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Utilization of Solar Panels as an Energy Source in the Egg Hatcher Temperature Control Automation System

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ABSTRACT

The purpose of this study was to increase the production of chicks through egg incubators by using solar panels as a backup source of energy in controlling the temperature and humidity of the air. Manufacture of egg incubators through design with a capacity of 20 eggs. Hatching room temperature during egg incubation in the first 18 days is 37 ^{0} C - 38 ^{0} C, while the hatching period from day 19 to day 21 is 38 ^{0} C - 39 ^{0} C. Humidity is maintained in the first 18 days 50% - 55% RH and in the hatching period on the 19th- 21st day air humidity 55% - 60%RH. From the results of tests and observations, the temperature and humidity values are in accordance with the desired 38°C - 39°C and relatively stable humidity that is 50% - 60%RH. This tool can be used as an egg incubator without worrying about the electricity flow is interrupted.

1. Introduction

Hatching eggs using natural breeding is less effective because of the limitations of incubation. The maximum number of eggs by the hen was 13 eggs, meaning that it takes some breeders to hatch in large quantities. To overcome these problems, can be done with the use of automatic egg incubator so that in the process of hatching eggs to be more practical and can be done in large quantities.

Obstacles often happens, the frequent blackouts in Indonesia make otomatiskurang egg incubator can work well. For this study utilizing solar panels as reserves that can backup and continuous supply electrical energy when the flow of electricity was disrupted in this egg incubator. This research is the aspect of temperature, humidity, and driving an egg on egg incubator box.

2. Literature review

Automatic egg incubator is a machine used to warm the egg so that the egg remains in a fixed and stable temperature so that the eggs can hatch. In this automatic machine, we do not need to move the eggs by hand, but the egg crates automatically shifts itself with the help of the motor. In automatic egg incubator, which is important to note is the setting of temperature and humidity are controlled by the microcontroller ATmega328. In addition, the egg incubator using solar panels as a back-up if the power supply PLN outages.

Automatic egg incubator tool has a kapastitas 20 eggs. Old chicken eggs penetasaan process takes between 21-22 days. Room temperature during incubation hatching chicken eggs (first 18 days) set around 37 ° -38 ° C, while the hatching period (around day 19-21) a temperature between 38 ° C - 39 ° C. Relative humidity, the incubation period, the humidity is maintained at 50% - 55% and the hatching period or on days 19-21 with increased air humidity is about 60% - 65%.

Set the humidity aims to maintain the stability of the water content in eggs. Observation was conducted to determine the proper moisture levels periodically egg on day 7, 14 and 18. [1] Entering prior

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to hatching, the humidity is usually increased because the vents must be opened fully so that O2 can be inhaled by chicks who was about to hatch. Ideally, the moisture needed on the first day until the eighteenth of 55% - 60%.

2.1 Solar panels

Solar panels are energy conversion devices solar light into electrical energy (Figure 1). There are 2 types of technology applied to exploit the potential of solar energy, namely photovoltaic energy (PV) and solar thermal energy [3]. PV is widely used to supply electricity for lighting, water pumping, telecommunications and others. Specifications of solar panels that are used can be seen from Table 1.

Figure 1. Solar Panels

Table 1
Solar panel specifications

Monocrystalline SOLAR MODULE		
Model Type	:	SSPM 50 WP / 12V
Rated Maximum Power	:	[Pmax] 50W
output Tolerance	:	0 ~ + 3%
Voltage at Pmp	:	[Vmp] 18V
Current at Pmp	:	[Imp] 2.78A
Open-Circuit Voltage	:	[Voc] 22.0 V
Short-Circuit Current	:	[Isp] 3:03 A
Maximum System Voltage	:	1000 V
Maximum Series Fuse Rating	:	15.0 A
weight	:	[Kg] 4.0
Dimension	:	[Mm] 540 * 670 * 30
Application Class	:	
Application Class: A		
AM = 1.5 E = 1000W / M2 TC = 25 ^{0} C		

Solar panel system is interconnected with the network, overload which can not be supplied by the solar panels will be supplied by the network. Conversely, if the weather conditions are very good as well as the load demand decreases, the excess energy litrik generated by the solar panels will be accommodated by the network users. [5]

2.2 Sensor DHT 11

DHT 11 is a sensor that can measure the temperature and humidity of the air (humidity).

Figure 2. Sensor DHT 11

Pin Description:

1) VDD power supply 3.5 ~ 5.5V DC

2) DATA series of data, a single bus
3) NC, empty pin
4) GND ground, the negative power

Table 2
Specifications DHT 11 [4]

operating voltage	3.3 - 5.5 V
operating current	Measuring: 0.3 mA, standby: 0.6 uA
Humidity measurement range	5-95% RH ± 5% RH
Temperature measurement range	-20 - 60 ° C ± 2 ° C
Sampling period	> 2 seconds
Dimension	15.5 x 12 x 5.5 mm
dimensions Pin	8 mm in length, 2.54mm spacing
profit	The cost is very low

3. Research methods

By using a control diagram of the system, such as a closed block diagram below.

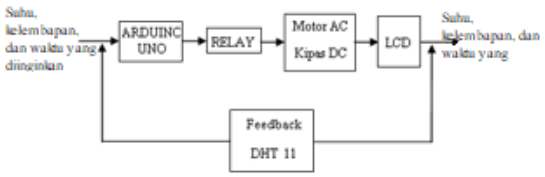

Figure 3. Control Systems

The function of each block in the system control diagram above is as follows:
1) The power supply, as the source to turn on components.
2) DHT 11, to detect the temperature and humidity in the box.
3) Arduino Uno, as receivers, processors, and control the entire device tools.
4) RTC DS 1307, to count the days.
5) LCD, as a tool to show the magnitude of temperature, humidity, and date.
6) AC motor, which serves as the driving rack eggs
7) AC fan, to stabilize the temperature and humidity
8) Incandescent bulbs, to stabilize the temperature
9) and moisture when the temperature and humidity drops.

The circuit works as in the following flow chart.

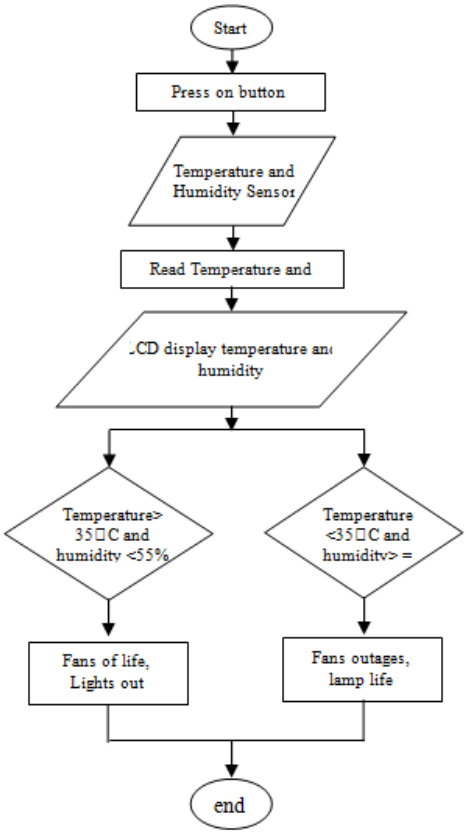

Figure 4.Flow Chart Research

4. Results and Discussion

4.1 Temperature and humidity testing

Testing is done to ensure a temperature of 37-38 ^{0} C, and humidity is 50-60% RH.

table 3
Temperature And Humidity Air

Time	Temperature ^{0}C		Air humidity (% RH)	
(GMT)	DHT 11	Thermo Hygro AMT 123	DHT 11	Thermo Hygro AMT 123
08:00	37	37	58	58
09:00	37	37	58	58
10:00	37	37	58	58
11:00	37	37	57	58
12:00	37	38	57	57
13:00	38	38	56	57
14:00	38	38	56	56
15:00	37	38	55	56
16:00	38	37	55	55
17:00	38	37	56	56
18:00	37	37	57	56
19:00	37	37	56	56

Measuring instrument used to measure the temperature (^{0} C) and humidity (% RH) is the Thermo Hygro AMT 123 with the following specifications:

1. Temperature range: -10 ° C ~ 60 ° C; 14F ~ 140F
   a. Resolution: 0.1 ° C, 0.2 ° F
   b. Accuracy: ± 1 ° C; ± 1.8 ° F
2. Humidity: 20% ~ 95%

a. Resolution: 1%
b. Accuracy: ± 5% RH in 25% ~ 85% and 0 ~ 50 ° C

From table 5.1 it can be seen that the temperature and humidity from 08.00 till 19.00 am is 37-38 ° C, humidity 55-58 (% RH). Likewise, the use of Thermo Hygro AMT 123, the temperature and humidity from 08.00 till 19.00 am is 37-38 ° C, humidity 55-58 (% RH). The test results 't' with statistical analysis, no significant difference between the measuring instrument with a Thermo Hygro DHT 11 AMT 123 at odds (p) = 99% (α = 0.01) in.

4.2 Testing of Solar Cell

Measures were taken to measure the output voltage of the solar cell and the intensity of light from the sun.

Table 4
The output voltage and light intensity

Time (GMT)	The output voltage (V)		Light intensity (Lux)	Lux Meters (Lux)
	Voltmeter 1 (V)	Voltmeter 2 (V)		
09:30	20.8	20.8	39100	39100
10:00	20.6	20.7	45600	45 602
10:30	20.5	20.5	49 600	49 602
11:00	20.2	20.2	67600	67601
11:30	20.3	20.3	69200	69200
12:00	20.2	20.3	82500	82501
12:30	20.6	20.5	84200	84 201
13:00	18.0	18.0	72300	72300
13:30	18.7	18.6	15000	15001
14:00	19.7	19.6	18700	18702
14:30	19.8	19.8	15700	15701
15:00	19.4	19.4	10400	10401
15:30	19.2	19.3	44200	44 201
16:00	20	19.9	86000	86002
16:30	20	19.9	86000	86002
17:00	18.5	18.5	188 000	188 002

From Table 4 battery output voltage during sunlit is 18.5 - 20.8 Volts. Likewise, the output voltage of the battery during sunlit by using a voltmeter 2 as the comparison is 18 - 20.8 Volt. From the measurement results, there is no significant difference between the voltage measuring apparatus of the second voltmeter at p = 99% (α = 0.01) in.

4.3 Discussion

The results of measurements of air temperature and humidity as shown in Table 3 to ensure a temperature of 37-38 degrees Celsius, and humidity is 50-60% RH. Thus the testing apparatus in accordance with the purpose of research.

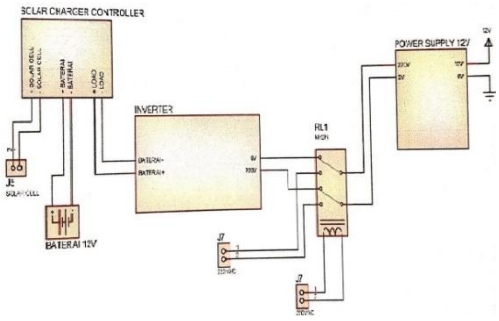

Figure 5. The series of Solar Charge Controllers and Change Over Switch.

The solar panels on egg incubator apparatus is used as a backup power supply suppy can download this tool so that the tool can function kontinu.Energi generated on solar panels will be used if the suppy of PLN dead. The energy generated by solar panels is stored in batteries 12 AH. Before the on-supply voltage, the voltage of the battery will go into an inverter to convert the DC voltage into AC. Change Over Switch on the device to function as an electric power transfer automatically between PLN and battery. At present electricity is extinguished, then the relay will turn on the solar cell and move the

battery change over switch automatically and vice versa.

5. Conclusion

From this study concluded:

1. The temperature on the energy source at a temperature controlling automation systems, continuous, with a range of 37-38 degrees C and humidity is on average 50-60%.
2. Solar cell on tool temperature control function well as a back-up supply voltage source replacement, if the power supply is interrupted PLN.
3. The output voltage for each component in accordance with the programmed on Arduino.

6. Reference

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