

Smart Fish Tank

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Problem Statement:

Poor water quality is the most common killer of fish.

Problem Justification:

- > Small tropical fish are more susceptible to diseases from a poorly maintained tank
- > Making an automated system benefits both the fish and the care-taker
- > Automation increases the efficiency of tank maintenance, less water changes, less stress on the fish, less chemicals.

Research Articles:

1.

- **Title:** Toxicology of aquarium fish
- **Citation:** Roberts, Helen, and Brian S. Palmeiro. "Toxicology of aquarium fish." *Veterinary Clinics of North America: Exotic Animal Practice* 11.2 (2008): 359-374.
- **Abstract:** Most aquarium fish live in a closed system, so the effects of toxins can be cumulative and devastating. Most cases of toxicity are due to deficiencies in husbandry and tank maintenance. Poor water quality kills more fish than infectious agents, making client education a very important preventive tool for aquatic practitioners. This article includes a discussion of toxicities related to water quality, chemotherapeutics, pesticides, and household substances.
- **Relevance:** It is important that fish are placed in clean shelter areas so that they are not exposed to diseases and so that they don't die.

2.

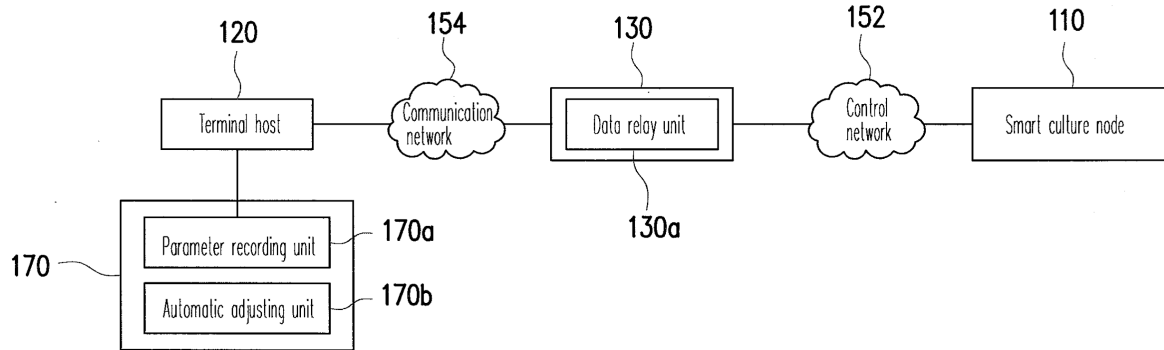
- **Title:** Environmental Toxicology: Considerations for Exotic Pets
- **Citation:** Murphy, Lisa A. "Environmental toxicology: considerations for exotic pets." *Journal of Exotic Pet Medicine* 24.4 (2015): 390-397.
- **Abstract:** Wherever companion exotic animals are housed, they may be exposed to potential toxins either inside or outside their primary enclosures. The relatively small body size of many exotic pets may increase their susceptibility to toxicants that they may encounter. Contaminants that are either absorbed by or deposited on the surfaces of plant and animal-based food items or present in water may be subsequently ingested and absorbed, which often adversely affects the animal's health.
- **Relevance:** Many people are busy and don't have time to clean the fish tank, which is why it is important to develop a smart fish tank in order to clean the water constantly and to keep the fish in a healthy environment to live in.

Similar Patents:

Patent 1:

- **Title:** System and method for monitoring and controlling the quality of culture water and integrated water quality analyzer thereof
- **Patent Number:** US20100099193A1
- **Inventor:** Kun-Cheng Hsu; Yung-Ching Huang; Yu-Hsien Chiu
- **Image:**

100



- **PROS:** Integrated water quality analyzers, controls water quality, automated
- **CONS:** Difficult to pass down human experience with controlling the culture waters

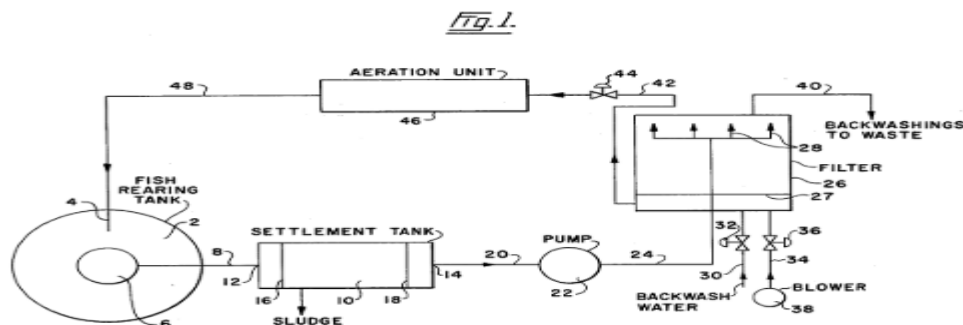
Patent 2:

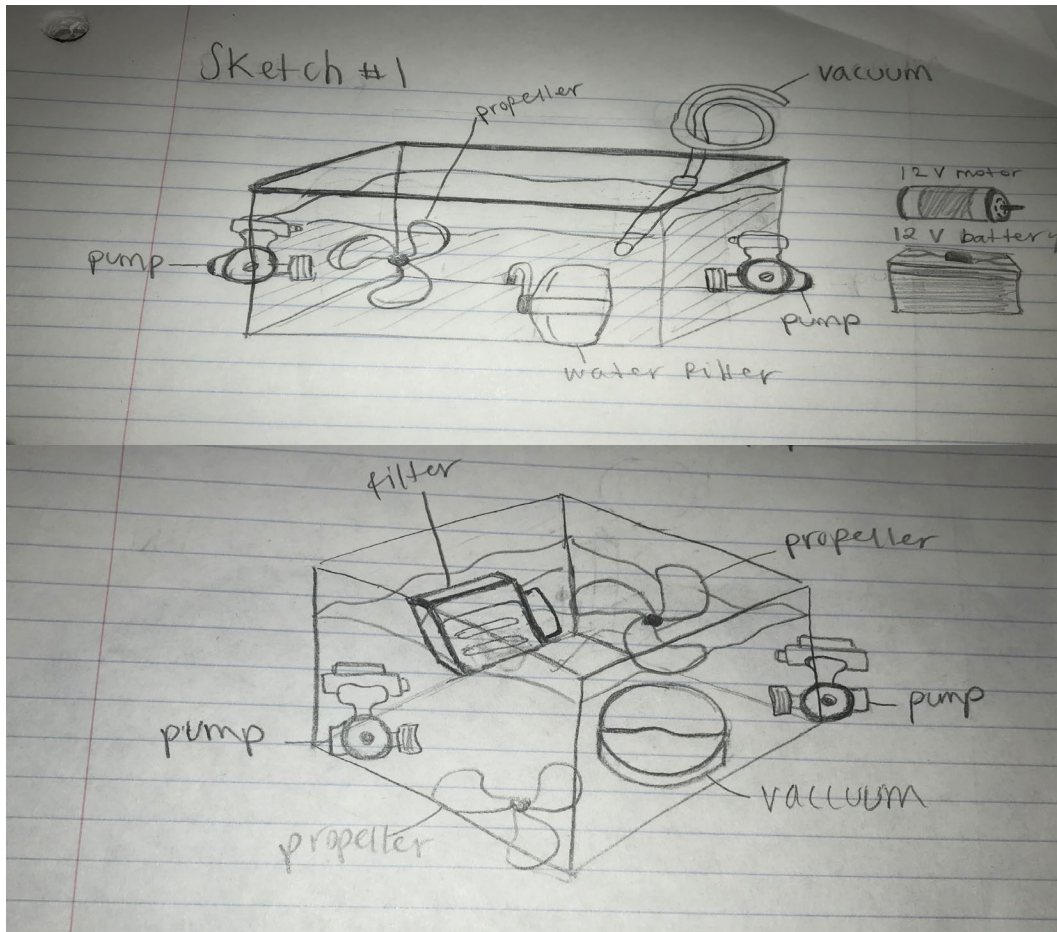
- **Title:** Fish rearing system
- **Patent Number:** US20100099193A1US20100099193A1
- **Inventor:** Alexander E. Birkbeck; Craig C. Walden
- **PROS:** This system helps in the reduced need for water changes. Allows the user to recycle the water from the tank by removing solids from the tank and recycling the water.
- **CONS:** System takes up a large area of space. Uses many electrical components, making energy consumption greater.

Design Specification:

1. Form - small plastic apparatus; fish feeder in the shape of a fish
2. Function
 - a. Performance - keeps fish fed, keeps the water clean
 - b. Durability - 6mo-1yr
 - c. Maintenance - change battery, clean cleaning pad
3. Mater
4. Cost -
5. Aesth
6. Ergon
7. Safety

Sketches:



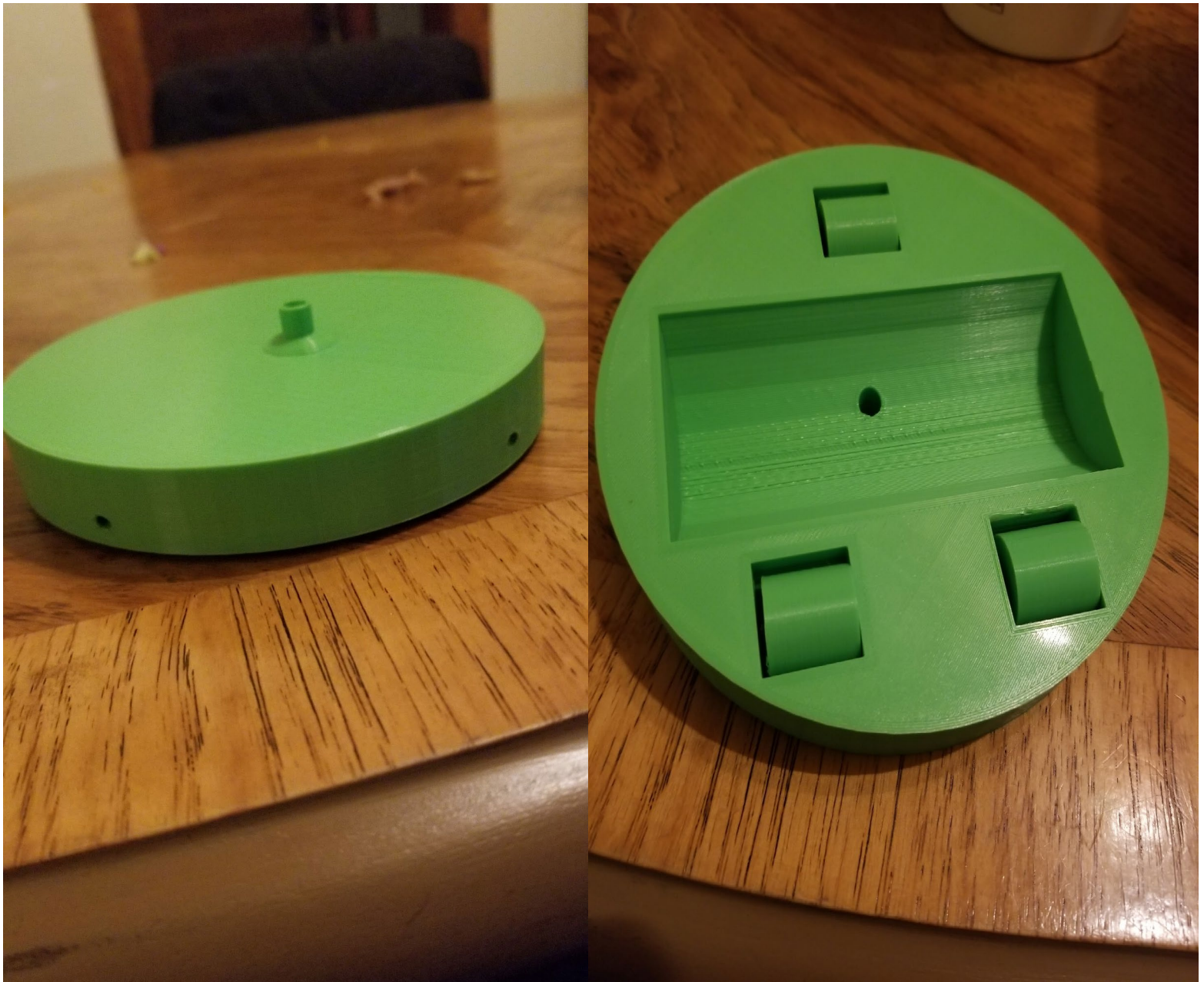


Bill of Materials:

Item	Link	Price
Water pump	https://www.amazon.com/Anself-Ultra-quiet-DC12V-Micro-Brushless/dp/B00OIHLUFA/	\$10.99
12v battery	https://www.ebay.com/itm/Turnigy-2200mAh-3S-25C-35C-Lipo-Battery-Pack-E-Flite-Blade-450-E325-XT60-XT-60/131422837104	\$17.99
Propellor	https://www.amazon.com/Yuengoang-Brushless-Underwater-Thruster-Propeller/dp/B07VDRV431/	\$43.99

2ft minimum of 5/16 hose	https://www.webstaurantstore.com/dormont-1650npfs36-36-stainless-steel-stationary-foodservice-gas-connector-hose-1-2-diameter/3201650NPF36.html?utm_source=Google&utm_medium=cpc&utm_campaign=GoogleShopping&gclid=EAIaIQobChMIvLalxcSw5gIVx8DACH0kNwEKEAQYASABEgl70vD_BwE	\$32.99
Total		\$105.96

Pictures During the Project:



Concepts/ Ideas:

Automated Fish Feeder (First-attempt):

1. Form - small plastic apparatus; fish feeder in the shape of a fish
2. Function
 - a. Performance - keeps fish fed, keeps the water clean
 - b. Durability - 6mo-1yr

- c. Maintenance - change battery, add fish food, clean periodically
3. Material - plastic, servo motor
4. Cost - \$15-30
5. Aesthetics - clean, sleek design, fish design
6. Ergonomics - automation prevents overfeeding causing dirty water
7. Safety/Legal issues - no safety issue

Underwater Tracked Vacuum (Second-attempt):

1. Form - Plastic encased motor with track system. Packback style water pump with vacuum on front.
2. Function
 - a. Performance - travels through tank vacuuming and sending debris to filtration system.
 - b. Durability - 2-3 years
 - c. Maintenance - change battery, clean vacuum
3. Material - plastic, water pump, water filter, 12v battery, track system, arduino, waterproof bearings.
4. Cost - \$180-300
5. Aesthetics - clean, sleek design
6. Ergonomics - you don't have to clean the tank yourself
7. Safety/Legal issues - plastic is safe for fish

Scuumba (Final-attempt):

- Re-designed the track system vacuum to get rid of the added cost and wear of the water proof bearings.
- Removed encased electronics and wires outside of the tank.
- Used Tinkercad to model design, converted to stl file, used a program called Cura Slicing to convert stl file into gcode file.
- Reduced cost by changing propeller movement into water pumps that caused movement.
- Added water filtration to get rid of hose to filtration system.

Notes/ Program:

```
#pragma config(Motor, port1, leftM, tmotorVex393_HBridge, openLoop, driveLeft,
encoderPort, None)
#pragma config(Motor, port5, pump1, tmotorVex393_MC29, openLoop)
#pragma config(Motor, port10, rightM, tmotorVex393_HBridge, openLoop)
/**!!Code automatically generated by 'ROBOTC' configuration wizard !!**//
```

```
task main()
{
    while(0==0)
    {
motor(pump1) = 127;

motor(leftM) = 127;
motor(rightM) = 127;

wait1Msec(5000);

motor(leftM) = 0;
motor(rightM) = 127;
wait1Msec(1000);

    }

}
```

Conclusion:

In conclusion, we attempted the project several times due to extensive added costs and redesigned it into a track system vacuum called "Scuumba." In the new design, we removed encased electronics and wires outside of the tank, we changed the propellor movement into water pumps to still cause movements, and we added water filtration system to get rid of the hose. Even though our project turned into a different design than what we desired, we are satisfied because we were able to decrease the total cost.