

PERSONNEL DETECTION SYSTEM

Is someone in the building or not?

Your task is to create an automated personnel detection system that detects for the presence of a person in a warehouse of IPB Corporation, a business entity for selling Rice and Copra. In the opinion of the company's owner, the existing sensors being used at this moment aren't particularly accurate. So, you need to improve the existing process using fuzzy logic.

One of the two inputs is an **optical sensor** whose fuzzy sets are named *Slow*, *Medium*, and *Fast*. It is measured in miles per hour from 0 to 9. The other input is an **infrared sensor**, with fuzzy sets named *Very Low*, *Low*, *Medium*, *High*, and *Very High*. Its units are temperatures from 94° to 108° Fahrenheit. The output is an audible signal with adjustable-length sound pulses. Its fuzzy sets are named *Very Low*, *Low*, *Medium*, and *Very High*, measured in milliseconds from 500 to 2000.

Sensors' input range and audible sound's output

Name	Units Name	Min	Max
Input:			
Optical sensor	Mph	0	9
Infrared sensor	Degrees Fah	94	108
Output:			
Audible signal	Milliseconds	500	2000

Suppose that at the same time, you are the expert assigned to determine the membership function of the value ranges of the two inputs and one output. So, using the table below, you need to supply the triangular membership values for each range. The shape of the membership function would be entirely up to you as long as the correct range of the inputs and output are properly maintained.

The membership functions and their values (developer-defined)

Name	Description	Values		
Input:		Left	Center	Right
Optical sensor	Slow			
	Medium			
	Fast			
Infrared sensor	Very Low			
	Low			
	Medium			
	High			
	Very High			
Output:				
Audible signal	Very Low			
	Low			
	Medium			
	High			
	Very High			

As can be seen from the table, the membership values of the three variables are left blank because you will be the one to set it and whatever values you set will be applied to your fuzzy logic code. On the other hand, the rules construction matrix is shown below.

Infrared		VLOW	LOW	MED	HIGH	VHIGH
Optical	SLO	Very low	Low	Very low	Low	Very low
	MED	Low	Medium	Low	Medium	Low
	FAST	Medium	High	Medium	Low	Very low

To demonstrate these rules, if the optical sensor detects fast movement and the infrared sensor sensed low temperature, then the alarm (audible sound) is High, etc.

LO1 Tasks:

Fuzzy Controller Design & Development in Python (80%)

Sample Interaction:

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*****
Optical Sensor (0-9) in miles/hr: ____
Infrared Sensor (94-108) in Degrees Fah: ____
Audible signal (milliseconds): <Fuzzy logic output>
*****
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Design & Development Documentation (20%)

1. Document briefly the steps that you have developed in solving the given problem starting from the design of the membership functions to the rule's creation. Also, include the screenshot of the membership functions of the 2 inputs and 1 output.
2. In the given problem, can you adjust the membership values of the 3 variables to suit your needs? Yes or No. Explain your answer.
3. Explain what difficulties can be encountered when this particular problem is solved using crisp logic.
4. Aside from the required outputs which is an audible sound for alarm, what other outputs do you think can be used here. Justify your answer.

Deliverables:

In zip file – Ex. BENITEZ.zip that contains the following:

- The developed fuzzy control system (Ex. BENITEZ_detection.py)
- The documentation in PDF format (Ex. Benitez_docu.pdf)