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IMPLEMENTATION OF FUZZY LOGIC CONTROLLER IN GREEN HOUSE AUTOMATION

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ABSTRACT: FOR GREEN HOUSE CLIMATE CONTROL, IN NOW DAYS COMPUTERIZED CONTROL IS REQUIRED. MANY TRADITIONAL SYSTEMS ARE BASED ON (1)ON-OFF (2)PROPORTIONAL CONTROL METHODS, WHICH ARE NOT SO EFFECTIVE .DRAWBACKS OF THIS METHODS ARE LOSS OF ENERGY, LABOR ,PRODUCTIVITY.(1)IN ORDER TO MAINTAIN A STEADY CLIMATE A MORE SOPHISTICATED SYSTEM MUST BE USED. BY USING FUZZY LOGIC LOGIC PROGRAMMING GREEN HOUSE CLIMATE CONTROLLER(GHCC) WILL BE DESIGNED. DEVELOPED FUZZY LOGIC CONTROLLER(FLC) IS BASED ON MAMADANI CONTROLLER & IT IS BASED ON MATLAB SOFTWARE .

The controller developed effectively controls factors such as temperature &another important parameter,
humidity of green house.

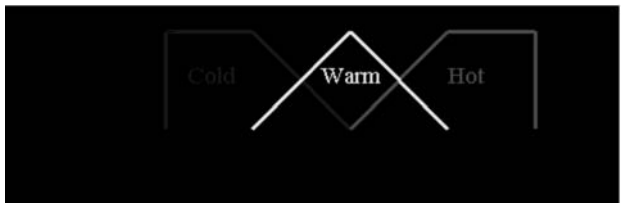
Introducton:

Conventional approach uses steps such as Understand physical system & control requirements, develop a linear model of plant sensor & actutators, determine a simplified controller from control theory, develop an algorithm for the controller, simulate, debug implement the design.

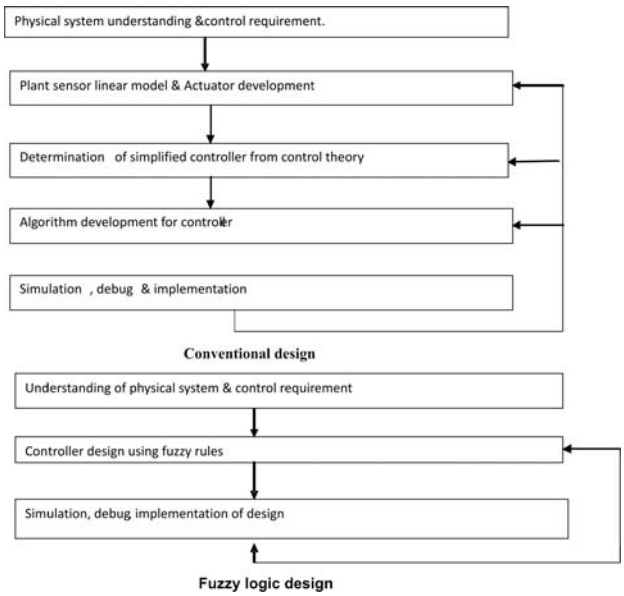
If the performance is not satisfactory then the system must be remodeled, the controller must be redesigned, algorithm must be rewritten & retry. If we use fuzzy logic the steps are as follow

1) Understand physical system & control requirements.
2) Design controller using fuzzy rules
3) Simulate, debug implement the designIf the performance is not well, we only need to modify some fuzzy rules & retry. Advantages of fuzzy logic:1) Simplified design complexity. 2) Reduced hardware costs 3) Simplified implementation (1) Fuzzy Logic is a very powerful concept applied to control systems. It allows control system designers to greatly reducethe number of rules necessary to deploy a strategy. Additionally, it allows rules to be crafted in a syntax. Finally, if properly designed, instabilities and hysteresis can be reduced or eliminated.

Fuzzy Logic is a very powerful concept when applied to control systems. It allows control designers to greatly reduce the number of rules necessary to deploy a desired control. Additionally, it allows rules to be crafted in a very linguistic syntax. Finally, if properly designed, instabilities and hysteresis can be reduced or eliminated.



In the example above, temperature values from 0 to about 20 are defined as being “cold” without question. In the overlap region from about 20 to 37.5 the temperatures are described as being somewhat “cold” and somewhat “warm”. As can be seen from the defining contours, the degree of “warmness” increases with increasing temperature while the degree of “coldness” decreases. We can continue the discussion in a similar fashion as we transition from “warm” to “hot”.



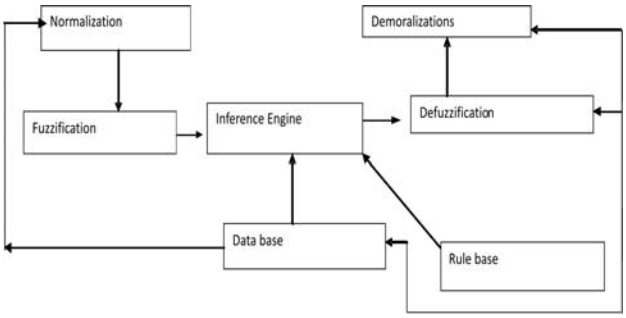
Fuzzy Logic Controller has following blocks

(1) Fuzzification interface :It measures the values of input variables & performs scale mapping that transfers the range of values of input variables into corresponding universe of discourse. Actually it does the function of fuzzification which converts input linguistic values.

(2) Knowledge data base: It consists of (a) data base & (b) rule base

(3) Here data base provides necessary definitions which are useful for defining linguistic control rules & fuzzy data manipulation in FLC .The rule base characterizes the control goals &control policy of the domain experts by means of

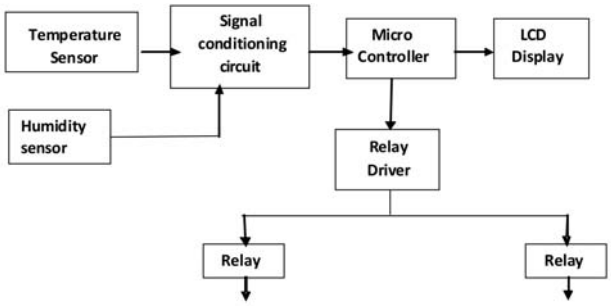
(4) Defuzzification: It performs scale mapping which converts the range of values of output variables into set of linguistic control rules corresponding universe of discourse.



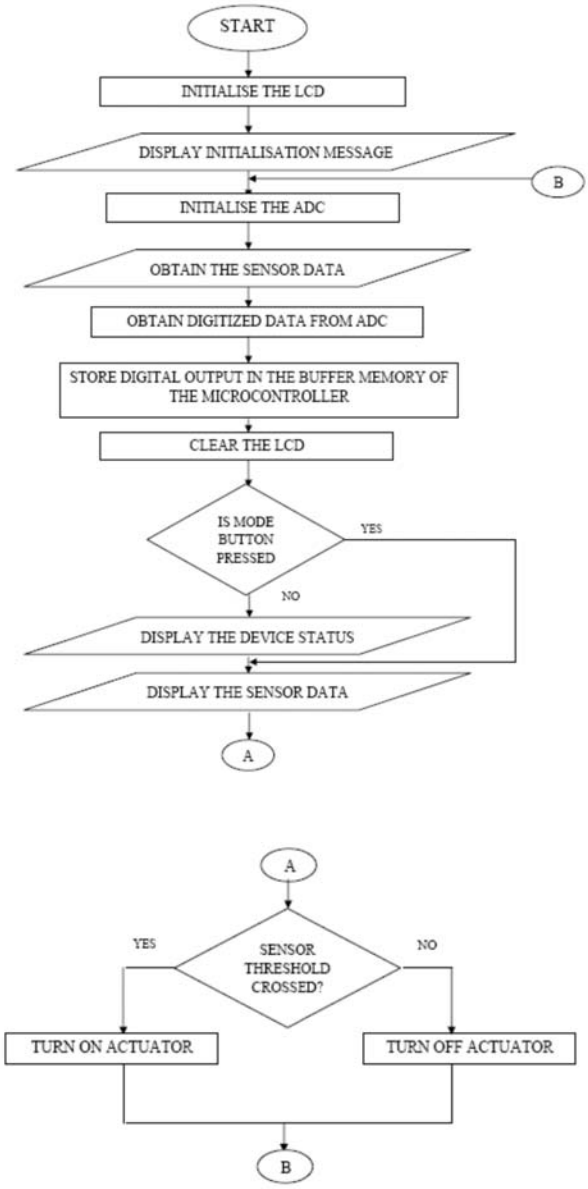
Fuzzy Logic Controller

Block diagram: Temperature, Humidity are analog in nature.

These signals will be converted into digital signals by using on chip A/D converter .The sensor outputs are applied to ADC (on chip) of microcontroller (LP2148) which is to be programmed to work as a Fuzzy Logic Controller(FLC).LCD display will show current as well as modified values of humidity, temperature and intensity..

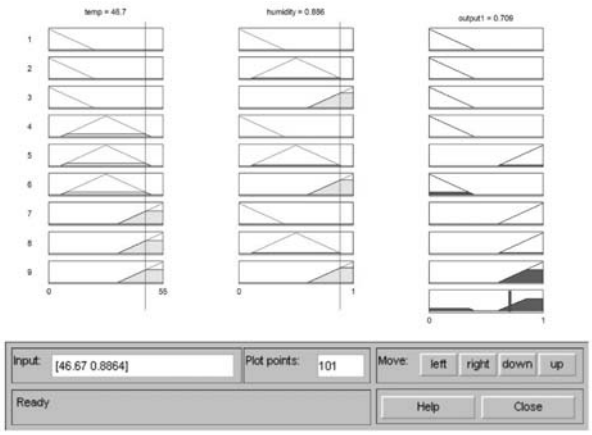


Flow chart



Results:

Following figure shows results I have come across. It shows relationship how one can adjust the o/p parameter(e.g.fan) . By looking at the temperature & humidity we can monitor green house climate.



Mamadani Fuzzy Inference:. Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. Mamdani's method was among the first control systems built using
fuzzy set theory. It was proposed by Mamdani (1975) as an attempt to control.

Mamdani type inference, as defined it for the Fuzzy Logic Toolbox, expects the output membership functions to be fuzzy sets. After the aggregation process, there is a fuzzy set for each output variable that needs defuzzification. It is possible, and in many cases much more efficient, to use a single
spike as the output membership function rather than a distributed fuzzy set.This is sometimes known as a *singleton* output membership function, can be thought of as a pre-defuzzified fuzzy set. It enhances the efficiency of the defuzzification process because it greatly simplifies the computation required
by the more general Mamdani method, which finds the centroid of a
two-dimensional function. Rather than integrating across the two-dimensional
function to find the centroid, the weighted average of a few data points. To compute the output of this FIS given the inputs, six steps has to be followed:

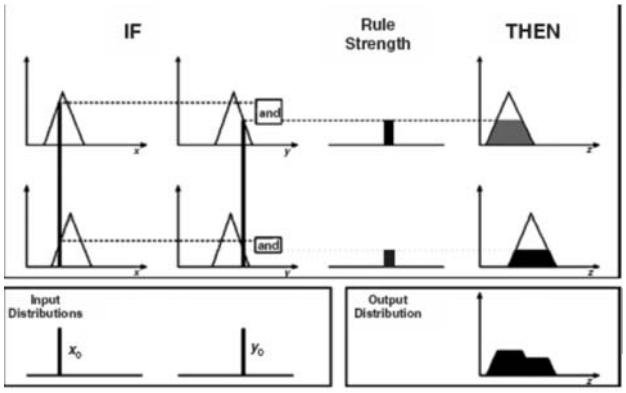


Fig. 6.2. A two input, two rule Mamdani FIS with crisp inputs

1. Determining a set of fuzzy rules
2. Fuzzifying the inputs using the input membership functions
3. Combining the fuzzified inputs according to the fuzzy rules to establish a rule strength
4. Finding the consequence of the rule by combining the rule strength and the output membership function

5. Combining the consequences to get an output distribution
6. Defuzzifying the output distribution (this step is only if a crisp output

Creating Fuzzy Rules

Fuzzy rules are a collection of linguistic statements that describe how the FIS should make a decision regarding classifying an input or controlling should make a decision regarding classifying an input or controlling an output should make a decision regarding classifying an input or controlling an output..

Fuzzy rules are always written in the following form:

if *(input 1 is membership function 1)* ***and/or*** *(input 2 is membership*
function 2) ***and/or****. . .* ***then*** *(outputn is output membership functionn)*.

For example:

if *temperature is high* ***and*** *humidity is high* ***then*** *room is hot.*

There would have to be membership functions that define high temperature
(input 1), high humidity (input 2), and a hot room (output 1). This
process of taking an input such as temperature and processing it through a
membership function to determine "high" temperature is called fuzzification and is discussed in section, "Fuzzification." Also, "AND"/"OR" in the fuzzy
rule should be defined

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