Forecast Flood Condition by Using Fuzzy Logic

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Abstract

This system forecasts in water level in Pyay river state. Water level is forecasted by using water level is forecasted by using Fuzzy Logic. *This paper is to describe the implementation of flood condition system of Pyay. The data for daily Rainfall (Rf), Daily River state (Rv) of Aunglan Township are accepted as input and result will be the output river state of Pyay. This paper is implemented in C# graphic mode.*

Keywords- Fuzzy Control System, Center of Gravity Method ,Forecast Flood Condition by Using Fuzzy Logic.

1. Introduction

In the recent years, applications of the idea of Fuzzy sets have been increased considerably and have become very successful in practical situations. In parallel to all those successful applications, a lot of efforts have been put in developing the theory of Fuzzy logic and its applications to the control engineering. Fuzzy logic incorporates ways of thinking, which allows modeling complex systems using human's knowledge and experience. Fuzzy logic is a formulation of logic using mathematical framework to deal with concepts such as few, very, much and many. Fuzzy logic allows the system to be defined by logic.In this system will accept Rainfall(Rf), River stage(Rv) and Date (y,m,da) as the input values to make fuzzification. This paper is to study the very basic notation of Fuzzy system on Meteorology and Hydrology.

2. Related Work

Fuzzy logic can helps use make decision when lack of specific facts or lolfi Zadeh in1965.Fuzzy logic (FL) extends the general form of Boolean logic, true and false to handle the concept of vagueness and uncertainly[5].This approach takes a value between 1 (full belongingness) and 0 (non belongingness) rather than a crisp values[2].Fuzzy logic is a rule –based decision process that seeks to solve problems. Fuzzy logic is a multivalued logic that allows intermediate values[3].

All these modules have their own independent effect on the final control output obtained from fuzzy control. All these modules have their own independent effect on the final control output obtained from fuzzy control.The main concept of software is fuzzy logic system and it can be used as a flood forecast system. Fuzzy set values and membership values can be achieved and viewed in the graphical form as well as text format are required [1,7]. By minizing previous membership values, µ premise values, as a result are achieved .In the viewed of inference meahanism, fuzzy conclusion can be made by matching with Rule-based built by data received from the Department of Meteorology and Hydrology and µ premise value by matching fuzzification[4].

3. General Fuzzy Control System

In the fuzzy control system, the max- min implication technique is used. The final output membership function for each rule is the fuzzy set assigned to that output by forecasting of water values of the membership function of each output fuzzy variables is determined. All the rules that are being fired are then combined and the actual crisp output is obtained through defuzzification. The Center of Gravity Method (COG) defuzzification method is used to obtained real crisp output in this system.

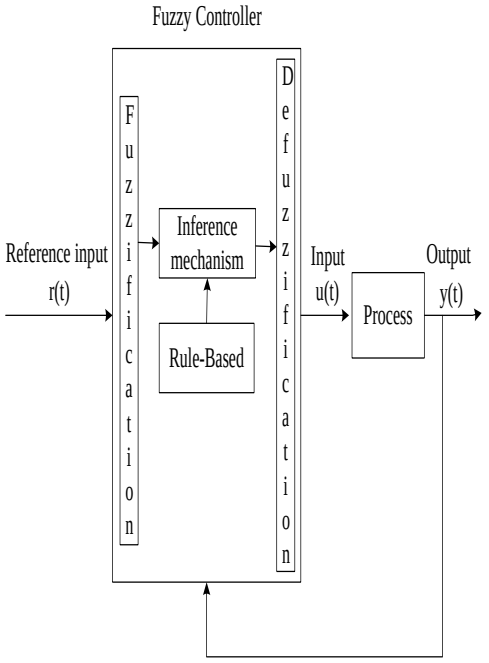

Figure 1: Fuzzy logic scheme work

Defuzzification

This method chooses an arbitrary value, from the set of maximizing elements of *C*, i.e.

$$Z_0 = £ \{ z / C(z) = \max C(w)$$

Center of Gravity (COG) difuzzification methods are more effective.

First consider the "center of gravity"(COG) defuzzification method for combining there

commendation represented by the implied fuzzy Sets from all the rules.

The COG method computes W-crisp to be

Implied area A (w_1) = w (h-h2/2)

$$W-crisp=\frac{(center\ \ of\ \ W_1)\times A(\ W_1)+(center\ \ of\ \ W_2)\times A(W_2)}{A(W_1)+A(W_2)}$$

Equation 1: COG Method

h =height=μ premise (i) min {ai,qi}

W = base width

A (w_1) = Area of base width

4. System Implementation

4.1 Fuzzification for Inputs and Outputs

There will be "Linguistic Description " that describe each of the time-varying fuzzy controller inputs and output. Fuzzy controller inputs variables are as follows:

"Rain Fall" Rf { mm,(or) in}

"River Stage Rv{cm}

"Date" { m,da,y}

Fuzzy controller output variables aer as follows:

"River level" W

Rain Fall, River State and Date are taken as the linguistic variables .

Linguistic variables for "Rainfall" is express as " linguistic-numeric values" for (seven levels).

" Very Very Small" to represent "VVS"
"Very Small" to represent "VS"
"Small" to represent "S"
"Medium" to represent "M"
"Large" to represent "L"
"Very Large" to represent "VL"
"Very Very Large" to represent "VVL"

Linguistic variables for "River State" is express as " linguistic-numeric values" for (seven levels).

Shorter description integers can be use as follows:

" Very Very Small" to represent "VVS"
"Very Small" to represent "VS"
"Small" to represent "S"
"Medium" to represent "M"
"Large" to represent "L"
"Very Large" to represent "VL"
"Very Very Large" to represent "VVL"

Linguistic variables for "Date" (m,da,y) is express as " linguistic-numeric values" for (four levels).

Shorter description integers can be used as follows:

" 0" to represent " Normal "
"1" to represent " Warming "
"2" to represent " Caution "
"3" to represent " Critical "

4.2 Setting up the Rule – base

The data of Rainfall (Rf), River Stage (Rv) are obtained from Department of Meterology and Hydrology. By observing the data obtained from relation curve and knowledge base from experts, itcan be seen as follow:

(i)The Rf can be divided into seven levels from its maximum and minimum value (universe of discourse).

(ii) The Rv can be divided into seven levels from its maximum and minimum value (universe of discourse).

(iii)Date can be divided into five levels as summer, the beginning of raining season, the end of raining season, the mid-raining season and winter.

The data of Pyay Township is min 2727cm to max 2345cm in 2009. The water level can be divided into four levels according to the knowledge from exports as follow:

(i) 0cm to 985.5cm is normal level
(ii) 492.75 cm to1971cm is warning level
(iii) 1478.25 cm to2956.5cm is caution level
(iv) 2463.75 cm and above is critical level

5.Proposed System Design

This system flow diagram, the data for Daily Rainfall (Rf) , Daily River Statel (Rv) of Aunglan Township are obtained from the Department Meteorology and Hydrology.the Rule base is set up by combing the data experts from Department Meteorology and Hydrology.Then Rf, Rv and prescribed Date (year (y) , month (m) , day (da) are taken as input in Fzzification process.Then fuzzy conclusions can be produced as crisp of defuzzification part.

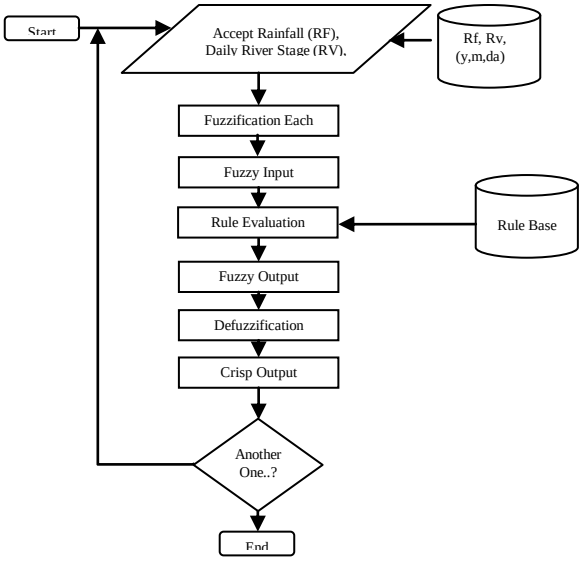

Figure 2: System Flow Diagram

5.1 System Results

In forecasting for 2010 by using of data from 2000 to 2009.

To construct the membership functions for Date (m, da, y) with input value.

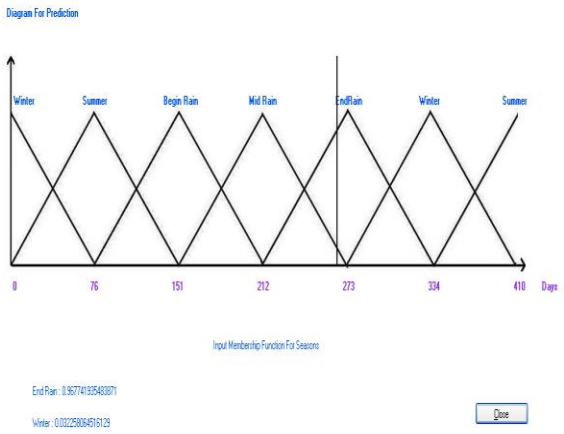

Figure 3: Input membership for Date (m, da, y) with input value.

To construct the membership functions for Aunglan Rain Fall (Rf) with input value.

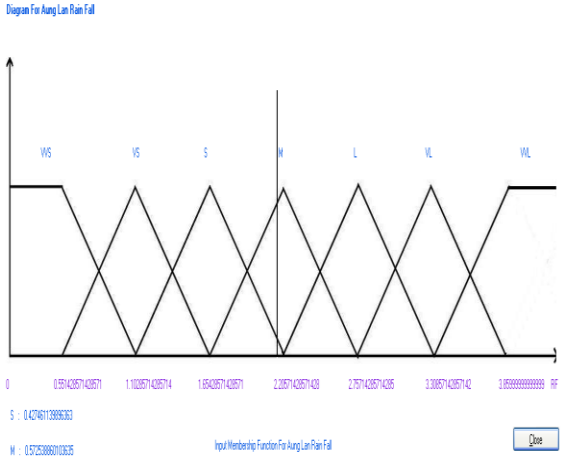

Figure 4: Input membership for Aunglan Rain Fall (Rf) with input values.

To construct the membership functions for Aunglan River State (Rv) with input value.

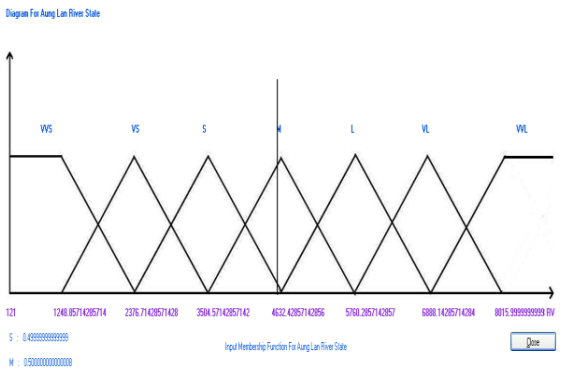

Figure 5: Input membership for Aunglan River State (Rv) with input value.

In figure 6 and 7 show fuzzy crisp output of between mid-raining and end-raining season in 2010 by using data from 2000 to 2009.

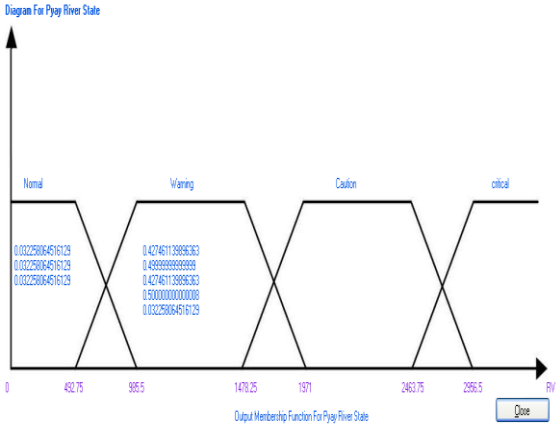

Figure 6: Crisp output for Pyay River State.

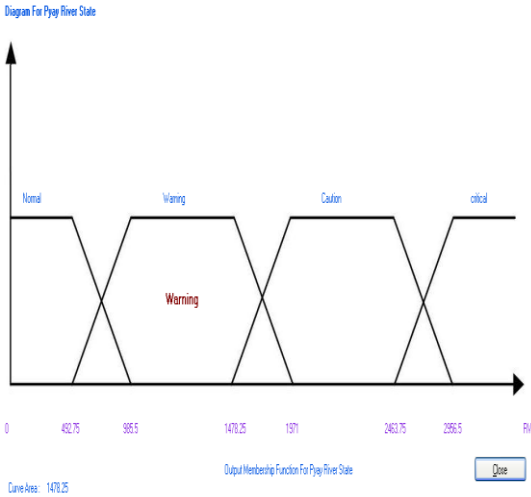

Figure 7: Crisp output for Pyay River State

In forecasting for 2011 by using of data from 2000 to 2009.

To construct the membership functions for Date (m, da, y) with input value.

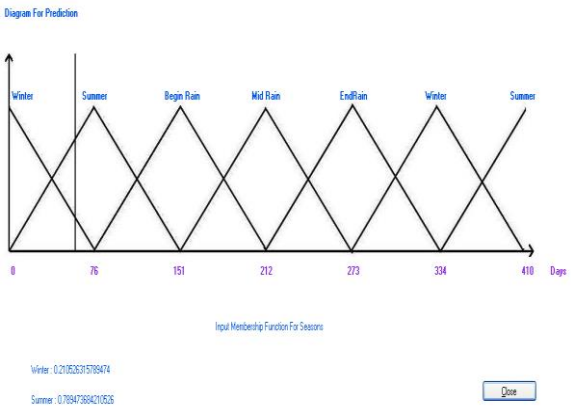

Figure 8: Input membership for Date (m, da, y) with input value.

To construct the membership functions for Aunglan Rain Fall (Rf) with input value.

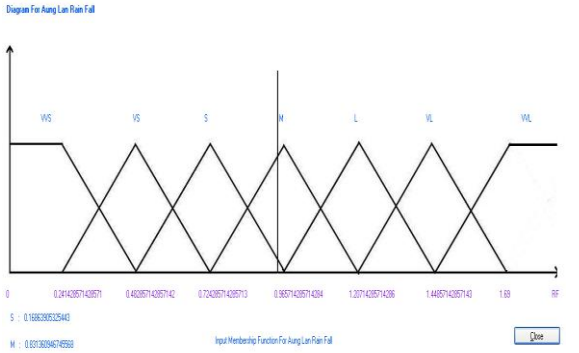

Figure 9: Input membership for Aunglan Rain Fall (Rf) with input value.

To construct the membership functions for Aunglan River State (Rv) with input value.

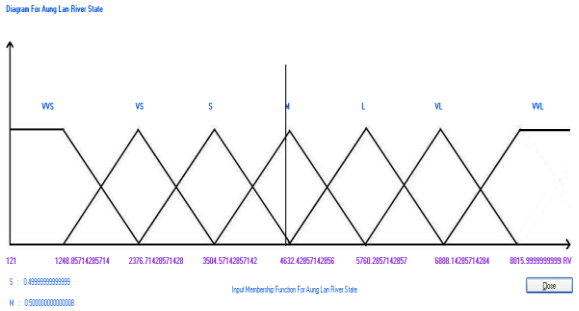

Figure 10: Input membership functions for Aunglan River State (Rv) with input value.

In figure 11 and 12 show fuzzy crisp output of between Winter and Summer season in 2011 by using data from 2000 to 2009.

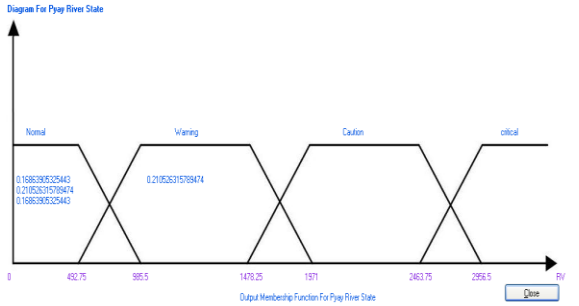

Figure 11: Crisp output functions for Pyay River State.

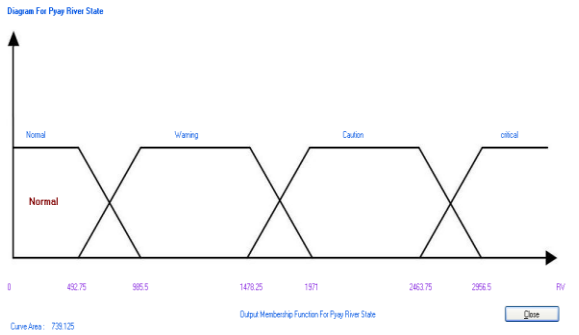

Figure 12: Crisp output for Pyay River State.

6. Conclusion

Being Myanmar is agriculture-based country ; the national economy greately relies on the weather condition which can influence on the cultivation Accurate and timely weather forecasting fan lead not only to develop but slso the national economy is to prevent lies and property of people. So the thesis is developed with the aim computerization for activities of Department of Meteorology and Hydrology. Comparison of the system behavior before and after the implementation of fuzzy control system proved the benefit of the Fuzzy logic based on operation system.

7. References

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