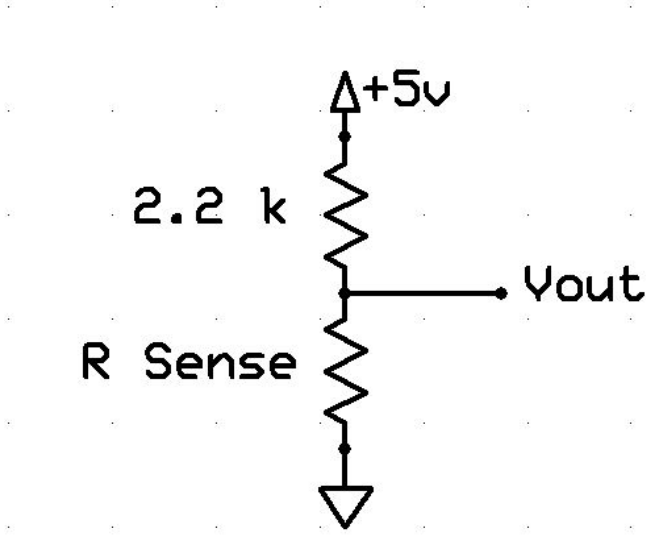
03/23/2016

MiloneTech Etape Liquid Level Sensor (LLS):
https://www.adafruit.com/datasheets/eTapeApp.pdf

Hardware Setup:



Rsense found across the red and white wires coming from the LLS.

Software Setup:
Vout goes to A0

Download and run arduino sketch (Liquid_Level_Sensor). Open the serial monitor and the program will output the raw value from the circuit as well as the converted inch value.
Conversion equation:

$$y = -9 * 10^{-05} x^2 + 0.0268\,x + 10.325$$

Accuracy: ± 0.064 inches
Repeatable with an accuracy of at least: ± 0.104 inches

Fit was made to these values:

Inch	6	5	4	3	2
DAC Value	412	435	452	469	488

0.16 was added to the fit equation output by excel to get the above equation.

Compared the visually measured values of the water level to the inch values output by the arduino sketch. Found the average difference between the measured and the derived values to find a baseline accuracy.

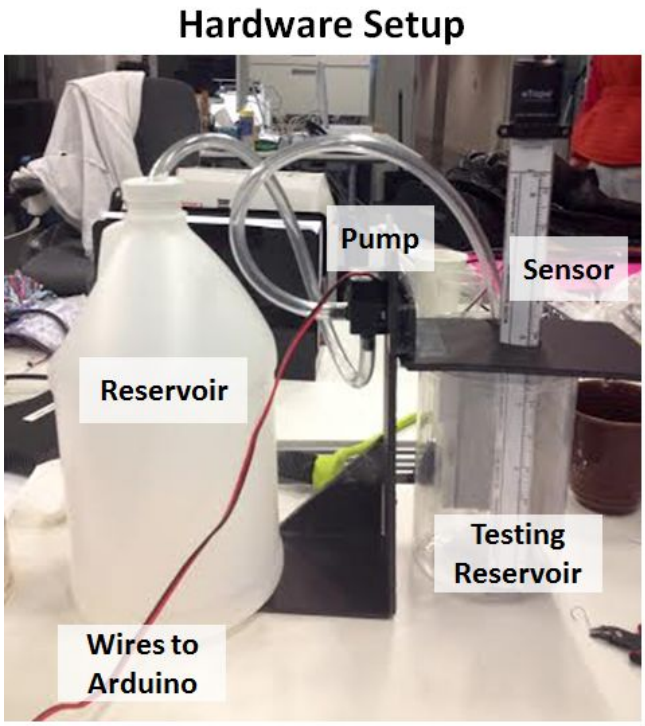
polynomial fit

meas	derive	difference	abs diff.
1.75	1.73	0.02	0.02
2.25	2.28	-0.03	0.03
2.4	2.35	0.05	0.05
2.8	2.81	-0.01	0.01
3.1	3.21	-0.11	0.11
3.4	3.4	0	0
3.5	3.44	0.06	0.06
3.9	3.89	0.01	0.01
4.2	4.26	-0.06	0.06
4.5	4.6	-0.1	0.1
4.75	4.79	-0.04	0.04
5.05	4.97	0.08	0.08
5.5	5.41	0.09	0.09
5.8	5.56	0.24	0.24
6.1	6.16	-0.06	0.06
	ave	0.064	
	pos	0.06875	
	min	-0.05857	

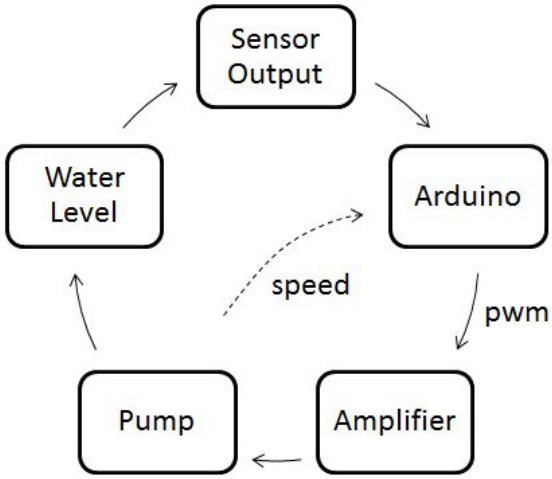
The other fits tried (linear fit and exponential fit) gave an accuracy of $\pm$ 0.095 inches.

Code for calibrating the sensor is found in the Git. Filename: Liquid_Level_Sensor

Liquid Level Sensor Control Loop



Current Design: maintain constant water level
Future Design: control pump speed



Current implementation: LLS is used as a sensor switch. In code, a threshold is set and once the water drops below the set value as read by the arduino from the LLS, the Arduino will turn on the water pump to siphon water from the reservoir into the testing reservoir. Final pump not selected; current pump leaks. Pump runs off of 12 V. Two stage BJT circuit didn't work, need a high power motor controller to drive pump.

Options for motor controller:

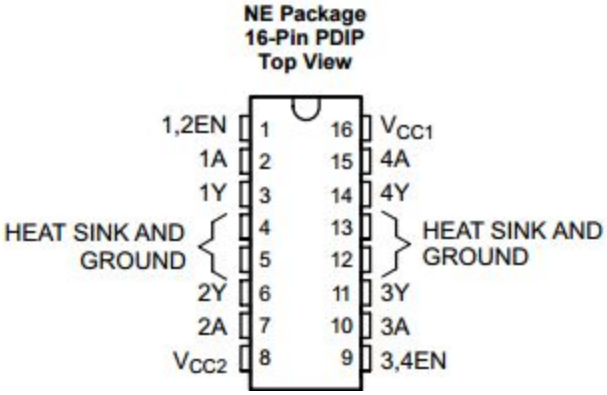
Pololu HIgh-Power Motor Controller (found in parts bin, unsure if in working condition)
L293DNE - Quadruple Half-H Drivers

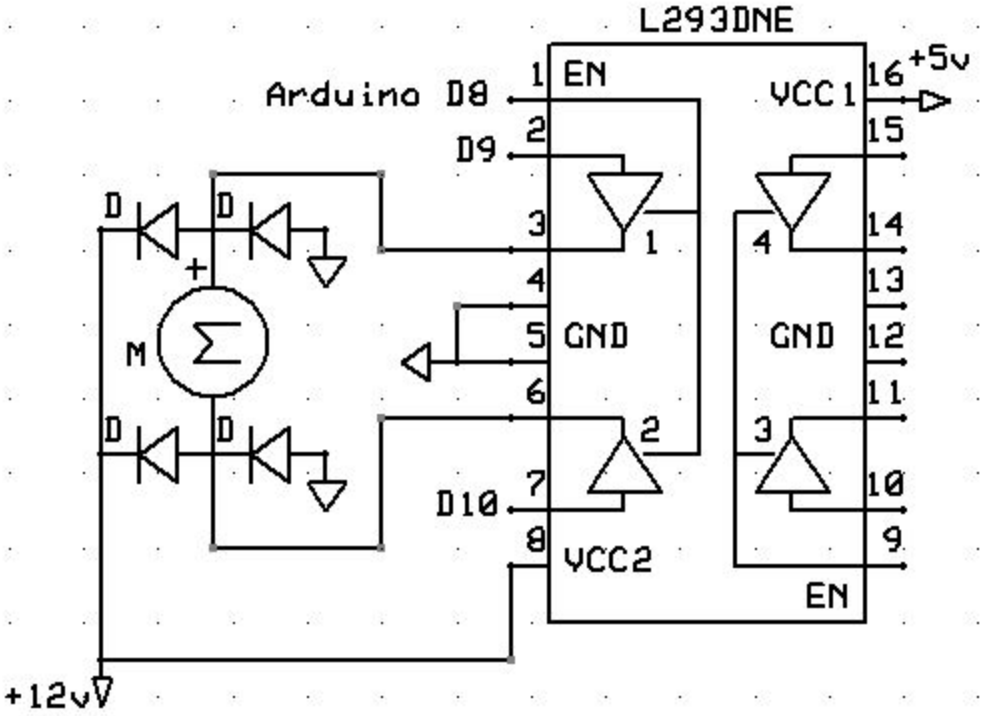
Could use a simple relay but eventual goal is to enable speed control for mass transfer pumps. Relays can't be PWMed because they will eventually break.

Code for LLS Control is found on Git. Filename:

L293DNE: http://www.mouser.com/ds/2/405/l293d-441879.pdf

Hardware Setup:





Current setup: only running one motor but could be set up to run more. Digital Arduino 8 enables the drivers, and D9 and D10 control the speed and direction.