Journal of Integrated and Advanced Engineering (JIAE)
Vol. 2, No. 2, September 2022: 77-88
http://asasijournal.id/index.php/jiae
http://doi.org/10.51662/jiae.v2i2.42

Monitoring chicken livestock process using Vento Application at a farm

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Abstract
Regular temperature monitoring in the poultry industry is necessary to produce high-quality products. However, the traditional methods of these activities are still massively applied. Therefore, a modest process on poultry farms requires temperature monitoring and control. Vento is a climate controller developed by Big Dutchman that is easy to understand and user-friendly. Further, the module provides a handy installation and operation on the farm. Therefore, Vento is suitable to use in hot climates area. Vento performs temperature control by reading the input collected from the DOL114 sensor and the DOL12 sensor. The DOL114 sensor performs temperature and humidity detection in the front area of the cage. At the same time, the DOL12 was installed to obtain temperature information behind the cage. Both functions as input to operate the Heater, but only the DOL114 sensor is used to activate the cooling pad. The temperature value gathered by the DOL114 sensor and the DOL12 sensor will be processed by Vento, resulting in average temperature data. Thus, the data obtained from the sensor will be transferred to the Vento system to operate the output in the form of an exhaust fan. The exhaust fan serves as a tool that removes air and ammonia in the cage so that the cage temperature complies with a predetermined setpoint.

Keywords:
Coops;
Monitoring;
Temperature;
Vento;

Article History:
Received: March 30, 2022
Revised: May 27, 2022
Accepted: July 14, 2022
Published: September 4, 2022

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INTRODUCTION

Old cages or farms usually still use a manual system, in contrast to the latest model farms, which use an automatic system starting from feeding to regulating the temperature in the chicken coop. Chicken farming requires regular temperature control to get good production results. The ideal chicken coop temperature varies depending on each chicken's age [1, 2, 3, 4]. Regular control of chicken temperature is one of the maintenance processes to produce good chicken production. Thus, the temperature of the chicken coop must be controlled, so the temperature of the chicken remains stable even though the weather is rainy.

Because of the importance of temperature conditions in the cage, this quantity must be monitored continuously. The temperature data in the chicken coop is used as a basis for comparison of farmers or chicken farm managers to take action so that the temperature of the chicken coop can be kept constant at a comfortable range for the chickens. Temperature monitoring relies solely on estimates people tend to be less precise because it is not based on quantitative data. Monitoring the temperature based on measuring instruments and recording will require a particular person to read the temperature and record the data. It also takes quite a long time.

At this time, there are still many breeders who still use relatively simple technology. One of the problems is the level of ammonia around the cage. Ammonia is flue gas from

broiler chickens [5, 6, 7, 8]. Ammonia can cause disease for chickens and is dangerous for chicken growth. In addition, the influence of temperature can also affect the growth and development of broiler chickens. Temperatures that are too high will cause a decrease in the chicken's appetite and cause the chicken to drink more often than eat. This condition will impact reducing the weight of the chicken produced. Lack of ventilation can also affect the temperature of the coop, which causes the coop to feel hot for the chickens.

For this reason, the temperature is also an important element for the growth and development of broiler chickens [9][10]. As a solution, it is necessary to have a system that regulates the temperature of the cage. So that the cage temperature is maintained and ideally according to the needs of broiler chickens, as well as monitoring the temperature and humidity settings in the cage starting from the beginning of the doc to harvesting chickens [11, 12, 13, 14].

Besides technology development, practicality is needed in all respects, including applying temperature and humidity control systems in chicken coops. For example, setting the temperature and humidity in the chicken coop at PT. Multi Sarana Pakanindo already uses the Vento application. In this study, monitoring of the growth process of broiler chickens from small chickens to harvested chickens will be carried out. By monitoring the temperature settings inside and outside the cage and humidity in the cage using Vento as a control module.

METHOD

Vento application is a tool for controlling the temperature in the cage. Many authors use Arduino controllers as well as the Internet of Things system [15, 16, 17]. In this study, the authors monitored the temperature regulation of the cage in the chicken farming process using the Vento application [18, 19, 20]. Vento is a climate controller developed by Big Dutchman that is easy to understand and user-friendly. This module is also straightforward to install and operate. Fresh air and exhaust air, heating and cooling are controlled reliably. Therefore, Vento is very suitable for livestock production houses, especially in hot climates.

Monitoring can be described as being aware of what one wants to know. Sometimes, high-level monitoring is done to make measurements through time that indicate movement towards a goal or away from it. Monitoring will provide information about the status and the tendency of measurements and evaluations to be completed repeatedly from time to time. Monitoring is generally carried out for a specific purpose, to check the following processes and objects or to evaluate conditions or progress towards management results goals on the effects of actions of some kind between other actions to maintain ongoing management.

Many studies have been conducted using microprocessors. It was monitoring the temperature control system in the chicken farming process. In addition, monitoring systems such as using the Internet of Things (IoT), GSM 800L v2 modules, Arduino, Android, and others [21, 22, 23]. Find the advantages and disadvantages of each direct monitoring system and the internet of things-based monitoring system used. For example, when using the internet of things, sometimes there is a time delay of 5-19 seconds, and it turns out that the time can change because there are aspects that can hinder it, such as an unstable internet connection. This is, of course, the author's consideration for using the Vento application as a monitoring system

In this research, the experimental method was used. This experimental method is a quantitative method, used especially if the research wants to experiment to find the effect of the independent variable/treatment/certain treatment on the dependent variable/outcome/output under controlled conditions [24, 25, 26]. The experimental method

carried out in this study used data collection techniques, namely by observing a monitoring system based on the Vento application.

Material

Vento is a climate controller developed by Big Dutchman, which is easy to reach and very user-friendly as can be seen in Figure 1. This module is also straightforward to install and operate. Fresh air and exhaust air, heating and cooling are controlled reliably. Therefore, Vento is very suitable for livestock production houses, especially in hot climates.

The well-laid-out 7-inch touchscreen shows the relevant curves as a graph. The daily functions are immediately available in the menu, making the computer very easy to handle. For example, Vento regulates the climate on up to 64 preset levels. Each level can be adjusted via a matrix which allows the exact climate adjustment requested by the user. Vento can also control the climate according to temperature curves, heat and minimum and maximum ventilation rates.

DOL 12 Sensor is a simple temperature sensor packaged in plastic. It is suitable for use in environments that require a robust design. This sensor is designed to measure indoor and outdoor temperatures. First, the sensor will start monitoring the amount of hot/cold energy produced by the object so that it is possible to sense the changes to the temperature in the form of analogue or digital output. The DOL 12 sensor is usually used to detect the temperature in the chicken coop. This sensor has two wires connected to control modules such as Vento, temptron, viper touch, and TC5. An example of a DOL 12 sensor image can be seen in Figure 2. The characteristic of this sensor is listed in Table 1.

Besides, the DOL 114 sensor is a high-precision sensor for measuring relative humidity and temperature. These sensors are also suitable for some industrial applications. It has two analogue outputs rated from 0 to 10 volts with very low output resistance and full protection against short circuits and cable failure. A DOL 114 is depicted in Figure 3. Table 2 lists the characteristic of this sensor.

Special sensor elements and a built-in Teflon filter support applications in stables with constant high humidity. The sensor can be equipped with built-in connectors or cables as needed. It also has a bi-colour light-emitting diode (LED) to communicate operating status and fault diagnostics. In addition, sensors can be equipped with blind LEDs for applications that require them.

Figure 4 shows an exhaust fan exchanging hot air for fresh air in the cage. This tool works by sucking hot air inside the cage, expelling it out, and taking fresh air from outside into the cage. In addition, the exhaust fan can also adjust the volume of air to be circulated in the cage. The cage needs circulation so that there is always air circulation in the cage with fresh air from outside the cage to stay healthy.

Figure 1. Vento

An exhaust fan is used for air circulation in or at home. Therefore, the placement is between indoor and outdoor. Exhaust fans are widely used to cool the room without air conditioning. Even so, those who use air conditioning can also install an exhaust fan to reduce humidity in the room.

Figure 2. DOL 12 Sensor

Figure 3. DOL 114 Sensor

Table 1. DOL 12 sensor technical data

Electrical	
Measuring range	-10°C…+40°C
Accuracy	±0.5°C
Time constant	2 min.
Supply voltage	10V
Environment	
Ambient temp., operation	-10°C…+40°C
Ambient temp., storage	-30°C…+75°C
Protection class, electronics	IP67
Shipping	
Length	75mm
Diameter	14mm
Cable2-leder	2-wire,1.4m, ø5mm
Weight incl. of cable	80g

Table 2. DOL 114 sensor technical data

	Humidity measurement	Temperature measurement
Measuring range	0–100% RH	-40°C–60°C
Accuracy1	2%RH(40–85%)-3%RH(10-95%) At 0-40 °C	+10°C–40°C: 0.5°C -30°C–60°C: 1.5°C
Output signal	0.1 V/% RH	0,1 V/°C;0°Cat4V
	Common	
Time constant		2 min.
Supply voltage		11–30VDC
Supply Current		20mAat noload70mAatmax.load
Load		<500Ω - >10MΩ
Recommended load		≥100kΩ
Output current		20mA per output (current limited)
Output impendence		<1Ω
Temperature, operation and storage		-40°C–60°C
IP classification		IP 67
Cable		2m.4x22AWG/0.34 mm^2
Max. cable length/		100m@0,75mm^2, 200m@1,50 mm^2
Shipment weightex.connector		150g
Measure, shipment		275 ×200 ×20mm

Figure 4. Exhaust Fan

The cooling pad is an essential tool in a cage near the house, especially if the cage is in tropical or sub-tropical areas. It works to keep the air temperature in the cage optimal and comfortable for the chickens. Figure 5 works by evaporating the water dripping onto the fins of the cooling pad with the air being sucked in from the outside using a blower fan at the end of the cage. The change of state from water droplets to inhaled air decreases the temperature.

Because of the vital role of the cooling pad, many cage owners are looking for a cooling pad with the best possible quality. This is good, and indeed quality goods will have better performance.

Methods

This experimental method is a quantitative method, which is used especially if the research wants to experiment to determine the effect of the independent variable/treatment/certain treatment on the dependent variable/outcome/output under uncontrolled conditions. The experimental method carried out in this study used data collection techniques, namely by

observing a monitoring system based on the Vento application. The independent variables used in this study were variations in temperature settings (34.5°C, 31.0°C, 28.0°C, 26.0°C, 24.5°C, 23.0°C). The dependent variable, influenced by the independent variable, is the actual temperature, Heater, exhaust fan, and cooling pad. Therefore, the research design used in this study was a pre-Experimental design in the form of a One-Shot Case Study. The research design in the form of a One-Shot Case Study can be seen in Figure 6.

Information:

X1 = Independent variable in the form of temperature 34.5°C
O1 = Observation of actual temperature with independent variable 34.5°C
X2 = Independent variable in the form of temperature 31.0°C
O2 = Observation of actual temperature with independent variable 31.0°C
X3 = Independent variable in the form of temperature 28.0°C
O3 = Observation of actual temperature with independent variable 28.0°C
X4 = Independent variable in the form of temperature 26.0°C
O4 = Observation of actual temperature with independent variable 26.0°C
X5 = Independent variable in the form of temperature 24.5°C
O5 = Observation of actual temperature with independent variable 24.5°C
X6 = Independent variable in the form of temperature 23.0°C
O6 = Observation of actual temperature with independent variable 23.0°C

Temperature and humidity will be detected on the DOL12 sensor and the DOL114 sensor. The ventilation will control the Heater, exhaust fan, and cooling pad. The Vento workflow can be seen in Figure 7. Figure 7 depicts a flowchart of Vento's work description which can be explained. It starts with the administrator or farm supervisor filling in the setpoint data in the Vento module. Then Vento will read or process the data detected by the DOL12 sensor, temperature data, especially in the area behind the cage. After that, Vento will read or process the data detected by the DOL114 sensor, temperature and humidity data in the cage, especially in the front area of the cage. When the DOL114 sensor has received the actual temperature data, the temperature will follow the setpoint temperature set in Vento. Then Vento will turn on the Heater in the front area of the cage. If the actual temperature is the same as the setpoint temperature, Vento will turn off the heating area in front of the cage.

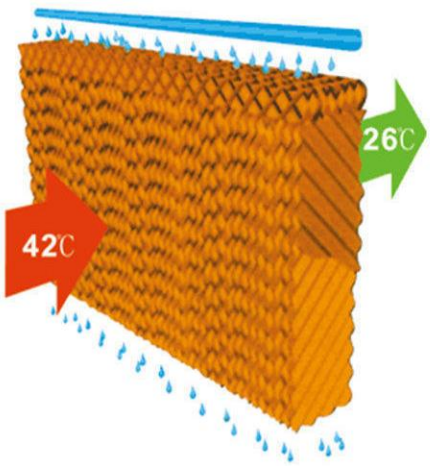

Figure 5. Cooling Pad Figure

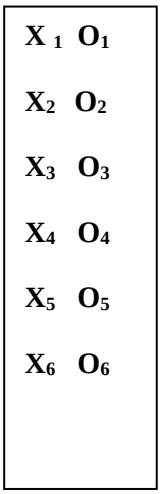

Figure 6. One-Shot Case Study

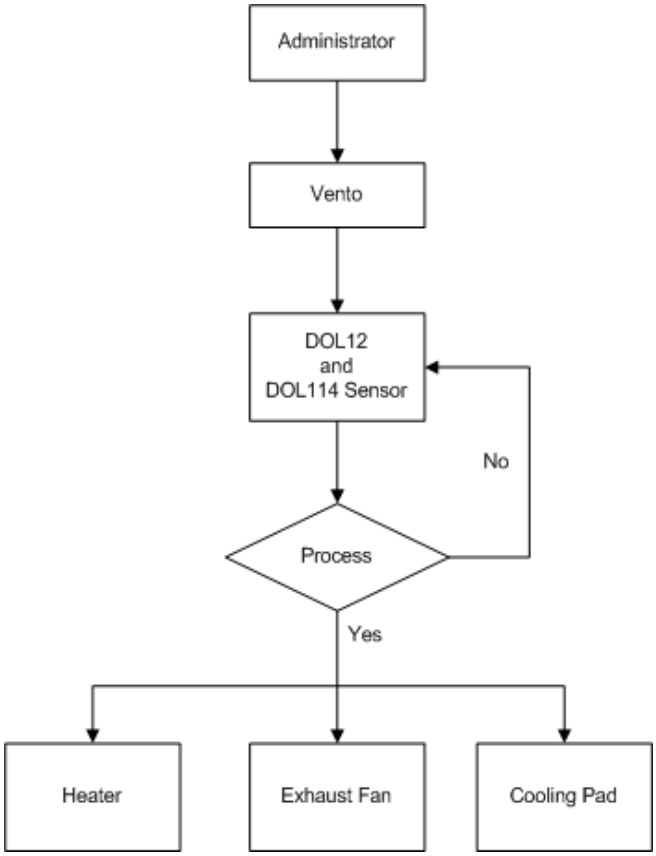

Figure 7. Vento Workflow

When the average temperature from the input of each DOL12 sensor and DOL114 sensor is processed. Then, Vento will process the output to turn on the exhaust fan as much as the administrator has set. The cooling pad will work when the temperature in the room is too hot or has exceeded the set limit that has been set. If the DOL114 sensor has detected more than 80% humidity, Vento will process the output to turn off (OFF) the cooling pad.

Before data collection, a block diagram is designed. It will serve as an outline for the equipment installed in the cage using the Vento application. The block diagram for monitoring the chicken farming process using the Vento application can be seen in Figure 8.

Vento monitoring system can be explained as follows; First, the Input provides for a particular data or object that is used as a prefix for a reading identifier. In the input section, the Vento monitoring system consists of Administrators, DOL12 Sensors, and DOL114 Sensors. Then, the process is a system where the input reading is managed to become a result which will be forwarded to the output. In this part of the process, the Vento application is a tool used to handle Input from the administrator, reading the DOL12 Sensor and the DOL114 Sensor. After that, the Output that contains the results of an input has gone through the process section. So that the purpose of the system will be realized. In the output section, the Vento monitoring system consists of three tools that serve as a system goal: Heaters, Exhaust Fans, and Cooling Pads.

The Vento system uses a built-in power supply from Vento with a voltage source of 220 volts AC. The output of the power supply is 12 volts DC and 24 volts DC. The Vento electrical circuit in more detail can be seen in Figure 9.

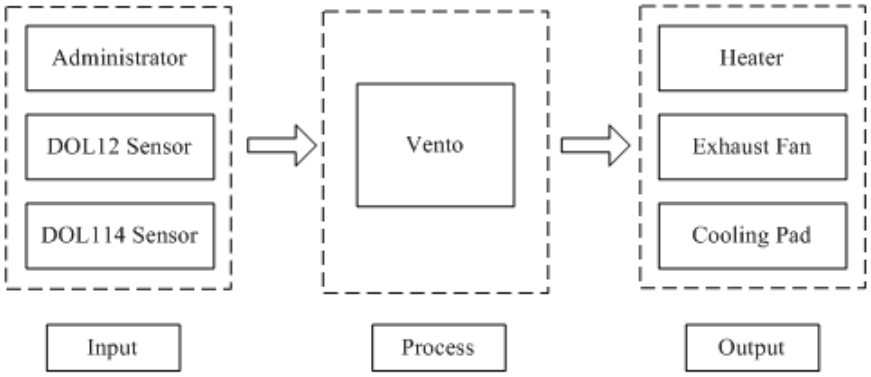

Figure 8. Vento Monitoring System

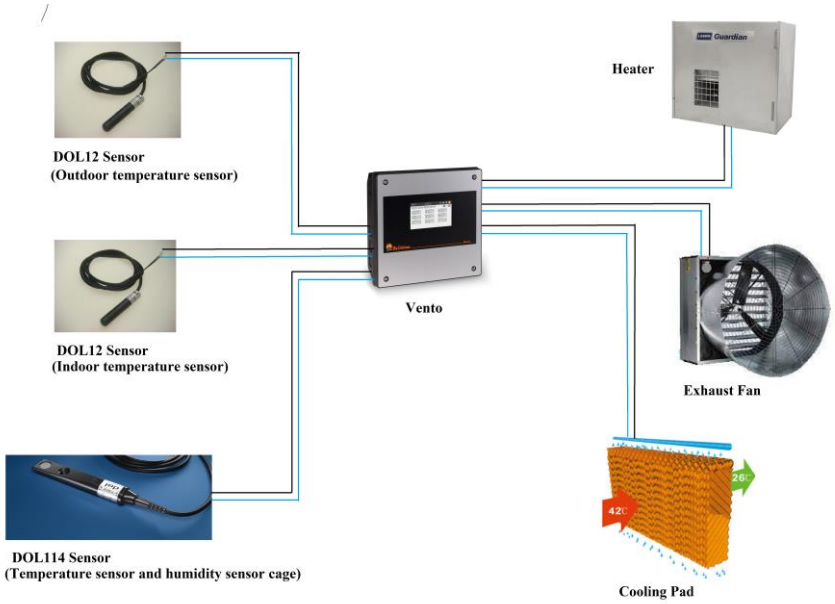

Figure 9. Vento Electric Circuit

The electrical circuit of the Vento working system is described. The components used include Vento, DOL12 sensor, DOL114 sensor, Heater, Exhaust fan, and Cooling pad. A 220-volt AC voltage source is used for the Vento built-in power supply, 24 volt DC output from the power supply to power the Vento application. The DOL12 sensor and the DOL114 sensor take 12 volts of DC voltage to detect the temperature and humidity in the cage. Vento receives data from the DOL12 sensor and DOL114 sensor, then Vento processes the data and turns on the Heater to change the cold temperature to warm. Next, Vento will turn on the exhaust fan to remove ammonia gas and make the air in the cage fresher. Finally, Vento will turn on the cooling pad if the temperature in the cage is too hot and will delay the cooling pad if the humidity in the cage has exceeded 80%.

RESULTS AND DISCUSSION

This research collected temperature data from Farm Bubulak and Farm Ciampea for two periods at each farm. At Farm Bubulak, temperature data were obtained in the first period starting from September 26, 2021, to October 30, 2021, and the second period beginning in November 13, 2021, until December 18, 2021. In the first period at Farm Bubulak, there was a chicken population with a total of 35,000 heads; in the second period, there was a

population of chickens with a total of 35,000 tails. In addition, there are 11 exhaust fan units, two heater units and two cooling pad units installed on Bubulak Farm.

At Farm Ciampea, temperature data were obtained in the first period starting from September 31, 2021, to October 6, 2021, and the second period beginning on November 14, 2021, to December 19, 2021. In the first period at Farm Ciampea, there was a population of 24,000 chickens, and in the second period, there was a population of 24,000 chickens. In addition, there are ten exhaust fan units, two heater units and two cooling pad units installed on Farm Ciampea.

There is a comparison of temperature data in one farm at different periods (first and second periods). This comparison is used to determine the difference in temperature data between periods that can affect the output of the Vento application system. For example, Figure 10 is a graph comparing temperature data at Bubulak Farm. The figure explained that the graph of the actual temperature of the first and second periods differs at each time it takes.

A comparison of temperature data at Farm Ciampea explained that the actual temperature graph for the first and second periods differs at every required time. Data analysis shows the difference between the set temperature and the actual temperature. This difference will affect the control of the Vento application system output by turning on or off the Heater, Exhaust Fan, and Cooling Pad. Figure 11 is a graph of temperature data on the Vento application.

Based on Figure 10 on Week 0 at Bubulak Farm, the ventilation application system is 1 unit of Heater and 1 unit of Exhaust Fan to achieve temperature regulation. From the 1st week to the 5th week, the Heater does not turn on. However, the Exhaust Fan is on, and the number of units will increase sequentially from week 1 to week 5 (1, 3, 4, 7 and 9 units). While the 2 Cooling Pads only turn on in the last 5 weeks.

Based on the data analysis, the difference between the set temperature and the actual temperature is obtained. This difference will affect the control of the ventilation application system output (ON) or turn off (OFF) the Heater, Exhaust Fan, and Cooling Pad. The graph of temperature data using the Vento application can be seen in Figure 11.

Based on Figure 11, in Week 0 at Farm Ciampea, the ventilation application system is 1 unit Heater and 1 unit Exhaust Fan to achieve temperature regulation. From the 1st week to the 5th week, the Heater does not turn on. However, the Exhaust Fan is on, and the number of units increases sequentially from week 1 to week 5 (1, 2, 6, 7 and 8 units). Meanwhile, 2 Cooling Pad units only turn on week 5.

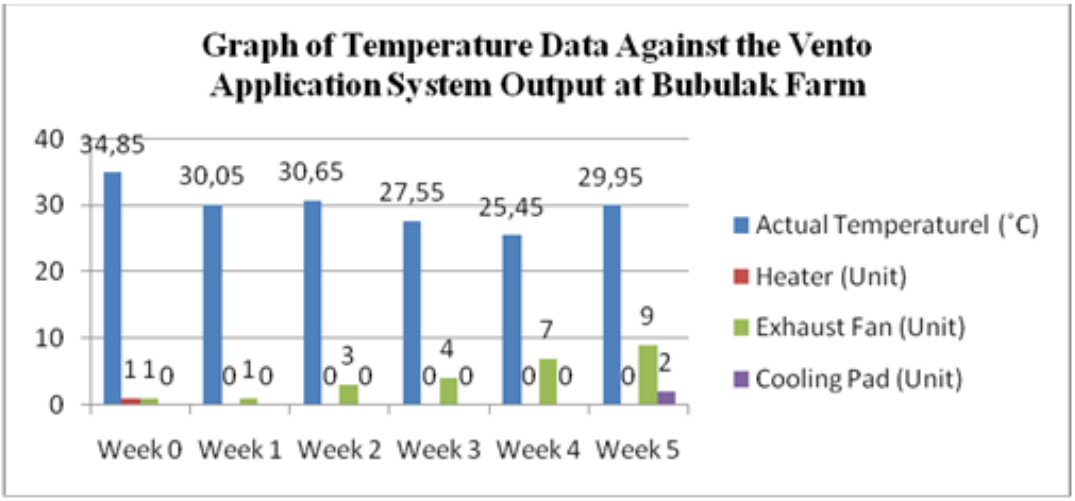

Figure 10. Temperature Data Against the Vento Application Output at Bubulak Farm

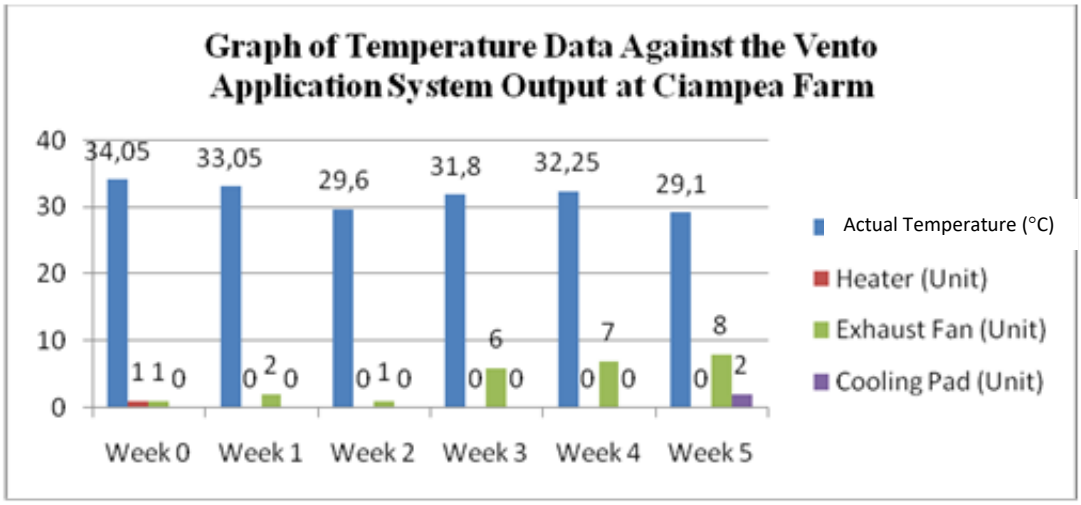

Figure 11. Temperature Data Against the Vento Application Output at Ciampea Farm

CONCLUSION

Raising chickens using the Vento application is carried out for five weeks. Every week there is a temperature setting based on the condition of the chicken in the cage. Based on the analysis and discussion of data, in week 0, the temperature tends to be conditioned at warm temperatures (>33°C). In contrast, for weeks 1 to 5, the temperature of the Vento system tends to decrease successively up to 27.5°C. The actual temperature from each sensor will match the set temperature so that the chickens still feel comfortable in the cage. The use of the Vento application in the chicken farming process is carried out by the administrator, who is in charge of controlling the setting temperature by considering the chickens' condition in the cage. The administrator is in charge of keeping the condition of the chickens comfortable. Temperature settings are carried out on the Vento application display during preparation before the chickens are put into the cage and every week. Outputs such as the Heater, exhaust fan, and cooling pad will function as an adjustment tool between the actual temperature reading by the sensor and the set temperature.

ACKNOWLEDGMENT

The first special thanks go to Universitas Mercu Buana for supporting foreign collaborative research, and the second goes to the Beijing Institute of Technology, Mirna Yunita, for her help and cooperation during this research. Third, to the Universitas Sumatra Utara, Mhd Adanan Purba, who has provided continuous support and encouragement. Hopefully, there will always be a paper collaboration with the Beijing Institute of Technology and Universitas Sumatra Utara in further research.

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