Luke Tormey – B00107768

Computational Intelligence Design Document
-
Fuzzy Logic Air Conditioner

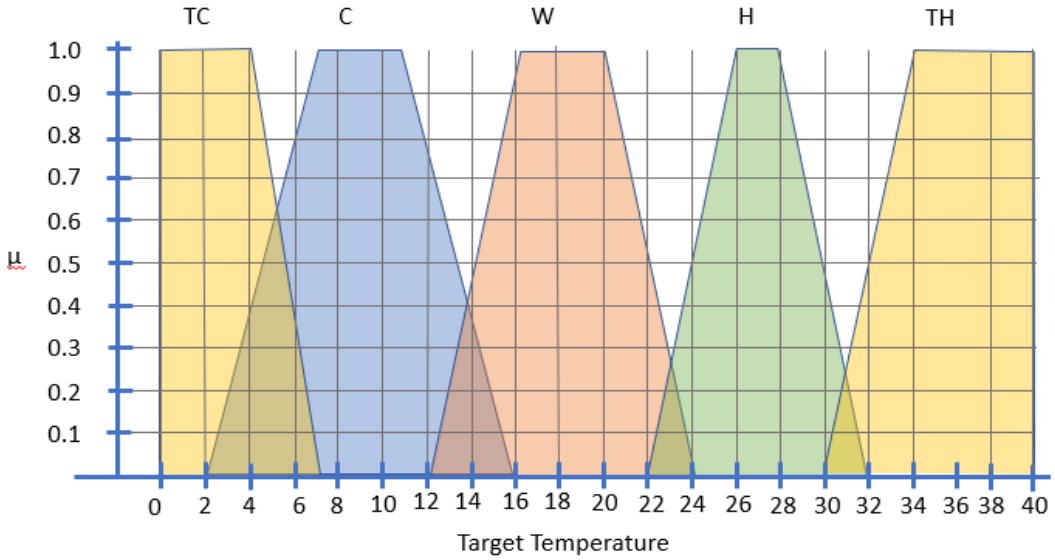
TU Dublin Blanchardstown Campus
February 2022

Fuzzy Air Controller Design

The design of the fuzzy air controller is made using two input variables and which are the target temperature and the room temperature. It also uses an output variable to release the command needed to bring the room temperature up to the level of the target temperature. Outside temperature is a random variable that influences the room temperature. The target temperature is set using the temperature dial and causes the room temperature to release its command variables and alter the temperature of the room to match that of the target temperature.

Linguistic Variables

The design implements linguistic variables that represent an input and an output, deciding on the domain range for each of the variables to alter the system. The variable was split into terms and then conditions to assign a membership function. The linguistic variables that were created are TC for too-cold, C for cold, W for Warm, H for hot, and TH for too-hot. Next, we choose the membership function for the range of the domains.



The domain of each linguistic variable plays a vital role in the performance of the system. The values were chosen based up various testing and being realistic to how the temperatures would work in an actual production situation. There are three outputs cool, normal and heat which range between the values of –10 to 10 so that there is never too much pressure on the system and the system is built without omissions. We can use these linguistic variables to create a table of fuzzy rules in a decision matrix.

Fuzzy Rules

Target Temperature					
Temperature	Too-cold	cold	warm	hot	Too-hot
Too-cold	No-change	heat	heat	heat	heat
cold	cool	No-change	heat	heat	heat
warm	cool	cool	No-change	heat	heat
hot	cool	cool	cool	No-change	heat
Too-hot	cool	cool	cool	cool	No-change

We can use our decision matrix to create these rules which take in both input variables and creates the output that captures our decision matrix. Fuzzy rules are referred to as the IF-THEN rule base form, the rules are defined by selecting the right sequence in the If-then sequence. The rules are based on natural language representation and models which are themselves based on fuzzy sets and fuzzy logic.

Rule Matrix

1. IF (temperature is too-cold AND (target is too-cold) THEN command is no-change
2. IF (temperature is too-cold AND (target is cold) THEN command is heat
3. IF (temperature is too-cold AND (target is warm) THEN command is heat
4. IF (temperature is too-cold AND (target is hot) THEN command is heat
5. IF (temperature is too-cold AND (target is too-hot) THEN command is heat
6. IF (temperature is cold AND (target is too-cold) THEN command is cool
7. IF (temperature is cold AND (target is cold) THEN command is no-change
8. IF (temperature is cold AND (target is warm) THEN command is heat
9. IF (temperature is cold AND (target is hot) THEN command is heat
10. IF (temperature is cold AND (target is too-hot) THEN command is heat
11. IF (temperature is warm AND (target is too-cold) THEN command is cool
12. IF (temperature is warm AND (target is cold) THEN command is cool
13. IF (temperature is warm AND (target is warm) THEN command is no-change
14. IF (temperature is warm AND (target is hot) THEN command is heat
15. IF (temperature is warm AND (target is too-hot) THEN command is heat
16. IF (temperature is hot AND (target is too-cold) THEN command is cool
17. IF (temperature is hot AND (target is cold) THEN command is cool
18. IF (temperature is hot AND (target is warm) THEN command is cool
19. IF (temperature is hot AND (target is hot) THEN command is no-change
20. IF (temperature is hot AND (target is too-hot) THEN command is heat
21. IF (temperature is too-hot AND (target is too-cold) THEN command is cool
22. IF (temperature is too-hot AND (target is cold) THEN command is cool
23. IF (temperature is too-hot AND (target is warm) THEN command is cool
24. IF (temperature is too-hot AND (target is hot) THEN command is cool
25. IF (temperature is too-hot AND (target is too-hot) THEN command is no-change