Fish Cultivation Engineering in Buckets Based On the Internet of Things (IoT)

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***Abstract*—The development and population growth that are increasing from time to time have an impact on the expansion of housing areas. This results in a decrease in the land that can be used by the community for raising livestock and planting crops. To keep maximizing the remaining land, several community groups utilize the remaining land by cultivatingfish through the Fish Cultivation Technique in Buckets. The current problem is that fish cultivators are still manually measuring water quality by visiting fish ponds and using simple measuring instruments. It affects the effectiveness of fish farming. so the researchers create a monitoring system with the title Fish Cultivation Technique in Bucket Based on the Internet Of Things (IoT). In this study, researchers used 3 sensors: the DS18B20 sensor, the Turbidity sensor, and the water level sensor. The DS18B20 sensor is used to measure the water temperature, the turbidity sensor is used to measure the turbidity of the water, and the water level sensor is used to measure the water level. From the test results of the whole system, it can be seen that if the water turbidity sensor readingis less than 15.24 NTU then the bucket water is said to be normal, while if the sensor reading is more than 15.24 NTU,the water is said to be cloudy so the relay will be on to drain the bucket water. While the results of the water temperature sensor readings are less than 26.2 to 30.0°C then the water is said to be normal bucket water. If the temperature sensor readings are more than 30°C then the water is said to be hotthe relay will be active to turn on the aeration.**

Keywords—Fish, Turbidity, DS18B20, Water Level, Internet of Things

I. INTRODUCTION

The increasing development and population growth from time to time have an impact on the expansion of residential areas. This resulted in the reduction of land that can be used by the community to raise livestock and grow crops. To keep maximizing the remaining land some community groups make use of the remaining land by doing fish farming through fish farming techniques in buckets as done by the people of Muara bulian Jambi province. Catfish Clarias gariepinus is a superior commodity that currently continues in the fishery. This mustachioed catfish family is one of the leading fishery commodities in Indonesia, especially freshwater aquaculture. Director General of processing and marketing of fishery products (P2HP) said, 60% of fishery production that has a very high domestic market is freshwater fisheries including Catfish. Several factors that must be considered to produce fish with good quality are water quality and proper feeding time. Water quality is the main thing in catfish farming which includes the temperature of 25-30°C, optimal pH that is 6.5-8, and turbidity of less than 400 NTU. Internet of Things is a concept that in its application seeks to integrate and connect all electronic devices using the internet network. This research applies IoT to monitoring water turbidity and water temperature in Bucket Fish Cultivation. Research on Fish Cultivation Techniques in Buckets Based on the Internet of Things has been carried out by several researchers. Some summaries of the Literature Study are used to determine the extent to which the research has been carried out.[1], [2] with the title Catfish Cultivation in Catfish Farmers. The purpose of the training is to increase catfish production using the biofloc method. The biofloc system of catfish farming is a fish rearing system by growing microorganisms that function to process the aquaculture waste itself into small lumps that are useful as natural fish food. This biofloc system is consideredeffective and able to increase the productivity of catfish. Theproduction of catfish produced is around 3000 fish with a weight of 96 110 kg from 4000 fish seeds. This method also produces 20% heavier fish with a faster harvest period of about 20% (2.5 months) than the conventional method [3] with the title "Automating Monitoring and Adjusting Acidity of 114 Solutions and Water Temperatures of Fish Ponds in Catfish Hatcheries" about automation of monitoring PH and temperature levels with the output displayed on the LCD screen and the monitor in graphic form. [4], [5] with the title "Water Turbidity Monitoring System and Automatic Feeding on Microcontroller-Based Fish" about feeding three times a day automatically and measuring the level of water turbidity using a sensor processed by the microcontroller as a controller with the output displayed on the LCD screen followed by LED lights. [6] about monitoring basic needs using a microcontroller-based android. The researcher uses a limit switch sensor to count the number of eggs, a load cell sensorto calculate the weight of rice, an Arduino microcontroller as a control, and Android as a display to determine the amount of staple food inventory that can be accessed via wifi. [7], [8] Cigarette Smoke Monitoring System Using Internet of Things (IoT) Based Smartphones. This study develops a cigarette smoke monitoring system using the internet so that the monitoring range becomes wider. This system uses an MQ 135 sensor as a smoke detector, Arduino Uno will process input from the sensor, and Arduino Ethernet Shield which is already connected by a modem will send sensor input data to the Thingspeak web server and then it will be displayed to the smartphone. The internet is used as a transmission medium between smartphones and smoke detectors. The test results prove that this system can monitor smoke anywhere as long as the smartphone is still connected to the internet. [9] with the title Designing a Water Quality Monitoring System in Freshwater Fish Cultivation Previous research has been carried out by monitoring the condition of water quality using only one or two sensors, for example, pH and temperature. Meanwhile, several other parameters should also be considered, such as water turbidity and dissolved oxygen for better fish growth. This research is expected to minimize the mortality of freshwater cultured fish so that fish production increases and creates good community food security. Testing this sensor using coffee water as in the 5th cup, tea water like the 6th glass, and milk like the 7th glass, the results of the turbidity sensor testing by testing coffee water, the measurement results on the LCD are 8617.95 Nephelometric Turbidity Units (NTU). is the result of testing the turbidity sensor by testing on tea water, the measurement results on the LCD are 125333.75 NTU. As the result of testing the turbidity sensor by testing on milk, the measurement results on the LCD are 5483.52 NTU.

II. METHODOLOGY

The research steps that will be carried out in the Fish Cultivation Technique in Bucket (Budikdamber) are Based on the Internet Of Things (IoT). The research flow used is shown in Figure 1.

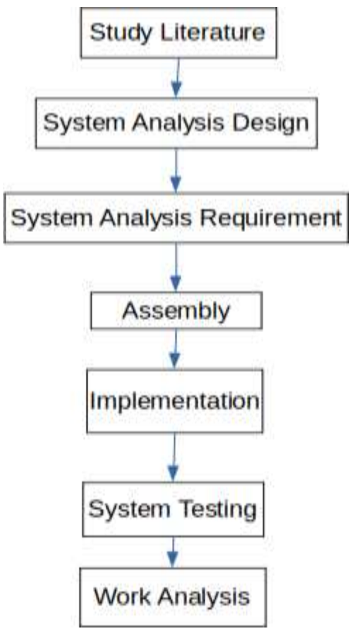

Figure 1. Research Flow

Before making Fish Cultivation Techniques in Buckets (Budikdamber) Based on the Internet of Things, several tools must be prepared. The list of equipment used in this research can be seen in table

Table 1. Main materials used

Material Name	**Function**
Turbidity Sensor	Read the turbidity level of the water
Temperature Sensor	Read water temperature value
Blynk app	To display the reading turbidity and water temperature sensor
Aerator	Use to help dissolve oxygen what is in the air into the water
Relay	As *on/off*
acrylic box	As a place or home of all components
NodeMCU ESP8266	As a control module where to store programs and run programs, so that the system can run as desired

System design is something that is done to simplifythe process of making tools. DraftFish Cultivation Techniques in Buckets (Budikdamber) Based on the InternetOf Things (IoT) illustrated in the block diagram can be seenin Figure 2.

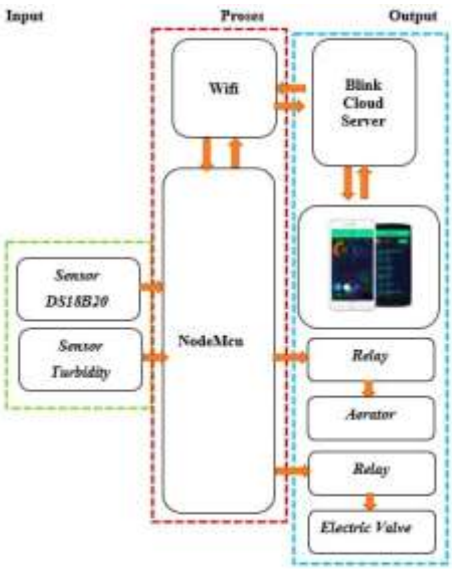

Figure 2. System Block Diagram

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The power supply circuit is used to change the AC 220V voltage to DC 12V in the 12 volts and 5-volt power supply maker using IC LM7812and the LM7805 distributes a voltage source to all electronic components, namely a voltage of 12 volts will be used as a voltage source from a DC motor and 5 volts is used as a voltage source on an Arduino that is in a circuit so that the circuit can work well in the power supply circuit as shown in Figure 3.

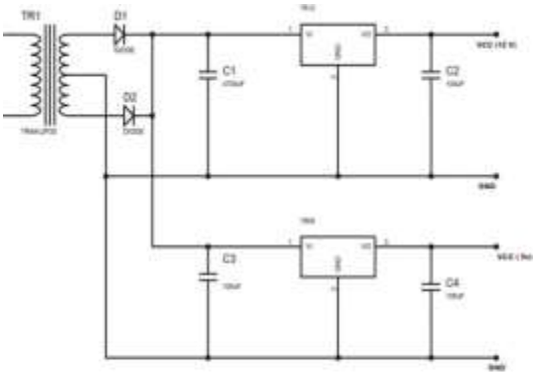

Figure 3. Power Supply Circuit

The DS18B20 sensor is used as an input to read thetemperature on the budikdamber. The image of the DS18B20 sensor circuit can be seen as shown in Figure 4.

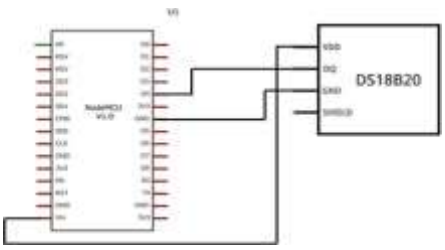

Figure 4. DS18B20 Sensor Circuit

The Turbidity circuit is used as an input to be processed by nodemcu so that it will read the turbidity of thewater. The image of the turbidity circuit and layout can be seen in Figure 5.

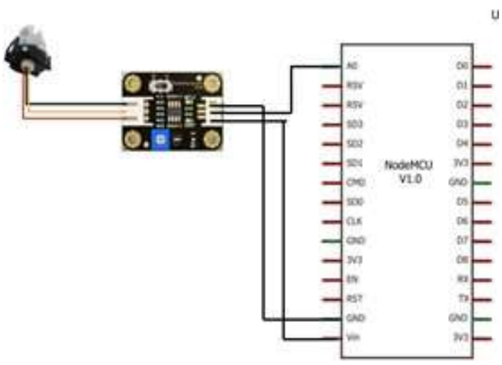

Figure 5. Turbidity sensor circuit

Software design is made from making flowcharts to making hardware. Figure 6 will show the flowchart of theprogram that will be made in this research.

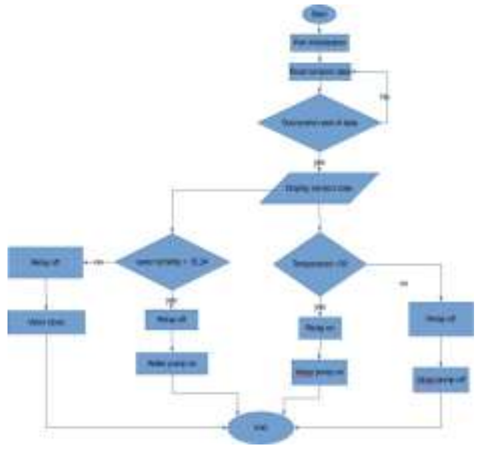
Figure 6. Flowchart system

This design needs to be made to help or facilitate researchers in implementing tools in fish farming in a bucket of mechanical system design drawings that will be made as follows:

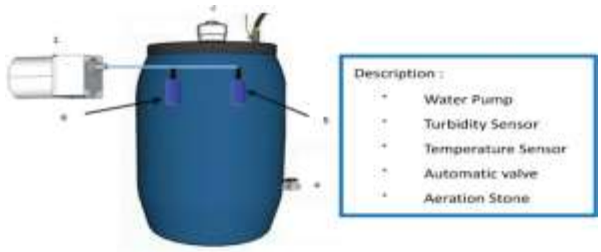

Figure 7. Mechanical Design

III. RESULT AND DISCUSSIONS

Testing begins by ensuring each component (Nodemcu, Turbidity sensor, DS18b20 temperature sensor, relay, and blynk application) whether the tool that has been made is in good condition and can work properly according to the program that has been made, then checks every line connected to the component used. has been connected, where the circuit is adjusted to the schematic drawing.

The tests carried out include testing the Turbidity sensor, DS18b20 temperature sensor, relay, and blynk applications and testing the whole system.

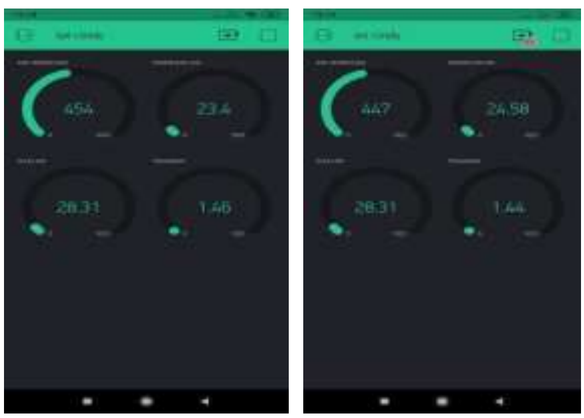

Figure 8. Testing on the Blynk application

Temperature sensor testing was carried out so that researchers knew the response of the DS18B20 temperature sensor with water in the room within a few minutes. In this trial, the researchers conducted 2 experiments, namely by measuring the temperature of warm water and cold water temperature and using a digital thermometer to compare the sensor readings. The results of the temperature sensor readings are shown in Table. To determine the accuracy of the DS18B20 sensor readings, a temperature sensor response test was carried out on different media. Test data can be seen in the table

Table 1. Testing the Response of the DS18B20 Warm Water Sensor

t(minutes)	Therm (“C)	Sensor (“C)	Error(%)
1	48.8	48.89	0.184
2	48.5	48.85	0.103
3	47.9	47.94	0.013
4	47.5	47.49	0.021
5	47	47.11	0.234
6	46.5	46.5	0
7	46	46.11	0.239
8	45.7	45.61	0.196
9	45.2	45.24	0.088
10	48.8	48.8	0
Average			0.00714

The measurement results by the DS18B20 sensor show that the temperature of the warm water decreases every minute. This decrease is due to the heat present in the warm water releasing heat into the air. The temperature response obtained is linear, that is, the average temperature decreases by C every minute.0. 184

$$Er(\%) = \frac{(valueofSensorDS18b20)-(value\ of\ Thermometer)}{value\ of\ Thermometer}\ x100$$

$$Er(\%) = \frac{(48.89)-(48.8)}{48.8}\ x100\%$$

$$Er(\%) = \frac{(0.9)}{48.8}x100\%$$

$$Er(\%) = 0.184$$

Calculation of the average error when testing the DS18b20 temperature sensor.

$$Average\ Error(\%) = \frac{\sum Error}{\sum Trial}$$

Table 2. Testing the Response of the Cold Water DS18B20 Sensor

t(minutes)	Therm (“C)	Sensor (“C)	Error(%)
1	14.2	14.18	0.14
2	14.2	14.2	0
3	14.3	14.27	0.209
4	14.4	14.38	0.138
5	14.5	14.48	0.137
6	14.6	14.57	0.205
7	14.6	14.61	0.068
8	14.8	14.77	0.202
9	14.9	14.88	0.134
10	15	15.12	0.28
Average			1.828

The results of the DS18B20 sensor measurement with cold water media, the temperature response in cold water will gradually change in magnitude from low temperature to high temperature. This is because there is a temperature difference between cold water and room temperature. From the data obtained, the readings every minute experience a temperature change of around 1.82^oC. It can be said that the temperature detects linearly.

$$Er(\%) = \frac{(valueofSensorDS18b20)-(value\ Thermometer)}{Value\ of\ Thermometer}x100\%$$

$$Er(\%) = \frac{(14{,}18)-(14{,}2)}{14{,}2}\ x100\%$$

$$Er(\%) = \frac{(0.00241)}{14.2}x100\%$$

$$Er(\%) = 0.140$$

Calculation of the average error when testing theDS18b20 temperature sensor.

$$AverageEr(\%) = \frac{2.0395475}{10}$$

$$AverageEr(\%) = 0{,}183$$

$$AverageEr(\%) = 0.00714$$

From some of the test results above, it can be concluded that the DS18B20 sensor can be used (not damaged). In the test results, there are differences in the results of reading the temperature value of the DS18B20 sensor with a digital thermometer. The difference is due to the different sensitivity and accuracy of each sensor. The temperature change on the DS18B20 sensor is faster than that of a digital thermometer.

Table 3. DS18b20 Temperature Sensor Test Results in Bucket Tub

Trial of TemperatureSensor	Measurement Results Aeration	Relay Condition
bucket 1	26.2	OFF
bucket 2	29.81	OFF
bucket 3	35.03	ON
bucket 4	33	ON

Note: If the temperature is > 30 then the aeration pump will turn on

Table 4. Testing the Measurement of the Water Turbidity Sensor

Trials	Voltage (v)	Value ADC	Turbidity (NTU)
1	1.8	558	5.85
2	1.83	568	4.84
3	1.73	536	9.56
4	1.72	535	9.73
5	1.75	549	7.37
6	1.44	448	24.41
7	0.33	103	82.79
8	1.63	505	14.79
9	1.6	498	15.97
10	1.58	489	17.49

From the results of sampling some water with known turbidity values, it can be seen the relationshipbetween the voltage generated by the sensor and the level of turbidity. From the test results, it can be concluded that the higher the level of turbidity measured, the smaller the voltage generated by the sensor, which also causes the ADCvalue to be smaller. The calculation of the conversion of ADC to NTU values is as follows:

Formula:
$voltage = ValueADC * (Value\ Ref\ )$
$Turbidity = 100 - (\ tage\ Ref) * 100$

Table 5. Relay Test

Trials	Relay	Voltage	Relay Condition
1	Low	2.26	Off
2	Low	2.27	Off
3	High	5.01	On
4	High	5.02	On

From the test results of the whole system, it can be seen that if the water turbidity sensor reading is more than 1.04 and less than 12.26 NTU then the bucket water is said to be normal, while if the sensor reading is more than 15.24 NTU then the water is said to be cloudy so the relay will be on to drain the bucket water. While the results of the water temperature sensor readings are less than 26.2 to 30.0ºC then the water is said to be normal bucket water and if the temperature sensor readings are more than 30ºC then the water is said to be hot so the relay will be active to turn on the aeration.

IV. CONCLUSION

From the test results, it is found that if the value of the NTU unit dissolved in water is read higher, the lower the water quality and the higher the turbidity of the water, and vice versa if the NTU unit value dissolved in water is readlower, it can be said that the water quality is getting worse. good and the turbidity of the water is getting lower. From the test results of the whole system, it can be seen that if the water turbidity sensor reading is more than 1.04 and less than 12.26 NTU then the bucket water is said to be normal, while if the sensor reading is more than 15.24 NTU then the water is said to be cloudy so the relay will be on to drain thebucket water. While the results of the water temperature sensor readings are less than 26.2 to 30. 0ºC then the wateris said to be normal bucket water and if the temperature sensor readings are more than 30ºC then the water is said to be hot so the relay will be active to turn on the aeration. From the test results, it can be concluded that the higher the level of turbidity measured, the smaller the voltage generated by the sensor, which also causes the ADC value to be smaller.

LIMITATIONS AND STUDY FORWARD

The scope or plan of the study for this paper must use artificial intelligence and use more than one kind of sensor.

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