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% ENGR 130 Module 2.1 Report
% Section E
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Lab 1 Discussion Questions:

1. The lowest voltage that we could read from the sensor in analog mode was zero and the highest voltage that we could read was 3.79. This tells us that the sensor works by detecting the amount of light passing through. We tested this by measuring the voltage without anything between the sensor, which generated the maximum value, and with paper between the sensor, which generated the minimum value. This means that the sensor is functioning correctly and is able to process an accurate output, which also tells us that we assembled all the components correctly.

2. The sensor gives off a certain amount of voltage based on the turbidity of the water. In other words, clean and clear water will give off a high amount of voltage while opaque and dirty water will give off little voltage. Using this concept, a dishwasher could use a turbidity sensor to read the water that is being passed during a cycle. As the dishwasher is running through its cycle, the dishes are being berated by water, with the runoff containing chunks of food, sauces, and oils that would cause the water to become cloudy. As the cycle comes to an end and the dishes are clean, the water runoff would be clean along with the dishes. A turbidity sensor in a dishwasher would work by reading the voltage off the sensor, and only stopping the wash cycle once the voltage reaches a certain threshold. A switch of some sort would have to be in the dishwasher to recognize the increased voltage, and stop the cycle once a consistent amount of the threshold value is detected.

Lab 2 Discussion Questions:

1. If the time between voltage samples was reduced to 0.2 seconds, the frequency would be 5 Hz (f=1/T)

2. Converting 2.5 V to NTU:
   $NTU =- 260(2.5)^2 + 1800(2.5) - 3000 =- 125\,NTU$
   This dummy equation is truly giving a wrong value for NTU since it should not be possible to get a negative turbidity value. Since turbidity measures the quality of water, the lowest turbidity value has to be zero at which the water is perfectly clean. Since the equation allows for negative values to be outputted, it is not the most accurate way to calculate NTU.

Another reason why this equation is inaccurate is because it is not calibrated specifically for the provided sensor and the lab environment. Different sensors will output different voltage values for the same water quality. Thus having an extremely generalized equation will not account for the differences between devices. Furthermore, since the room lights are on during the lab, this could affect how well the turbidity sensor detects its own light. The given equation might be assuming that the experiment will be done in complete darkness which is not the case for the lab conducted now.

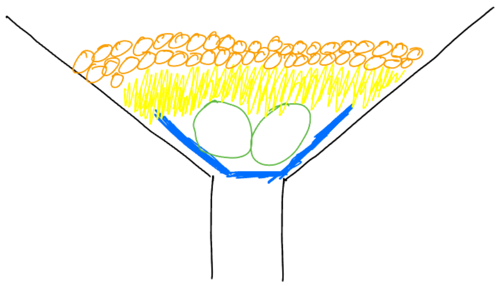
3. Algorithm
   a. Start a count by setting a variable equal to 1
   b. Check if button is pressed
      i. If the button is pressed, stop running completely
      ii. If the button is not pressed, continue running
   c. Measure the voltage from the turbidity sensor
   d. Store the voltage in the next unused term in a list
   e. Add 1 to the variable assigned in step ‘a’
   f. Temporarily stop the voltage reading cycle
   g. Resume after one second
   h. Repeat steps ‘b’ through ’g’ until the value of the variable in ‘a’ exceeds 100

4. Objectives:
   - To obtain clean water from dirty water
   - To remove turbidity from water
   - To produce correct results
   - To develop a prototype that fulfills the job of the filter

   Constraints:
   - Finding the design that produces the correct results
   - Figuring out the right filter materials to use
   - Figuring out the proportions of the right filter materials that work

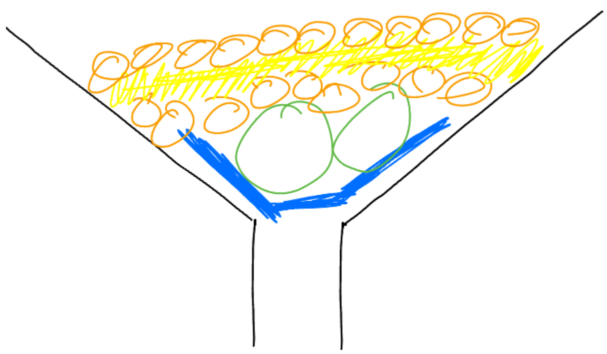
5. Filter Designs

Design 1



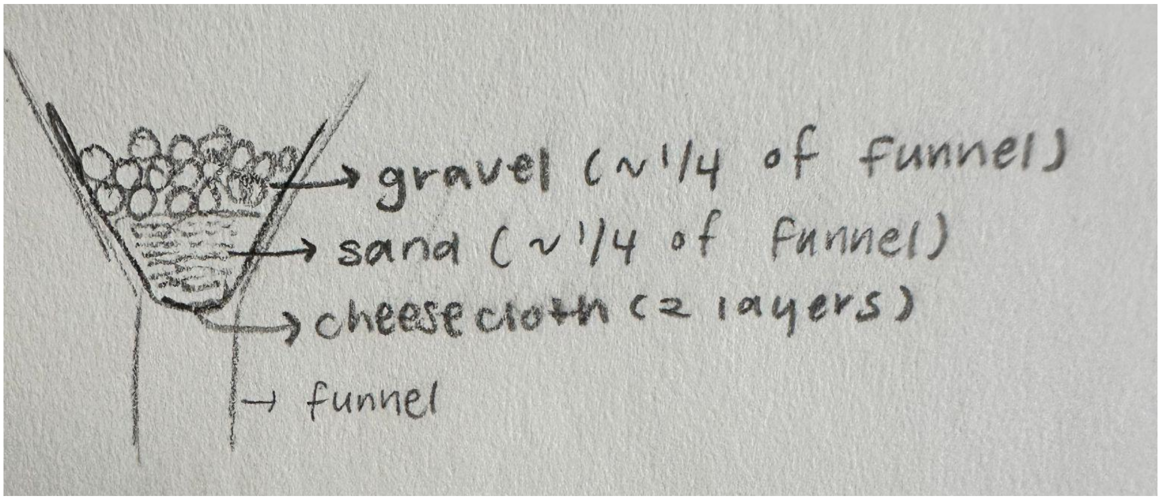
- Funnel is in black
- Cover the tip of the funnel with a small amount of cheese cloth (in blue)
- 2 to 3 cotton balls (green) depending on funnel size
- Fill about ¼ of the funnel with sand (yellow)
- Fill about ¼ of the funnel with gravel (orange)
- Funnel should be about 70% full

Design 2 - Modified version of design 1

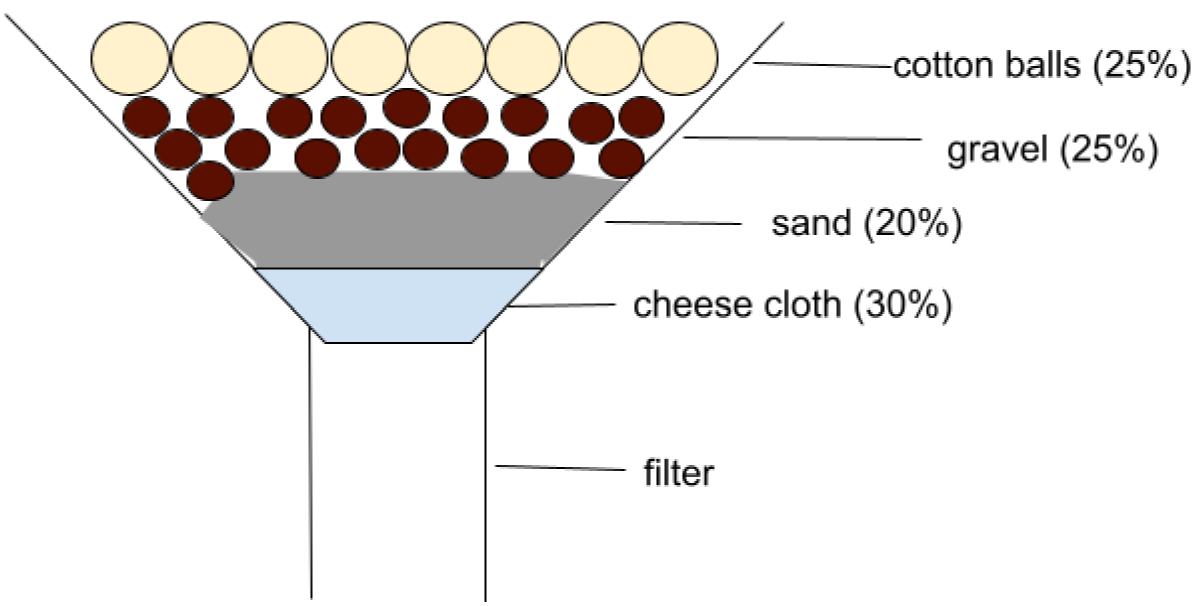


- Funnel is in black
- Cover the tip of the funnel with a small amount of cheese cloth (in blue)
- 2 to 3 cotton balls (green) depending on funnel size
- Place enough gravel (orange) so cotton balls cannot be seen
- Do the same for the amount of sand (yellow) on top of the gravel, and the gravel on top of the sand
- Funnel should be 70-75% full

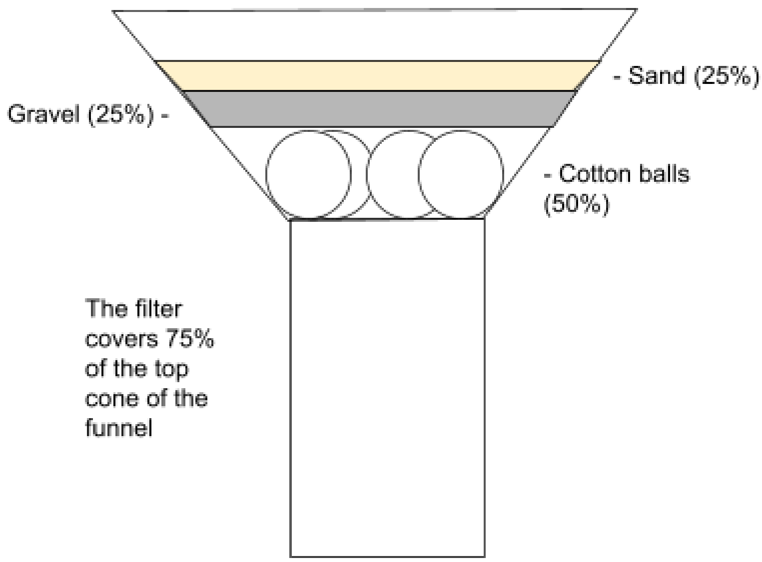
Design 3



Design 4



Design 5


- Sand (25%)
Gravel (25%) -
- Cotton balls (50%)
The filter covers 75% of the top cone of the funnel