

Design of pH Monitoring System for Koi Pond

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Abstract:

Koi fish farming has increased significantly and become a promising profession in Bantul, however the farmer faced many challenges to produce good Koi fish. Koi fish productivity affected by water quality as a result of good water treatment and filtering. pH is one of the main indicators for good water quality in Koi farming, whilst not many Koi farmer can afford to buy adequate equipment for their ponds. The purpose of this Community Service Program was to help and empower the community in increasing the koi fish farming productivity. The target group of this project was either groups or persons running micro-enterprises in Koi farming. The specific target of this project is to be able to provide and apply appropriate technology to the community. pH monitoring system was designed to provide cheap and appropriate tools applicable and available in the community. By making the design available for replication, the community can work together to procure goods/systems independently. Therefore, the system designed will not burden the community individually. The targeted koi fish farmers are expected to be role models for other farmers. The results of the manufacture of this precise technology-based tool have been completed with the results of the pH meter monitoring accuracy was higher than 98%.

Keywords: pH meter, Koi Fish, Koi Farming, Koi Pond Productivity

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Introduction

one of the hobbies that many people like. There are hundreds of species of freshwater ornamental fish from all over the world, inside and outside Indonesia, almost 90% are tropical fish. One of the most popular tropical fish in Indonesia is koi fish. Koi fish was originating from Japan and has beautiful shapes and colors. Due to its color and shape, this fish is in high demand and cultivated by community (Fahriyanto, F. (2012), Iskandar et al., 2021).

Not only as a hobby but keeping freshwater ornamental fish also has a very high economic value and tends to increase from year to year. Around millions of koi fish are exported to other countries every month. Koi fish farming has become popular and increase economical value in Bantul, Special Region of Yogyakarta Province, considering that there are still open areas that have the potential to be developed into koi fish ponds (Kaswidjanti & Boedi, n.d.).

Koi fish farming affected by water quality as the result of good filtering and affected by weather such as rain and debris. Several things must be considered, the size of the pond or aquarium, water

circulation, water cleanliness, and water quality. Potential Hydrogen or commonly called pH is one of the indications of water quality that affects the growth and development of the koi fish itself (Putri & Dewi, 2019).

According to research conducted by (Sari et al., 2019), regarding the effect of pH on the growth and development of koi fish, that the optimal growth of koi fish occurred when the water pH = 8.5. While the minimum growth of koi fish occurred when the water pH = 5.5. It can be concluded that koi fish can grow and develop in the water pH range of 5.5 – 8.5. In research conducted by Sahu, B. K. et al., (2000) and Kusrin and eni (2020), it was stated that during the maintenance of koi fish seeds, changes in pH in the water greatly impacted the survival of koi fish seeds which resulted in an increase in the percentage of fish seed survival by 67.90%.

Andhi Fish Farm is one of the community businesses in the farming of koi fish owned and managed by Andhi Raharjo. This koi fish farming pond is in Rejokusuman RT. 04 Tamanan, Banguntapan, Bantul, Special Region of Yogyakarta. Koi fish farming is a promising

business as part of a hobby that can provide economic value. Koi fish farming is influenced by many things, namely:

1. water quality, clarity
2. water acidity level,
3. nutrition,
4. Oxygen content in water.

The quality of water clarity was determined by the filter used to filter the dirt that enters the pool, ideally, the filter size is one-third of the size of the pool. In rainy season conditions, water entering the open pool causes changes in acidity levels. The water in the koi pond must be continuously circulated through the filter and an aerator must be added to maintain the oxygen content in the water. In addition, the pH content must also be maintained at a certain level (Afriandini & Suwartiningsih, 2021).

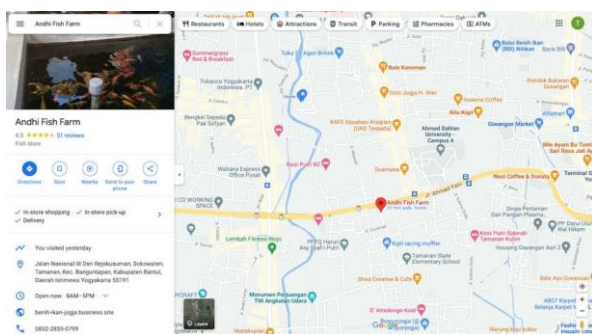


Figure 1. Location of Andhi Fish Farm

Referring to the situation analysis, koi fish farming must be equipped with adequate equipment such as pumps, aerators, and even water coolers. Andhi Fish Farm at the beginning of its establishment experienced electrical problems in the event of a power outage by PLN. If there is a power outage for a very long time, the oxygen supply and pool filtration will stop. As a result, many fish die and cause significant losses. At this time Andhi Fish Farm has been equipped with a self-contained electric generator.

The Optimal growth of koi fish is strongly influenced by water conditions, including pH. Andhi Fish Farm does not yet have equipment that can detect and control the pH of koi fishponds. In general, the problems faced by Andhi Fish Farm are as follows:

1. Monitoring of water pH is done manually and increases in the rainy season,
2. Koi fish suffer from diseases caused by fleas.



Figure 2. The Situation of Andhi Fish Farm's Pond

Method

Automatic monitoring has been widely carried out and has proven to be quite reliable by using a microcontroller. In general, a microcontroller is a digital device that functions as a data processor and can be connected to various sensors according to user needs (Goud, E. H., et al., 2017) With uncertain water conditions, this tool is designed to use a pH sensor as the main parameter, in this tool, two DC motors function as pH stabilizer liquid sprayers.

The pH meter sensor is an electronic device that functions to measure the pH (acid or base) of a solution. The pH meter consists of a pH measuring probe connected to the measured value which measures the pH value and displays the pH value. In this study, a pH sensor was used to measure the pH levels in the koi fishpond. The price of this PH meter is quite expensive and there is no automatic pH setting, therefore the solution offered is to: Create a tool that can monitor the pH in koi fishponds automatically.

1. Needs analysis

This needs analysis consists of an analysis of the hardware and software requirements that you want to use IN the development of a pH control system in fishponds. The following are the software and hardware details that will be used in system development.

The Software which will be used:

- Proteus 8.6. Serves as a PCB design and circuit schematic as well as simulates the tool to be made.
- Arduino ideas. Serves as a platform to run and create program code to execute C++ code that will run on the tool system which includes the pH sensor module program, DC motor, and Arduino Uno microcontroller to transmit pH sensor module data.

Hardware that will be used:

- pH Meter Sensor. Serves to measure the level of acid-base dissolved in a solution. In this study, the pH meter sensor functions as a measure and monitors the dissolved acid-base levels in the koi fishpond

- Arduino Uno. Serves as a center for processing electronic signal inputs into the required output. In this study, Arduino Uno converts the input electronic signal obtained from the pH sensor into the desired output. The output itself is when the pH sensor detects that the pH dissolved in the koi fishpond does not meet the standard, the DC motor will pump the solution so that the desired pH will be found
2. How the tool works
- The tool that will be designed in this service will be used to monitor the pH in the koi fishpond, here is how the tool works.
- The pH meter sensor is dipped into the pond, the position of the pH meter sensor installation itself depends on the position of the shower in the fishpond.
 - After the device is turned on, the pH meter sensor will start to calculate the pH value dissolved in the water.

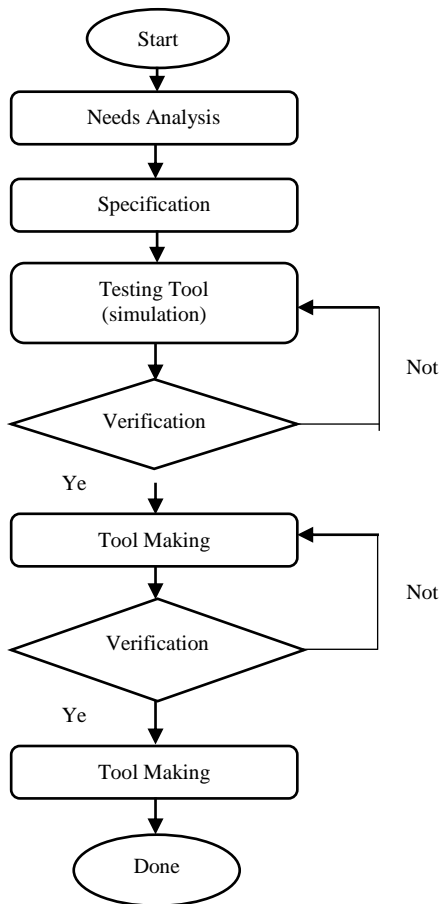


Figure 3. TTG Design Flow

Results and discussions

This appropriate technology community service program has produced a device that can monitor water pH continuously. The specifications of the tools made based on the needs analysis disclosed in the method are:

1. The working voltage on this tool is 5 V.
2. Capable to measure and monitor pH in fishponds.

3. The microcontroller used in this circuit is Arduino Uno.
4. Led indicator to display the pH value and temperature in the fishpond.
5. Can be used indoors and outdoors.

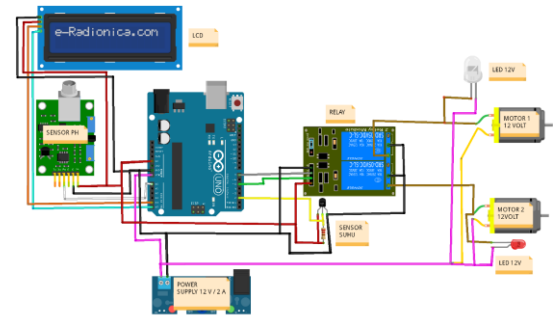


Figure 4. pH Monitoring Device Circuit

Table 1. Comparison with standard pH meters

Measurement of the pH Value of the Buffer Solution				
pH Sensor Type	Standard pH Value	Measured pH Value	Difference in pH Value	Error Percentage
YY-400	4.01	4.02	0.01	0.25%
	6.86	6.87	0.01	0.15%
	9.81	9.18	0	0.00%
AS218	4.01	4.02	0.01	0.25%
	6.86	6.9	0.04	0.58%
	9.81	9.24	0.06	0.65%
SENO161	4.01	4.07	0.06	1.50%
	6.86	6.95	0.09	1.31%
	9.81	9.27	0.09	0.98%

Figure 5 shows a graph from table 1. This graph shows the results that coincide between the designed tool and a standard pH meter. This indicated that the designed pH meter is accurate because it is close to the standard pH meter value. Table 1 also shows a very small error presentation, which is below 2%.

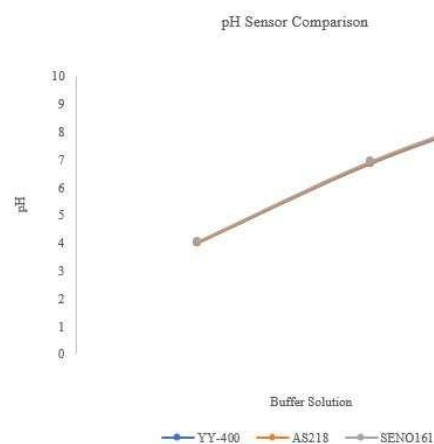


Figure 5. Comparison Graph of pH meter



Figure 5. Handover to Community Service Partners

Conclusion

The results of the appropriate technology community service (TTG) to make koi pond pH monitoring equipment has been successfully carried out. Tests have also been carried out on real ponds and indicated pH monitor results with an accuracy above 98%, the highest error rate is 1.496%.

Andi fish farm as the project partner was happy welcomed the results of this appropriate technology and suggested expanding this service activity to other partners. It is also recommended to expand TTG to other aspects of increasing koi fish culture.

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