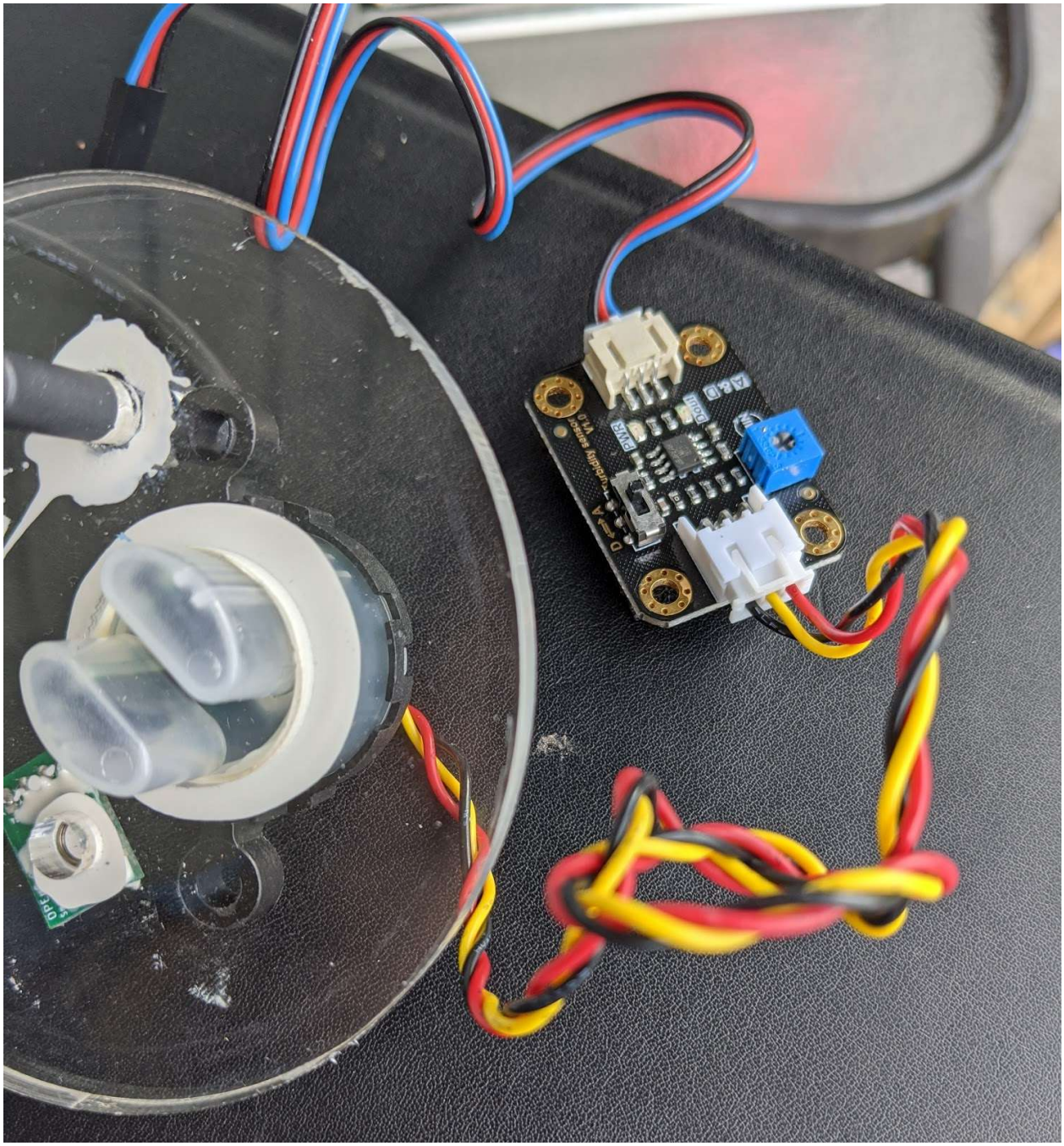
Objective:

To evaluate turbidity sensor using different amounts of coffee

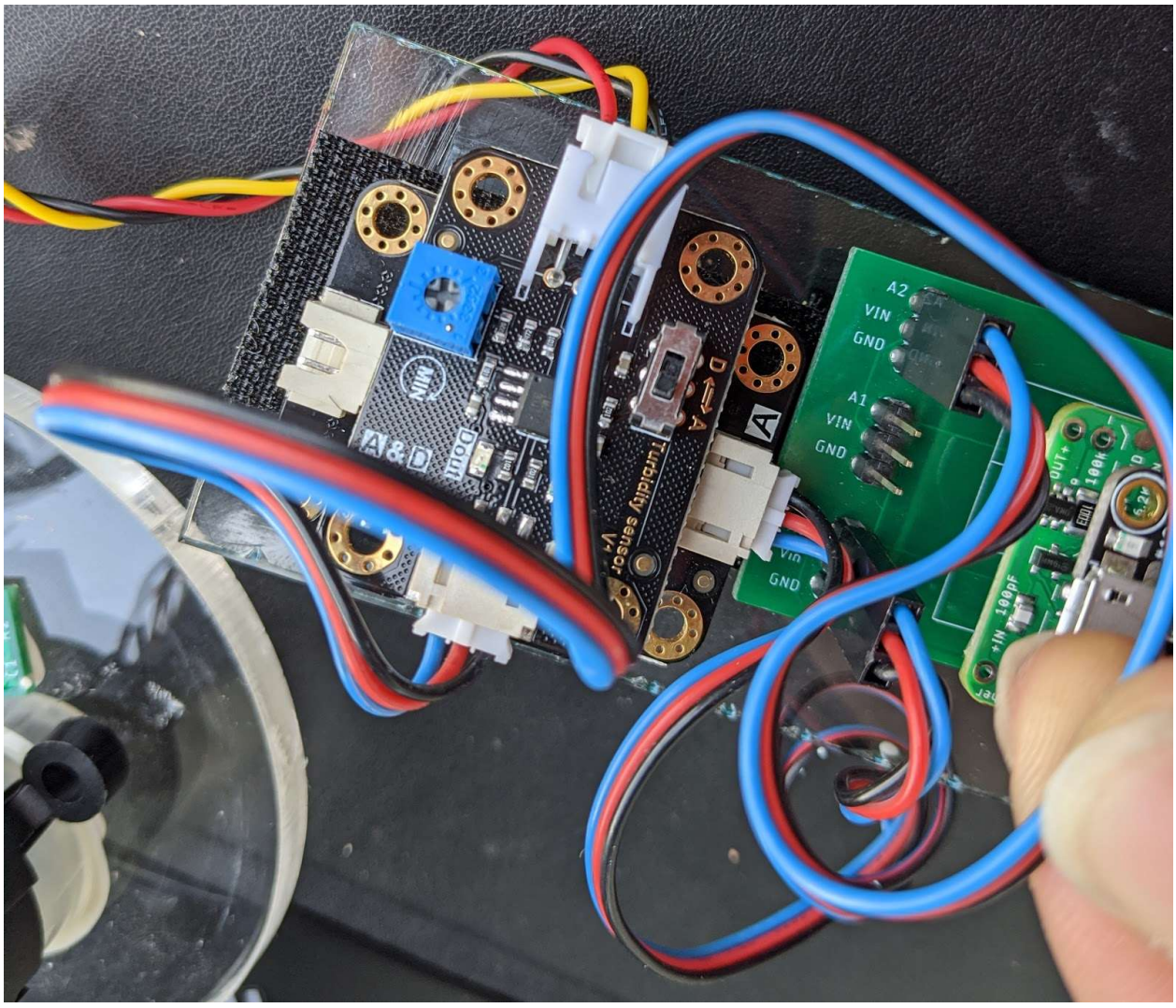


Supplies needed:

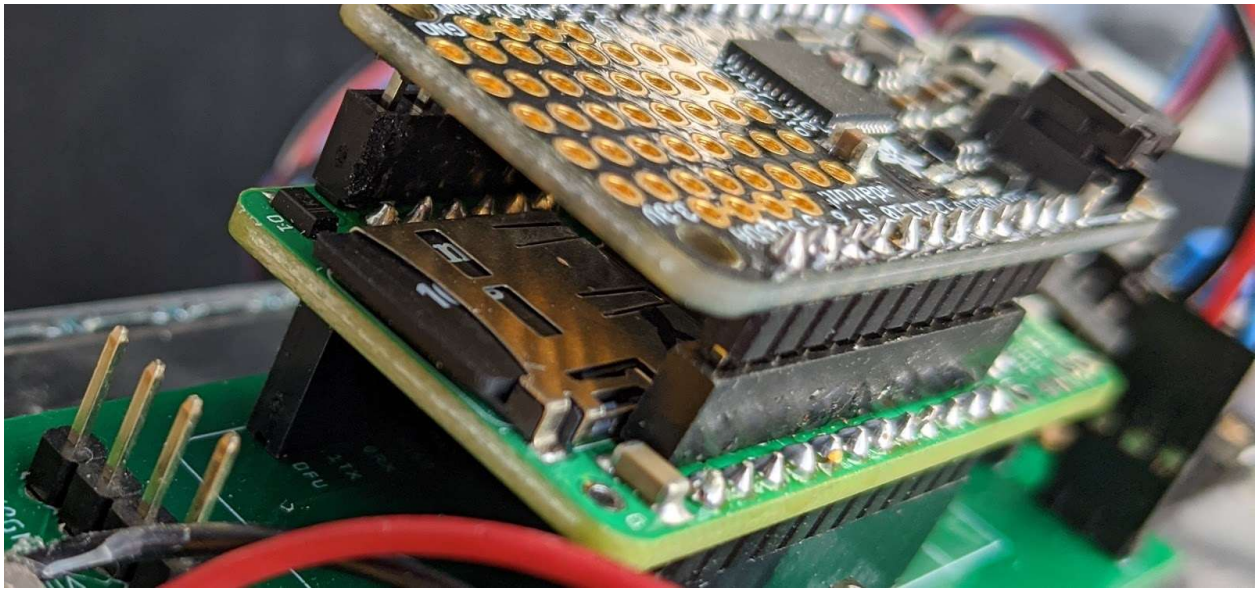
- Completely assembled Smart Rock w/ battery and SD card
- J-hook/U-bolt assembly
- 5 gallon bucket
- Box of instant coffee (medium roast 3 g packets)
- Ruler
- Paper towels
- Plastic measuring cup in mL
- One large 16oz mug (or equivalent beverage containers)
- 5 different beverage containers for 5 different amounts of coffee solution [not pictured]
- A location that you can make dark (e.g. bathroom or garage)

Preparation:

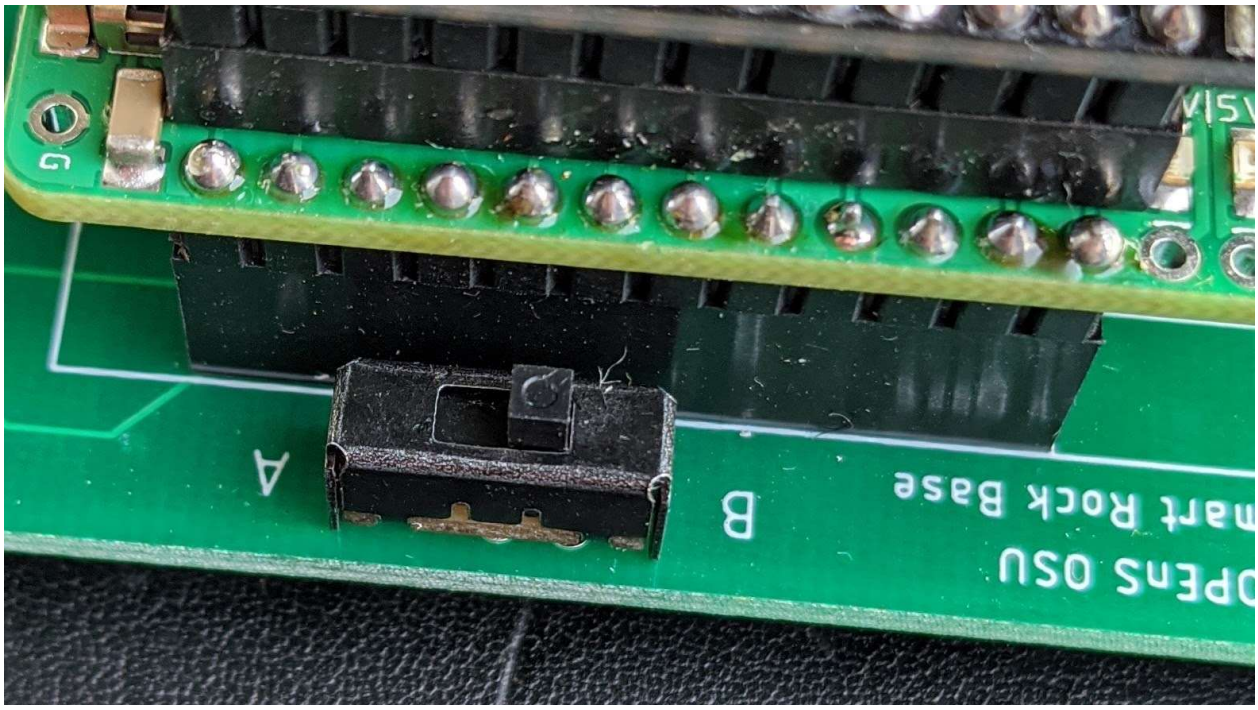
1. Open SmartRock and check that the turbidity sensor is connected to A2 on Hydro PCB. Make sure that the switch is on “A” to output analog.



2. Check that SD card is inserted into Hypnos board



3. Set switch on Hydro PCB to B, calibration mode (2 second intervals)



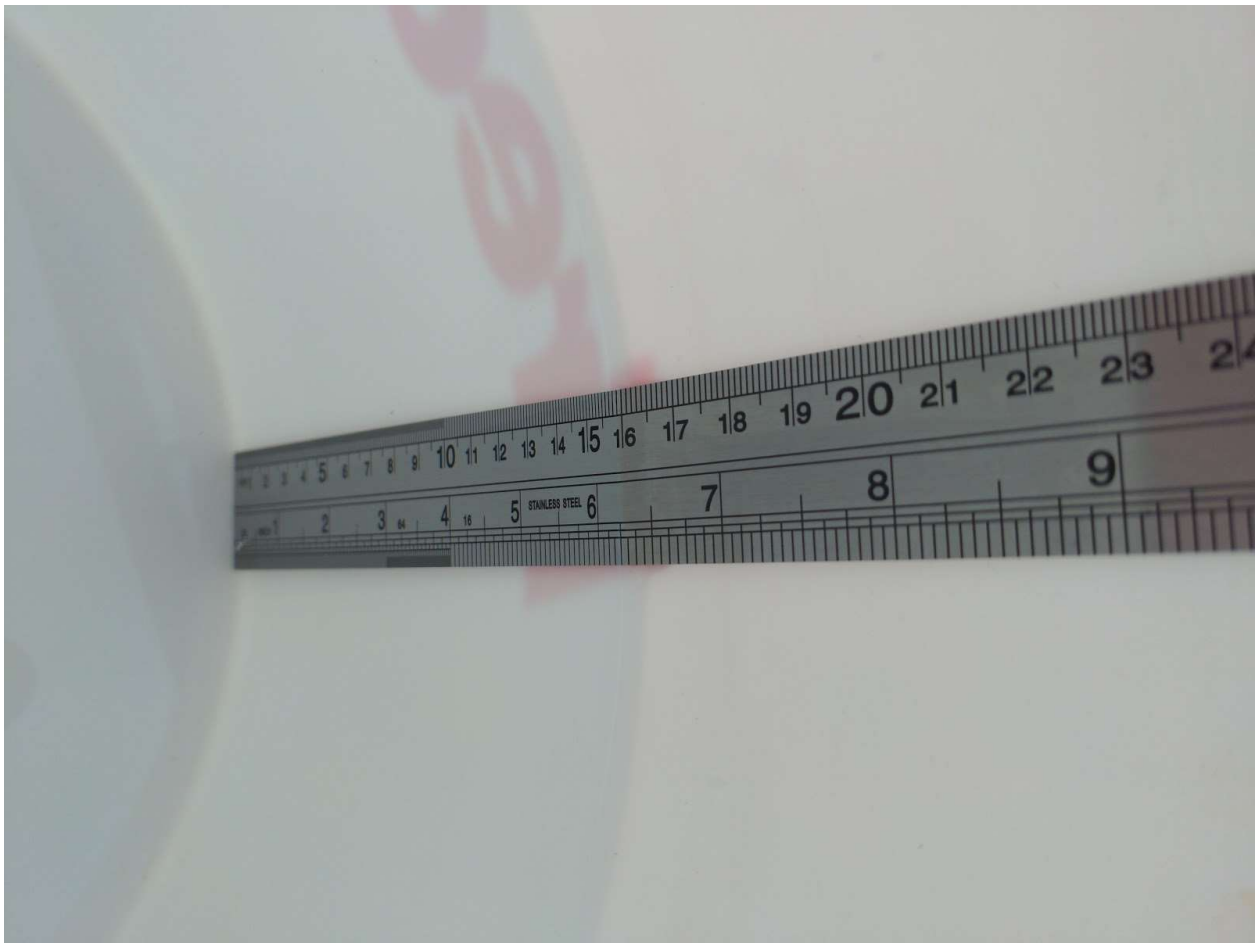
4. Check that battery pack is charged (don't connect until ready to turn on)

[IMPORTANT NOTE]

Parts of this activity will need to take place in the dark (**Step 10 and onward**). It would be helpful to move and prepare all your materials in an area where you are easily able to darken. A bathroom or your garage would work great.

Procedure:

1. Insert ruler into 5 gallon bucket
2. Fill bucket to ~15 centimeters of clear water (to ensure sensor is submerged)



3. Fill large coffee mug with 16 oz of warm water (this will make it much easier for the instant coffee crystals to dissolve)

4. Add 2 instant coffee packets to your cup of water and mix until coffee is completely dissolved.

[note: picture above only has 8 oz, actual amount in mug should be 16 oz]

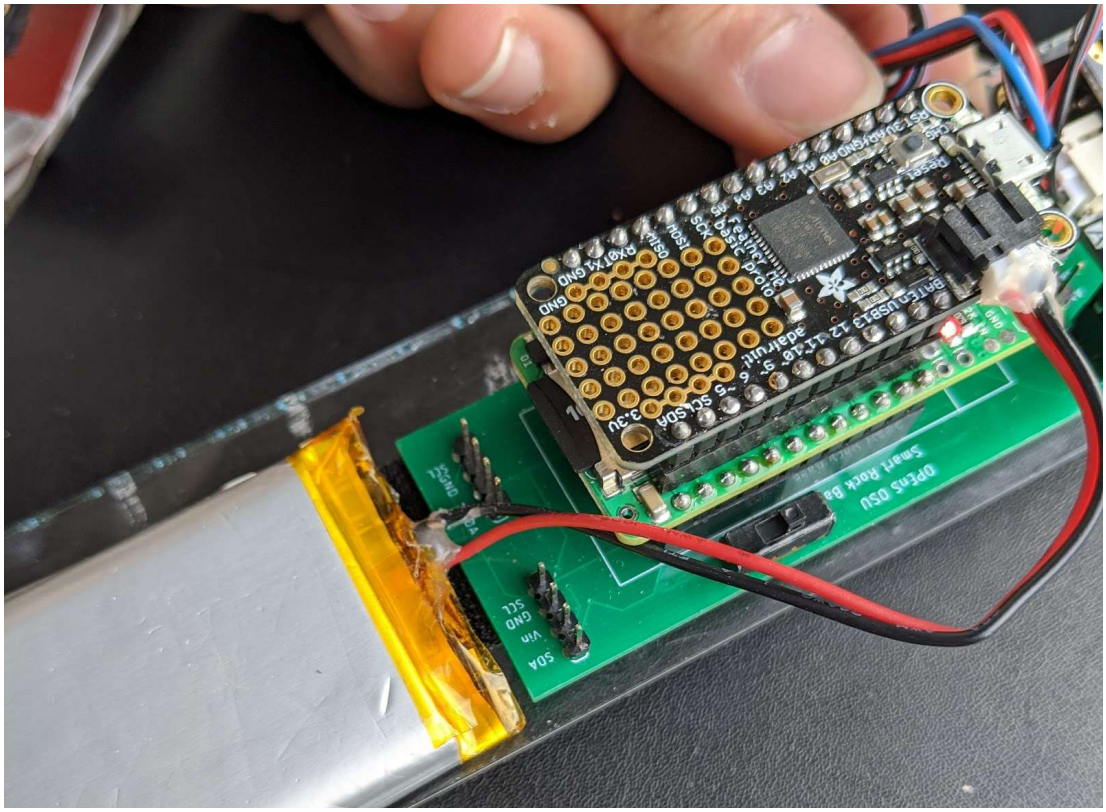
5. In 5 different cups or other liquid containers, fill each cup with the 5 different amounts of the coffee solution in the chart below the following image.

[left to right: 10mL, 70mL, 80mL, 120mL, 200mL]

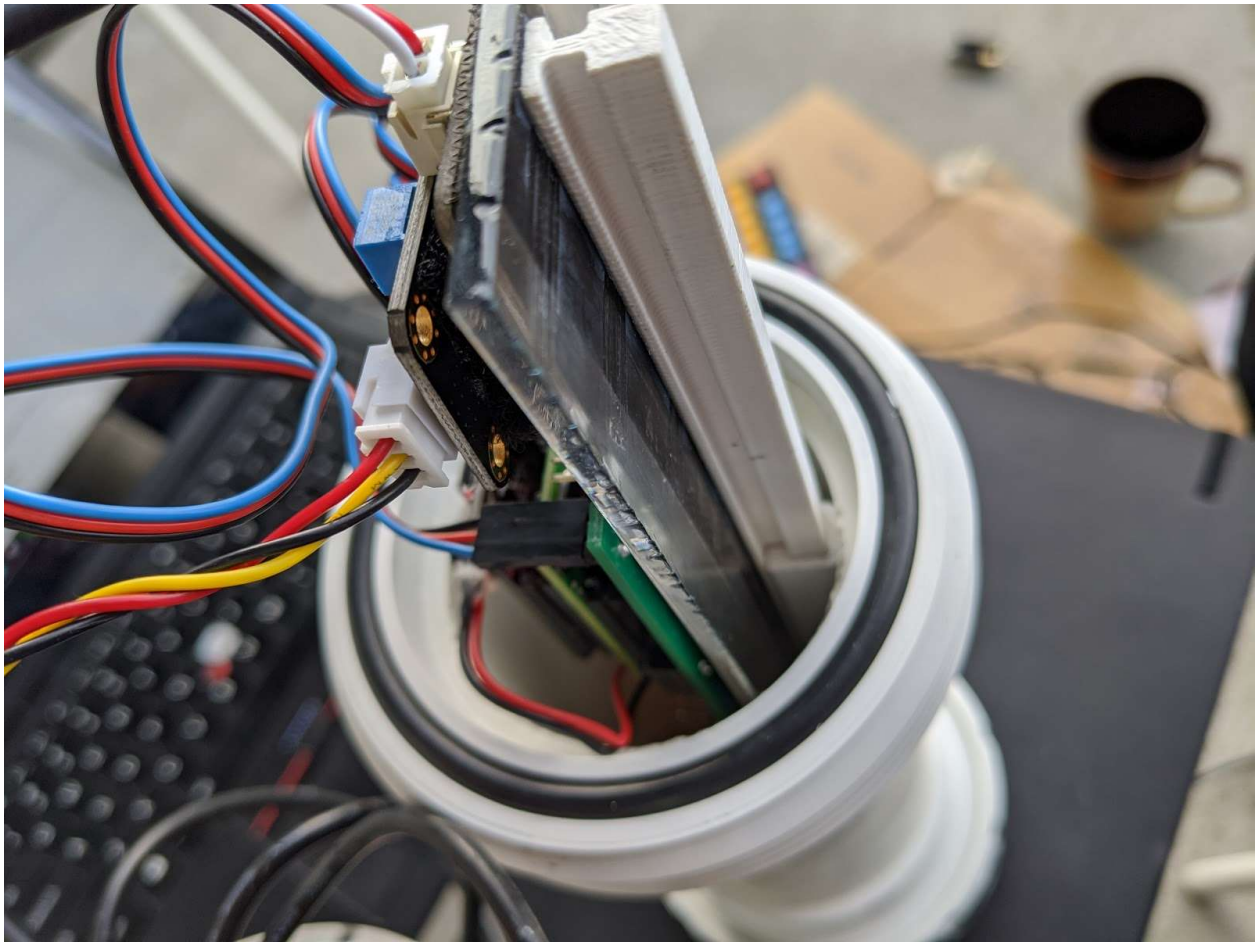
Table 1: Coffee solution amounts

Cup Number	1	2	3	4	5
Dose (mL)	10	70	80	120	200

6. Connect battery power to Smart Rock



7. Insert Smart Rock slide into inner enclosure rail with sensors



8. Seal Smart Rock with end cap

[IMPORTANT NOTE]

At this point in the procedure make sure that all your materials are in an area where you are easily able to find them in the dark (having your laptop on with a dimmed screen should be fine).

9. Attach Smart Rock to bucket via j-hook/u-bolt assembly

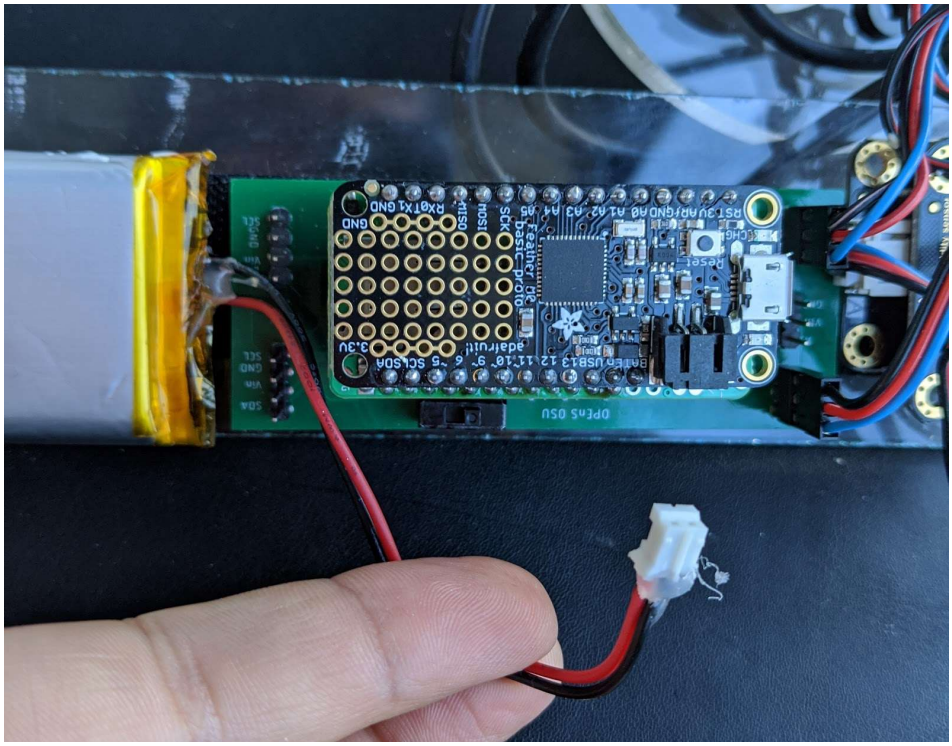
******Turn off your lights in your bathroom or garage and proceed to Step 10 below.******

10. Collect data on SD card for 1 to 2 minutes in clear water.
11. Add the first dose of coffee (10 mL) to bucket, mix well with ruler
12. Collect data on SD card for 1 to 2 minutes in coffee solution
13. Repeat steps 11 and 12 with remaining doses of coffee (refer to **Table 2**)

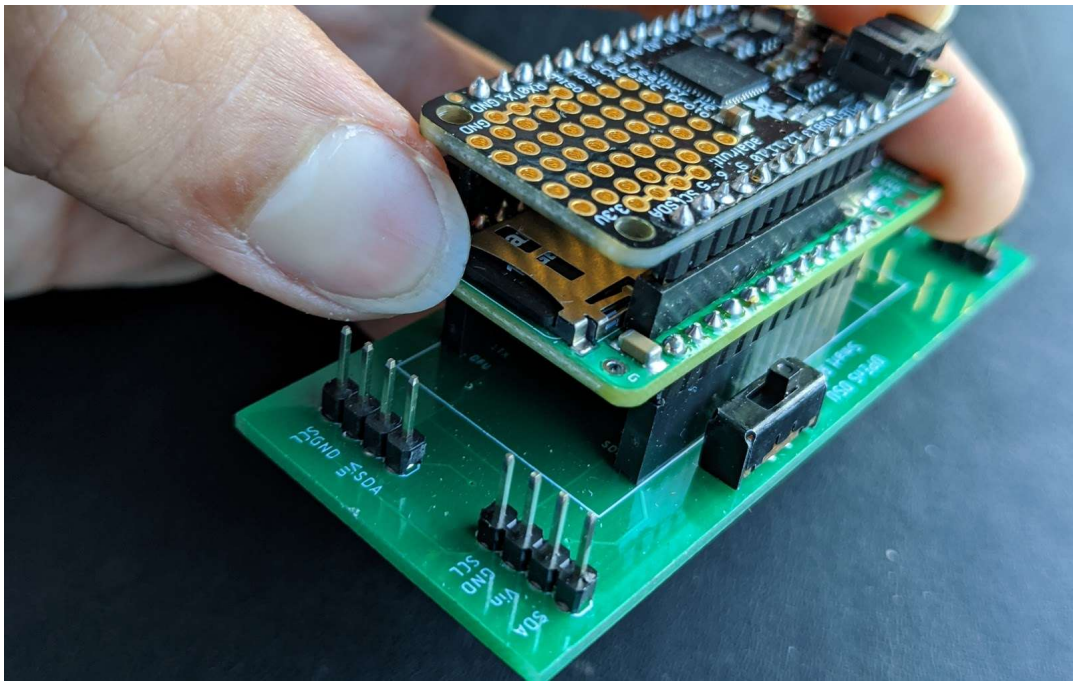
Table 2: Coffee solution additions

Number	Dose (mL)	Total coffee (mL)
1	10	10
2	70	80
3	80	160
4	120	280
5	200	480

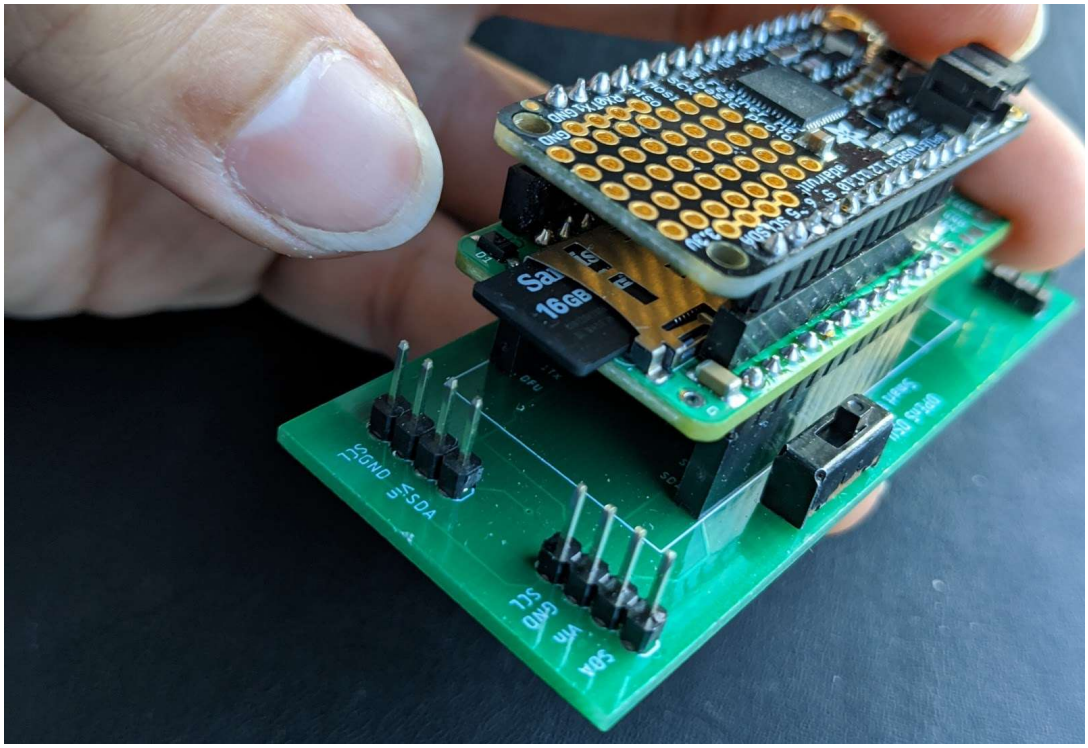
14. Turn on your bathroom or garage lights
15. Remove Smart Rock from bucket and dry with paper towels
16. Unscrew end cap and remove acrylic slide from enclosure
17. Remove power from Smart Rock



18. Remove SD card from Hypnos board: press the SD card until an audible click



SD card should eject itself, now safe to remove from Hypnos board.



19. Insert SD card into adapter and then computer
20. Open csv file and graph to check for changes in turbidity or copy and paste columns into Turbidity_example_CUAHSI_SmartRock_2020.xlsx. You may need to zoom in on the y-axis as the changes will likely be over a very limited range. Values should start high and decrease in steps as more coffee solution is added. EC is plotted for context.