IoT based Vaname Shrimp Cultivation System Model

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ABSTRACT

Vaname shrimpis one of the shrimp varieties that is suitable for cultivation, where this type of shrimp is resistant to disease and has a high survival rate. The cultivation process of Vaname shrimp is also influenced by water temperature, where the suitable water temperature for the growth and development of Vaname shrimp ranges from 28°C to 32°C. In addition, the level of acidity and alkalinity (pH) of water can also affect the development of Vaname shrimp, where the suitable pH for Vaname shrimp cultivation ranges from 6.8 to 8.5. Based on the issues in Vaname shrimp cultivation, a process is needed to produce shrimp production that meets the expected target. If the Vaname shrimp cultivation process is done conventionally (manually), the likelihood of achieving the target production as expected will not be achieved, because it requires time and energy in monitoring water temperature conditions, monitoring the pH of water, and adjusting water conditions to changes in temperature and pH of water.

Therefore, a system is needed to monitor the growth process of Vaname shrimp, where the monitoring process is related to the condition of the pond water (water temperature and pH). To make the monitoring process effective, it can be done anywhere and anytime through the implementation of the IoT concept. In addition to monitoring the condition of the pond water, a control system is needed to regulate the water condition to meet the growth needs of Vaname shrimp, which includes adjusting the water temperature to stay within the appropriate range (28°C to 32°C) and maintaining the pH of water between 6.8 to 8.5.

From the testing conducted on the Vaname shrimp cultivation model system by implementing automated systems and IoT technology, it was found that the system was able to perform remote monitoring of the water temperature and pH conditions in the pond. The system was also able to automatically control the water temperature and pH in the pond. For example, when the water temperature in the pond is detected to be below 28°C, the system will automatically activate the hot water pump and channel it into the pond until the water temperature increases to the range of 28°C to 32°C, at which point the pump will stop operating.

Keywords

Control, monitoring, IoT, Vaname Shrimp

1. INTRODUCTION

Vannamei shrimp is one of the shrimp varieties that is very suitable for cultivation. This variety of shrimp is resistant to disease, making it one of the shrimp varieties that has a high survival rate [1]. Although Vannamei shrimp is classified as a shrimp variety that is resistant to disease, it can still be affected by diseases caused by viruses, which can affect the expected production quantity [2][3].

The cultivation process of Vannamei shrimp is also influenced by water temperature, where the suitable water temperature for the growth and development of Vannamei shrimp ranges from 28°C to 32°C. In addition, the level of acidity and alkalinity (pH) of the water can also affect the development of Vannamei shrimp, where the suitable water pH for the cultivation of Vannamei shrimp ranges from 6.8 to 8.5. [4][5].

The growth of Vannamei shrimp is also influenced by its feeding. Feeding of Vannamei shrimp must be done according to its needs, where the food requirement is adjusted based on the size of the pond and the number of shrimp placed in the pond. The appropriate method for feeding is the high-density stocking method [6].

Based on the problems in Vannamei shrimp farming, a process is needed to produce shrimp production that meets the expected target. If conventional (manual) Vannamei shrimp farming is carried out, the possibility of achieving the production target as expected may not be achieved, because it requires time and energy in monitoring the water temperature conditions, monitoring the pH of the water, and the process of adjusting the water conditions to changes in temperature and pH of the water.

Therefore, it is necessary to add a system that can monitor the growth process of Vannamei shrimp, where the monitoring process is related to the condition of the pond water (water temperature and water pH). To make the monitoring process effective, it can be done anywhere and anytime, through the implementation of the IoT concept [5][7][8]. In addition to monitoring the condition of the pond water, a control system is also needed to regulate the water condition to meet the growth requirements of Vannamei shrimp, which includes adjusting the water temperature to stay at the appropriate condition (temperature range of 28°C – 32°C) and water pH ranging from 6.8 – 8.5 [9][10].

2. METHODOLOGI

The method used to produce the Vaname shrimp farming system model based on IoT is prototyping, where the stages in producing such a system model include: literature study related to research related to this research, data collection, design and construction of the IoT-based Vaname shrimp farming system model, and testing the system model through simulation programs.

2.1 Concept Diagram System

The Concept Diagram is created in the form of a Block Diagram, which aims to represent the relationship between components that will be used in the control and monitoring system of Vaname shrimp cultivation based on IoT, where the block diagram is shown in Figure 1.

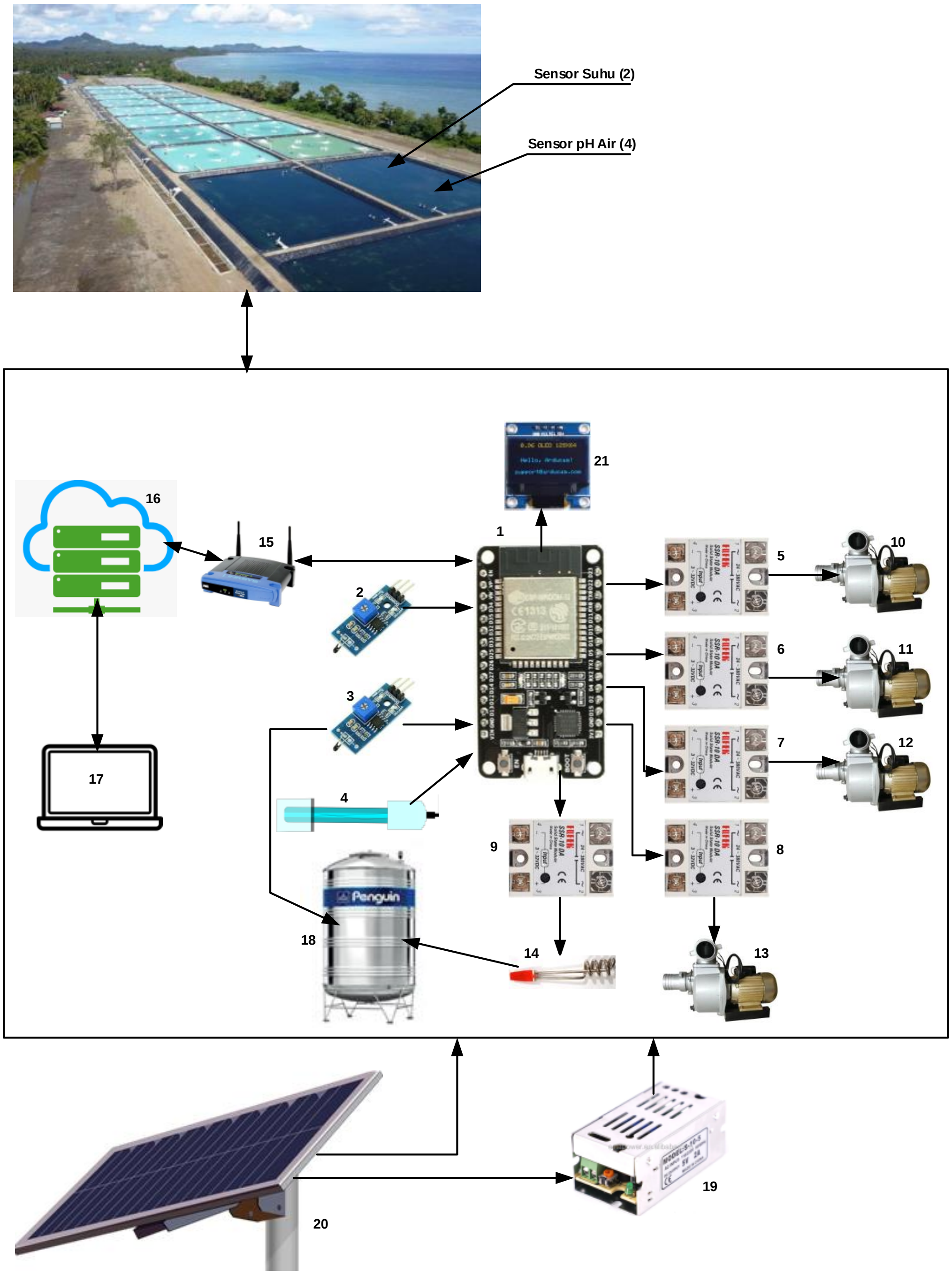

Fig 1: Concept diagram system

Based on the block diagram in Figure 1, the working principle of the IoT-based control and monitoring system for Vaname shrimp cultivation can be described as follows:

- Detecting the temperature condition of the pond water When the Controller (1) reads the temperature data of the pond water through the Temperature sensor (2), the Controller will process it and compare it with the setpoint value. If the received temperature data indicates that the pond water temperature is below the minimum limit required for the pond water temperature, then the Controller will take the necessary action to adjust the temperature, such as turning on the heater or adjusting the water flow rate The automatic controller (1) will activate the Pump (10) by activating the relay (5), which aims to pump hot water into the pond to increase the water temperature if the detected temperature value of the pond water is below the minimum threshold for the water temperature requirement. If the detected temperature value is within the required range, the controller (1) will automatically deactivate the Pump (10). If the detected temperature value is above the maximum threshold, the controller (1) will automatically activate the relay (6) to operate the Pump (11) in order to cool down the pond water by flowing cool water into the pond. The Pump (11) operation will be deactivated if the detected temperature value of the pond water has reached the maximum temperature requirement and is within the normal temperature range.

- Detecting the water pH condition of the pond

  The water pH sensor (4) functions to detect the pH value of the pond water, where the output from the water pH sensor (4) is input to the Controller (1). If the pH value of the pond water is below the minimum value required for the pond water pH, then the Controller (1) will process it to activate the Pump (12) through the activation of relay (7). The activation of Pump (12) aims to flow a mixture of coral stones, coral, and lime immersion water into the pond to increase the pH value of the pond water. If the pH value of the pond water is within the required range, then the operation of Pump (12) will be automatically turned off. If the pH value of the pond water is above the required maximum value, then the Controller (1) will automatically activate the Pump (13) through the activation of relay (7). This condition aims to lower the pH value of the pond water by flowing water that has been mixed with alum into the pond.

- Heating process of water for increasing the temperature of the pond water

  To maintain the suitable temperature for the cultivation of vannamei shrimp in the pond, hot water is required to increase the temperature of the pond water when needed. For this purpose, a water storage tank (18) is needed, which is maintained at a suitable temperature range of $65^{o}C$ to $75^{o}C$, and a heater (14) is controlled On and Off through the Controller (1). The operation of the heater (14) is regulated by detecting the temperature of the water in the tank (18) using a temperature sensor (3). If the detected temperature is below $60^{o}C$, the Controller (1) will automatically activate the heater (14) through the activation of relay (9) to heat the water in the tank (18). The heater will be turned off if the temperature of the water in the tank (18) reaches $70^{o}C$. This process will continue continuously to maintain the temperature of the water in the tank.

- The process of displaying information on the display media (21) regarding the detection of pond water conditions (pond water temperature, tank water temperature, and pond water pH).

  - The process of sending monitoring data to the Web Server.

    To facilitate monitoring of the vannamei shrimp cultivation process, wireless communication devices such as access points are needed (15). The access point functions as a data transmission medium from the Controller (1) to the Web Server (16). The data sent to the Web Server (16) includes pond water temperature, pond water pH data, and tank temperature conditions (18).

  - The process of monitoring pond conditions through the Web Server.

    To monitored the condition of vaname shrimp aquaculture ponds, it can be done from anywhere as long as there is an internet connection. Monitoring devices such as laptops or PCs (17) can access the monitoring system via the Web Server address (16).

  - The electrical requirements of the IoT-based control and monitoring system for vannamei shrimp cultivation are met by utilizing solar energy through a Solar Photovoltaic (PV) system (20). This system is used to power the operation of the pumps and heaters.

    For the 5-volt DC electrical requirement of the control system, it is supplied through a switching regulator (19) that receives power from the Solar PV system (20). By harnessing solar energy, the control and monitoring system for vannamei shrimp cultivation can operate using a renewable energy source, reducing reliance on conventional electricity and minimizing its environmental impact.

2.2 Software Design Concept

The software design for operating the IoT-based control and monitoring system for vannamei shrimp cultivation consists of two main components: the embedded software for the controller and the design of the dashboard for monitoring the shrimp cultivation process. The web server used for this purpose is ThingsBoard.

Software design for tool work requirements, where the design is in the form of a flow chart. The flow chart is shown in Figure 2.

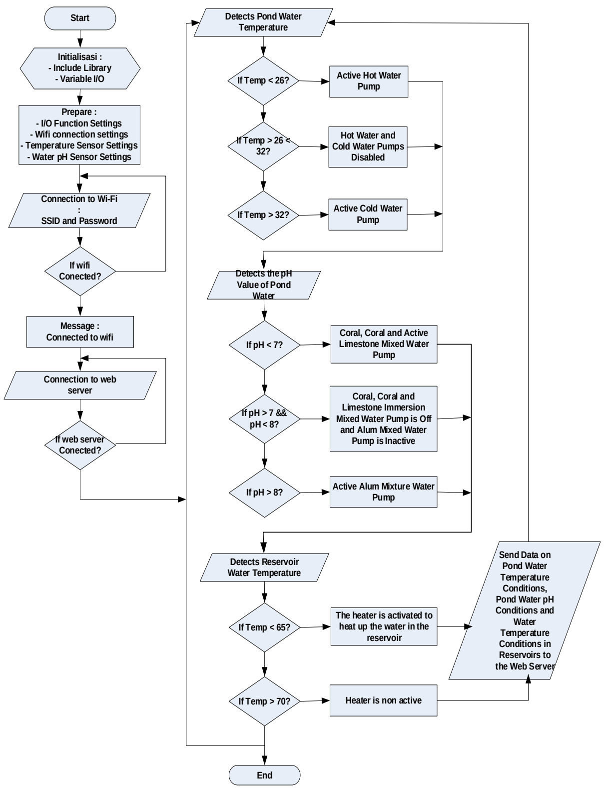

Fig 2: Software design flow chart for tool requirements

The flow chart diagram workflow is as follows:

- When the system is activated, the first part that is executed is the initialization process, where the system will read the libraries used, variables used, input and output function settings, sensor operation settings, and wifi connection and Web Server connection settings.

- The next step performed by the system (Device) is to establish a connection to the access point (wifi network) through username and password authentication. If the wifi network connection is not established, the system will continue to execute this process until it is connected to the wifi network.
- If the system has successfully connected to the wifi network, the next step is to establish a connection to the Web Server (in this case, ThingsBoard) through the ThingsBoard.cloud address, using authentication via the Device Token generated for the specific Device.
- If the connection to the Web Server is established, the next process is to detect the temperature of the pond water using a Temperature sensor. If the detected temperature value is below 26°C, the Controller will automatically activate Pump 1 to circulate hot water from the hot water storage tank into the pond, in order to increase the temperature of the pond water. If the detected temperature value is in the range of 28°C to 32°C, the Controller will automatically deactivate Pump 1 and Pump 2. If the temperature of the pond water is detected to be above 32°C, the Controller will activate Pump 2 to distribute cold water into the pond, in order to lower the temperature of the pond water.
- The next process is to detect the pH level of the pond water. If the pH value of the pond water is below 7, the Controller will activate Pump 3 to circulate water infused with coral rocks, coral, and limestone into the pond to increase the pH value of the pond water. If the pH value of the pond water is above 8, the Controller will activate Pump 4 to distribute water mixed with alum to lower the pH level of the pond water. If the pH value of the pond water is within the range of 7 to 8, the Controller will not activate Pump 3 or Pump 4.
- The next process is to detect the temperature of the water in the hot water storage tank. If the detected temperature of the water is below 65°C, the Controller will activate the Heater to heat the water. If the detected temperature of the water is above 75°C, the Controller will deactivate the Heater.
- The next process is to display information through the display medium (Oled) regarding the detection of pond conditions (Pond Water Temperature, Tank Water Temperature, and Pond Water pH).
- The next process is data transmission to the Web Server, where the data being sent includes the Pond Water Temperature, Pond Water pH condition, and data related to the operation of the hot water supply (Tank).
- This process will continue to run continuously until the system is deactivated.

2.3 Web Server Design

For the purpose of monitoring the conditions of the shrimp farming ponds, specifically the Vannamei shrimp, a Web Server is needed as a storage container for monitoring data and as a platform for monitoring processes. The monitoring that can be performed on the ponds (Pond 1 and Pond 2) includes monitoring the Pond Water Temperature, Pond Water pH, and the temperature of the hot water supply tank. Before creating the Dashboard on the Web Server, a design process is carried out to determine the layout of the Dashboard, which is shown in Figure 3.
Caption for Figure 3:

- Pond and Pond 1 Graphs: These sections display data visualization graphs for each data, including Pond Water Temperature, Temperature of the hot water supply tank, and Pond Water pH. The graphs are specific to each pond.
- The Metering section is where data is displayed for Pond and Pond 1, related to Pond Water Temperature, Temperature of the hot water supply tank, and Pond Water pH.
- The Maps section serves to display the locations of both Ponds (Pond 1 and Pond 2) as well as information about the conditions of the two Ponds. The information displayed on the Maps includes the coordinates of the Pond locations, Pond Water Temperature, Temperature of the hot water supply tank, and Pond Water pH data.

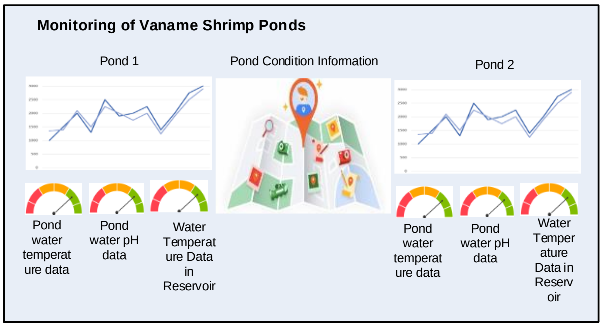

Fig 3: Dashboard Web Server

2.4 Concept Of System Development

After the system design process is complete, the next step is to develop an IoT-based control and monitoring system for vannamei shrimp farming. The system development process refers to the results of the design, both hardware and software. System development is carried out using the Wokwi simulation program, where a device will be made for controlling and monitoring vannamei shrimp farming based on IoT. The Wokwi simulation program provides sections for hardware and software components to run the system. System development is illustrated in Figure 4 (Hardware) and Figure 5 (Software).

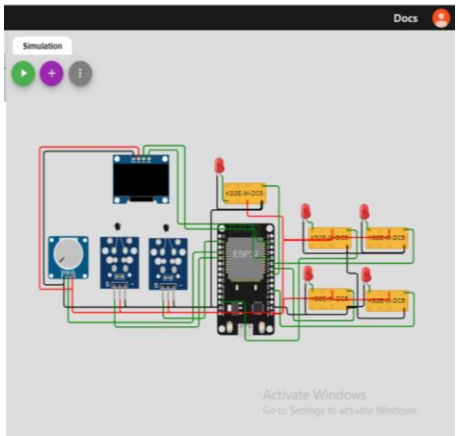

Fig 4: Model of the IoT-based Vaname Shrimp cultivation control and monitoring system (Hardware)

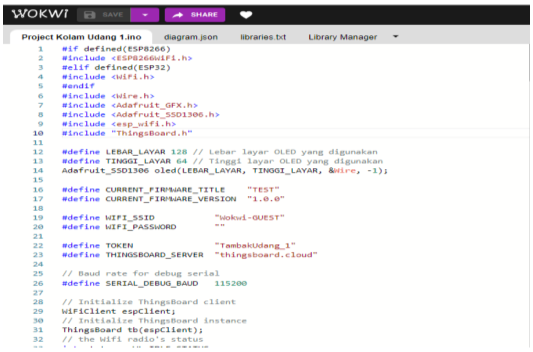

Fig 5: Model of the IoT-based Vaname Shrimp cultivation control and monitoring system (Software)

Making a web server, refers to the results of the web server display design, where the web server will display information regarding the condition of Pond 1 and the condition of Pond 2. The information that will be displayed on the web server is related to monitoring results of Pond water temperature, Pond water pH and location from the two ponds. Figure 6 shows the user interface display through the web server.

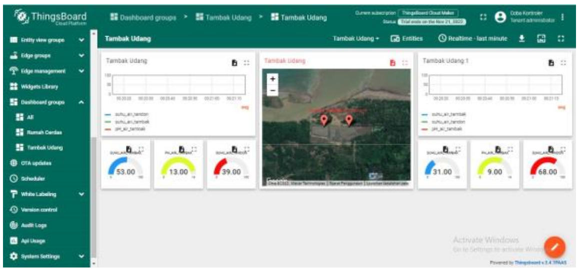

Fig 6: User interface display through the web server

3. RESULT AND DISCUSSION

For the System Testing process, first run the simulation program wokwi for Shrimp Pond Device 1. Once Shrimp Pond Device 1 is running, wait for the connection process, both the Wi-Fi device connection process and the connection with ThingsBoard. The communication information between Shrimp Pond Device 1 and ThingsBoard can be seen in the Serial Monitor. Next, run Shrimp Pond Device 2 following the same steps as activating Shrimp Pond Device 1. The process of running Shrimp Pond Device 1 and Shrimp Pond Device 2 is shown in Figure 7.

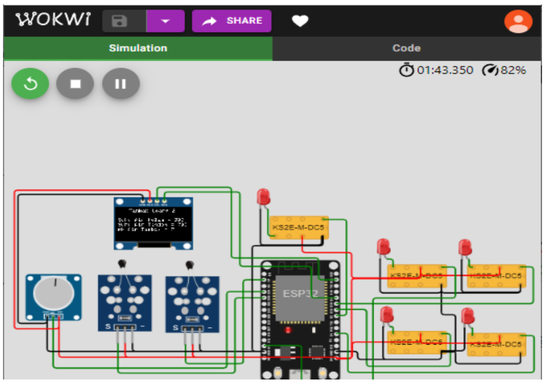

Fig 7: Activate the Program Simulation

3.1 Shrimp Pond Water Temperature Condition:

The testing process is carried out on the system to obtain the system's response to monitoring the water temperature of the shrimp pond and how the system adjusts to maintain the water temperature within the appropriate range. The target range for the shrimp pond water temperature is maintained between 28°C to 32°C. The detection process of the shrimp pond water temperature value is performed through a temperature sensor (NTC) immersed in the water.

- During normal water temperature conditions in the shrimp pond (28°C - 32°C), to obtain the system's response when it is detected that the water temperature is within the normal range, the action taken is to adjust the output value of the temperature sensor within the range of 28°C - 32°C, for example, setting it to 29°C. This adjustment process is carried out through the wokwi simulation program, as shown in Figure 8.

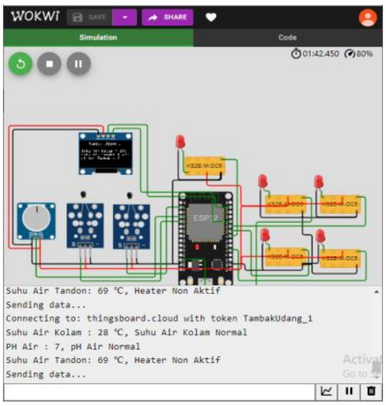

Fig 8: Pond water temperature conditions are normal

From the conducted testing results, it is observed that when the water temperature in the shrimp pond is within the normal range, the Controller will provide information through the display on the Serial Monitor stating "Shrimp Pond Water Temperature: 29°C, Normal Water Temperature".

The program section that are executed are as follows:

```
void read_water_temperature (){
  analogValue = analogRead(36);
  celsius = 1 / (log(1 / (4095. / analogValue - 1)) /
  BETA + 1.0 / 298.15) - 273.15;
  Serial.print("Water Temperature in the Pond: ");
  Serial.print(celsius);
  if (celsius > 26 && celsius < 32){
     digitalWrite (Pump1, LOW);
     digitalWrite (Pump2, LOW);
     Serial.println (", Water Pond is Normal");
 }
```

- During the testing process, when the water temperature in the shrimp pond falls below the minimum value (28°C), the test is conducted by reducing the value of the temperature sensor below the minimum requirement for the shrimp pond. The temperature sensor value is set to 24°C. Figure 9 shows the system's response to the decrease in the water temperature value in the shrimp pond.

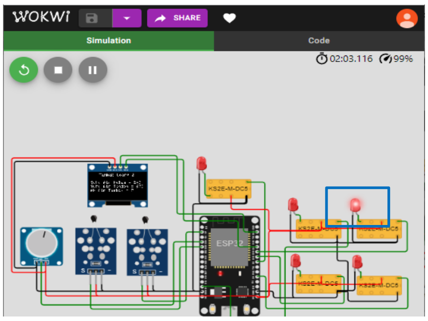

Fig 9: Pond water temperature conditions below the minimum value

From the conducted testing results, the system's response to the decrease in the water temperature in the shrimp pond below the minimum temperature requirement (24°C) is that the system (controller) will automatically activate the hot water pump to circulate hot water from the hot water Tank into the shrimp pond. This is done to increase the water temperature in the pond until it reaches the normal temperature value according to the shrimp pond's requirements.

The program section that are executed are as follows:

```
Serial.print("Water Temperature in the Pond: ");
 Serial.print(celsius);
 if (celsius < 26){
    digitalWrite (Pump1, HIGH);
    digitalWrite (Pump2, LOW);
    Serial.println (", Cold Water Temperature in the
                       Pond, Hot Water Pump Activated ");
 }
```

During the testing process, when the water temperature in the shrimp pond exceeds the maximum value (32°C), the test is conducted by increasing the value of the temperature sensor above the maximum temperature requirement for the shrimp pond. The temperature sensor value is set to 33°C. Figure 10 shows the system's response to the increase in the water temperature value in the shrimp pond above the normal temperature value.

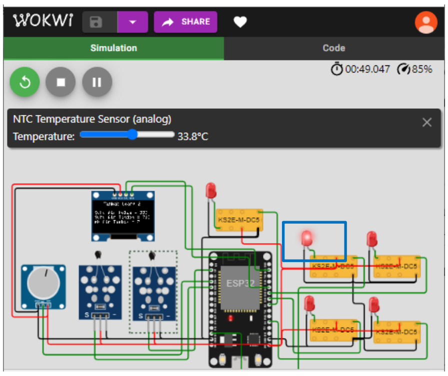

Fig 10: Conditions Pond water temperature above the maximum value

From the conducted testing results, it is observed that when the water temperature in the shrimp pond rises above the maximum temperature requirement, reaching a value of 33°C, the system (controller) will automatically activate the cold water pump. This is done to introduce cold water into the pond and lower the water temperature. The pump will stop working once the water temperature in the shrimp pond is within the normal temperature range.

The program section that are executed are as follows:

```
Serial.print("Water Temperature in the Pond: ");
 Serial.print(celsius);
 if (celsius  > 32){
    digitalWrite (Pump1, LOW);
    digitalWrite (Pump2, HIGH);
    Serial.println (", Hot Water Temperature in the
                       Pond, Cold Water Pump Activated ");
 }
```

For test results data Shrimp Pond Water Temperature Condition, can be seen in Table 1.

Table 1. System Test Results For Fhrimp Pond Water Temperature Conditions

Temperature Sensor Value (ºC)	Pond Water Temperature Conditions	State of the Hot Water Pump	Cold Water Pump Condition
28ºC > Temp < 32ºC	Normal	OFF	OFF
Temp > 32ºC	Heat Detected	OFF	ON
Temp < 28ºC	Cold Detected	ON	OFF

3.2 Pond water pH conditions:

The testing process is conducted on the system to obtain the system's response to monitoring the pH value of the shrimp pond water and how the system adjusts to maintain the pH level within the appropriate range. The target range for the pH of the shrimp pond water is maintained between 6.8 and 8.5. The detection process of the pH value of the shrimp pond water is performed using a pH sensor that is replaced with a Potentiometer.

- When the water pH in the shrimp pond is below the minimum value (6), the testing is conducted by decreasing the value of the pH sensor below the minimum pH requirement for the shrimp pond. The pH sensor value is set to 6. Figure 11 shows the system's response to the decrease in the pH value of the shrimp pond water.
  From the conducted testing results, it is observed that when the pH value of the shrimp pond water decreases below the minimum pH requirement (6), the system's response is to automatically activate the pump to circulate a mixture of soaked Coral Stones, Rock Stones, and Limestone into the shrimp pond. This is done to increase the pH value of the pond water until it reaches the normal pH value according to the shrimp pond's requirements. Once the water pH in the pond reaches the normal range, the pump will be deactivated.
  The program section that are executed are as follows:

```
void read_water_pH (){
  output_value = analogRead (34);
  output_value = map(output_value, 0, 4095, 0, 14);
  Serial.print("Water pH : ");
  Serial.print(output_value);
  if (output_value < 7){
     digitalWrite (Pump3, HIGH);
     digitalWrite (Pump4, LOW);
     Serial.println (", Insufficient Water pH, Mixed
     Soaked Coral, Rock, and Limestone Water Pump
      Activated ");      }
```

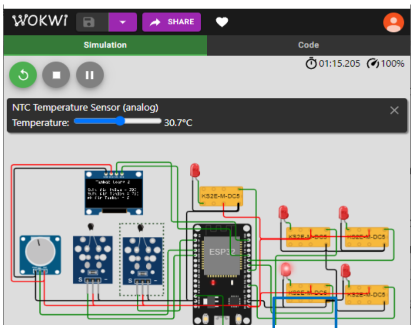

Fig 11: Pond water pH conditions below the minimum value

- During normal pH conditions in the shrimp pond (6.8 - 8.5), to obtain the system's response when it is detected that the pH of the water is within the normal range, the action taken is to adjust the output value of the pH sensor within the range of 6.8 - 8.5, for example, setting it to 7. This adjustment process is carried out through the wokwi simulation program, as shown in Figure 12.

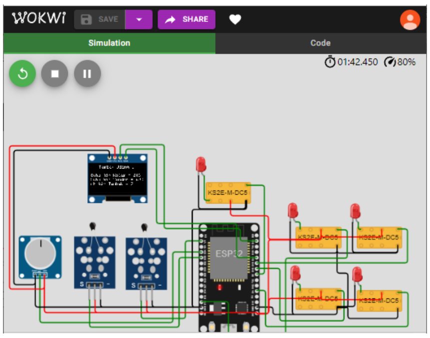

Fig 12: Pond water pH conditions is normal

The program section that are executed are as follows:

```
Serial.print("Water pH : ");
Serial.print(output_value);
if (output_value >= 7 && output_value <= 8){
  digitalWrite (Pump3, LOW);
  digitalWrite (Pump4, LOW);
  Serial.println (", Water pH is Normal");
}
```

- When the water pH in the shrimp pond exceeds the maximum value (9), the testing is conducted by increasing the value of the pH sensor above the maximum pH requirement for the shrimp pond. The pH sensor value is set to 9. Figure 13 shows the system's response to the increase in the pH value of the shrimp pond water above the normal pH value.

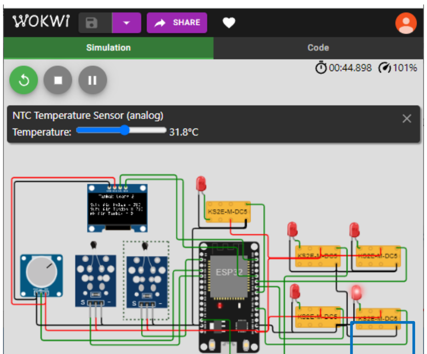

Fig 13: pH Water Condition Above the Maximum Value

From the conducted testing results, it is observed that when the pH value of the shrimp pond water rises above the maximum pH requirement, reaching a value of 9, the system (controller) will automatically activate the pump to introduce a mixture of Alum into the pond. This is done to lower the pH value of the pond water. The pump will stop working once the pH value of the shrimp pond water is within the normal pH range.

The program section that are executed are as follows:

```
Serial.print("Water pH : ");
Serial.print(output_value);
if (output_value >= 7 && output_value <= 8){
  digitalWrite (Pump3, LOW);
  digitalWrite (Pump4, HIGH);
  Serial.println (", High Water pH, Alum Mixture
  Water Pump Activated ");
}
```

3.3 Hot Water Tank conditions:

The testing process is conducted on the system to obtain the system's response to monitoring the water temperature in the hot water Tank and how the system adjusts to maintain the water temperature in the Tank above 70°C. The detection process of the water temperature in the hot water Tank is performed using a temperature sensor (NTC) as the medium.

- When the water temperature in the hot water Tank is in normal condition (> 70°C), if it is detected that the water temperature in the Tank is normal and above 70°C, through input from the temperature sensor (for example, at a temperature of 73°C).

  From the conducted testing results, it is observed that when the water temperature in the hot water Tank is in normal condition (above 70°C), the controller will inform through the display on the Serial Monitor that the water temperature in the Tank is normal.

  The program section that are executed are as follows:

```
void read_the_water_temperature_in_the_tank (){
  Water_Temp = analogRead(35);
  Temperature = 1 / (log(1 / (4095. / Water_Temp – 1)) /
                    BETA + 1.0 / 298.15) – 273.15;
  Serial.print (“Water Temperature In The Tank: “);
  Serial.print (Temperature);
  Serial.print (“ °C”);
  if (Temperature > 70){
    digitalWrite (Heater, LOW);
    Serial.println (“, Water Temperature In The Tank is
                 Normal”);
  }
}
```

- When the water temperature in the hot water Tank needs to be heated below a certain value (65°C), From the conducted testing results, it is observed that when the water temperature in the hot water Tank decreases below the minimum specified temperature, for example, it is detected at 64°C, the system (controller) will automatically activate the heater to heat the water in the Tank. The heater will be deactivated once the water temperature in the Tank is detected to be above 70°C. This ensures that the water temperature in the Tank is maintained within the desired range by activating the heater when needed and deactivating it when the desired temperature is reached. Figure 14 shows the system response to a decrease in deep water temperature Tank.

  The program section that are executed are as follows:

```
void read_the_water_temperature_in_the_tank (){
```

```
Water_Temp = analogRead(35);
Temperature = 1 / (log(1 / (4095. / Water_Temp – 1)) /
                                  BETA + 1.0 / 298.15) – 273.15;
Serial.print (“Water Temperature In The Tank: “);
Serial.print (Temperature);
Serial.print (“ °C”);
if (Suhu > 0 && Suhu < 65){
   digitalWrite (Heater, HIGH);
   Serial.println (", Active Heater, Heating Process");  }
```

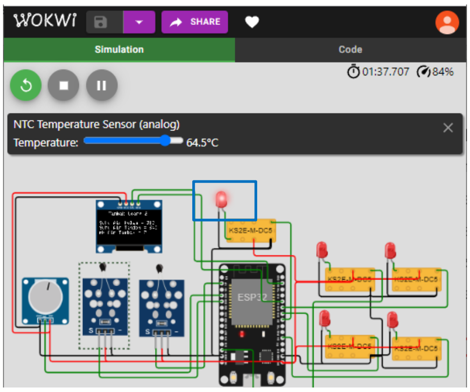

Fig 14: Conditions The temperature of the water in the tank is below the minimum condition

3.4 Monitoring the condition of Vaname Shrimp Ponds through a web server

The monitoring process of Vaname Shrimp Ponds can be done from anywhere as long as the monitoring device (laptop/PC) is connected to the internet. To perform the monitoring process, the monitoring device should be directed to the web server that has been set up, in this case, the Vaname Shrimp Pond Dashboard on ThingsBoard, as shown in Figure 15.

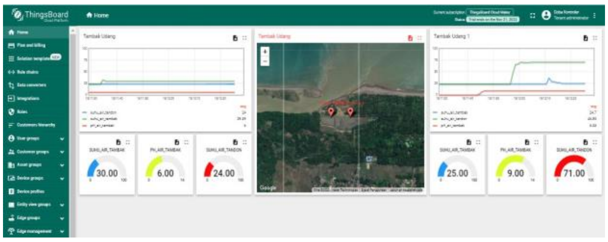

Fig 15: Display of the Shrimp Pond Dash Board section on the ThingsBoard

From the conducted testing, it is observed that the monitoring process for the Vaname Shrimp Pond's condition can be carried out using a laptop/PC connected to the internet through the Vaname Shrimp Pond Dashboard on ThingsBoard. The monitoring data includes the temperature of the pond water, pH level of the pond water, and the temperature of the hot water tank.
For comprehensive monitoring of the Vaname Shrimp Pond, the Maps section provides complete data, including the coordinates of both shrimp pond locations. This allows for a visual representation of the pond's locations on the map. Figure 16 illustrates the monitoring process conducted through the Maps section.

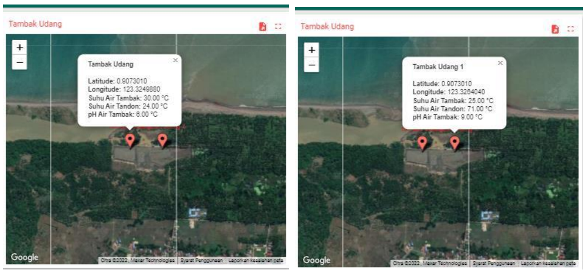

Fig 16: The monitoring process from the Maps section

4. CONCLUSIONS

Based on the conducted testing of the IoT-based control and monitoring system for Vaname shrimp cultivation, the following conclusions can be drawn:

The developed system is capable of adjusting the conditions of the shrimp pond, including the temperature and pH level of the water, as well as the temperature of the hot water tank. The adjustment process is based on sensor indicators as input to the controller, which makes decisions on necessary actions. For example, if the temperature of the pond water, detected by the temperature sensor, falls below the minimum threshold (28°C) required for ideal Vaname shrimp cultivation, the controller automatically activates the hot water pump to increase the temperature of the pond water.

Additionally, the system is capable of monitoring the conditions of the shrimp pond, including the temperature and pH level of the water, as well as the hot water tank. The monitoring process can be performed from anywhere using user devices such as laptops or PCs connected to the web server via wireless communication (Wi-Fi).

Overall, the system demonstrates the capability to adjust and monitor the shrimp pond's conditions effectively, providing an automated and remote-controlled solution for Vaname shrimp cultivation.

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