Stephanie Conley

Milestone Reports

Week 3

This is the first week of the project. I added the class at the end of week 2. Since the majority of class has already pitched their projects, I must do the same. Therefore, Tuesday-Thursday was spent putting together a presentation pitch on Evaluating Stereo Cameras for Robotics and Data Collection.
Before pitching the project, I noticed that a couple of teams were kind of similar. To diversify, I requested to do my project on finding a cost-effective system for growing algae. The project is titled Cost-Effective CyanoStat Array for Algae Cultures. A presentation pitch was made and scheduled to be presented on the upcoming Tuesday.

Week 4

Tuesday:
Project presentation.

Rest of the week:

I ran out of photoresistor sensors, so I purchased more from RadioShack for convenience. Once the photoresistors were soldered in place, I tested the photoresistor sensors with a voltmeter to see if there were any short circuits. All photoresistor sensor components passed the test successfully.

(self-timer camera skills)

Each of the new photoresistor sensors was tested to ensure they were functional. This was carried out by connecting each photoresistor sensor to the Arduino circuit.

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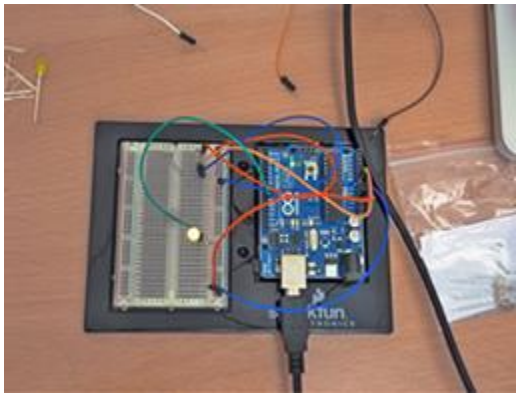
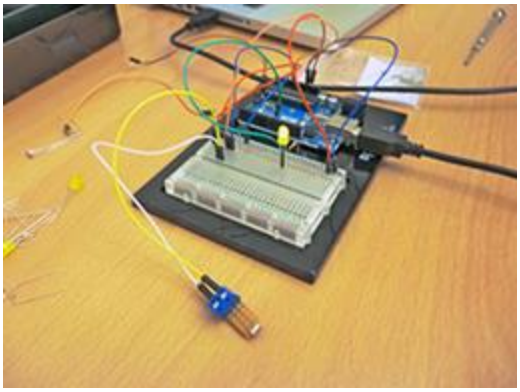


I ran a simple program that told me the reading each photoresistor was collecting. If the sensor is covered, the light bulb on the breadboard will become brighter. Once the sensor is exposed to light again, the bulb will dim. A one—inch black rubber tube was used to cover the sensors.



The program gives a data collection range of 0-140 when the photoresistor sensor is uncovered. When the sensor is covered, the range is 200-600. The reason why the gap is so big is due to the size of the rubber tubing. To fix this, rubber tubing should be small enough to fit the sensor. More than this is overkill. Sizing makes a huge difference in readings. So, it would be nice to 3D print some design that guarantees a range.

The sensor also needs to be stationary. Holding it or causing some sort of motion will affect the range by causing fluctuations. This can be further stabilized by placing the bread board, Arduino, and photosensors in a box. The test tube is taped down in the box because the tube will serve as a holder for the component and decrease the amount of movement. A lamp was placed above the box and the room lights were turned off, so that the light to the sensor could be controlled.

This set-up improved readings greatly by establishing a median range among the photosensors and a constant reading. For example, the reading would stay at a number and sometimes fluctuate up or down by a one, or stay constant at a number with no fluctuation. The less amount of fluctuation, the better.

I met with Frank Cardone in the Prototyping Lab for mentoring with Altium. We talked about the project and what I wanted to accomplish. Frank offered some advice on parts I can use for the design. I expressed that the photoresistors need to be kept away from light that isn't created by the system's light source. The extra ambient light from the room affects the readings enough to make data ineffectual. Frank suggested using IR sensors and LED lights for optical density data collection and day cycles.

Week 5

This week I focused on setting up the circuit and testing it with a toy motor (similar to how the solenoid functions). This involved obtaining diodes and transistors. Like the photoresistor sensors, I ran out of these components too. So, I purchased more from RadioShack. The diode I am using is IN4001 and is known as a "flyback diode" because it absorbs the voltage pulse created by the solenoid (the inductor). Inductors store energy temporarily, causing a delay between a voltage and current. If interrupted, this inductor will take all the stored energy in its magnetic field and immediately convert it to a voltage pulse. If the circuit is not properly protected with the diode, then damage will occur.

For the transistor, the solenoid requires a certain amount of energy that may be too much for the Arduino (Arduino handles 5 volts), so the transistor makes certain that the higher voltage used by the solenoid (12 volts) does not interact with the Arduino. The transistor switches a lot of current using a smaller current. The maximum voltage is 40 volts and its maximum current is 200 milliamp.

This is what the schematic of the set-up looks like:

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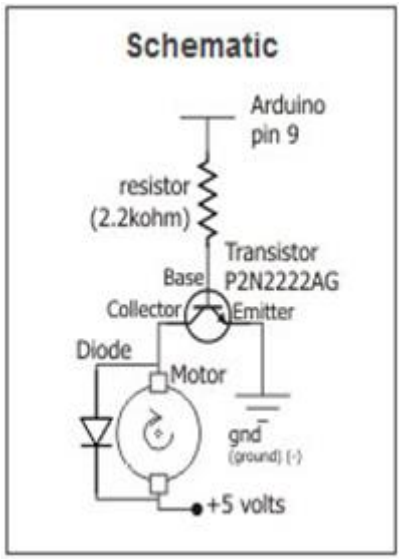
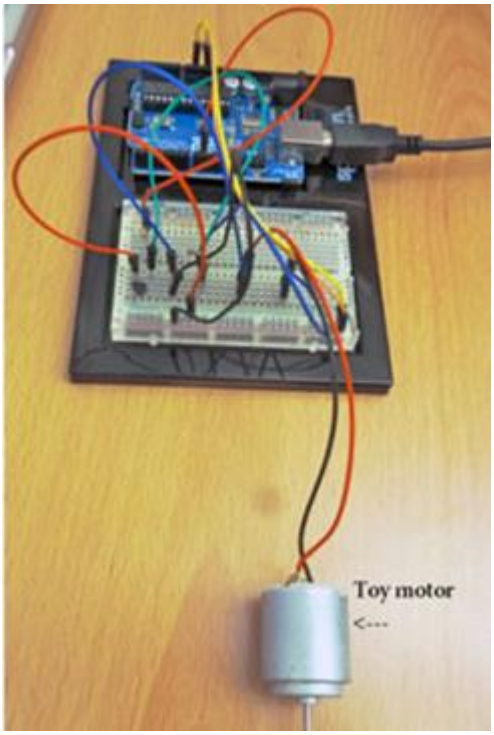
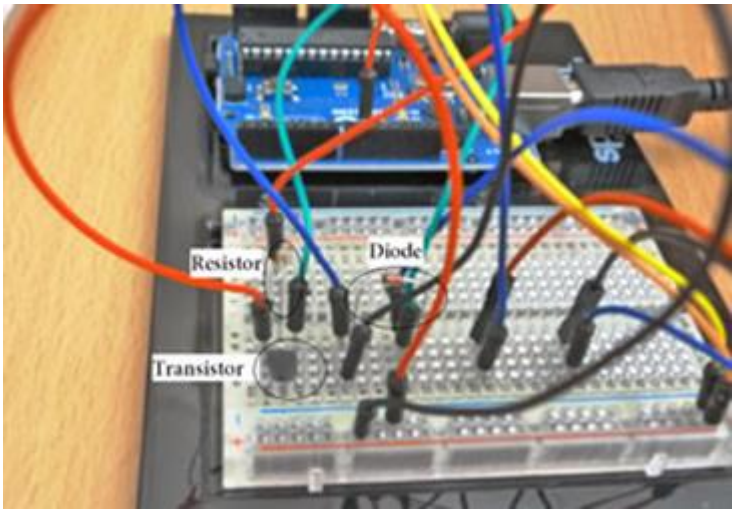


Visually:



Close-up (note: that resistor is a 10K ohm resistor):



Next, I ran the code specific from "ardx.org/CODE03" to run some new solenoids that I acquired from an old Sapphire Energy tubidostat-type system. This was to make sure the circuit wiring is correct and that the solenoids still work.

Issue: The motor did not immediately turn on and it sitting idle.

Question: Is there an issue with the motor? It is nonfunctional or demanding too much power that cannot be supplied by the Arduino?

Solution: Attach the motor to an external power supply (5 volts) to see if that will power the motor. This will show me that if the motor does work – it is not at fault.

Result: The motor works with the external power supply. So, I will attach the external power supply to the circuit and not use the Arduino power supply.

After switching to a new power supply for the circuit, the motor still does not work.

Question: Is the external power supply actually supplying energy to the circuit?

Solution: Test with a voltmeter.

Result: Yes, the external power supply is supplying 5 volts of energy.

Question: Are any of the wires incorrectly pinned?

Solution: Use schematics and diagrams to re-evaluate pinning.

Result: All wires are correctly pinned.

Question: Are any of the wires faulty?

Solution: Test each wire with a voltmeter to make sure they are all connected.

Result: All wires work.

Question: Is the transistor faulty?

Solution: Check to make sure we are using the correct transistor (P2N2222AG) because there are thousands of different kinds of transistors. It is, therefore, important to use the correct type. Also, a voltmeter test was conducted.

Result: Correct transistor and the voltmeter reading checks out.

Question: Is the code wrong?

Solution: Read through code and change values to see if that changes anything.

Result: No change when code is changed. Code is not the issue.

Question: Is the diode faulty?

Solution: Use voltmeter to test diode.

Result: Diode works. Not the issue.

Question: Is the 10k ohm resistor faulty?

Solution: I researched the resistor and found that the instructions said to use a 1k ohm resistor instead. Maybe I made a purchase mistake. I found a 1k ohm resistor in my research space. Yay!

Result: Still no change.

Question: What happens when it's hooked up to the Arduino and use it again for the power supply, as opposed to the external power source?

Solution: Change from external power supply to Arduino.

Result: Motor works.

End result:
I needed a lower ohm resistor (10k to 1k ohm) for the digital switching pin. Also, switching to the Arduino power supply helped.

Still uncertain if this is the true reason.

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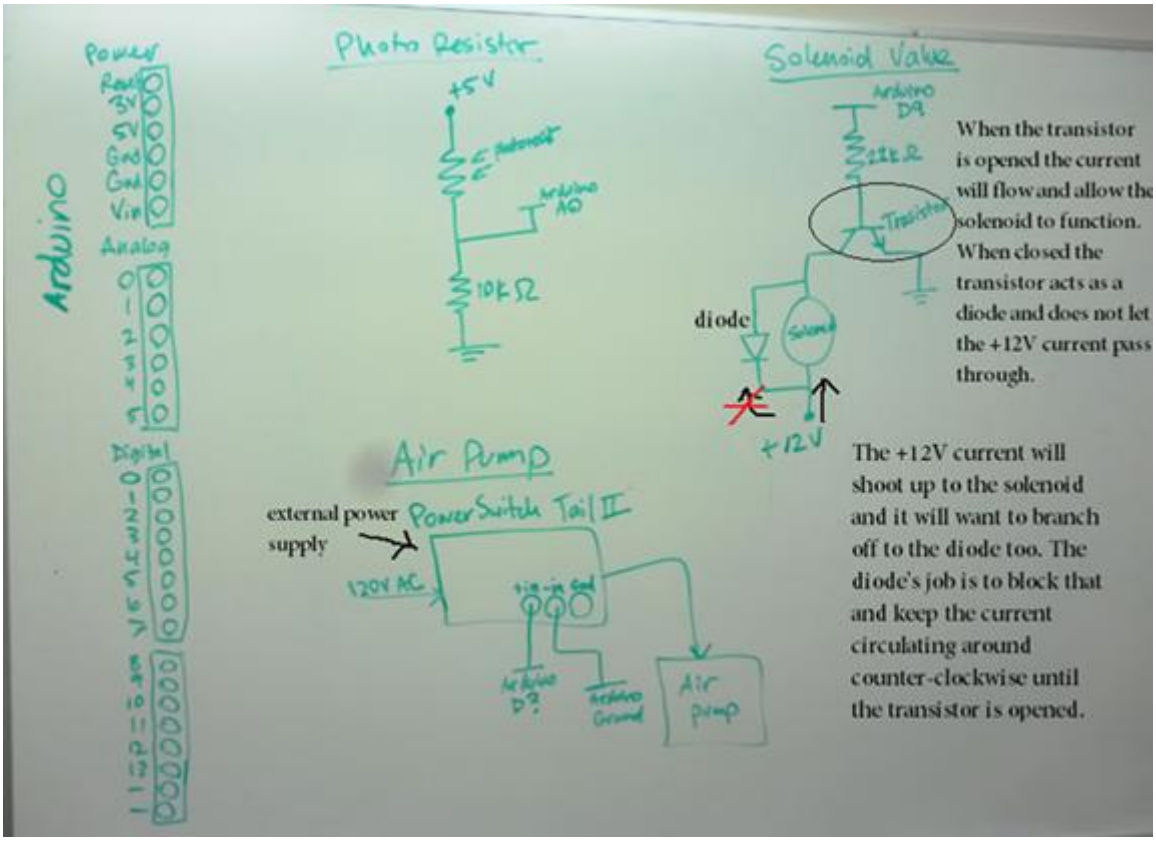
Week 6

Schematic design revisited for the project. This is new:



Revisiting last week, the problem was a faulty transistor. I replaced it with a new one and the wiring works.

Renowned Researcher Eric Lo suggests using a BeagleBone Black and write a Python code. I purchased one from Adafruit.com and selected cheap 1 week shipping.
I don't know Python, so I started using CodeAcademy.com for lessons.

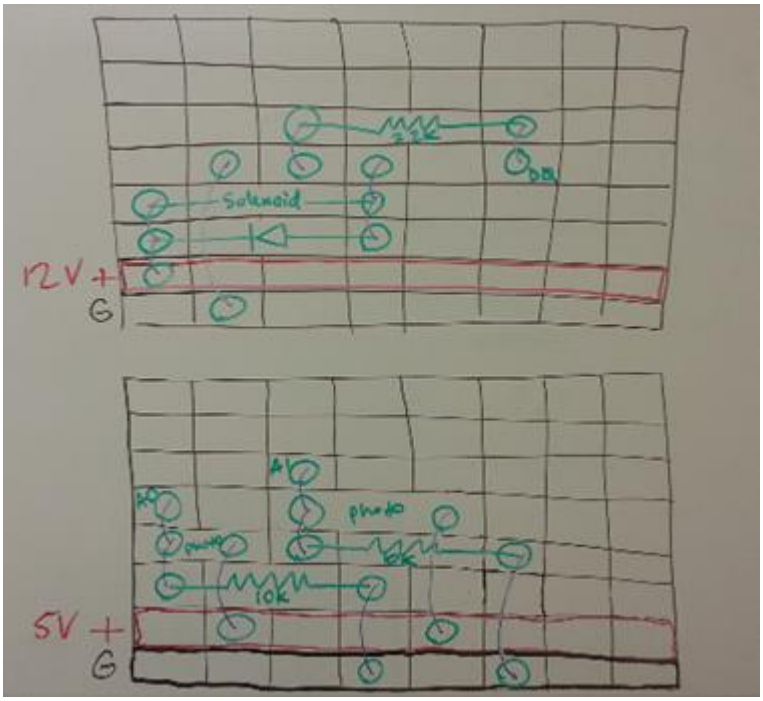
Week 7

BeagleBone received. The BeagleBone Black/Python transfer is not working out as planned. It's actually complicated things even more. This is probably because I think that too much for what I

want to do. Arduino was fine to begin with. It offered a straightforward and easy approach for the user. I am going back to Arduino because it worked to begin with and didn't need to be made fancy.

So, I worked on cleaning up the PCB boards.

Before:



After:

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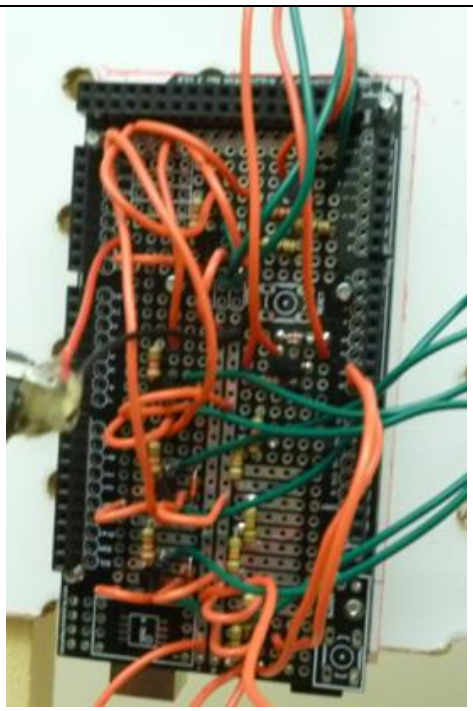

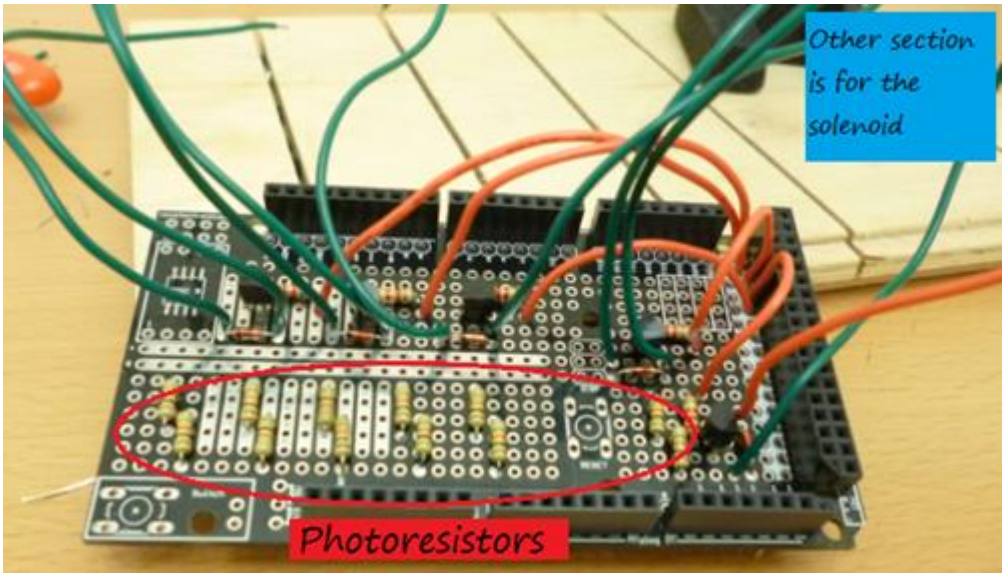

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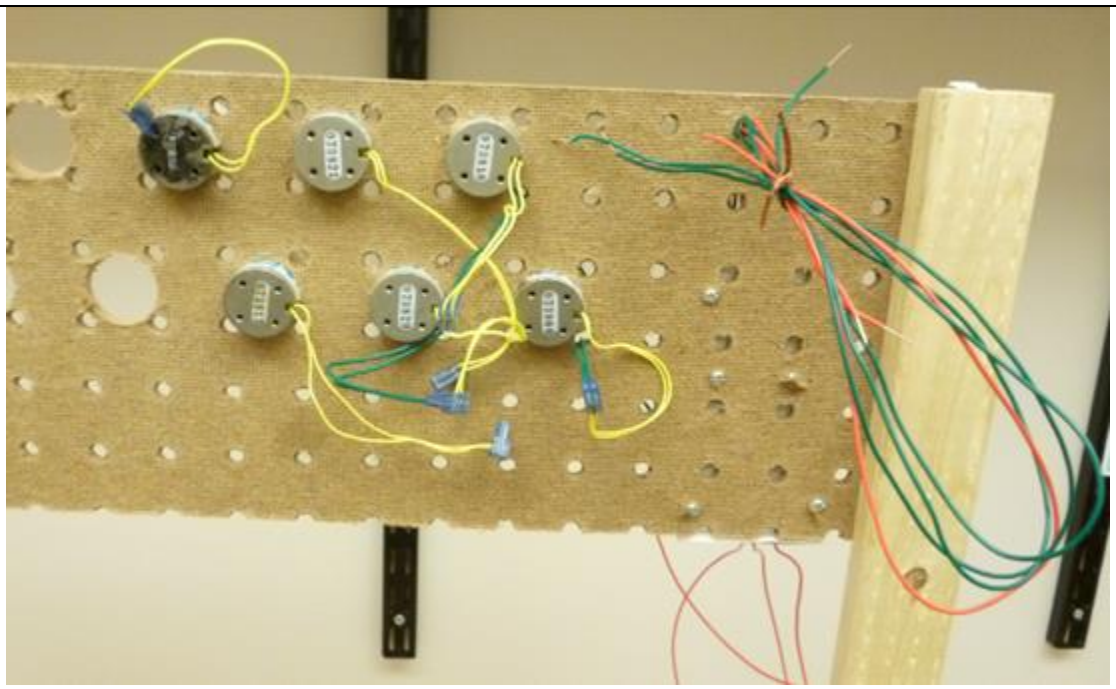
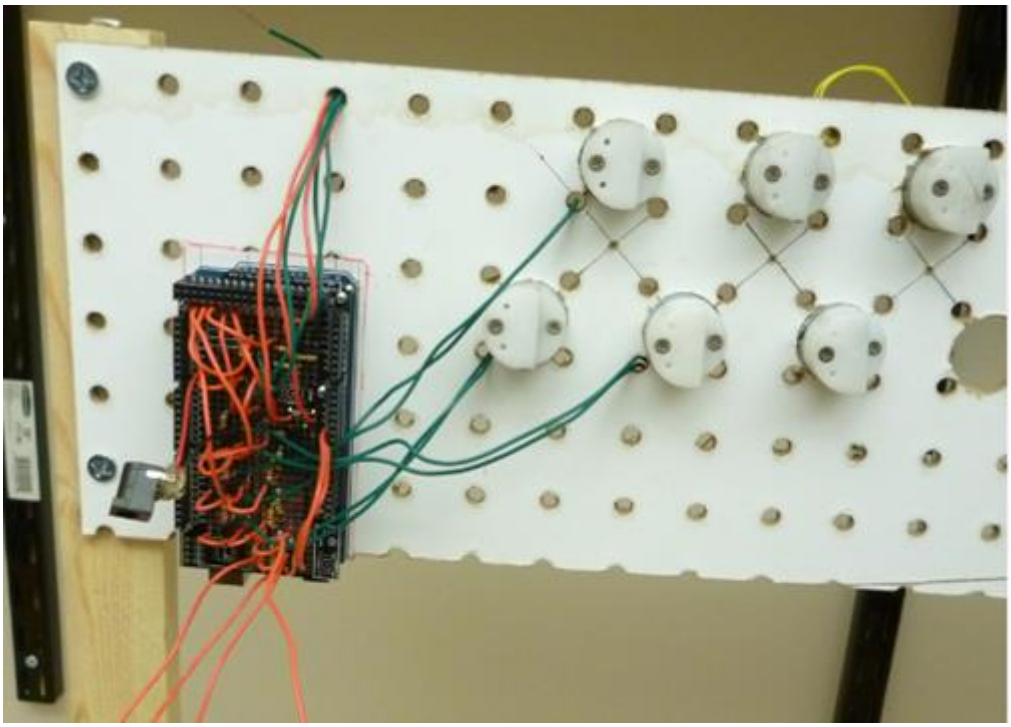
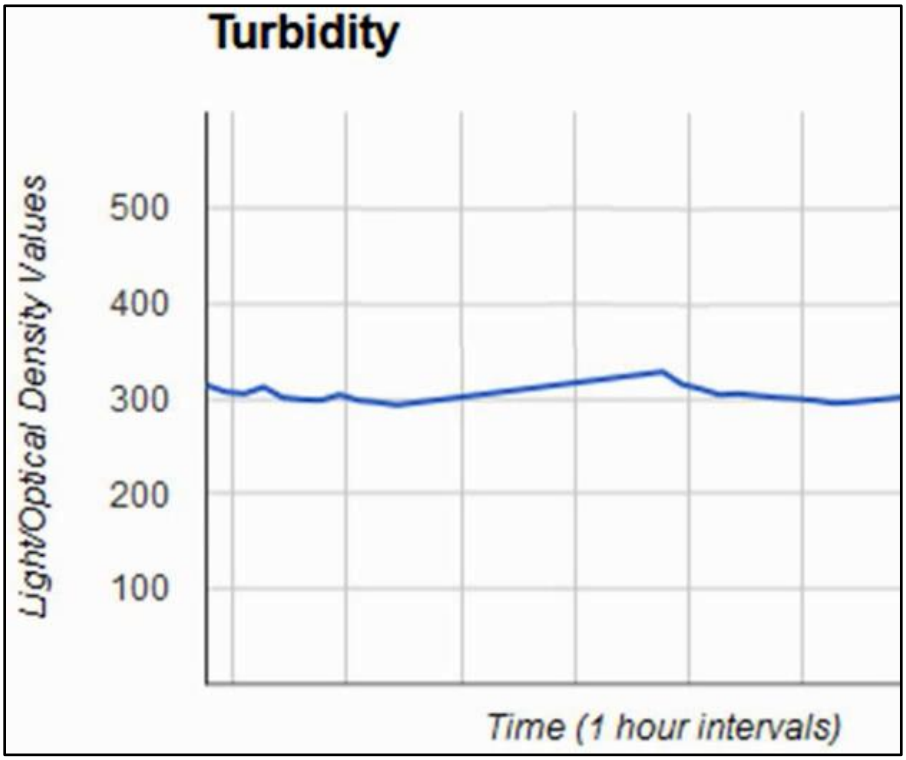




Person suggests looking into IR grow lights. This looks like a very nice option. So, I bought a grow light for $30 and it has about 12 watts. I will receive it next week.

C code updated but it's kind of buggy. I have noticed some processes aren't as smooth or in sync. I will more on this. Here is a test sample:

	A	B
1	Timestamp	PS1
2	5/15/2014 17:36:17	307
3	5/16/2014 18:36:21	305
4	5/17/2014 19:36:28	312
5	5/18/2014 20:36:32	301
6	5/19/2014 21:36:36	299
7	5/20/2014 22:36:39	298



The data is promising but I think the code needs to be rewritten. This is my next focus.

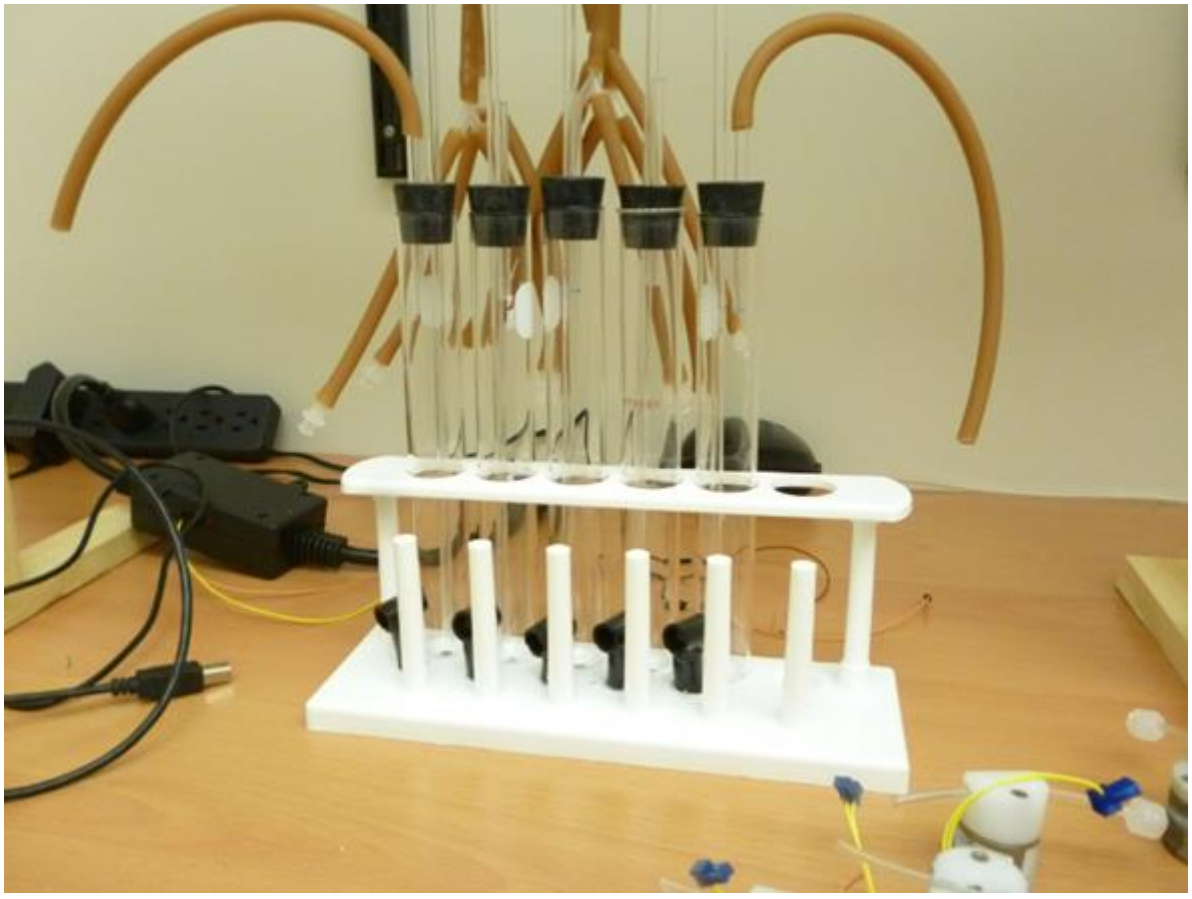
Week 8

Red-blue grow light received and tested. I think this wasn't a great idea with such a short amount of time. Also, the light is really aggravating for my eyes. Something like this would have to be put in casing or have the light focused on the algae as much as possible. I don't have this fellowship yet, so I don't want to put too much into a design that is just going to get by for the

end of the quarter. That is pointless and a waste of energy. Now I have a grow lamp and haven't quite decided to mail it back yet.
Although I have actively sought out advice from Prototyping Lab and others, I feel that the advice is conflicting and has pushed me in different directions. The three LED light/3 IR sensor design is too much as well. I would like to do some tests with the IR sensors but I think it would be a waste of energy. I'm just going to stick with the fluorescent lamp and do tests. It's worked quite well in the past and I don't need to reinvent the wheel.

Code Update:
Frustrated with the last rewrite I decided to once again set out in search for someone worth talking to. Luckily, I found Tom Wypych chilling on a sofa. Armed with delicious candy and chips, I asked his advice on how I should approach a rewrite. He pointed out all the things that should not be done (mistakes in the code). This was extremely helpful because he's been the only person who agreed to look at the code. Furthermore, he's the only one to look at it AND actually think about it. Although we discussed it for a short time, I feel like I am steps ahead of where I have been...and low on candy. Yay Tom.

Sample algae obtain from Cal-CAB. A small amount is added to each tube and the system is turned on. Light optics is important, so it will be interesting to see how the tubes differ in regards to the heat lamp position. It can't possibly hit all six with equal attention.



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Single test

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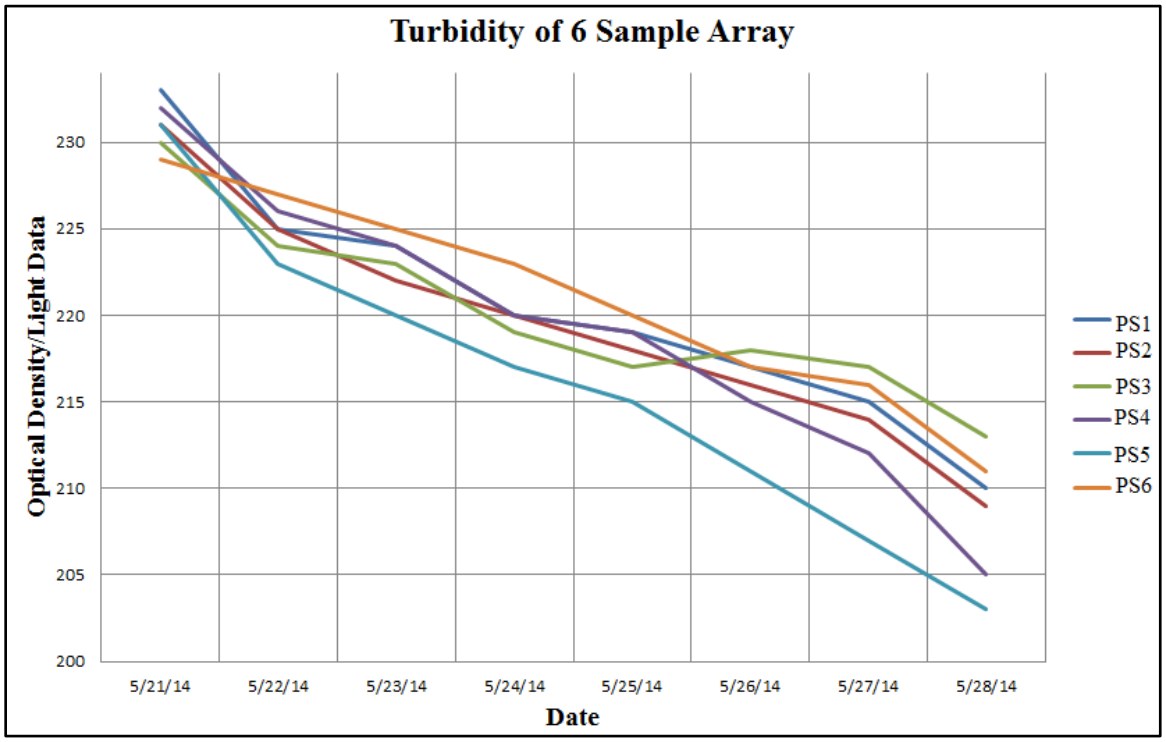
Week 9

Algae data collection finished. I have been watching the results for a week and I am pleased with the results. I am glad the heat lamp had no bearing on the differences in optic density readings.



All in all, I think a major milestone has been achieved.