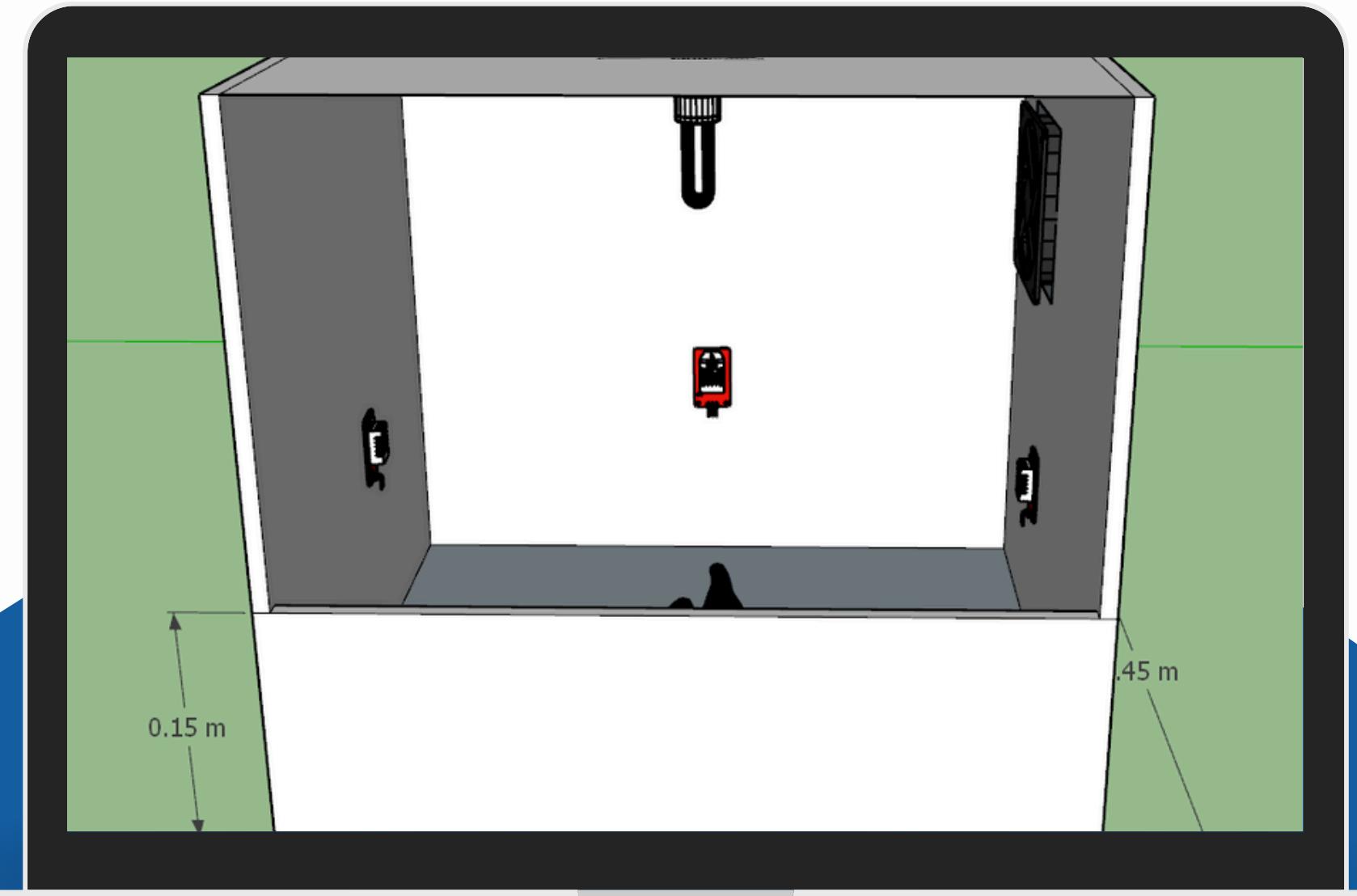


TEMPERATURE CONTROL SYSTEM IN PIGEON CHICKS' CAGE USING FUZZY LOGIC

Figo Febriyanto Al Rosyid





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**STr LJ ELECTRONIC ENGINEERING PROGRAM
DEPARTMENT OF ELECTRICAL ENGINEERING
ELECTRONIC ENGINEERING POLYTECHNIC INSTITUTE of SURABAYA**



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Introduction

Bird training, especially parrots and pigeons, has its own challenges because of their different characteristics. Parrots tend to bond more easily with trainers, while pigeons require a special approach from an early age, namely when they are 1-2 days old. The earlier the bonding process is carried out, the greater the chance for the pigeon to respond to training, especially in developing skills such as free fly. Therefore, pigeon chicks need to be taken from their mothers since they are small, but this requires extra attention to their health, especially regarding the temperature and humidity of the cage. To maintain the health of baby pigeons, the temperature of the cage must be in the range of 30°C - 35°C with a humidity of between 50% - 60%. A fuzzy logic-based temperature control method is used to ensure that the temperature and humidity remain stable as needed. With effective temperature control, baby pigeons remain healthy even though they are separated from their mothers early on, so that they can achieve their maximum potential in the expected training.



Formulation of the Problems

Based on the background that has been explained, the problems that will be solved in this research are:

Problem 01

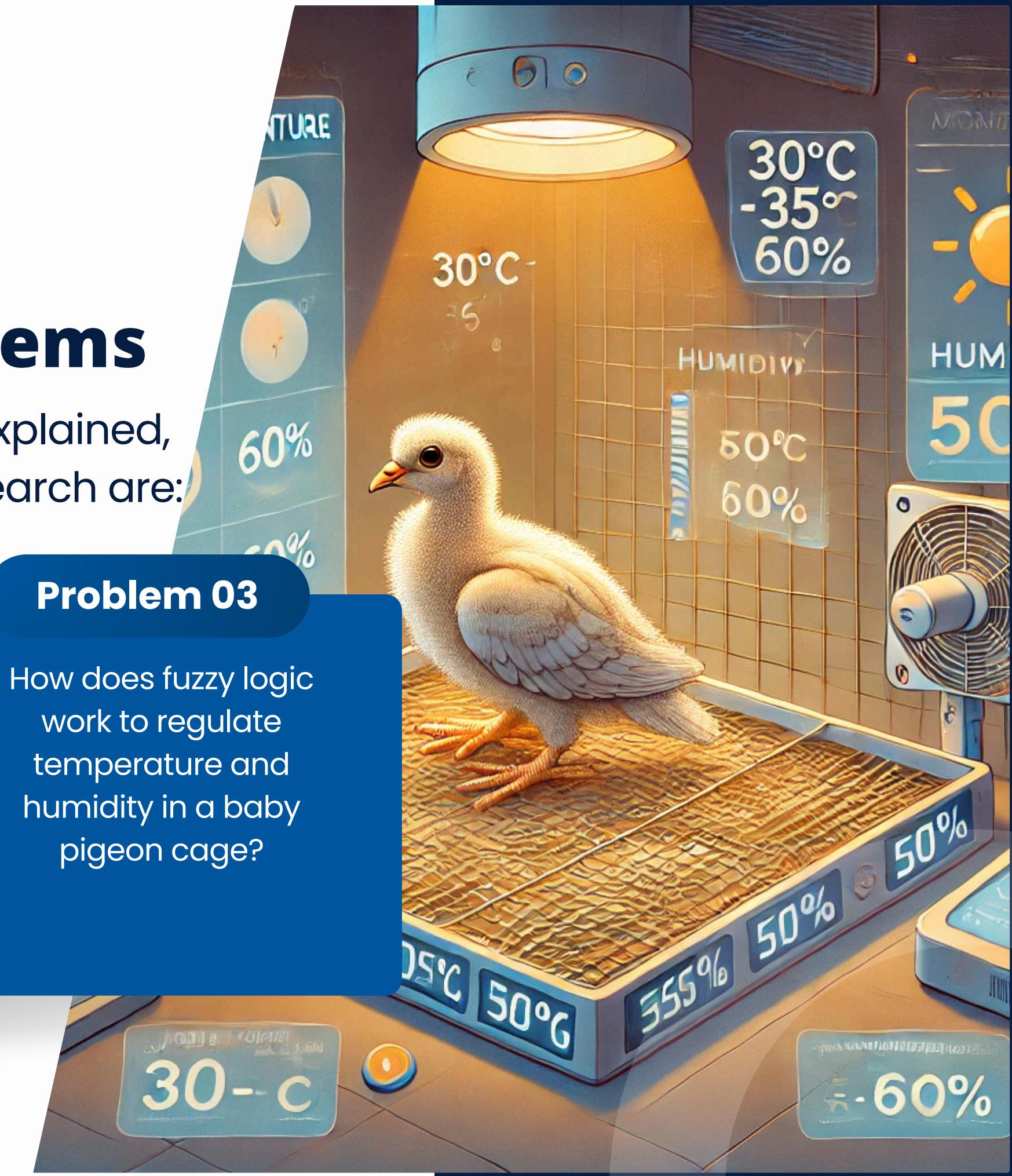
How to implement intelligent control to automatically regulate drum temperature?

Problem 02

How to maintain the ideal temperature for baby pigeons so that they remain healthy outside the engram of the mother pigeon?

Problem 03

How does fuzzy logic work to regulate temperature and humidity in a baby pigeon cage?



Purpose

The objectives of this research are as follows:

01

Help trainers to bond with baby pigeons from an early age by paying attention to the comfort and health parameters of baby pigeons.

02

Creating an intelligent control system for temperature and humidity for baby pigeon cages using the fuzzy logic method.

03

Maintain the ideal temperature and humidity conditions required by baby pigeons, according to the range that has been set.



Scope of the Problems

Problem 01

The research object is only for the pigeon species

Problem 02

There is a difference in the age of the baby pigeons when testing the equipment.

Problem 03

The baby is disabled or dies because there is an error when the system is operating.





Benefits

The benefits gained by the community from this tool are as follows:

Objective 01

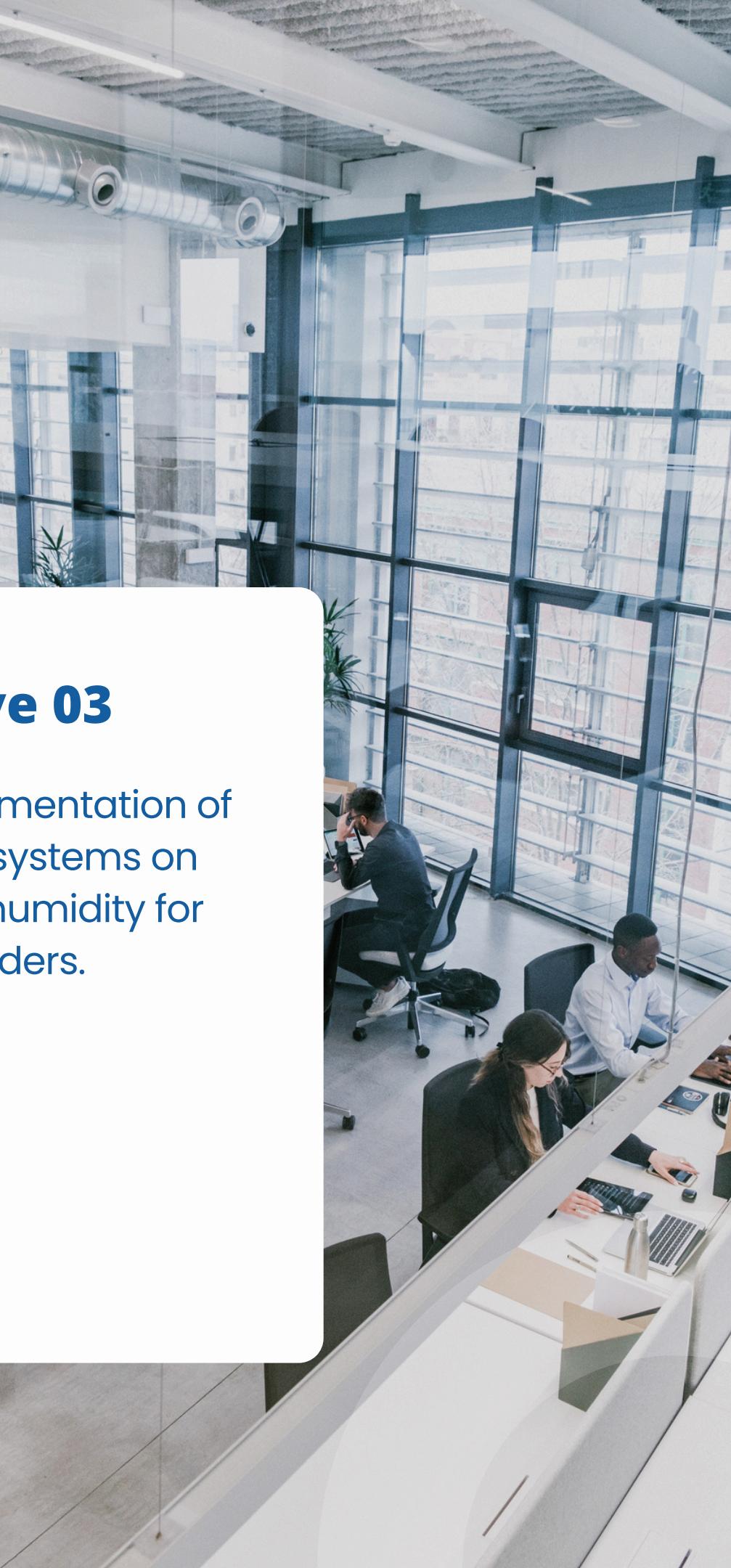
1. Help pigeon trainers bond with pigeons from an early age.

Objective 02

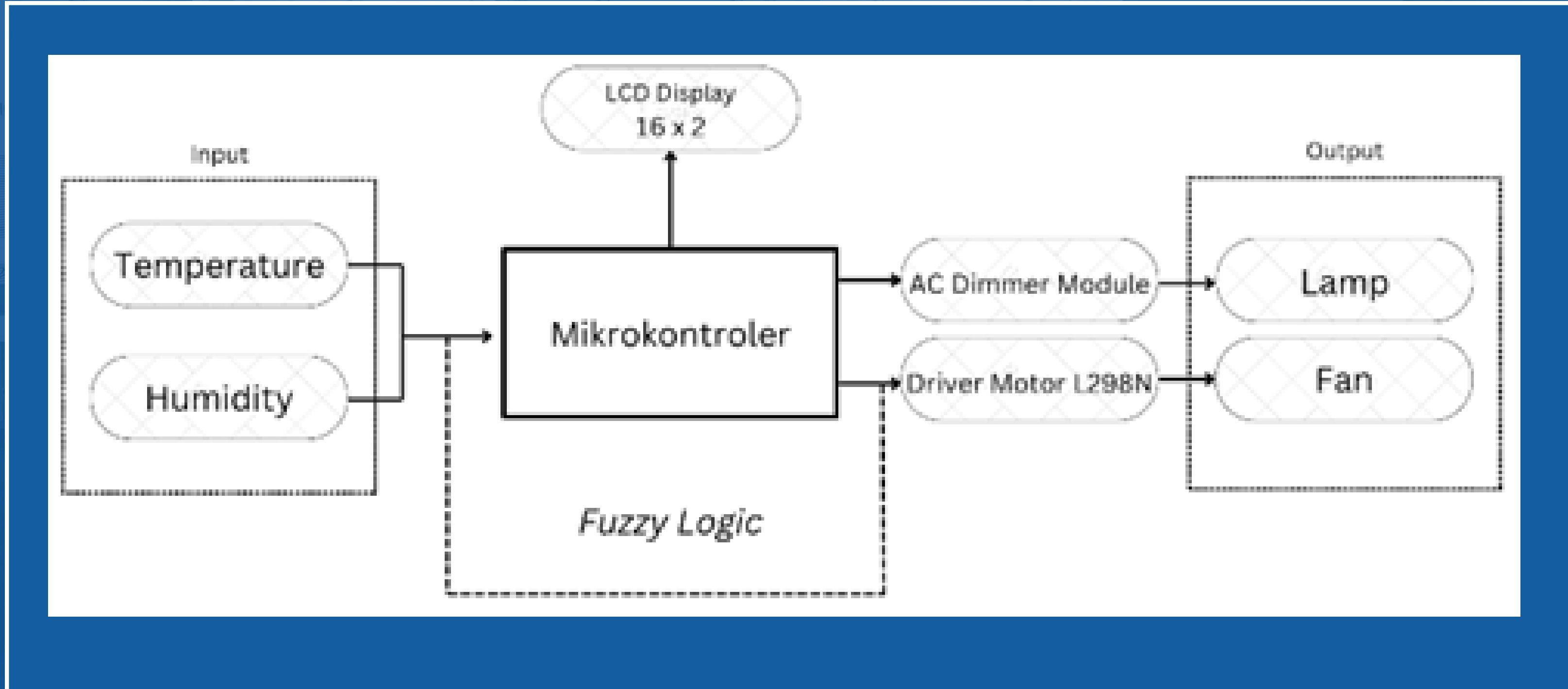
2. Apart from pigeons, the system can also be applied to other types of birds while still taking into account the required temperature conditions.

Objective 03

3. Assist in the implementation of intelligent control systems on temperature and humidity for pigeon breeders.



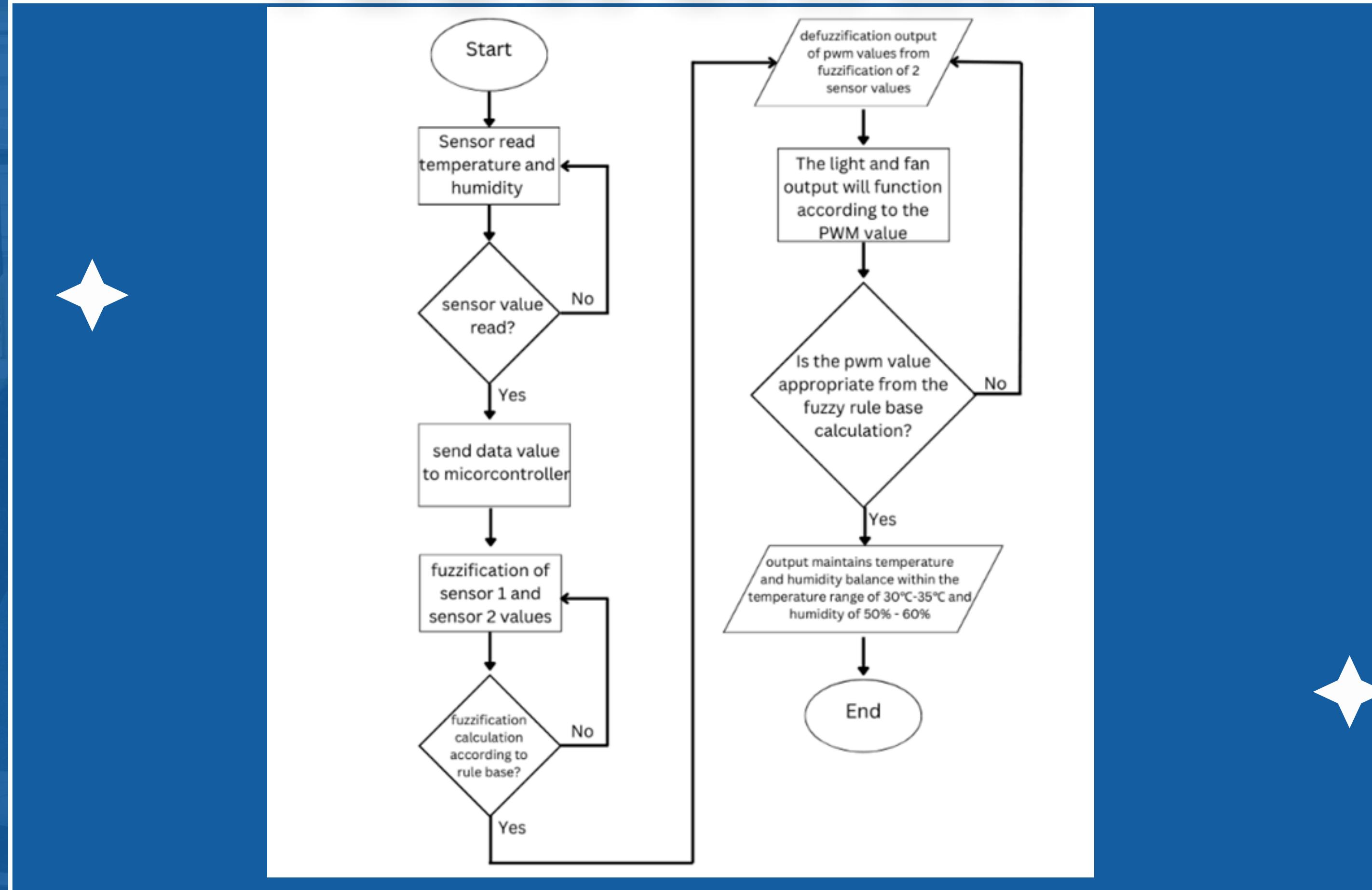
BLOCK DIAGRAM



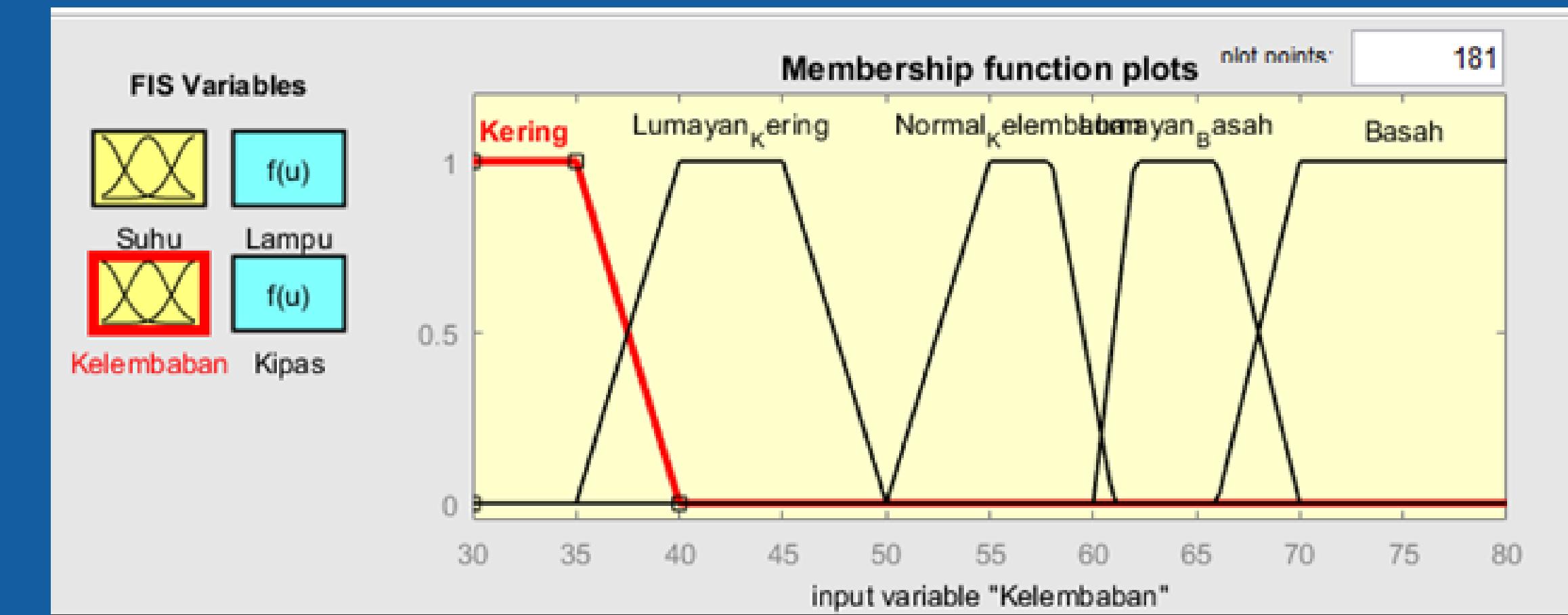
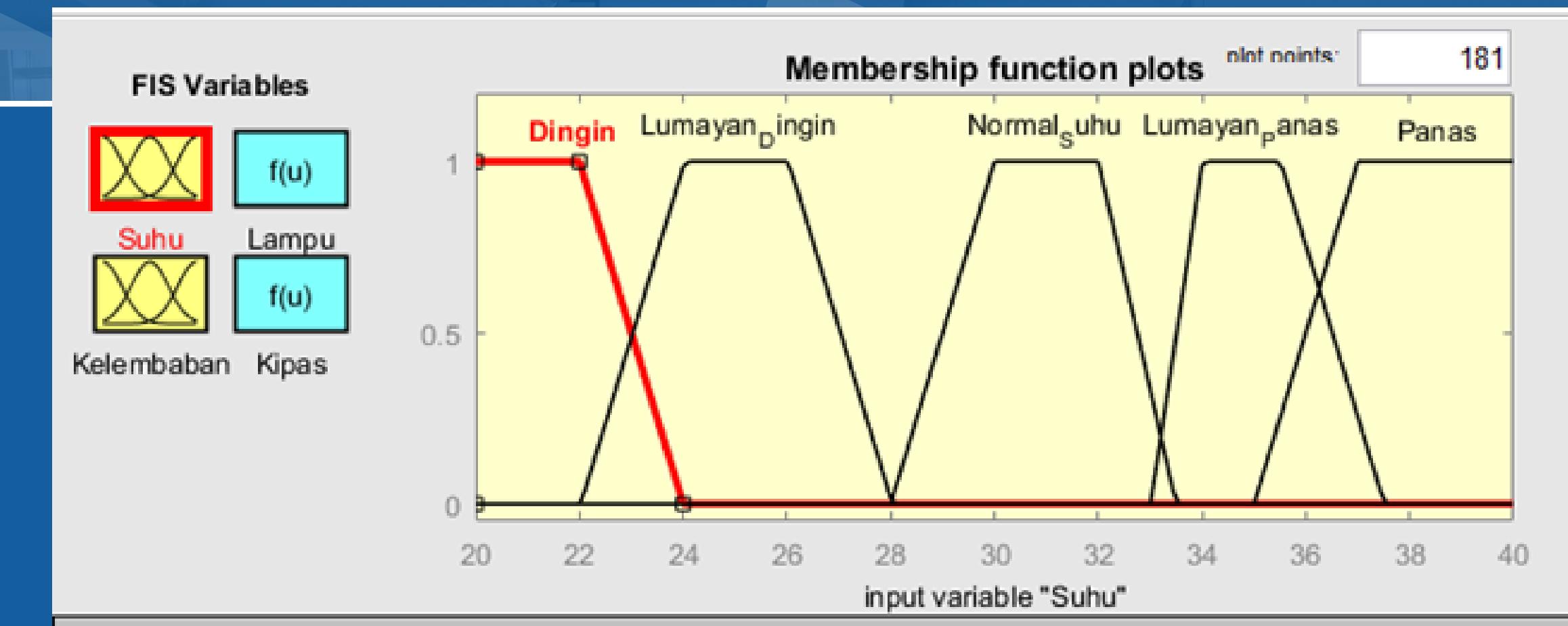


PENS

FLOWCHART

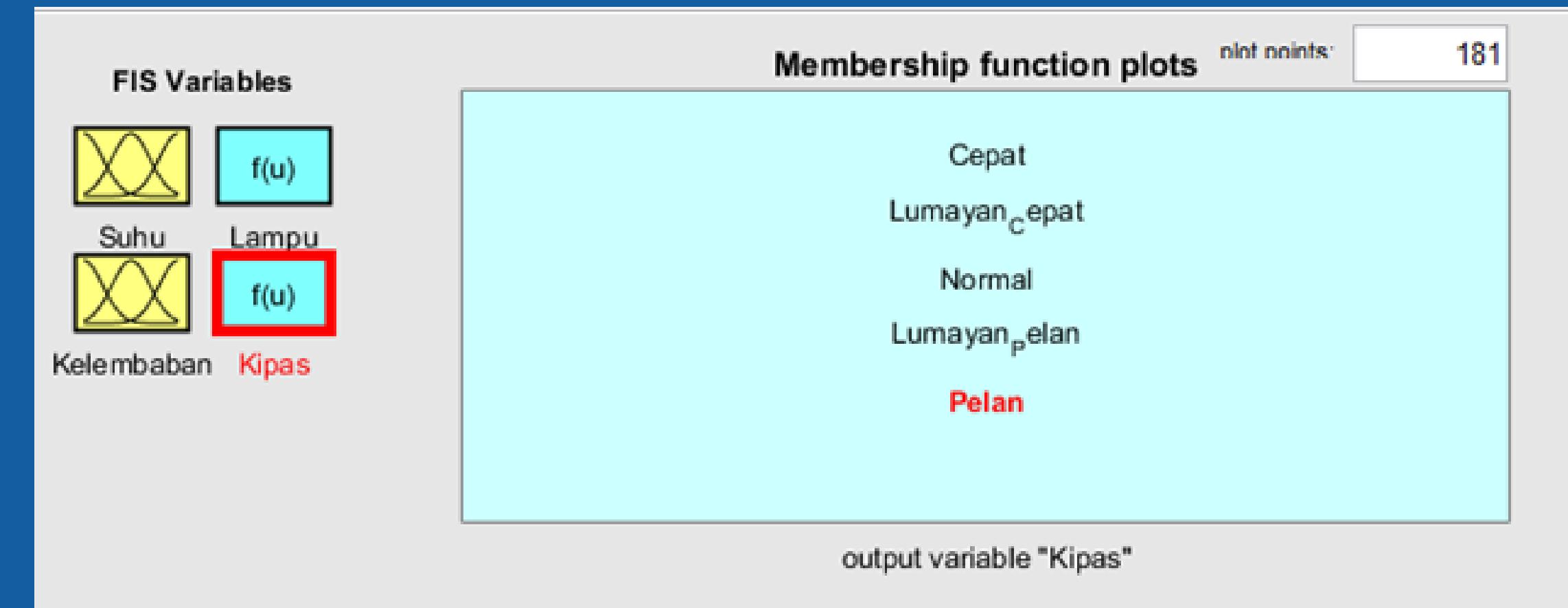
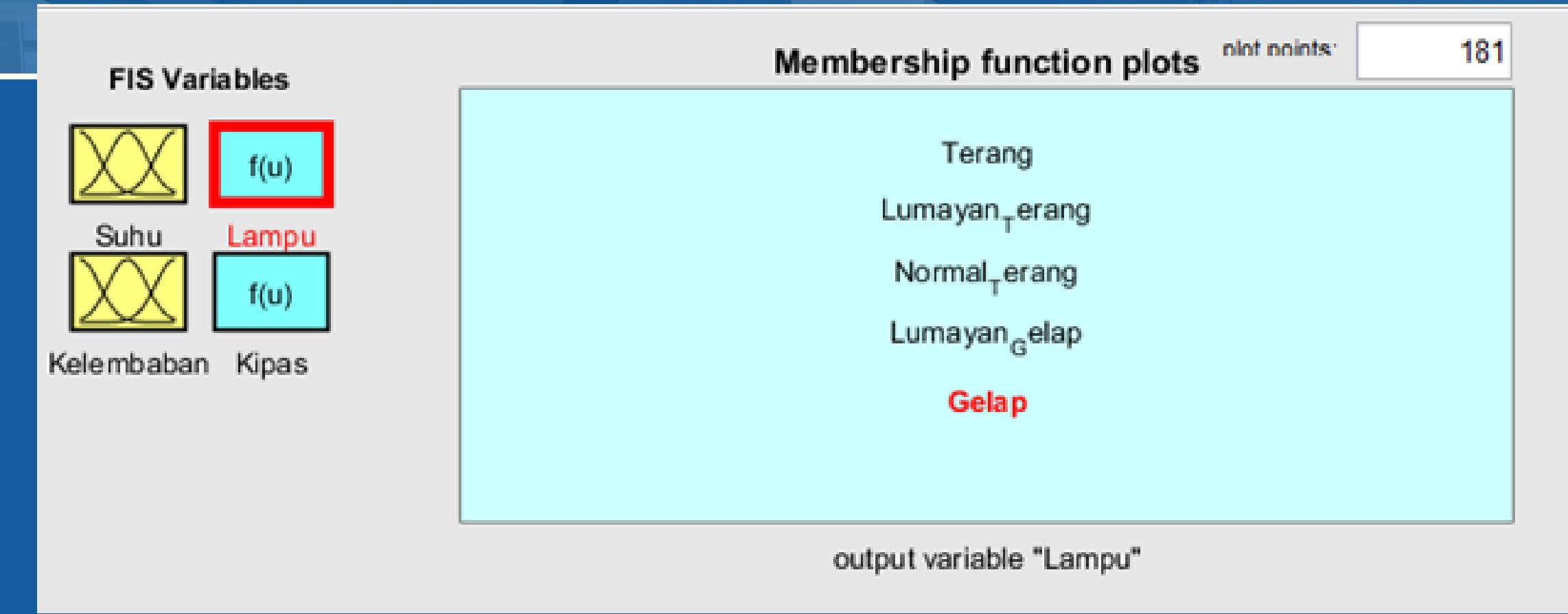


FUZZY DESIGN





FUZZY DESIGN

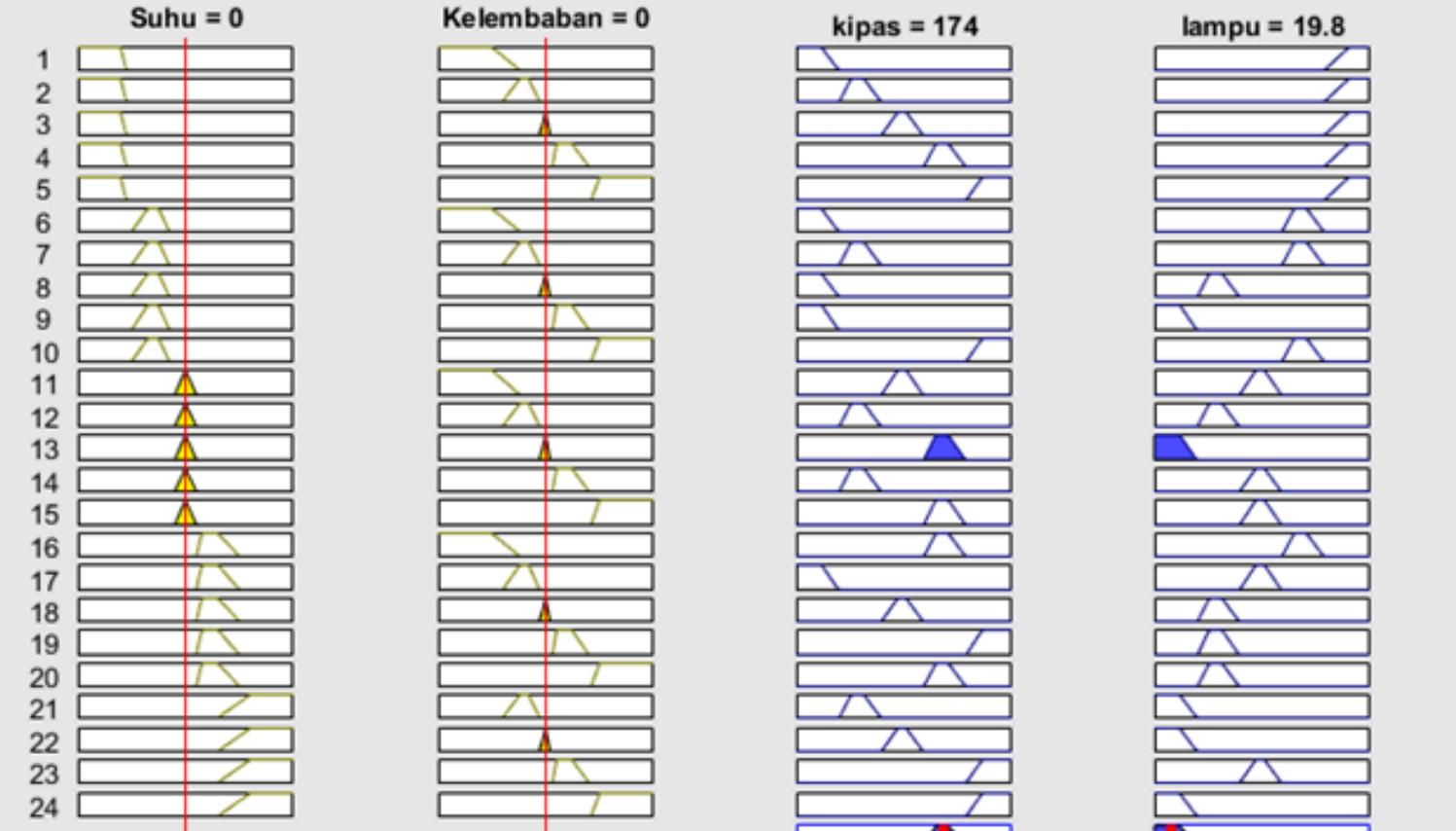


FUZZY RULE



File Edit View Options

Suhu = 0 Kelembaban = 0 kipas = 174 lampu = 19.8



Input: [0 0] Plot points: 101 Move: left right down up

Opened system 5mf-24rbsgn-V2, 24 rules

Help Close

1. If (Suhu is dingin) and (Kelembaban is kering) then (kipas is pelan)(lampu is terang) (1)
 2. If (Suhu is dingin) and (Kelembaban is lumayan_kering) then (kipas is lumayan_pelan)(lampu is terang) (1)
 3. If (Suhu is dingin) and (Kelembaban is normal_kelembaban) then (kipas is normal)(lampu is terang) (1)
 4. If (Suhu is dingin) and (Kelembaban is lumayan_basah) then (kipas is lumayan_cepat)(lampu is terang) (1)
 5. If (Suhu is dingin) and (Kelembaban is basah) then (kipas is cepat)(lampu is terang) (1)
 6. If (Suhu is lumayan_dingin) and (Kelembaban is kering) then (kipas is pelan)(lampu is lumayan_terang) (1)
 7. If (Suhu is lumayan_dingin) and (Kelembaban is lumayan_kering) then (kipas is lumayan_pelan)(lampu is lumayan_terang) (1)
 8. If (Suhu is lumayan_dingin) and (Kelembaban is normal_kelembaban) then (kipas is pelan)(lampu is lumayan_gelap) (1)
 9. If (Suhu is lumayan_dingin) and (Kelembaban is lumayan_basah) then (kipas is pelan)(lampu is gelap) (1)
 10. If (Suhu is lumayan_dingin) and (Kelembaban is basah) then (kipas is cepat)(lampu is lumayan_terang) (1)
 11. If (Suhu is normal_suhu) and (Kelembaban is kering) then (kipas is normal)(lampu is normal_terang) (1)

If Then
 Suhu is Kipas is
 Kelembaban is lampu is
 dingin kering
 lumayan_dingin lumayan_kering
 normal_suhu normal_pelan
 lumayan_panas lumayan_gelap
 panas normal
 none lumayan_cepat
 not lumayan_terang

 Connection
 or
 and

 Weight:

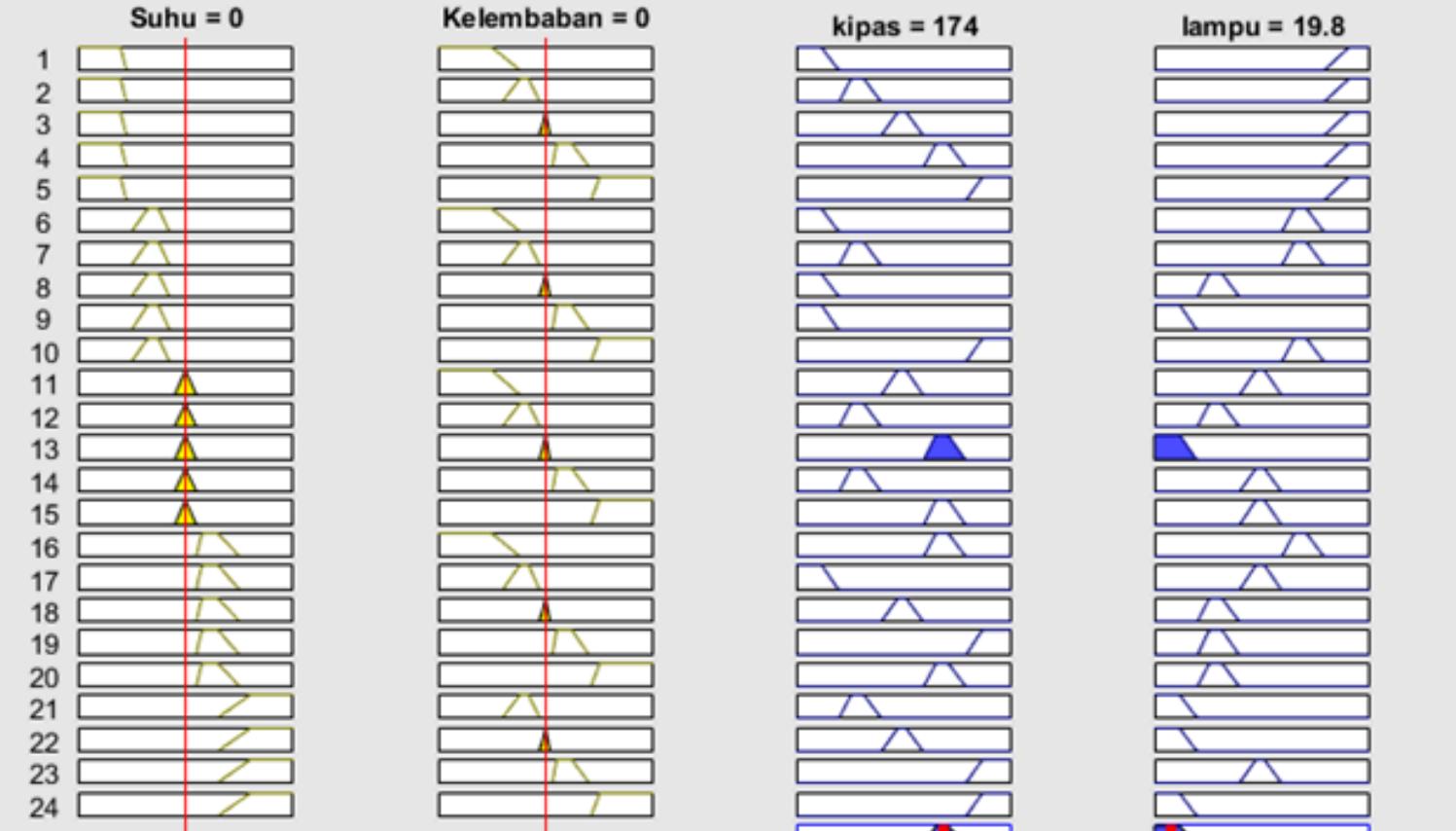
 Delete rule Add rule Change rule

FUZZY RULE



File Edit View Options

Suhu = 0 Kelembaban = 0 kipas = 174 lampu = 19.8



Input: [0 0] Plot points: 101 Move: left right down up

Opened system 5mf-24rbsgn-V2, 24 rules

Help Close

1. If (Suhu is dingin) and (Kelembaban is kering) then (kipas is pelan)(lampu is terang) (1)
 2. If (Suhu is dingin) and (Kelembaban is lumayan_kering) then (kipas is lumayan_pelan)(lampu is terang) (1)
 3. If (Suhu is dingin) and (Kelembaban is normal_kelembaban) then (kipas is normal)(lampu is terang) (1)
 4. If (Suhu is dingin) and (Kelembaban is lumayan_basah) then (kipas is lumayan_cepat)(lampu is terang) (1)
 5. If (Suhu is dingin) and (Kelembaban is basah) then (kipas is cepat)(lampu is terang) (1)
 6. If (Suhu is lumayan_dingin) and (Kelembaban is kering) then (kipas is pelan)(lampu is lumayan_terang) (1)
 7. If (Suhu is lumayan_dingin) and (Kelembaban is lumayan_kering) then (kipas is lumayan_pelan)(lampu is lumayan_terang) (1)
 8. If (Suhu is lumayan_dingin) and (Kelembaban is normal_kelembaban) then (kipas is pelan)(lampu is lumayan_gelap) (1)
 9. If (Suhu is lumayan_dingin) and (Kelembaban is lumayan_basah) then (kipas is pelan)(lampu is gelap) (1)
 10. If (Suhu is lumayan_dingin) and (Kelembaban is basah) then (kipas is cepat)(lampu is lumayan_terang) (1)
 11. If (Suhu is normal_suhu) and (Kelembaban is kering) then (kipas is normal)(lampu is normal_terang) (1)

If Then
 Suhu is Kipas is
 Kelembaban is pelan
 and and
 kering lumayan_pelan
 lumayan_kering normal
 normal_suhu lumayan_cepat
 lumayan_panas lumayan_terang
 panas cepat
 basah none
 none
 not not
 Connection Weight:
 or 1
 and Delete rule Add rule Change rule
 not not
 Help Close



PENS

DHT22 SENSOR TESTING

No	DHT 22		Hygrometer		%Error	
	Suhu°C	Kelembaban%	Suhu°C	Kelembaban%	Suhu°C	Kelembaban%
1	32.1	75.9	32.3	76.1	0.8	0.26
2	32.1	75.9	32.2	76.1	0.56	0.26
3	32.1	76	32.4	76.2	1.17	0.26
4	32.1	76.1	32.5	76.3	1.32	0.26
5	32.2	76.4	32.3	76.6	0.34	0.26
6	32.2	76.2	32.5	76.4	1.14	0.26
7	32.3	76.3	32.5	76.5	0.89	0.26
8	32.3	76.3	32.5	76.5	0.86	0.26
9	32.4	76.3	32.7	76.4	1.16	0.13
10	32.4	76.2	32.6	76.3	0.74	0.13
11	32.4	76.6	32.6	76.8	0.89	0.26
12	32.4	76.1	32.7	76.3	1.01	0.26
13	32.4	76.2	32.8	76.4	1.34	0.26
14	32.5	76.5	32.7	76.7	0.85	0.26
15	32.5	76.6	32.7	76.8	0.67	0.26
16	32.5	76.7	32.8	76.9	1.01	0.26
17	32.5	76.6	32.9	76.8	1.37	0.26
18	32.6	76.6	32.8	76.7	0.82	0.13
19	32.6	76.6	32.8	76.8	0.64	0.26
20	32.6	76.5	32.9	76.7	1.12	0.26
21	32.6	76.6	32.8	76.8	0.7	0.26
22	32.6	76.6	32.9	76.9	0.94	0.39
23	32.6	76.5	32.7	76.6	0.49	0.13

DHT22 SENSOR TESTING

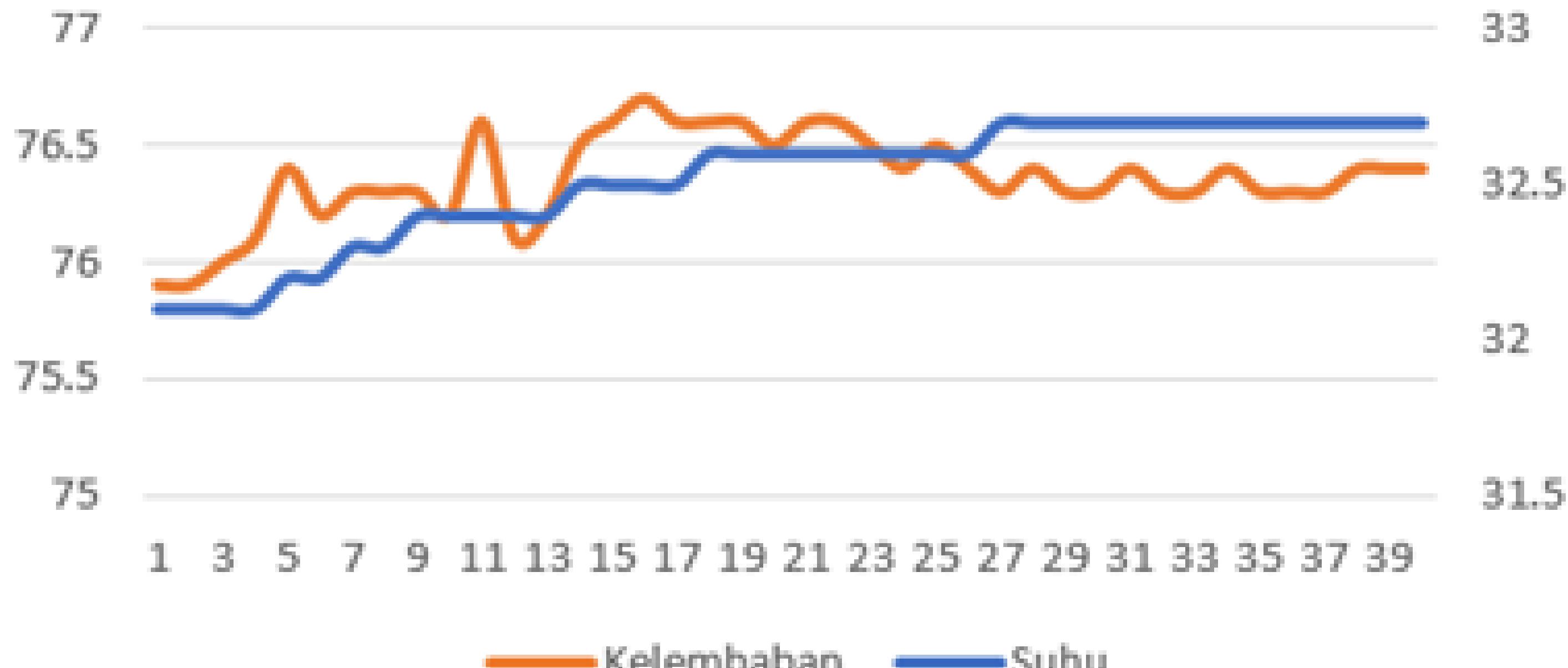


24	32.6	76.4	32.8	76.6	0.88	0.26
25	32.6	76.5	32.9	76.7	0.97	0.26
26	32.6	76.4	32.8	76.5	0.76	0.13
27	32.7	76.3	32.9	76.5	0.73	0.26
28	32.7	76.4	32.8	76.6	0.55	0.26
29	32.7	76.3	32.9	76.5	0.64	0.26
30	32.7	76.3	32.8	76.5	0.37	0.26
31	32.7	76.4	32.9	76.6	0.7	0.26
32	32.7	76.3	32.8	76.5	0.52	0.26
33	32.7	76.3	32.9	76.4	0.79	0.13
34	32.7	76.4	32.8	76.6	0.43	0.26
35	32.7	76.3	32.8	76.5	0.61	0.26
36	32.7	76.3	32.9	76.4	0.27	0.13
37	32.7	76.3	32.8	76.5	0.55	0.26
38	32.7	76.4	32.9	76.6	0.67	0.26
39	32.7	76.4	32.8	76.5	0.46	0.13
40	32.7	76.4	32.9	76.6	0.82	0.26
Rata-rata %error					0.78%	0.24%

DHT22 SENSOR TESTING

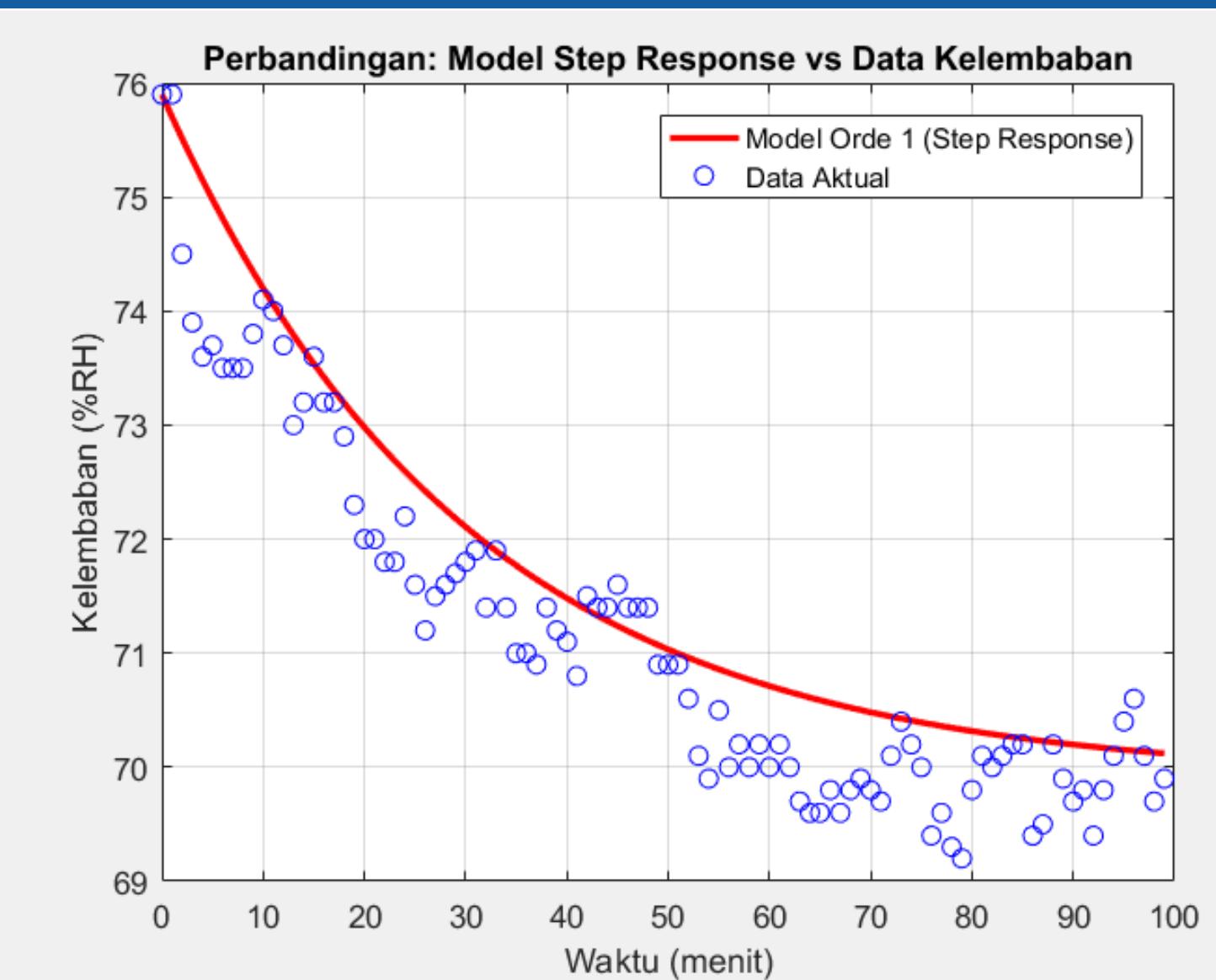
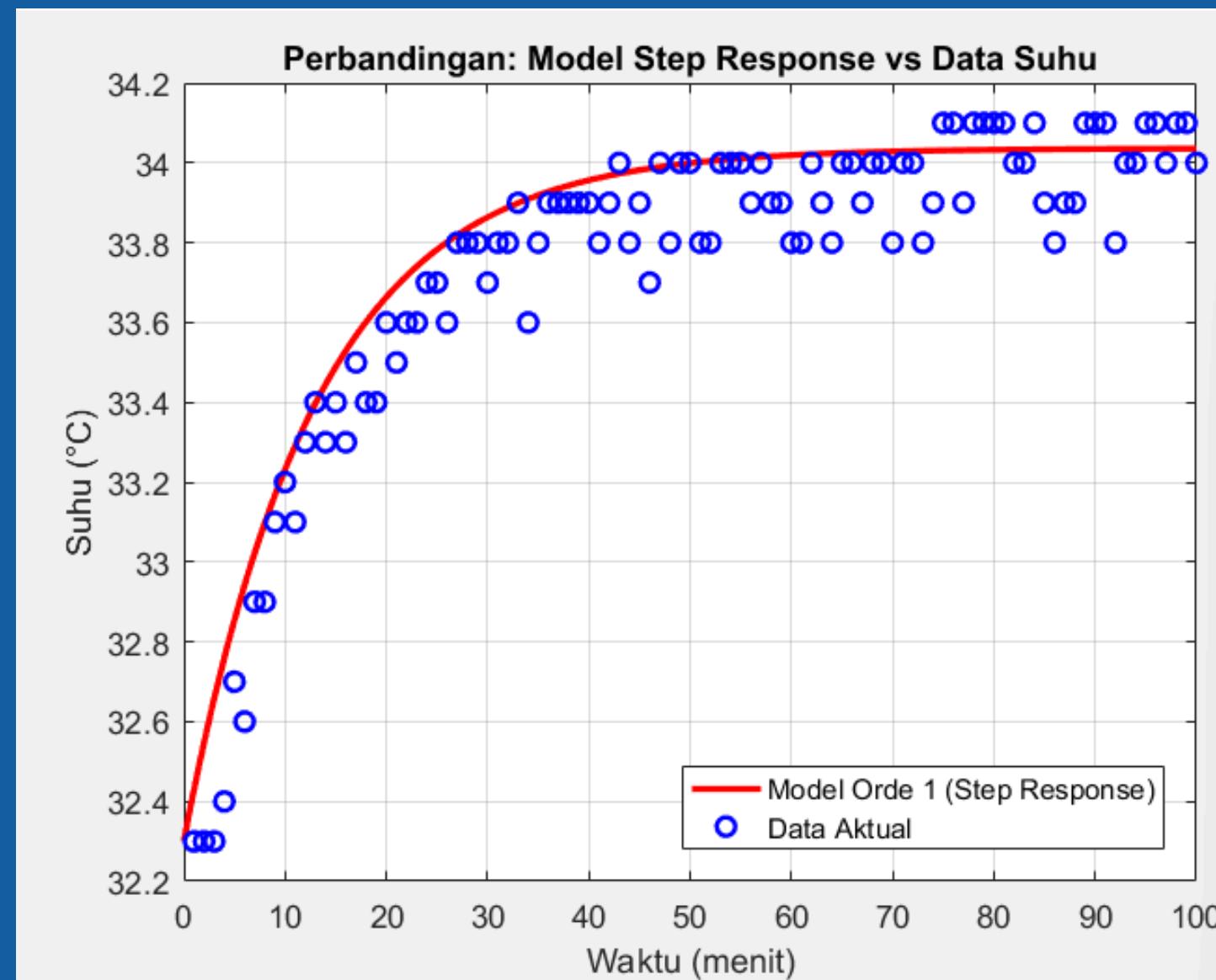


Pengukuran Aktual Tanpa Kontrol

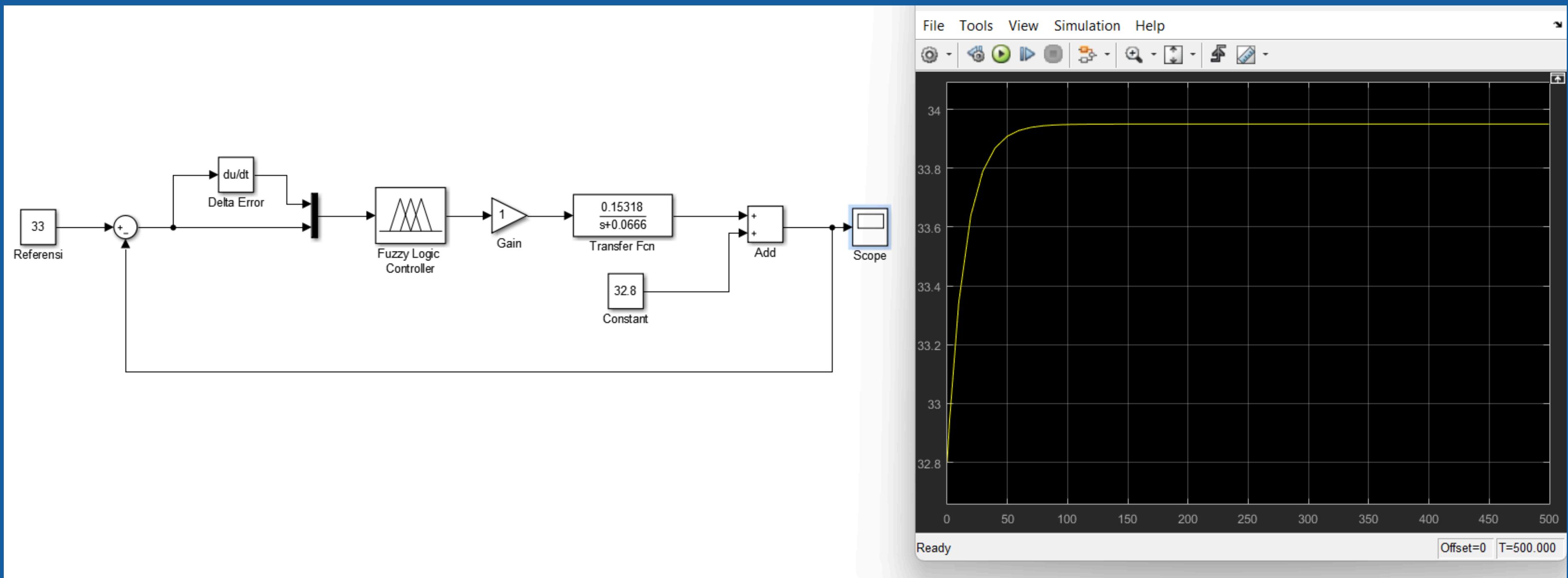




SUHU KELEMBABAN 100MIN



SIMULATION





pens

HARDWARE TESTING

No	Time (min)	Ref setpoint 33°C 65%		Pengukuran DHT22		PWM		%Error	
		Suhu	Kelembaban	Suhu	Kelembaban	Lampu	Kipas	Suhu	Kelembaban
1	0.2	33	65	33.3	67	21	174	0.3	3.08
2	1.2	33	65	33.4	66	20	174	0	1.54
3	2.2	33	65	33.4	66	20	174	0	1.54
4	3.2	33	65	33.4	66	20	174	0	1.54
5	4.2	33	65	33.5	65	20	174	0.3	0
6	5.2	33	65	33.5	65	20	174	0.3	0
7	6.2	33	65	33.5	65	20	174	0.3	0
8	7.2	33	65	33.5	65	20	174	0.3	0
9	8.2	33	65	33.5	65	20	174	0.3	0
10	9.2	33	65	33.5	65	20	174	0.3	0
11	10.2	33	65	33.5	65	20	174	0.3	0
12	11.2	33	65	33.5	65	20	174	0.3	0
13	12.2	33	65	33.5	65	20	174	0.3	0
14	13.2	33	65	33.6	64	21	174	0.61	1.54
15	14.2	33	65	33.6	64	21	174	0.61	1.54
16	15.2	33	65	33.6	64	21	174	0.61	1.54
17	16.2	33	65	33.6	64	21	174	0.61	1.54
18	17.2	33	65	33.6	64	21	174	0.61	1.54
19	18.2	33	65	33.6	64	21	174	0.61	1.54
20	19.2	33	65	33.6	64	21	174	0.61	1.54
21	20.2	33	65	33.6	64	21	174	0.61	1.54
22	21.2	33	65	33.6	64	21	174	0.61	1.54
23	22.2	33	65	33.7	64	21	174	0.91	1.54
24	23.2	33	65	33.7	64	21	174	0.91	1.54
25	24.2	33	65	33.7	64	21	174	0.91	1.54
26	25.2	33	65	33.7	64	21	174	0.91	1.54
27	26.2	33	65	33.7	64	21	174	0.91	1.54
28	27.2	33	65	33.7	64	21	174	0.91	1.54
29	28.2	33	65	33.7	64	21	174	0.91	1.54
30	29.2	33	65	33.7	64	21	174	0.91	1.54



pens

HARDWARE TESTING

31	30.2	33	65	33.7	64	21	174	0.91	1.54
32	31.2	33	65	33.8	64	21	174	1.21	1.54
33	32.2	33	65	33.8	64	21	174	1.21	1.54
34	33.2	33	65	33.8	65	20	174	1.21	0
35	34.2	33	65	33.8	65	20	174	1.21	0
36	35.2	33	65	33.8	65	20	174	1.21	0
37	36.2	33	65	33.8	65	20	174	1.21	0
38	37.2	33	65	33.8	65	20	174	1.21	0
39	38.2	33	65	33.9	65	20	174	1.52	0
40	39.2	33	65	33.9	65	20	174	1.52	0
41	40.2	33	65	33.9	65	20	174	1.52	0
42	41.2	33	65	33.9	65	20	174	1.52	0
43	42.2	33	65	33.9	65	20	174	1.52	0
44	43.2	33	65	33.9	65	20	174	1.52	0
45	44.2	33	65	33.9	64	21	174	1.52	1.54
46	45.2	33	65	33.9	64	21	174	1.52	1.54
47	46.2	33	65	33.9	64	21	174	1.52	1.54
48	47.2	33	65	33.9	64	21	174	1.52	1.54
49	48.2	33	65	33.9	64	21	174	1.52	1.54
50	49.2	33	65	33.9	64	21	174	1.52	1.54
51	50.2	33	65	33.9	64	21	174	1.52	1.54
52	51.2	33	65	33.9	64	21	174	1.52	1.54
53	52.2	33	65	33.9	64	21	174	1.52	1.54
54	53.2	33	65	33.9	64	21	174	1.52	1.54
55	54.2	33	65	33.9	64	21	174	1.52	1.54
56	55.2	33	65	33.9	64	21	174	1.52	1.54
57	56.2	33	65	33.9	64	21	174	1.52	1.54
58	57.2	33	65	33.9	64	21	174	1.52	1.54
59	58.2	33	65	33.9	64	21	174	1.52	1.54
60	59.2	33	65	33.9	64	21	174	1.52	1.54
61	60.2	33	65	33.9	64	21	174	1.52	1.54
Rata-rata Ref		33	65						
Rata-rata Pengukuran sensor DHT22				33.7	64.5	Rata-rata %Error	0.98%	1.06%	

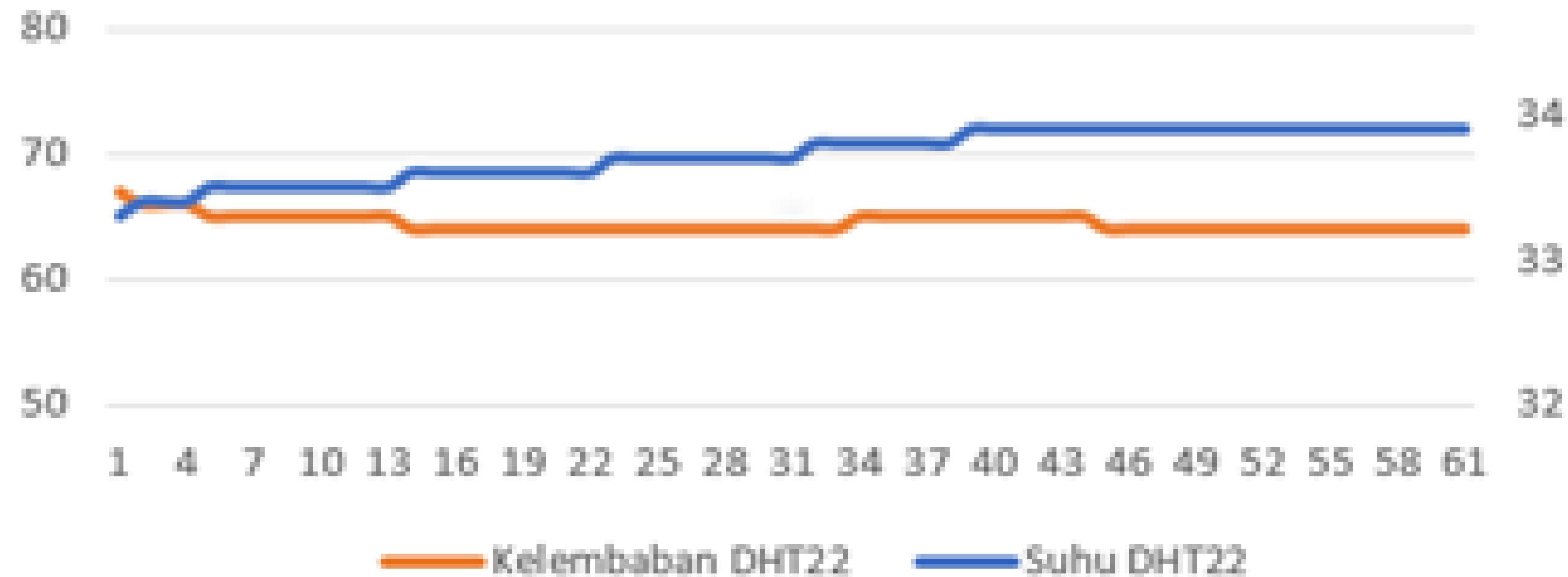


pens

HARDWARE TESTING



Pengujian Sistem dengan Fuzzy
Setpoint 33°C 65%



FUZZY CONTROL TESTING

No	Pengukuran DHT22		PWM SIMULASI		PWM HARDWARE		%Error		Akurasi	
	Suhu°C	Kelembaban%	Lampu	Kipas	Lampu	Kipas	Lampu	Kipas	Lampu	Kipas
1	33.3	67	22.9	175	21	174	8.3	0.57	91.7	99.4
2	33.4	66	21.3	175	20	174	6.1	0.57	93.9	99.4
3	33.4	66	21.3	175	20	174	6.1	0.57	93.9	99.4
4	33.4	66	21.3	175	20	174	6.1	0.57	93.9	99.4
5	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
6	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
7	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
8	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
9	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
10	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
11	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
12	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
13	33.5	65	20.8	175	20	174	3.85	0.57	96.2	99.4
14	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
15	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
16	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
17	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
18	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
19	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
20	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
21	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
22	33.6	64	22	175	21	174	4.55	0.57	95.5	99.4
23	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
24	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
25	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
26	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
27	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
28	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
29	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
30	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4

FUZZY CONTROL TESTING

31	33.7	64	22	175	21	174	4.55	0.57	95.5	99.4
32	33.8	64	22	175	21	174	4.55	0.57	95.5	99.4
33	33.8	64	22	175	21	174	4.55	0.57	95.5	99.4
34	33.8	65	21.5	175	20	174	6.98	0.57	93	99.4
35	33.8	65	21.5	175	20	174	6.98	0.57	93	99.4
36	33.8	65	21.5	175	20	174	6.98	0.57	93	99.4
37	33.8	65	21.5	175	20	174	6.98	0.57	93	99.4
38	33.8	65	21.5	175	20	174	6.98	0.57	93	99.4
39	33.9	65	21.7	175	20	174	7.83	0.57	92.2	99.4
40	33.9	65	21.7	175	20	174	7.83	0.57	92.2	99.4
41	33.9	65	21.7	175	20	174	7.83	0.57	92.2	99.4
42	33.9	65	21.7	175	20	174	7.83	0.57	92.2	99.4
43	33.9	65	21.7	175	20	174	7.83	0.57	92.2	99.4
44	33.9	65	21.7	175	20	174	7.83	0.57	92.2	99.4
45	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
46	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
47	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
48	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
49	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
50	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
51	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
52	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
53	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
54	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
55	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
56	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
57	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
58	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
59	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
60	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
61	33.9	64	22	175	21	174	4.55	0.57	95.5	99.4
Rata rata %Error dan Akurasi							5.1	0.57	94.9%	99.4%



BABY PIGEON CONDITION

Umur	Berat Badan		Ukuran				Kondisi	
	Kandang dengan Kontrol	Konvensional	Kandang dengan Kontrol		Konvensional		Kandang dengan Kontrol	Konvensional
			Panjang	Lebar	Panjang	Lebar		
1 Hari	236gr	235gr	5cm	2cm	5cm	2cm	Sehat	Sehat
2 Hari	337gr	276gr	6cm	3.4cm	5.9cm	3cm	Sehat	Sehat
3 Hari	394gr	301gr	7cm	4cm	6cm	4cm	Sehat	Suhu kandang lebih dingin di malam hari
4 Hari	418gr	318gr	8cm	5cm	7cm	4cm	Sehat	Suhu kandang lebih dingin di malam hari
5 Hari	455gr	346gr	8cm	5cm	7cm	4cm	Sehat	Suhu kandang lebih dingin di malam hari

IN CAGE



CONVENTIONAL





PENS

DOCUMENTATION





CONCLUSION

FROM THE TEST CASES ON THE SENSOR AND ALSO THE TESTING OF THE ENTIRE SYSTEM, THE FOLLOWING CONCLUSIONS CAN BE DRAWN:

1. AT THE DHT22 SENSOR TESTING STAGE, THE FINAL SENSOR VALUE AT A STABLE TEMPERATURE READING OF 32.7°C . THIS IS DONE WITHOUT ANY CONTROL OR FACTORS THAT CAN AFFECT LOW FLUCTUATING CHANGES AT EACH TIME READ. DIFFERENT FROM TESTING THE RELATIONSHIP BETWEEN TEMPERATURE AND LIGHTS, AND FANS WITH HUMIDITY.
2. IN TESTING THE RELATIONSHIP BETWEEN LIGHTS AND TEMPERATURE, IT WAS CONCLUDED THAT IF THERE IS A HEATING FACTOR IN THE CAGE SUCH AS LIGHTS, THE TEMPERATURE READ BY DHT22 CANNOT BE STABLE, THERE MUST BE AN OSCILLATION WITH AN OSCILLATION RANGE OF $33.9^{\circ}\text{C} - 34.1^{\circ}\text{C}$ WITH A DIFFERENCE OF 1.8°C .
3. THERE IS AN OSCILLATION WITH A RANGE OF $70.1\% - 69.9\%$ IN TESTING THE RELATIONSHIP BETWEEN HUMIDITY AND FANS. SIMILAR TO TESTING THE TEMPERATURE WITH FANS, THERE IS STILL OSCILLATION AND IT CANNOT BE STABLE WITH AN OSCILLATION DIFFERENCE OF 0.2% .
4. THE SYSTEM CAN CONTROL TEMPERATURE AND HUMIDITY AT THE DESIRED SETPOINT. THE INPUT SETPOINT IS 35°C AND 65% WITH AN ERROR IN EACH OUTPUT PARAMETER TEMPERATURE = 0.98% , AND HUMIDITY = 1.06% .
5. IN THE OVERALL SYSTEM TEST THAT HAS BEEN EMBEDDED WITH FUZZY CONTROL, THE READING RESULTS FROM THE DHT22 SENSOR HAVE AN AVERAGE TEMPERATURE VALUE OF 33.8°C , AND HUMIDITY OF 64.2% .
6. THE DEVELOPMENT OF BABIES IN CONVENTIONAL REQUIRES MORE ATTENTION SUCH AS GOOD WARMTH AS WHEN THEY ARE STILL WITH THEIR MOTHER



THANK YOU!

any question ?

