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PROCEEDING

Academic Role in Facing **Asean Economic Community (AEC)** Global Challenge, Local Act

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PREFACE

Praise being said to Allah Almighty God for all the grace and guidance that has been given to us all, so the Proceedings of the 11th ADRI 2017 International Multidisciplinary Conference and Call for Papers Nganjuk, March 18, 2017 can be realized. Proceedings contains a number of articles and research papers from lecturers, teachers, students, researchers and / or observer of the development of science and technology.

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Hopefully, these proceedings may give benefit to us all, for the development of science, technology, arts, culture, and sports. In addition, is also expected to be a reference for the nation and state-building efforts so that science and technology become a strong pillar in the face of the ASEAN Economic Community.

Lastly, there is no ivory that is not cracked. We are sorry if there are things that are less pleasing. Thanks you very much.

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AUTOMATION OF FISH POND WATER CIRCULATION BY USING ARDUINO UNO- BASED CONTROL SYSTEM

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Abstract. Freshwater aquaculture is the most cultured fish by fishery farmers with its success is determined by several factors, one of which is the water quality in accordance with the levels required that oxygen content in water is greater than 3, 5 ppm and pH content of water in the pool range from 7.8 to 8.0. Microcontroller technology development is very fast. Electronic devices have been requirement to meet in supporting daily life activities. Most fish ponds are now using manual tools using water pumps. This is less efficient and effective for fish ponds. This research focuses to make automation of fish culture water pond circulation with pH control device. ATmega 328P integrated with Arduino and Analog sensor of pH meter is used as control device.

Keywords: fish farming, pH control, microcontroller, arduino

I. INTRODUCTION

The development of microcontroller-based technology is increasingly encountered with rapid technology development. Electro devices have been a requirement to be met. Currently most fish ponds use manual tools such as water pumps making it less efficient for an fish. Some consider this way is less practical due to its manual system. Freshwater aquaculture is the most cultured fish by fishery farmers with its success is determined by several factors, one of which is the water quality in accordance with the levels required that oxygen content in water is greater than 3,5 ppm and pH content of water in the pool range from 7.8 to 8.0. pH concept was first introduced by a Danish chemist expert named Søren Peder Lauritz Sørensen in 1909. The certain meaning of "p" on "pH" abbreviation is unknown. Some references hint that the p stands for *power* (rank), others refer to German word *Potenz* (which also means rank), and some refer to the word *potential*. Jens Norby's paper published in 2000 argue that p is a negative logarithm.[1] In fisheries world, particularly aquaculture, pool entrepreneurs are still using the manual system to control water pH levels by the manual water pumps. This will slow down their performance as it is double work. With our creation of tool, fish entrepreneurs do not need to drain fish pool manually. Regarding the brief review of the background, problem of how to perform neutralization automation to control the moisture content automatically that owner of water pool does not have to intervene directly to drain and refill fish pond water. The purpose of this study are:

1. Creating automation system of fish pond water circulation by using Arduino to control fish pond water pH and can be implemented on all fish pond.
2. The system will be integrated with a water level sensor to monitor the volume of water in fish ponds.

The research benefits include: 1) Maximizing manual water circulation system in the pool, 2) Facilitating the work of fish pond owner to measure the pH level of the water, 3) keeping pH level of fish pond water in normal conditions, 4) keeping the fish pond water volume according to the level needed.

II. METHODS

The first step in initiating this study is to gather data needed. These data can be obtained in the field. Once the data is collected, the data is further processed by using direct method by going into the field. A study aims to produce data useful to provide an adequate understanding of the object of research and problems faced. Therefore, data obtained from the study should be reliable, relevant, and can provide insight into actual condition. Data collection was conducted by library research. Library research method is carried out by collecting data from literature as well as books of reference and data that have a relationship with the problems examined. System floating methods to control pH uses *System Development Life Cycle (SDLC)* that can be described in several stages, they are [7]: 1) Determining Information needs, this stage puts anything decisive and determine information to the users involved. The device used to specify information is to determine the sample and examine the raw data and interview. 2) Analyzing Information Needs, particular tools and techniques help determining needs. The device use is data flow diagrams to draw up a list of inputs, processes and outputs in the form of a structured chart. It is developed into data dictionary which contains a whole list of items of data used in the system. 1) Designing Information Systems recommended, using the information gathered earlier to achieve logical design of information systems, designing procedures of data entry that the data

entered into the information system is completely accurate and to use techniques and the design of a particular *layer* to ensure enter the effectiveness of information systems. 2) Developing and Documenting Programs, at this stage, initial software is developed. It needs some structured techniques for designing and documenting software including plans and pseudocode. 1) System Trial, prior to using, information must be tested to find out the problems before the system is implemented. This phase is performed routinely during the update is run. 2) Implementing and Evaluating System, this stage involves training for users to control the system. This evaluation is intended for discussion actually done at each stage, the main criteria to meet is whether the designated user actually uses the system. Identifying Problems, Opportunities and Interest, activity in this phase includes interviews with user management, concludes the knowledge gained, estimate the project scope, and documenting results. The output of this stage is a flexible report contains definitions, problems and summary purposes.

III. RESULT AND DISCUSSION

PH is the degree of acidity used to express the degree of acidity or alkalinity of solution. It is defined as logarithm activity of dissolved hydrogen ions (H^+). Hydrogen ion activity coefficients cannot be measured experimentally, thus, the value based on the calculation of theoretical pH scale is not absolute. It is relative to a set of standard solutions whose pH is determined on the basis of international agreements [2].

Figure 1.pH Sensor [2]

Figure 2 Relay

Relay is an electromagnetic switch component that can turn switch contacts in it at the time electrical signal is received. Relay was invented by Joseph Henry in 1835. Work system relay is as follows. Coil wire flown by electric current will cause electromagnetic fields and make soft iron core magnetized, as a result, *armature* will be attracted by the iron core (same magnetic poles),

armature will move suppressor (suppressor has hinge for easy movement) to push the input contact arm connected with contact input which is connected with output contact arm_1 to output arm_2. Three types relay condition is as follows: 1) *Normally Open* (NO), a condition of zero current flow on open connection of coil wire 2. *Normally Closed* (NC), a condition zero current flow on close connection of coil wire. 2) *Change-Over* is relay condition that has a pair of *normally open* and *normally closed* contact lever. As wire coil electrified with electric current, *normally open* condition will be closed and *normally closed* condition will be opened or otherwise [3].

Water Pumps

Figure 3 Pump

Water pump work is basically very simple, it sucks water from lower area and pushes it to higher ground or water body. Each pump is equipped with automatic equipment that would enable it to ease operation and does not require any activity of switching on and switching off the pump with automatic sensor that works based on the pressure contained in pipes or drains at the output of the pump.

At engine water pump, there is suction and exhaust channels. The automated tool or sensor uses pressure sensor or Pressure Switch and installed on the tube at the pump output channels. When the pump is turned on or connected to the mains, the pump will rotate that the inside of the vacuum pump occurs due to the difference in pressure, so that the water contained in the soil will be sucked upwards.

When the engine is off, the rotor also rotates together with the propeller. Vane movement is limited by ring and drain the water from the suction hole or a large hole or a small press, and all the water faucets in the house is closed. The pump output channel will arise considerable pressure. When the pressure generated exceeds the existing press set on the sensor, the sensor will work and the water pump will be witched off instantly, water pump will live longer if a water tap is open as the water pressure has dropped. The existing system on the machine pump valve is a volume control and idle-up system.

- 1) Volume control valve is required by the water pump for higher rotor rotation. The volume of fluid produced by rotor is higher. Too big power is detrimental to the stability of driving as the driver cannot feel the wheel contact with the road surface and this is very dangerous. This is the function of volume control

valve. Thus, the pump needs water pressure drop as engine requires contact or friction with other devices to make pumping process run well.

- 2) idle-up system or increase idle rotation serves to drive the pump. Rotor and propeller can continue to spin when idle rotation is increased with this system.

When we forget to turn off the water pump, the water pump engine will not be burnt. This is due to continuous work, and again we do not need to install or remove the plug from the engine water pump as everything works automatically. In short, pump produces water pressure. The pressure pushes the suction valves, and on suction channels, the suction is bigger, the pressure arising from water drops down opening the gas valve. [3]

Water Level

Figure 4 Water Level

Water Level Sensor is a device used to provide a signal to the alarm / automation panel as the water level has reached a certain level. Sensor will provide dry contact signal (NO / NC) to the panel. The detector is useful to provide alerts or to drive other automation devices. Water sensor is equipped with a built-in buzzer that produces sounds when triggered. Water height sensor is normally used to calculate the height of the water in rivers, lakes, or water tank. This sensor is very easy to make for the simple tools and low risk.

Arduino Uno

Figure 5 Arduino Uno

Arduino Uno is one of complete, small sized microcontroller development board and support the use of breadboard. Arduino Uno is created with a base of ATmega328 microcontroller (for Arduino Uno version 3.x) or ATmega 168 (for Arduino version 2.x). Arduino Uno has nearly the same function as Arduino Duemilanove, yet in a different package. Arduino Uno does not include Barrel Jack-typed DC plug, and connected to a computer using a USB Mini-B port. Arduino Uno is designed and

manufactured by Gravitech company. Below are the specifications Arduino Uno [3].

Programming

Arduino Uno can be programmed with the Arduino software (Download Arduino software). Select "Arduino Diecimila, Duemilanove, or Nano w / ATmega168" or "Arduino Duemilanove or Nano w / ATmega328" via Tools menu > Board (adjust to the type of microcontroller that you have). ATmega168 and ATmega328 on Arduino Nano has been packaged preburned with bootloader that allows you to upload new code without using external hardware programmer. This is because the communication that occurs uses the original STK500 protocol. You can also pass through (bypass) bootloader and microcontroller program through pin header ICSP (In-Circuit Serial Programming) by using Arduino ISP or similar [3]

Pond definition

Swimming is an area created to accommodate a certain amount of water that can be used for the gathering fish or other aquatic animals. Based on the technical sense, pool is an artificial water with limited area and deliberately made by human to be easily manageable in terms of water setting, the type of farming animal and production targets (Arsyad, 2006). There are three types of aquaculture systems: traditional / extensive, the pond used is made from ground. Semi-intensive pond is one whose part of the pond (bund wall) is made of a wall while the base is made of ground pond. Intensive pond is one whose the entire section consists of a wall.

Based on the technical sense (Susanto, 1992), pond is an artificial waters with limited area and deliberately made by man to be easily manageable in terms of water setting, the type of farming animal and production targets. In addition to medium of live fish it also functions as a natural food source for fish, which means that pool must have potential to be able to grow food naturally [5].

Definition of Fish

Fish are members of Poikilotherm vertebrates (cold-blooded) that live in water and breathe with gills. Fish is the most diverse vertebrate groups with the number of over 27,000 around the world. Taxonomically, fish are a paraphyletic group whose exact relationships are much debated, fish are usually divided into:

- Jawless fish (Agnatha class, 75 species including lampreys and hagfish),
- Elasmobranchii (Chondrichthyes class, 800 species including sharks and rays)
- Bony fish (class Osteichthyes)

Fish come in different sizes, ranging from whale shark measuring up to 14 meters to stout infant fish of only 7 mm (approximately 1/4 inch). There are several aquatic animals frequently regarded as "fish", such as whales, squid and dugongs, which is not classified as a fish. Fish are generally consumed immediately. Processing effort still has not been done much except for dried / salted fish. Fish can be processed into various products such as dried fish,

shredded fish, fish crackers, salted fish, kemplang, fish balls and fish blood meal as fertilizer for crops and fish feed [6].

Definition of Fish According to the Fisheries Act (Act 45 of 2009) Under the Law 45 of 2009. Fish can be defined in general as animals that live in water, invertebrates, poikilothermic, moving by using fin, breathing with gills, and has a lateral line (linealateralis) as organ of balance. However, referring to law 31 of 2004 on fisheries as amended by law 45 of 2009, the definition of fish is different and wide-ranging. According to Article 1 of Law 45 of 2009, fish are all kinds of organisms that all or part of their life cycle is in the water environment.

In explanation part, it is described that below are included as type of fish:

- a. finned fish (Pisces);
- b. shrimp, crab, and the like (crustacea);
- c. shell, oysters, squid, octopus, snails, and the like (molluscs);
- d. jellyfish and the like (Coelenterata);
- e. sea cucumber, sea urchins, and the like (echinoderms);
- f. frog and the like (amphibia);
- g. crocodile, turtles, tortoises, lizards, water snakes, and alike (reptiles);
- h. whale, dolphins, dugongs, and the like (mammalian);
- i. seaweed and other herbs that lives in water (algae); and
- j. other waters biota

From the description we can conclude that fins and gills are not the only animals belonged to fish, but all aquatic biota whose all or part of cycle of life is in the aquatic environment, including coral, crocodiles, turtles, tortoises etc.

The use and definition of the word "fish" in the fishery laws is actually less accurate for society or academia. It might be more appropriate to use the word aquatic species or "biota / aquatic organisms". However, laws and explanation of fisheries is expected to clarify the scope of work of the Ministry of Maritime Affairs and Fisheries, which was previously owned by the department of agriculture and forestry. Thus, there is no difference in comprehension when doing work in the field, especially in law enforcement and supervision. [6]

Manufacturing water pH control circulation tool. The device made consists of two modules, namely water pH sensor module which connect with arduino and communication modules that transmit sensor readings to be delivered in the form of android notifications.

Figure 5. Technology Architecture of pond water Circulation

PH sensor system and Water Level Sensor will send data to arduino if the fish pond water ph is <7 or pH > 8.5, arduino will transmit data to water pump to drain or fill the water up to normal level as desired.

Model process

The process model of the system to be created uses model applied using UML (Unified Modeling Language). Diagrams of UML applied to the system is explained as follow:

Use Case Diagram

In the use case diagram, the processes to be performed by users in the ph control using arduino is explained

Figure 3 Use Case Diagram System

Formulation

Below is data processing of pH level of water in the water circulation system with pH control. Data processing is used to determine pH level of the water the fish pond. In the previous study, grade or content limit of the water content both normal or dangerous is shown in table 1.

Table 1 Levels of water ph	
Category	Ph levels of water
Acid	1-6
Normal	6.5 to 8.5
alkali	8-14

Table 1 describes the pH level of the water status categories:

1. When water content is less than neutral 7, acid level in the pond is less good.
2. Neutral value in the pool ranged from 6.5 to 8.5.
3. When water level exceeds neutral level of 7, the base level is unfavorable.

process Model

The system series describes the system hardware workflow of water pH sensor system when receiving signal and then received by arduino to control the water pump. The entire circuit water circulation system to control ph as shown in Figure 5 and automation system flowcharts pool water circulation is shown in Figure 4

Figure 4 Flowchart of Fish Pond Water Circulation System

Figure 4 illustrates water circulation system workflow with automatic pH control by using arduino. The system will read the keypad to select the type of fish. pH sensor will then sends data to LCD and then pH sensor will transmit data to the arduino after receiving data from the pH sensor.

Figure 5 circuit Overall water ph sensor control system

In Figure 4, the hardpart of overall circuit of water circulation system with ph control by using arduinoare:

- arduino
- uno,

- ph sensor,
- keypad,
- LCD,
- RTC (real time clock),
- water level height sensor.

The focus of this section discusses the implementation of water circulation system design with ph control. The trial results of water circulation system with ph control by using arduinois logged in the form of a .txt file that displays data date, time and ph levels. The data in this txt file is the result conveyed through communication tools to android device. From the existing data in the image it can be concluded that water content data dated 01.16.2017, at 22:34:18, ph levels by 0.00 to 6.87 is dirty water and to 7:14 to 7.67 is normal ph level of normal water and water content of 8:15 to 15:36 is dirty water pH levels, as seen in Figure 6.

Figure 6 the contents of the log file txt trial results

Precision and Recall. Common measure used to measure the quality of data is a combination of *precision* and *recall*. *Precision* is the ratio of the amount of relevant information from which system with all the information is picked by both relevant and non-relevant system. *Recall* is the ratio of the amount of relevant information obtained throughout the system with relevant information contained in the collection of information (whether drawn or not drawn by the system). Generally *precision* and *recall* can be formulated as follows:

Table 2 Formula of *Precision* and *Recall*

$$\text{recall} = \frac{TP}{TP + FN}$$

TP = True Positive

FN = False Negative

		ACTUAL VALUE	
		TRUE	FALSE
VALUE FORECASTS	TRUE	TP (TRUE POSITIVE) <i>correct RESULT</i>	FP (FALSE positive) <i>UNEXPECTED RESULT</i>
	FALSE	FN (FALSE POSITIVE) <i>correct RESULT</i>	FN (FALSE POSITIVE) <i>UNEXPECTED RESULT</i>

	FALSE	FN (FALSE NEGATIVE) <i>MISSING</i> <i>RESULT</i>	TN (TRUE NEGATIVE) <i>Absence</i> <i>of correct RESULT</i>
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$$\text{Precision} = \frac{TP}{TP + FP}$$

A test on water pH sensor calculates the success rate of how much the system can be run. From the experimental results, the system is performed by 20 (twenty) times with the following result

The results of the experiment as follows:

1	Condition of appropriate water pH content	15 kali
2	Condition of inappropriate pH water content	5 times
3	Data is not recognized	0 times

Thus, the value of *Precision* and *Recall* is as follows:

Table 3 Implementation of *Precision* and *Recall* Formula

		Actually Value	
		TRUE	FALSE
System Value	TRUE	15	5
	FALSE	0	0

$$\text{Precision} = \frac{TP}{TP + FP} = \frac{15}{15 + 5} = 0.55 * 100\% = 75\%$$

$$\text{Recall} = \frac{TP}{TP + FN} = \frac{15}{15 + 0} = 1 * 100\% = 100\%$$

After testing by using precision and recall, the *precision* value obtained was 75%, this indicates that the pH control system by using arduino runs well.

Recall indicates the value of 100% indicating that pH control system worked very well, pH sensor is always able to read water pH level repeatedly that it never occurred error

IV. CONCLUSIONS

pH control system for pond water pH is able to work and function as planned. It is indicated by precision and recall test results with the value of 75% for precision and 100% for recall value. The following suggestions and input: 1) Updating these systems into android that the owner can watch the pond extensively. 2) Adding Phsensors that the data obtained are more stable.

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