ISBN : 978-602-1178-11-9

PENERBITAN & PERCETAKAN UNP PRESS
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PROCEEDINGS 4th International Conference on TVET Padang, November 9-11, 2017

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4th International Conference on Technical and Vocational Education and Training (TVET)

Theme :

Technical and Vocational Education and Training for Sustainable Societies

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FOREWORDS

This proceeding aims to disseminate valuable ideas and issues based on research or literature review in the field of vocational, technical and engineering studies, which have been presented in 4th International Conference on Technical and Vocation Education and Training. This conference has taken place in Hospitality Center Universitas Negeri Padang, November 9-11, 2017.

The theme of Conference focused on the perspective of technical and vocational education and training for sustainable society to face the challenges of 21st century, globalization era, and particularly Asian Economic Community. To overcome the challenges, we need the innovation and change in human resources development. Technical vocational educational and training have essential roles to change the world of education and work in order to establish sustainable society.

Undoubtedly, TVET need to enhance the quality of learning by developing various model of active learning, including learning in the workplace and entrepreneurship. Create innovation and applied engineering as well as information technology. Improvement of management and leadership in TVET Institution, and development of vocational and technical teacher education.

Many ideas and research findings have been shared and discussed in the seminar, more than 176 papers have been collected and selected through scholars, scientists, technologist, and engineers'. as well as teachers, professors, and post graduates students who participated in the conference.

Eight keynote speakers have taken a part in the conference, namely Prof. Intan Ahmad, Ph.D. (Director general of learning and student affairs, Kemenristek Dikti) and Prof. Josaphat Tetuko Sri Sumantyo, Ph.D. (CEReS Chiba University) and Prof. Dr. Maizam Alias (UTHM Malaysia) and Prof. Ganefri, Ph.D. (Rector of UNP) and Prof. Dr. Ramlee bin Mustapha (UPSI Malaysia) and Prof. Nizwardi Jalinus, Ed.D. (Chair of TVET doctoral program, FT UNP) and Prof. Michael Koh, Ph.D. Dr. Fahmi Rizal, M.Pd., MT (Dean of FT UNP). They all have a great contribution for the success of the conference.

Finally, thank a million for all participants of the conference who supported the success of 4th International conference on TVET 2017 and most importantly, our gratitude to all scholars who support and tolerated our mistake during the conference.

Padang, 9 November 2017

Prof. Dr. Nizwardi Jalinus, M.Ed
Chair of Scientific Committee

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A MICRO HYDRO POWER GENERATOR AS AN ALTERNATIVE SOLUTION FOR ENERGY PROBLEM SOLVING IN INDONESIAN REMOTE AREA

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ABSTRACT: This research aims to design a micro hydro power generator as an alternative electric energy for Indonesian remote area. The research is located in Nagari Sungai Abu-Solok, West Sumatera. The cross flow turbine type has been used as power generation by considering the water flow characteristics and local area condition. The turbine geometry is customized according to the electrical power needs and potential of the water resources. This experimental study is conducted in three parts: the field investigation concerning water flow characteristics, the need analysis of Panasahan community on electricity and technical design and development of generator. Results showed that the design of cross flow turbine power generator can produce 12kW of electrical power which is able to meets 80% of local electricity demands.

Keywords: Cross flow turbine, micro hydro, power plant

1. INTRODUCTION

One of the fundamental problems confronted by Indonesia in recent decades is the crisis of energy supply including electrical energy. The total electricity production of *Perusahan Listrik Negara* (PLN), an Indonesian electricity producer, is unable to meet the overall national electricity demand. In 2014, the total production and number of power plant units of PLN are about 39.3 GW and 5007 units. 79.12% of total production and electric power plants are installed in Java island [1]. The total net production in this year is 175.3 TWh. This electric energy production is generated by natural gas power stations 28.1%, Coal 48%, oil 15%, water energy 6.4% and geothermal 3%. Meanwhile, Indonesian electrification for 2014 just only about 81.7 % [1]. While for West Sumatera region, at least 441 of the 4750 districts (9.3%) have not been supplied by PLN [2]. Unbalanced supply and distribution of electricity to all regions of Indonesia caused by: uneven source of power generation, non-concentrated residential location and high electrical distribution cost.

In fact, Indonesia has a great potential in energy reserves both fossil energies/unrenewable energy (oil, coal) and renewable energies, such as solar radiation, wind power, hydro power, biomass, geothermal, etc. Table 1 presents the potential of renewable energies in Indonesia as alternative national energy resources. Unfortunately, these free energies are not well-explored yet. The poor level of renewable energy exploration is due to the high investment and maintenance cost for individual renewable plant power generators than the PLN electricity tariff. Consequently, the national electricity supply depends on PLN production. In the next, exploration of renewable energy sources for power generation by the local communities should be intensified to meet the national energy needs especially in the remote areas that are not covered by PLN's distribution network.

Table 1. Indonesia renewable energies reserves

Sources	Reserves
Mini/micro hydro	450 MW
Biomass	50 GW
Solar energy	4.8 kWh/m2.days
Wind Energy	3-6 m/s

The present study aims to design a micro hydro power plant (PLTMH) at Panasahan, Sungai Abu-Solok, West Sumatra. The power generator is designed to be able to meet domestic energy needs (lighting, auxiliary) of 102 families who have not been powered by PLN electricity. The expected long-term impacts of this research are to increase the community professional work productivity, income and society welfare in Panasahan. Besides, this research can help the government program in accelerating the development of Micro hydro Power Plant (PLTMH) which is targeted to 2.85 MW until 2025, according to Presidential Decree No. 5, 2006 [3].

2. METHODOLOGY

In this research cross flow turbine power generator will be designed a by taking into account the local area characteristics. This experimental study is conducted in three parts: (1) site investigation and analysis of local micro hydro potential, (2) analysis of energy demand of

Panasahan community and (3) design and development power generator which consists of turbine, generator, dam according to production capacity.

2.1. Local area presentation and problematics

Geographically, Panasahan is a mountains area with an elevation of 700m above sea level. It is located near of *Kerinci Sablat* National Park. Because it's high elevation, the daily average temperature of Panasahan territory is about 23.4°C, and relatively cooler compared to the surrounding areas. The average annual rainfall is quite high, 2257 mm [4]. Panasahan presents many potential natural resources that can be developed such as (a) agricultural land and plantations, (b) the river for fish cultivation, irrigation and mineral resources, (c) forest resources, (d) renewable energy resources such as energy solar and wind energy.

One of the main problems faced by Panasahan local society is the absence of electricity network supplied by PLN. This condition makes it difficult for residents to perform various economic activities and socio-cultural interactions. For energy needs completion,

Some Panasahan residents who have sufficient financial capability make a small-scale individual hydropower power generator. Therefore, to improve resident's income and welfare and to help the the realization of government program national energy sustainability, hence the production of micro hydro electric energy should be escalated.

a. b.

Fig. 1. a. Location of Panasahan on the map, b. Site inspection

2.2. Investigation of Panasahan energy needs

Panasahan is inhibited by 102 families who do not have access to electricity facilities of PLN. Based on site investigation and field survey on the community's energy needs, the total power required by Panasahan residents is 23 kW. The detail of electric power needs is presented in the following table:

Table 2.Electricity needs of Panasahan society

Items	Unit (kW)	Total (kW)
Domestic lighting (102 units)	0.2	20.4
Public facilities:		
Lighting of public lane:20 spots	0.1	2
Community meeting hall	0.2	0.2
Mosque	0.2	0.2
Community activity center	0.2	0.2
Total electrical energy need		23

2.3. Water resources and flow characteristics

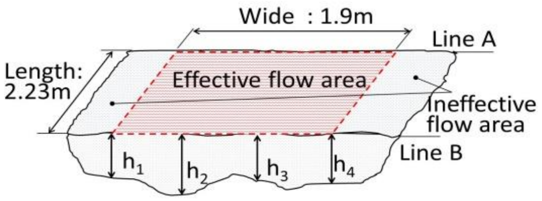
With high rainfall level [4], Panasahan is bypassed by many tributaries. The selected tributary as a turbine driving power is located near the settlement area. The flowing water comes from a water spring located one of the hilltops. The river flowrate is relatively stable. In field investigation in Mid-June 2017, showed that this tributary can be utilized as water resource for micro hydro power generation. For feasibility analysis, several parameters will be analyzed in order to design an effective turbine, described as follows:

2.3.1. Water flowrate

Measurement of water flowrate is performed by a simple technique. The investigation team members determine a specific area on water flow path (red shades). In this area the water flows freely without obstacles such as rocks, plantation, etc. The length of the observed river area is 2.23 m and the width of 1.9 m (Fig. 2.b). A twig is released moving freely following the water pathway from line A to line B. After repeating the measurement five times, the average moving time of the object across the specified lines is 5.9 seconds. Meanwhile, to measure the depth of the water channel, the high of water level is measured by a stick on four different spots: (h1, h2, h3 and h4). The depth measurements are performed on five times in each to spot. Therefore, the actual depth is determined by the average value of these four different spots (Fig. 2.b). In this case study the water channel depth is approximately 0.33 m. The flow rate water streamline can be calculated using the continuity equation. The flow effectiveness coefficient for a rocky river is 0.7. Therefore, the debit can be calculated with the following expression:

$$\boldsymbol{Q} = \mathbf{0.7}\,.\ \boldsymbol{A}\,.\ \boldsymbol{V} \qquad \textit{Eq. 1}$$

a. Water resources and flow



b. Flow rate measurement

Fig. 2. Flow representation

The measured river water flowrate is obtained at 100 - 300 liters per second. The height of water fall (*head*) in this turbine design (from intake to turbine) is about 7.1 m. Fluctuations in water flowrate due to seasonal changes are observed not significant. By using equation 1, the flow rate of water flowing in the determined area is 0.237 m^3s^{-1} (237liters). Based on literature review, the appropriate turbine for low head and debit as described above is cross flow turbine. (Purwantono et al, 2015)

2.3.2. Head

Head is one of the important parameters to determine the power capacity to be generated. To measure the height of water head, the following equipment's are required: laser distance meter, arc-meter, etc. Head is measured by comparing the intake elevation and the location of the turbine. Based on the land availability, the longest possible distance between dam and turbine location is 50 meters. Fig. 3 illustrates the measurement process of the length of piping system and the water head.

Fig. 3. Water head and piping system measurement

3. DESIGN OF MICROHYDRO POWER GENERATOR

Micro hydro power generator has several main components, including: electric generator, turbine as the driving force, piping system, reservoir (water dams), etc. The cross flow turbine is determined as the best turbine choice for case this study [5]. Actually, few studies have been conducted by some pervious researchers with different topics: the number of blade, optimum angle of blade, blade radius, diameter of runner, etc. An experimental study about the effect of blade angle showed that the optimum blade angle for cross flow turbine is about 30^0 [6]. The in site investigation result about flow characteristic, we observe some important parameters in generator design such as: the speed of water jet in the nozzle, diameter runner, geometry of blades, etc.

3.1. Turbine characteristics

3.1.1. Speed of water jets on the nozzle

According to Bernoulli statement, a moving fluid has three energy components: potential energy, hydrostatic pressure energy and kinetic energy. The Bernoulli equation states that there is no energy loss on a fluid that moves on two points still in the same streamline level. If the fluid has a low pressure then its velocity will be faster, and vice versa. Therefore, for a moving fluid flow across two different points without any external energy changes, then the energy equation at all points within the fluid streamline can be calculated by Eq. 2.

$$H_e = h + \frac{P}{\rho} + \frac{\bar{V}^2}{2 . g} = Constant \qquad \text{Eq. 2}$$

In cross flow turbine, the blades are driven by the water kinetic energy on the blades surface. This kinetic energy is a linear to water jet speed and the mass of water spreading out of the nozzle. The speed of water jet can be calculated by the following expression:

$$V = C_d . \sqrt{2.\ g\ H_e} \qquad \textit{Eq. 3}$$

Where *Cd* is discharge coefficient of nozzle (dimensionless) that depending on its dimension (usually 0.6), *H* is the water head measured from the reference point (turbine location) and *g* is the force of gravity ($m.s^{-2}$). By using *Eq. 3*, the water jet speed can be determined; in this case study is about 7.1 $m.s^{-1}$.

3.1.2. Diameter of runner

Runner is one of the most important components in cross flow turbine. Runner consists of three main elements, namely shaft, disc plate and blades. In this study, diameter of runner is 20cm, the shaft diameter is 10cm.. Fig. 4 presents the design of the studied cross flow turbine

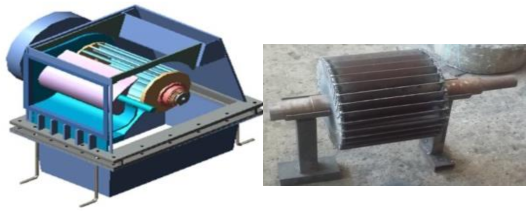


Fig. 4. a. Crossflow turbine [7], b. Design of Runner

In order to design the dimension of turbine runner, the following parameters must be determined: outer diameter (D_{out}), inner diameter (D_{in}) width of the blades (L), distances between the blades (l), the thickness of nozzle (m), blades radius (r_l), the numbers of blades (N) dll [8]. Then, the outer diameter of the turbine runner can be determined by solving the following equation [9]:

$$\boldsymbol{D_{out}} \,.\, \boldsymbol{L} = \frac{\mathbf{2.62.}\ \boldsymbol{Q}}{\sqrt{\boldsymbol{H_e}}} \qquad \text{Eq. 4}$$

By defining the length of runner 40cm, the result indicates that the outer diameter of runner is 58cm. While the inner diameter of the runner can be calculated by using the *Mockmore's* equation, $D_{in} = 2/3\ D_{out} = 38.7\ cm$

3.1.3. Turbine blades

The optimum distance between the blades (*1*) is calculated by the equation: $l = 0.1\ D_{out}$. After calculating the outside diameter of runner, the distance of the blades is about 10.15 cm. Therefore, with a specific blades distance as calculated above, the number of turbine blades (N) can be determined by this equation $N = (\pi.d) / l$. After calculating the runner circumference and dividing it by the distance of blades, the number of blades is obtained for 32. The runner blades are made of steel plates with 4mm thickness.

3.1.4. Turbine house

Based on the investigation result about flow characteristics and area topography, the most appropriate location for the cross flow turbine is 45m from the intake piping system. In addition, the selected turbine area is quite safe and protected from risk of flooding. The turbine house is built permanently with a small geometry of 2m x 1.5m and a height 2m. The main construction material of turbine house is concrete and bricks.

3.1.5. Penstock

Penstock pipe has length of 45m. The length of penstock pipe is a representation of the distance between the intake hole and the turbine location. The diameter of pipe is about 12 inches with 10 mm pipe thickness. The slope of the penstock is for 30º.

3.1.6. Turbine Power

As an impulse turbine, the driving energy produced by the kinetic energy of the water flow that hits the runner blades. By combining the kinetic energy equation and continuity equation, the theoretical power produced by turbine (Pa) can be written in the following expression:

$$\boldsymbol{P_a} = \frac{\mathbf{1}}{\mathbf{2}}\, \boldsymbol{\rho} \,.\, \boldsymbol{A} \,.\, \boldsymbol{V^3} \qquad \text{Eq. 5}$$

V is the water speed out of the nozzle (m.s^{-1}) which can be calculated by *Eq. 3*.

In fact, the kinetic energy that hit the turbine blades cannot be fully converted into motion mechanical energy to rotate the turbine shaft. If the turbine efficiency is considered η_T, by substituting the expression *Eq. 3* into *Eq. 5*, the power generated on the turbine shaft can be determined by the following equation:

$$\boldsymbol{P_T} = \boldsymbol{\rho} \,.\, \boldsymbol{g} \,.\, \boldsymbol{Q} \,.\, \boldsymbol{H_e} \,.\, \boldsymbol{\eta_T} \qquad \textit{Eq. 6}$$

Where ρ water density (1000 g.m^{-3}), g is gravitational force (9.81 m.s^{-2}), Q is the debit of water (m^3.s^{-1}), H_e is the height of water head (m). According to the literature survey, the efficiency of the cross flow turbine is about 80% [7]. From the equation 5, the power generated on the turbine shaft is 13.2 kW. This electrical power production can cover 57.4% of the total electricity needs of Panasahan community.

3.2. Design of civil construction

3.2.1. Water dam

The dam is constructed on high area with altitude 560 above sea level. The dam location is located 50m from the nearest residential concentration point. The dam profile and its geometry are presented Fig. 5. According to the land availability, the width of river are that can be dammed is 8m. The dam embankment is constructed on the downstream side of water flow and the left and right side on the river. Some parts of river area are already surrounded by the natural rocks, so the embankment construction process becomes simpler. Based on investigation data and analysis of river characteristics, the optimal embankment height is between 1m to 1.5 m.

Fig. 5. Water dam

3.2.2. Intake and exhaust system

Intake serves as a controller of water flow to the turbine nozzle. In this study, the intake gate has a width of 1.25 m and a length of 1 m. The surface are of intake gate is 1.25 m^2. While the turbine exhaust system will return back the water to the river after passing the turbine blades. In the present study, the exhaust canalization system of turbines is a trapezium open conduit with an angle 60^0.

4. CONCLUSIONS

The design of this PLTMH in the present document can produce 13.2 kW electricity power and cover 57.4% of the total electricity needs of the Panasahan residents. The cross flow turbine generator has been selected by considering the water flow characteristics. This turbine is able to generate the electricity power for the low head and low debit of water resources. However, the power generated by power plant system has not been able to meets the all energy needs of Panasahan residents. The outlook of the present study is to develop a multilevel turbine generator.

5. ACKNOWLEDGEMENTS

The authors would like to thank the ministry of Research, Technology and Higher Education for their financial support.

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4th International Conference on Technical and Vocation Education and Training
Padang : November 9-11, 2017

FUNCTIONAL MEMBERSHIP ANALYSIS OF FUZZY INFERENCE SYSTEM SUGENO IN ANEMIA CLASSIFICATION

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ABSTRACT: Determination of anemia classification based on morphology will make it easier to diagnose the disease of a patient further because each classification also has many possible types of illness. The concept of fuzzy logic is very flexible and has a tolerance to data that is not appropriate and based on natural language to determine a result. There is still often a mistake in determining the classification of anemia resulting in a miscarriage in the patient. Therefore we need a system as a tool in determining whether a patient entered on which classification of anemia with the concept of fuzzy logic. The input of fuzzy set in this research is data of laboratory result of routine blood examination from 40 patient samples conducted in one laboratory. The method used is Sugeno's fuzzy inference system in the classification of anemia.
Keywords: fuzzy logic, fuzzy inference system, sugeno

1. INTRODUCTION

Anemia is a decrease in the number of measurable red blood cells per millimeter cell on the slide or by volume per 100 ml of blood. A person is said to be anemic if hemoglobin or hematocrit values are more than 2 standard deviations below normal. The lower limit varies depending on age and gender. The main cause of anemia is the loss of red blood cells without the destruction of red blood cells or due to reduced red blood cell production and also because of the increased destruction of red blood cells after production.

This can lead to reduced red blood cell deposits required by the body resulting in anemia. Simple checks for anemia that can be used include hemoglobin (Hb), hematocrit (HT), erythrocyte size, reticulocyte, erythrocyte morphology, complete feces and ferritin. From the examination results of anemia panel will be classified based on the morphology of red blood cells such as micrositic anemia anemia, normokrom anemia normositer or macrositer hiperkrom anemia.

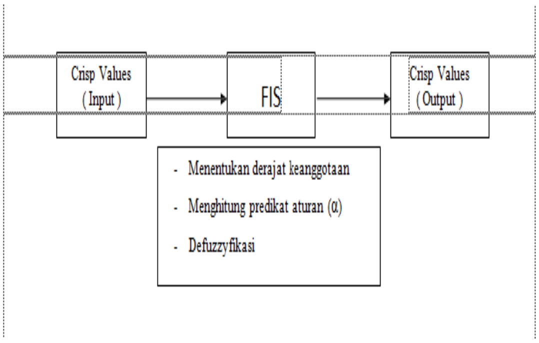
Determination of anemia classification based on morphology will make it easier to diagnose the disease of a patient further because each classification also has many possible types of illness. The concept of fuzzy logic is very flexible and has a tolerance to data that is not appropriate and based on natural language to determine a result. There is still often a mistake in determining the classification of anemia resulting in a miscarriage in the patient. Therefore we need a system as a tool in determining whether a patient entered on which classification of anemia with the concept of fuzzy logic.

The use of the system can be implemented easily into the machine language and by using fuzzy logic. Fuzzy logic is a logic that has the concept of partial truth, where fuzzy logic allows membership values between 0 and 1. While classical logic states that anything can be expressed in the value of truth 0 or 1. In theory there is already a way to calculate the components and the formation of classification determines anemia, but the calculation and determination use the set crisp (assertive). On a firm set, a value has a membership level of one if the value is a member in the set and zero if the value is not a member of the set. This is very rigid, because with a small change of value results in different categories.

The fuzzy set is used to anticipate this, since it can tolerate values so that a slight change in value will not make a significant difference. The method that can be used in applying fuzzy logic in determining the classification of anemia is the Sugeno method. The creation of a fuzzy expert system is usually based on the domain of certain knowledge for a particular expertise that approaches human reasoning and reasoning in any one field. Generally the fuzzy expert system tries to find a satisfactory solution that is a good enough solution for the work to run even if it is not an optimal solution.

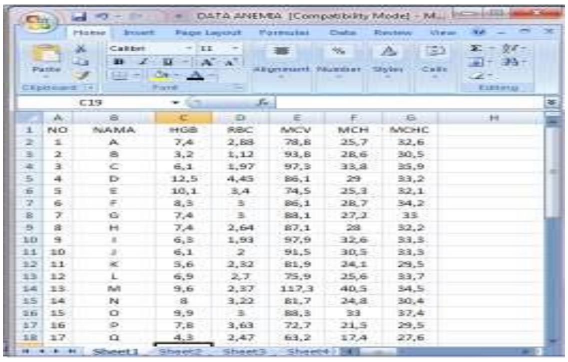
2. RESEARCH METHODS

The purpose of this research is Sugeno's fuzzy inference system in determining the classification of anemia. Based on the basic concept of fuzzy logic is the theory of fuzzy set, where membership value is as a determinant of the existence of elements in a set is very important. The membership value or membership function is the main characteristic of fuzzy logic reasoning, when compared with the firm set that in fuzzy logic something proposition can be equally true or equally wrong at the same time. Fuzzy inference system draws conclusions from a collection of fuzzy rules.



3. RESULTS AND DISCUSSION

The results of fuzzy inference system Sugeno analysis in determining the accuracy of anemia classification that follow the rules of fuzzy inference system Sugeno or in other words the process begins with penginputan data results of the laboratory until the defuzification process. The author also compares the accuracy of system results using two different membership functions with expert readings from the same manual input. The input of fuzzy set in this research is data of laboratory result of routine blood examination from 40 patient samples conducted in one laboratory.



	A	B	C	D	E	F	G
1	NO	NAMA	HGB	RBC	MCV	MCH	MCHC
2	1	A	7,4	2,88	78,8	25,7	32,6
3	2	B	3,2	1,12	93,8	28,6	30,5
4	3	C	6,1	1,97	97,3	33,8	35,9
5	4	D	12,5	4,45	86,1	29	33,2
6	5	E	10,1	3,4	74,5	25,3	32,1
7	6	F	8,3	3	86,1	28,7	34,2
8	7	G	7,4	3	88,1	27,2	33
9	8	H	7,4	2,64	87,1	28	32,2
10	9	I	6,3	1,93	97,9	32,6	33,3
11	10	J	6,1	2	91,5	30,5	33,3
12	11	K	5,6	2,32	81,9	24,1	29,5
13	12	L	6,9	2,7	75,9	25,6	33,7
14	13	M	9,6	2,37	117,3	40,5	34,5
15	14	N	8	3,22	81,7	24,8	30,4
16	15	O	9,9	3	88,3	33	37,4
17	16	P	7,8	3,63	72,7	21,5	29,5
18	17	Q	4,3	2,47	63,2	17,4	27,6

3.1 Fuzzy Set Assembly Degrees Process

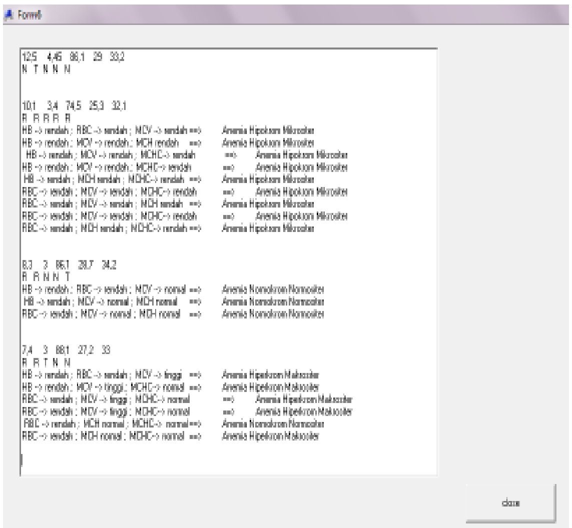
From input laboratory results such as Figure 4.4 then the next step is the formation of fuzzy membership degree for each variable. The formation of fuzzy membership degree is selected according to the curve. Here's a picture of the formation of fuzzy membership degrees for the trapezoid curve.

3.2 Analysis of Results

After inputting the data of the laboratory results to the decision result based on predicate rules using the system then the next comparison of decision results that membership function is different. This comparison uses 40 samples of the same laboratory input data as well as with the results of each classification based on anemia's existing blood morphology.

The linguistic decision result is obtained by determining predicate rules and defuzzyfication so that the results are presented in linguistic form as well. The resulting decision result is obtained by using the membership function of the trapezoidal fuzzy set based on predicate rules and deffuzyfikasi.

Decision results are obtained from predicate rules that have been established based on variables HB, RBC, MCV, MCH and MCHC with fuzzy inference Sugeno even if there is a decision that shows a patient anemia anemia meaning the patient is not anemic. Further the decision results based on the predicate rules for the membership function of the fuzzy set of triangle curves as follows.



With 40 samples obtained 55% result is Hypochromic Anemia Micrositer, 37.5% Normochrome Normochrome anemia and 7.5% Anemia Macroperitic Hyperkrom. It can be seen that there is difference of result of comparison of analysis of decision result from two different membership function on classification of Hypochromic anemia Micrositer equal to 7.5%, Normal Normokrom Normal anemia 10% and Hyperkrom Makrositer Anemia 2.5%.

This difference is caused by changing the distance between a standard value used in a certain membership function so as to produce a different decision. The author also found an out-of-rule result so the decision result for an input does not exist. This classification involves all blood morphological variables that can not be taken or read only because the MCV, MCH and MCHC variables affect each decision result.

4. CONCLUSION

As a result of research that the authors do, it can be concluded several things including:

1. Determination of classification using trapezoidal membership function and triangle membership function.
2. The result of the analysis of the membership function of the triangle curve with the trapezoid curve in the classification of anemia indicates that the decision result obtained with the trapezoid curve membership function is better because it approximates the actual result of an expert. While the membership function of the triangle curve found results of a decision that does not exist on the basis of the rules.
3. The result of the decision is limited to determining the classification of anemia only.

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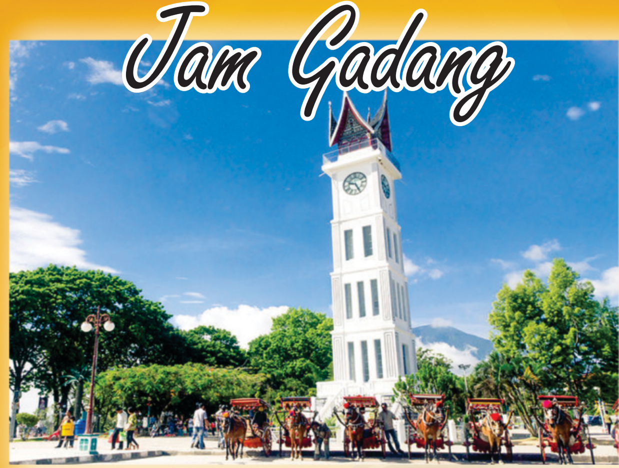

Big Ben Tower is the name for the tower clock located in the center of Bukittinggi, West Sumatra, Indonesia. This clock has a tower with a large building on the four sides so-called Clock Tower, designation Minangkabau language meaning "big ben".

Sianok Canyon is a steep valley (ravine) located in the border town of Bukittinggi, in the district IV Koto, Agam, West Sumatra. The valley is elongated and meandering as the southern boundary of the city of Koto Gadang to nagari Sianok Anam Tribe, and ends in the district Palupuh. Sianok canyon has a very beautiful view and also became one of the flagship attraction province.

Japan holes Bukittinggi (also spelled Japanese hole) is one of the historical attractions in the city of Bukittinggi, West Sumatra, Indonesia. Japan hole is a tunnel (bunker) protection built Japanese occupation army around 1942 for defense purposes.

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