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Prototype of the Monitoring System and Prevention of River Water Pollution Based on Android

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Prototype of the Monitoring System and Prevention of River Water Pollution Based on Android

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Abstract. This paper aims at a solution to overcome and reduce river water pollution; factories waste and residential waste that is discharged into river areas that are still used by pond farmers as a source of fresh water in their ponds. If the river water is polluted, it will adversely affect the productivity of the ponds. To overcome the problem of pollution in ponds, it is necessary to research the parameters of pH, temperature and oxygen content in river water. Therefore, flexibility is needed from a system for monitoring the quality and prevention of river water pollution, based on the Android operating system that helps the performance of farmers to find out more about river water pollution wherever they position is. This system design uses Atlas Scientific's DO (Dissolved Oxygen) sensor, v1.1 module pH sensor and DS18b20 temperature sensor. Oxygen content data by DO sensors, pH and water temperature of the river, which have been processed by the system will be displayed on the LCD monitor, then the data will be sent in the form of SMS (Short Message Service) to the user's Smartphone using a modem. If river water pollution is detected, the accuracy rate of this monitoring system is 90% with an average error rate of 3.9% on the measurement of oxygen levels, 2.8% on pH measurements and 1.01% for temperature measurement on river water.

1. Introduction

Ponds are artificial water ponds, which are a growing cultivation medium for shrimp or fish that are kept. In order to obtain optimum results, it is necessary to prepare certain environmental conditions that are in accordance with the cultivation life. The main factor that determines the productivity of ponds is water in the pond, which is a growing medium for the shrimp or fish that are raised. Water quality in accordance with the needs of cultivation commodities needs to be balanced with the adequate quantity of water based on the Android operating system [1]. For traditional ponds, the most important effort to increase pond productivity is to provide water in ponds with good water quality. Ponds generally require brackish water which can be found at tide meetings and water flow from the river. So far, pond farmers have indicated pollution only by looking at the color of the water surface, while according to [2] the indicator or watermark has been contaminated by changes or signs that can be observed through changes in pH or Hydrogen Ion Concentration, colour Change, odour and Sense of Water, changes in Water Temperature, occurrence of sediments, colloids and dissolved materials, microorganisms. Of the many polluted watermark indicators attached above that will be used in the study only three indicators are indicators of changes in pH, changes in water temperature, dissolved oxygen. Changes in each indicator by sensor detection When pollution occurs, farmers take precautionary measures by closing the sluice gate that connects the river and pond water manually. In addition, when they want to put water in the pond, the farmers do not check the quality of the water that will be put into the pond. When the water is put into the pond turned out to be polluted can endanger the growth and survival of the shrimp or fish that are cultivated.

Oxygen plays an important role as an indicator of water quality, because dissolved oxygen plays a role in the oxidation and reduction of organic and inorganic materials. If oxygen is dissolved in water <3 mg/l, it will inhibit the growth of shrimp and fish, and can even lead to death. The causes of the decreasing quality of oxygen dissolved in water include waste that causes a decrease in the quality of pH and temperature in water [3]. Looking at these problems, there needs to be research on water quality monitoring and prevention of water pollution to minimize the risk of contaminated water entering the pond. In this study the author will design a tool that can monitor water pollution by using a pH sensor, temperature sensor, Dissolved Oxygen and prevent contamination with an automatic door opening system.

2. Literature Review

2.1 Sensor Thermometers Digital DS18B20

The Sensor DS18B20 was digital thermometer made by Dallas Semiconductor. DS18B20 has a digital output, so there is no need for an ADC circuit anymore, and has an accuracy of temperature reading and measurement speed has a much better stability than LM35DZ sensor. For temperature reading, the sensor uses a protocol with the one wire bus communication method. DS18B20 is a very practical sensor because it only requires 1 pin of I / O data to be processed by a microcontroller. The physical image of DS18B20 is shown in Figure 1. The DS18B20 digital temperature transducer is used as multi-angle testing method in the process of testing the pitch transport vehicle's temperature. [4]

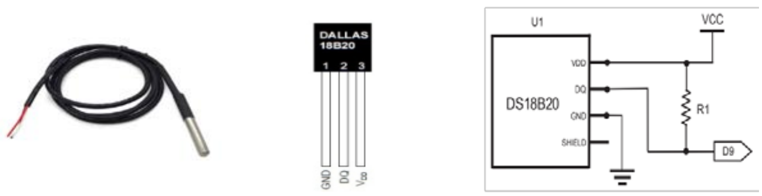

Figure 1. Pin configuration and DS18B20 sensor physical form (source*: Datasheet DS18B20 Dallas semiconductor, Inc.,*2015)

2.2 Sensor PH Probe And Module

In principle, the measurement of the pH sensor is based on the electro-chemical potential that occurs between the solution contained in the glass membrane (electrode) which is known with the solution found outside the glass electrode which is unknown. This is because a thin layer of glass bubbles will interact with hydrogen ions whose size is relatively small and active; the glass electrode will measure the electrochemical (EC) potential of hydrogen ions or termed the potential of hydrogen. Most modern pH meters are equipped with thermistor temperature. Thermistor temperature is a tool to correct the influence of temperature. Between the comparison electrodes and the glass electrodes are arranged in one unit. Sensors commonly used to measure pH are ion-sensitive electrodes or also called glass electrodes. This electrode consists of an electrode rod (made of well-insulated glass) and a glass membrane (thin-walled and sensitive to H ions). A reference there is also a reference electrode. Both of these electrodes exist independently and some are incorporated into one unit, commonly called a combination electrode. A pH measuring sensor element is in the middle, covered by a silver-silver chloride solution (Ag-AgCl). The lower part of the sensor element is related to the glass membrane and contains a silver-silver chloride solution. The ionic contact of the silver-silver chloride solution to the sample occurs through a ceramic connector. The ceramic connector acts as a selective membrane that passes certain ionic currents. Naturally, the glass electrode output impedance is very large (because of the chemical processes that occur on the surface of the electrode), the size is between 50-500 MΩ so that the input impedance is very big. In figure 2.6 is a ph probe sensor which is equipped with a modulee. [5]

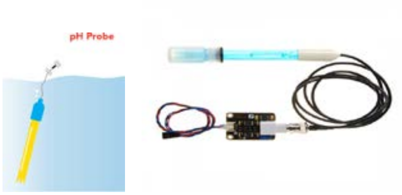

Figure 2. pH Probe Sensor with the module (*source : pH probe module datasheet*)

2.3 Oxygen Sensor Atlas Scientific Kit's Dissolved

The working principle of DO meter is based on polar graphic phenomena that occur between two cathode and anode electrodes. Negative electric voltage is given to the cathode electrode. As a result of this negative voltage, there will be a rapid chemical reaction between water and dissolved oxygen on the cathode surface. Electricity voltage will continue to rise until it reaches saturation value, which is equivalent to the reaction of all dissolved oxygen on the surface of the cathode electrode. The occurrence of a saturated electric voltage is indicated by the almost increase in the reading of the electric current, after a while of being silent at one value even though the voltage value is increased. After passing this saturated voltage value, the electric current continues to rise if the voltage continues to increase. Rising current values are caused by other chemical reactions that have occurred, such as the reaction of breaking H2O water molecules into H and OH ions. [6]

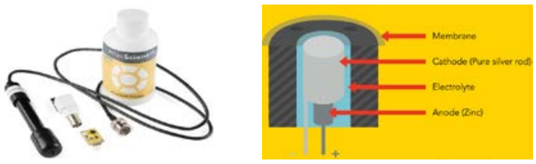

Figure 3. Sensor DO probe with module (*source : Dissolved Oxygen Atlas Scientific datasheet*)

3. Method

3.1 Module The System Mechanic To Mechanical

In this study, the hardware monitoring and prevention system for water pollution consists of servo that prevents the entry of water pollution, accompanied by warnings from alarms (LED and Buzzer circuits), temperature sensors, pH sensors, DO (Dissolved Oxygen) sensors and Arduino Uno. Sending data from hardware to the user is sent via SIM800l communication.

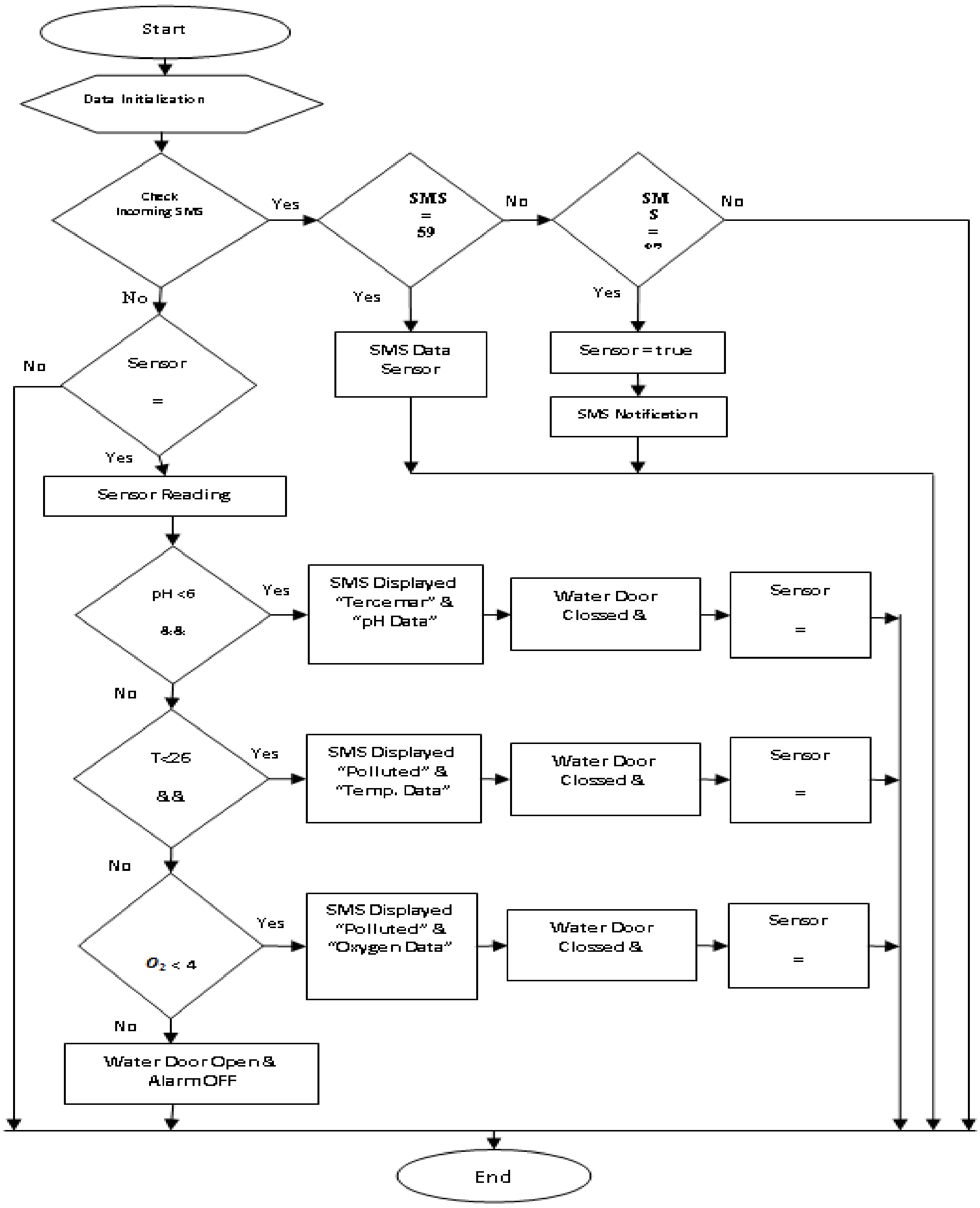

Figure 4. Flowchart of Android-based River Water Pollution Monitoring and Prevention System

A Prototype of monitoring system and prevention of Android-based River water pollution with input of three types of sensors. The sensor used is a pH probe sensor with module V1.1 where the output voltage is affected by the pH concentration in the water. The temperature sensor DS18B20 where the voltage value is linear with readable temperature. Atlas Scientific DO (Dissolved Oxygen) sensor kit module in which the output voltage value is affected by the amount of oxygen dissolved in water. Changes in PH, dissolved oxygen and water temperature are one indication of pollution. If the water is said to be polluted, the servo motor will close the sluice gate as an early precaution against pollution and the SIM800l module will send a notification in the form of an SMS about the water condition.

4. Result and Discussion

4.1 Testing 1 System Effect of Acid pH and Temperature ± 40 °C on Oxygen

Testing 1. System Effect of Acid pH and Temperature ± 40 °C on Oxygen. Testing the effect of temperature and pH on oxygen is intended to determine the results of changes in water conditions after adding pollutants as much as 10 times. The test was carried out randomly within one minute to determine the effect of temperature on the increase or decrease in pH levels of river water. The first step is to take 500ml of random river water samples. Then the water added with acid pollutant in the form of lime juice for 10%, then the oxygen sensor readings were observed. After observing the oxygen sensor readings, the water sample mixture in the acid condition is heated to a temperature of ± 40 ° C.

The equipment used in the test are: Atlas Scientific's Dissolved Oxygen Sensor, V1.1 module pH sensor, DS18B20 Dallas Sensor, LCD circuit, indicator circuit with buzzer, 12 V. power supply.

Table 1. Testing the Effect of Acid Temperature and pH on Oxygen

No	Initial conditions of O_2 River water (ppm)	Initial conditions of water pH	Initial conditions of water Temp.(°C)	Water O_2 after mixed with acid<4 pH (ppm)	Water O_2 acid <4 pH on Temp. ±40°C
1	5,61	7,11	28,86	4,08	3,03
2	5,63	7,13	28,35	4,18	3,08
3	5,60	7,14	28,59	4,04	3,11
4	5,59	7,23	28,01	3,96	3,21
5	5,60	6,87	28,86	4,01	3,15
6	5,62	6,93	28,35	4,03	3,32
7	5,62	7,17	28,86	4,03	3,25
8	5,62	7,08	28,37	4,09	3,22
9	5,61	6,90	28,35	3,99	3,03
10	5,59	6,99	28,86	3,96	3,28
Average Oxygen				4,037	3,168

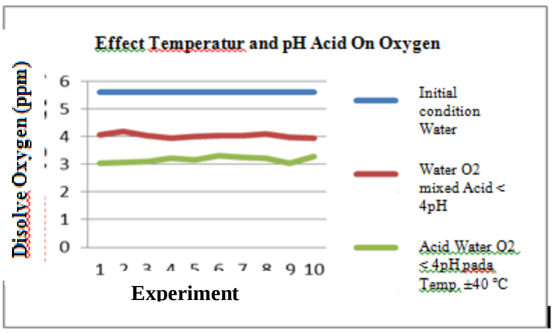

Figure 5. Graph Effect of Temperature Changes and Acid PH on Oxygen

4.2 Testing 2 System of Effect of Base pH and Temperature ± 40 ° C on Oxygen

Table 2. Testing the Effect of Base Temperature and pH on Oxygen

No	Initial conditions of O_2 river water (mg/L)	Initial conditions of pH water	Initial conditions of temp. (°C)	Water Base Basa pH O2 >9 (mg/L)	Water O_2 Base >9 pH on Temp. ±40°C (mg/L)
1	5,61	7,11	28,86	5.00	3.86
2	5,63	7,13	28,35	4.99	3.67
3	5,60	7,14	28,59	5.03	3.86
4	5,59	7,23	29,01	5.15	3.93
5	5,60	6,87	28,86	5.01	3.62
6	5,62	6,93	28,35	4.98	3.47
7	5,62	7,17	28,86	4.99	3.52
8	5,62	7,08	28,37	5.09	3.54
9	5,61	6,90	28,35	4.93	3.61
10	5,59	6,99	28,86	5.01	3.67
Average Oxygen				5,018	3,675

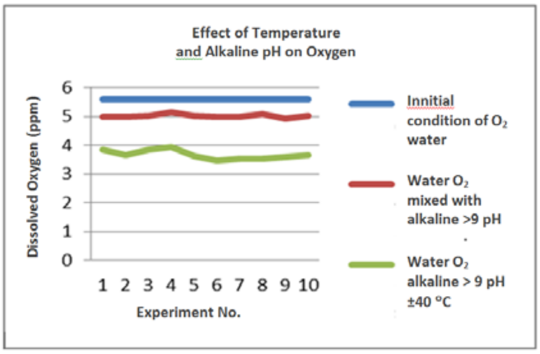

Figure 6. Graph Effect of Changes in Temperature and PH Base on Oxygen

4.3 Testing 3 Sluice Closure Response to Polluted Conditions

Testing 3. Sluice Closure Response to Polluted Conditions Testing of the sluice closure response to polluted conditions is intended to determine the length of time the closure of the sluice door when water pollution is detected as an early preventive measure against pollution.

Table 3. The response of closure of sluice gates when polluted conditions

Experiment no.	**Contitions**	**Motor Servo Response time**	
		Time (s)	**Door status**
1	Polluted	0,66	clossed
2	Polluted	1,1	clossed
3	Polluted	1	clossed
4	Polluted	0,93	clossed
5	Polluted	1,21	clossed
6	Polluted	1,48	clossed
Average time		**1,03**	

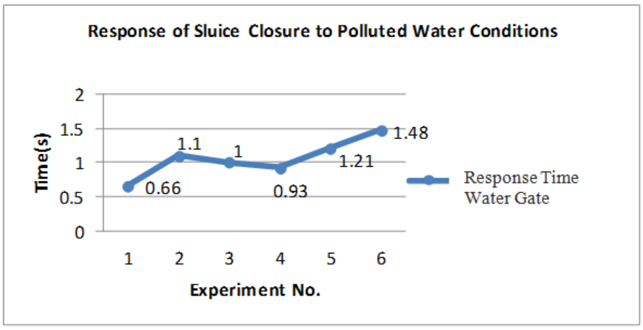

Figure 7. Results of Graph Response of Closing Time of Water Gate to Polluted Water Conditions

5. Conclucions

From the overall test, the average error results from the testing of 3.9% oxygen levels were measured at a pH measurement of 2.8% and 1.01% for temperature measurement. When the acid and alkaline solution is added the sluice closes with an average response time of 1.03 seconds, then sms notification that the contamination can be sent. Tool success rate is 90%. The sluice gate can function as an early prevention of pollution because water pollution leaks are not detected at the time of testing but often experience obstacles to the slow process of sending SMS notifications.

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