Aquatic Nitrogen Monitor

Jade Chapman; Gage Arter;Truc Le; Kevin Zhang
Electronic Systems Engineering Technology Department
Texas A&M University

Professor Behbood B. Zoghi
Electronic Systems Engineering Technology Department
Texas A&M University

Abstract

With an explosively growing world population, the need for an efficient, ergonomic, and extensive food production process is at an all-time high. This is seen the most in the meatpacking industry, with common agricultural practices under scrutiny as of recent, particularly pertaining to how antiquated and detrimental the traditional methods of raising livestock are. Seafood has slowly become considered the most efficient type of meat to produce, and so a slow push towards effective aquatic breeding has begun. In any productive aquatic meat farm, the chemical balance of the water is of utmost importance, increasing even more so with the size of the breeding fish population. Of the many substances found in an aquatic reservoir, there are three that are a direct byproduct of aquatic life: nitrate, nitrite, and ammonia. For home owners who have fish tanks or farmers who own large farms of fish or shrimp, this is a rising problem across the globe as it is increasingly difficult to keep aquatic life healthy in a convenient way. By effectively measuring the concentration of these chemicals and balancing the water chemistry accordingly, aquatic farms can be set up on a much larger scale, thus leading to an exponential increase in viable meat production.

Introduction

Keeping a well-maintained aquarium is difficult nowadays due to the complexity of monitoring adequate nitrite, ammonia, and nitrate. Whether the user is trying to keep a few aquatic fish in the living room as a pet, or farming tropical freshwater fish for their rich mineral, the monitoring of nitrate, nitrite, and ammonia concentration in the water is crucial for overstocked aquatic farming. During nighttime, the phytoplanktons and the microorganisms became inactive as the sun sets. As a result, the concentration of these three elements can increase and become harmful to the livestock. The traditional ways of measuring these 3 elements are through the API test kits or paper tests, which can be found in stores such as Petco, however, they are time consuming, ineffective and messy. Having a system that checks the nitrate, nitrite and ammonia at regular basis can be very helpful to increase the size and population of the livestock. The overall goal is to reduce this difficulty from the equation for new/old users, enabling a thriving fish environment by creating an automated system that uses a device that measures ammonia, nitrite, and nitrate levels. This device will use simple test strips and a color-reading sensor to determine the levels from rotating vials. The system will enable the user to determine these elements without the hassle of doing it themselves constantly. With this, the fishing industry will become an automated world of measuring and

filtering.

Automated System

For the year, AquaTronics will be going to develop an automated waterproof system that measures and detects traces of nitrite, nitrate, and ammonia using the API method in a mid-to-large sized water container. This means that the system will automatically dose and mix the solutions followed by calculating the concentration of the elements based on their colors. The device within the overall system will detect the concentration of these aquatic livestock byproducts and alert the user of actions that should be taken to balance the water chemistry of the breeding environment. The "wow factor" of the project will be the design of this device and layout of the overall automated system, as it will be unique to any system out on the market.

Sampling Breakdown

The system will monitor the aquatic tank by rotating the values to obtain a water sample. The water sample will then be tested using basic API test. These tests will give the results needed to alert the farmer or owner of rising or toxic levels of ammonia, nitrate, or nitrite in the tank. The breakdown of the device can be seen in Figure 1.

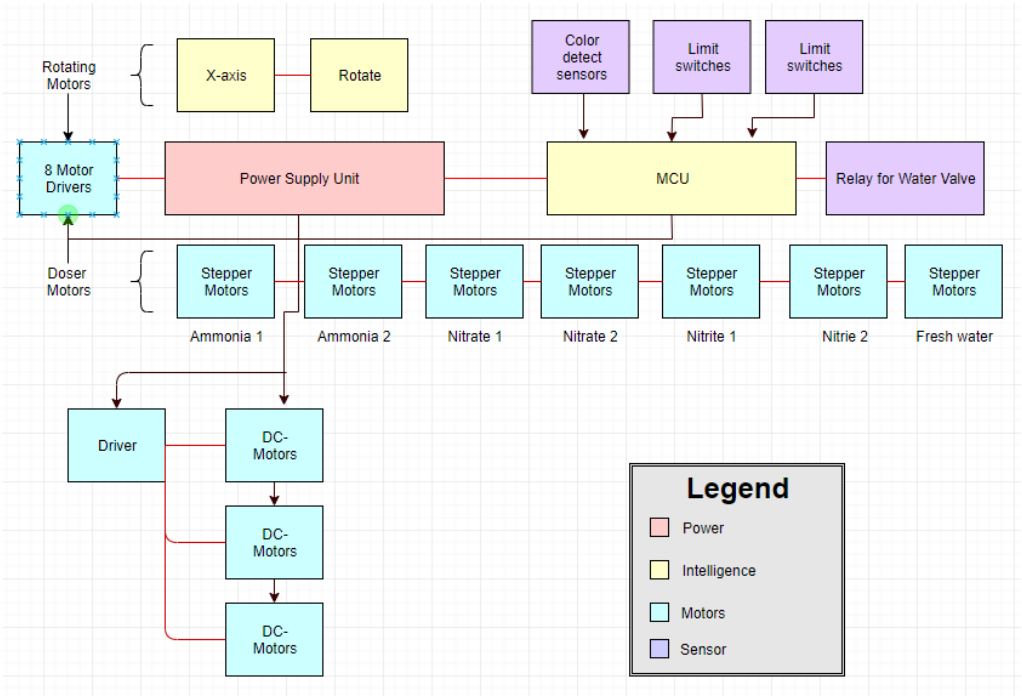

Figure 1. Aquatic Nitrogen Monitor Functional Block Diagram

Summary and Conclusions

Creating an automated system that uses a waterproof device that measures ammonia, nitrite, and nitrate levels of fish or shrimp tank will save homeowners and farmers a great deal of time in monitoring and taking care of their tanks. AquaTronics will strive to complete the blueprint of the device in the Spring of 2020 and push to order parts that same semester. This will give us time in the Fall of 2020 to construct, test, and make any last-minute changes to make sure the system functions as a whole with the device.

References

1. URL: https://www.hach.com/asset-get.download.jsa?id=7639982680
2. URL: https://www.usgs.gov/special-topic/water-science-school/science/nitrogen-and-water?qt-science_center_objects=0#qt-science_center_objects