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Application of Fuzzy Logic in Air Conditioner Temperature Control in Rooms with Partitions in Boarding Houses

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Abstract

This research investigates the application of fuzzy logic with the Mamdani method to regulate room temperature using an air conditioner (AC) in a boarding house environment with a partition at Bogor City, Indonesia. By considering variables such as room size, external temperature (weather), and air conditioner specifications, this research aims to achieve a balance between occupant comfort and energy efficiency. The optimal temperature for each room in the boarding house will be determined through fuzzy logic calculations. This research aims to open up new potentials in intelligent and sustainable temperature regulation in a boarding house or similar environment. This research method uses fuzzy logic for room temperature control using Matlab software.

Keywords: AC, fuzzy logic, optimal, room, temperature.

INTRODUCTION

The idea of fuzzy logic was first proposed in 1965 by Lotfi A. Zadeh from the University of California at Barkley, and it has been developed into a concept called fuzzy sets since 1973 (Egoigwe Sochima Vincent et al., 2019) . In contrast to classical logic or digital logic, which operates on discrete values of 0 or 1, fuzzy logic is a mathematical system that analyses analog input values in terms of fuzzy variables that take continuous values between 0 and 1, unlike classical logic or digital logic (Riyadh Waheed et al., 2020).

There are several benefits to this fuzzy logic method, including its ease of use and ability to make decisions based on human conditions (Pooja et al., 2017). Fuzzy logic using fuzzification to transform crisp values into linguistic values, which are subsequently incorporated into knowledge-based rules to represent emotions or intuition (Made & Pramesti, 2022). Fuzzy logic is also suitable for most problems faced in the real world. Fuzzy logic with non-linear linguistic values is appropriate since the majority of real-world problems are non-binary and non-linear (Ravindra et al., 2017). Although fuzzy logic initially received a lot of criticism, it has had many successful applications that prove the potential and usefulness of fuzzy logic in solving problems in everyday life (Alif Kurnia Utama et al., 2023).

Fuzzy logic is widely used in various fields in everyday life. One of them is the field of electronics in household appliances (Pratama & Sarno, 2018). Several examples of fuzzy logic's use in the automatic management of electronic devices such as air conditioners (AC), washing machines, spice grinders, and others (Mastacan & Dosoftei, 2018). Technology to improve the performance of household appliances is increasingly used to provide greater comfort of use and improve efficiency, both technically and economically (Muchtar & Syamsur, 2021).

Applying fuzzy logic to control room temperature using an air conditioner (AC) is also a big concern for further research to develop a more optimal and efficient room temperature control system

(Prasanda et al., 2019). Air Conditioner is one of the needs in household equipment. Climate change in the world today is one of the factors for Indonesians to use air conditioning(Fitriana, 2019).

An air conditioner is a necessary item to create a comfortable atmosphere for each person's needs (Kee et al., 2019). The treatment in controlling room temperature using an careless air conditioner is actually very inefficient, because it is not good for personal health, saving electricity usage or durability of the tool (Khairudin et al., 2021) . The temperature setting that must be set on this AC device must be as optimal as possible, in this case what must be considered is the outdoor ambient temperature factor, the size of the room, and the specifications of the AC used (Moler & Little, 2020) . Using the basis of fuzzy logic, air conditioners can be used optimally so that the health of users, electricity and equipment age can be maintained properly and wisely.

In the context of boarding houses or rental houses, where variations in occupants' preferences and needs can vary significantly, adaptive and responsive temperature control becomes very important (Kumar et al., 2014) . The purpose of this study is to explore the implementation of fuzzy logic in air conditioner (AC) temperature control in partitioned rooms in boarding houses, to achieve an optimal balance between occupant comfort and efficient energy use. This research is expected to open up new potentials in smarter and more sustainable temperature regulation for similar boarding house or rental house environments (Islam & Islam, 2021).

METHODS

This research was conducted from March 3 to March 9, 2024, at a boarding house at Jalan Artzimar 3, Bogor City, West Java, Indonesia. Methods of quantitative research are used in this study. Numbers that can be added together, ranked, and then measured in units of measurement are the data collected by quantitative research methods (Chung et al., 2016) . With this kind of data, raw data tables and graphs can be produced (Mohajan, 2020). This quantitative research method's goal is to create mathematical theories, models, and hypotheses about a phenomenon in order to ascertain how variables in a population relate to one another (Yani Balaka, 2022).

This study will compute the temperature of a room using an air conditioner (AC) by utilizing fuzzy logic and the Mamdani method in a room with insulation in a boarding house. In the boarding house, there are three rooms that are only limited by walls without doors, including the living room, bedroom, and laundry room. The boarding house only has one air conditioner (AC) located in the bedroom. There are three input data sets that will be used: room size, external temperature, and AC specifications. This input data will be used to determine the optimal temperature of the air conditioner (AC) to cool the room based on calculations using fuzzy logic with the Mamdani method built using Matlab software.

This study employs a fuzzy logic method that goes through multiple steps to generate the desired value, including:

1. *Fuzzyfication*: fuzzyfication is the first phase of fuzzy calculations, namely converting firm values to fuzzy values (Yanto, 2017). Fuzzification will get an analog value as input and produce a fuzzy value (membership degree) of the analog value as output (Kurniawati, 2015). The fuzzy Mamdani method has a way of working by performing MIN-MAX operations (Rochman et al., 2020).
2. *Inferention:* create rules or Fuzzy Rule Based System (Chaudhari & Patil, 2015). The goal of the fuzzy rule-based system is to solve problems using rules that come from expert knowledge. There are actions (then) and conditions (if) in the rules. The output result of this Mamdani method is in the form of a value in a fuzzy set, which is categorized into linguistic components (Alif Kurnia Utama et al., 2023).
3. *Defuzzyfication*: The final stage of a fuzzy logic system is called defuzzification, and its goal is to transform each fuzzy set result that the inference engine produces into a real integer (Salam & Ibrahim, 2020) . The fuzzy logic control system's action is the outcome of the conversion.

RESULTS AND DISCUSSION

In this results and discussion chapter, we will discuss the research results of the application of fuzzy logic Mamdani method in controlling the temperature of air conditioners (AC) in insulated rooms in boarding houses in the Bogor City area, using input external temperature (weather), room area, and air conditioner (AC) specifications as data for calculations so that the optimal temperature issued by the AC for the room is produced.

The numbers in the range of each variable were obtained from experts who work in the field of air conditioning and college students of the Politeknik Negeri Bandung in Refrigeration and Air Conditioning Engineering study program. However, there is an exception for the external temperature variable. The range of the external temperature variable was obtained from the Weather Forecast site in Bogor City on March 9, 2024, from the Badan Meteorologi, Klimatologi, dan Geofisika (BMKG) (Badan Meteorologi, 2024).

Table 1. Type, Variable, and Range Used

Type	Variable	Range
Input	Room Size	[8 20]
	External Temperature	[17 32]
	AC Spesification	[0 2]
Output	Optimal AC Temperature	[16 32]

The following is a membership function or implementation of the number range of inputs and outputs determined. This membership function was created using Matlab software. By using a membership function, the author can describe the membership level of a variable to the fuzzy set in a more flexible way than a discrete set.

Membership Function of Room Size

The following is the membership function of the room size input. In Figure 1, it can be seen that the variables of input room size are small, medium, and large. Each variable has a range of numbers that state how significant the variable is. Small variables range from 8 to 12 m^2, medium from 12 to 16 m^2, and large from 16 to 20 m^2.

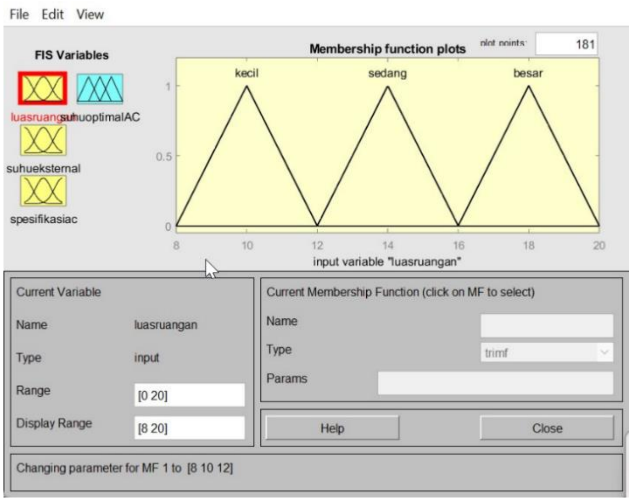


Figure 1. Membership Function of Room Size

The picture above represents variable data from the membership function of room size presented in Matlab software. The following is a manual calculation to find the membership degree value.

1) Living Room

$$\frac{12-10{,}5}{12-6}=\frac{1{,}5}{6}=0{,}25$$

Membership degree = 0,25

2) Bedroom

$$\frac{12,6-12}{14-12}=\frac{0,6}{2}=0,3$$

Membership degree = 0,3

3) Laundry Room

$$\frac{12-9}{12-6}=\frac{3}{6}=0,5$$

Membership degree = 0,5

Membership Function of External Temperature

The following is the membership function of the external temperature input. In Figure 2, it can be seen that the variables of the external temperature input are cold, medium, and hot. Each variable has a range of numbers that state how significant the variable is. Cold variables range from 17 to 23°C, medium from 23 to 28°C, and hot from 28 to 32°C.

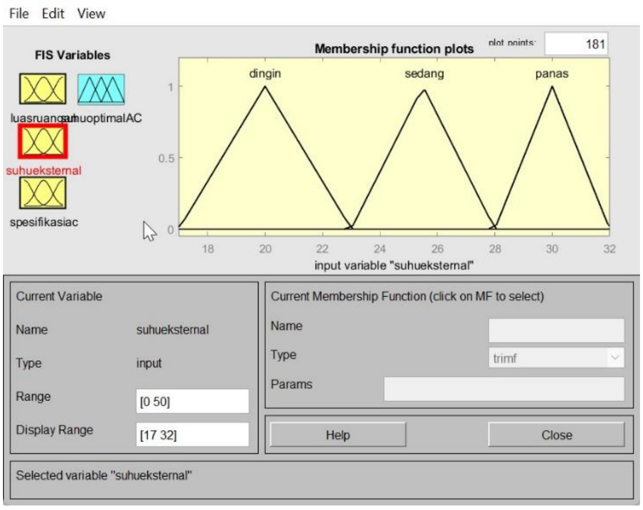


Figure 2. Membership Function of External Temperature

The picture above represents variable data from the membership function of external temperature presented in Matlab software. The following is a manual calculation to find the membership degree value.

1) Living Room

$$\frac{19-17}{20-17}=\frac{2}{3}=0,666$$

Membership degree = 0,666

2) Bedroom

$$\frac{32-31}{32-30}=\frac{1}{2}=0,5$$

Membership degree = 0,5

3) Laundry Room

$$\frac{24-23}{25,5-23}=\frac{1}{2,5}=\frac{4}{10}=0,4$$

Membership degree = 0,4

Membership Function of AC Spesification

The following is the membership function of the AC specification input. In Figure 3, it can be seen that the variables of the AC specification input are small, medium, and large. Each variable has a range of numbers that state how significant the variable is. Small variables range from 0 to 0.75 PK, medium from 0.5 to 1.5 PK, and large from 1.25 to 2 PK.

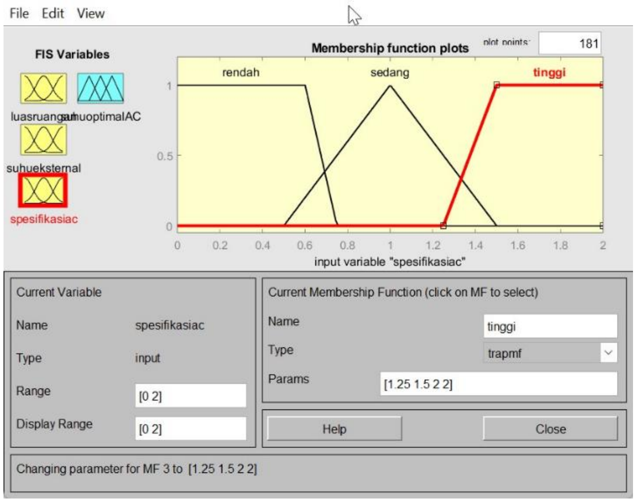


Figure 3. Membership Function of AC Spesification

The figure above represents variable data from the membership function of AC specification presented in Matlab software. The following is a manual calculation to find the membership degree value.

1) Living Room
   Membership degree = 1
2) Bedroom
   Membership degree = 1
3) Laundry Room
   Membership degree = 1

Membership Function of Optimal AC Temperature

The following is the membership function of the optimal output AC temperature. In Figure 1, it can be seen that the variables of the optimal output AC temperature are cold, medium, and hot. Each variable has a range of numbers that state how significant the variable is. Cold variables range from 16 to 22°C, medium from 20 to 28°C, and hot from 26 to 32°C.

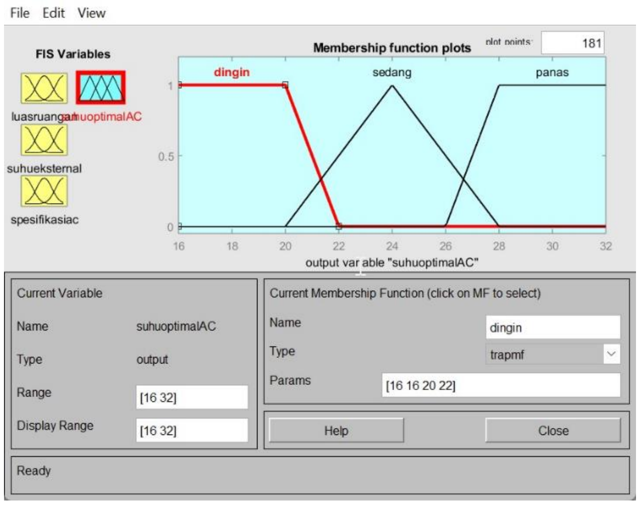


Figure 4. Membership Function of Optimal AC Temperature

After determining the range of numbers for the input and output variables and implementing them into the membership function in Matlab software, the next step in designing a fuzzy logic system is to determine the fuzzy rules (Balenorezky et al., 2019). These rules determine how the input variables affect the output variables in the fuzzy system (Hasim et al., 2014). In research on applying fuzzy logic Mamdani method in controlling the temperature of air conditioners (AC) in insulated rooms in boarding houses, this study uses 27 rules obtained from calculating inputs and outputs above. The following are the 27 rules used:

Table 2. Fuzzy Rules

No.	Room Size	External Temperature	AC Spesification	Optimal AC Temperature
1.	Small	Cold	Small	Cold
2.	Small	Cold	Medium	Cold
3.	Small	Cold	Big	Cold
4.	Medium	Cold	Small	Cold
5.	Medium	Cold	Medium	Cold
6.	Medium	Cold	Big	Cold
7.	Big	Cold	Small	Normal
8.	Big	Cold	Medium	Cold
9.	Big	Cold	Big	Cold
10.	Small	Normal	Small	Normal
11.	Small	Normal	Medium	Normal
12.	Small	Normal	Big	Cold
13.	Medium	Normal	Small	Normal
14.	Medium	Normal	Medium	Normal
15.	Medium	Normal	Big	Normal
16.	Big	Normal	Small	Hot
17.	Big	Normal	Medium	Normal
18.	Big	Normal	Big	Normal
19.	Small	Hot	Small	Hot
20.	Small	Hot	Medium	Normal
21.	Small	Hot	Big	Cold
22.	Medium	Hot	Small	Hot
23.	Medium	Hot	Medium	Normal
24.	Medium	Hot	Big	Cold
25.	Big	Hot	Small	Hot
26.	Big	Hot	Medium	Hot
27.	Big	Hot	Big	Cold

In this case, the author researched a boarding house in the Bogor City with 3 partitioned rooms without doors. The rooms consist of a living room, a bedroom, and a laundry room. Each room has a different size. The research was conducted on the same day but at different times: morning, afternoon, and evening. For the AC specifications, it is 1 PK and located in the bedroom. The following are the results of applying fuzzy logic using the Mamdani method in controlling the temperature of the air conditioner (AC) in partitioned rooms in the boarding house.

1. Living Room

Research in the living room was conducted in the morning at 6.00 AM. In Figure 7, it can be seen that based on calculations using fuzzy logic Mamdani method on Matlab software to control the room temperature with air conditioner (AC) in the living room with an external temperature of 19°C, a room size of 10.5 m^2, and 1 PK AC specifications is 18.6°C.

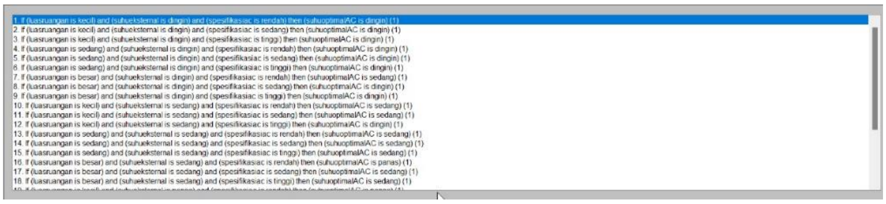


Figure 5. Fuzzy Rules Used in The Living Room

The condition of the room is included in fuzzy rules number 2. It can be seen in Figure 5; namely, IF room size is small AND external temperature is cold AND AC specification is medium THEN the optimal AC temperature is cold. In this case, the membership value selected for the output (optimal AC temperature) will be the minimum of the corresponding membership values of each condition that the rule is based on. Therefore, this rule still uses the min operation in fuzzy logic.

- Simplifying Composition Functions

$\mu_{SF\,[Z]} = \{0 \quad \frac{x-16}{16-16} \quad 1 \quad \frac{22-x}{22-20} \quad 0$

$\int_{16}^{20} \blacksquare (1)\; x\, dx = 72$

$\int_{20}^{22} \blacksquare (11 - 0{,}5x)\; x\, dx = 20{,}666$

- Composition of Output Values

The following is the composition of living room output values, combining fuzzy output values generated by fuzzy rules to produce concrete or firm output values. In Figure 6, it can be seen that the shape of the composition of living room output values is rectangle and triangle.

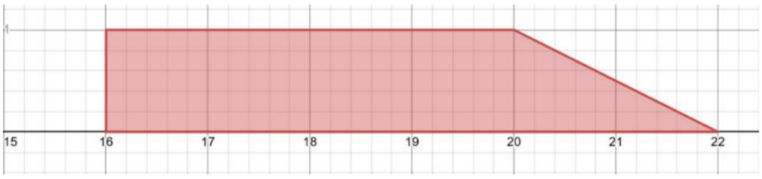


Figure 6. Composition of Living Room Output Values

The image above represents the data composition of living room output values presented in graphical form. The following is a manual calculation to find the value.

- Area I (Triangle)

$$\frac{h\,.\,b}{2} = \frac{(22-20).1}{2} = \frac{2}{2} = 1$$

Area II (Rectangle)

$$p.l = (20-16).1 = 4.1 = 4$$

- Defuzzification

$Z* = \frac{\sum \quad moment}{\sum \quad area} = \frac{72 + 20{,}666}{5} = \frac{92{,}6}{5} = 18{,}52 \approx 18{,}6$

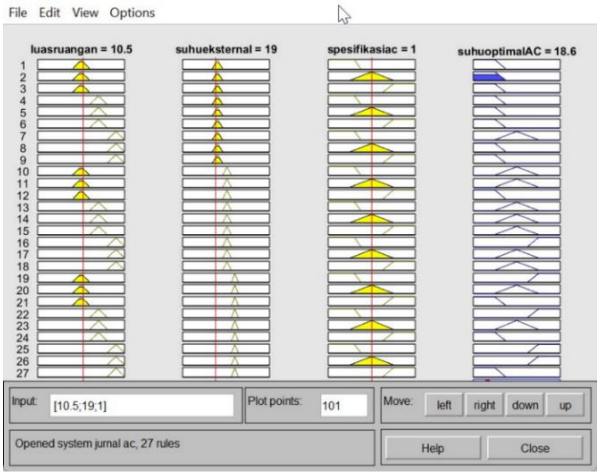


Figure 7. Optimal AC Temperature in Living Room

As in Figure 7 states the optimal temperature of the air conditioner in the living room is 18.6°C. While the manual calculation results in 18.52°C. However, in the living room, it takes longer to get the optimal AC temperature because the distance of the AC placement is not strategic, and it is not as close as the bedroom, which is the room where the AC is placed.

The results of fuzzy calculations manually and using Matlab software may not always be exactly the same (Saepullah & Wahono, 2015). Although both methods aim to interpret data using predefined rules, differences in results may arise because the use of Matlab software may involve more precise numerical processing, while manual calculations may be limited to lower accuracy due to rounding or errors in number manipulation (Shodiya et al., 2017).

2. Bedroom

Research in the sleeping room was conducted in the afternoon at 1.00 PM. In Figure 10, it can be seen that based on calculations using fuzzy logic Mamdani method on Matlab software to control the room temperature with an air conditioner (AC) in the bedroom with an external temperature of 31°C, a room size of 12.6 m^2, and 1 PK AC specifications is 24°C.

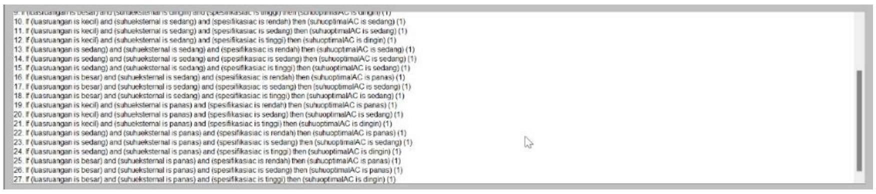

10. If (luasruangan is kecil) and (suhueksternal is sedang) and (spesifikasiac is rendah) then (suhuoptimalAC is sedang) (1)
11. If (luasruangan is kecil) and (suhueksternal is sedang) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
12. If (luasruangan is kecil) and (suhueksternal is sedang) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)
13. If (luasruangan is sedang) and (suhueksternal is sedang) and (spesifikasiac is rendah) then (suhuoptimalAC is sedang) (1)
14. If (luasruangan is sedang) and (suhueksternal is sedang) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
15. If (luasruangan is sedang) and (suhueksternal is sedang) and (spesifikasiac is tinggi) then (suhuoptimalAC is sedang) (1)
16. If (luasruangan is besar) and (suhueksternal is sedang) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
17. If (luasruangan is besar) and (suhueksternal is sedang) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
18. If (luasruangan is besar) and (suhueksternal is sedang) and (spesifikasiac is tinggi) then (suhuoptimalAC is sedang) (1)
19. If (luasruangan is kecil) and (suhueksternal is panas) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
20. If (luasruangan is kecil) and (suhueksternal is panas) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
21. If (luasruangan is kecil) and (suhueksternal is panas) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)
22. If (luasruangan is sedang) and (suhueksternal is panas) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
23. If (luasruangan is sedang) and (suhueksternal is panas) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
24. If (luasruangan is sedang) and (suhueksternal is panas) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)
25. If (luasruangan is besar) and (suhueksternal is panas) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
26. If (luasruangan is besar) and (suhueksternal is panas) and (spesifikasiac is sedang) then (suhuoptimalAC is panas) (1)
27. If (luasruangan is besar) and (suhueksternal is panas) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)

Figure 8. Fuzzy Rules Used in The Bedroom

The condition of the room is included in fuzzy rules number 23. It can be seen in Figure 8; namely, IF room size is medium AND external temperature is hot AND AC specification is medium THEN the optimal AC temperature is normal. This rule uses the min operation too because all conditions must be met simultaneously to activate the rule.

- Simplifying Composition Functions

$\mu_{SF\ [Z]} = \{0 \quad \frac{x-20}{24-20} \quad \frac{28-x}{28-24}$

$\int_{20}^{24} \blacksquare (0{,}25x - 5)\, x\, dx = 45{,}333$

$\int_{24}^{28} \blacksquare (7 - 0{,}25x)\, x\, dx = 50{,}666$

- Composition of Output Values

The following is the composition of bedroom output values, which combines fuzzy output values generated by fuzzy rules to produce concrete or firm output values. In Figure 9, it can be seen that the shape of the composition of living room output values is triangle.

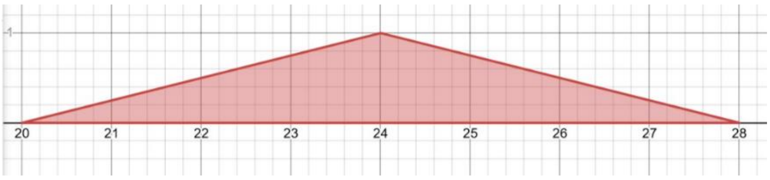


Figure 9. Composition of Bedroom Output Values

The image above represents the data composition of bedroom output values presented in graphical form. The following is a manual calculation to find the value.

- Area (Triangle)

$$\frac{h\,.\,b}{2} = \frac{(28-20).1}{2} = \frac{8}{2} = 4$$

- Defuzzification

$$Z* = \frac{\sum \quad moment}{\sum \quad area} = \frac{45{,}333 + 50{,}666}{4} = \frac{95{,}999}{4} = 23{,}975 \approx 24$$

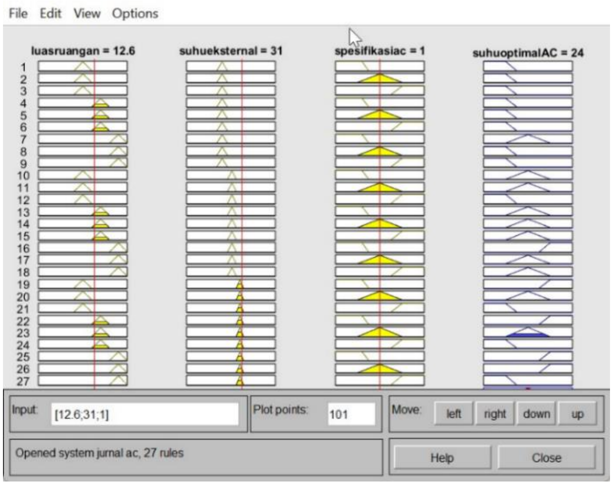
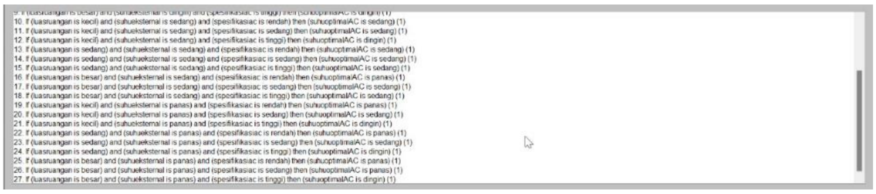


Figure 10. Optimal AC Temperature in Bedroom

In figure 13, calculations using Matlab software in the bedroom produce the optimal AC temperature of 24°C. While the manual calculation produces the optimal AC temperature of 23.975°C. The results of fuzzy calculations manually and using Matlab software may not always be exactly the same. However, the results of both calculations are not much different (Husaini et al., 2021).

3. Laundry Room

Research on the laundry room was conducted at 7:00 PM. In Figure 13, it can be seen that based on calculations using fuzzy logic Mamdani method on Matlab software to control the room temperature with an air conditioner (AC) in the laundry room with an external temperature of 24°C, a room size of 9 m^2, and a 1 PK AC specification is 24°C.


10. If (luasruangan is kecil) and (suhueksternal is sedang) and (spesifikasiac is rendah) then (suhuoptimalAC is sedang) (1)
11. If (luasruangan is kecil) and (suhueksternal is sedang) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
12. If (luasruangan is kecil) and (suhueksternal is sedang) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)
13. If (luasruangan is sedang) and (suhueksternal is sedang) and (spesifikasiac is rendah) then (suhuoptimalAC is sedang) (1)
14. If (luasruangan is sedang) and (suhueksternal is sedang) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
15. If (luasruangan is sedang) and (suhueksternal is sedang) and (spesifikasiac is tinggi) then (suhuoptimalAC is sedang) (1)
16. If (luasruangan is besar) and (suhueksternal is sedang) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
17. If (luasruangan is besar) and (suhueksternal is sedang) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
18. If (luasruangan is besar) and (suhueksternal is sedang) and (spesifikasiac is tinggi) then (suhuoptimalAC is sedang) (1)
19. If (luasruangan is kecil) and (suhueksternal is panas) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
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22. If (luasruangan is sedang) and (suhueksternal is panas) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
23. If (luasruangan is sedang) and (suhueksternal is panas) and (spesifikasiac is sedang) then (suhuoptimalAC is sedang) (1)
24. If (luasruangan is sedang) and (suhueksternal is panas) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)
25. If (luasruangan is besar) and (suhueksternal is panas) and (spesifikasiac is rendah) then (suhuoptimalAC is panas) (1)
26. If (luasruangan is besar) and (suhueksternal is panas) and (spesifikasiac is sedang) then (suhuoptimalAC is panas) (1)
27. If (luasruangan is besar) and (suhueksternal is panas) and (spesifikasiac is tinggi) then (suhuoptimalAC is dingin) (1)

Figure 11. Fuzzy Rules Used in The Laundry Room

The condition of the room is included in fuzzy rules number 11. It can be seen in Figure 11; namely, IF room size is small AND external temperature is normal AND AC specification is medium THEN the optimal AC temperature is normal. This rule is also a type of fuzzy rule that uses the min operation, just like the previous rule. The min operation is used when all conditions must be met (AND) to produce the corresponding output in fuzzy logic.

- Simplifying Composition Functions

$\mu_{SF\,[Z]} = \{0 \; \frac{x-20}{24-20} \; \frac{28-x}{28-24}$

$\int_{20}^{24} \blacksquare (0{,}25x \; - \; 5)\; x\; dx = 45{,}333$

$\int_{24}^{28} \blacksquare (7 \; - 0{,}25x)\; x\; dx = 50{,}666$

- Composition of Output Values

The following is the composition of laundry room output values, which combines fuzzy output values generated by fuzzy rules to produce concrete or firm output values. In Figure 12, it can be seen that the shape of the composition of living room output values is triangle.

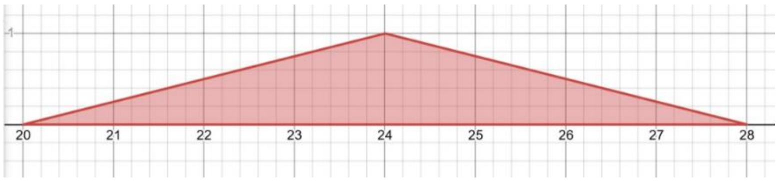

Figure 12. Composition of Laundry Room Output Values

The image above represents the data composition of laundry room output values presented in graphical form. The following is a manual calculation to find the value.

- Area (Triangle)

$$\frac{h\,.\,b}{2} = \frac{(28-20).1}{2} = \frac{8}{2} = 4$$

- Defuzzification

$$Z* = \frac{\sum \quad moment}{\sum \quad area} = \frac{45{,}333 + 50{,}666}{4} = \frac{95{,}999}{4} = 23{,}975 \approx 24$$

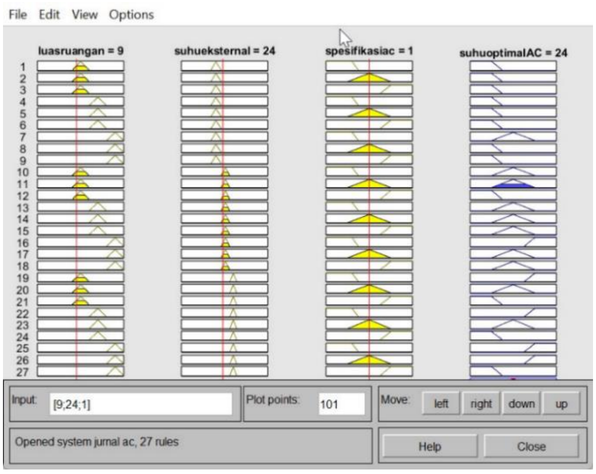

Figure 13. Optimal AC Temperature in Laundry Room

In figure 13, calculations using Matlab software in the laundry room produce the optimal ac temperature of 24°C. While the manual calculation produces the optimal ac temperature of 23.975°C. The results of fuzzy calculations manually and using Matlab software may not always be exactly the same (Raja & Ramathilagam, 2021). The results of both calculations are not much different. However, in the laundry room, it takes longer to get the optimal AC temperature because the distance of the AC placement is not strategic, and it is not as close as the bedroom, which is the room where the AC is placed.

CONCLUSION

From the research that has been done, the results of fuzzy calculations manually and using Matlab software may not always be precisely the same. Although both methods aim to interpret data using predefined rules, differences in results may arise because Matlab software may involve more precise numerical processing.

At the same time, manual calculations may be limited to lower accuracy due to rounding or errors in number manipulation. Application of fuzzy logic using the Mamdani method to control room temperature with an Air Conditioner (AC) in an insulated room in a boarding house can be used to help determine the optimal temperature for each room in the boarding house so that it does not affect the health of people in the room, save on electricity use, and extend the life of the Air Conditioner (AC).

From the research that has been done, it can be advised that fuzzy logic programs utilizing the Mamdani method to regulate room temperature with an Air Conditioner (AC) in insulated rooms in boarding houses can be adapted for determining room temperatures in other settings. However, this adaptation requires careful consideration of membership functions and range ranges to align with the specific conditions of the environment.

For instance, if the field conditions exhibit a more extensive range compared to typical boarding house settings, adjustments in the membership functions and range ranges are necessary to ensure accurate and efficient temperature control. By customizing these parameters to suit the specific environmental conditions, the fuzzy logic program can effectively regulate room temperature across various settings, ensuring optimal comfort and energy efficiency. Additionally, ongoing monitoring and refinement of the fuzzy logic program based on real-world feedback can further enhance its performance and adaptability to diverse environments.

This research focuses on temperature regulation in boarding houses with partition rooms. In addition, factors that affect air conditioning temperature control were considered, such as room size, external temperature, and air conditioning specifications. Especially in the case of external temperature, this research considers factors coming from the outside environment, not just those inside the room itself. By incorporating various variables into the fuzzy logic system, this research provides a more comprehensive approach to regulating temperature than previous studies.

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