Volume 8, No. 1, May 2024, pages 23 - 33

JEE

Jurnal Edukasi Elektro

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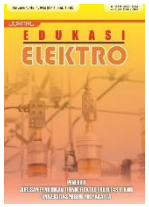

Incubator Control System Automatic Temperature Stabilizer Bangkok Chicken with LM35 Sensor

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Abstract— Many cases of death of chicks in farmers are caused by drastic changes in temperature which result in stress and death of chickens. In this study the authors made a chick coop design equipped with an LM35 sensor which functions to control the temperature of the chicks. The research object is Bangkok chicken aged 7-10 days which has a temperature requirement of 300°C. The test results show that the temperature stabilizer incubator for both the sensor test separately and the integration of the incubator control system as a whole works according to the program design, this is based on the test results that the lights and fans work according to the LM35 sensor reading input with 100% accuracy where as long as 3 days of testing the average temperature of the first, second and third days is below 300°C so that the output is in the form of lights on and the fan is off. On Day 3 all the chickens were healthy and growing well.

Keywords: arduino, chicken, LM35 sensor, temperature controller

Article submitted 2023-11-27. Resubmitted 2024-01-06. Final acceptance 2024-01-08. Final version published as submitted by the authors.

1 Introduction

The main problem for chicken farmers is the number of cases of death of chickens in the process of chicken development, many factors are the main causes of death of chickens, one of the highest factors is the influence of environmental temperature caused by drastic changes in temperature from hot to rainy or vice versa causing stress and death of chickens. The need for stable temperatures is needed by poultry farmers [1]. The initial phase and the critical period of chicken life, which occurs in the first two weeks or often referred to as the brooding period, during this brooding period determines the survival of the chickens, so that during the brooding period the chickens require intensive attention [2].

The determinants of success during the critical period of brooding are influenced by temperature, humidity, air quality and cage design. Robby et al [3] stated that the temperature requirement for chickens aged 1-3 days was 34^0C, aged 4-6 days was 32^0C, aged 7-10 days 30^0C and chickens aged 11-15 days had the required room temperature of 28^0C. Nadzir et al [4] stated that a coop design that is not in accordance with the technical requirements of a good coop can cause many problems such as cold or hot chickens, chicken legs stuck to the floor of the coop, chicken wings stuck to the floor of the coop. Based on the results of interviews with chicken farmers, farmers use lamps to warm their chickens, but the disadvantages of using lights continuously without tempera-

ture control and adjusting the temperature of the chicks are also bad for the chicks which result in bone abnormalities and disruption of the daily (diurnal) rhythm. , so that the use of lights is considered less effective in reducing cases of death of chicks.

This tool uses an incubator control system equipped with an LM35 sensor. An incubator is a device specifically designed to provide a controlled environment temperature so that chicks grow healthier [5]. The design of the incubator is adjusted to the needs of the temperature and age of the chickens so that the incubator can be reprogrammed according to the temperature requirements of the chickens, so that the working principle of the incubator, namely the LM35 sensor will detect the temperature of the room temperature in the working chicken incubator after that the results of the temperature will be used as input in the system control.

The main components of the chick temperature control incubator control system are LCD, LM35 sensor, Arduino, relay, fan and lights. Bayu et al [7] The LM35 sensor is used to measure the temperature in the incubator, in line with that Anizar et al [8] stated that the LM35 temperature sensor is used to maintain temperature and to determine the increase and decrease in temperature. The working system of the LM35 sensor, namely the temperature value generated by the LM35 Arduino sensor will regulate the PWM output which functions as an AC light dimmer input in the form of a PWM value with a function as an AC voltage controller, when the PWM value is high the AC voltage is also high according to the output of the AC light dimmer , whereas when the PWM value is low or up to zero the AC voltage can be low [9].

Relay is an electrical switch that has the function of closing and opening the current of an electric circuit with the working principle of conducting low-voltage and high-voltage electricity [10], in line with that Saleh and Munnik [11] stated that a relay is an electromechanical component consisting of two parts namely electromagnetic and mechanical. Arduino is a single-board microcontroller designed to make it easier for users because it is open-source. This tool can be used to create electronic circuits from simple to complex.

The controller for this incubator is Arduino Uno. Lucky and Bambang [12] explained that Arduino is a single-board micro controller that has open source properties which has an Atmel AVR processor and Arduino software has C language besides Arduino Uno is equipped with a 16 MHz oscillator, 5 volt regulator, so Arduino is designed to make it easy to facilitate the use of electronics in various fields [13]. A similar opinion was expressed by Pramudita et al [14] who stated that Arduino is used to create electronic circuits ranging from simple to complex electronic circuits. Arduino is equipped with an Arduino e-board that uses an IDE or Integrated Development Environment which is a special program for a computer so that it can make a program design or sketch for the Arduino board [15]. Based on the description above, the authors designed and implemented a system to create a tool entitled "Automatic Chick Temperature Stabilizer Control System with LM35 Sensor".

2 Research Methods

2.1 Design Hardware

The incubator control system for stabilizing the temperature of automatic chicks with LM35 is designed automatically using Arduino Uno R3 with the aim of making it easier for chicken farmers to control the temperature according to the room temperature needed by the chickens, this incubator is equipped with an LCD, lights and fans that will work will work according to with the reading of the LM35 sensor where the temperature will be displayed on the LCD screen, so that the end result of this tool is expected to be effective in reducing cases of death of chicks during the brooding period. The steps for designing a temperature stabilizer incubator for chicks are observing chicken farmers about the problems they face, making a design and performance program for the tool, assembling components, and testing the incubator.

The object of this study was Bangkok chicken aged 7-10 days. Selection of age and chicken types because Bangkok chicken is relatively difficult to care for compared to other chickens, espe-

cially during the critical period of chickens, namely 1-14 days of age. This chick temperature stabilizer control system is programmed for chicks aged 7-10 days with an ambient temperature requirement of 30^0C. If the age of the chicken is past 10 days, this tool can be reprogrammed according to the temperature requirements of the chicken. The control system uses the Arduino Uno R3 and the LM35 sensor consisting of input, data processing, and output in the form of lights and fans.

The temperature controller for the incubator to stabilize the temperature of these chicks is arranged in a small box inside the incubator, the placement of the temperature control box in the incubator aims to ensure that the room temperature is detected on target because the temperature inside and outside the incubator is different, where the temperature inside the incubator is warmer than the temperature outside the incubator. Figure 1 is a circuit diagram of a chick temperature stabilizing incubator made using proteus.

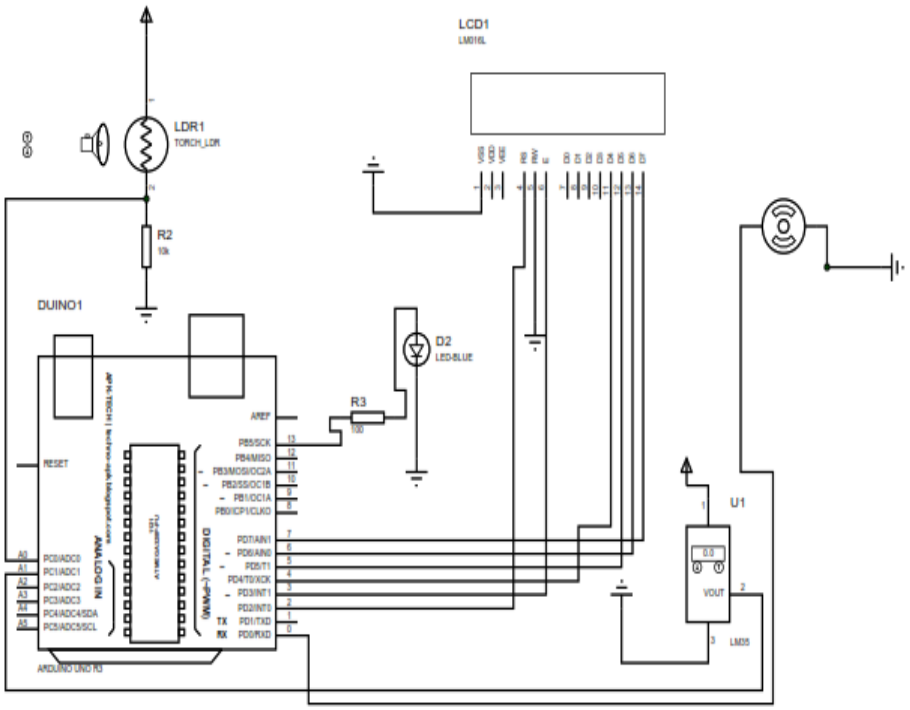

Fig 1. Proteus design of an automatic incubator temperature stabilizer for arduino-based chicks with a LM35 sensor

2.2 Software Design

Software is a part of a computer system that has no form, where software has a special term for data that is created, formatted, and stored digitally, including computer programs, documentation, and various information that can be read and written by computers [16]. The automatic chick temperature stabilizing incubator control system with an LM35 sensor is programmed using the Arduino Ide software so that the system can run according to the performance desired by the researchers.

The program is made with the independent variable in the form of room temperature and the dependent variable in the form of lights and fans. In this incubator control system, the program is set for chickens aged 7-10 days with the required room temperature of 30^0C so that if the temperature is less than that, the light will turn on and if the room temperature exceeds the specified maximum temperature, the fan will turn on, the fan rotation speed is determined by room temperature is detected where when the temperature is higher the fan rotation will be faster. Program testing is

carried out in two stages, namely the first stage is testing on Proteus with the aim of knowing whether the program is running according to the desired performance, in addition to minimizing print errors on the PCB and the second stage testing the program is directly transferred to the automatic chick temperature stabilizing incubator control device with LM35 sensors. The flow chart is shown in Figure 2 below.

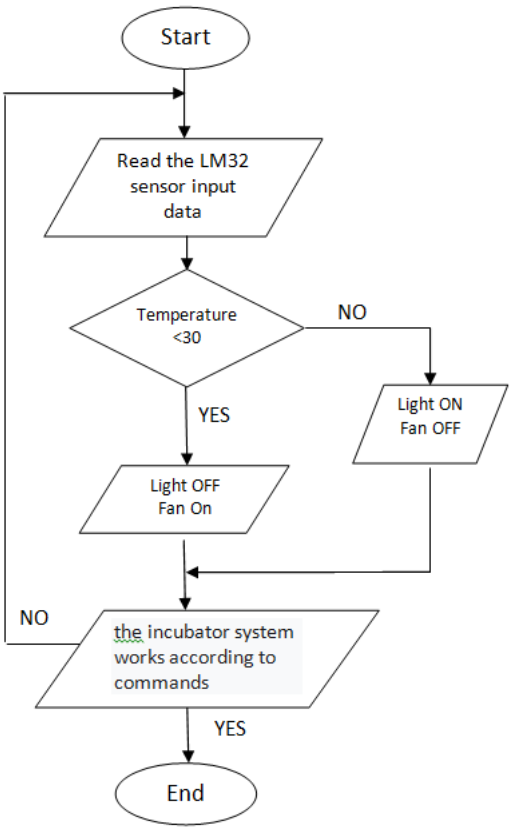

Fig 2. Flowchart of arduino-based automatic incubator temperature stabilizer design with LM35 sensor

The flow chart in Figure 2 above shows that if the sensor detects a temperature below 30^0C then the light will automatically turn on and the fan will turn off and if the temperature detects more than 30^0C then the fan will turn on and the light will turn off. The temperature is adjusted for the /needs of chickens aged 7-10 days and the fan speed is adjusted according to the temperature detected by the LM35 sensor, where the higher the temperature, the faster the fan rotates. If there is a failure in the fan and the light the system will back into proses on read the LM35 sensor input data, the system is still ON.

3 Result and Discussion

3.1 Chick temperature stabilizing incubator design result

The incubator is made with a length of 38, a width of 31, and a height of 25. This incubator uses an insect net covered with thick ultra violet plastic. The capacity of chickens in the incubator is 7 chicks with an age range of 7-10 days. The incubator can stabilize the temperature of the chicks so that the growth and development of the chicks is good and healthy. The incubator that the researchers have made has been calculated based on the average size for chicks aged 7-10 days.

Making this incubator can be made a reference for making incubators with a larger amount of capacity. However, for larger incubators, more lights and fans are also needed to optimize the work of the incubator system. For example, if the researcher wants to make an incubator for 14 chicks, feeding requires 2 lamps and 2 fans for the manufacture of the incubator.The results of the incubator design are shown in Figure 3.

Fig 3. Display of chick temperature stabilizer incubator

Fig 4. Display in the chick temperature stabilizer incubator

3.2 LM35 sensor test result

Testing the chick temperature stabilizer, which aims to test whether the chick temperature stabilizer box works according to the program before being installed in the incubator box. The results of testing the room temperature stabilizer are shown in Table 1.

Table 1. Result testing of chick's temperature stabilizer incubator

No	Temperature	Lamp	Fan
1	16^0C	On	Off
2	25^0C	On	Off
3	27^0C	On	Off
4	29^0C	On	Off
5	35^0C	0ff	On, the speed 25%
6	37^0C	Off	On, the speed 48%
7	38^0C	Off	On, the speed 48%

In Figures 5, 6, 7, and 8 are the results of experiments for testing tools whose results are shown on the LCD that has been installed in the incubator device.

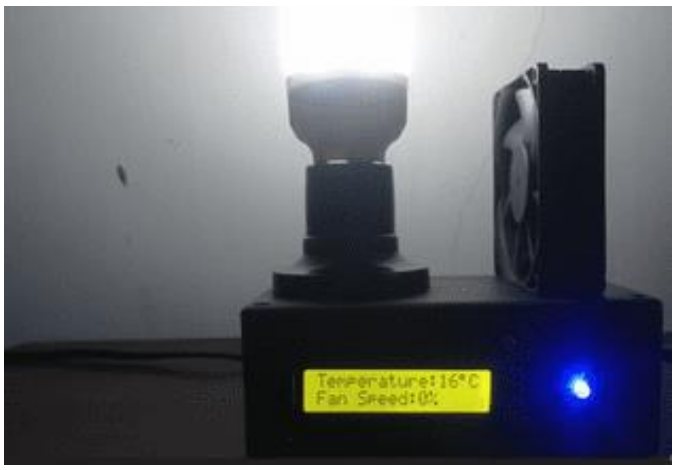

Fig 5. Display temperature 16^0C the light is on and the fan is off and

Fig 6. Temperature display 35^0C the lights go out and the fans turn on at 25% speed

Fig 7. The temperature display is 38^0C the light is off and the fan is on at 48% speed

Fig 8. The temperature display is 38^0C the light is off and the fan is on at 48% speed

The test results above show that the series of tools have worked according to the program where if the sensor detects a temperature above 30^0C then the fan will turn on and the light will turn off otherwise if the sensor detects a temperature below 30^0C then the light will turn on and the fan will turn off, the fan rotation speed also matches the temperature room detected by the LM35 sensor. Testing of this tool is carried out before the tool is put into the incubator box where the trial for room temperature regulation is assisted by matches so that the heat produced varies and the tool is effective in detecting room temperature. In this tool the direction of fan rotation can also be adjusted to the layout of the incubator so that it is effective in its use.

3.3 Test result of chick temperature stabilizer incubator

The process of testing the chick temperature stabilizer incubator with the LM35 sensor was carried out for 3 days on bangkok chickens aged 7-10 days with a total of 7 chicks. Sensor checks and tool performance are carried out every hour for 3 days, Start from 6 am untul tomorrow morning at the same time. The selection of hours is based on the significance of changes in room temperature during these hours. Table 2 below shows the test results on the first day.

Table 2. Testing of chick's temperature stabilizer incubator on the first day

No	Time	Input LM35	Output		Information
			Light	*Fan peed*	
1	06.00	24^0	On	0%	Right
2	07.00	24^0	On	0%	Right
3	08.00	24^0	On	0%	Right
4	09.00	27^0	On	0%	Right
5	10.00	28^0	On	0%	Right
6	11.00	28^0	On	0%	Right
7	12.00	26^0	On	0%	Right
8	13.00	25^0	On	0%	Right
9	14.00	25^0	On	0%	Right
10	15.00	25^0	On	0%	Right
11	16.00	26^0	On	0%	Right
12	17.00	26^0	On	0%	Right
13	18.00	25^0	On	0%	Right
14	19.00	25^0	On	0%	Right
15	20.00	25^0	On	0%	Right
16	21.00	25^0	On	0%	Right
17	22.00	24^0	On	0%	Right
18	23.00	24^0	On	0%	Right
19	24.00	24^0	On	0%	Right
20	01.00	24^0	On	0%	Right

No	Time	Input LM35	Output		Information
			Light	*Fan peed*	
21	02.00	26^0	On	0%	Right
22	03.00	24^0	On	0%	Right
23	04.00	24^0	On	0%	Right
24	05.00	24^0	On	0%	Right

On the first day of testing the rainfall was high enough so that the room temperature was below 30^0C even, so the chicks showed good characteristics in the incubator where the chickens were agile, had bright eyes, loud voices, big and clean feet. Table 1 shows that the average temperature is below 30^0C where this temperature is less than the room temperature needed by Bangkok chickens aged 7-10 days so that the output of the incubator is in the form of a continuous light and the fan is off or the rotation speed is 0%. The test results on the second day are shown in Table 3.

Table 3. Testing of chicks temperature stabilizer incubator on the second day

No	Time	Input LM35	Output		Information
			Light	*Fan peed*	
1	06.00	24^0	On	0%	Right
2	07.00	24^0	On	0%	Right
3	08.00	24^0	On	0%	Right
4	09.00	27^0	On	0%	Right
5	10.00	28^0	On	0%	Right
6	11.00	28^0	On	0%	Right
7	12.00	26^0	On	0%	Right
8	13.00	25^0	On	0%	Right
9	14.00	24^0	On	0%	Right
10	15.00	25^0	On	0%	Right
11	16.00	26^0	On	0%	Right
12	17.00	26^0	On	0%	Right
13	18.00	26^0	On	0%	Right
14	19.00	26^0	On	0%	Right
15	20.00	25^0	On	0%	Right
16	21.00	25^0	On	0%	Right
17	22.00	24^0	On	0%	Right
18	23.00	24^0	On	0%	Right
19	24.00	25^0	On	0%	Right
20	01.00	25^0	On	0%	Right
21	02.00	25^0	On	0%	Right
22	03.00	24^0	On	0%	Right
23	04.00	24^0	On	0%	Right
24	05.00	24^0	On	0%	Right

Testing on the second day of high rainfall is the same as testing on the first day, in this test the chickens are in good condition and grow healthily in the incubator. The test results in Table 2 show that the average temperature on the second day of testing is less than 30^0C so that at this temperature the output from the sensor results in the light on the incubator turning on for 24 hours and the fan turning off. The test table on the third day is shown in Table 3.

Table 4. Testing temperature stabilizing incubator tests for chicks on the third day

No	Time	Input LM35	Output		Information
			Light	*Fan peed*	
1	06.00	24^0	On	0%	Right
2	07.00	24^0	On	0%	Right
3	08.00	24^0	On	0%	Right
4	09.00	25^0	On	0%	Right
5	10.00	26^0	On	0%	Right
6	11.00	27^0	On	0%	Right
7	12.00	28^0	On	0%	Right
8	13.00	28^0	On	0%	Right
9	14.00	28^0	On	0%	Right
10	15.00	27^0	On	0%	Right

No	Time	Input LM35	Output		Information
			Light	*Fan peed*	
11	16.00	26^0	On	0%	Right
12	17.00	26^0	On	0%	Right
13	18.00	26^0	On	0%	Right
14	19.00	26^0	On	0%	Right
15	20.00	25^0	On	0%	Right
16	21.00	25^0	On	0%	Right
17	22.00	24^0	On	0%	Right
18	23.00	24^0	On	0%	Right
19	24.00	24^0	On	0%	Right
20	01.00	24^0	On	0%	Right
21	02.00	24^0	On	0%	Right
22	03.00	23^0	On	0%	Right
23	04.00	23^0	On	0%	Right
24	05.00	23^0	On	0%	Right

Tests in Table 3 show that the average temperature on the third day of testing is the same as on the second and third days, namely below 30^0C so that the light on the incubator turns on and the fan turns off. The highest temperature on the third day of testing was 29 ^{0}C and the lowest temperature was 23 ^{0}C. The low temperature on the 3 days of incubator testing was due to rain and overcast both during the day and at night, causing the air temperature to be cold and less than 30^0C. On the third day of testing, the growth of healthy and good chickens was shown, where the chickens grew bigger and agile.

Based on the results of testing the chick temperature stabilizer incubator in Table 1, Table 2, and Table 3, the accuracy calculation is carried out as follows.

$$\text{ccuracy} = \frac{appropiate\ amount\ of\ data}{the\ amount\ of\ data\ tested}\ x\ 100\% = \frac{24}{24}\ x\ 100\% = 100\%$$

Based on the test results, the chick temperature stabilizing incubator works according to the program that has been made, where the lights and fans work according to the sensor readings that detect the temperature of the incubator room temperature for 3 days with an accuracy rate of 100%.

4 Conclusion

Based on the results of the design, the incubator was made with a length of 38, a width of 31 and a height of 25 which was covered with an insect net and ultraviolet plastic. From the results of testing the incubator temperature stabilizing device for both the sensor testing separately and the integration of the overall incubator control system which was carried out for three days with readings every hours, start at 6 am until 5am in the next day, the result of data it can be concluded that the chick temperature stabilizing incubator works according to the program design to stabilize the temperature of chicks aged 7-10 days with the required room temperature of 30^0C. This is based on the test results that the lights and fans work according to the LM35 sensor reading input with 100% accuracy and the chicks in the incubator grow healthily.

5 Acknowledgment

This research was funded by the Nusantara University PGRI Kediri Foundation Grant in the field of research for the 2022 fiscal year. We would like to thank LPPM for facilitating the implementation of the research and thank the Nusantara University PGRI Kediri for funding and supporting the implementation of the research "Automatic Chick Temperature Stabilization System with LM35 Sensors".

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