Water level measurements at the cikupa pandeglang bantendam using fuzzy sugenowith microcontroler-based ultrasonik sensor

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Abstract. This cikupa dam is very useful so that irrigation in the fields is not too much, one of the officers' negligence in the rainy season was forgetting to close the door of the dam which resulted in flooding in the area of rice fields. If a large flood occurs, this will result in the possibility of crop failure. Therefore, a tool was made in the form of a water level measurement tool using an ultrasonic sensor with Fuzzy Sugeno method.The existence of this logic is expected to increase the accuracy of water level measurements as the scope of research writing. The results obtained in this study are accurate water level measurement models. By the research of ultrasonic sensors using the Fuzzy Sugeno method, it is expected that the dam guard will get a warning sound to close the door of the dam. The conclusion obtained is that by using the Fuzzy Sugeno method the calculation of accuracy can be more maximal.

1. Introduction

Water level measurements are intended for paddy fields where this area is an important part of the Pandeglang area, if there is no control in irrigation, then the possibility of rice field failure will occur. So from that, a water level measurement was made at the Cikupa dam, Banten Province.The working system of this tool is quite good for smooth drivingreference to previous researcherswater level monitoring system based on micro controller (khairul saleh 2003)Measurement of height measurement and water discharge in rivers based on ATMEGA16 microcontroller (2013 shutter yuliawati), measurement of water level in rice fields (Basman 2012) distance measurement using ultrasonic sensors (supeno 2011), automatic door openers with ultrasonic sensors (andi yogyakarta (2009).

The biggest problem is the frequent failure of rice field crops due to the lack of control of the Cikupa paddy irrigation dam, Pandeglang, Banten. This is the reason for the research on the title**"MEASUREMENT OF WATER LEVEL IN CIKUPA PANDEGLANG BANTEN DAM USING FUZZYSUGENO WITH MICROCONTROLLER BASED ULTRASONIC SENSOR"**

2. Methodology and Research Design

2.1Block diagram

The design is carried out based on block blocks of each chain, where each block has its own function and one of the rangkayan blocks with one another is a unit that is interrelated and related and forms a unity that supports the work of the syste

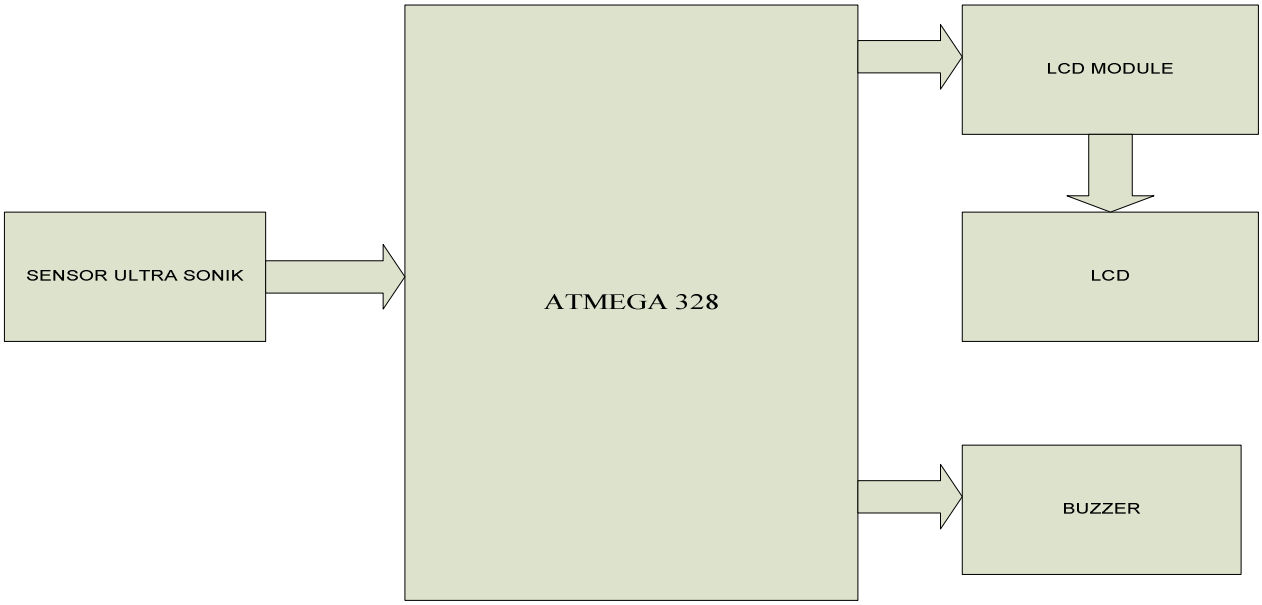

Figure 1. whole block diagram

The system block diagram in the image consists of:

1. Block input in the form of an ultrasonic sensor.

Ultrasonic sensors are used to detect objects

2. Process Block in the form of ATmega 328.

ATMega 328 microcontroller is used as a control center.

3. Output Block
   a. LCD to see actual distance display output with a barrier
   b. Buzzer for alarm alerts

2.2The overall flowchart of the tool

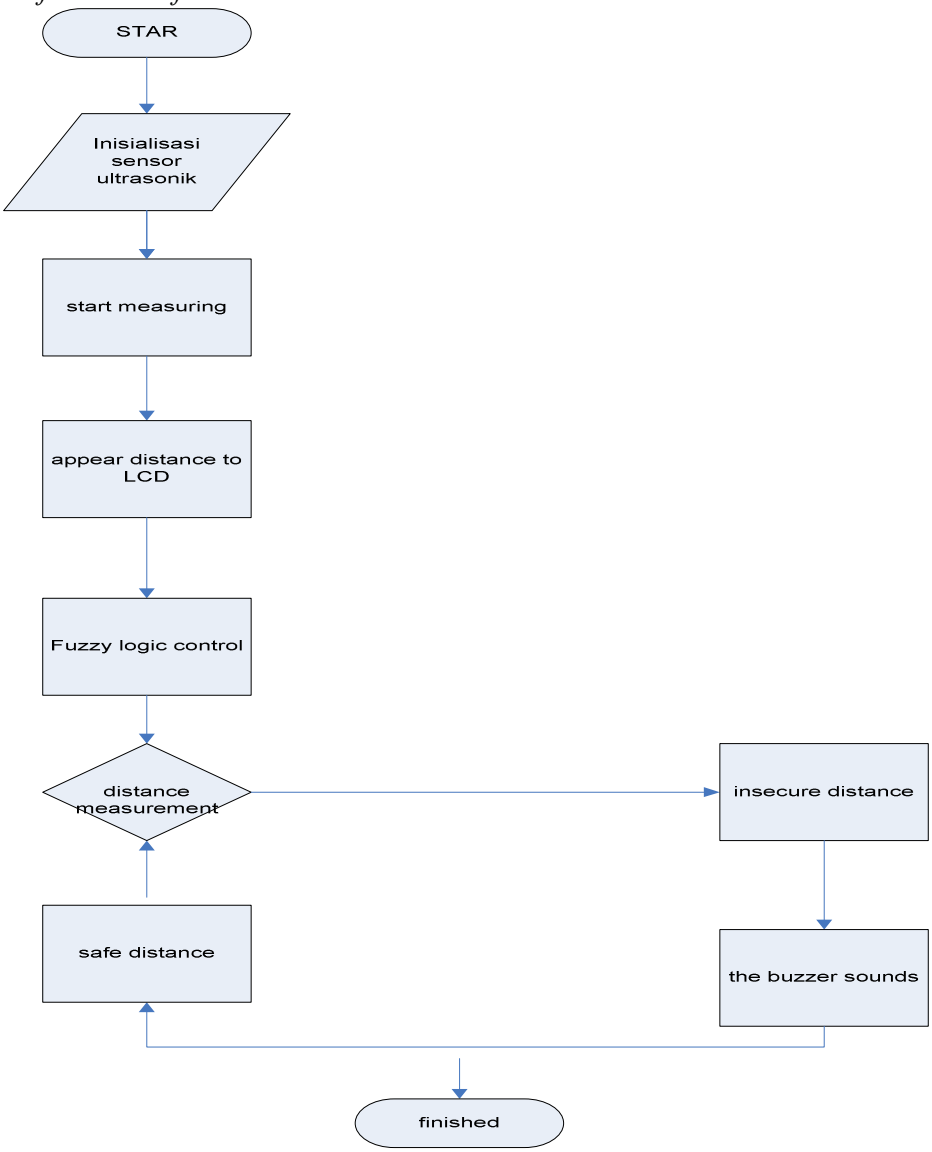

Figure 2. Whole system flow cart

3. Results of discussion and research

3.1 Fuzzy logic testing

In testing the next tool is testing Fuzzy Logic. From the results of reading the sensor value, it will be processed using fuzzy logic to produce the middle value in the program. Fuzzy method used in this tool is using zero order fuzzy Sugeno method.

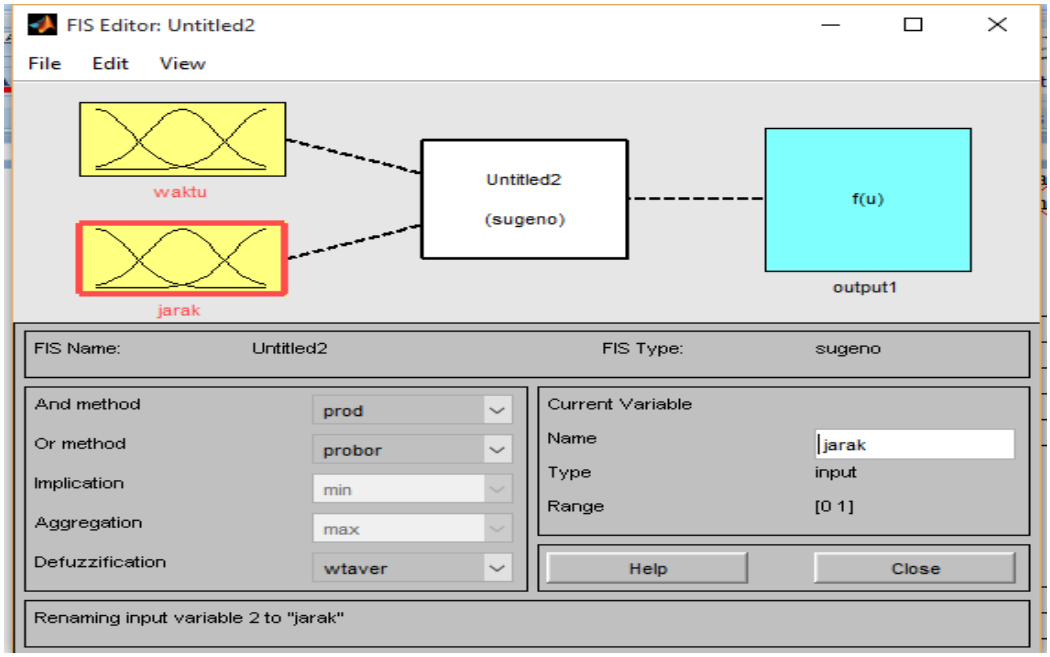

Figure 3. FIS fuzzy sugeno

3.2 Fuzzy Variables

In a fuzzy system there is a fuzzy variable. Fuzzy variables are variables that will be discussed in a fuzzy system. In this tool there are 2 fuzzy variables, namely: time and distance.

3.3 Membership function

In the process there is a membership function. Can also be described the sensor membership function.

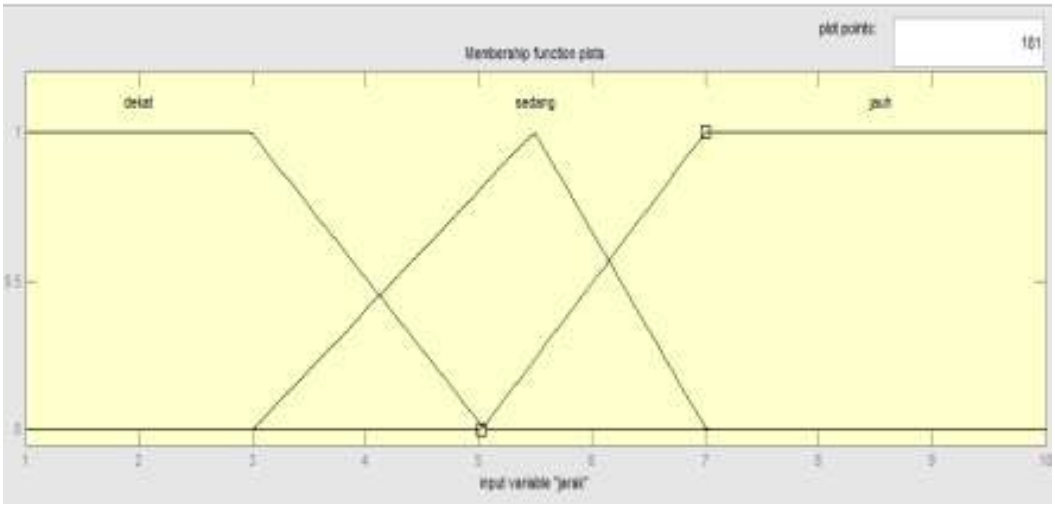

Figure 4. short-range fuzzyfication images

From the picture above, it can be seen that distance has a membership function including:
Close :

$$\begin{cases} 1 & x \leq 3 \\ \dfrac{5-x}{5-3} & 3 \leq x \leq 5 \\ 0 & x > 5 \end{cases}$$

Medium distance :

$$\begin{cases} 0 & x \leq 3 / x \geq 7 \\ \dfrac{x-3}{5-x} & 3 \leq x \leq 7 \\ \dfrac{7-x}{7-5} & 5 \leq x \leq 7 \end{cases}$$

Far :

$$\begin{cases} 1 & x \leq 5 \\ \dfrac{7-x}{7-5} & 5 \leq x \leq 7 \\ & 0x > 7 \end{cases}$$

From the membership function above, the program can then be created as fuzzyfication for. This fuzzyfication program can be seen in the program listing below:

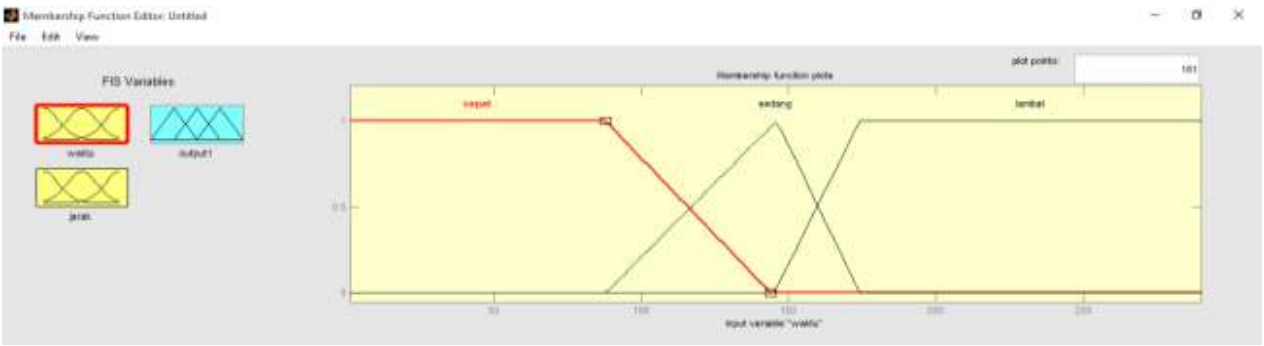

Figure 5. Fuzzyfication ulta sonic sensor image time

$$\begin{cases} 1 & x \leq 87.21 \\ \dfrac{145.35-x}{145.35-87.21} & 87.21 \leq x \leq 145.35 \\ 0 & x > 145.35 \end{cases}$$

$$\begin{cases} 0 & x \leq 87.21 / x \geq 174.42 \\ \dfrac{x-87.21}{145.35-x} & 87.21 \leq x \leq 174.42 \\ \dfrac{174.42-x}{174.42-145.35} & 145.35 \leq x \leq 174.42 \end{cases}$$

$$\begin{cases} 1 & x \leq 145.35 \\ \dfrac{174.42 = x}{174.42 - 145.35} & 145 \leq x \leq 174.42 \\ & 0x > 174.42 \end{cases}$$

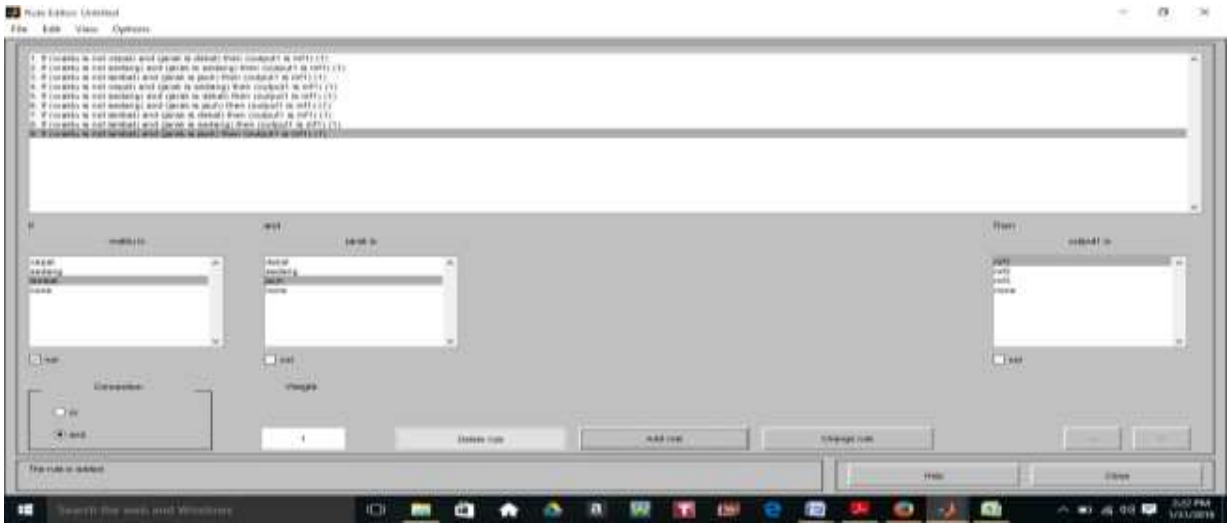

Figure 6. Fuzzy algorithm rule table

3.4 4rule base fuzzy image

Information :

- if the short distance and time are fast the alarm sounds
- if the short distance and time are fast the alarm sounds
- if the short distance and time are fast the alarm sounds
- if the distance is medium and the time is running then the alarm sounds
- if the distance is moderate and the time is moderate, then it sounds
- if the distance is long and the time is long then the alarm is off
- if the distance is long and the time is long then the alarm is off
- if the distance is long and the time is long then the alarm is off
- if the distance is long and the time is long then the alarm is off
- if the distance is long and the time is long then the alarm is off

4. Defuzification Process

The input in the defuzification process is a fuzzy set that is obtained from the composition of the rules that have been made, while the resulting output is a number in the fuzzy set domain.

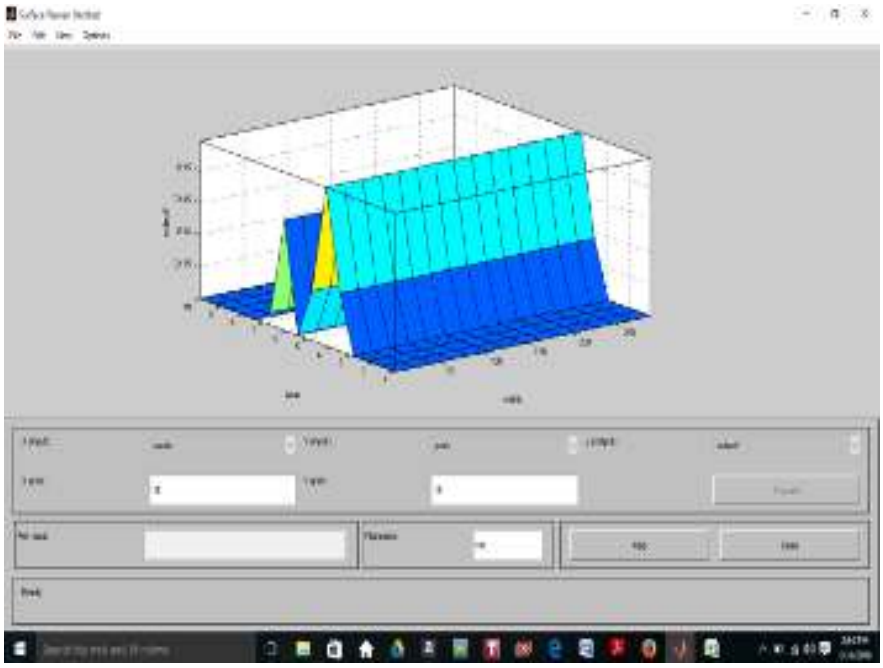

Figure 7. Fuzzy education education final graph

The function of defuzification is to translate fuzzy information, from the computing process Defuzification is the final process of fuzzy logic processes.

While writing the formula program on the microcontroller is as follows:
void defuzification ()

{Penjumlahan=((pred1*Z1)+(pred2*Z2)+(pred3*Z3)+(pred4*Z4)+(pred5*Z5)+(pred6*Z6)+(pred7*Z7)+(pred8*Z8)+(pred9*Z9)+(pred10*Z10));
Pembagi=(pred1+pred2+pred3+pred4+pred5+pred6+pred7+pred8+pred9+pred10); Zt=penjumlah/pembagi }

Table 1. Fuzzy calculation results

number	distance	Fuzzy result
1	1cm	2.4
2	2cm	1.9
3	3cm	1.4
4	4cm	0.9
5	5cm	0.4
6	6cm	0.0
7	7cm	0.0
8	8cm	0.0

9	9cm	0.0
10	10cm	0.0

5. Conclusion

Based on the description in the previous chapters, the conclusions can be taken is:

- Measurement of water level in ultrasonic sensors can be constructed using the Sugeno fuzzy logic approach
- The distance measurement system using ultrasonic sensors with the Sugeno fuzzy method approach is very accurate.

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