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Development of Tools Growth Catfish Based on the Internet of Things (IoT)

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ABSTRACT

Factors that affect the growth of catfish include water temperature, pH levels, and feeding according to the growth of catfish. Feeding and water replacement are currently still done manually, using human power. Maintaining feed and water quality in the tub automatically is necessary to save time and effort. The automatic settings to maintain feed and water temperature as well as good water acidity for catfish in the tub can use the NodeMCU microcontroller. This research method is carried out by designing tools, testing tools, objects and stages of tools and concluding. Parameters of water temperature and pH levels of water are sent to the telegram application, as well as to regulate the discharge of water, a pump that works automatically is used through a relay that is installed automatically. The monitoring results are successfully displayed via the ThingViewer application. The tool has worked well with tests carried out including testing the design of the tool, testing the temperature sensor, testing the pH sensor, and testing the sending of orders from Telegram. The yields obtained were different between the two treatments, namely without using tools (non-tools) using tools (tools), the ideal growth of catfish for a temperature of 29 °C and a minimum pH of 6.5 and a maximum of 9.

Introduction

Catfish is one type of fish that can live in high density (Abdel-Aziz et al., 2021; Saputro, 2016). This fish has a good conversion rate of feed into body weight. For properties like this, catfish farming will be very profitable if done intensively (Suraya et al., 2016). There are two segments of the catfish farming business, namely the hatchery segment and the rearing segment. The hatchery segment aims to produce catfish fry, while the rearing segment aims to produce catfish ready for consumption (Retnowati et al., 2020). Cultivation of catfish is generally carried out with tarpaulin ponds or soil ponds (Mulyani, 2017). But now people are starting to cultivate catfish in tubs. In general, it is also called fish cultivation in a tub. Fish farming in this tank is suitable for utilizing narrow land. More precisely, for urban areas where land is already limited, there is no other choice but to take advantage of improvised land. As a distributor of hobbies and spare time, it also turns out to be very good in fulfilling catfish which is healthier and does not contain contamination with harmful ingredients.

In ponds where catfish are cultivated, it is very important to pay attention to the condition of the pond water. Water that does not meet the requirements is a source of disease which will be very dangerous for the growth of catfish, while the quality of water that is considered good for the life of the catfish is as follows. The optimum water temperature in intensive catfish rearing is 25 – 30 °C (Besson et al., 2016). Another parameter that must be considered is that catfish generally live normally in an environment that has a dissolved oxygen content of 4 mg/l. Often the oxygen content changes suddenly, for example, due to the decomposition of organic matter. Acidity or a good pH for catfish is 6.5 - 9.0 pH less than 5 is very

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bad for catfish, because it can cause clumping of mucus in the gills, while a pH of 9 and above will cause a reduced appetite for catfish (Azizah et al., 2019; Hasyimia et al., 2016; Junaidi et al., 2021; Prihatini & Febrianto, 2021).

Along with the development of current technological advances, ease in caring for catfish farming is needed. Especially for cultivation on a small scale. The maintenance of catfish farming in tanks that is quite often carried out is to provide feed and change the water. Feeding and water replacement are still done manually, using human power. To maintain feed and water quality in tanks automatically is necessary to save time and effort. Automatic settings to maintain feed and water temperature as well as good water acidity for catfish in tanks. This research aims to develop a catfish growth tool using the NodeMCU microcontroller and other supporting tools that are quite simple, both in terms of work systems and circuits. The advantage of this tool is that this tool can provide feed automatically, regulate water according to water temperature and acidity, and provide reports (feeding, temperature and water acidity) to the owner as a monitoring of catfish growth. This is done so that everyone who uses it can understand it easily. NodeMCU is an open source IoT platform. Consists of hardware in the form of System On Chip ESP8266 from ESP8266 made by Esperessif System. NodeMCU can be analogized as an Arduino board connected to the ESP8622 (Bento, 2018; Škraba et al., 2016). ESP8266 is a wifi module that functions as an additional microcontroller device (Nugroho & Pantjawati, 2018). This versatile WiFi module is already a SoC (System on Chip), so we can do programming directly to the ESP8266 without the need for an additional microcontroller.

Methods

Tool Design

At this stage, the tool is designed with circuits in each component to become a unified tool that functions and works well. Several stages are carried out in designing the tool, such as studying and recognizing the characteristics of each of the main components.

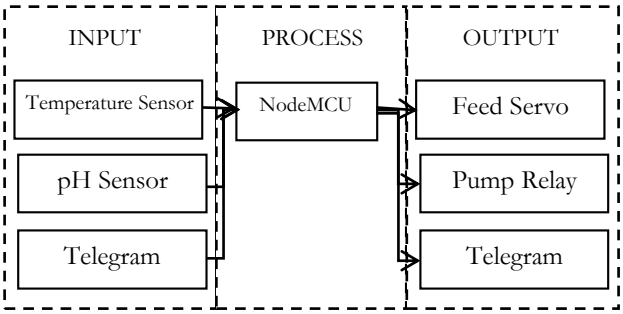
Testing Tool

At this stage the tool is tested in accordance with the design that has been done, aiming to find out if the circuit that has been carried out is working properly and correctly without any obstacles. This is also to find out that each component works according to the function of each component.

Objects and Tool Stages

The object of this research is to design a growth tool for catfish farming based on the Internet of Things (IoT) using the NodeMCU microcontroller. This tool can monitor pH levels, water temperature, feed trays automatically to catfish, and make reports of water control handling actions via telegram to catfish farmers automatically.

Figure 1
Tool Work Stage



The general stages of the tool in Figure 1 consist of three parts, including input, process, and output. The input stage of the tool is a temperature sensor which is useful for knowing the condition of the water temperature in the tub, and a pH sensor which is useful for knowing the acidity of the water in the tub. The process stage is carried out by NodeMCU, the working

principle of NodeMCU will receive input from components in the input stage such as the Waterproof DS18b20 temperature sensor and sensor 3. pH meter Detector PH-4502C.

Withdrawal of Conclusion

At this stage, conclusions are drawn from the research that has been carried out by reporting the results that have been carried out including explanations and processes during the research during the study by comparing the tools made with standard tools.

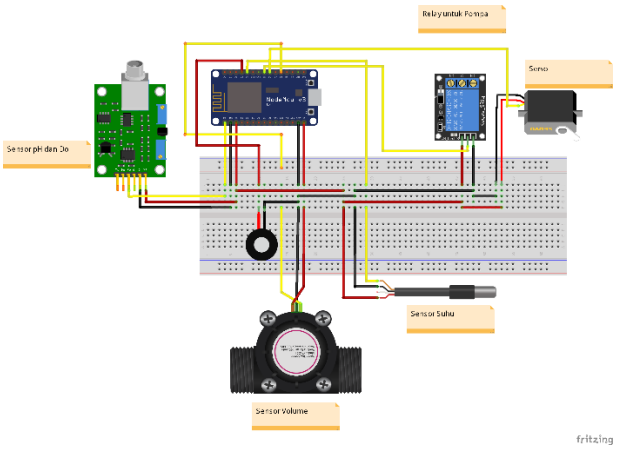
Result and Discussions

Tool Design

The design of growth tools in Internet of Things (IoT) based catfish farming uses a NodeMCU microcontroller which will automatically feed and replace water according to the standard of living of catfish. The design of the tool is carried out by combining components, including the Waterproof DS18b20 temperature sensor, pH meter sensor Detector PH-4502C, Micro Servo Motor SG90 9G,

Relay, connecting cable and NodeMCU microcontroller as command memory.

Figure 2
Tool Design



Temperature Sensor Test

The process of testing the temperature sensor by observing the results of the sensor by comparing it with a thermometer. The data is observed by looking at the temperature value for an interval of one second for each temperature sensor reading with a temperature measuring instrument, a thermometer, and a probe from each tool placed in the water medium.

Table 1
Test Data of Water Temperature Sensor

No.	Delay (second)	Temperature (°C)	
		Sensor	Thermometer
1.	1	29.0	29
2.	2	29.0	29
3.	3	29.0	29
4.	4	29.0	29
5.	5	29.0	29

The value of the measurement results in Table 1 the average value of the temperature sensor is 29.0 °C, while the average value of the thermometer measuring instrument is 29 °C. The results of the comparison of the temperature sensor with the thermometer measuring instrument found the same value. Testing the temperature sensor is also a calibration for the temperature sensor to be used (Prihatmoko, 2016).

pH Sensor Test

The process of testing the pH sensor is carried out to determine the characteristics of the pH meter sensor and prove that the sensor is working properly (Vera et al., 2021). Another purpose of this test is to make it easier to calibrate the pH meter sensor if an error occurs in the sensor reading result.

Table 2
Test Data of pH Sensor

No.	Delay (second)	pH	
		Sensor	Digital pH Meter
1.	1	3.18	3.16
2.	2	3.18	3.16
3.	3	3.19	3.18
4.	4	3.19	3.18
5.	5	3.18	3.16

The value of the results obtained from testing the pH sensor is shown in Table 2, getting an error of 1.6% from the comparison of the results of measuring the pH sensor with a digital pH meter. This data has a greater pH value compared to a digital pH meter because the pH sensor used has a high sensitivity (Fitria et al., 2021).

Testing Sending Orders from Telegram

The testing process from commands from the telegram application to the development tool is carried out to see the success of the changes made by the tool in accordance with the commands given through the telegram application as shown in Table 3.

Table 3
Messaging Data from Telegram

No.	Message	Change	
		Telegram	Tool
1.	1	Receive Message Feed	Feed Catfish
2.	2	Receiving Messages for Water pH Data	Sending Water pH Data Message
3.	3	Receiving Water Temperature Data Message	Sending Water Temperature Data Message
4.	4	Receiving a Pump On Message	Turning on the Pump Relay
5.	5	Receiving Pump Off Message	Turning off the Pump Relay

Harvest

There are two conditions of treatment carried out in this study, namely treatment using tools (tools) and treatment not using tools (non-tools). These treatments are to see the ideal growth of catfish (Sihombing et al., 2018).

The pond is left for 5 days until the moss or phytoplankton grows naturally and then the catfish are stocked in the tub. The tool is installed when the catfish has adjusted to the conditions of its environment for about 7 days. The yield of catfish in Table 4 which was carried out in a 5-week trial of the tool showed the difference between the two treatments.

Table 4
Catfish Harvest Data

Week	Treatment	Average			Number of Fish
		pH	Tempera-ture	Fish Weight (gram)	
0	Tool	7.26	29	78	26
	Non Tool	7.06	29	91	28
1	Tool	7.35	29	109	26
	Non Tool	9.25	26	101	24
2	Tool	7.25	29	142	26
	Non Tool	9.10	26	118	22
3	Tool	7.26	29	180	25
	Non Tool	9.13	26	132	20
4	Tool	7.25	29	202	25
	Non Tool	9.10	26	144	19
5	Tool	7.02	29	230	25
	Non Tool	9.00	26	150	18

The initial data is given the difference in the number of catfish because the containers used have different sizes. The data in Table 4 shows that the differences between the two treatments can be seen in the weight of catfish and the number of catfish that are still alive each week. Feeding using the same portion. The differences that affect the growth of catfish are in the water temperature and pH levels of the water (Taragusti et al., 2019). A tub that uses a tool will optimize the growth of catfish in accordance with the viability of the catfish. On the other hand, a tank without a catfish growth tool cannot be monitored regularly. Conditions like this cause the water temperature and pH levels of the water in the tub to change and affect the catfish's appetite (Hasan et al., 2020).

Conclusions

The growth tool in the Internet of Things (IoT) based catfish farming using the NodeMCU microcontroller has successfully obtained the results of the monitored parameters including temperature using the Waterproof DS18b20 temperature sensor, water pH traps using a sensor 3 pH meter Detector PH-4502C, and the automation process of feeding using Micro Servo Motor SG90 9G. To maintain the parameters of the water temperature and pH levels of the water sent to the telegram application, as well as to regulate the discharge of water, a pump that works automatically is used through a relay that is installed automatically. The monitoring results are successfully displayed via the ThingViewer application. The yields obtained were different between the two treatments, the ideal growth of catfish for a temperature of 29 °C and a minimum pH of 6.5, and a maximum of 9.

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