Design Of a System Feeding, Vitamin, Drinking and Cage Cleaning for Chicken Coops Based on Android Applications

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***Abstract* — The food filling system in raising chickens is still relying on human power. Breeders must regularly check on everything in the cage. In addition, if the farmer forgets to check it will be fatal and will affect chicken production. The research method will be carried out by monitoring feeding, drinking, vitamins and cleaning cages when ammonia gas is detected which increases above 50. Where in previous studies it was still done manually. Automatic control will be carried out using a microcontroller as the command brain and processing sensor data on the system. Where the trigger for cleaning is based on the ammonia level, while for feed it is based on the volume of the place to feed and drink. The weight sensor has an accuracy rate of 99.9% while the range is 99.13%. For the measurement of chicken manure ammonia gas can be done with a reading accuracy level of 99.69%. After using this system, the value of weight and gas content of Ammonia decreases from the first day to the third day. From the 3-day test, the highest value of ammonia gas content was obtained at a value of 197.56 ppm with a weight of 9.8 grams. The lowest was obtained on the third day with ammonia gas content of 18.37 ppm with a weight of 2.1 grams. For network quality, the system has an average delay of 0.07580 seconds and the packet loss obtained when testing is 6.11% (Very Good).**

Keywords* — *Controlling, IoT, Chicken Coop, Firebase.

I. INTRODUCTION

Cassava or Livestock is one of the business lines that is often chosen because it brings short-term profits. One of the most common types of poultry in Malang is laying hens [1]. However, compared to neighboring countries such as Malaysia, the level of consumption of chicken meat and eggs in Indonesia is still very low. This is due to the relatively more expensive price compared to other countries]2].

The food filling system in raising chickens still uses manuals that rely on human power [3]. Breeders must regularly check the condition of the food supply so that it is not empty. The process of feeding by hand. This system is less effective because it will consume a lot of time, labor, cost, and lack of hygiene in the food. In addition, if the breeder forgets to check it will be fatal, so that the chicken will lack food which will affect chicken production. [4]

Based on the problems above, this research, entitled Design of a system for feeding, vitamin, drinking and cleaning chicken coops based on an android application [5], will be carried out by monitoring feed [6], drinking water [7], vitamins, weight [8] and ammonia levels [9] of chicken manure which will trigger the cage cleaning system when detected. Ammonia gas which increased above 50 [10]. Where in previous studies it was still done manually, while in this system it will be controlled automatically. Automatic control will be carried out using a microcontroller as the command brain and processing sensor data on the system. Where the trigger for cleaning is based on the ammonia level of the drum, while for feed it is based on the volume of the place to feed and drink.

II. RESEARCH METHOD

The stages of research that will be taken in determining the next steps in the preparation of this research are as follows:

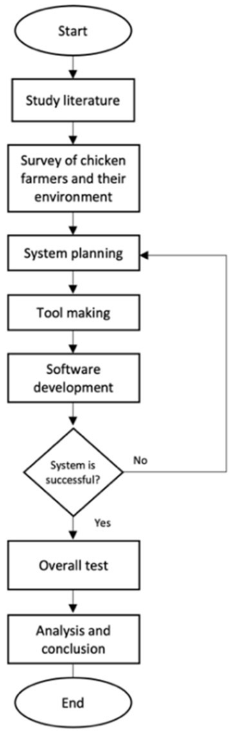

Figure 1. Research Design Flowchart

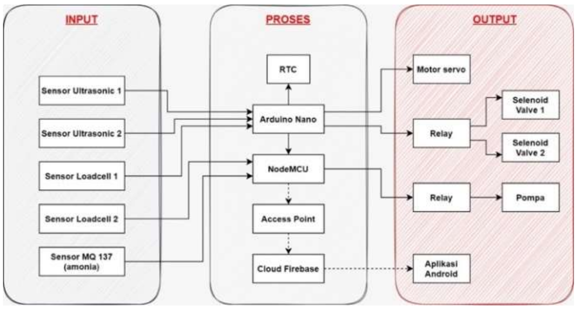

Figure 2. System Design Block Diagram

The block diagram of the system in this study is depicted in Fig. 2 This system has input in the form of data from loadcell sensors, ultrasonic, MQ137 gas sensors and water levels which are used to measure the amount of feed, drink livestock and chicken manure. Then, all sensors are connected to the microcontroller to process data from each sensor. When the value of the sensor is less than the specified standard, the NodeMCU esp8266 will process automatically to activate the actuator. Smartphone application as a device used to monitor sensor data and receive notifications.

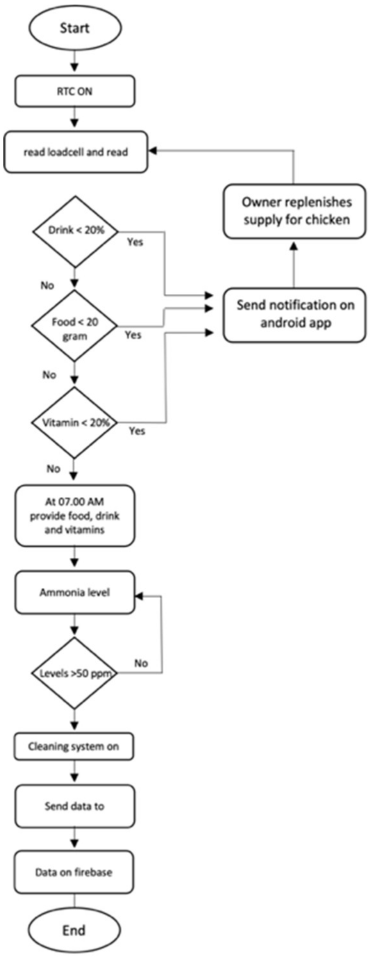

Figure 3. System Flowchart

When the RTC is on, the gas sensor will automatically work to detect ammonia levels. At this stage the gas sensor begins to detect where the dirt is underneath. Processing is carried out if the ammonia content in the existing impurities is more than 25 ppm. The content of ammonia levels that exceed 25 ppm is not good for chicken health, so the DC pump in the vitamin reservoir will turn on and distribute vitamins according to the specified amount. The water level sensor will detect the water level in the tendon of the drinking container. The level of drinking water in the reservoir will be monitored in the system. The DC pump in the drinking water reservoir is activated to distribute drinking water from the reservoir to the drinking water tank once a day using the RTC system. The first loadcell sensor will detect the weight of the manure in grams as well as the second loadcell sensor which will monitor the weight of the feed. The results of the weight sensor readings will be monitored in the system. For the method of feeding in a day, ordinary chickens eat about 110 grams of chicken feed for one laying hens. So the servo will be given an open delay of 11 seconds so that feeding can be optimal because in one second it distributes 10 grams of feed.

III. RESULTS AND DISCUSSION

A. Load Cell Weight Sensor Test

The following is a test to see how well the system's scales (load cell sensor) work. This experiment aims to evaluate the precision of readings made from chicken excrement in the cage shown in Fig. 4.

Figure 4. Loadcell Measurement Display

TABLE I
ACCURACY VALUE BETWEEN LOADCELL SENSOR AND SCALE 5 KG

Test to -	Test result		
	Scales (gram)	Sensor Loadcell (gram)	Error (%)
1	100	100.2	0.20%
2	100	100.1	0.10%
3	200	200.4	0.20%
4	200	200.3	0.15%
5	250	250.1	0.04%
6	250	250.3	0.12%
7	350	350.2	0.06%
8	350	350.3	0.09%
9	500	499.9	0.02%
10	500	500	0.00%
Average			0.10%

The test of the load cell sensor compared to the scale has almost the same value, it shows that the accuracy of the load cell sensor is good. The average error value that results is 0.10%.

B. Ultrasonic Weight Sensor Testing

The ultrasonic sensor used to determine the volume of the water container is tested in the following test.

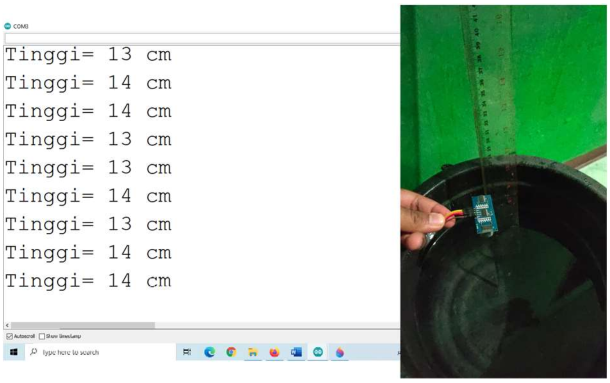

Figure 5. Ultrasonic Sensor Accuracy Measurement Process

TABLE II
ULTRASONIC SENSOR ACCURACY MEASUREMENT

Test to -	Test result		
	Ruler (cm)	Sensor Ultrasonic (cm)	Error (%)
1	3	3	0
2	4	4	0
3	5	5	0
4	6	6	0
5	7	7	0
6	8	8	0
7	9	9	0
8	10	10	0
9	11	11	0
10	12	13	8,33%
Average			0,83%

Results of the accuracy testing of ultrasonic sensors are shown in Table 2 with an average inaccuracy of 0.83% across 10 tests. Because the feed used is only 15 cm tall, the maximum test is conducted at a height of 12 cm. The test results for the ultrasonic sensor and ruler are nearly identical, demonstrating the high accuracy of the ultrasonic sensor.

C. Testing of Ammonia Sensor

Finding out the degree of precision between the ppm readings on the sensor that are close to or exactly the same as the ammonia meter illustrated in Fig. 6 is the goal of calibrating ammonia readings on the sensor with an ammonia meter.

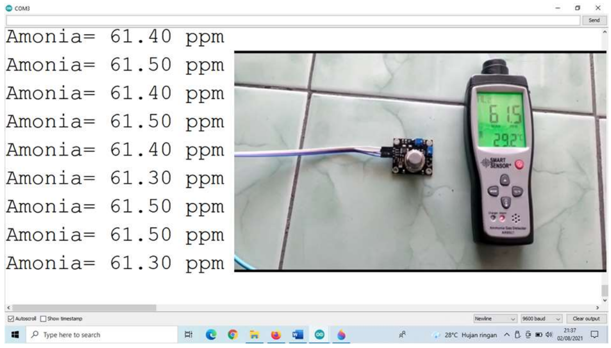

Figure 6. Display of Ammonia Meter Readout Values

TABLE III
ACCURACY VALUE BETWEEN AMMONIA SENSOR AND AMMONIA METER

Test to-	Test Result		
	Ammonia gas detector (ppm)	Sensor MQ-135 (ppm)	Error (%)
1	55.9	55.7	0.44
2	56.4	55.2	0.22
3	55.5	55.3	0.44
4	55.8	55.7	0.22
5	57.2	57.3	0.21
6	55.2	55.4	0.44
7	56.2	56.1	0.22
8	61.5	61.7	0.45
9	60.6	60.5	0.2
10	56.7	56.8	0.21
Average			0.31

The average error value in 10 tests of ammonia readings between the MQ-137 sensor and the ammonia meter was 0.31%. Testing results for the ammonia sensor and ammonia meter are nearly identical, demonstrating the ammonia sensor's high degree of accuracy.

D. RTC Testing

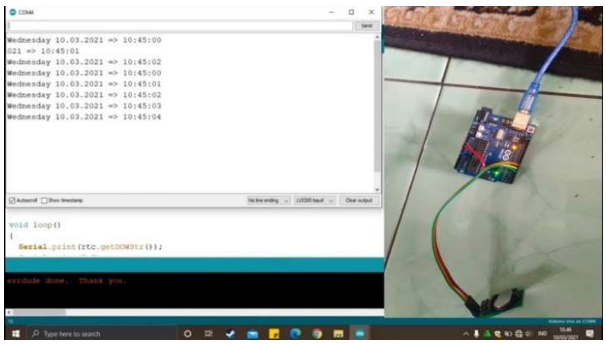

Figure 7. RTC Test

RTC testing is done to identify real-time notifications from applications that come from previously defined monitoring parameters.

TABLE IV
APP NOTIFICATION TEST

No.	Water Stock	Vitamin Stock	Food Weight	Notif
1	60	50	8	"-"
2	40	50	7	"-"
3	40	40	4	Less food notif
4	30	30	4	Less food notif
5	25	25	4	Less food notif
6	20	20	4	Notif of food vitamin water is lacking
7	19	19	3	Notif of food vitamin water is lacking
8	18	17	3	Notif of food vitamin water is lacking
9	15	16	2	Notif of food vitamin water is lacking
10	14	14	3	Notif of food vitamin water is lacking

RTC testing in this study can be said to have a 100% success rate since after 1 minute of monitoring, the value issued is consistent with what is set.

E. Delay Test

A packet's delay is the amount of time it takes to get there. A sample of 20 packets is shown in Table 5.

TABLE V
RESULT OF ACCURACY

No.	Source	Delay (detik)
1	192.168.43.223	0.032247
2	192.168.43.223	0.035482
3	192.168.43.223	0.048457
4	192.168.43.223	0.03343
5	192.168.43.223	0.025804
6	192.168.43.223	0.027413
7	192.168.43.223	0.114918
8	192.168.43.223	0.029873
9	192.168.43.223	0.10853
10	192.168.43.223	0.120457
11	192.168.43.223	0.116236
12	192.168.43.223	0.117127
13	192.168.43.223	0.084248
14	192.168.43.223	0.081568
15	192.168.43.223	0.115812
16	192.168.43.223	0.097703
17	192.168.43.223	0.094296
18	192.168.43.223	0.000375
19	192.168.43.223	0.116017
20	192.168.43.223	0.116036
Average		0.07580
in ms		75.80145

The average delay calculated from the packet calculation is 0.07580 seconds. Since there won't be any information delay, the quality of a data transmission improves with decreasing delay.

F. Packet Loss Test

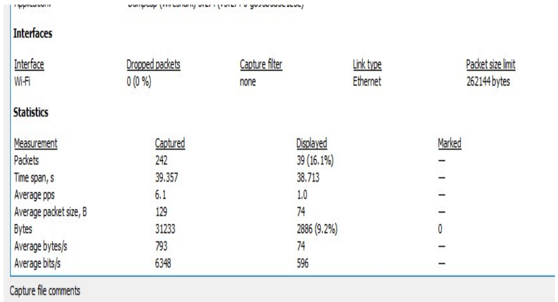

Figure 8. Capture File Properties

Wireshark's data showed that 242 packets were successfully transmitted. There were 39 packets that the server failed to successfully receive. acquired packet loss of 6.11%.

G. Overall System Test

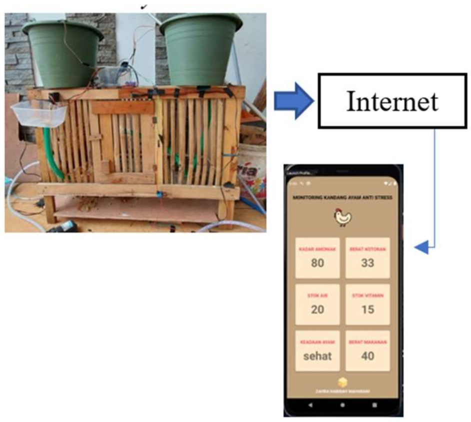

Figure 9. Overall System Results

Testing has been done on the designed system, including determining the precision of the weight sensor, ammonia sensor, and ultrasonic sensor. A cage monitoring app is downloaded to the smartphone and shows information on ammonia levels, dung weight, water stock, vitamin stock, feed weight, and chicken status.

IV. CONCLUSION

System design that can run well. The weight sensor has an accuracy rate of 99.9% while the range is 99.13%. For the measurement of chicken manure ammonia gas is 99.69%. For application testing, it has a 100% success rate when compared with the data displayed on the serial monitor with what is stated in the application. From the 3-day test, the highest ammonia gas content was obtained at 197.56 ppm with a weight of 9.8 grams. For network quality, the average delay obtained is a delay of 0.07580 seconds and packet loss obtained during testing is 6.11% (Very Good).

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