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Fuzzy Based Controlling for Accurate Temperature in Poultry Machinary

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Abstract

Generally, thermostat is used to control temperature manually. However, unstability temperature has rises during egg hatching proces operates. It's coverage more than 38,2 ^{0}C and cannot automated controlled. Therefore, egg hatch temperature should be controlled to avoid the damage of eggs and sensor. To addresing this limitation, fuzzy logic based algorithm is proposed with arduino and DHT 11 are uses which controlled temperature is stabilizer. During experimentally setup, the result shows that using fuzzy logic and arduino is able to perform good controller of egg hatching machine. The productivity of egg becoming poultry is rises 92%. Experimental shows that, by wading 20 egg in hatching machine, the prototype device able to stabilized temperature in 15 minutes into 37-38,2 ^{0}C.

Keywords*: DHT 11, Fuzzy Logic, Temperature Controller*

1. Introduction

1.1. Backgrounds

To aid poultry farmer produced hens, egg hatching machinary is used. There have been many egg hatching machine which is used thermostat as temperature sensor. However, the egg hatching machine is not used controlly temperature mechanism. Manually controlling is done to set temperature which reffers to the set points. Moreover, error reading is happen during the hatching process. In other hand, there's no correction mechanisms for error readig temperature or temperature rising or lowering from the set point, therefore egg hatching production is decreased. Those are done in manually. A control mechanism for the poultry form esspecially in egg hatching machine could be done manually and automatic.

Stability temperature is principles method that used in egg hatching machinary, refers to [1] around 37,2 – 38,2 ^{0}C. Therefore, at this set point optimum production can be achievable. However, most of egg hatchery machine is not applied intelligence system which addressing lackability during control temperature. Autonomously could be achieve by applied inttelligence system and combined with microcontroller. Refers to [2] fuzzy logic programable can be applied in microcontroller such as arduino uno / mega to compute autonomously based on membership values. Rengeability of membership value between 0 and 1, gray or black or in languistik form such "little","tolerable" and "very".

This paper is proposed autonomous egg hatching machine which applied fuzzy logic based programmable, to achived accuracibility of temperature during process. The aim's of the reseach is increased the efficiency and performance of egg hatching machine using arduino uno and DHT 11 by self controlling using fuzzy based logic conditioning.

1.2. Backgrounds System Model

[3] has develop egg hatching machine using SHT 11 sensors as indicator temperature readingness which able conductod fan speed. Fuzzy logic is used to perform intellegent control of temperature, however [3] has only one sensor usage while [4] has proposed DHT 11 and Arduino AT Mega 2560 which applied fuzzy logic to conduct. Egg hatching machine temperature, however only one sensor is deployed on the machine. AT Mega 128 and LM 35 temperature sensor has exploration by [4] to conduct egg hatching machine temperature. Fuzzy

logic is used to fullfil automatic temperatur of the machine. The resulls shows that 88% of egg has been proposed by [5] which able to controll fan sepeed based on fuzzy logic and Arduino Mega-R3 2560. Outcome of the fuzzy is able to controll fan speed to decrease temperature of the egg hatching machine. Whereas, RFD and DHT 11 has been used by [6] to control humidity and temperature based on fuzzy logic conditioning. Furthermore, fuzzy-integrator-intervention has been setup to conduct temperature on egg hatching machine. However, data reading is cannot automatically done by computer (PC) and power supply of the hatching machine and microcontroller is not separated which caused temperature or microcontroller is damaged.

The fuzzy set is based on the idea of extending range of characteristic functions so that the function will include real numbers at 0.1 intervals. The value of membership shows that a value is in linguistic form is not only in the values 0 and 1, but also the value that lies between them [2]. Morever [2] said that the fuzzy is vague which indicated by reading temperature expressed as hot, rather hot or very cold in certain values.

Fuzzy logic recognizes the value between right and wrong. Truth in fuzzy logic can be expressed in degrees of truth whose value is between 0 and 1.

For example in dayly of life, an adult is defined with the age of 17 years and over. But in fuzzy logic, people less than 1 day can be expressed by almost adulthood. Comparative logic and fuzzy logic are shown in Figure 1.

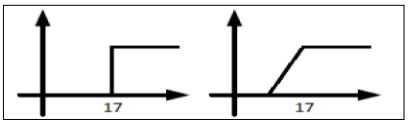

Figure 1. Comparison of Firm logic and Fuzzy Logic [2].

In general, fuzzy logic is an arithmetic methodology with word variables (linguistic variables), instead of counting with numbers.

2. Research Method

Based on the previous research models, accuracion is not focused on the objective, those researchers has only setup how fuzzy is applied in the egg machine. However, only one sensor is used to perform temperature controller with fuzzy logic. Therefore, accuracy is not precission. To adressing the limitation, there DHT 11 sensors, one current and voltage sensors is used as input parameters to conduct temperature using fuzzy logic.

The proposed model is designed by the number of DHT 11 sensor as 3 sets, which are connected with arduino uno while a relay are connected lamp 1, lamp 2, lamp 3, lamp 4, and fan. Which detected by voltage and current sensors. The objective is controlling temperature based on fuzzy set membership such as, norm, warm and hot.

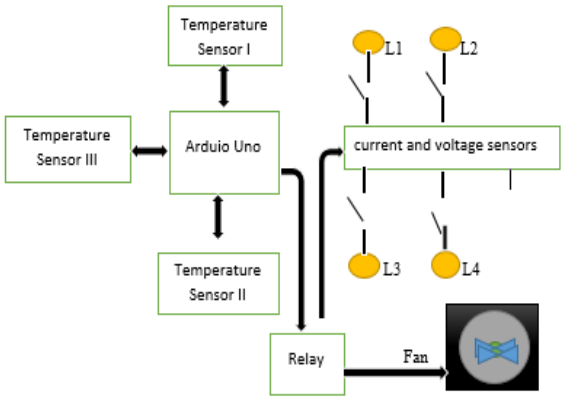

Figure 2. Proposed Model Block Diagram Blocks Temperature Based Fuzzy On Egg Shell

In Figure 2 is the overall model of the block diagram of the fuzzy egg-based hatching machine. DHT 11 sensor as much as 3 pieces as fuzzy input on arduino uno. The output of the arduino is connected to a relay of 4 pieces controlling the AC 220V lamp and 1 relay controlling the 12V DC fan.

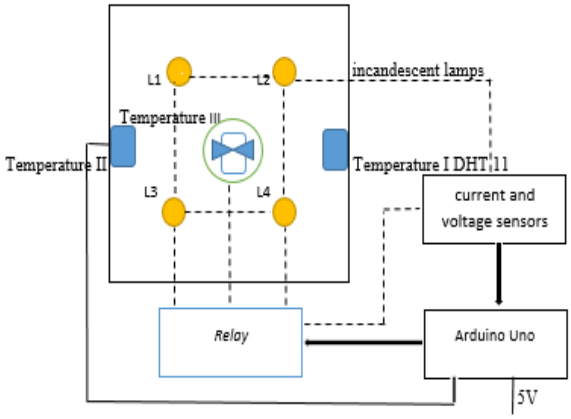

Figure 3. Machine-based Fuzzy Egg Tool Models

Figure 3 shows the fuzzy egg tools which consisting of 4 incandescent lamps, 3 DHT11 temperature sensors, DC fan and 1 Arduino Uno as control center in this works, each sensor has a membership function that consists of 3 memberships, such as Normal, Warm and Heat as seen in Figure 4.

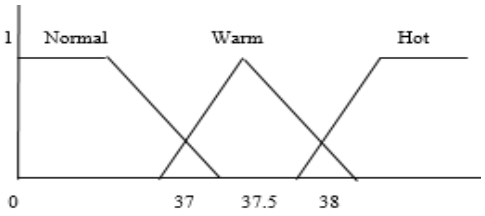

Figure 4. Membership Function Temperature

The setup model are :

- if temperature > 38 then 4 lamps OFF and fun ON
- if temperature < 37,5 then 4 lamps ON and fun OFF

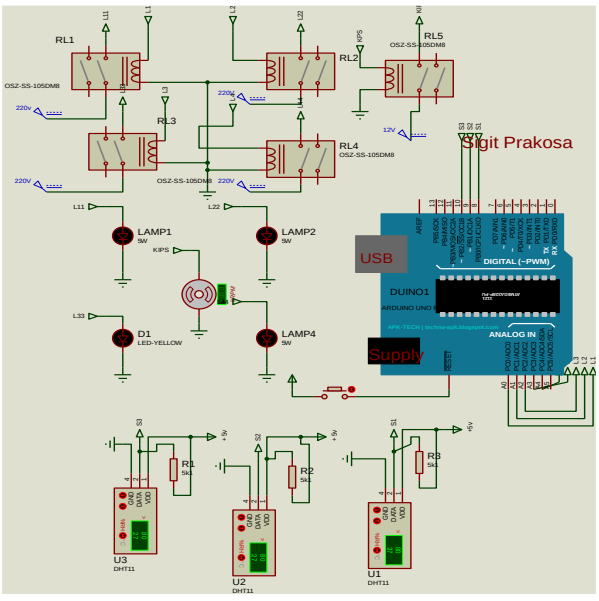

Figure 5. Input – Output Egg Encoder Control Circuit Based Fuzzy Logic Arduino Uno

Figure 5 the whole set of fuzzy logic based egg-hatchery machines controlled by arduino uno. 3 DHT11 temperature sensors, that function to give input to arduino uno. In arduino uno processed with fuzzy logic control. Output is a 5V voltage that servers to control the 5W 220V lamps with a relay bridge.

3. Results and Analysis

The experiments are experienced into five categories, such as (I) Testing Prototype Without Egg and without Using Fuzzy Control. (II) Testing Prototype Without Egg After Using Fuzzy Control. (III) Testing Prototype With Objects 5 Eggs and Using Fuzzy Control. (IV) Testing Prototype With Objects Of 10 Eggs With Fuzzy Control. (V) Testing Prototype With Objects Of 20 Eggs With Fuzzy Control. The method of testing is aimed knowing the performance of sensor while working with fuzzy set membership. By this configuration the performance of propose model is invetigated and the resull shows the measuren of sensors.

3.1. Prototype Testing Without Egg and without Using Fuzzy Control

The testing is experienced by leght ON of four lamps and without fuzzy control figure 6 shows that without fuzzy set control membership function, the temperatures are rises on to 50 ^{0}C. At this condition, egg embrios becoming die and damages.

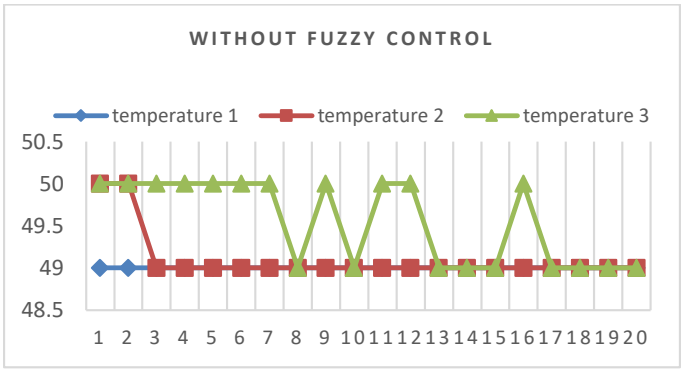

Figure 6. Temperature 1, temperature 2, temperature 3 Without fuzzy control

3.2. Prototype Testing Without Egg Using Fuzzy Control

Second modul testing are design to tested the devices with fuzzy control four lamps are lights ON during 2 hours and temperature are measured. Figure 7 show that sensor number 1 and number 3 are set into 38 ^{0}C while sensor number 2 is measured on 37 stability and ability of fuzzy control which manage temperature condition are perform well on the device whitout eggs.

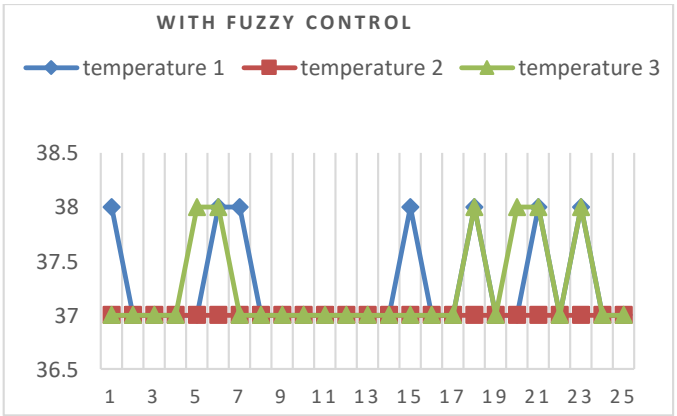

Figure 7. Temperature 1, temperature 2, temperature 3 With Fuzzy Control

3.3. Prototype Testing Tool With Objects 5 Eggs and Using Fuzzy Control

3rd testing model is setup with loaded 5 eggs using fuzzy control. After light on during 2 hours and sensors are stable between 37 ^{0}C to 38 ^{0}C the device is loaded by 5 egg measure ment shows that the lowest temp are 34 ^{0}C at the first moment low level tempereture due to early start of device during loadingeggs in the early minutes, thats temperatur is decreased. However after minutes, temperature rise to normal. Figure 8 show that in the early moment egg is loded. Those sensors needed the changing of environment with temperature is decreased. Whereas after a moments, fuzzy control start stabilized the temperature into 37 ^{0}C to 38 ^{0}C.

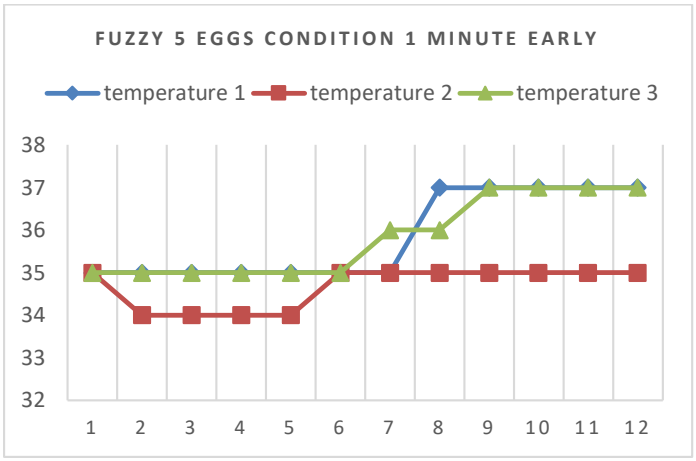

Figure 8. Temperature 1, temperature 2, temperature 3 Fuzzy Control 5 Early Egg Cover

Figure 9 shows duration of sensor is stabilized by fuzzy controlling within 7 minutes. Fuzzy works by received measurement results from sensors to current and voltage lamps ON or OFF and fan ON/OFF condition which able stabilized the temperature using fuzzy set function.

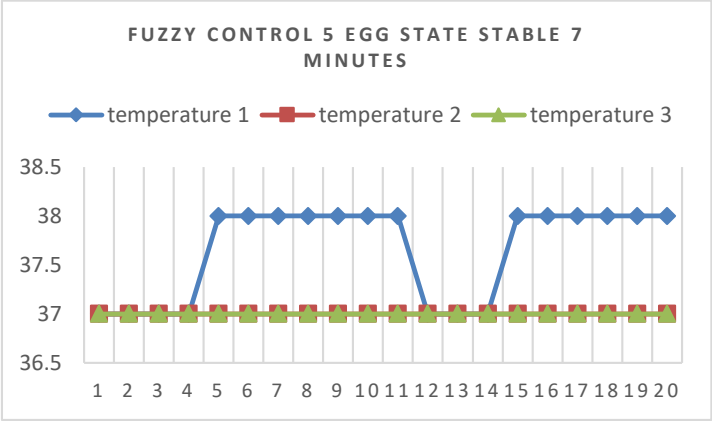

Figure 9. Temperatures Fuzzy Control 5 Eggs Stabilized The Temperature After 7 Minutes

Figure 10 shows that during endurance of device within 1 hours operating the measurements show that stabil on to 37 – 38 ^{0}C, whereas sensor number 1 is volatine in the range of 37 – 38 ^{0}C.

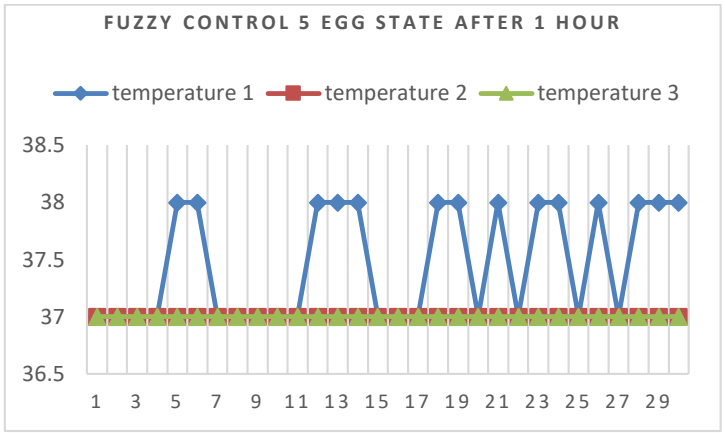

Figure 10. Temperatures by Fuzzy Control with 5 Egg After 1 Hour

3.4. Prototype Testing Method With ten's Eggs Using Fuzzy Control

The 4th testing method as configured by loaded ten's eggs into devices. In the early process, temperature are decreased into 35 ^{0}C and rised into stabilized temperature is needed 13 minutes by fuzzy control.

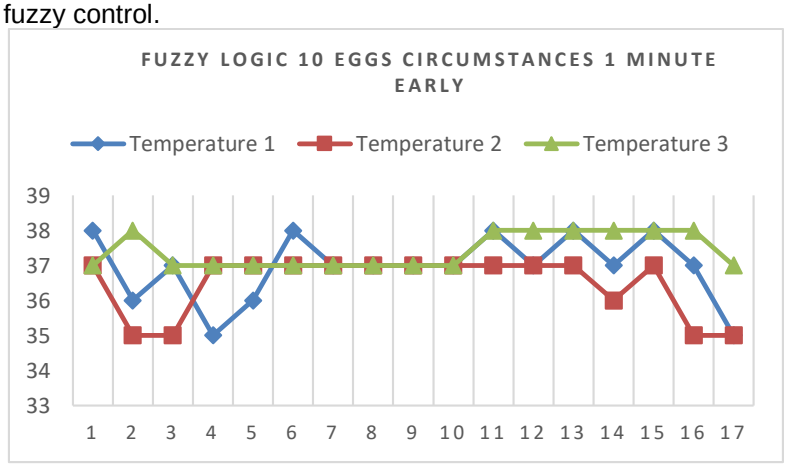

Figure 11. Temperatures With Fuzzy Control 10 Eggs at 1 Minute Started

Figure 11 shows the readingness of sensors in the early moment in 1 minutes. As show in figure 12, 13 minutes is needed to reach up temperature is stable. However after 1 hour figure 13 show that the temperatures are stable and fuzzy set function is works well.

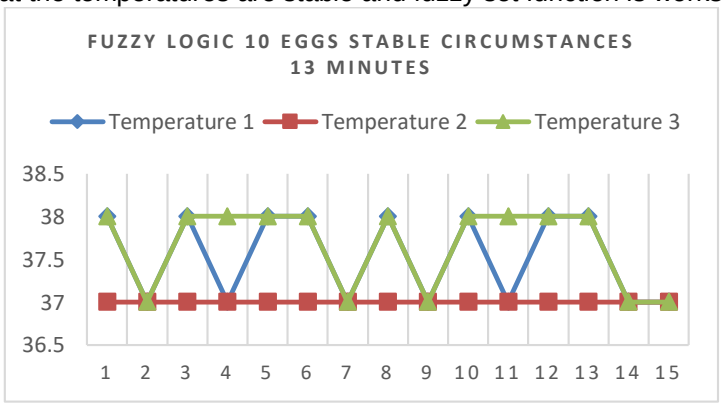

Figure 12. Temperatures Full fuzzy 10 Eggs Stabilized

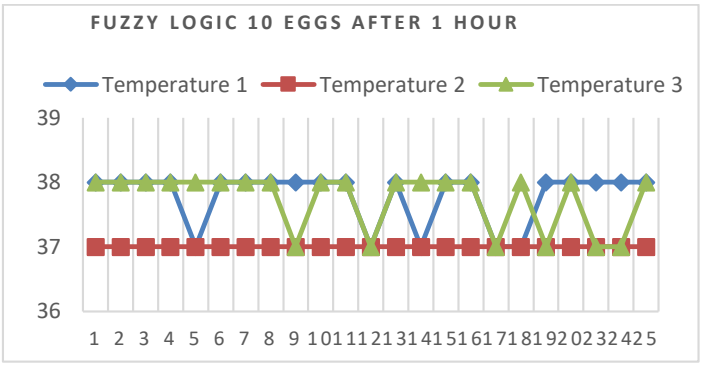

Figure 13. Temperatures Full fuzzy 10 Egg After 1 Hour

3.5. Prototype Testing With Objects Of 20 Eggs With Fuzzy Control

The fifth model is setup by loaded more eggs arround 20. In the early begining , temperature start to decrease onto 35 ^{0}C, as shown in figure 14, whereas after 15 minutes, temperature is began onto stabilized as show in figure 15. shows the condition after loaded 20 eggs during 1 hour operates. The temperature which applied fuzzy set function is able stabilized and the device able perform well.

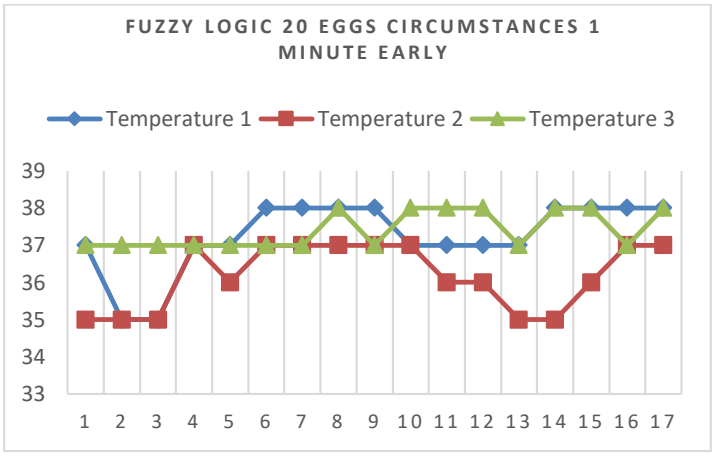

Figure 14. Temperatures Fuzzy Control 20 Egg 1 Minute

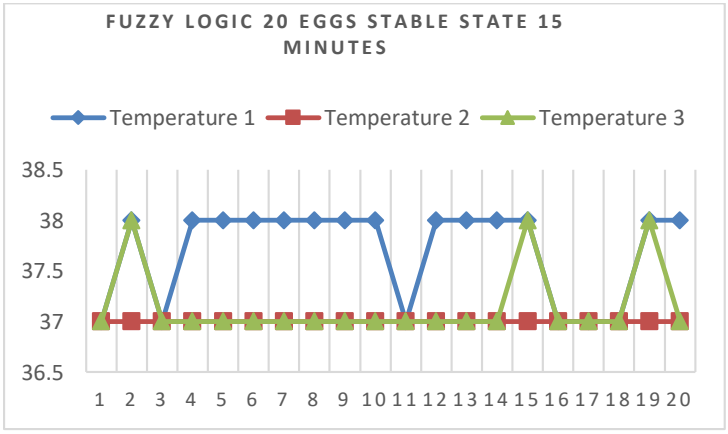

Figure 15. Temperatures Using Fuzzy Control with 20 Eggs loaded

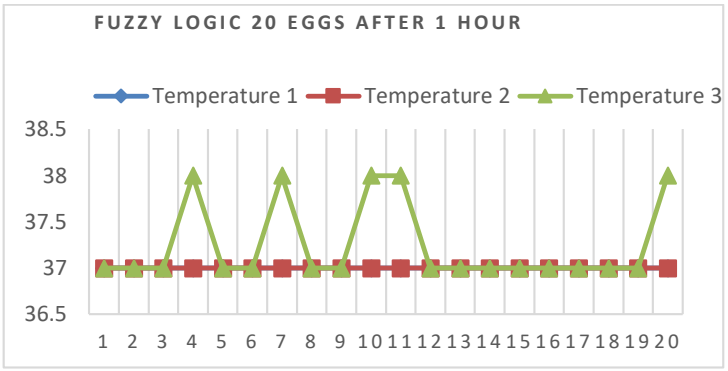

Figure 16. Read Results DHT Sensor 11 FullFuzzy 20 Egg After 1 Hour

4. Conclusion

An egg hatching machine device are setup with temperature controller is work well. 3 sensors and four lamps and fan are used and combinied with Arduino Uno I ,V and current. Sensors and relays are able work well for egg hatching machine. Fuzzy set function that applied into device is able to control and manage the temperatures perfeetly.

For the future work, controlling lower of the lamp (light in low in can descent up to light on hight) is needed to reduce time needed of temperatures stabilized.

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