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Design Smart Chicken Cage Based On Internet Of Things

Design Smart Chicken Cage Based On Internet Of Things

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ABSTRACT. Cages are a place for all livestock activities. One important part to be considered in raising broilers is the temperature and humidity in the cage must be maintained so that growth can be optimal. And the air quality in the cage must be maintained so that the chicken is not exposed to the disease because with a closed cage system can remove excess heat, harmful gases such as NH_3 (ammonia), CO, CO_2. With the advancement of technology that continues to grow until now by developing internet of things based products that can communicate with each other through the internet. Then a device was designed to control temperature and humidity using DHT22 sensor, ammonia gas with MQ-135 sensor, and automatic feeder with HY-SRF05 sensor and servo motor. Furthermore, from the three sensors processed by Nodemcu ESP8266, the results are displayed on the 20x4 LCD and Android smartphones with the Blynk application. After collecting data and testing analysis, it can be concluded that the results of the sensor accuracy test to measure temperature with DHT22 sensor are 97.99%-100% and to measure humidity with DHT22 sensor is 97%-99.94%. For the measurement of ammonia levels the largest average reaches 9.33-11.33 ppm, where there is a warning notification when ammonia gas is more or equal to 25 ppm. While the accuracy of feed distance measurements using the HY-SRF05 sensor the largest average reached 92.27%-96.91%. on IoT testing it has run well as long as it is connected to WiFi. With this system it can make it easier for farmers to monitor and control the condition of the chicken coop.

Keywords:Closed Enclosure, DHT22, HY-SRF05, Internet of Things, MQ-135, Nodemcu ESP8266

1. Introduction

Cage is a place for all livestock activities to protect from the heat of the sun, rain and other animal disturbance so that it produces optimally (K. Tentang et al., 2016). In general, there are two cage systems that are used in chicken farms, namely the open house system and the closed house system. But in an open cage, where the micro elements in the cage depend on the natural conditions around the enclosure environment, while the enclosure system is closed, where the microclimate in the cage can be adjusted as needed [2]. Controlling temperature and humidity in a closed chicken coop is very important for broilers, so that chickens can have the temperature and

humidity as needed [3]. High temperatures in the environment of raising chickens can cause heat stress which will cause disruption to the growth of chickens [4]. Broilers are animals that maintain a more stable body temperature through increased breathing and the amount of drinking water consumption [5]. Maintenance of chicken farms has a negative impact on chickens, humans and the environment. Because the amount of chicken manure that has accumulated for many days will produce a variety of gases including ammonia, nitrates, nitrites and hydrogen sulfide gas [6]. From the presence of these gases can cause a decrease in productivity for chickens and can also cause humans to be affected by respiratory problems.

From the above problems there have been several studies making models of temperature and humidity control of broiler chicken coops using an atmega328 microcontroller and DHT 11 sensor, the results are displayed on the LCD and via sms [3]. The design of a chicken coop temperature control system using SMS Gateway [7]. The prototype of the temperature and humidity control system of Atmega328 microcontroller-based broiler chicken cages by utilizing the DHT 11 sensor and the display used is 16x2 LCD [8]. IOT-based smart farm design using the Blynk application [9]Based on the explanation above, this study with the title "Design of Smart Chicken Cages Based on Internet of Things". In order to facilitate breeders in making improvements and innovations for better cages to increase the productivity of broilers, by using Nodemcu ESP8266 based on the internet of things (IoT). This tool utilizes an android smartphone as a display media and a 20x4 LCD. In this chicken coop has the advantage of feeding automatically, controlling the temperature and humidity of the coop, and detecting ammonia gas in the chicken coop. With this technology it is expected to be an innovation and a new strategy in the world of chicken farming.

2. Methods

Facilitate breeders to improve and innovate better cages to increase the productivity of broilers. Use of the Nodemcu ESP8266 is based on the internet of things (IoT) and utilizes an Android smartphone as a display. From the chicken coop has the advantage of feeding automatically using the Ultrasonic Sensor HY-SRF05, controlling the temperature and humidity of the cage using the DHT Sensor 22, and detecting ammonia gas in the chicken coop using the MQ-135 Sensor.

2.1. Tool Design

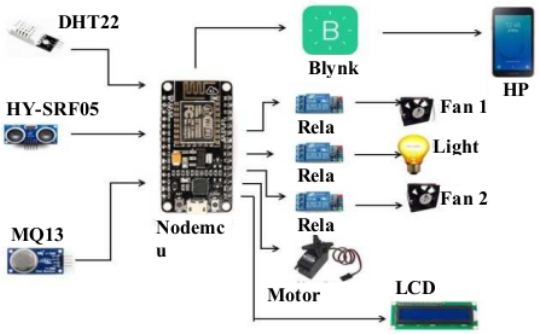

Figure 1. Tool Design

Figure 1. is a tool design using a DHT 22 sensor to measure temperature and humidity, Ultrasonic Sensor HY-SRF05 to measure feed distance, Sensor MQ-135 to detect Ammonia gas. The three sensors are processed by Nodemcu ESP8266 through Blynk, the results are displayed on a 20x4 LCD and smartphone. The indicator lights work if the temperature and humidity are below the range and the fan is working if the temperature is above the specified range. Servo motor works when the feed distance reaches 13 cm, automatically the valve rotates 13 degrees after 10 seconds the servo motor returns to 0 degrees.

2.2. Blynk Application Design

Blynk is an IOS and Android application that aims to control the Arduino module, Raspberry Pi, Nodemcu ESP8266, WEMOS D1 and the like through the internet. This research makes an android application that can display the value of temperature, humidity, ammonia levels, and feed distance, as well as remote control of fans and lights using Nodemcu ESP8266.

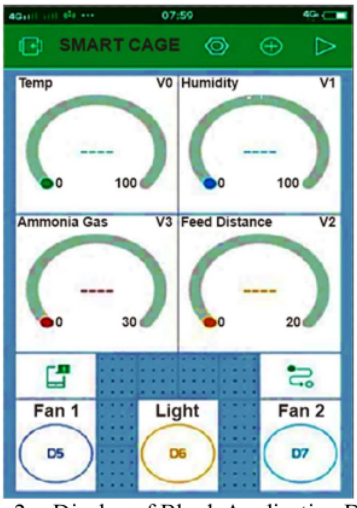

Figure 2. Display of Blynk Application Design

Figure 2. is a display design of blynk application where the top has a widget gauge for temperature, humidity, ammonia gas, feed distance and the bottom there is a notification and eventor and button for fan 1, lights, fan 2.

2.3. Mechanical Design

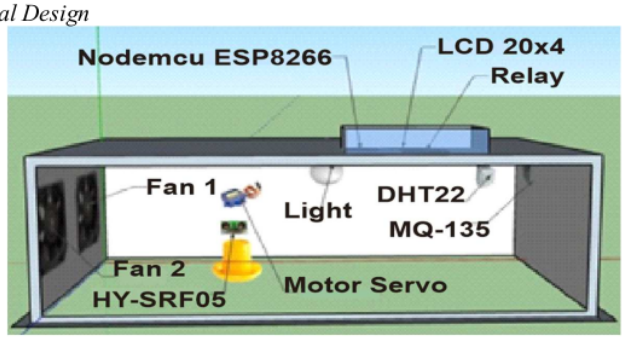

Figure 3. Mechanical Design Tools

Figure 3. Is the design of the equipment consists of a power supply, Nodemcu ESP8266, DHT 22 module, MQ-135 module, HY-SRF05 ultrasonic module, 4 channel relay, DC fan, lamp, water pump, LCD i2c 20x4. This tool is made of plywood which has dimensions of length 100 cm, width 60 cm and height 50 cm. This design works to control the temperature and humidity of the chicken coop, detect ammonia levels, provide automatic feed, the data of which will be displayed on the LCD i2c 20x4 and on Android smartphones.

3. Results And Discussion

3.1. Testing the DHT22 Sensor

DHT22 sensor testing is done to find out the sensor can work and can measure the temperature and humidity values properly. Figure 4. is a DHT22 sensor test on the Blynk display whose value compared to HTC1 is in a chicken coop.

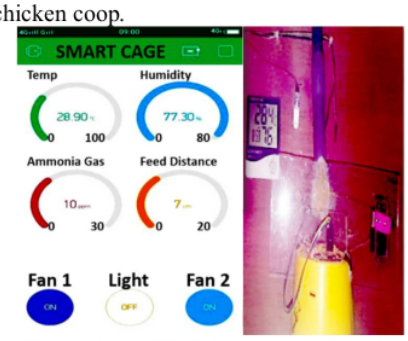

Figure 4. DHT22 Sensor Test Results

3.2. Testing of the MQ-135 Sensor

MQ-135 sensor testing is done to find out which sensor can work and can measure Ammonia levels well. Figure 5. is a Blynk display for monitoring ammonia levels detected by the MQ-135 sensor, measuring 10 PPM.

Figure 5. Display of MQ-135 Sensor Test results

3.3. Testing Notifications With Ammonia Gas Values More Or Equal To 25 PPM

Figure 6. Is a notification on Blynk if the ammonia gas value is more or equal to 25 PPM, the smartphone displays the notification "Dangerous Ammonia Gas" with an alarm marked. Table 1. Is the result of notification testing on Blynk if it then more or equal to 25 ppm then Blynk sends a notification "Dangerous Ammonia Gas". With 5 trials obtained an average value of 1 and a standard deviation of 0. At the age of 1 day with an average ammonia level of 11.33 PPM, in that experiment the fan was not turned on. Because the chicken body is still small and chicken dung is still small. Ammonia gas does not exceed the quality standard influenced by the presence of a fan, because with high wind speeds the air is more tenuous so that ammonia is lower. And also the state of the cage is diligently cleaned every day.

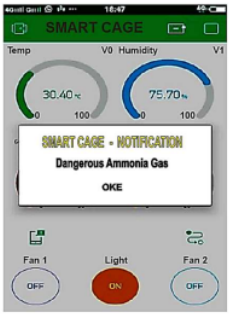

Figure 6. Display of Notification Test Results Ammonia Gas Value Is More or Equal To 25 PPM

Table 1. Warning Notification Test Results with Ammonia Gas Values More Or Equal To 25 PPM

Trial	Ammonia (PPM)	Condition
1	25	1
2	25	1
3	26	1
4	27	1
5	26	1
Mean		1
Standard Deviation		0

Information:
a. Condition 1 states send a warning notification.
b. Condition 0 states that it does not send warning notifications.

3.4. Pengujian Sensor Ultrasonik HY-SRF05

Ultrasonic Sensor Testing HY-SRF05 is performed to determine the chicken feed distance. Figure 7. is a blynk display for monitoring the distance of chicken feed detected by the HY-SRF05 sensor. Testing the distance of chicken feed based on the difference in value between the HY-SRF05 sensor with a standard tool (meter) on average almost the same, where the feed automatically comes out when the feed distance reaches 13 cm then the servo rotates 13 degrees.

Figure 7. Pengujian Sensor HY-SRF05

3.5. Internet Testing of Things Using Nodemcu ESP8266

Testing data transmission to find out the extent of the connection between the smartphone and Nodemcu ESP8366. The testing steps are as follows:
1. Turn on the device first and connect to the internet
2. Open the Blynk application on the smartphone after that monitor and control

From these steps, some distance testing of data transmission from the device (in Village Sumberejo. Village Sumberwaru, Sub-Districts Wringinanom, Districts Gresik) was produced to the smartphone.

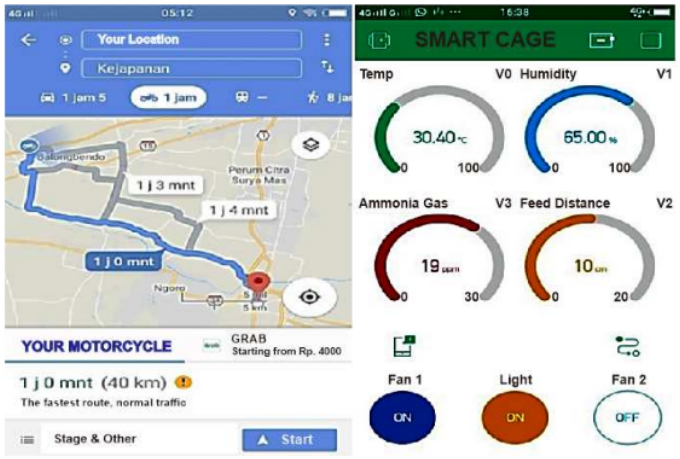

Figure 8. Display the results of IoT Testing with Smartphone

Figure 8. Is a screenshot of the google maps application map the distance between Sumberwaru Village and Kejapanan Village, Gempol District. Google maps show the distance between the house and the village of Gempol, which is 40 km in 1 hour. Measurement of data retrieval with the condition of the equipment is at home in Sumberejo Hamlet, Sumberwaru Village, Wringinom District, Gresik Regency. The smartphone display shows a temperature of 30.40, humidity 65.00, ammonia content of 19 PPM, feed distance of 10 cm. This is that the android application has been running well while connected to WiFi.

Based on the results of testing the instrument shows the results of measurements of temperature, humidity, ammonia gas, and feed distance obtained temperature and humidity measurements using a DHT sensor 22, the accuracy of the temperature of 100%, humidity accuracy of 99.94%, the average ammonia content using the MQ sensor -135 of 9.33 PPM-11.33 PPM, feed distance using the HY-SRF05 sensor with an accuracy of 98.36%. Output conditions are fan 1, lamp 2, fan 2, servo motor. Warning notification test results can send a message "Harmful Ammonia Gas" with an alarm if the ammonia gas is more or equal to 25 PPM and distance testing with a smartphone based on the internet of things can be connected in all places while connected to the internet.

4. Conclusion

The temperature, humidity and ammonia gas control system in the chicken coop works as specified using the Blynk application. When the temperature of the enclosure rises above 320C the fan works, when the temperature is below 25oC the lamp is on. Ammonia gas above or equal to 25 PPM, the Blynk application sends a notification notification "Dangerous Ammonia Gas" marked by an alarm and the fan is running. Chicken feed when a distance of 13 cm then the servo will rotate 13 degrees and automatically feed the chicken will be filled. DHT22 sensor to detect temperature and humidity compared with HTC1, the value of the accuracy of the DHT22 sensor to measure temperature is 97.99%, humidity is 97%. The MQ-135 sensor detects ammonia gas compared to the average ammonia standard of 9.33 PPM-11.33 PPM. The HY-SRF05 sensor measures the feed distance compared to a standard tool, the accuracy value of the HY-SRF05 Sensor is 92.27%. The measurement results of the three sensors used work well.

Nodemcu ESP8266 sends information on the results of temperature and humidity readings, Ammonia Gas, and feed distance displayed on LCD 20x4 and Android smartphones using the Blynk application, can be controlled and monitored at any distance as long as it is connected to Wifi or internet networks.

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