Optical Sensors for Detection of HABs

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Background

- Water quality at Lake George is deteriorating as excessive phosphate and nitrate runoff gives rise to **Harmful Algal Blooms** (HABs)
- HABs damage an environment by consuming dissolved oxygen and releasing harmful toxins
- Jefferson Project - studies the impact of human activity on freshwater to mitigate the effects of HABs using a network of water-monitoring sensors

Purpose

- To develop an inexpensive, deployable device to detect HABs across lakes like Lake George
- Aid in mitigating the effects of HABs by adding additional data to an existing sensor network

Semester Objectives

- Design an inexpensive fluorometer unit for the detection of HABs capable of outputting high frequency wavelength data and integrating into existing communication infrastructure
- Develop a robust testing procedure for:
  - Fluorometer output
  - Fouling management method
- Build the fluorometer and document test results

Major Design Requirements

Criteria	Metric
Sensor Position	2 - 6 cm
Cost	< $500
Biofouling Management	< 10% Δ transparency
Temperature Reading	± 2 °C
Environmental Guidelines	yes/no

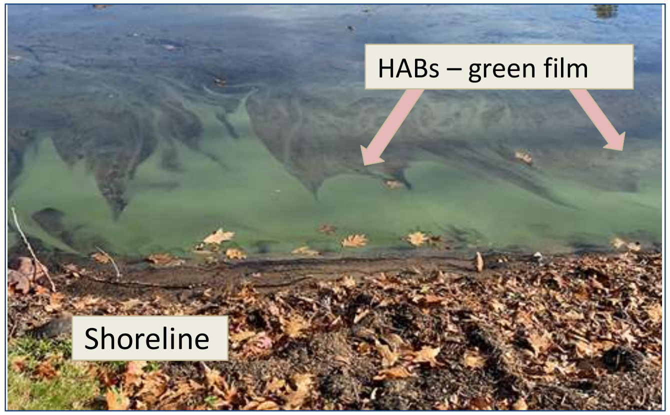

Figure 1 - Evidence of HABs at Harris Bay, Lake George

Technical Approach

Benchmark Marketplace
Circuitry & Fluorometer

Construct In-Lab Fluorometer
Experiments determine capabilities

Documentation
Calculations, Test Results, Operating Procedure

Model Deployable Device
Fluorometer meeting customer needs

Technical Progress

- Fluorometer: device used to detect (photodiode) emitted photons of light (fluorescence) by using an excitation source (LED)

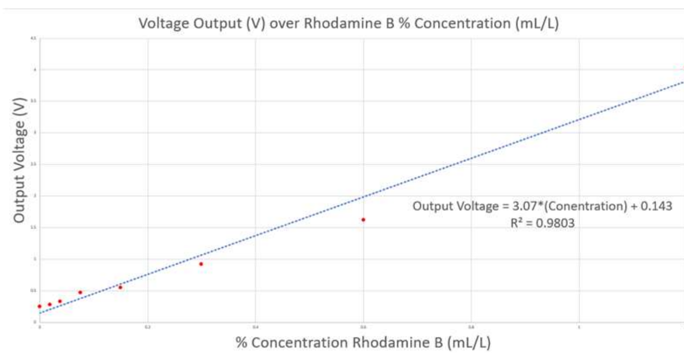

Figure 2 – Rhodamine B Concentration on Voltage Output (Blue LED)

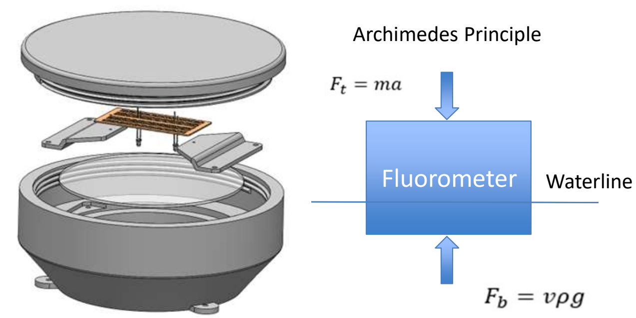

Figure 3 – Enclosure Design and Buoyancy Calculation

- Enclosure – single sided, LED and detector face down, shroud and recessed electronics limit ambient light, tethering points added
- To maintain required sensor depth, need 0.0166 m^3 or 0.58 ft^3 of expanded polystyrene material

Future Improvements

Further Circuit Development:
- Less sensitive to ambient light (measure during the day)
- Develop single sided timing sequence

Further Enclosure Development:
- Completely dark sampling area
- Bio-fouling prevention: mechanical brush and UV light
- Research buoyant materials

- Add tethering device to include power
- Waterproof interior and temperature sensor
- Measure intensity of LED each cycle

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