DESIGN AND SIMULATION OF AN INTELLIGENT FUZZY LOGIC CONTROLLED ELECTRONIC THERMOSTAT (A RESEARCH PROPOSAL)

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ABSTRACT
This paper outlines the proposal for the design of an intelligent electronic thermostat that achieves control by means of fuzzy logic, with the view of bringing about greater comfort by imitating human reasoning, and more efficient utilization of power. A cheap low cost microcontroller would be used for the implementation of this design. Ambient conditions that influence the perception of temperature serve as inputs to the thermostat and the output is automated and put into effect in temperature adjustment. Program development is to be broken into five parts namely fuzzification, inference, composition and defuzzification and this will be carried out using Inform® software FuzzyTECH®. Automatic decision making of the controller is based on a set of rules generated by the program. After specifying the relationship between the inputs and outputs, a certain number of rules will be generated on which to base decision-making. The number of rules is likely to be high, which will make decision making unpredictable so the system has to be fine-tuned to reduce the number of rules. The behaviour of the thermostat based on the new set of rules generated, will demonstrate the ability of the thermostat to imitate human reasoning and save on power consumption.
Keywords: Fuzzy Logic, Intelligent, Thermostat, fuzzyTECH®,

1:0 Introduction

Energy loss, when dealing with temperature control, has been of great concern, especially in developing countries like Nigeria. Electricity demand is quite high while supply is so inadequate and as such erratic. Thus, any strategy to minimize energy losses is a welcome development in our society, which is humid and tropical.

Keeping consumers of home cooling appliances like air conditioners at comfortable temperatures over long periods of time has been difficult to achieve. Regular home air conditioners do not have humidifiers and as such, regardless of the humidity of the surrounding, the air conditioner can only cool the air, implying that the effects of humidity on temperature are not taken into consideration. This has been a great limitation in home air conditioning and gives reason to include a means of temperature adjustment based on the humidity of the surrounding.

The intensity of ultra violet light incident on an air-conditioned area is also a factor that has been greatly neglected. The same measured room temperature is usually perceived as warmer if there is light incident on the room. The temperature control will also depend on the brightness in the room.

The aim of this work is to design an intelligent air conditioner thermostat that will operate based on the principles of Fuzzy Logic, with the aid of Inform® software fuzzyTECH® [1], which may be implemented on a low cost 8-bit microcontroller. This will be able to regulate temperature, mimicking human reasoning

to a very large extent, thus obtaining greater control and increased savings on power. Fuzzy logic is able to achieve control using elements of everyday human language. Factors that bring about the need for temperature adjustment are incorporated into the electronic thermostat model so that adjustment is automated with the objective of reducing energy loss in home air conditioners and adding great functionality to their control systems based on human perception and reasoning.

The methodology that has been chosen is outlined as follows:

i) Definition of the inputs and outputs of the controller
ii) Specifying the circuit elements needed to accurately tack changes in the input variables
iii) Design of the fuzzy logic controller
iv) Fuzzification, inference and defuzzification of all the variables
v) Testing and fine-tuning of the controller.

2:0 Development Of Fuzzy Logic Controller

The development of a fuzzy logic system involves a number of design steps:

i) Design of the inference structure. Specify how the output variables shall be connected to the input variables by the rule blocks.
ii) Definition of the linguistic variables. They form the "vocabulary" used by the fuzzy logic rules expressing the control strategy.
iii) Creation of an initial fuzzy logic rule base using all available knowledge on how the system should perform.
iv) Off-line debugging, testing and verification. Test for completeness and non-ambiguity of the system. If a software simulation or sample data of the process exist, it is used in this step.
v) On-Line Debugging. Connect the fuzzy logic system to the process under control and analyze its performance in operation. Because fuzzy logic lets you modify the system in a straightforward way from the performance you observe, this step can rapidly expedite system design.

3:0 References

[1] Inform GmbH (2001), fuzzyTECH® 5.5 User's Manual, Inform Software Corporation.