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JADWAL ACARA
SEMINAR NASIONAL TEKNIK ELEKTRO (SNTE)
TAHUN 2013

Waktu	Kegiatan	Penanggung jawab
08.00 – 08.30 WIB	Registrasi Peserta	Penerima tamu
08.30 – 09.00 WIB	Pembukaan	Acara
	Menyanyikan Lagu Kebangsaan Indonesia Raya	Acara
	Laporan Ketua Panitia	Ketua Panitia SNTE 2013
	Sambutan Ketua Jurusan Teknik Elektro	Ketua Jurusan Teknik Elektro PNJ Iwa Sudradjat, ST., MT.
	Sambutan Direktur Politeknik Negeri Jakarta Sekaligus Membuka Seminar Nasional Teknik Elektro 2013	Direktur Politeknik Negeri Jakarta Abdillah, SE., MSi.
09.00 – 09.45 WIB	**Pembicara Tamu I :** Hiskia. PhD. Kepala Pusat Penelitian Elektronika dan Telekomunikasi (PPET) - LIPI. **"Smart Sensor and Intelligent System"**	Moderator : Sutanto, ST, MT
09.45 – 10.30 WIB	**Pembicara tamu II :** Ir Budianto Surbakti, MM. Deputi Sales Director PT Schneider Indonesia. **"Aplikasi Teknologi Instrumentasi"**	Moderator : Toto Supriyanto, ST, MT
10.30 – 11.00 WIB	Coffee Break	Panitia
11.00 – 12.30 WIB	Presentasi Sesi 1 Paralel	Moderator :
12.30 – 13.30 WIB	Ishoma	Konsumsi
13.30 – 15.30 WIB	Presentasi Sesi 2 Paralel	Moderator

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MODEL AND SIMULATIOAN OF TEMPERATURE FUZZY CONTROL SYTEM ON BROILER CLOSED HOUSE

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Abstract

High body temperature which makes the chicken has limited ability to adjust to the ambient temperature . Therefore, the chicken will feel very depressed if the ambient temperature is higher than the ideal temperature is 19 - 30°C. Broilers maintenance issues arise unstable environmental conditions so that the chickens can stress and even death. The use of broiler closed house system better production results than the house opened. Improved technology and control system a closed house thoroughly major impact for increased production. The purpose of this study is 1). Modeling heat transfer in closed broiler house with mathematical equations and laplace function of time .2). Simulate the temperature control system based on a broiler house closed Fuzzy Logic. Fuzzy Logic control system response result rise time, percent surge, sedentary time, steady state error, the delay time corresponding sustainable with parameter response. Results of testing on the model desired temperature within the maintenance period in the three scenarios starter, grower and finisher can be obtained with good isolation without significant disruption. The Broiler closed house heater power starter period on average 297,000 watts and future grower, finisher requires 5,400 watts.

Keywords—Model, temperature, fuzzy control system, broiler closed house

I. INTRODUCTION

Chicken is homeothermis or warm-blooded animals with a body temperature of 40.6°C and 41.7°C . High body temperature which makes the chicken has limited ability to adjust to the ambient temperature. Therefore, the chicken will feel very depressed if the ambient temperature is higher than the ideal temperature is 19 - 27°C for him [1] . Maintenance of broiler chickens with bad environment all countries. Broilers maintenance issues arise unstable environmental conditions so that the chickens can stress and even death. In the maintenance condition of broiler chickens housed there fatherly konventional opened house and more modern closed house. The use of broiler closed house system better production results than the house opened. Improved technology and control system a closed house thoroughly major impact for increased production. This is a modern way to increase broiler production significantly. In this way there is no interference due to the curvature of broilers maintenance better, more efficient site maintenance, better quality chicken, low death rates, growth conditions chicken evenly, and the appearance of the chicken that produced both maximal . This method is already known to the public that poultry in the world and particularly in Indonesia in this decade. Closed house system is more widely used for the maintenance of broiler. In order to use the system there is a match then the required theoretical models and simulation control are closed house environment before being applied in the field (realtime).

Theoretical inquiry closed house and control systems for the environment with broiler. Theoretical modeling on changes in heat transfer function (t) on the closed house and transfer function model (s) for the purposes of the model temperature in broiler closed house . Transfer function is modeled in the form of

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mathematical heat transfer conditions on the closed house. Transfer function is used to characterize the input and output relationship of the components or systems that can be described by linear differential equations , time-invariant in the form of mathematical equations in the form of laplace. Fuzzy Logic Control System is a way to control/identify system, with customized experiences and existing rules, membership functions, fuzzification [2].

The state of the art of control systems on broiler closed house is studies of environmental control in the broiler closed house has been done include: Broiler closed house with 21^{0}C temperature and 60 % humidity, environmental control for poultry buildings in Riyadh Saudi Arabia [3]. In the summer the temperature in the closed house 26^{0}C, 70 % humidity, winter temperatures in the closed house 34^{0}C , 70 % humidity , and ammonia is less than 25ppm, temperature humidity control in livestock pens nonlinear [4] . In the winter the temperature 22°C , humidity 70 % , wind speed of 1 m/s and the summer temperature is 26^{0}C , humidity 70 % , wind speed 3.7 m/s, modeling ammonia emissions from broiler litter with Dynamic flow through the chamber system [5]. Supervisory control result in the controlled temperature for 5 days 29.5^0 C - 30.90^{0}C , 29.^{0}C - 34.2^{0}C 25 days, 30 days 29^{0}C - 33.2^{0}C [6]. Control using Artificial Neural Networks produces 18^{0}C - 32^{0}C Temperature [7]. Analysis settings with traffic lights using fuzzy logic mamdani centroids (case study of Makassar Bawakaraeng Mountain crossroads) [8]
Effect of Ambient Temperature and Light Intensity on Growth Performance and Carcass Characteristics of Heavy Broiler Chickens at 56 Days of Age [9]. Simulation of the Microclimate in Poultry Structures in Kenya [10]. ANFIS Control in Broiler ClosedHouse [11]. Humidity and temperature control in an evaporative cooling system of a poultry house [12]. The Supervised Multi-Agent Systems for a Closed-House Based Broiler Industry [13]. The Effect Of Elevated Air Temperature On Physiological Indicators Of Broiler Chickens Of Different Origin [14]. Design of a high temperature erosion apparatus for testing of boiler tubes [15]. Energy efficiency of DH system with wood chips boiler houses and flue gas condensing unit [16]. Monitoring Environmental Parameters in Poultry Production Facilities [17]. As for the renewal of the previous research on the control of broiler house environment still use ON-OFF control so that in this study uses fuzzy logic control system environments on broiler closed house.

The purpose of this study is 1). Modeling heat transfer in closed broiler house with mathematical equations and laplace function of time . 2). Simulate the temperature control system based on a broiler house closed Fuzzy Logic .

II.RESEARCH METHOD

2.1. Material Research

The method issued to model mathematical heat transfer temperature to create a mathematics model of mathematics to the equation function differential then transformed by the transfer function Laplace equation. Function as a substitute over alleged real-time then be included in the process transfer function simulation control. Simulation control of broiler closed house with 3 scenarios time during starter, grower and finisher. Software used matlab versi 7.1.

2.2. Modeling of Temperature on Broiler Closed House System

Model of energy balance included result the heat transfer and on boiler closed house. Modeling humidity broiler closed house assuming there is research [1] as also studying in the modeling of the temperature [1,15,17], the energy balance equation (energy balance) then the model of the humidity in the room is closed, then the equation is expressed as follows :

Room temperature (T_{room})

$$mc_p\frac{dT_{room}}{dt} = h_1A_{floor}(T_{floor} - T_{room}) + h_2A_{roof}(T_{roof} - T_{room}) + Q_{Evap} + Q_{fan} + Q_{env} \quad (1)$$

Floor temperature (T_{floor})

$$mc_p\frac{dT_{floor}}{dt} = h_1A_{floor}(T_{room} - T_{floor}) \quad \ldots\ldots(2)$$

Roof temperature (T_{roof})

$$mc_p\frac{dT_{roof}}{dt} = h_2A_{roof}(T_{room} - T_{env}) + h3\,A\,(Troof - Tenv) + \sigma A_{roof} I\,\alpha\,cos\theta \quad \ldots\ldots(3)$$

Wall temperature (T_{wall})

$$mc_p\frac{dT_{wall}}{dt} = h_2A_{wall}(T_{room} - T_{wall}) + h3\,A\,(Troof - Tenv) + \sigma A_{wall} I\,\alpha\,cos\theta \quad \ldots\ldots(4)$$

Where:

m_r = Mass flow rate in a broiler closed house

m_{umk}= Mass flow rate of air in and out the broiler closed house

ρ = space density (1.2 g m/3),

Cp= specific heat of air (1006 J (kg K)/1).

Equation *energy balance* the model of humidity broiler closed house is expressed in the equation: total and psikrometrik functions are as follows:

1. Total heat transfer coefficient

$$U = \frac{1}{\frac{1}{f_1} + \frac{x}{k} + 1/f_2} \quad \ldots\ldots(5)$$

2. Vapour pressure at temperature T

$$Pv = \frac{HrPatm}{0.6219 + Hr} \quad \ldots\ldots(6)$$

3. Saturated vapor pressure at saturation temperature T

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P_s= RxExp (A+BT+CT^2+DT^3+ET^4)/ (FT-GT^2)..... (7)

Where constant-constants are: R= 22105649, 25, A = -27405, 526, B= 97, 5413, C = 0,146244, D = 0,000126, E = 0, 0000000485, F = 4, 34903, G= 0, 00394, Patm= 101325Pa

2.3. Mathematical Model Control Temperature in the Room Broiler Closed House

Modeling theoretically represent a closed house in the field of heat transfer by lowering function of time for the transfer function of the heating temperature equation in a closed control system with zero initial conditions.

$$SC_1T_{room}(s) = q_{flow}(s)\lambda - \frac{T_{room}(s) - T_{air}(s)}{R_{room}} \quad \text{(8)}$$

$$SC_{air}T_{air}(s) = C_2\frac{dT_{wall}(t)}{d(t)} + C_3\frac{dT_{floor}(t)}{d(t)} + C_4\frac{dT_{roof}(t)}{d(t)} \quad \text{(9)}$$

From equation (9) dan $T_{air}(s)$, diperoleh:

$$T_{air}(s) = \left(\frac{1}{R_{room}C_{air}S + 1 + \frac{R_1}{R_{room}}}\right)T_{room} + \left(\frac{\frac{R_1}{R_3+R_2+R_4}}{R_1C_{air}S + 1 + \frac{R_1}{R_4R_2R_3}}\right)T_{air}(s) \quad \text{(10)}$$

Substitution of equation (8) dan (10) :

$$T_{room}(s) = \frac{(R_{room}+R_3)\lambda\left(1+\frac{R_4R_2R_3}{R_{room}+R_2+R_4+R_3}R_{room}C_{air}S\right)}{R_{room}C_1R_2C_2R_3C_3R_4C_4S^2+(R_{room}C_1+R_3C_3+R_2C_2+R_4C_4+R_3C_1)S+1}q_{flow}(s) + \frac{1}{R_{room}C_1R_2C_2R_3C_3R_4C_4S^2+(R_{room}C_1+R_3C_3+R_2C_2+R_4C_4+R_3C_1)S+1}q_{flow}(s) \quad \text{.....(11)}$$

Transfer function of a closed control system, the system is considered zero initial conditions (t = 0) result equal to 0.

Equation (8)

$$T_{room}(s) = \left(\frac{K(rT_3S+1)}{(r_1S+1)(r_2S+1)}\right)q_{flow}(s) \quad \text{...(12)}$$

dengan $r_1r_2 = R_{room}C_1R_3C_3R_2C_2R_4C_4$

$$r_1+r_2 = R_{room}C_1+R_3C_3+R_3C_1R_2C_2+R_4C_4 \quad \text{.....(13)}$$

$$r_3 = \frac{R_2R_4R_3}{R_{room}+R_2R_4R_3}R_{room}C_3 \quad \text{.....(14)}$$

$$K = (R_{room}+R_2R_4R_3)\lambda \quad \text{..... (15)}$$

From equation (15) to get transfer function G(s) for room heat transfer

$$G(s) = \frac{T_{room}(s)}{q_{flow}(s)} = \left(\frac{K(r_3S+1)}{(r_1S+1)(r_2S+1)}\right) \quad \text{...(16)}$$

So that laplace transformation output: $T_{room}(s) = q_{flow}(s)G(s)$ from invers Laplace from $T_{room}(s)$ adalah $T_{room}(t)$.

In this case the transfer function for the closed chicken coop temperature as follows:

$$G(s) = \frac{Troom(s)}{Q\ flow(s)} = \frac{6{,}804591(s) + 0{,}000725}{4{,}2(s^2) + 0{,}517(s) + 1} \quad \text{..... (17)}$$

To determine the performance of the system, and then made a graph of the output, disetelah know the graph of the system, given the control action on the system using the Fuzzy Logic control models. Assumptions, Initial conditions and boundary conditions in the calculation of the Air Flow Simulation: broiler closed house assumptions :

1) Not compressed air (incompressible), ρ is constant, 2) Numbers Prantilasi constant air (specific heat, conductivity and viscosity constant air), 3) Air moving in a steady state, 4 Ambient air is assumed to be constant during the simulation at 30^{0}C values, 4) Airflow laminier considered, based on the number Re = 1698.Laminar flow if Re <2000 (Holman 1997).

2.4. Modeling Approach with Fuzzy Logic

Fuzzy logic control is used to control the system consists of four basic parts, namely fuzzification, knowledge base, fuzzy inference engine and defuzzification. Basic structure of the fuzzy logic controller can be seen in the following figure:

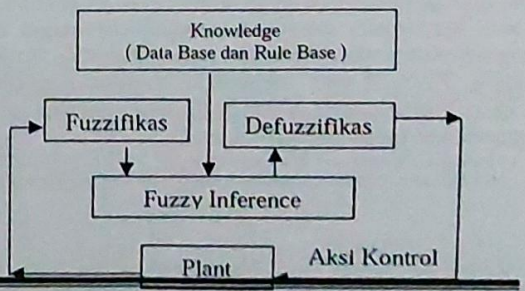

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Figure 1 Architecture Fuzzy Logic Control (Yan 1994)

Here is the fuzzy logic method according to Thomas Sowell: 1) Receiving of one, or a large number, of measurement or other assessment of conditions existing in some system we wish to analyze or control, 2) Processing all these inputs according to human based, fuzzy "If-Then" rules, which can be expressed in plain language words, in combination with traditional non-fuzzy processing, 3) Averaging and weighting the resulting outputs from all the individual rules into one single output decision or signal which decides what to do or tells a controlled system what to do.

The output signal eventually arrived at is a precise appearing, defuzzified, "crisp" value. Fuzzy set theory is an improvement upon the more popular bivalent set theory. Bivalent set theory is a "two-valued" type of logic where each object is assigned a value of "1 or 0" or "true or false". Because of this, bivalent set theory is limited when describing a humanistic or "real life" problem mathematically.

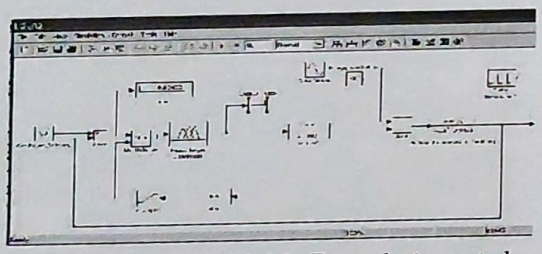

Figure 2 Simulink tool Matlab Fuzzy logic control system.

III.RESULT AND DISCUSSION

The results of mathematical modeling to the control of humidity in the input transfer function on equation 28 in block diagram matlab part in the process control system Fuzzy logic.

On Fuzzy Logic control simulation in closed broiler chicken broiler house using matlab tool library block diagram with input setpoin between 24^{0}C - 30^{0}C by using a model of the transfer function in closed broiler house temperatures aktuatornya heater control paired interference (ambient temperature) from the outside in the form of climate could be larger (+) or smaller (-) than room temperature result is no output and output fuzzy logic system preference broiler house closed. In the graph below Fuzzy Logic temperature control response in closed broiler starter house with the simulation period, grower and finisher (Figure 3 to 5)

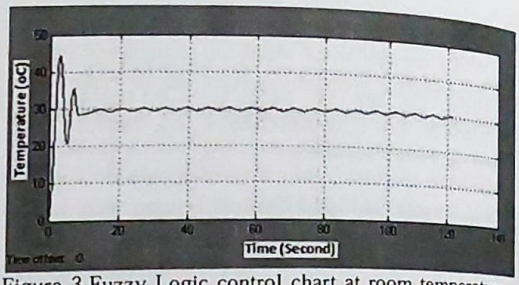

Figure 3.Fuzzy Logic control chart at room temperature 30^0 C setpoint Starter period, age (1-18 days)

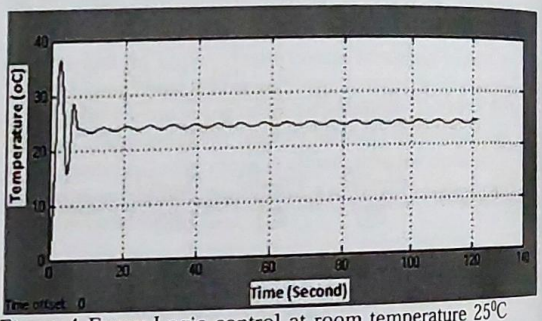

Figure 4 Fuzzy Logic control at room temperature 25^{0}C setpoin Grower, age (19-30 days)

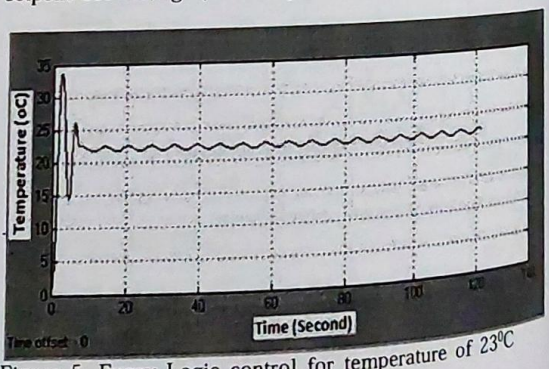

Figure 5. Fuzzy Logic control for temperature of 23^{0}C setpoin Finisher period, age (31-64 days)

Discussion of fuzzy logic control chart results in closed broiler house above shows the transient response to treatment patterns starter three scenarios (breeding period) age (0-18hari) with setpoin between 29-30^{0}C, grower (infancy) age (19-30 days) with setpoint 26,27,28^{0}C and finisher (the harvest) 30-38 ^{0}C setpoint is as follows:

Table 1. Response of Fuzzy Logic control system temperature in Broiler Closed House

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Period	Setpoint ppm	Delay time (Td)	Setting time l (Ts)	Rise time (Tr)	Overshoot (Os)	Error steady state (Ess)
Starter	30	1.2169	30.1551	1.2951	48.120%	0.171
Starter	29	1.187	17.9698	1.2837	33.764%	0.753
Starter	28	1.1762	14.4425	1.2312	49.219%	0.460
Starter	27	1.153	18.6913	4.996	42.917%	0.311
Starter	26	1.1456	27.033	1.1939	44.854%	0.840
Grower	25	1.101	36.1324	1.1682	46.066%	0.376
Grower	24	1.1042	33.35	1.1455	49.583%	0.250
Finisher	23	1.1451	32.45	1.1432	48.567%	0.0765

IV. CONCLUSION

Fuzzy Logic control system response result rise time, percent surge, sedentary time, steady state error, the delay time corresponding sustainable with parameter response. Results of testing on the model desired temperature within the maintenance period in the three scenarios starter, grower and finisher can be obtained with good isolation without significant disruption. The Broiler closed house heater power starter period on average 297,000 watts and future grower, finisher requires 5,400 watts.

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