Team 7: Microalgae Photobioreactor Midterm I (Spring Presentation)

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Presentation Outline

- Background and Project Scope
- Microalgae Growth
- Airlift Photobioreactor Design
- Control Design
- Addition/Extraction Unit Design
- Budget and Flow Chart Schedule
- Conclusion and Questions

Background and Project Scope

Goal: Microalgae → Biofuel

The customer needs a way to transform an airlift photobioreactors' current "batch" growth systems into a "semi-continuous growth systems."

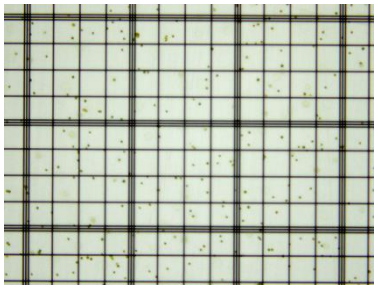
To accomplish this team 7 must:

- ✓ Find an affective and efficient way to grow microalgae
- ✓ Improve last semesters concentration and mass flow sensor
- ✓ Design an build a 35L Airlift Photobioreactor
- ✓ Design and develop fully automated addition/extraction units

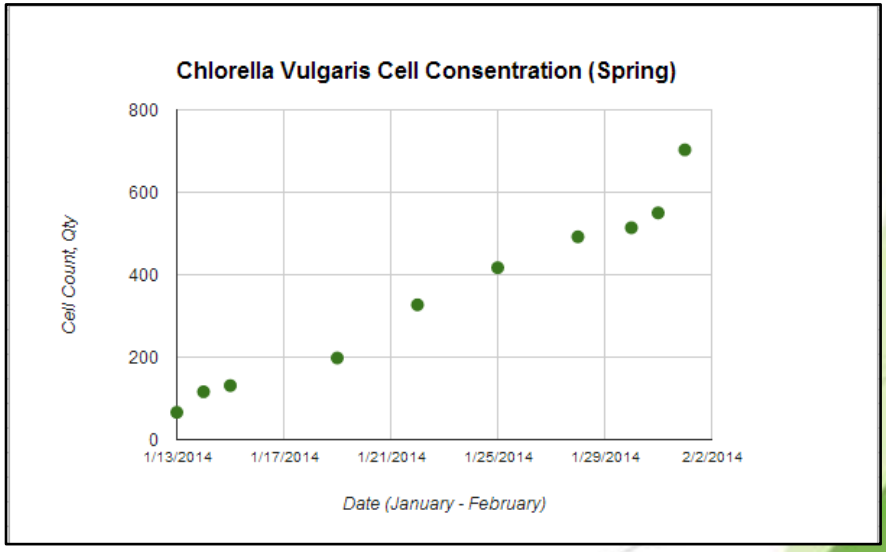
Algae Growth

- Currently have about 20 Liters of microalgae
- In the next couple of weeks we will subculture the algae to 50L
- Algae growth curves have been produced this semester to log the cell concentration

Cell Counting



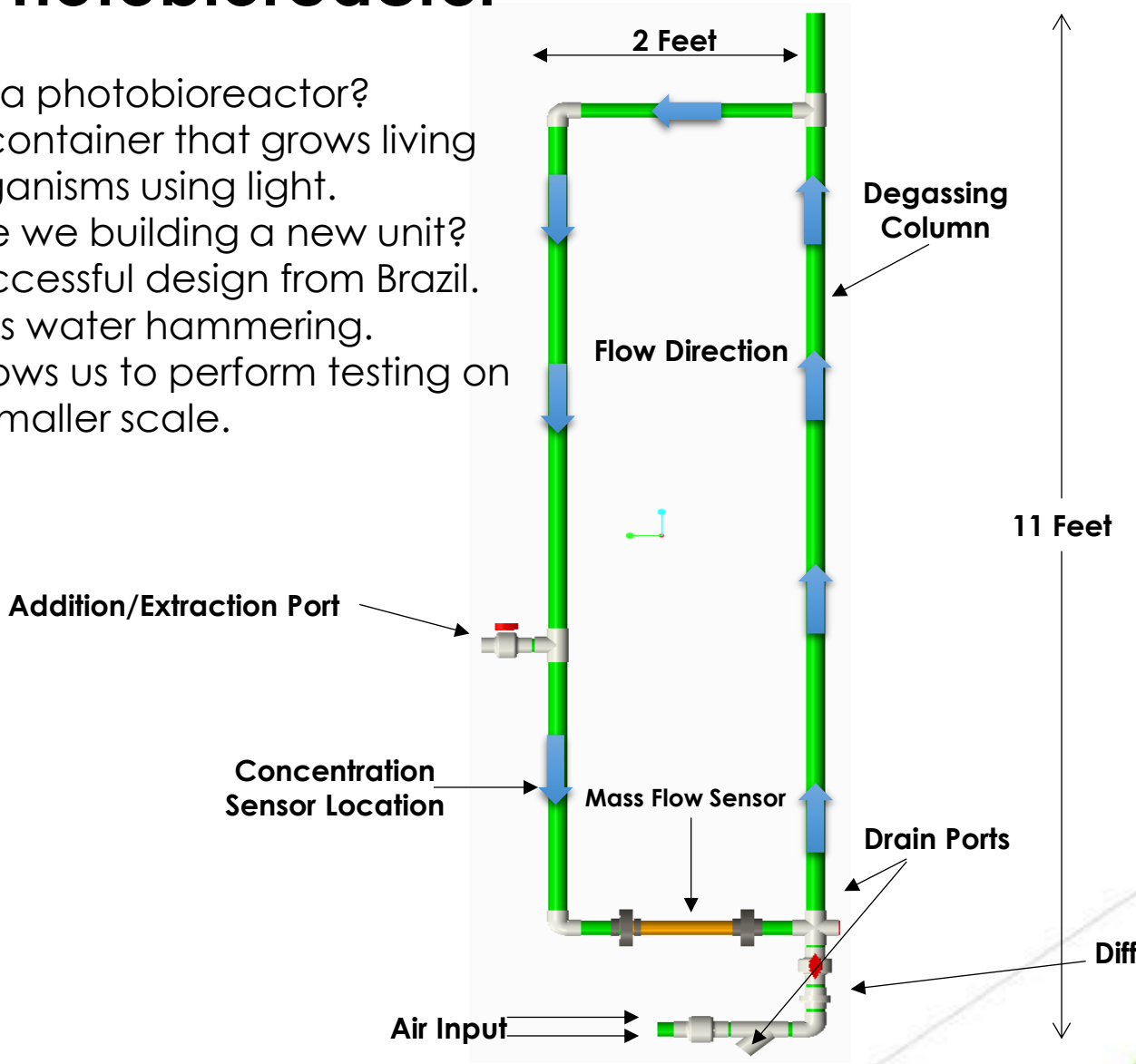
Current batches of microalgae being grown this semester.



Batch 4 cell growth chart.

Airlift Photobioreactor

- What is a photobioreactor?
  - A container that grows living organisms using light.
- Why are we building a new unit?
  - Successful design from Brazil.
  - Less water hammering.
  - Allows us to perform testing on a smaller scale.



Controls – Overview

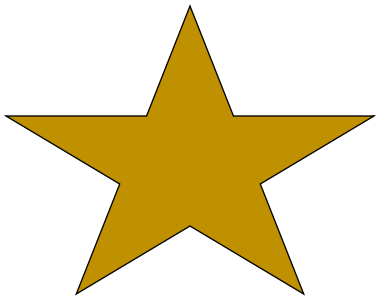
Batch operation: manual labor is reasonable

Semi-continuous operation: manual labor is not viable

Conclusion: Automated control systems needed

Concentration

Mass Flow



Addition/Extraction

Controls – Concentration Sensor

Current Design

Electrical Components:

- Light Emitting Diode (LED)
- Light Dependent Resistor (LDR)

Main Sections:

- Control
  - Full Light
- Test
  - Variable Light
- Wheatstone Bridge
  - Control & Test LDR's
  - Noise & Sensitivity

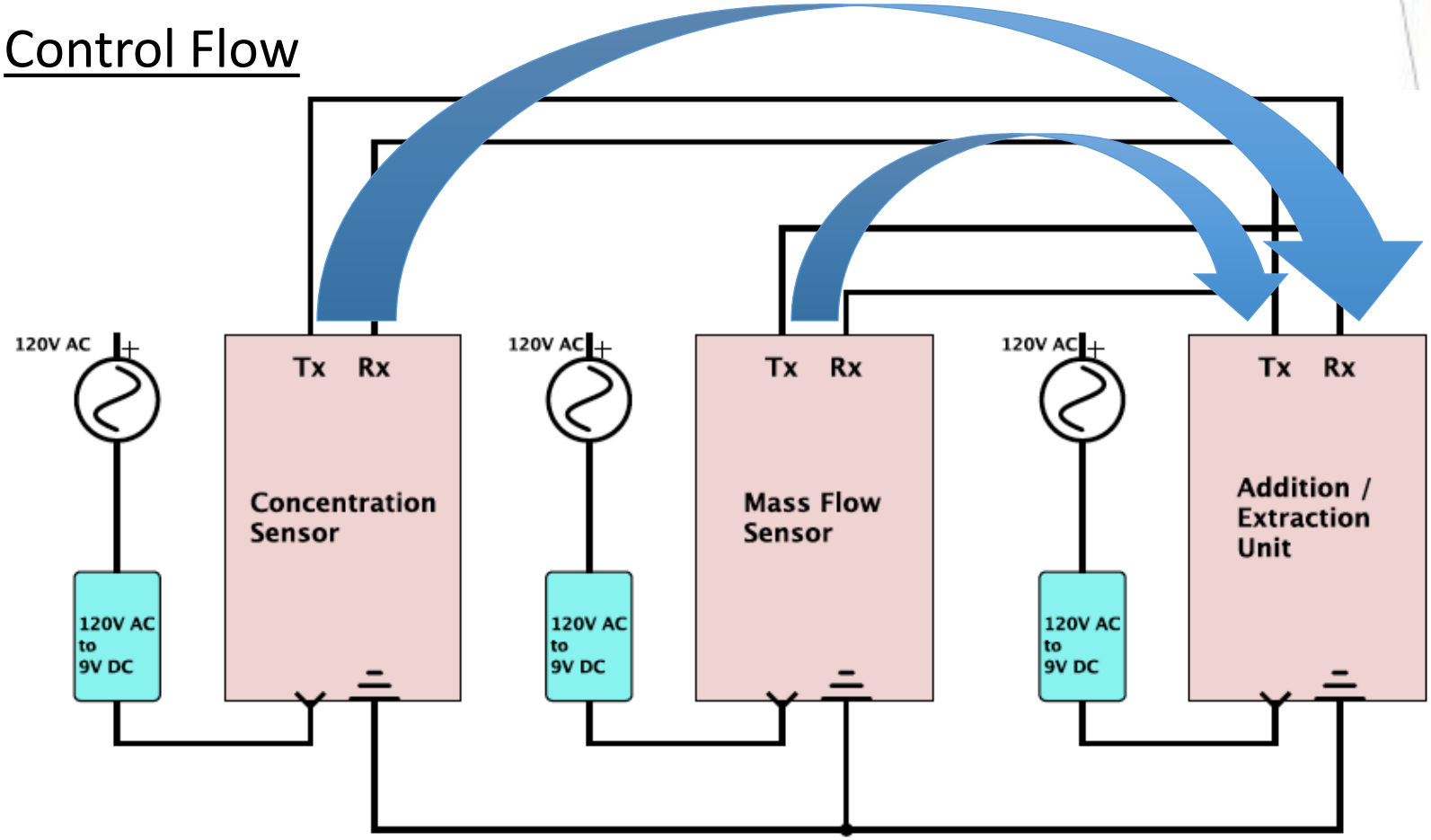
Controls – Concentration Sensor

Preliminary Tests – Food Dye

Number of Food Dye Drops	0	3	6
Light Sensor Reading (0-1023)	1023	950	915
	1023	600	200

Controls – Final Goal

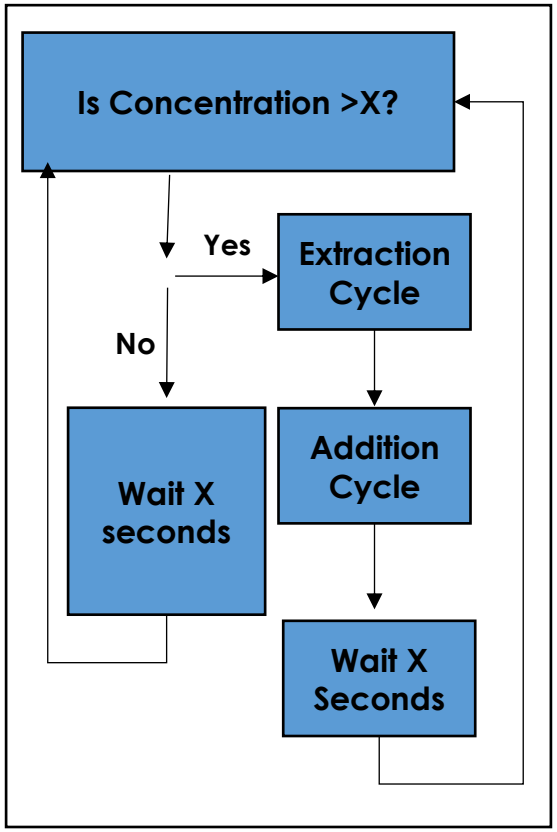
Control Flow

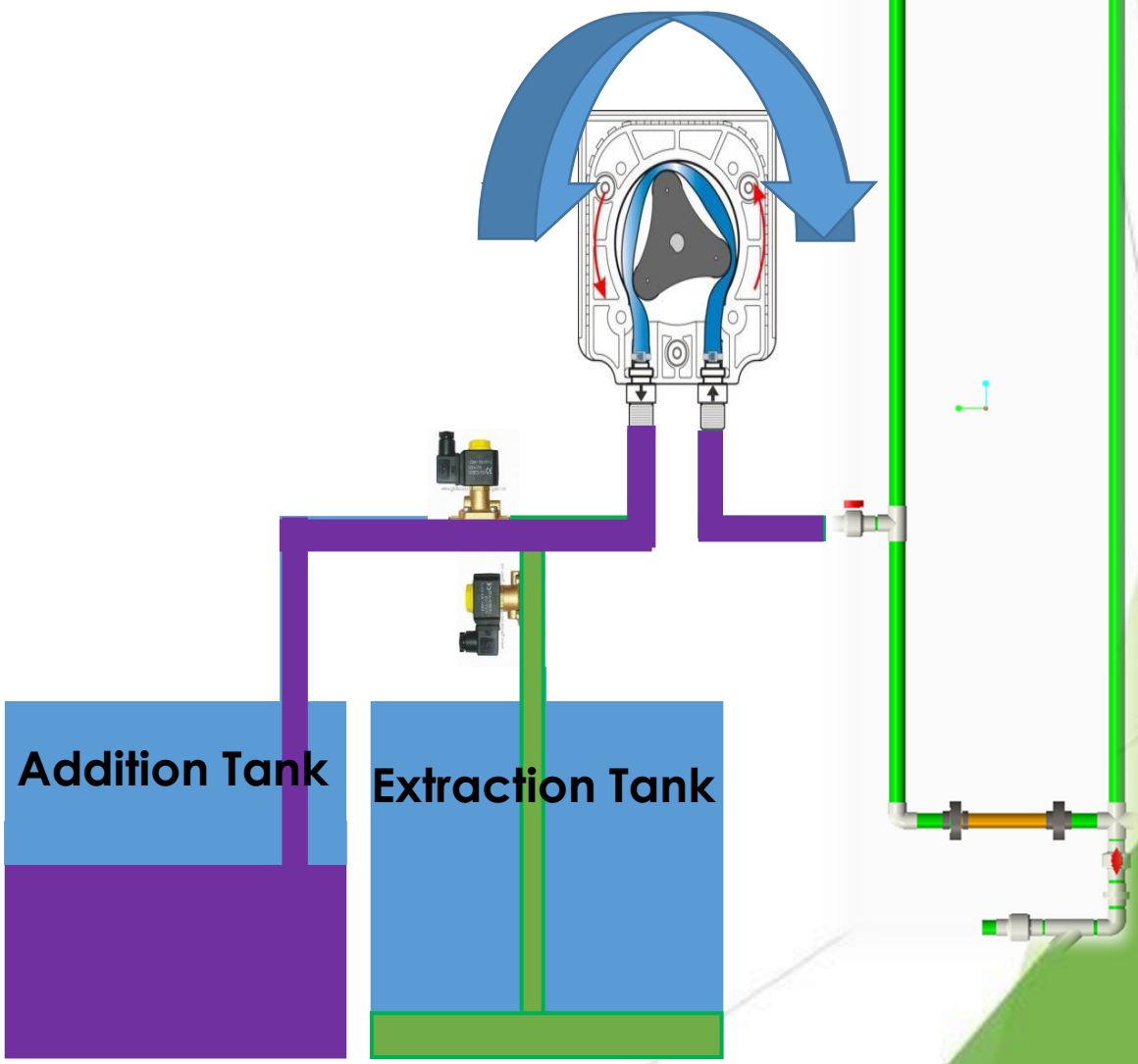


Addition and Extraction Design

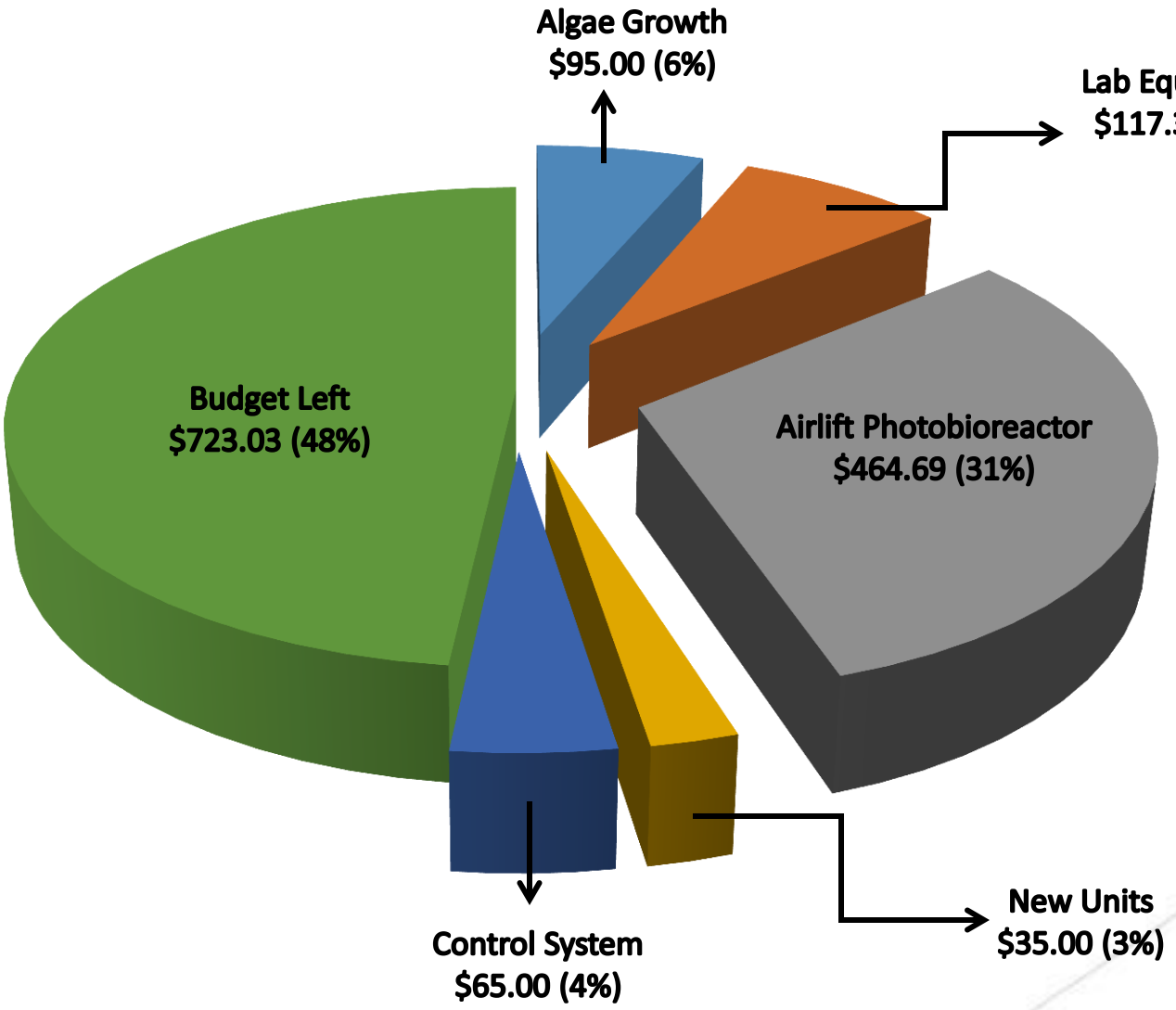
1- Extraction Cycle

2- Addition Cycle





Current Expenditures for Spring Semester



NOT COMPLETE

Flow Chart Schedule

WEEK 2 (Jan. 13-19)

- ✓ Create Pro-E CAD of new airlift photobioreactor
- ✓ Start counting cells to establish microalgae growth curve

WEEK 3 (Jan. 20-26)

- ✓ Complete bill of materials and procurement for airlift photobioreactor (not new units)
- ✓ Finalize CAD and order pipes and fittings for Airlift (not the new units)

WEEK 5 (Feb. 3-9)

- ✓ All Parts for airlift photobioreactor arrive at College of Engineering
- ✓ Perform Tests on Concentration Sensor
- ✓ Set up first meeting with chemical engineering students about counting algae

WEEK 6 (Feb. 10-16)

- ✓ Design I Presentation
- ✓ Assemble all parts and check water integrity of airlift (not including new sensors)
- ✓ Perform airlift flow test (not including new sensors)
- ✓ Create CAD with airlift and new addition/extraction units
- ✓ Order parts for addition and extraction units

WEEK 7 (Feb. 17-23)

- ✓ Start to assemble new addition and extraction units
- ✓ Perform water integrity tests with new units attached to photobioreactor

Thank You

Any Questions?

Control Sensors – Concentration Sensor

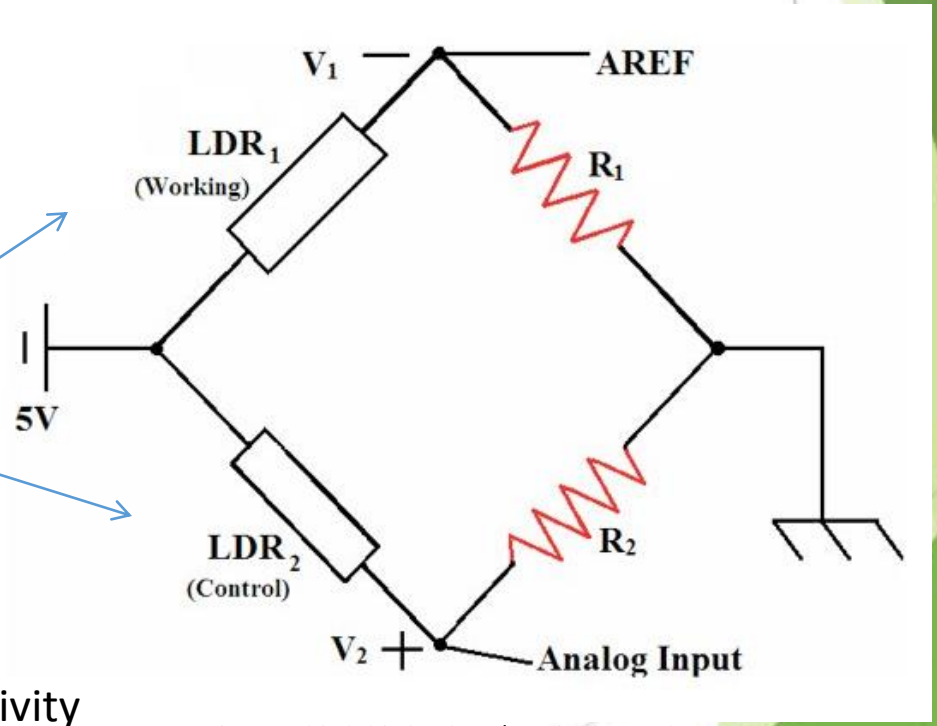
2012-2013

Wheatstone Bridge:

- Range of LDR Resistance Values
  - Full Light = 1kΩ
  - No Light = 100kΩ
- Working LDR (varies) → 1-100kΩ
- Control LDR (full light) → 1kΩ
- Aruduino Reading = V_aref – V_input

Main Advantages

- Noise Reduction and Increased Sensitivity



Source: 2012-2013 Microalgae Senior Design Team