

Abstract

A problem we found is the amount of PFAS (Perfluoroalkyl and polyfluoroalkyl substances) in water. PFAS is a man made forever chemical. When PFAS contaminated water, it can enter our food. At least 45% of the world's tap water contains at least one type of PFAS chemical. PFAS can cause health issues when you are exposed to them for too long, such as cancer, asthma, and liver damage. This is problematic because some parts of the world don't have access to good healthcare to help with these health issues. Our hypothesis is that with a few changes to our ROV, we will be able to detect PFAS in the water.

Background & Motivation

We were motivated to look into detecting PFAS because, in one of our Spanish classes, we were discussing how to send filters to impoverished countries, and we were able to send some. The only problem was that they could only filter out dirt and sand, not any chemicals in the water. The best way to solve this problem is to send an ROV with a sensor to detect if there is PFAS in the water. If PFAS is detected, we can start the cleanup process.

Acknowledgments

<https://www.epa.gov/pfas/pfas-explained>
<https://www.va.gov/exposures/pfas.asp#:~:text=According%20to%20the%20Agency%20for,Changes%20in%20the%20immune%20system>
<https://news.mit.edu/2024/new-sensor-detects-harmful-forever-chemicals-drinking-water-0311>
<https://www.nature.com/articles/s41545-023-00274-6>
<https://rshydro.ie/news/impact-of-pfas-on-our-environment-and-health>
<https://mediahub.unl.edu/media/22981>
<https://market.us/report/polyfluoroalkyl-substances-pfas-waste-management-market/>
<https://www.mlive.com/environment/2024/09/weve-never-seen-this-before-high-pfas-level-found-in-muskegon-lake-foam.html>
<https://canva.com> (Help with Background Image)
<https://grist.org/health/the-epas-proposed-pfas-regulations-ignore-a-major-source-of-drinking-water-contamination/>
<https://viriniamercury.com/2024/01/09/pfas-clean-up-could-cost-virginia-public-water-systems-millions-for-years-to-come/>

Methodology

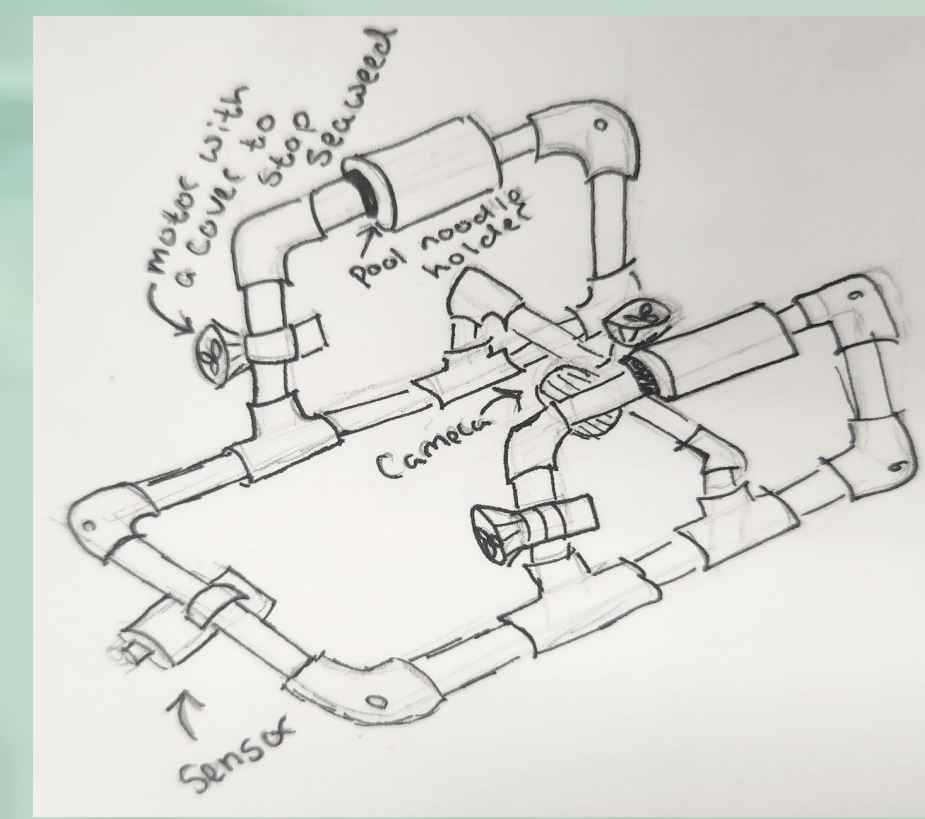
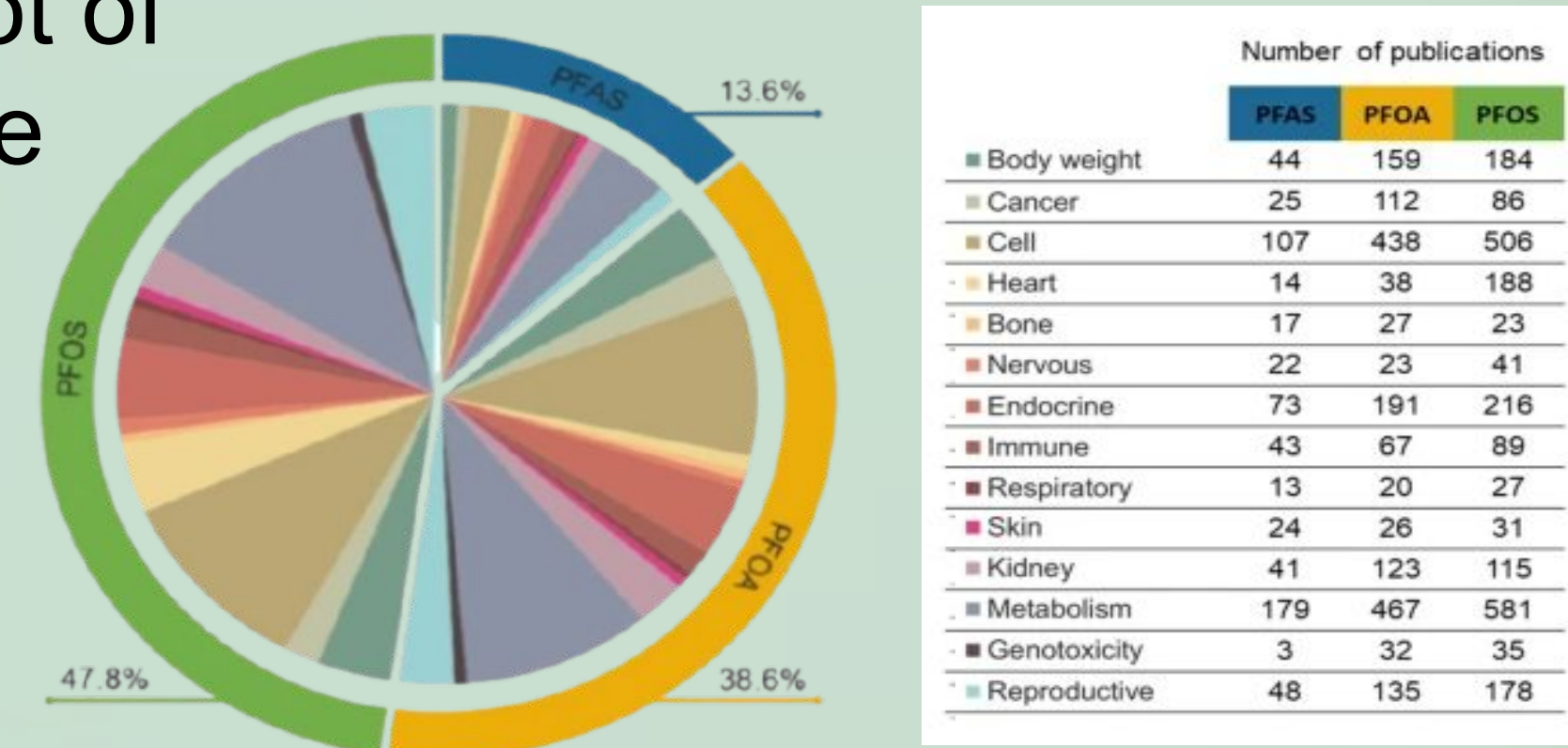
We approached this idea with a lot of questions to better understand the problem.

1. What are the negative effects of PFAS in water?
2. Is there a way to detect it in the water?

Next, we conducted research to answer these questions. We learned:

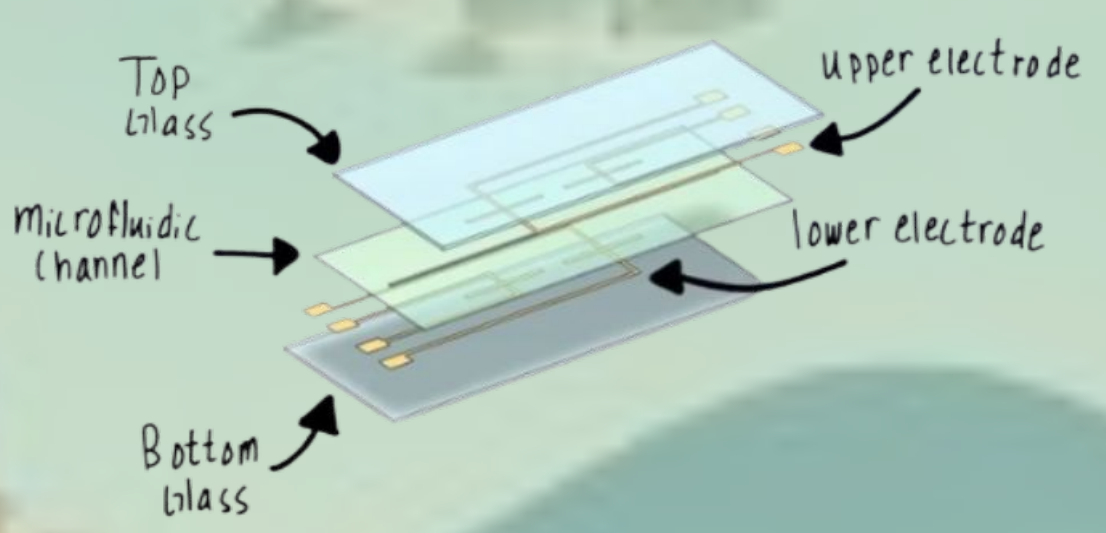
1. It affects our health and can lead to cancer and liver damage
2. MIT has a sensor that can detect PFAS in water.

Then, we imagined and planned how it would look and the materials we would need to get there. We took our ROV design from this year and added a camera and the PFAS sensor. Additionally, we included a special motor holder with a cover around the propeller to prevent seaweed and other debris from tangling in the motor.

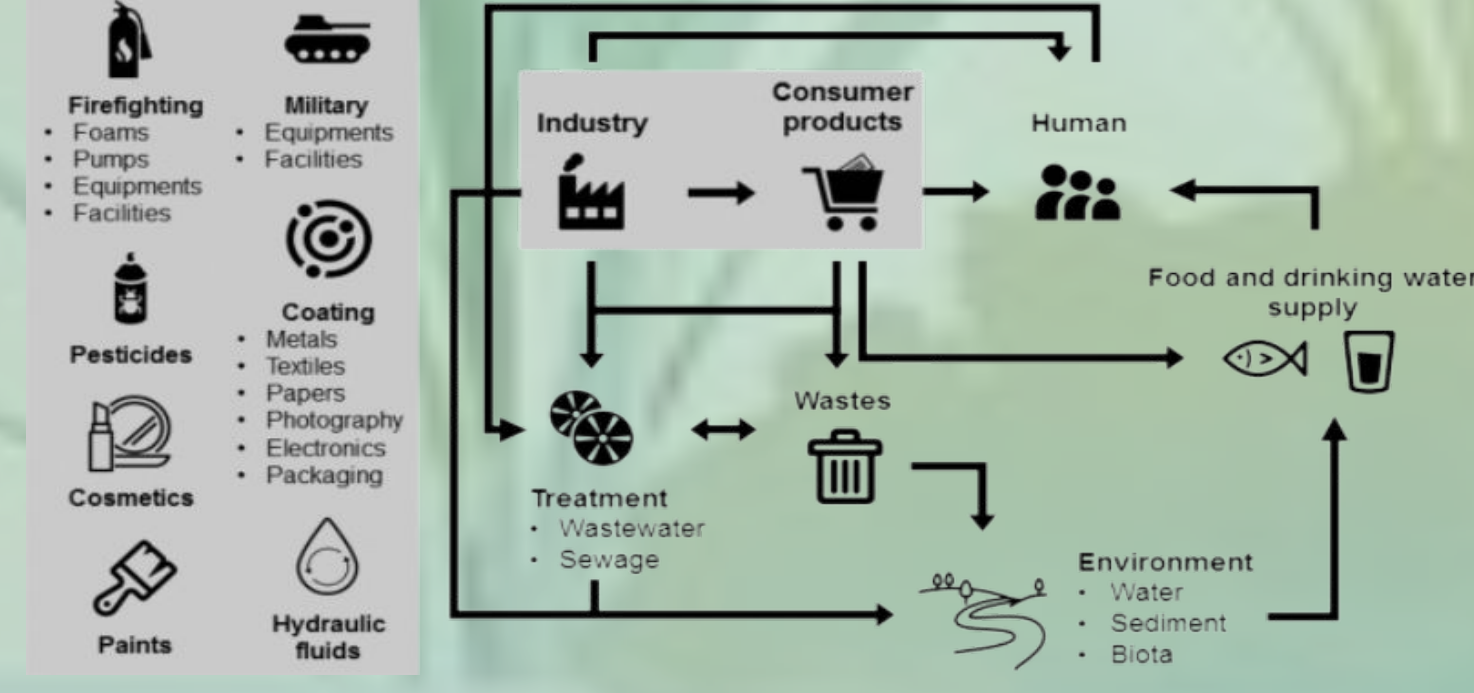


Results & Discussion

After researching PFAS and sensors, we discovered that PFAS is used in many common everyday items such as cleaning supplies, waterproof makeup, and some cookware. This means people are unknowingly using items containing PFAS, despite the associated health risks. This revelation made us even more determined to find a solution. MIT has developed a sensor capable of detecting tiny amounts of PFAS in water, marking an important step in addressing this issue.



The sensor works by using positive and negative electrodes, which allow you to track the flow of electrons. When PFAS is present in the water, the electrons will slow down. Additionally, our research revealed that PFAS contamination is a significant problem in Michigan. Muskegon Lake has been found to have high levels of PFAS, something we were previously unaware of. This is particularly concerning because Muskegon Lake is a popular beach during the summer months.



Next Step

Our goal is to create an ROV that can detect PFAS in the water before it can make it into our drinking water. The best way to do that is to get a PFAS sensor and attach to the ROV so you can test for PFAS in areas you can't reach.

Conclusion

The next step of our project is to find a sensor to put on our ROV and test its performance and accuracy by comparing it to a PFAS test for drinking water. Then, we will create a prototype with a camera and sensor. Once the prototype is working, we will test it and make any necessary changes. The final step will be to create a stronger, more durable ROV using better materials.