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Development of Smart Ph Stabilizer for Aquarium Fish Tanks Application

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Abstract: Sustaining the pH level of aquarium in the ideal range improves fish growth rate and reduces the incidence of fish death. Currently, to maintain the water quality, humans usually change the water in the aquarium manually when the water looks cloudy and dirty by the naked eyes. However, monitoring and replacement of water manually is time consuming and as water quality changes continuously, it will give an inaccurate result. Therefore, a Smart PH Stabilizer is invented for aquarium application which can monitor the pH level of water. It also changes the water automatically programmed by Arduino UNO to ensure good quality of water for the fish. This device works when the pH fluctuates, the mechanism begins to activate. One of the water pumps will on pump out the contaminated water. After a few minutes, another pump ill pump in a new quality of water. The integration of sensors in the system allows the system to adapt to human reactions, making it more efficient and user pleasant. a Smart PH Stabilizer worked by automatically controlling the pH value in an aquarium tank to generate clean water for aquatic life.

Keywords: Fluctuates, Integration, Water Quality, Aquatic Life

1. Introduction

In our new era of technology, many automatic or self-operate machines and invention are created for many purposes such as to lighten the burden of the human in future. Nowadays, most people have a hobby like having a pet fish [1]. So, taking care an aquatic life does not look easy at it seem. There is no question that fish make beautiful and entertaining pets but learning how to take care of a fish may seem daunting at first. One of the most important aspects of caring for a fish is ensuring it has balanced appropriate pH levels for the fish [2]. It is possible that the fish will die if the water gets excessively alkaline or acidic. Research the optimal pH level which is between 6.8 and 7.8 for the fish's species before balancing the tank, as each breed has varied environmental requirements [3].

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In this project, a smart pH stabilizer benefits to all fish lovers around the world to give fish a better environment and a good quality of water all the time. This is because the smart pH stabilizer is built on the Arduino Uno, which combines electronic components to function the system to on and off, control the sensor and water change itself. The result is the smart pH stabilizer always make sure the water is in the suitable and safe pH range for the fish [4].

1.1 Objectives

The objectives of this project are:

i. To design a smart pH stabilizer for aquarium application which can monitor the water pH level as well as automatic water changing.
ii. To investigate the functionality and stability of the smart pH system.
iii. To verify the performance of the operation via experimental setup

1.2 Problem Statement

The smart pH stabilizer is one of the most important factors for the fish lovers to ensure the fish is always kept in a good health. Majority people still use the same method by hand work water changing. Sometimes people take it too lightly to water change the fish tanks, this can lead the fish to death due to unstable level of pH value [5].

More individuals will benefit from this smart pH stabilizer based on Arduino. Furthermore, this smart pH stabilizer system can detect the pH level using the pH sensor. So, its automatically pumped out from the fish tank [6]. After several time set by the timer, the pumped stop and another water pump from a new water supply container will refill the aquarium and it will turn off using float sensor. This process can always ensure good quality of water every time for the fish due to water change itself. This project needs a very well piping system to allow the pump flow in a good pressure condition [7].

2. Materials and Methods

This chapter will focus on the approach that will be utilized to meet the goals of developing a Smart pH Stabilizer for aquatic livings in an aquarium tank. The goal of project initiation is to start a project, identify challenges, and specify project requirements. During this step, brainstorming is an excellent strategy for solving problems and determining objectives and scopes. The Gantt chart will act as a guide for the development process, ensuring that the project's goals are accomplished in the end. It is critical for project planning to review literatures based on a textbook or handbook, as well as previous work or projects from other investigators.

By investigating previous work or projects, detailed descriptions of the project and a project gap were achieved. Following that, the design and hardware will be chosen. The project design can be developed based on the information gathered throughout the implementation phase. All essential operations will be reviewed and documented. The project closing phase is the final step of a project in which all issues are tested and debugged to guarantee that the goals can be completed**.**

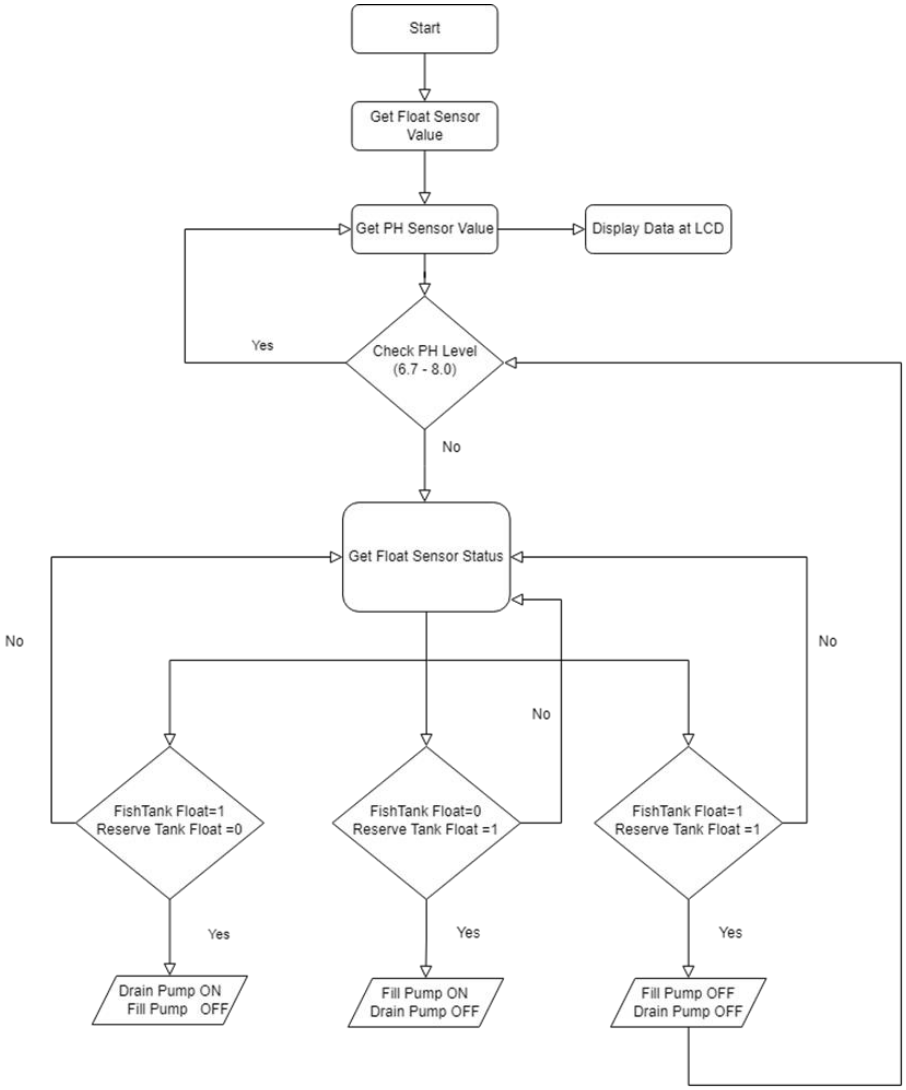

Figure 1: Overall flowchart of this project

When the pH of the water changes, the process is initiated. The water pump 1 is turned on when the pH sensor notices tainted water in the aquarium. To prevent the water pump from completely draining the tank, a float sensor was attached. Since there will still be fish in the aquarium, some of the water will not be forced out completely. The aquarium is continuously filled with new, treated water by water pump 2 when the float sensor detects the water level, doing so until the pH reaches 6.8 to 8.0. To prevent the water from overflowing, another float sensor was added in the tank. If the process fails, it will be repeated. The procedure will be repeated if the pH value stays outside the range, which is why it is called a smart pH stabilizer.

2.1 Materials

This section provides descriptions of the specifications and qualities of the tools, equipment, and other resources employed in the investigation. Below showed a bulleted list of electronic equipment used in this project.

- Durian UNO
- USB Cable
- Water Pump
- AC/DC Adapter

- PH Sensor kit
- Float Sensor
- Liquid Crystal Display (LCD)
- I2C Connector
- Jumper Wire

2.2 Methods

When the pH of the water fluctuates, the mechanism activates. The pH sensor will identify tainted water in the aquarium and activate the water pump 1. To halt the suction, a float sensor is installed. There will be water left in the aquarium; not all of it will be pumped out since there will be fish left in the tank. When the float detects, water pump 2 will engage and continue refilling the aquarium with new and treated water until the pH reaches 6.8 to 8.0. If the pH value remains beyond the range, the operation will be repeated, which is why it is termed a smart pH stabiliser.

3. Results and Discussion

The elements involved in the circuit for the complete hardware installation were an Durian UNO as the microcontroller. The notification system also included 16 X 2 LCD displays. The electrical circuit is then controlled by two motor drivers to support the water pumps for water changing purposes. Furthermore, there are two sensors specifically known as the pH sensor and float sensors. The pH sensor determines the pH value of the water in the fish tanks whether it is more alkalic or more acidic. Furthermore, two float sensors has been installed to monitor the water level by stopping the water pumps if it reaches the float sensors. One of them was installed in the aquarium fish tank while the other was installed in the sewage tank which is located under the fish tank. The system was powered by 12V adapter, and this operation wan fully controlled automatically

The hardware setup of final product prototype concept is assembled according to the schematic design as illustrated. These contains all the components that listed as in bill of materials and all the connection is follow with thee coding setup in Durian Uno to run the system.

Figure 2: Final Hardware Setup

Turn on the plug to allow current to flow and power the device. The Durian Uno receives current via the 12V adaptor. The pH sensor will then determine the pH level of the aquarium's water. The transformer included within the Durian Uno will scale down the voltage to 5V if the 12V adaptor is

turned on, turning on the device automatically. The Durian Uno may function as the CPU and turn on with enough electricity. A drop of acidic solution is added in the fish tanks to observe the pH value change below neutral range which is below 7. By sucking out the water from the fish tanks, the water pump in the aquarium was activated. The water empties into a holding tank for waste. This is due to the pH value's coding range of 6.7 to 8. Thus, if the pH level falls below 6.7 or rises over 8, the water pump will start. The water pump will stop operating after the float sensor determines the water level in the sewage tank. The float sensor turned off the water pump for the fish tank. The float sensor also activates the auxiliary water pump in the clean water supply tank to pump water into the fish tank. Finally, the water pump in the supply tank will cease pumping when it reaches another float sensor located in the fish tank after a few minutes of replenishing the fish tank with clean water. The pH value will become stable in range set by Durian Uno. If not, the process will repeat until it is stable.

The result is taken by five time of testing to see the stability of pH value in the fish tank. Below shows the data collected.

Table 1: Data Collection of pH value

Number	pH value	Status
1	7.372	Stable
2	7.802	Stable
3	7.212	Stable
4	7.774	Stable
5	7.392	Stable

Table 1 shows that the status after 5 times of water changing process. All of the tests develop good results which is the pH value in the fish tank is stable. The pH value is still in neutral range which is 7. If the result shows exceed 8 or less than 6.7, the process will be repeated to achieve stability in pH value.

Figures below shows a graph of the data collected in previous testing:

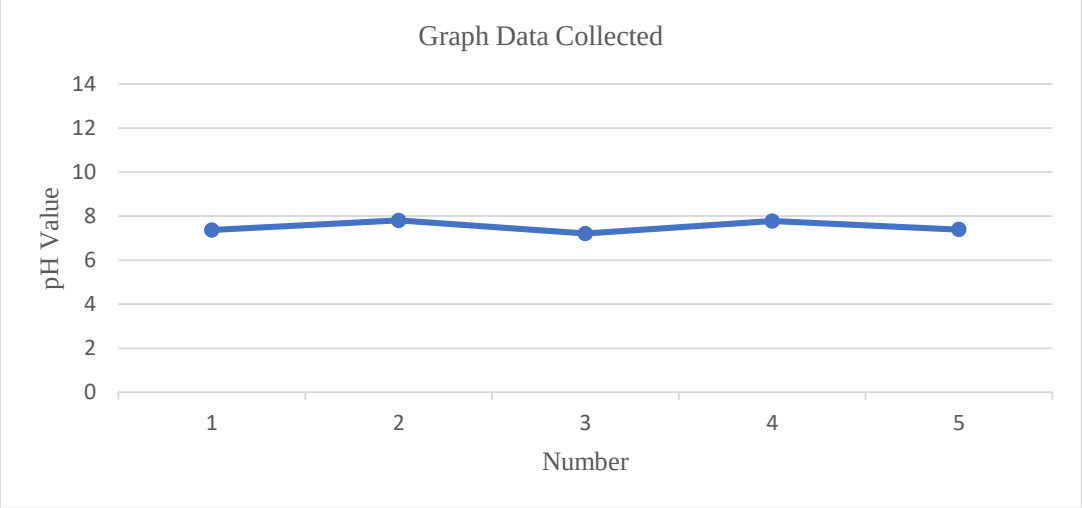

Figure 3: Graph PH value stability

The pH value in the aquarium is stable shown in the graph line which is slightly increase and decrease.

4. Conclusion

As conclusion, a Smart PH Stabilizer worked by automatically controlling the Ph value in an aquarium tank to generate clean water for aquatic life. So that the fish do not suffer from stress caused by high or low pH levels in the water. Unstable Ph value owing to poor water quality caused by fish droppings/faeces and excess food. When fish faeces begin to create bacteria that can infect the fish, the water quality deteriorates. That is why it requires water changes to maintain a steady Ph value. This Ph stabilizer would function automatically when it reaches the maximum or lowest level of Ph value via water change without any manual intervention. There will be two water pumps, one to drain the unclean water from the aquarium and the other to provide the anti-chlorine water. This project is constantly being updated to provide high-quality water to aquatic life.

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