E80 Project Proposal
Section 2 Team 3:

Our autonomous underwater vehicle (AUV) aims to analyze the relationship between turbulence of a body of water and water quality. Our robot will go out in a circular course for one minute, stopping several times over its course to collect data. At these stops our robot will dive to six feet and take multiple sets of data at various depths. We will use the AUV's built-in IMU and magnetometer to measure the turbulence of the surface water at each point, based on how much it rotates on the surface of the water when no motors are in use. Because of how sensitive the magnetometer is and the amount of rocking anticipated by the robot on the surface, we should have large enough sensor measurements to take data from. Then when diving, the robot will use a MPX5700 pressure sensor, connected using an interface circuit, in order to track its depth. At given depths the robot will collect data using a SEN0161 pH sensor, connected using an interface circuit, and an integrated silicon solid-state temperature sensor. The pH sensor should have a smaller swing, but hopefully we will be able to determine a difference between the pier and beach based on various pollutants in the different locations. This will be difficult to implement due to the fact that we don't know if the probe is entirely waterproof. However, we will contain the probe partially within our box, waterproofing the junction. Temperature will vary a large enough amount. From the collected data, we can hopefully analyze the relationship between currents (analyzed from the turbulence at the surface) and variation in water quality, based on temperature and pH away from the surface.

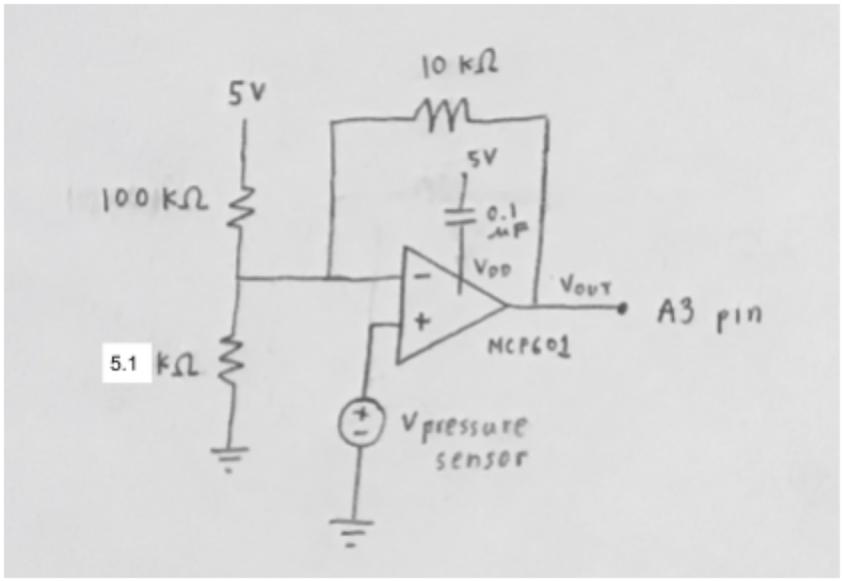
We would like to launch our robot at both the pier and the beach at Dana Point, in order to compare the water quality and turbulence at these two locations; which have different levels and types of human activity.

Budget:
Analog ph sensor - $29.50 + $16.00 tax and shipping = $45.50 total
will do the purchasing.

Design Alternatives:

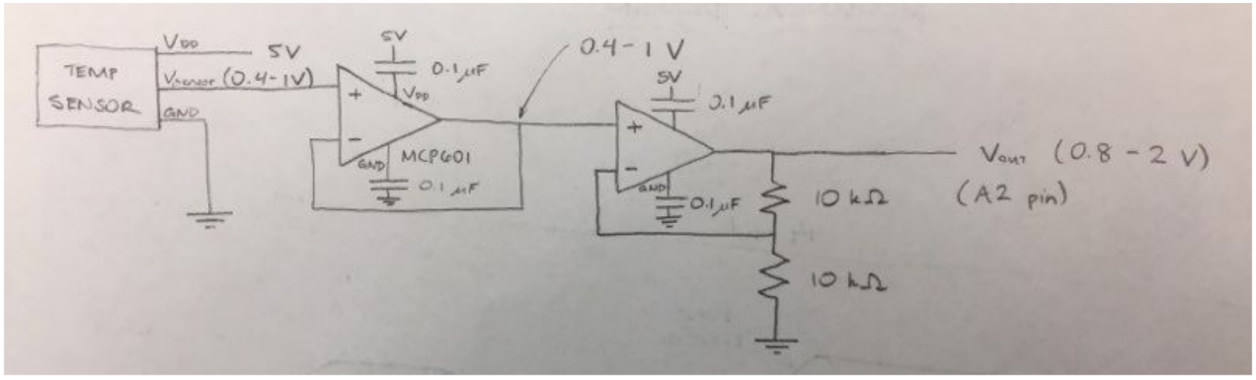
1. Two-part robot: The main robot will travel on the surface of the water and measure turbulence, while a smaller robot will dive and measure pressure/depth, temperature, and sunlight.
2. Seashell collector: Glides along the bottom of the ocean in a zigzag pattern looking for seashells or pebbles, and a small grating would be used to scoop up these objects and filter out the sand.
3. Trash collector: Similar to the sea shell collector, but will probably need to use some image recognition software to determine what is and isn't trash (which is likely out of our budget).
4. Child safety: Our robot will map out the distance from shore vs. depth (using sounding), as well as turbulence, which can be good to know in the interest of child safety.
5. Ocean health/pollution: Using the same process as turbidity measurements, we can measure the concentration of certain chemicals. We will compare our values to historical measurements of the area as well as current measurements in other parts of the world.

Sensor Schematics:



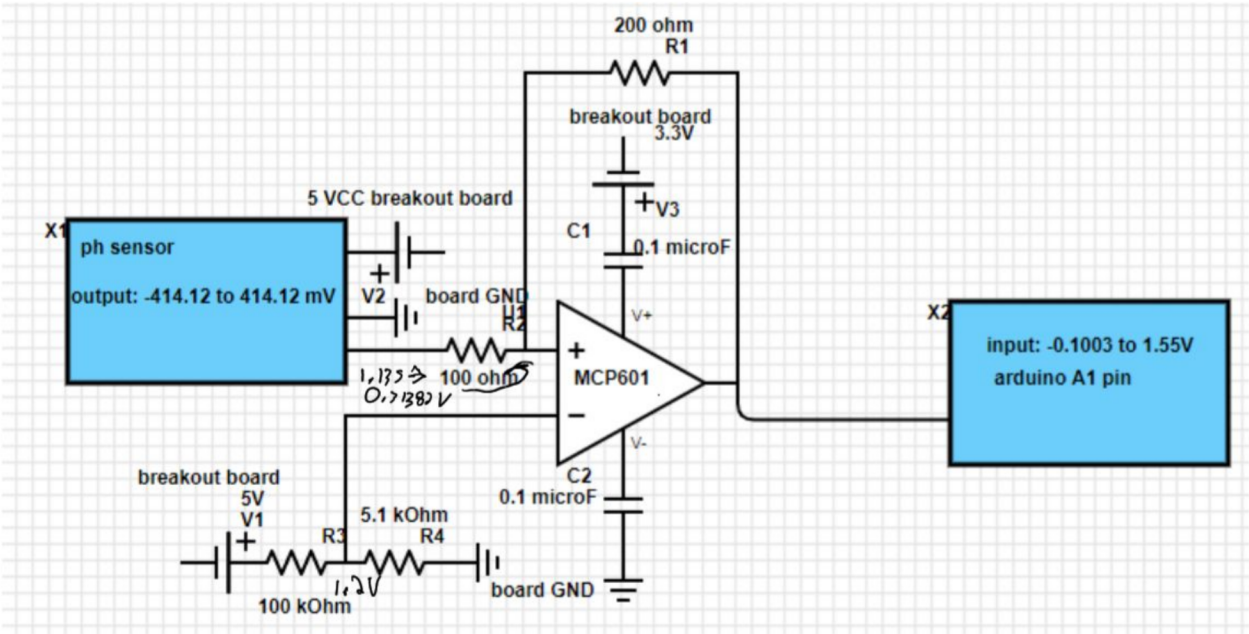
Vout = (1+(10/5.1)+0.1)*Vpressure - (0.1*VDD)
Vout = 3.06*Vpressure - 0.5

0.2 < Vpressure < 0.875 (based on depth of 2m max)
0.112 < Vout < 2.178



Vout = (1+(10/10))*Vtemp
Vout = 2*Vtemp

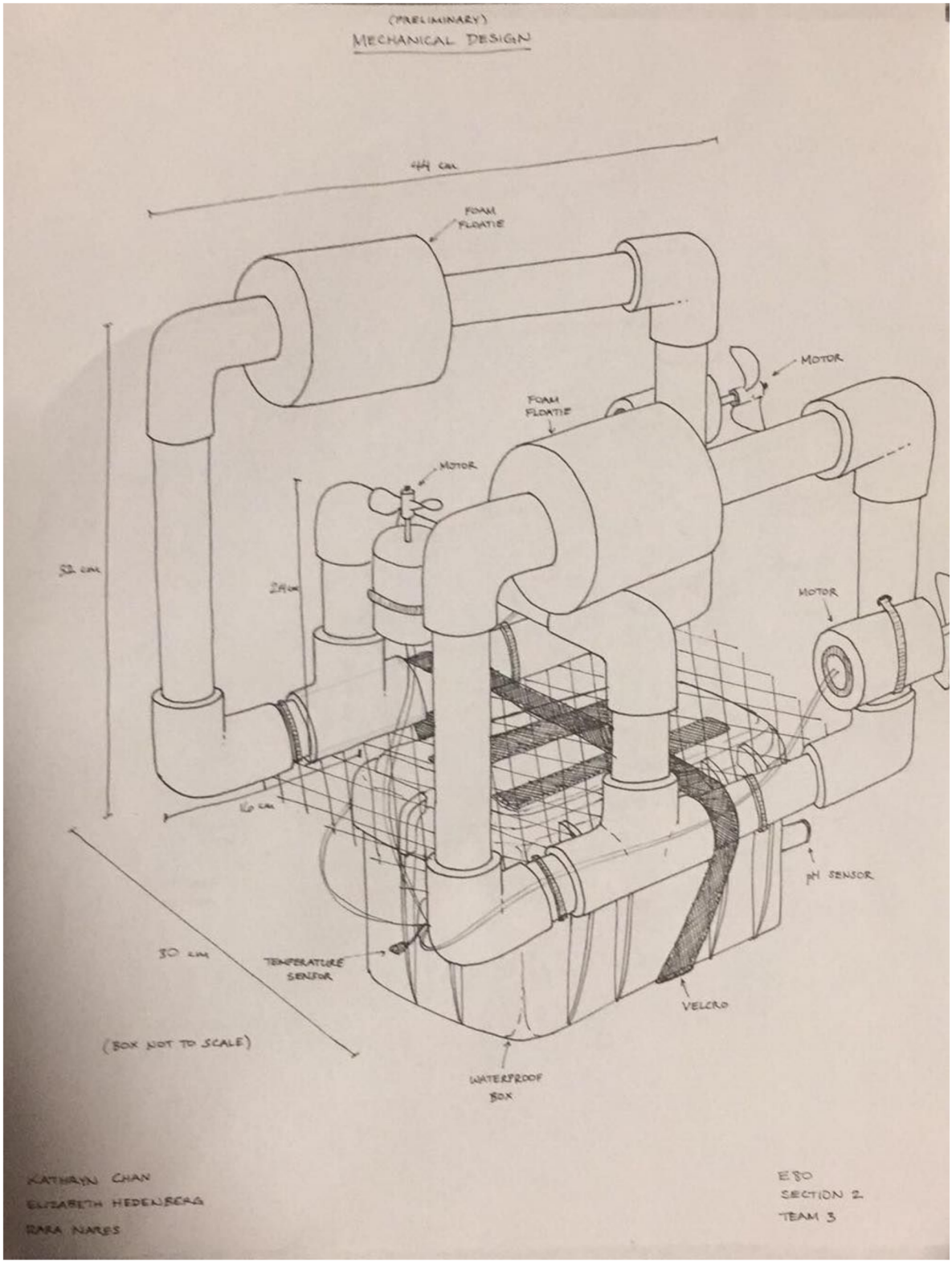
0.4 < Vtemp < 1.5 (based on temperature of 60oC max)
0.8 < Vout < 3



need s to be non inverting use tl081 check input leakage current of opamp, think about thermistor for faster 8626 doesnt work be midful

While there might be some clipping of the output voltage, due to the fact the ocean probably doesn't have a pH of 14, we should be able to make all reasonable measurements without clipping. The overall current consumption will be about 2.44A, based on 34 mA from the teensy, 0.8*3 A for the motors, and 10 mA for the pressure sensor, while all other electronics should have negligible current consumption. Since the battery we use has 3500 mAh, we can expect a maximum run time of 0.68 hrs or 41 minutes.

Mechanical Drawing:



https://www.dfrobot.com/product-1025.html?gclid=CjwKCAjwm-fkBRBBEiwA966fZEdP-uvOthRdAGUd9Smbq2uOVFQnB27gIdHfPwkHR3F0-FKVqNCP1hoCo0cQAvD_BwE