

Marine Health - A Smart Device to Monitor Aquarium

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Abstract:

Having a fish aquarium is a trendy affair. People have aquariums as an eye-pleasing tool or just as a hobby. Compared to pets like dogs and cats, Fishes need more intensive care since they live in water. We like to spend time watching the aquarium but give the least care to it. If it is not well maintained, it affects the health of the fish. The impurities in the existing aquarium create a threat to the life of fishes and could kill them as well. The health of the aquatic creatures directly depends on the water quality. Therefore, it is critical to monitor water conditions closely and improve the water quality in the aquarium tanks. Feeding fish manually is also another difficult task. If the owner is busy, the chances of him forgetting to feed the fish are very high. Marine health system utilizes sensors to drive the actuators in real time. It also has an intelligent fish feeding mechanism such that the fish is neither over nor underfed. The system will monitor the temperature, pH value, turbidity and alert you when required, and also feed your pet at regular intervals. It will reduce the manual effort required for the aquarium management process and the owner can spend more time watching the aquarium.

Keywords — Aquarium, Water monitoring, Aquatic life, Sensors, Arduino.

I. INTRODUCTION

In the 21st century, the word automation is not a new term. Each and everything in the world is made automated in this world for the betterment of human life. Temperature is very crucial for aquatic life. Temperature changes are often more extreme and happen much more rapidly in an aquarium, giving our fish little time to adapt. Keeping your aquarium pH in optimal ranges reduces stress on your fish and helps them resist disease. Maintaining an ideal pH can also dramatically improve the growth, behavior, and overall appearance of the fish. Feeding fish at regular intervals is difficult during busy schedules and creates a threat to its life. It is necessary to maintain all these parameters for the good health of the fish. This product named “Marine health” is an Arduino-based aquarium

monitoring system designed to help people who like to have aquariums as a hobby but find it difficult to maintain these parameters. The product also helps them when they are out of the station by feeding the fish automatically at regular intervals. The major function of the product is to monitor the aquarium which includes checking the water temperature, turbidity levels, and pH values of the water. The Display screen shows the values of the parameters in real-time. It also alerts the user with the help of a buzzer when the parameters exceed the safe limit so that the user can change the water. Arduino Uno board is chosen as the central board to collect data from the pH, temperature, and turbidity sensors. Servo motor is used to feed the fish at regular intervals. The product is designed user-friendly so that even normal people can use it without any technical knowledge.

II. COMPONENTS USED

Marine Health monitoring system uses many components such as Arduino Uno, Temperature sensor, Turbidity sensor, pH sensor, Servo motor, and LCD Screen module. The descriptions of various components are discussed below.

A. Arduino Uno

The Arduino Uno is an open-source microcontroller board. The board consists of both analog and digital input/output pins. It has 6 analog I/O pins and 14 Digital I/O pins whereas 6 digital pins are capable of PWM outputs. The board is programmable with the Arduino IDE via a type B USB cable. It can be powered using a USB cable or any external battery capable of producing voltages between 7 and 20 volts [1].



Fig. 1 Image of Arduino Uno board

B. Temperature Sensor (DS18B20)

DS18B20 is a digital temperature sensor. It is completely sealed and is used to precisely measure temperatures in wet environments. It is capable of providing 9 to 12-bit temperature readings over a single wire. Hence it has only 1 wire and ground connected to the central microprocessor [2].



Fig. 2 Image of Temperature Sensor (DS18B20)

C. Turbidity Sensor

Turbidity sensors are used to measure the total suspended solids in water. It measures the amount of light that is scattered by the suspended solids when light is passed through water [3].



Fig. 3 Image of the Turbidity sensor

D. pH Sensor

pH Sensors are used to measure the pH levels in the solution. It measures based on the activity of hydrogen ions in the solutions. A pH scale of 0-14 is used to compare with a neutral solution to determine the acidity/alkalinity in the solution [4].



Fig. 4 Image of pH Sensor

E. Servo Motor

A Servomotor is a simple electric motor that is controlled by servomechanism. It is a linear actuator or rotary actuator. It allows for precise control of acceleration, velocity, linear or angular position [5].



Fig. 5 Image of Servo motor

F. LCD Screen Module

The LCD is a type of display that uses liquid crystals for its operation. It has a 16-pin interface and is used to display texts. [6]



Fig. 6 Image of the LCD Screen Module

III. WORKING MECHANISM

The block diagram of the Marine Health - Arduino-based aquarium monitoring system is shown in fig.1.

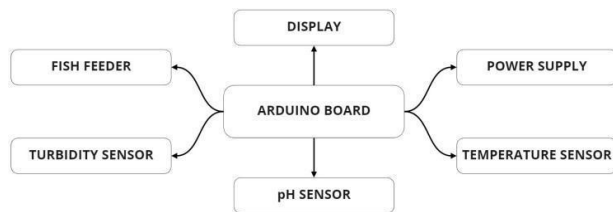


Fig. 8 Block diagram of Arduino based aquarium monitoring system

The Arduino Uno is a small microcontroller used to monitor and control the sensors. The controller board is connected to components like Analog pH Meter, DS18B20 Water Proof Temperature Sensor Probe, 16x2 LCD I2C, Real-time clock, turbidity sensor, and 180-degree metal Servo motors which are connected on the controller analog and digital pins. The pH of a liquid solution uses a gravity pH sensor which is used to measure the acidity of a liquid. The temperature probe will measure the tank water temperature and it will be controlled accordingly as per the season. At the same time Turbidity indicates the water quality by detecting suspended particles in water by measuring the light transmittance and scattering rate which changes with the amount of total suspended solids (TSS) in

water. As the TSS increases, the liquid turbidity level increases, and the results of the sensors are displayed on I2C Module LCD would show can the values of the temperature, turbidity, and pH level on the Screen which is attached to the outer body. An LED indicator is also used to indicate the quality of water. To add to the eating habits of the fish we have integrated the real timer clock with the motor, so every 4-5 hours required grams of food grains drop into the water tank.

IV. PRODUCT RENDERS

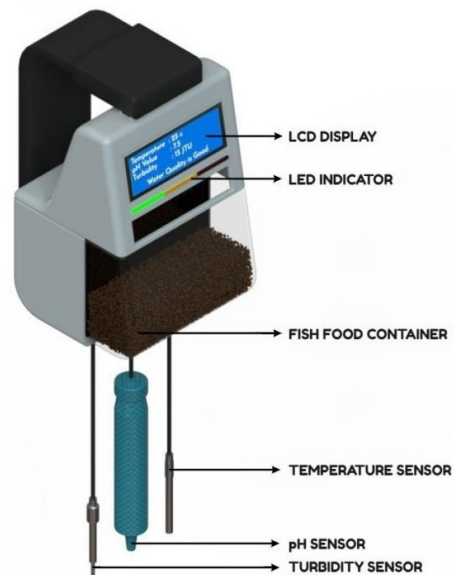


Fig. 9 Image showing different components of the system



Fig. 10 Zoom-in image of the Display panel

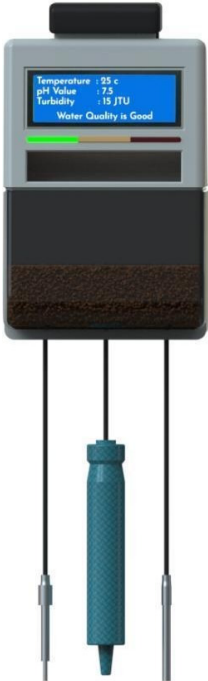


Fig. 11 Marine Health - Front view



Fig. 13 Isometric view of Marine Health in an aquarium



Fig. 12 Marine Health - Left Side View

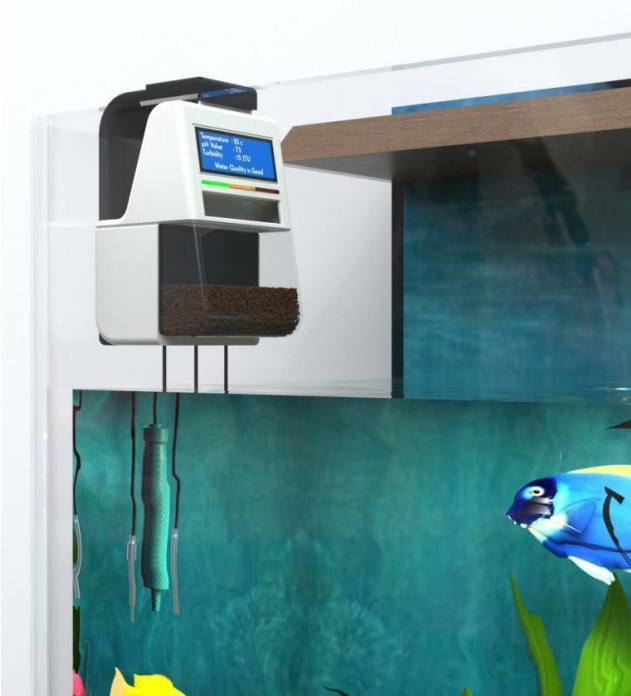


Fig. 14 Image showing the placement of Marine Health in an aquarium

V. CONCLUSIONS

In the existing world, Everything is being automated to make human life easier and better. Maintaining an aquarium is a new hobby that is gaining attraction among people. While having an aquarium is easy but maintaining it is a difficult task. Hence through this project, I have attempted to design an aquarium monitoring system that monitors essential parameters like Temperature, pH value, and turbidity using sensors. It also feeds the fish at regular intervals. Thus “Marine Health” - An Arduino-based aquarium monitoring system makes the task of maintaining an aquarium easier.

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