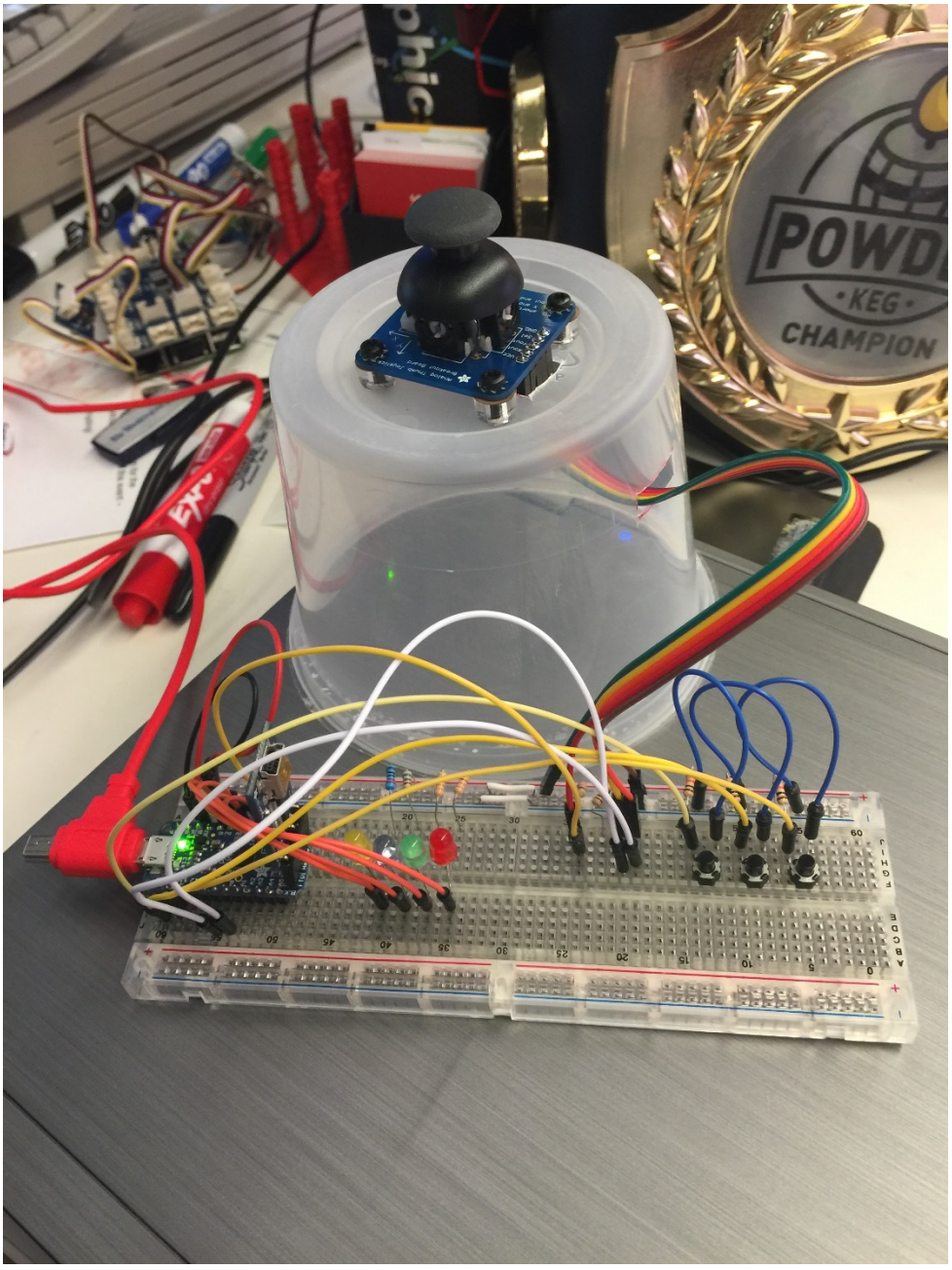
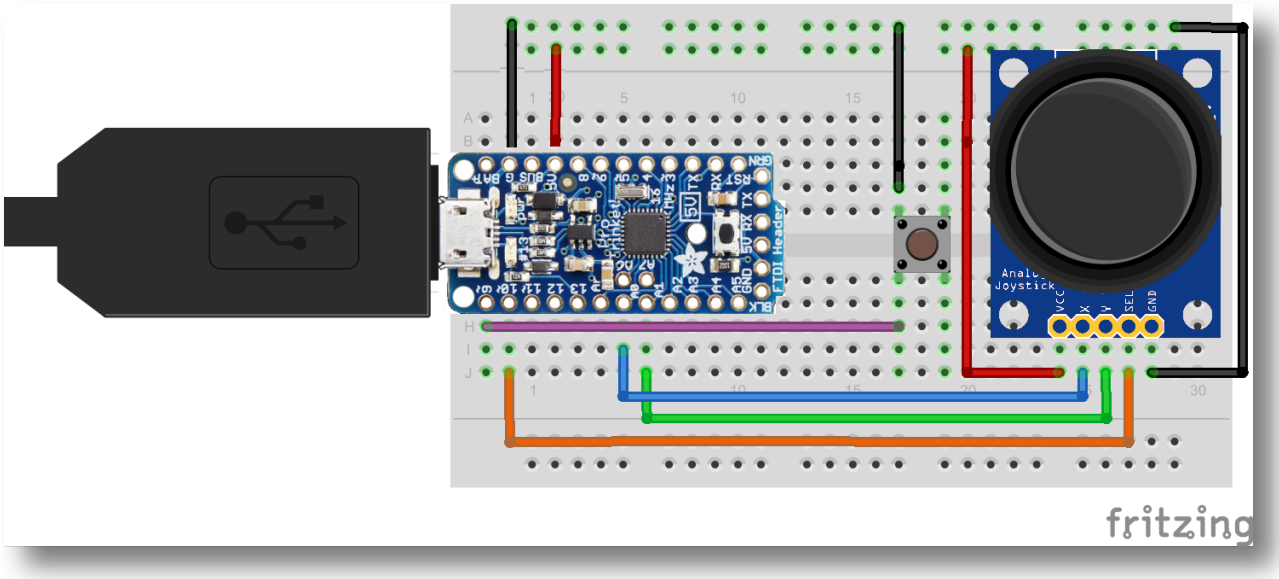
Hello and welcome to Hardware: It's not just for EE's anymore!

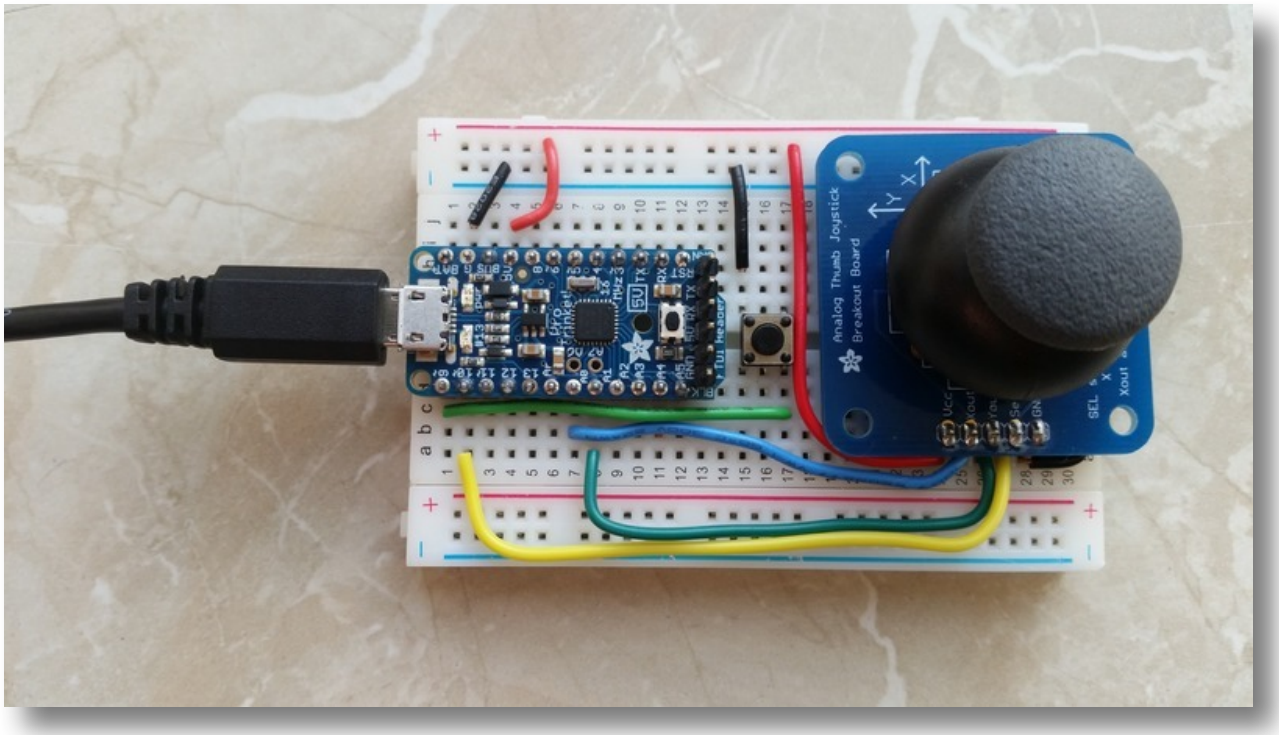
In this class we explore hacking together custom built hardware and off the shelf hardware. Normally we use a "solderless breadboard" to wire together circuits, checking out basic functions.



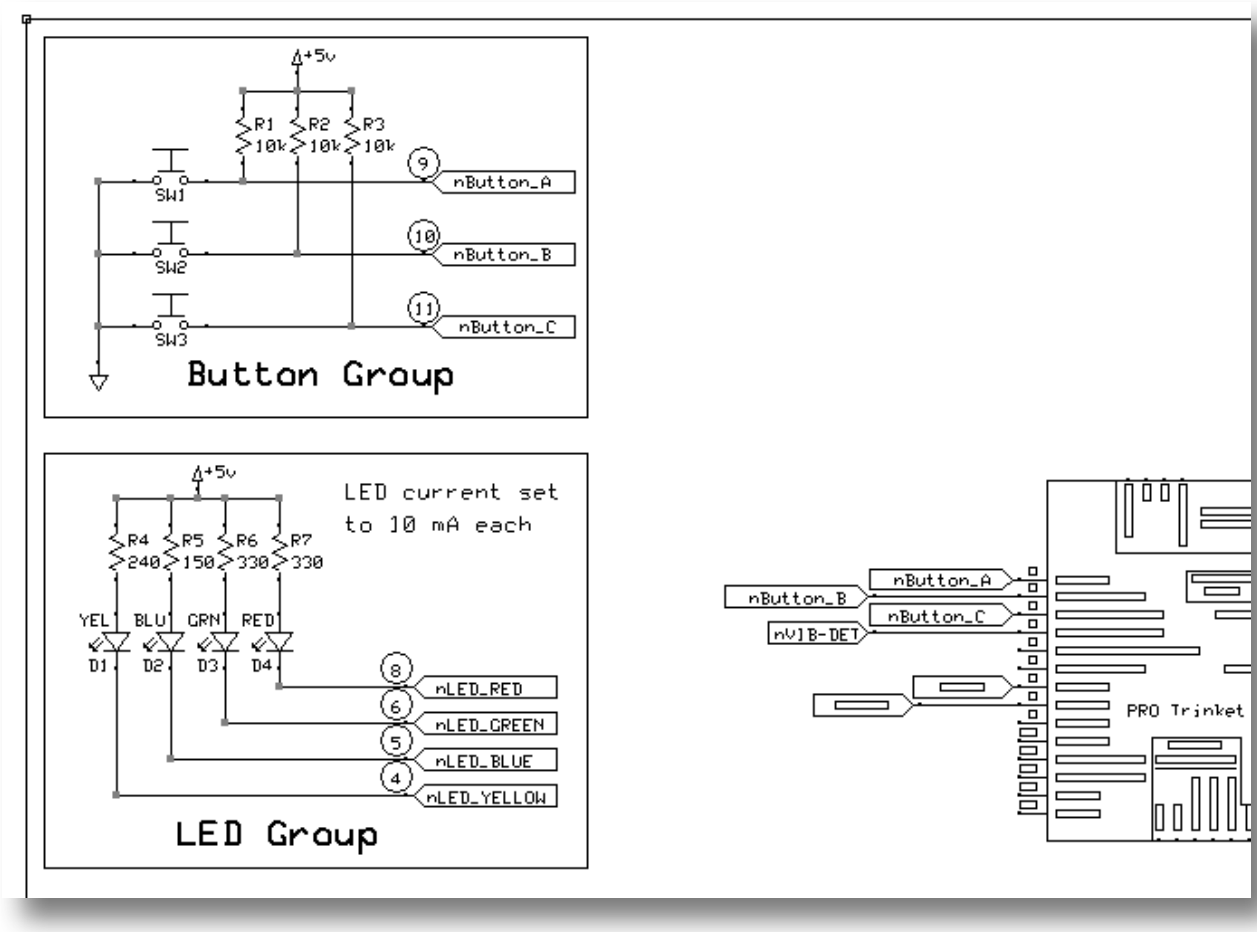
This is OK and we can do a lot of work quickly to try out an idea. There comes a time however when we spend more time mending wires that come loose then we spend debugging code. That is the time we translate the circuit onto a printed circuit board (PCB). Using free software from ExpressPCB, Fritzing or Eagle, you can create a logical diagram (schematic) of the physical wires you put together on the breadboard. Here is an example of an early prototype using a Fritzing application to diagram the circuit and the actual circuit built using a solderless breadboard:



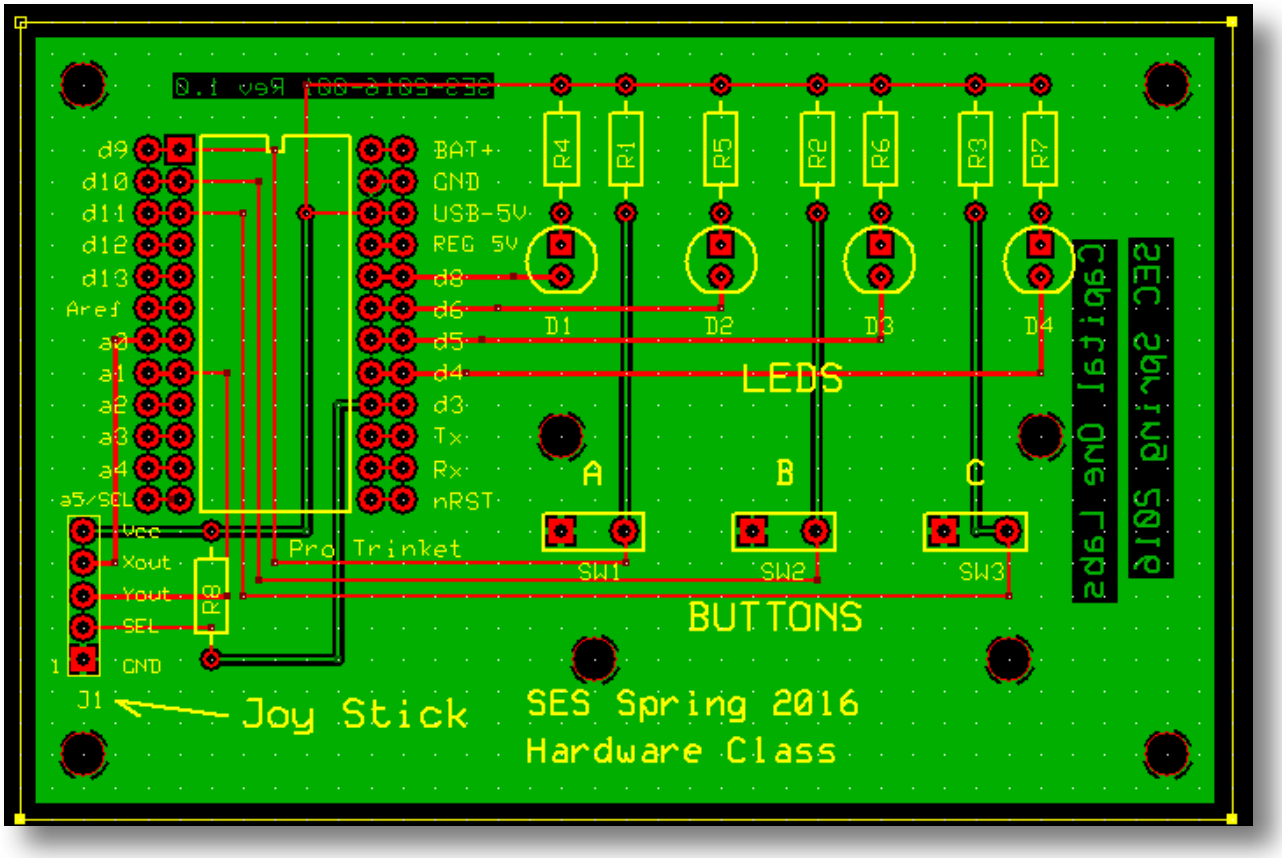
Once you work out the code, a printed circuit board can be designed



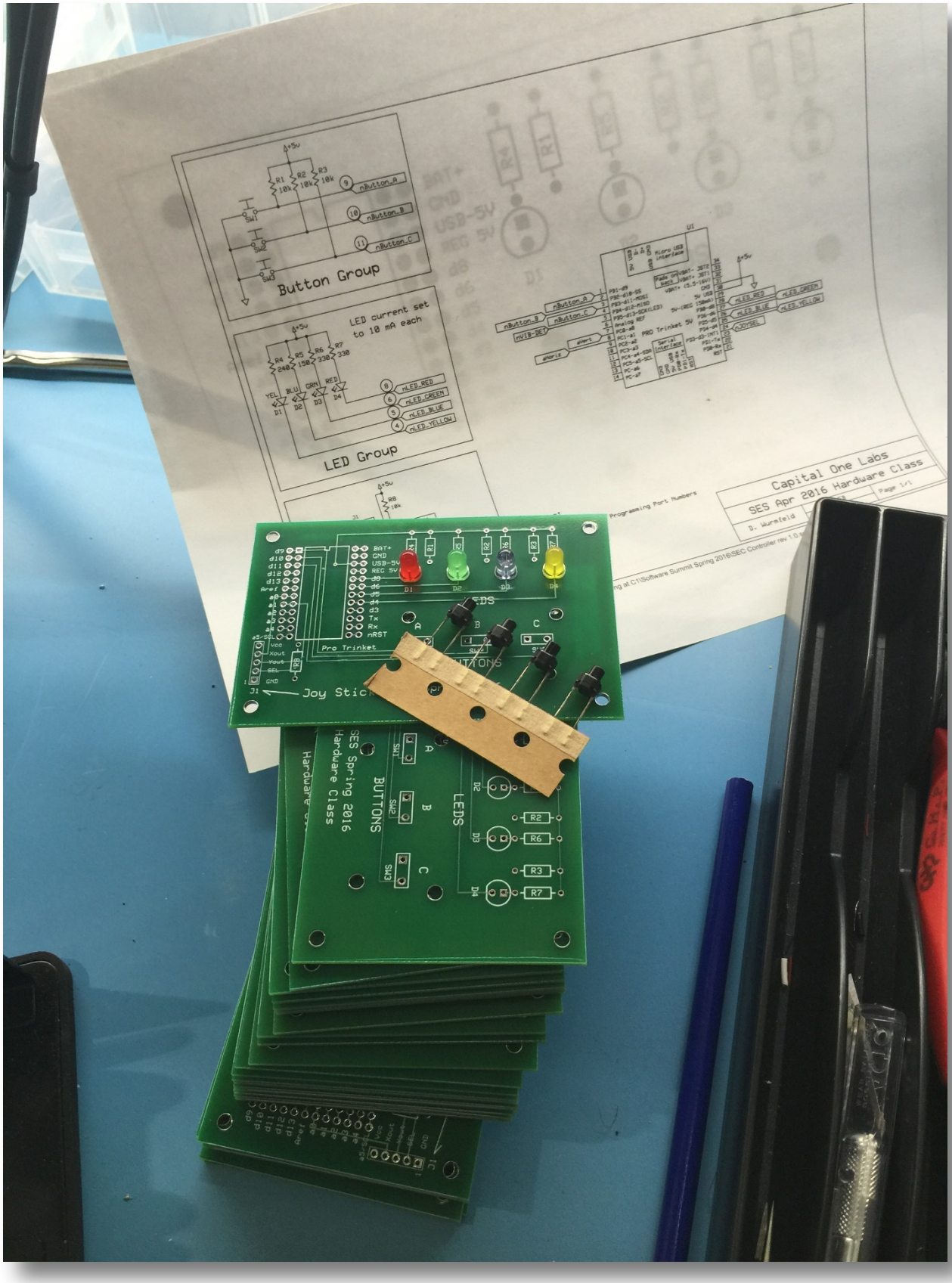
Once the circuit has been debugged, you can design a circuit to be laid out on a printed circuit board (PCB).


+5v
R1
10k
R2
10k
R3
10k
SW1
SW2
SW3
9
10
11
nButton_A
nButton_B
nButton_C
Button Group
+5v
LED current set
to 10 mA each
R4
240
R5
150
R6
330
R7
330
YEL
BLU
GRN
RED
D1
D2
D3
D4
8
6
5
4
nLED_RED
nLED_GREEN
nLED_BLUE
nLED_YELLOW
LED Group
nButton_A
nButton_B
nButton_C
nVIB-DET
PRO Trinket

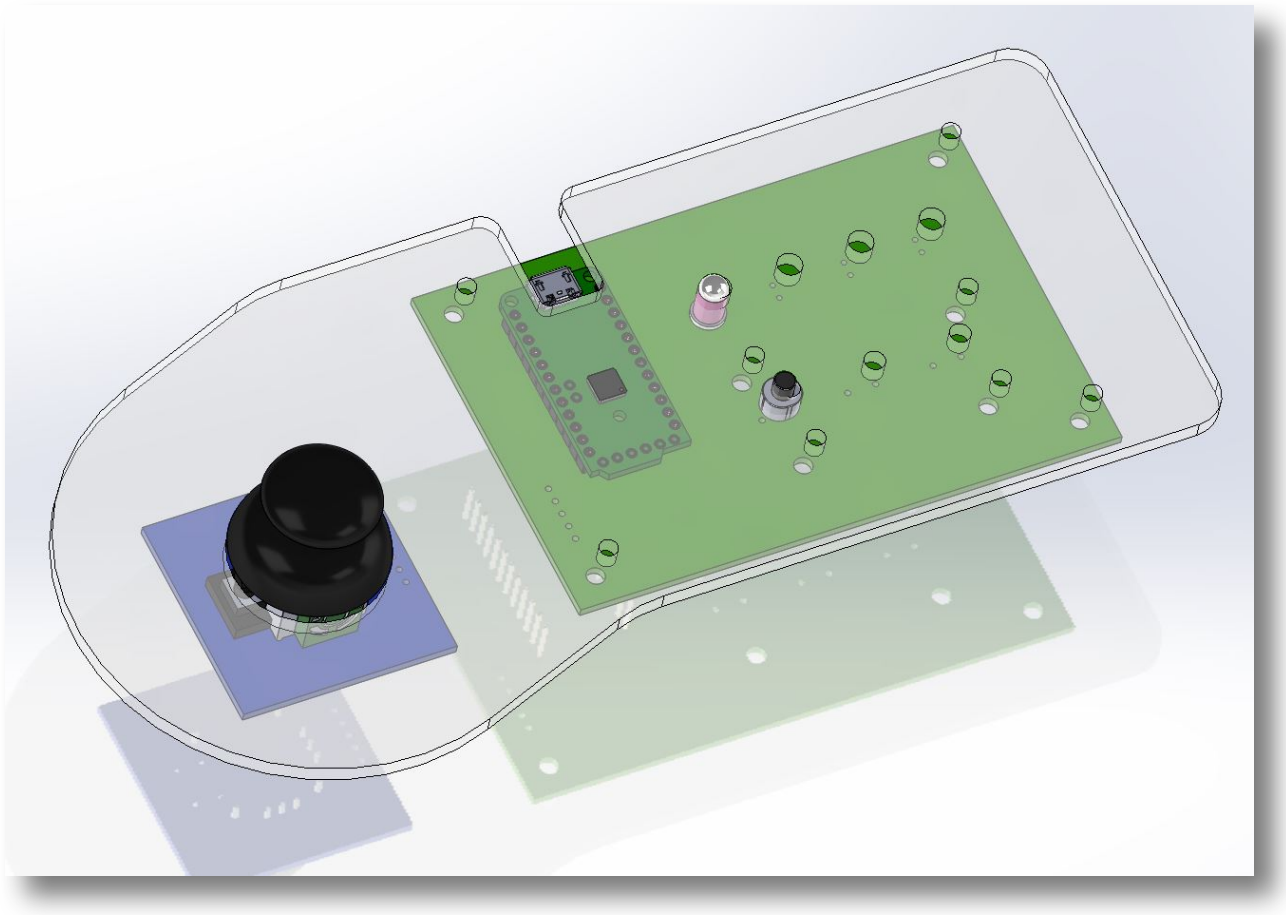
This schematic describes the logical connections between physical components. The PCB layout places the physical connections to realize the design:



Next - the PCB is assembled by soldering the components into the spaces and holes provided to complete the board:


Button Group
LED current set to 10 mA each
LED Group
Capital One Labs
SES Apr 2016 Hardware Class
Pro Trinket
BUTTONS
LEDS
SES Spring 2016
Hardware Class

Finally, we can design mechanical enclosures to make our idea complete:



As we will demonstrate in class, it is not magic to do any one of these pieces, you just need to develop e "tool box" of tacit knowledge – skills – that can be used in any combination to successfully conceive, design, prototype and make almost anything.