

Water quality monitoring at paddies farming based on android

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Abstract. Continuous rice cultivation results in changes in the environment due to poor water quality. House hold waste pollution and industrial waste have been made the degradation of water quality at the paddies farming. The changing of temperature and pH of rice fields influenced on rice crops. The process of rice water monitoring is needed by farmers, to know the quality of water in the rice fields. So in the process of cultivation of rice plants can be monitored the quality of temperature and water pH in rice fields using android. This research basically using DS18B20 Waterproof sensor and pH meter analog kit sensor to know the condition of water quality of paddy field, then can be known the measurement value in response by sensor then read and sent to android with distance up to 10 meter by using Bluetooth module which in with Arduino Uno. The data testing conducted at three difference time i.e. morning, afternoon and at evening. Test results show that if the daytime test, afternoon da early morning the tool can respond to the state of the quality of the rice water. The prototype has been show that parameters of water quality successfully monitored via android.

1. Introduction

Water has a very important role for human life; even water becomes the foundation of society for daily activities and become a source of community livelihoods such as irrigation to farmers and farmers needed as the needs of society in general. A monitoring system that can monitor current water quality has become an urgent need for rice fields spread across Indonesia [1]. This is due to the adverse record caused by underwater activity and the quality of the water did not monitored in real time, which comes suddenly resulting in losses to rice farmers.

The development of increasingly sophisticated technology at this time gave birth to a product that performed resembles a desktop computer device. Smartphone is a minicomputer model product as the development of mobile phone devices. Different applications similar to computer devices could been installed on it. The application of water quality monitoring of rice fields using a receiver inventor on android worked accurately [2] and some monitoring works using technology also have been developed by many researcher [3-7].

2. Research methods

2.1. System design

System design is presented in the form of block diagram. Blocks of this diagram that will help the manufacture of water quality monitoring tools based on android rice. The design block diagram and work system of the tool can be seen in figure 1.



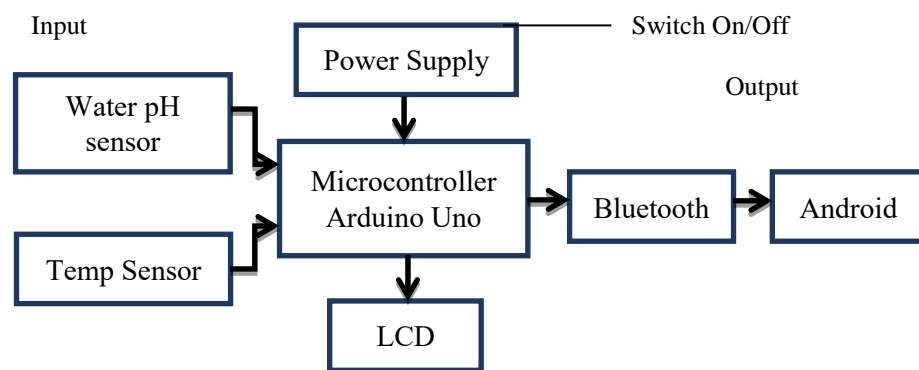


Figure 1. Block system design diagram.

2.2. Hardware Design

The design of hardware consists of a control system Arduino system that served as a sensor controller and perform data processing. The whole system set can be seen in figure 2.

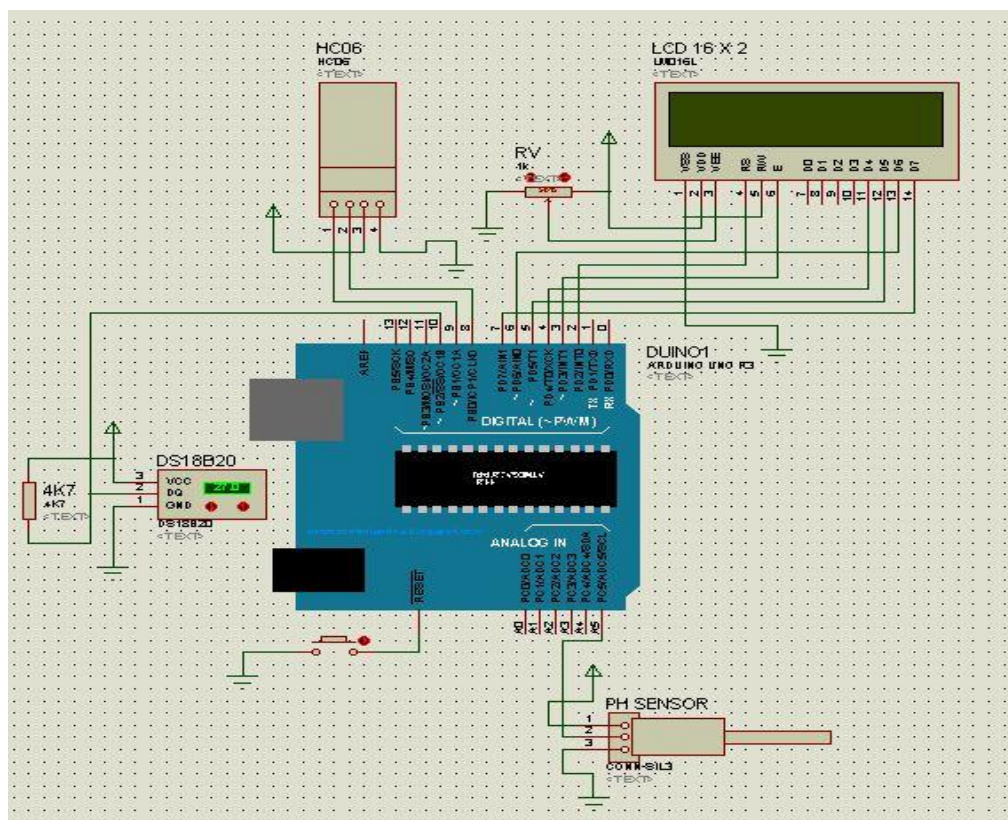


Figure 2. Overall system set.

2.3. Software Design

Software design using Arduino software which is then downloaded on Arduino Uno. Software design is displayed in the following flowchart diagram shown in figure 3.

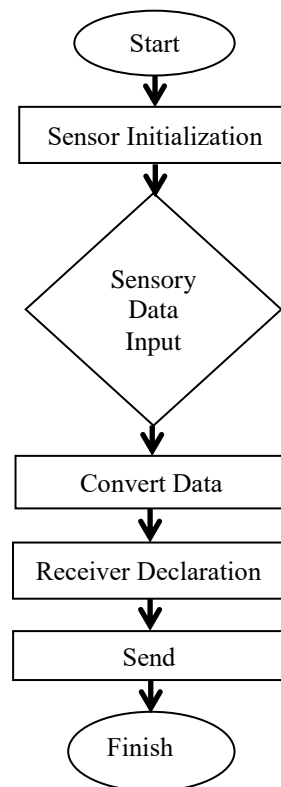


Figure 3. Flowchart diagram.

2.4. Android Device Design

The design of the android device is designed as a receiver. The design of the android device using MIT programming Inventor online mode. App Inventor is a tool for creating android apps. Interestingly this tool is based on visual block programming [5].

3. Results and discussion

3.1 Temperature sensor test DS18B20 waterproof

Waterproof DS18B20 sensor testing is done to determine the response provided by the sensor. Sensor testing is performed to be able to display the sensor measurements that present a temperature value in the water of paddy fields. Water temperature value test is done by using pure water sample, hot water and cold water which is assumed as wetland water to know the expected state of sensor reading. Waterproof DS18B20 temperature sensor testing can be seen in figure 4. Searched for average on sensors and measuring instruments and searched for average error then there will be comparable final results of both are calculated using equation (1) – (3).

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n} \quad (1)$$

$$E = \left[\frac{x - \bar{x}}{\bar{x}} \right] \times 100 \% \quad (2)$$

$$\bar{E} = \frac{\sum_{i=1}^n E_i}{n} \quad (3)$$

Information:

- \bar{x} : Average measurement results with the sensor
 E : *Error measurement with sensor*
 x : Measurement with sensor
 x_i : Number of measurement results with the sensor
 n : Number of measurements
 \bar{E} : Average measurement error with the sensor
 E_i : Number of errors



Figure 4. Testing temperature sensor DS18B20 waterproof.

3.2. Sensor analyzer pH meter testing kit

Basically testing the pH Meter Analog Kit sensor is the same as the previous temperature sensor test, done to find out a value indicated on the sensor. Sensor testing is performed to be able to display pH measurement of rice field water. The test was performed three times as in figure 5 the first test was performed using a well water test sample, the second test was carried out using soap water and the third test was performed using orange juice samples.



Figure 5. Testing pH meter analog kit sensor.

In the test of figure 5 it can be explained the sensor reading value will be in accordance with the water condition at that time, because basically soap water has a high or alkaline pH. The test is done three times, the first test, second and third then the results obtained as table 1.

Table 1. Test analyzer pH Meter kit sensor.

No	Test Material	Digital pH Meter	pH Meter Analog Kit	Info	Accuracy (%)
1	Orange Water	3.50	2.88	Acid	82.28
2	Pure Water	6.80	6.39	Normal	93.98
3	Soap water	10.60	10.84	Bases	97.79
Average accuracy					91.35

3.3. Android testing

In testing Bluetooth connection to android is a communication between hardware with android smartphone with the aim to know the transmission distance between Bluetooth found on android smartphone with Bluetooth module HC-06 which has been integrated with Arduino Uno circuit. The test of Bluetooth connection is shown in table 2.

Table 2. Testing Bluetooth connection

No	Distance (m)	Information
1	1	Current receive orders
2	5	Current receive orders
3	6	Current receive orders
4	7	Current receive orders
5	8	Current receive orders
6	9	Current receive orders
7	10	Current receive orders

3.4. Comparison of DS18B20 waterproof temperature value with digital thermostat

The temperature sensor and pH testing is done at day time. The results (table 3) obtained is the average DS18B20 Waterproof temperature of 29.44°C and the measuring instrument is a temperature of 29.55 °C. For the average of the measurement error generated from the two temperature sensors is 0.37, while for the average accuracy of the temperature measurement is 98.77% which means the accuracy of the measurement is approaching a significant result.

Table 3. Results of data collection on the temperature sensor.

No	Time	Temperature(°C)		Difference	Measurement Accuracy (%)
		DS18B20 Waterproof	Digital Thermostat		
1	13.33	29.30	29.7	0.40	98.65
2	13.36	29.32	29.7	0.38	98.72
3	13.39	29.32	29.7	0.38	98.72
4	13.42	29.40	29.4	0.00	100.00
5	13.45	28.99	29.1	0.11	99.62
6	13.48	29.56	29.2	0.30	98.98
7	13.51	29.67	29.2	0.47	98.41
8	13.54	29.88	29.3	0.58	98.05
9	13.57	30.01	29.4	0.61	97.96
10	14.00	30.11	29.7	0.41	98.63
Average		29.55	29.44	0.36	98.77

3.5. Comparison of pH Meter Analog Kit value with Digital pH Meter

The results (table 4) obtained are the average measurement of Digital pH Meter with a pH of 6.9°C and the average result on pH Meter Analog Kit sensor is 6.95. For the average of measurement error resulting from both pH sensors is 0.57, whereas for the average accuracy of pH measurement is 97.25%.

Table 4. Test results of data on the pH sensor.

No	Time	pH		Difference	Measurement Accuracy (%)
		pH Meter Analog Kit	Digital pH Meter		
1	13.33	7.11	7.0	0.11	98.45
2	13.36	7.09	7.0	0.09	98.73
3	13.39	7.09	7.0	0.09	98.73
4	13.42	6.92	6.9	0.02	99.71
5	13.45	6.80	6.9	0.10	98.26
6	13.48	6.68	7.0	0.40	94.28
7	13.51	6.76	6.9	0.14	96.84
8	13.54	6.79	6.8	0.01	99.85
9	13.57	7.23	6.8	0.43	94.60
10	14.00	7.16	6.7	0.46	93.57
Average		6.95	6.9	0.18	97.25

3.6. Comparison pH Meter Analog Kit and Digital pH Meter

The result of observed data on pH sensor is shown in table 5. Measurements using pH meter analog kit sensors obtained an average measuring value of pH 6.60 and measurements using digital measuring instruments obtained an average pH value of 6.99.

Table 5. The observed data on the pH sensor

No	Time	pH		Difference	Measurement Accuracy (%)
		pH Meter Analog Kit	Digital pH Meter		
1	06.33	6.55	6.8	0.25	96.32
2	06.36	6.55	6.8	0.27	96.04
3	06.39	6.60	6.9	0.30	95.65
4	06.42	6.70	6.9	0.20	96.82
5	06.45	6.72	6.9	0.20	96.82
6	06.48	6.65	7.0	0.35	94.72
7	06.51	6.50	7.1	0.60	91.42
8	06.54	6.50	7.0	0.60	91.54
9	06.57	6.51	7.2	0.69	90.41
10	07.00	6.68	7.1	0.42	93.42
Average		6.60	6.98	0.38	94.51

3.7. Android application tests

Testing this system is done by installing applications that have been created by using MIT Inventor with step barcode on android smartphone, application named "Rice Field". The display to open the app is shown in figure 6.



Figure 6. App display on android smartphone.

Display android smartphone applications in general just like any other application. Testing of this application is done to determine the response given by the application on android for monitoring the quality of rice water with temperature parameters and water pH. Once the application can already be installed on android then the next step is to activate the existing Bluetooth on android smartphone as wireless on the smartphone.

In the monitoring application android step to connect to the hardware is to click the Bluetooth button on the application, then connect with Bluetooth HC-06 with a note between the android with hardware not too far when connecting because it can interfere with the response given to the application and cause errors. After being able to connect with Bluetooth eat the results of monitoring will be displayed measuring value on android.

Following on the results of research and testing obtained evidence when the tool started on (connected to the battery) and both sensors dipped into wet water then the LCD will display the results of measuring. Then Bluetooth will send digital data to android which means monitoring tool can run as expected. The data will be displayed and always update if on the hardware change then the android application also changed with the same value. Next is when finished using the app on android then the next thing is logout on the app by pressing the back button on android then press "Yes". Here is the view when logout. Quality of connection is less or unstable.

4. Conclusion

In the results obtained in all tests, analog pH meter kit sensor and DS18B20 sensor performed water quality. The comparison of data between temperature and pH water readings using sensors and standard measuring instruments in can be temperature and pH of water on android can run and according to display data on LCD. If the temperature changes then the android display also changes and runs as where expected.

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