Controlling Temperature of water Using Microcontroller And Correction Using Fuzzy Logic

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Abstract

Many people of our country is involve in fishery, but different fish live in different temperature and pressure if the temperature vary the fish may be die, so the temperature must maintain within certain range but it is very difficult for them to maintain the temperature and pressure, if they try to maintain all the parameter the cost also higher, so we must think a alternate process which is our desire project.

In this project we basically control the water temperature using microcontroller PIC18F4520.We first measure the water temperature of the water and then display it in the seven segment display now if the temperature is higher than on the cooler and if the temperature is lower than on the hot air fan. We also use fuzzy controller to control the water temperature and pressure perfectly.

To program the microcontroller we first write the program in C-language, and then we convert the code in the hexadecimal code and burn the code within the chip and configure the microcontroller according to our requirement and perform all operation.

Keywords—*Fuzzy Logic, Microcontroller, PIC18F4520, RS232, Lampex Display*

I. INTRODUCTION

With the help of this project we contribute in our society and help many people who involve in the fishery. They get benefited from this project and their cost for business gets reduced so they get more profit. So this project is very much beneficial for our society as well as for our country. Our society gets benefit from this project and we can maintain all the parameter perfectly, the cost of maintain the temperature of the water get reduced and all can be done automatically without any man power, so it is very social project. The project is almost run perfectly but to control the temperature we must use fuzzy logic as well as fuzzy chip, but till d fuzzy chip is not available in our country and the cost is very much high, this is the main problem with this project.

II. DETAIL OF THE RESEARCH WORK

In this project control the temperature of water according to the necessity of the living of the fish. I.e. different fishsurvive in different temperature and pressure so we must maintain the proper temperature and pressure of the water. Here we first measure the temperature of the water by using a thermocouple if the temperature is high then we start the cooler system and if the temperature is low we on the hot water system, so by this method we maintain the proper temperature of the water. We also use fuzzy logic system to maintain the system within a proper range of temperature. We control the water temperature by using microcontroller pic18f4520 (pic series microcontroller) this microcontroller has 10 bit ADC converter which is able to sense temperature and display it in the lampex display, first we prepare the aquarium and place a thermocouple in the water, now the temperature converted to the voltage with the help of this thermocouple and converted to the digital format with the help of this microcontroller. Now if the measured temperature is out of range (the range which the fish can tolerate) we on our cooling system (which is ac fan or general cold water flow system),and the water temperature is cooling down towards normal range and we compare the temperature with the standard temperature if now this temperature is equal to the threshold and we leave the system without any change, now if the temperature is cold then we on the hot air system and water temperature is raised towards higher order and compare the temperature of threshold and if the temperature is equal to the threshold then we are not interested for any kind of change. We run the system after a certain interval of time within 24 hours, and fish can survive within the temperature without any problem. Now to control the temperature we apply fuzzy chip controller which check the temperature from the input and decide within which range it fall (I.e. hot, cold, very hot, very cold, normal etc)and fuzzified (fuzzification can be done by OR,AND ,NOT logic) the temperature and process the temperature to control it, and after processing it again defuzzified(by max membership principle, centroid method, weighted average method or mean max membership method) and send it to the output of the controller.

Fuzzy logic deals with the uncertainty in engineering by attaching degree of certainty to the answer to a logical question. It is commercial and practical. Commercially, fuzzy logic has been used with great success to control machines and consumer products. In the right applications fuzzy logic systems are simple to design, and can be understood and implemented by non-specialist in control theory. In most cases someone with a intermediate technical background can design a fuzzy logic controller. The control system will not be optimal but it can be acceptable. Control engineers also use it in applications where the on-board computing is very limited and adequate control is enough. Fuzzy logic can implement in control system where simplicity and speed is important. Fuzzy logic can be used in the following applications:

Environmental control
- Air conditions
- Humidifiers

Domestic Goods
- Washing machines/dryers
- Vacuum cleaners
- Toasters
- Microwave ovens
- Refrigerators

Consumer electronics
- Television
- Photocopiers
- Still and video cameras
- Hi-fi systems

Automotive systems
- Vehicle climate control
- Automatic gearboxes
- Four –wheel steering
- Seat/mirror control systems
- This is a list and gives an idea of the key applications areas. In general it explains application of fuzzy controller.

Engineering motivation
- In engineering we can apply fuzzy logic and can solve any problem with the help of this fuzzy logic rather we can obtain a optimum solution for any problem. A traditional logic decision block produces an outcome based upon binary logic. A firm YES or NO emerges as an output of the decision block. However the inventor of fuzzy logic LOFI ZADEH, noted that human decision making incorporate shades of meaning in which binary YES/NO might be replaced by

- DEFINITELY YES
- PROBABLY YES
- MAYBE
- PROBABLY NO
- DEFINITE NO

- Fuzzy logic copies this feature of human decision making using levels of possibility in a number of uncertain (or fuzzy) categories .for example, think about the coupled tank system in which the object is to adjust the input voltage, u, to the to the pump motor (as in fig1) so that level in tank 2 is held at a steady state value. The measured output is level in tank 2, denoted by the signal y2.A common sense controller could use the following fuzzy control rules:

- IF {LEVEL TOO HIGH} THEN {REDUCE PUMP VOLTAGE}
- IF {LEVEL TOO LOW} THEN {INCREASE PUMP VOLTAGE}
- IF {LEVEL CORRECT} THEN {SET PUMP VOLTAGE TO ZERO}
- The controller performance would not be as good as PI controller, but it is acceptable.

FUZZY LOGIC TO SOLVE OUR DESIRED PROBLEM

a>fuzzification: The first step in fuzzy logic is to convert the measured signal x(which is temperature and water pressure) into a set of fuzzy variables. This is called fuzzy classification or fuzzification. It is done by giving values (these will be our fuzzy variables) to each of a set of membership functions. The values for each membership function are labeled µ(x), and are determined by the original measured signal x and the shapes of the membership functions. A common fuzzy classifier splits the signal x into five fuzzy levels as follows:

1. LP: x is large positive
2. MP: x is medium positive
3. S: x is small
4. MN: x is medium negative
5. LN: x is large negative

- Membership functions for these five fuzzy levels are shown in figure 2.So,for example, the value(or fuzzy variable)for the MP membership function and a signal value of x=2.5v is µmp(2.5)=0.5.

III. RESEARCH BLOCK DIAGRAM

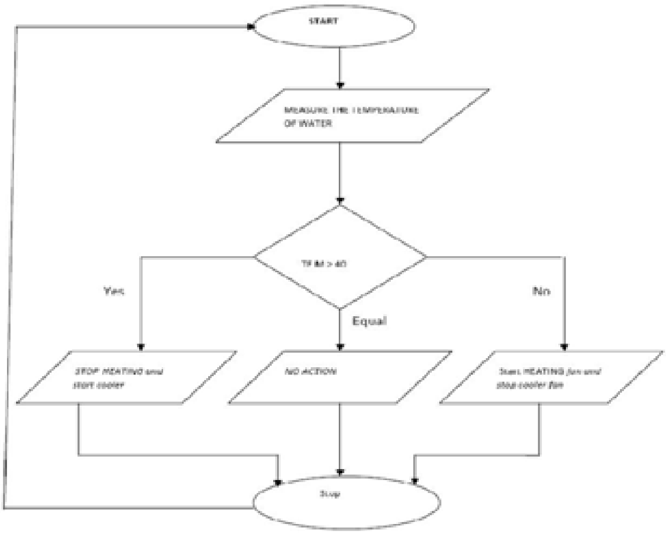

Fig1: Flow chart of the work

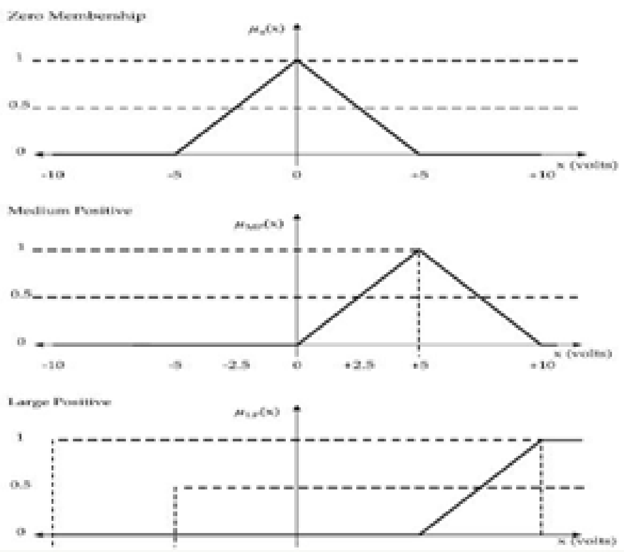

Fig2a: Membership Functions for zero membership(s: x is small), medium positive membership (MP), large positive membership (LP).

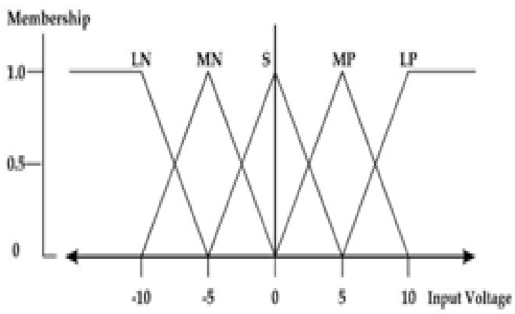

Figure 2b: The complete set of membership Functions for five level fuzzification.

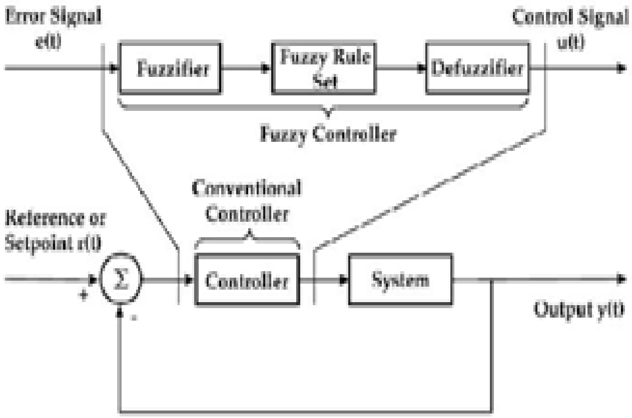

Fig 3: Fuzzy block diagram in our desire project

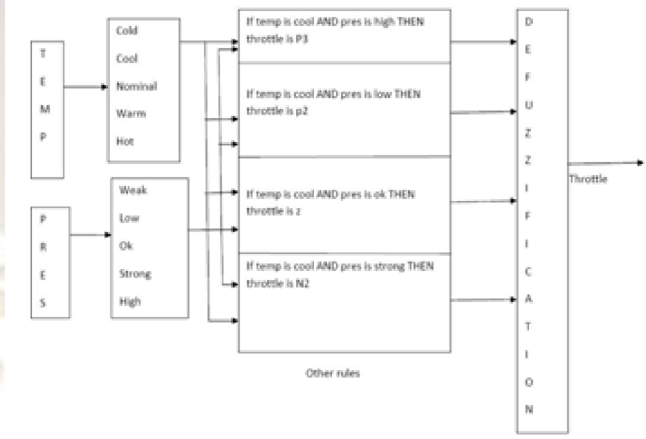

Fig4: Detail block diagram of fuzzy processing

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