Sensor Development

The Fall 2017 Sensor Development team worked on redesigning and calibrating the fluidized bed solids detector to be used for testing concentration of suspended particles in floc blankets as well as the submersible sensor designed to measure the height of the sludge blanket in the sedimentation tank.

Overview- Where does the fluidized bed solids detector fit in the process

- It will be used for floc blanket reactors

- Will be used by the HRS subteam

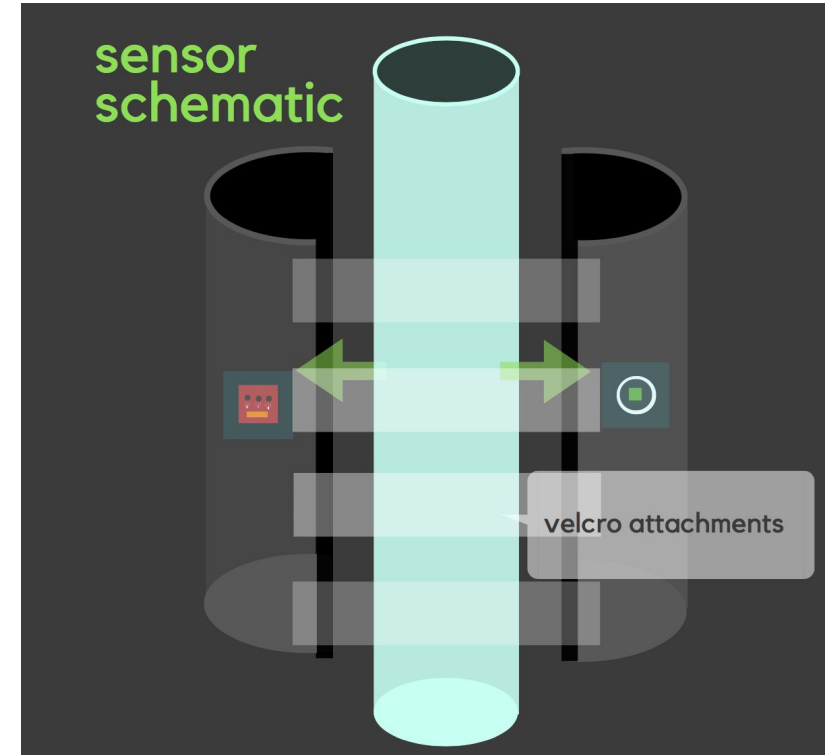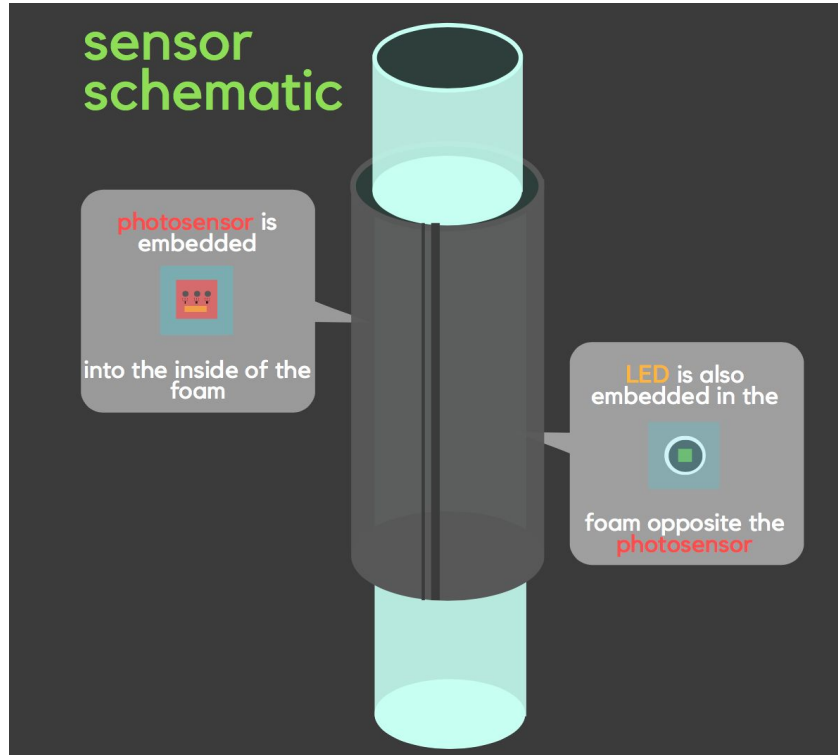- Multipurpose, could later be used in other context

Background - How sensor works

- The photoelectric sensor detects changes in light intensity by an emitted light source.

- LED provides a base light intensity.

- Through testing, a concentration vs. absorption relation will be developed.
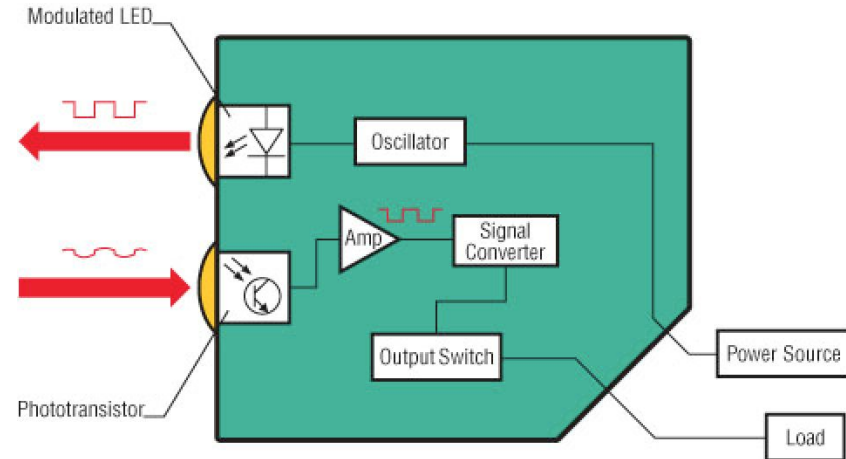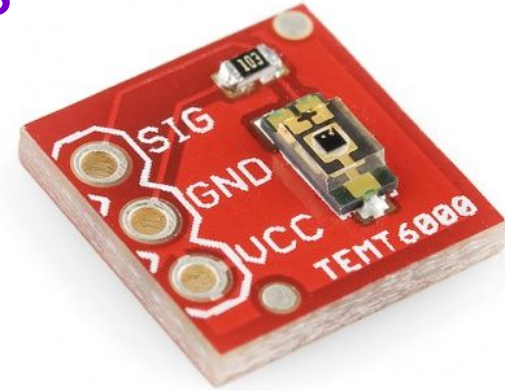
Fluidized Bed Solids Concentration Sensor - Adjustable, Portable, Flexible

Photosensor calibrated at concentrations from 0.005 g/mL to 0.3 g/mL.

Prepare clay solution

↓

Shake tube

↓

Record photosensor reading
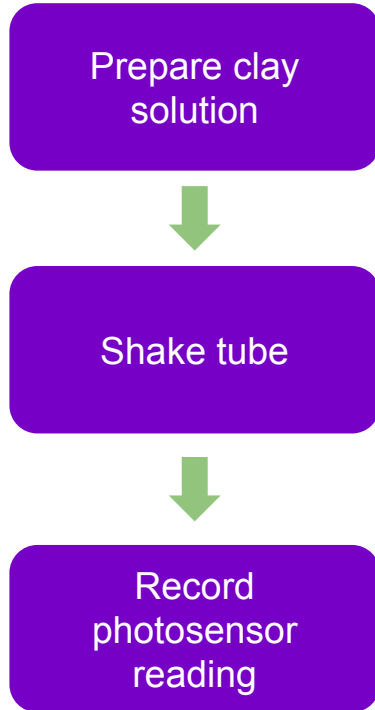
$$Absorbance = -\log\left(\frac{sample - dark}{blank - dark}\right)$$
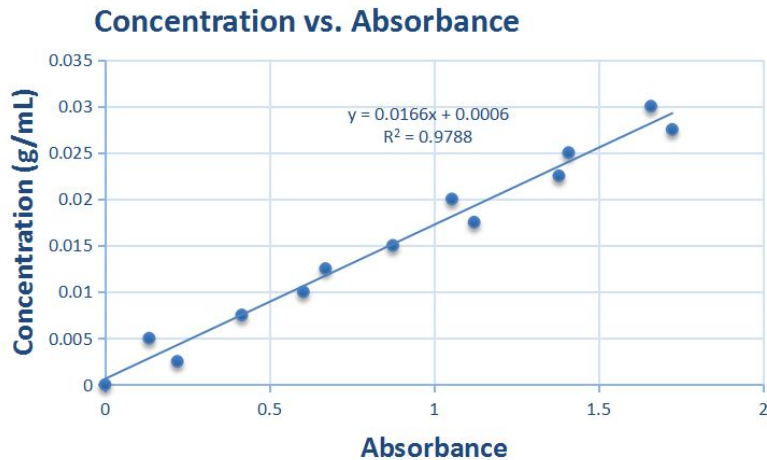
• Voltage is converted to absorbance in a logarithmic relationship.
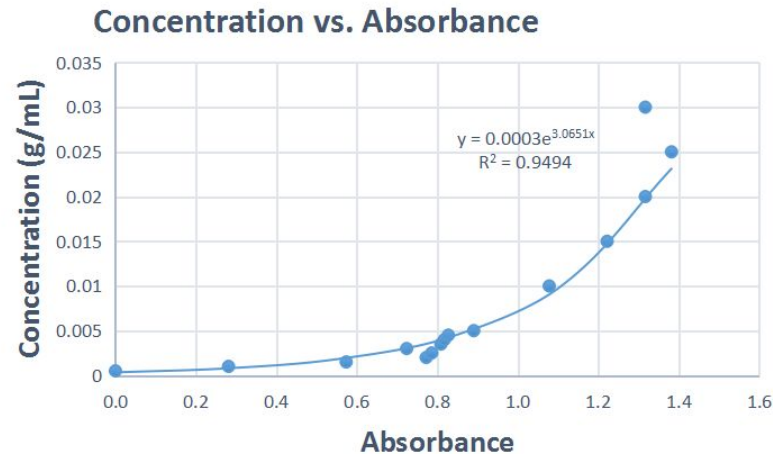
Beer-Lambert Law

$$A = \varepsilon bc$$

• A = absorbance
• ε = molar absorptivity coefficient
• b = the length of the path traveled
• c = concentration

Comparison between data from Fall 2017 and Spring 2017

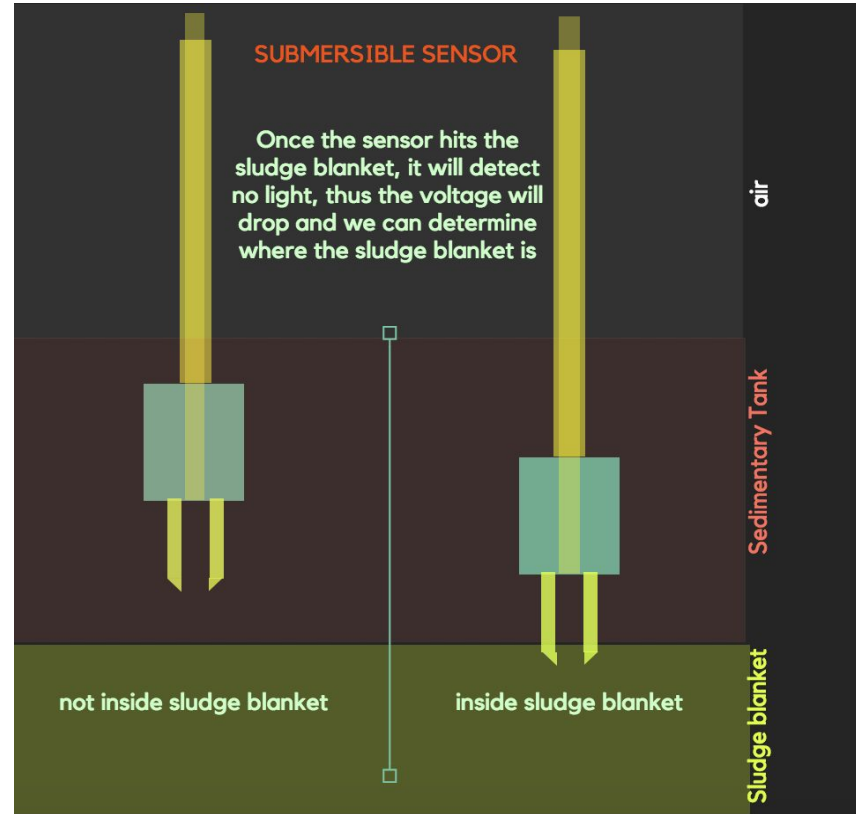
Fall 2017, R^2 = 0.9788

Spring 2017, R^2 = 0.9494

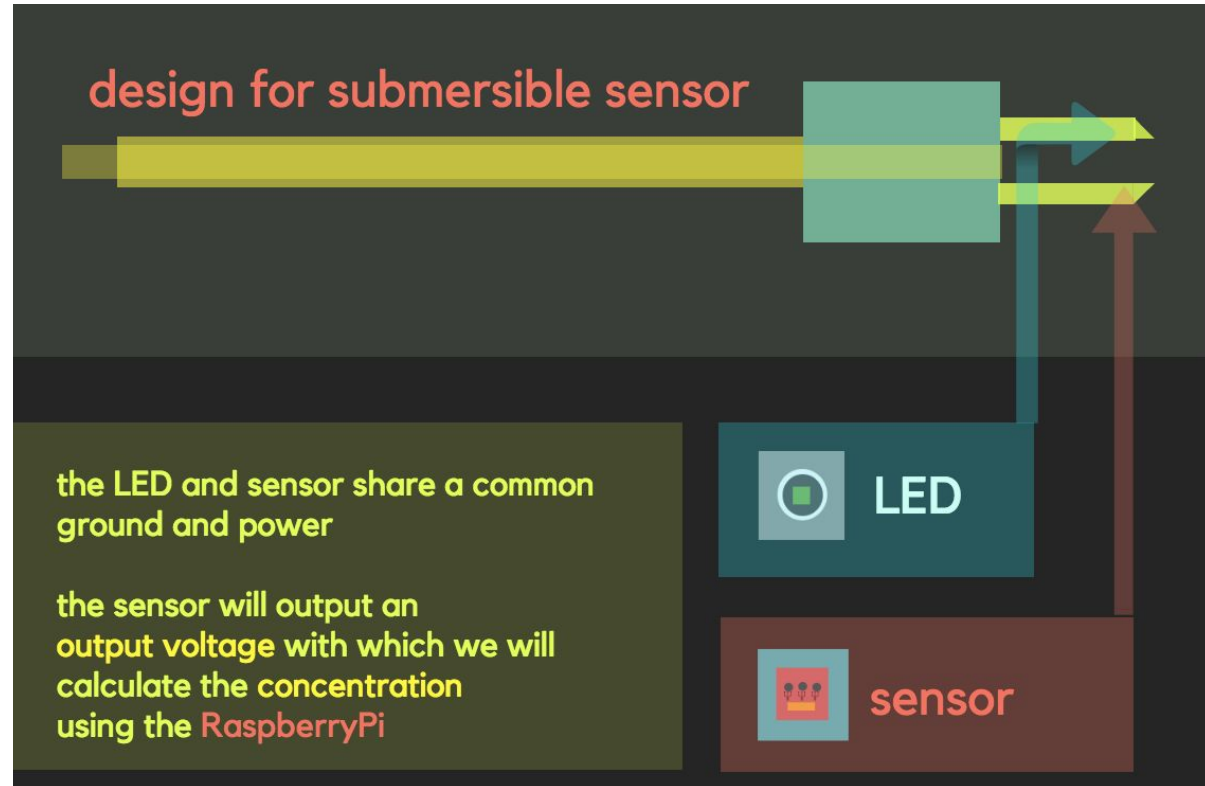Based on Beer-Lambert Law, absorbance is proportional to concentration

Submersible Sensor Basics

•Designed to measure the height of the sludge blanket in the sedimentation tank
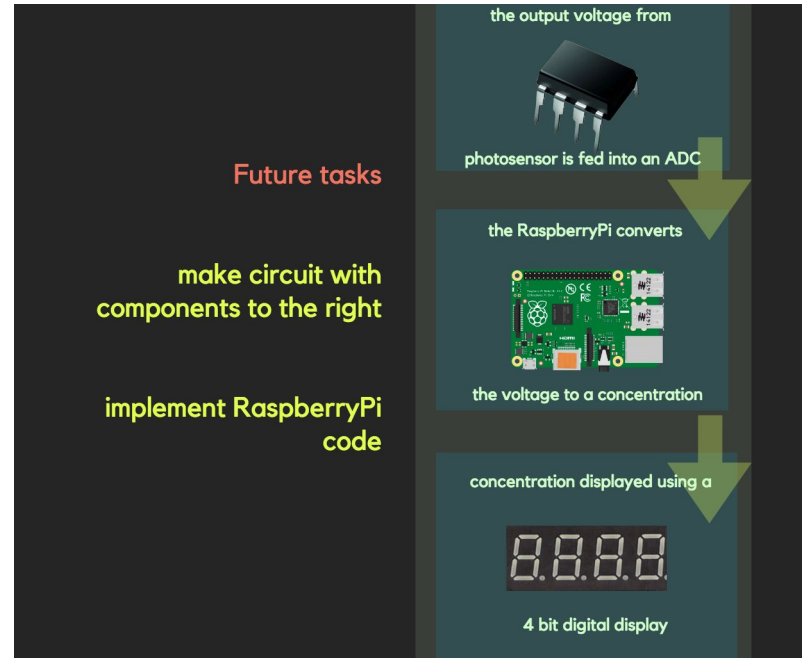
Submersible Sensor Schematics

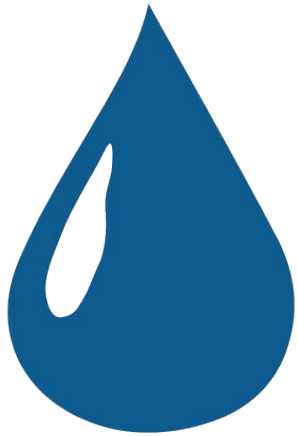•Adjustment of circuitry to incorporate RaspberryPi.

design for submersible sensor

the LED and sensor share a common ground and power

the sensor will output an output voltage with which we will calculate the concentration using the RaspberryPi

LED

sensor

Future Tasks

Future tasks

make circuit with components to the right

implement RaspberryPi code

the output voltage from

photosensor is fed into an ADC

the RaspberryPi converts

the voltage to a concentration

concentration displayed using a

4 bit digital display

Finish circuitry and test submersible sensor
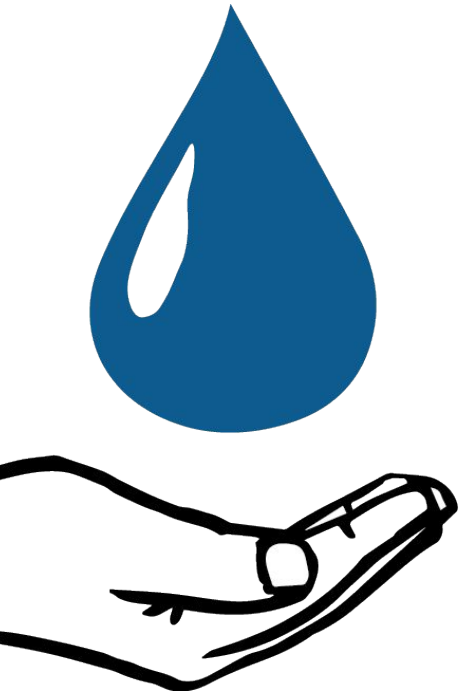
Questions and Recommendations

Grace Zhang
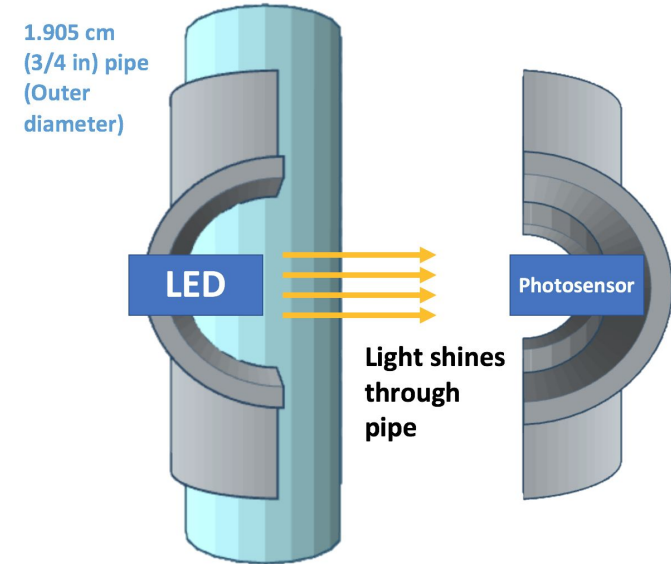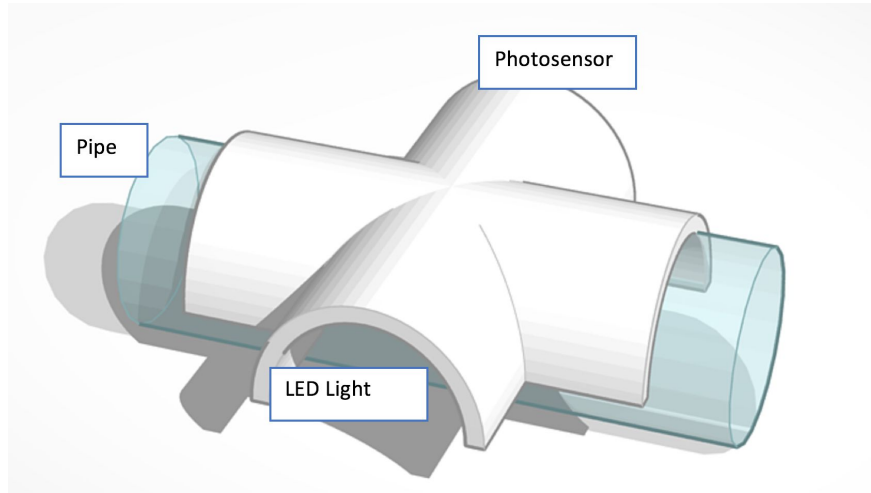B.S. in Environmental Engineering
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Appendix Slides

Schematics of sensor designed by the Spring 2017 team

1.905 cm (3/4 in) pipe (Outer diameter)

Pipe

Photosensor

LED Light

LED

Photosensor

Light shines through pipe

Breadboard and circuitry