Fuzzy Logic Project

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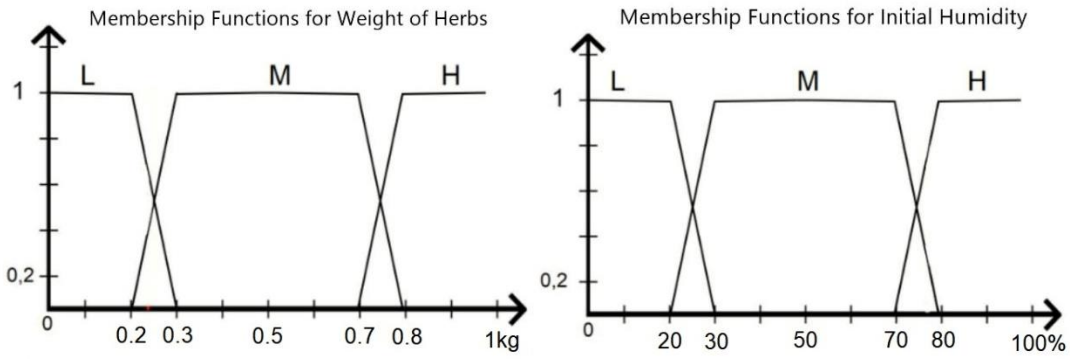
A fuzzy control system controlling the time of drying the herbs, depending on their weight and initial humidity

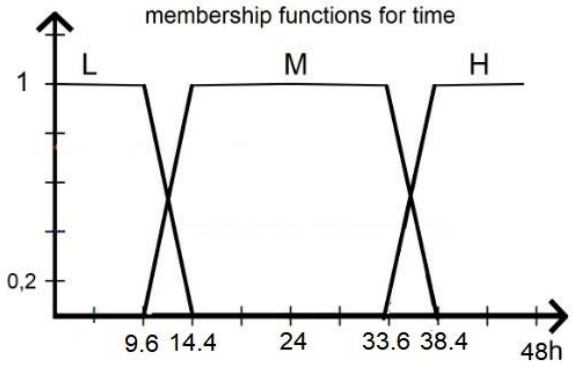
1. Range of input and output parameters variability:

   Input
   Weight of Herbs: 0 – 1Kg
   Initial Humidity: 0 – 100%
   Output
   Time for drying: 0 – 48h

2. Membership functions for **input** parameters:



3. Membership functions for **output** parameter:



4. Knowledge Database:

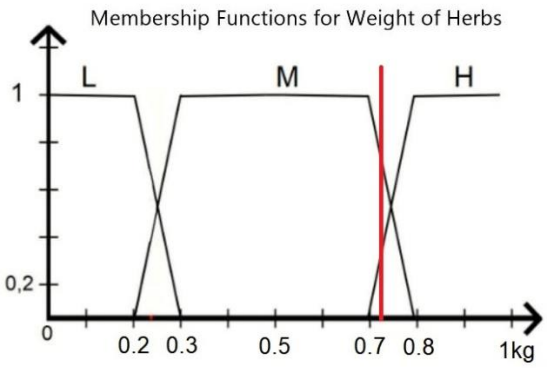
R	R1	R2	R3	R4	R5	R6	R7	R8	R9
Weight	L	L	L	M	M	M	H	H	H
Humidity	L	M	H	L	M	H	L	M	H
Time	L	L	M	L	M	H	M	H	H

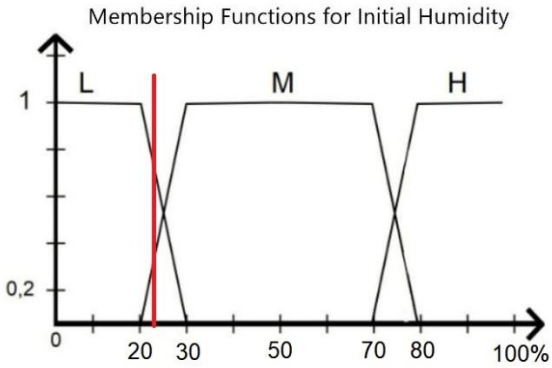
R1: If weight = low and humidity = low then, Time = low
R2: If weight= low and humidity = high then, Time = medium
R3: If weight = high and humidity = high then, Time = high

5. Example of controller operation for selected values of input parameters

Weight of herbs: 0.73Kg Humidity: 23%

Fuzzification





L: 0 M: 0.7 H: 0.3 L: 0.7 M: 0.3 H: 0

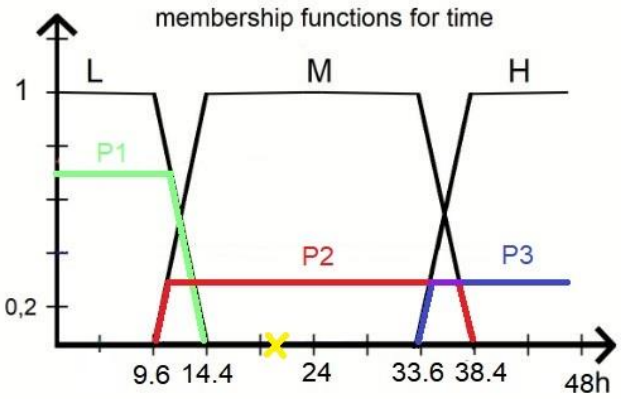
Rule Activation

R	R1	R2	R3	R4	R5	R6	R7	R8	R9
Weight	0	0	0	0.7	0.7	0.7	0.3	0.3	0.3
Humidity	0.7	0.3	0	0.7	0.3	0	0.7	0.3	0
Time	0	0	0	0.7	0.3	0	0.3	0.3	0

Connection of Rules and Aggregation (MAX)

L(R1,R2,R4) → L(0,0,0.7) → 0.7
M(R3,R5,R7) → M(0,0.3,0.3) → 0.3
H(R6,R8,R9) → H(0,0.3,0) → 0.3

Defuzzification



$$\text{Time} = \frac{P1C1+P2C2+P3C3}{P1+P2+P3}$$

$$P1 = \frac{1}{2}(A+B) * H = \frac{1}{2}\left(\frac{276}{25}+\frac{72}{5}\right) * 0.7 = 8.9$$

C1 = 7.2

$$P2 = \frac{1}{2}(A+B) * H = \frac{1}{2}\left(\frac{684}{25}+\frac{144}{5}\right) * 0.3 = 8.424$$

C2 = 24

$$P3 = \frac{1}{2}(A+B) * H = \frac{1}{2}\left(\frac{348}{25}+\frac{72}{5}\right) * 0.3 = 4.25$$

C3 = 40.8

$$\text{Time} = \frac{(8.9*7.2)+(8.424*24)+(4.25*40.8)}{8.9+8.424+4.25} = 20.38h$$