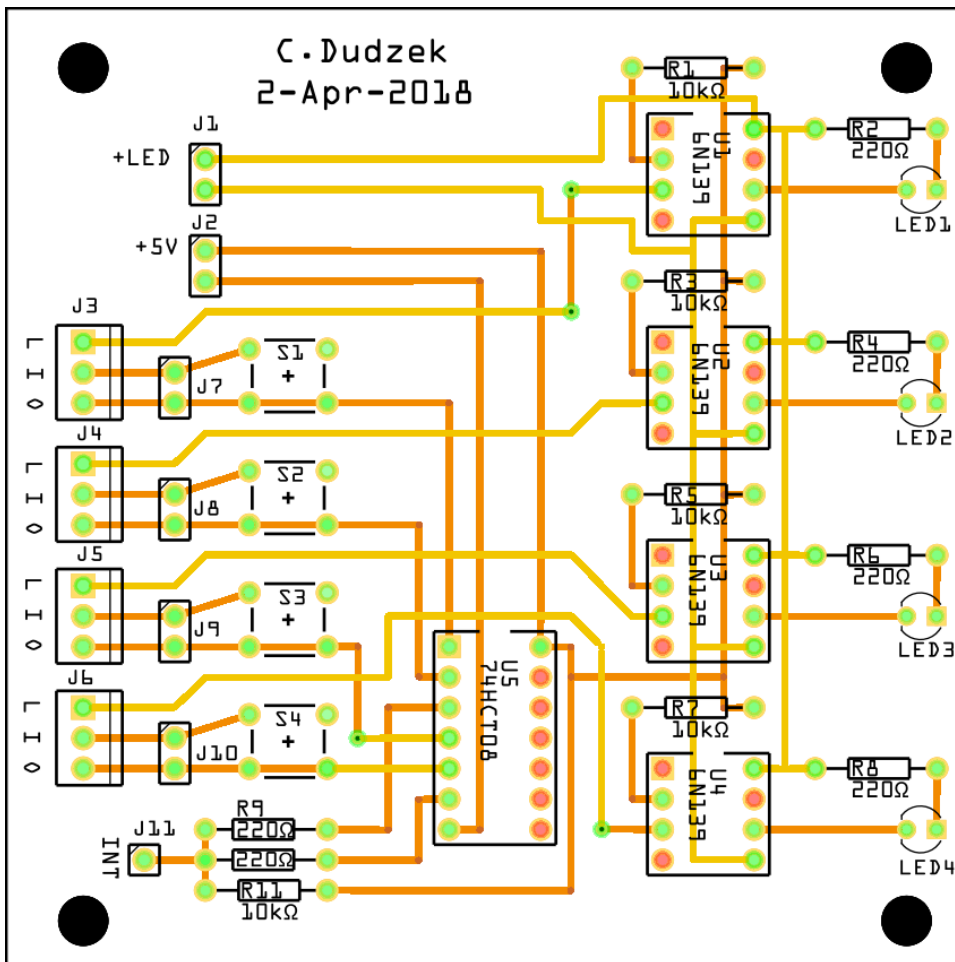
Connector J1 is input power for the target button LEDs. The 100mm buttons from Adafruit are 12V capable, and the U1-U4 chips are optoisolators (they work like relays) to allow the 12V to be used without frying your Arduino board. Pin 1 is up to +12V, and pin 2 is ground.

Chips U1-U4 will ground pin 6 to turn on the LEDs. Two-pin headers are soldered into the LED1-LED4 pins instead of LEDs so the target button LEDs can be attached.

Connector J2 is the +5V power for the ICs. U5 is powered directly on pin 14. Resistors R1, R3, R5, and R7 are used to drop the voltage to 1.4V for the optoisolator triggers on pin 2 of each chip.

Connectors J3-J6 are the controls for each target, which connect to the Arduino. Note that connectors have the pins labeled L-I-O next to each connector. These are "LED on", "Switch Input", and "Switch Output".
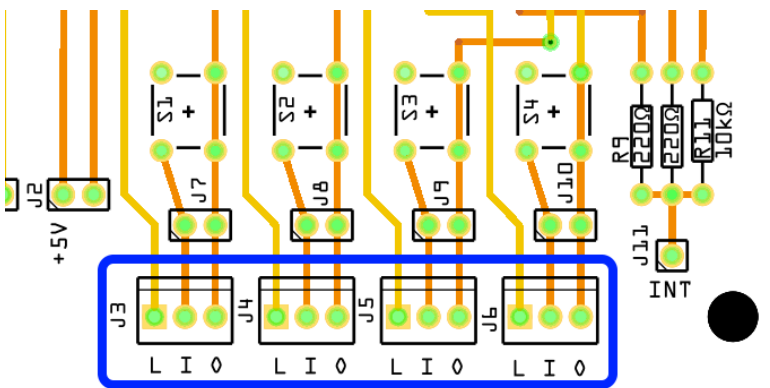
When the LED (L) pin on each connector is grounded, the LED for that target will be lit.

Connectors J7-J10 are headers to the target button switches. They short connect the Input (I) and Output (O) pins of each target when pressed. Switches S1-S4 are entirely <u>optional</u> to populate. They are sized for the 6x6mm tactile

switches from Adafruit. They are handy for testing the circuit without having to wire up the 100mm target buttons but are not required for proper game operation.

Chip U5 is the 4-input AND gate to output an interrupt signal when an enabled target button is pressed. When an Input (I) pin on J3-J6 is grounded, that target button is enabled. The AND gate isolates the buttons from each other, so only an enabled button can trigger the interrupt or be read from the Output (O) pin.

Pin J11 is the interrupt pin to signal the Arduino that an enabled target has been pressed. This is used especially for the Whack-A-Mole game to instantly signal the program that an active mole has been whacked.