Algae Window

Final Presentation - 4/19/21

Natasha von Seelen, Sophia Simms, Kyra Cooperman, Annika Allado, Vanessa Chen, Will Hess

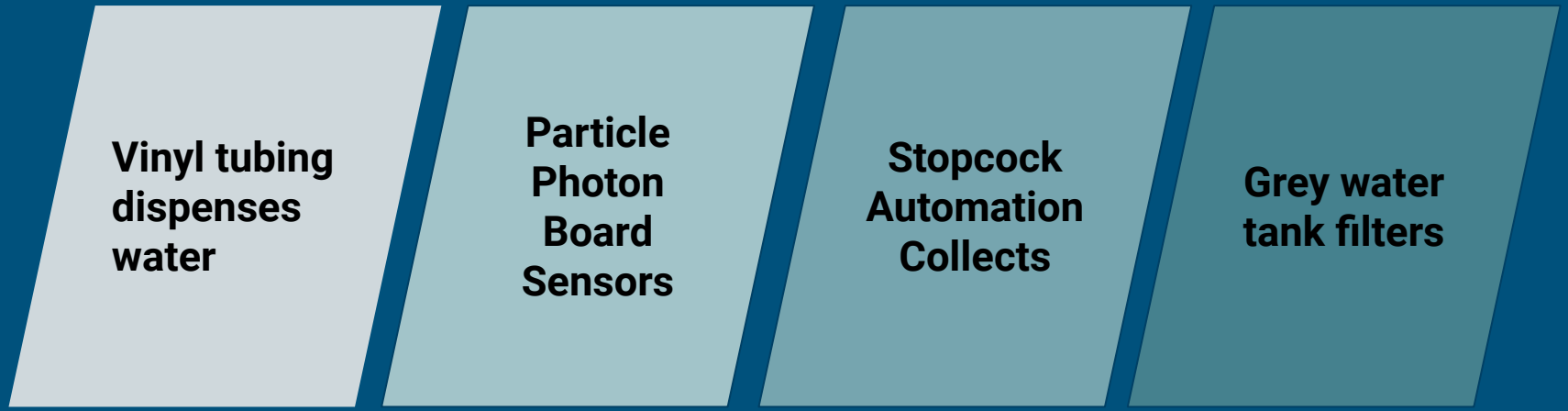
Motivation

Building Efficiency

Algae End Use Opportunities

Academic Curiosity

Technical Design - Final Design System



Technical Design - Growing Algae

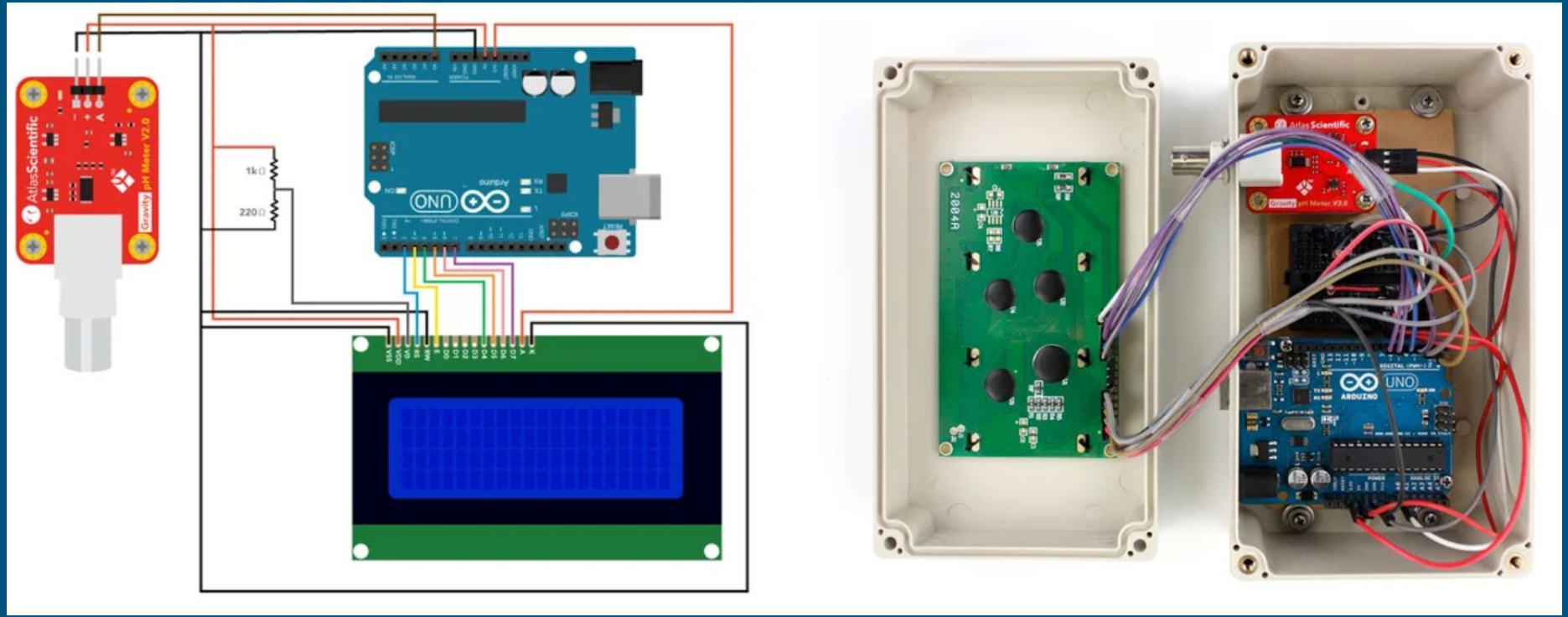
Technical Design - High Fidelity Prototype

Technical Design - Sensors (pH)

- Connect with Arduino
- Measure pH
- Constant monitoring (SMS / email)

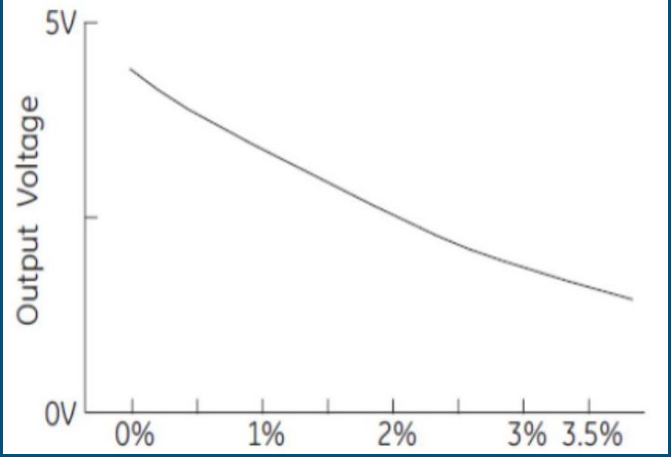

```
void loop() {
 if (input_string_complete == true) {                //check if data received
   inputstring.toCharArray(inputstring_array, 30);   //convert the string to a
char array
   parse_cmd(inputstring_array);                     //send data to pars_cmd
function
   input_string_complete = false;                    //reset the flag used to
tell if we have received a completed string from the PC
   inputstring = "";                                 //clear the string
 }
 Serial.println(pH.read_ph());                       //output pH reading to
serial monitor
 pH_lcd.setCursor(8, 2);                             //place cursor on screen
at column 9, row 3
 pH_lcd.print(pH.read_ph());                         //output pH to lcd
 delay(1000);
}
```

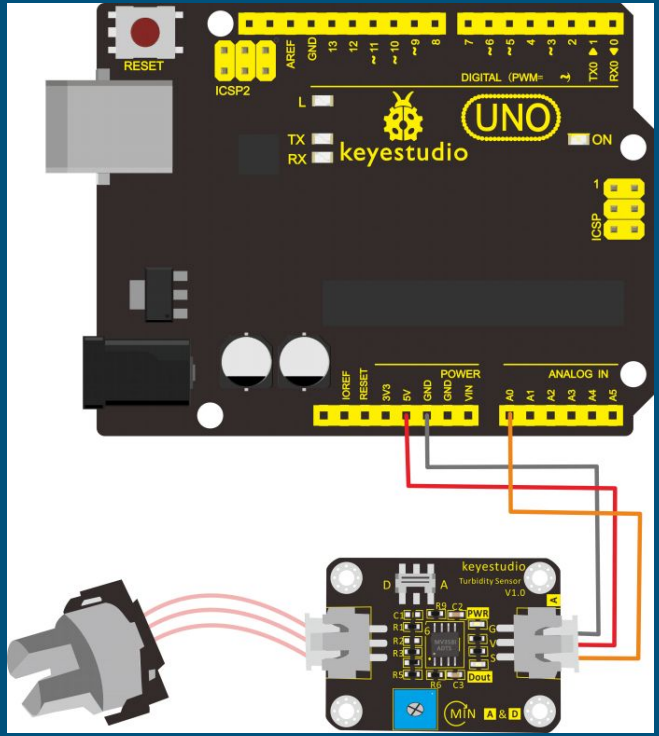
Technical Design - Electronic Wiring: pH



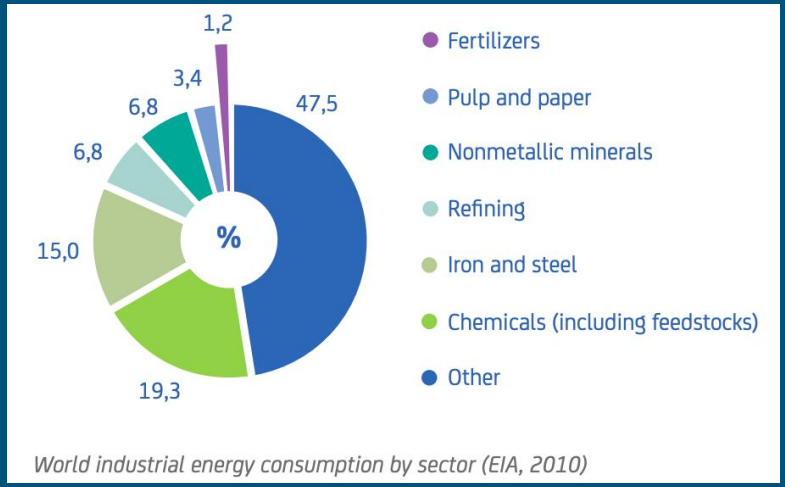
Technical Design - Sensors (turbidity)

- Used to identify erroneous changes
- NTU to Voltage: 3.5%=35000ppm
  - =35000mg/L=4550NTU





Benefit Analysis



World industrial energy consumption by sector (EIA, 2010)

Environmental	Social
energy savings	savings on heating / cooling costs
CO_2 absorption, O_2 release	Awareness of emissions from energy
use as fertilizer/biofuel/food	Environmentally conscious brand reinforcement for businesses

Target Market Analysis

EIA 2050 Projection: Office Buildings

- 34% expansion in commercial buildings
- Office buildings: 25% energy for AC

Locations

- Places with moderate temperatures and high number of sunny days
- Culture conducive to environmental innovation

Benefits

- Reduced energy costs
- Tax deduction of up to $1.80/sq foot (50% efficiency)
- Privacy
- Aesthetically pleasing

Testing Setup

Testing Results

Window Medium	Measured	Start	10 min	20 min	30 min
Algae Water	Window (C)	21.7	24.6	26.1	29.3
	Jar (C)	23.1*	22.2	22.2	22.2
Air	Window (C)	22.4	29.5	35	38
	Jar (C)	20.3	21	22	23

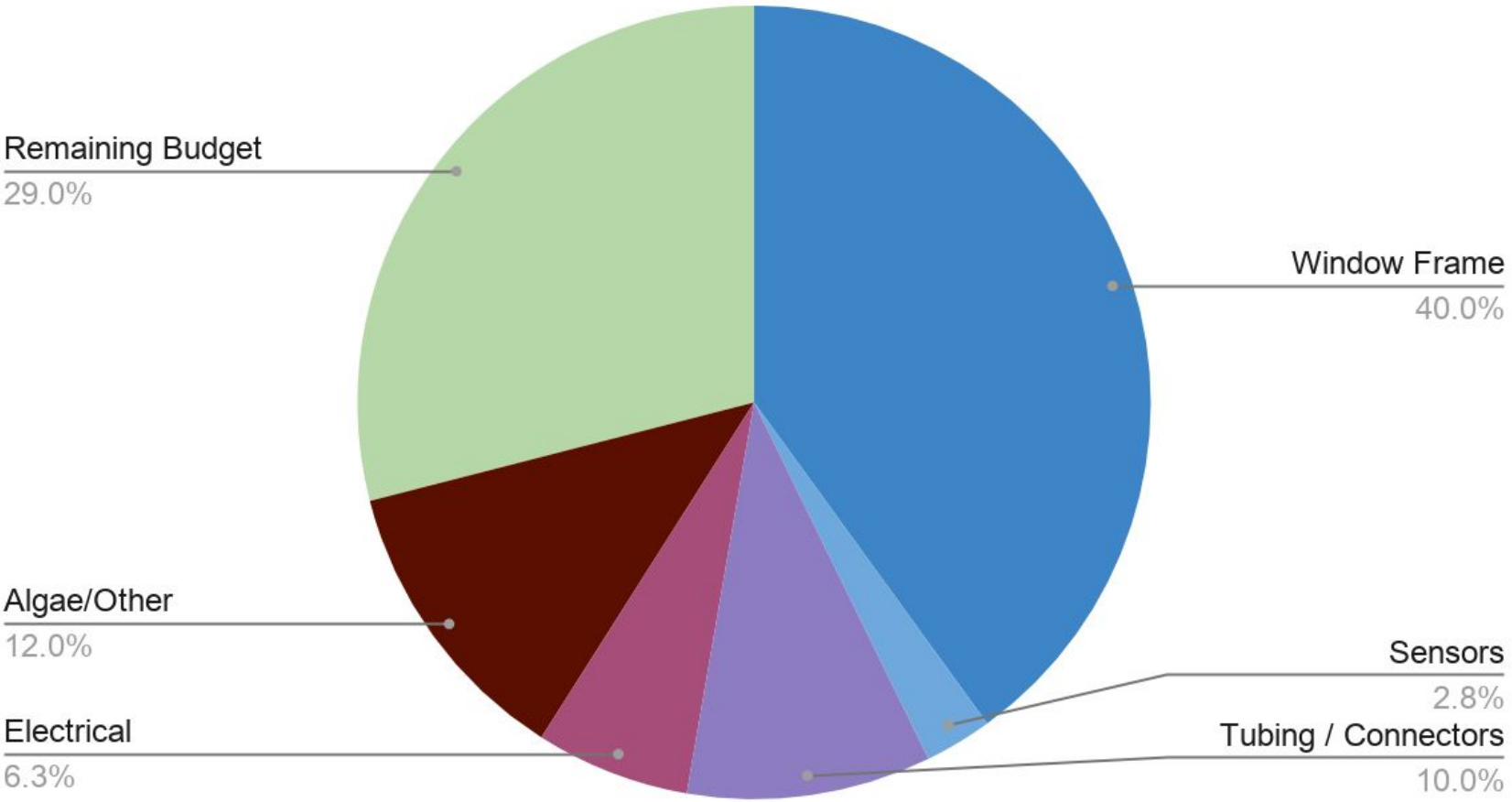
*Measurement was taken of a different jar of water that was filled at the same time because we forgot to take the starting measurement

Basic Business Plan

1. Primary Parts and Costs

Part	Description	Cost
Acrylic	.5” thick acrylic for algae windows	$480
Tubing / connectors	Sealant, PVC, hose fitting, etc.	$120
Sensor Systems	Automate process of algae filtration and ensure quality of algae nutrients are ideal	$33
Algae / other	Algae will grow within the windows to make the buildings more efficient	$144

Budget Breakdown



Conclusions

- More data and calculations needed
  - Quantity of algae produced
  - Calculate energy savings (fertilizer production, shading effect, etc.)
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Questions?