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Designing a Water Temperature control and Monitoring System for Vaname Shrimp cultivation based on the Internet of Things (IoT)

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ABSTRACT

Vannamei shrimp cultivation (Litopenaeus Vannamei) is one of the rapidly growing industries in fisheries. Optimal water quality, including the appropriate water temperature, is a crucial factor in maintaining the growth and health of vannamei shrimp. Therefore, this research aims to design and implement a monitoring and water temperature control system using a microcontroller in vannamei shrimp cultivation. The research method involves the development of a system prototype consisting of a water temperature sensors, microcontrollers, and temperature control modules. The water temperature sensor is used to measures the water temperature in the vannamei shrimp cultivation pond, while the microcontrollers is responsible for acquiring temperature data from the sensor and controlling the temperature control modules based on predetermined parameters. The research results show that the monitoring and water temperature control system using the microcontrollers is capable of accurately measuring the water temperature with high precision. The obtained temperature data can be displayed in real- time through the microcontroller's screen or accessed via computer-based applications. Moreover, the system is also capable of adjusting the temperature according to the setpoint, utilizing LEDs lights (red, green, yellow) US indicators for activating and deactivating the heating and cooling device. In field's trials, this system was implemented in vannamei shrimp cultivation ponds of a specific size.

KEYWORD Vannamei shrimp cultivation, Real- time monitoring, temperature sensors, microcontrollers.

1. INTRODUCTION

Vaname shrimp (Litopenaeus Vannamei) cultivation has become one of the rapidly growing fisheries sectors in recent years [1] . Optimal water quality, including proper water temperature, is a key factor in maintaining good growth and health of vannamei shrimp. Significant temperature variations can negatively impact shrimp growth, reproduction, and immunity, thereby affects overalls aquaculture productivity [2, 3].

To overcome this challenge, many studies have been carried out to develop an effective monitoring and regulation system for water temperature in vannamei shrimp farming [4]. In this research, we introduce an innovative system design that uses the Arduino Uno microcontroller as the main platform. This microcontroller will be used to monitor water temperature in real- time vannamei shrimp farming ponds and control heating and cooling devices to maintain water temperature in the desired range. The main objective of this research is to design a monitoring and regulation system for water temperature that can increase the efficiency and success of vannamei shrimp farming. By using the Arduino Uno microcontroller as the cores of the system, we can obtain accurate temperature data and ensure that the water temperature remains within the optimal range according to the needs of the vannamei shrimp at each growth stage. In this study, we will discuss the steps of system design and implementation, including the use of suitable water temperature sensors and automatically adjustable temperature controllers [5].

We will also discuss the integration of microcontrollers with computer-based applications to monitor real- time temperature data and provide precise temperature settings. it is hoped that this research will make an important contribution to the development of more efficient and sustainable vannamei shrimp farming technology [6]. With a sophisticated water temperature monitoring and regulation system, shrimp farmers can optimize the cultivation environment and increase the growth rates and health of vannamei shrimp. In addition, using the Arduino Uno microcontroller as a platform can pave the way for research and development of other

technologies in the fields of aquaculture fisheries [7, 8].

2. METHOD

Following are some of the stages in the research with the intention of making it easier for the reader to understand the research flow [4, 9]:

1. *Study of Literature*

   Researchers gained an in- depth understanding of related studies, the technology used, the methods that have been applied, and relevant findings in vannamei shrimp farming by monitoring and regulating water temperature using the Arduino Uno microcontroller. This will support the arguments and justification in writing the paper.

   As well as provide a solid frame of mind for the research being conducted.

2. **Components used in the system.**

   Based on study which done as for a few component / tools which used byresearcher that is:

   a) *arduino Uno R3 Compatible*

   arduino Uno is microcontroller open-sources Which designed for make it easy users in creating electronic projects. arduino Uno use Language C/C++ programming and can relate to a wide variety of sensors and devices electronic other.

Figure 1. Arduino Uno R3

   b) sensors LM35 temperature

   Sensors temperature LM35 is sensors temperature analog which can measure temperature with accuracy until 0.5 degrees Celsius. Sensors this operates in a temperature range of -55°C until 150°C and own sensitivity output as big 10mV per degree Celsius.

Figure 2. *Sensors LM35 temperature*

   c) Pump Water Aquarium

A water pump will be used to regulate temperature water in aquarium cultivation shrimp vaname. Pump water will arrange by microcontroller for pump water Which different temperature into the aquarium to temperature fixed water constant [10].

Figure 3. *Pump Water Aquarium*

   d) LCD (Liquid Cristal Displays) 16x2

Displays electronic is Wrong One component electronics which functionas a data display, good character, letters or graphics. LCD (Liquid *Cristal Displays)* is Wrong One type displays electronic Which made with technology cmos *(Complementary Metal- Oxide - Semiconductor)* logic it works with No produce light but reflect light Which There is in around him to front- lit ortransmit data Good in form character, letter, number, or graphics.

Figure 4. *LCD (Liquid Cristal Displays) 16x2*

   e) Heating Water (Heater)

Water heater or heating water is equipment which utilize source energydifferent ones to heat the water with temperature in accordance with desired. HeaterWater is widely used in various application domestic like cooking, bathing, and heating room. On case this, water *heater* which usedis kind for cook that is teapotheating water or *kettle water heater.*

Figure 5. *Heating Water (Heater)*

On stage This planning system function as description general about How water temperature

regulation system using LM35 waterproof sensors so the sensor will be being in water, using a heater (Heater) And cooler from Genre water [11]. On stage This planning system function to give description general about How method control system monitoring and arrangement water temperature on cultivation shrimp vaname [1, 12].

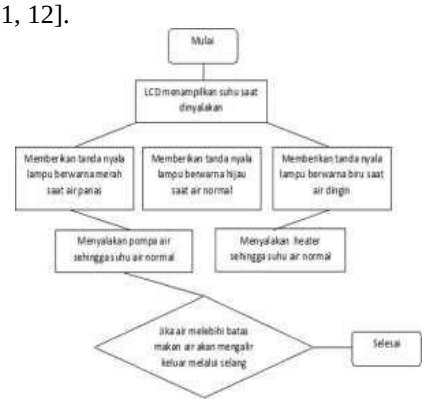

Figure 6. *Flowchart Process*

3. RESULT AND DISCUSSION

Relays use Principle electromagnetic for move Contact Switch so that with current electricity Which small (low power) [13] can deliver higher voltage electricity. As an example, with the Relays use electromagnet 5V And 50 mA capable move Armatures Relays (Which function as the switch) for deliver electricity 220V 2A.

So that in the relay circuit heater and and relays pump water This function as switch Which alternate (if water in circumstances cold so relays heater and lit, if deep water circumstances hot then relays pump light up And If water in circumstances normal so relays heater And And relays the water pump will stop). The relay has 3 pins namely IN, Gnd and Vcc. The following are the steps for installing the relay on Arduino [14, 15]:

a) Pin 5v on arduino relate to pin vcc on Relays. (Source voltage by 5 volts).
b) Pin Mr on arduino connected with pin Mr on Relays.
c) Pin 10 as pump water and pin 9 as heater on arduino in connect with the IN pin on the relay. Pins 10 as water pump and pin 9 as heater on arduino chosen for used as input data on relays.

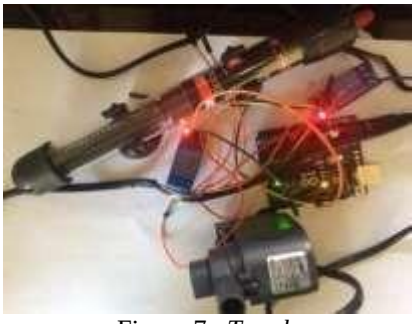

Figure 7. *Topology*

LED Light Series (Red, Green, Yellow) serves as a marker indicator when the LED light up colored red signify water in reservoir in circumstances hot (temperature water more from 31˚C),

Figure 8. Temperature water more from 31˚C

LEDs light up colored green signify water in circumstances normal (temperature water 28˚C - 30˚C)

Figure 9. Temperature water 28˚C - 30˚C

And led light up colored yellow signifies water in circumstances cold (temperature water less than 27˚C).

Figure 10. Temperature water less than 27˚C

4. CONCLUSION

In this study, we managed to design and implement system which integrated between Arduino Uno and water temperature sensor to control the temperature environment in pool cultivation shrimp. System This Capable of automatically measuring water temperature and regulating heating or cooler in accordance with limitation Which has determined. This research makes an important contribution in the development of

vannamei shrimp farming technology. Usage Arduino Uno as a water temperature control tool own potency for applied in scale commercial, help increase the income of those who want do business in the field fishery shrimp vaname.

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