Fish Tank Monitor Design Impact Assessment

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# Introduction

The Design Impact document, authored by Group 25, aims to provide a comprehensive overview of the public health, safety, and welfare impacts, cultural and social impacts, environmental impacts, and general economic factors related to the Fish Tank Monitor. This document assists users and designers in understanding the potential impacts of the proposed design. Additionally, the document includes an analysis of past, current, and future factors influencing the marketability of a Fish Tank Monitor.

# Public Health, Safety, and Welfare Impacts

One major safety concern of the project is ensuring there is no chance of electrifying the water. This poses a significant danger to the fish, as even a small electric current is more than enough to kill small fish in a confined space [11]. This also poses a danger to the user who may inadvertently shock themselves after witnessing harm to the fish. With this in mind, multiple water-blocking mechanisms will be implemented to prevent water electrification. The circuit boards will be coated with sealant, and the AC to DC power transition will occur outside the system. Power into the system will be limited to twelve volts at low amperage to mitigate the risk.

Another potential negative impact of our design is the danger of exposing toxic chemicals to the fish, which may leak from some of the coatings or materials used in the system [12]. This risk will be mitigated by using food-grade plastic in manufacturing all exterior parts. Food-grade plastics will not leach into the water during the device's lifespan. Additionally, all other external parts will be verified to be non-toxic to the fish.

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# Cultural and Social Impacts

Throughout human history, fishing and fishkeeping have played crucial roles in the welfare and nutrition of societies. While farming fish and fishing continue to be jobs and hobbies, the domestication of fish has gained popularity. For example, the eastern domestication and selective breeding of carp have led to the creation of new species like Koi fish, which have coexisted with humans for nearly 2000 years [9].

In modern western culture, having a pet provides children with a sense of responsibility and independence. It teaches them the importance of life, and fish can be an ideal first pet for a young child. Our product will enable parents to monitor their child's care of the fish without intervening in the learning process. Research has shown various benefits of keeping pets, such as reduced blood pressure, improved mood, and increased pain tolerance [10]. These benefits can extend to society as a whole, fostering a more relaxed environment and educating people about how ecosystems operate.

Additionally, keeping fish in an educational setting can expose future generations to the awe and natural beauty of life. This initial interest could spark curiosity that lasts throughout their lives.

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# Environmental Impacts

Because the Fish Tank Monitoring System must collect samples from the water, its interaction with aquatic species is inevitable. It is vital to consider the health of all aquarium species to maintain the environmental balance. Many varieties of plastic are not aquarium-safe, as they are known for leaching chemicals into water [8]. High-density polyethylene (HDPE) is suitable for underwater environments because it is nontoxic, non-contaminating, recyclable, and resistant to high and low temperatures [1].

Should any plastic leach chemicals into the water, there is the possibility of life-threatening harm to all living organisms within the tank. Studies have shown that plastics in natural environments can lead to increased liver and cell damage, as well as disruptions in the reproductive system [5]. In a smaller environment, such as a fish tank, the concentration of any chemical leaching may be higher, resulting in more significant risks to aquatic species [4].

The possibility of electronic components being exposed to the water within an aquarium leads to the risk of chemicals and metals leaching into the water [7]. This leaching can cause various water parameters to spike, such as pH, which can quickly become deadly for aquatic organisms [6].

To avoid causing environmental harm, it is essential to design the Fish Tank Monitoring System with these potential impacts in mind. Specifically, the external housing must be made from a material that is safe and will not leach harmful chemicals into the water. It must also be completely sealed with an aquarium-safe sealant to prevent electronic components from leaching chemicals or metals into the water. With these safeguards in place, the environmental impacts would be significantly reduced.

# Economic Factors

In 2022, the global ornamental fish market size was valued at 5.88 billion USD [2], and it is expected to grow annually by 8.5% until 2030 [2]. Over 15 million adults in the United States live in households with fish, and these households tend to have children under 18 and reside in urban dwellings such as apartments and condos [3]. Given this, it is crucial that the Fish Tank Monitor is accessible to all fish owners, regardless of income level and age. To ensure this, the product must be produced at a low cost and manufactured safely.

While the system must be accessible in the market, it must also simplify fish tank care. The use of a tank monitoring system that tests water parameters without human intervention allows aquarium hobbyists to save money on their aquariums by better observing their tank's health and more effectively responding to water quality changes. Testing water quality often enables tank owners to better care for their fish and avoid dangers to the organisms in the tank. Water quality issues can be observed quickly without relying on someone to complete a manual test, a process that can be confusing and difficult to complete accurately. The monitoring system's logging functionality allows the hobbyist to see trends over time, enabling more effective problem treatment.

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# Conclusion

In summary, Group 25's Design Impact document outlines key considerations for the Fish Tank Monitoring System. Addressing safety concerns, they've proposed safeguards against electrical risks and toxic chemical exposure. The system's cultural and social impacts highlight benefits for children, promoting responsibility and contributing to well-being.

Environmental concerns center around the choice of materials and measures to prevent leaching, demonstrating a commitment to the well-being of aquatic species. The economic perspective recognizes the growing ornamental fish market, emphasizing the need for an affordable and functional monitoring system.

In essence, the Fish Tank Monitoring System aims to be more than just a tech solution. It strives to balance safety, societal dynamics, environmental responsibility, and economic viability, offering a comprehensive approach to enhance the world of fishkeeping.

# Revision Table

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| **Date** | **Action Taken** |
| --- | --- |
| 11/9/2023 | Savannah: Initial Document Creation |
| 11/9/2023 | Savannah: Economic Factors, Environmental Impact write-ups |
| 11/9/2023 7:28pm | Draft of Cultural and social impacts, and introduction completed |
| 11/9/2023 8:14pm | Draft of, Public health, safety, and welfare impacts and conclusion completed |
| 11/9/2023 8:40pm | Fixed small grammar errors and titling issues |

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