

INTRODUCTION

Due to climate change, it is becoming increasingly important to manage resources effectively. **Industrialization** has led to an increase in water pollution. **Lack of clean water** serves as a growing issue which targets the **survival of wildlife populations** [1]

In urban and residential areas, industrial pollutants that accumulate in runoff lead to concentrated amounts of **heavy metals in water**, which **negatively impacts ecosystems**. Small to medium-sized ponds in urban areas are generally filled **solely with this contaminated runoff and drainage water**. They generally lack a self-sustaining ecosystem to maintain the water quality [2]. These toxic pollutants can be absorbed by plants and animals through the various interactions between species and the water sources.

Existing filtration systems:

- Expensive
- Complicated installation
- Disruptive to wildlife



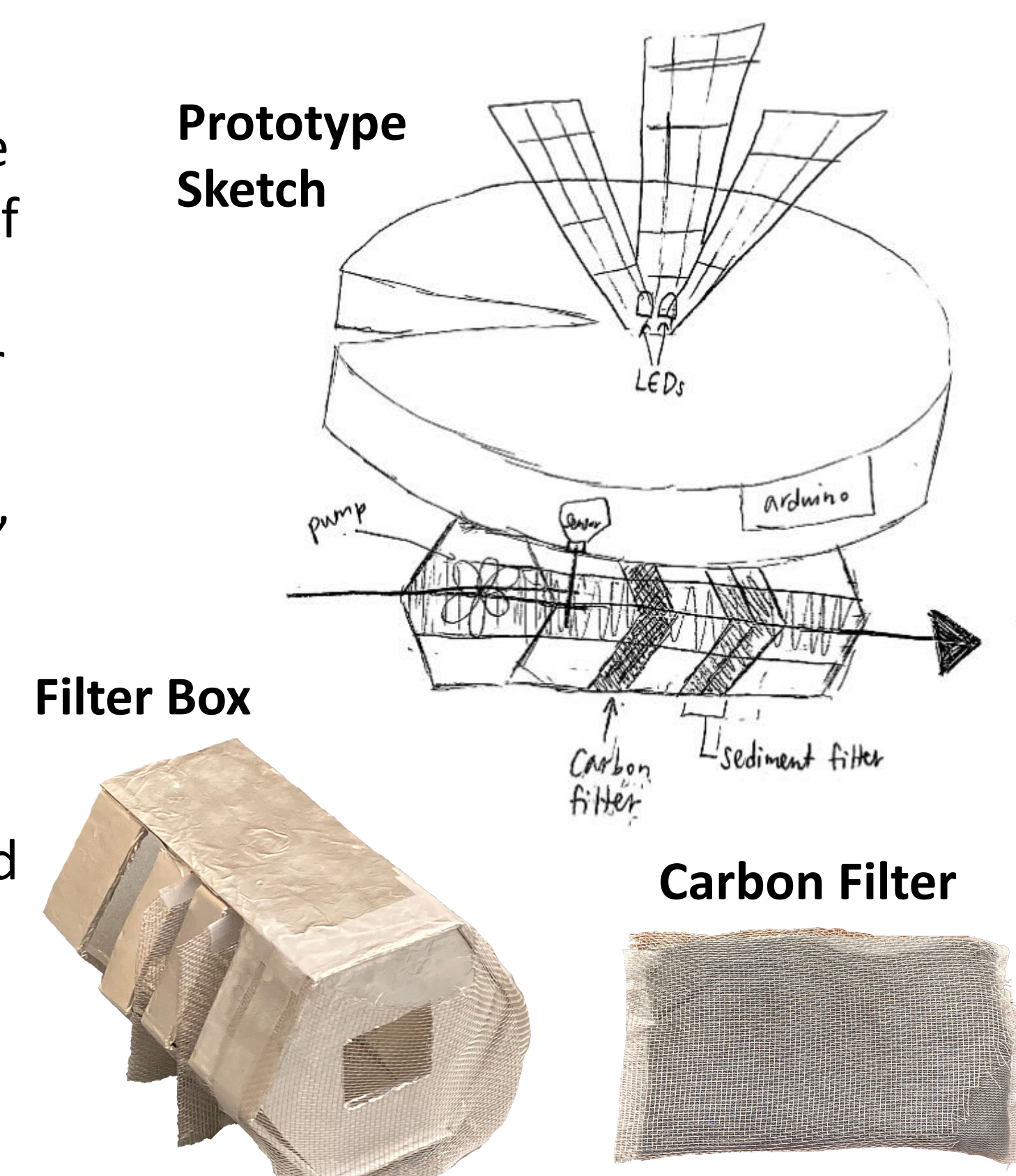
METHODS

Design Concept:

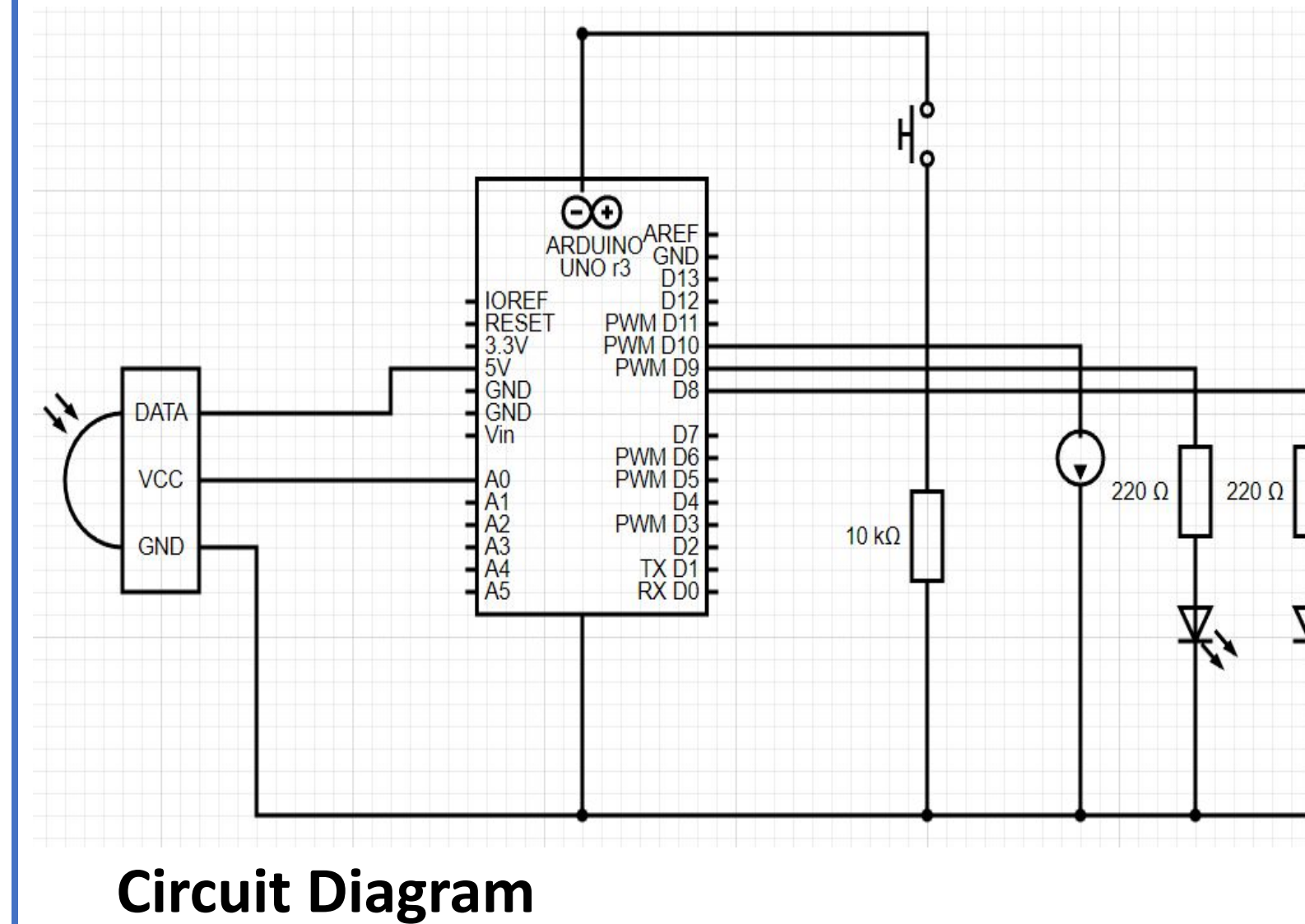
The water-filtration system pumps water through a series of **replaceable carbon and sediment filters to remove heavy metal pollutants**. When the sensor detects the specified amount of dissolved solids in water, the pump and red LED turn on. The lotus-like appearance lets the device blend into the natural environment. Aquatus is minimally disruptive and **safe for wildlife**, with a large lily pad shaped surface that serves as a **resting platform for animals**.

Features

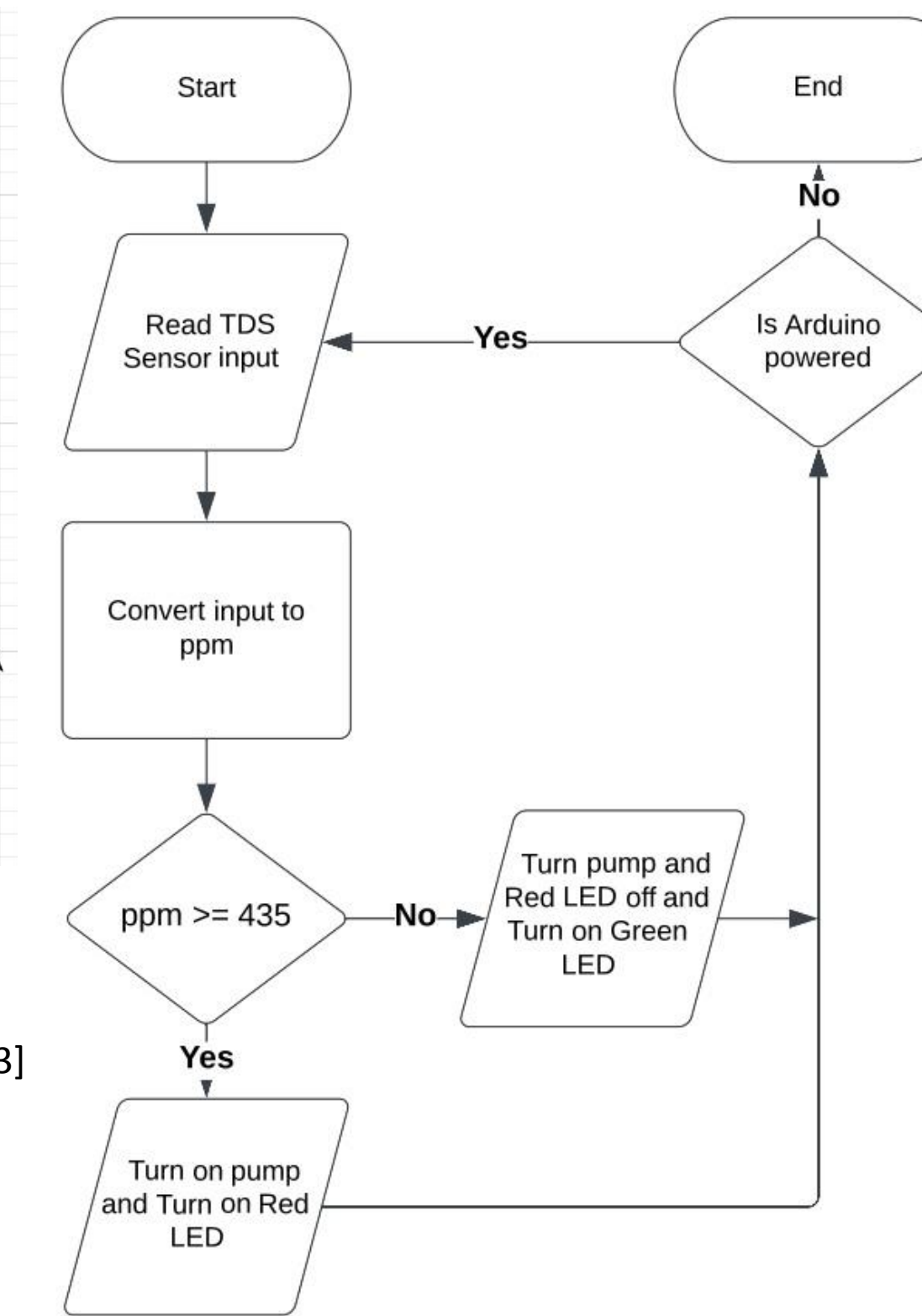
- **Pump:** circulates water into device
- **TDS Sensor:** detects the amount of total dissolved solids in water
- **Carbon and sediment filters:** filter pollutants
- **Solar panel:** Powers pump, sensor, and LEDs
- **LEDs:** Show the pump/water quality status
- **Arduino:** Contains the program, and controls the pump/LEDs based on the TDS Sensor.
- **Mesh Wire:** protect animals from being pulled into the device



RESULTS



Code Flowchart [3]



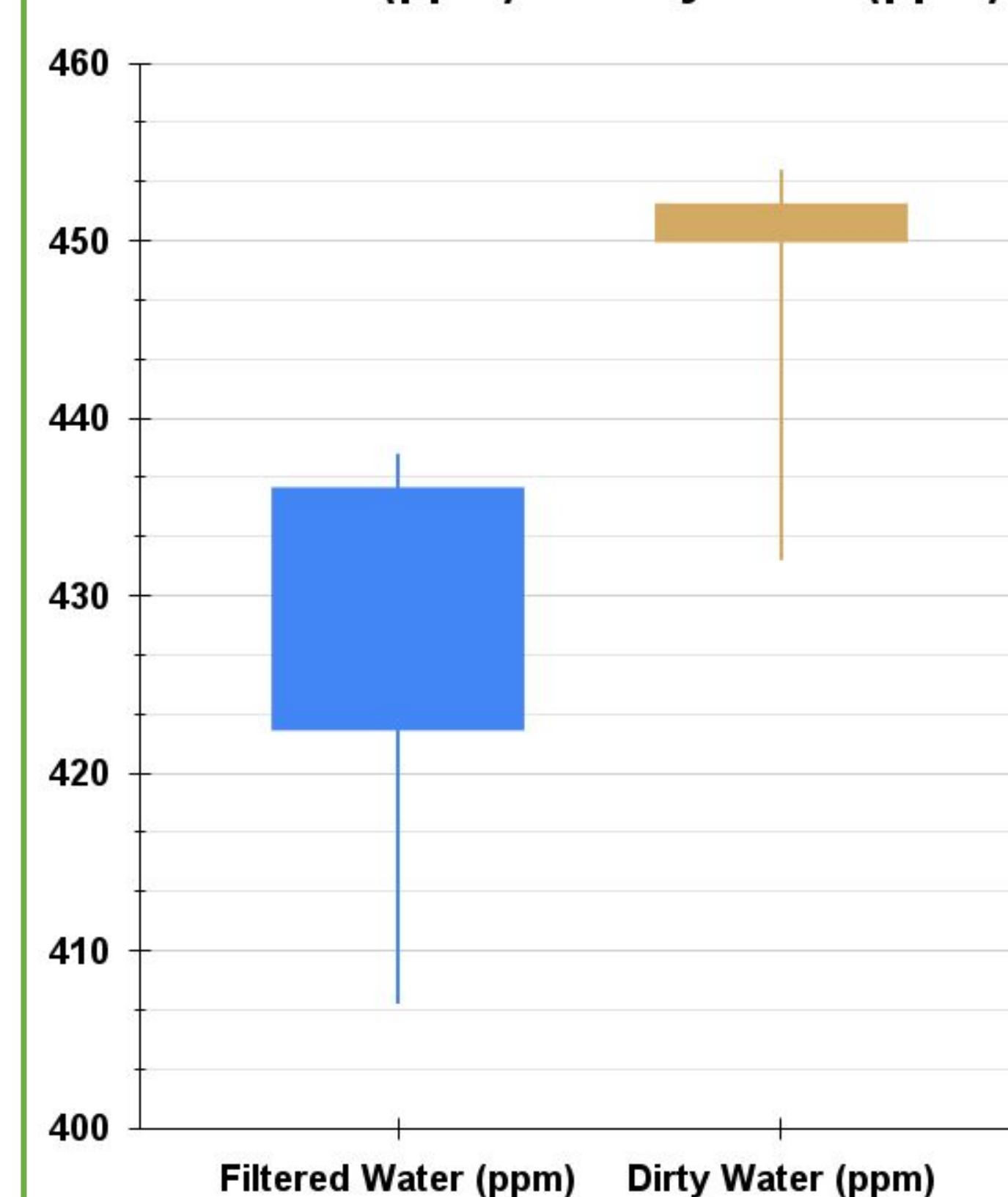
TDS Sensor Calibration



LED and Pump Tests

TDS:	Red LED:	Green LED:	Pump Status:
>=435 ppm	ON	OFF	ON
<435 ppm	OFF	ON	OFF

Filtered Water (ppm) vs Dirty Water (ppm)



Watertight Floatation Test (performed in shallow pool of water)

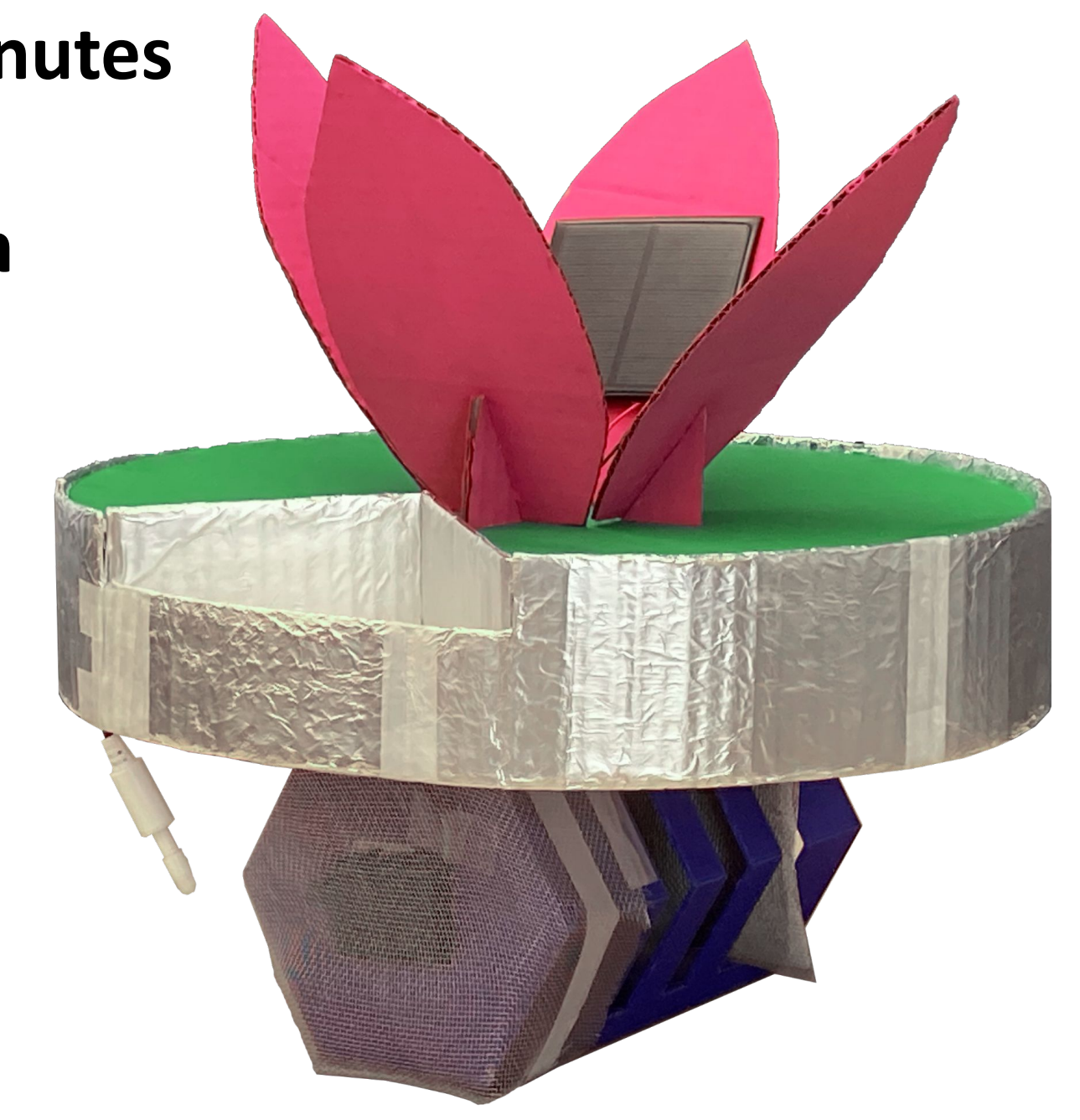
	Time in water (s)	Floating?	Water leakage inside?
Empty	20	YES	NO
	40	YES	NO
	60	YES	NO
With additional 480g ~ 1.06lb	20	YES	NO
	40	YES	NO
	60	YES	NO



The prototype and final versions of the **hexagonal filter box** were **waterproof and retained structural integrity** when submerged in water for **1, 2, and 3 minutes**

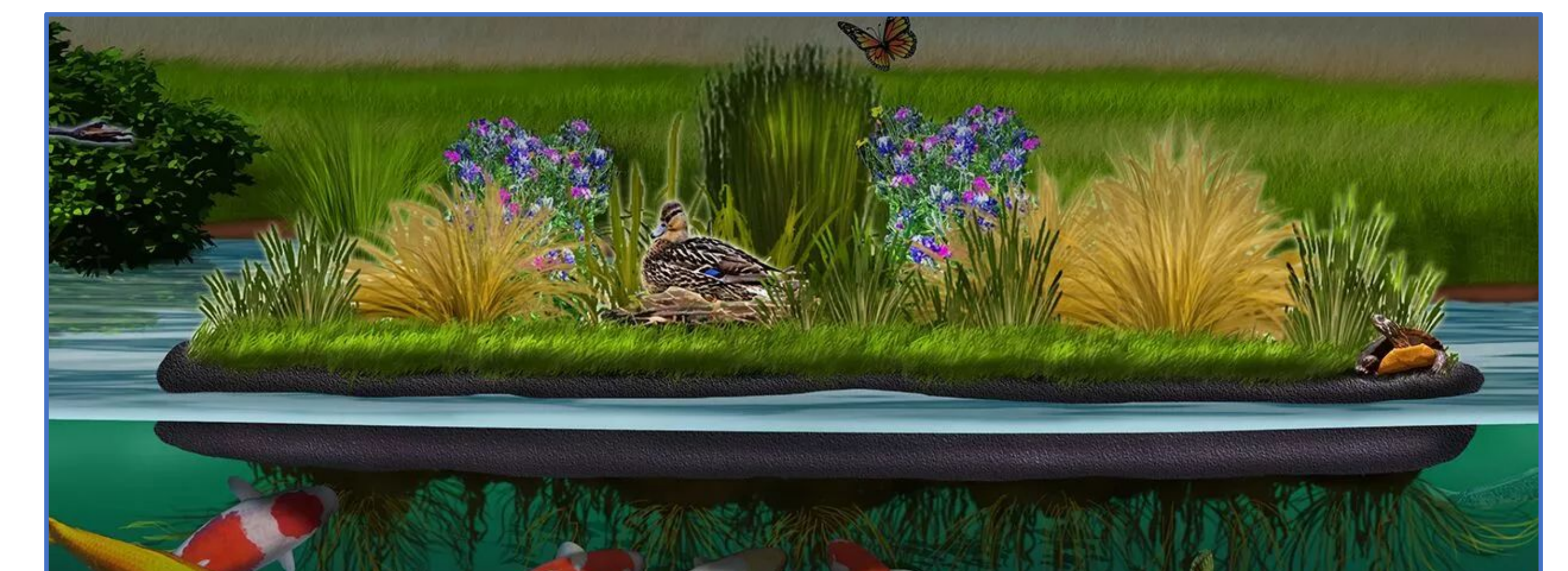
DISCUSSION OF RESULTS

- Calibration of the TDS sensor showed a measurable difference in TDS levels between filtered tap water and dirty water, so the sensor threshold for the pump was set at **435 ppm**
- **LEDs successfully turned on and off** when tests were run at this threshold
- Hexagonal filter box is sturdy and **waterproof** after being submerged in water for up to **3 minutes**
 - **Will be able to withstand being submerged in a pond and retain functionality**
- Lily pad base floats with **no water leakage** with an additional **1 pound** of weight
 - **Will be able to float and function in a pond**
 - **Will be able to support weight of small animals**



FUTURE WORK

- Improved and sustainable materials
- Implementing different surface types on the device to mimic various environments and appeal to various wildlife; native plants
- Improving protection of solar panels by creating a raised platform
- improved location and visibility of LEDs
- Additional sensors for water quality



REFERENCES

- [1] World Wildlife Fund. (2021, Jul. 01). Plastic in our oceans is killing marine mammals [Online]. Available: <https://www.wwf.org.au/news/blogs/plastic-in-our-oceans-is-killing-marine-mammals>
- [2] C. L. Riley and C. A. Nezat. (2020, June) "Controls on major ion chemistry and metals in a suburban pond fed by municipal water and treated stormwater." *Applied Geochemistry* [Online], vol. 117. Available: <https://www.sciencedirect.com/science/article/pii/S0883292720300597>
- [3] Admin. (2022, Aug. 21). TDS Sensor & Arduino Interfacing for Water Quality Monitoring [Online]. Available: <https://how2electronics.com/tds-sensor-arduino-interfacing-water-quality-monitoring>

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