DC MOTOR CONTROLLER DESIGN FOR TRACKING ANTENNA SYSTEM BASED ON CVBS ANALOG SIGNAL PROCESSING

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ABSTRACT

DC motor is often used in tracking antenna system. Generally rotation of the motor is controlled manually by using the remote control. To be able to rotate automatically, then the tracking antenna system requires compatibility between input parameters with decision making process. Thus, the ability of auto tracking on tracking antenna system can be achieved. In this research, DC motor controller is designed as an effort to build the tracking antenna system which has auto tracking capability. In the design, the input parameters are obtained from analog CVBS signal processing. Results from the processing yield 2 parameters, among other are Composite rising transition and Vertical rising transition. Characteristics of both parameters are used as a reference in the decision making process. The trial results show that the DC motor controller has been designed to produce minimum tracking time of 1.6 second and maximum 115.2 second.

Keywords : *Tracking Antenna System, CVBS, Auto Tracking, Analog Television, DC Motor*

1. INTRODUCTION

In analog TV receivers, the automatic tracking function of the antenna tracking system allows the antenna to rotate automatically in an effort to achieve optimal video clarity. Tracking antenna systems on analog television is generally based on user control. In this case, the tracking process done by using the remote control manually. By using the automatic tracking function, the tracking process becomes easier for the user.

The automatic tracking function of the antenna tracking system can be built if there are 2 points. The first point is the existence of input parameters used as a reference. The second is the decision making process that matches the input parameters. In terms of input parameters, one of the potential parameters used is AGC *(Automatic Gain Control)* as performed on satellite receiver technology [1]. In this case the antenna rotates based on AGC signal processing. But on analog TV, this method is less effective because generally the AGC out facility is not present physically on the TV panel. Another way is using analog signal processing of CVBS *(Composite Video Baseband Signal)* which is generally available on AV-Out connection [2]. While the compatibility between input parameters and decision making process can be achieved if the input parameter characteristics are adjusted to the type of actuator used. The most commonly used actuator component is a DC motor. Not only in analog television, DC motors are also commonly used in satellite TV receivers as in previous research [3], [4].

The current study is a continuation of previous research, where CVBS signal processing performed in an attempt to obtain the input parameters for the tracking antenna system [2]. If in previous research used servo motor as actuator to rotate antenna, hence in this research used motor DC. Therefore, the design and implementation of DC motor controller in this research is equipped with decision-making algorithm that is arranged to be able to adjust to analog CVBS signal processing result.. The parameters tested are, *minimum azimuth rotation*, *optimum drive timing* and tracking time.

2. METHODOLOGY

In this research, the design of DC motor control system including implementation, trials and analysis. The design of the DC motor control system is as shown in Figure 1. CVBS analog signal on AV-Out TV will be inputted to DC motor control block input. Then the output block DC motor controller will produce a decision related to DC motor rotation. In the DC block of the motor controller, there are 2 important parts including the analog signal processing block CVBS and decision making algorithm.

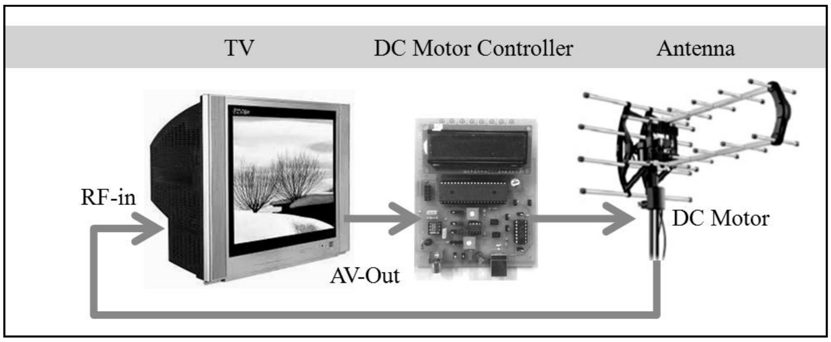


Figure 1. System Design.

2.1 CVBS Analog Signal Processing

Signal CVBS *(Composite Video Baseband Signal)* or so-called *Composite Video* is analog video interface that contains a combination of *luminance signal* (black and white image), *chrominance* signal (color), *burst signal* and *synchronization* are channeled on a single wire [5]. Tracking antenna system on analog television requires reference parameter. In a previous study [2], in order to obtain input parameters, the method used to perform analog CVBS signal processing on AV-Out. In detail, the *sync pulse* on the CVBS signal is calculated every second. To calculate the *sync pulse,* the thing to do is to calculate the number of *transitions rising* between the *sync level* and the *blanking level* on the CVBS signal. This calculation result is called *rising transition*. Figure 2 shows the visual definition of the *rising transition* parameter.

At the PAL B/G standard, the number of lines is 15625 per second or 625 per frame.The number of frames is 25 per second and each frame has 2 fields (odd and even) so the number of fields is 50 per second. The number of *rising transitions* on the overall *sync pulse* is 640 per frame. If every second there are 25 frames, then the *rising transition* number is 16000 per second. This nominal is calculated from standard PAL B/G system *synchronization pulse*. In detail as shown in Figure 3. If the video clarity level is optimal, the value of the *rising transition* parameter will be closer to 16000. Conversely, if the video clarity level gets worse, it will further away from the value of 16000.

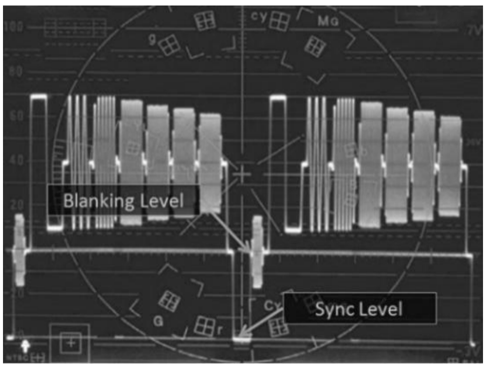


Figure 2. Rising Transition [6].

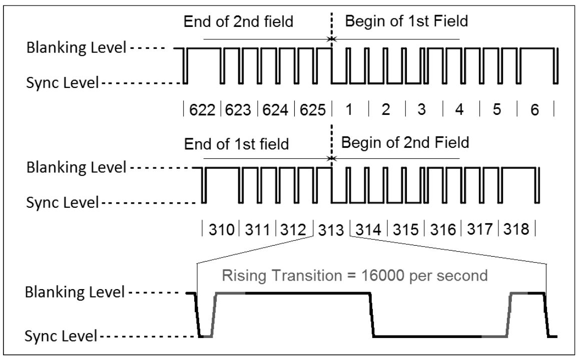


Figure 3.
PAL B/G Pulse Synchronization Standard [7].

2.1.1 Sync Separator Block

In this research, to get the *rising transition* parameter, the thing to do is to separate the *synchronization pulse* from CVBS signal by using *sync separator* block. This block can separate the *composite synchronization* and *vertical synchronization pulses* from the CVBS signal. This block has been designed to have 2 outputs namely CSO *(Composite Sync Output)* and VSO *(Vertical Sync Output).* CSO output serves to produce the *composite synchronization pulse.* While VSO serves to produce the *vertical synchronization pulse.* Then, both CSO and VSO outputs will be calculated the amount of *rising transition* using 2 timer counter on the microcontroller. The microcontroller used is type AT-Mega 32 A. Counter timer counting results will produce 2 variable values used as parameters. In this study, these parameters were initialized as *composite rising transition* (C_{RT}) and *vertical rising transition* (V_{RT}). In this case, both parameters are variables that have no units. Figure 4 shows a complete DC motor controller block diagram in which there is a *sync separator* block. While figure 5 shows the realization of *sync separator* block

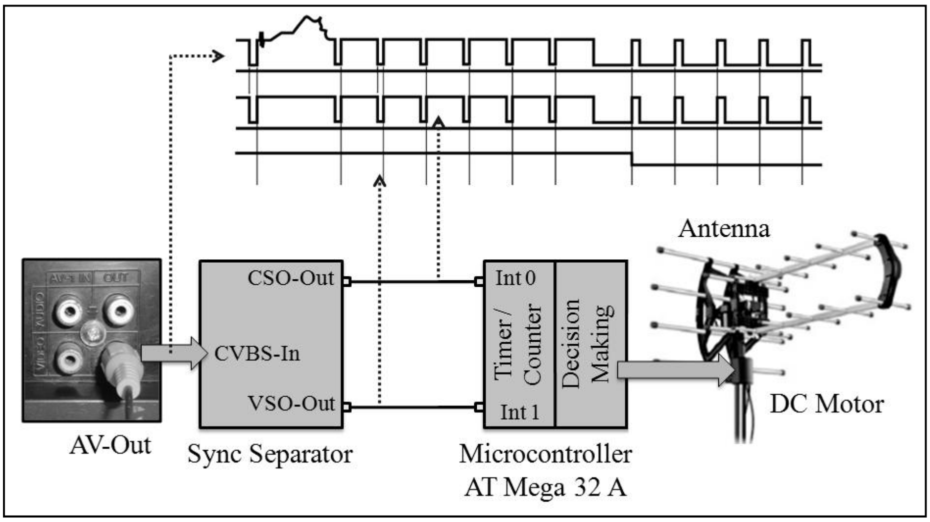


Figure 4. Block Diagram of DC Motor Controller.

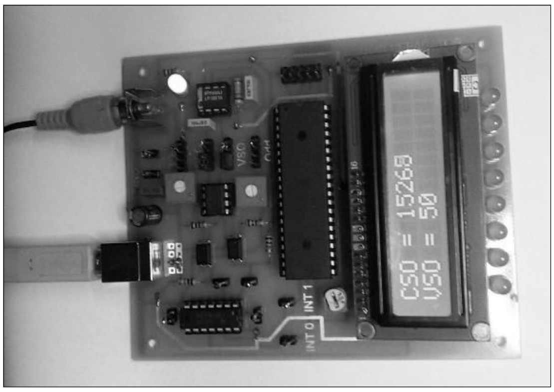


Figure 5. Realization of Sync Separator Block.

2.1.2 Composite Rising Transition (C_{RT}) and Vertical Rising Transition (V_{RT}) Characteristic

Composite rising transition (C_{RT}) and *vertical rising transition (C_{RT})* are the parameters used in the decision making process. Therefore, an analysis of the characteristics of both parameters needs to be done. Characteristics are obtained from trials at several levels of video clarity. Trials were conducted by observing C_{RT} and V_{RT} parameters at several levels of video clarity. In this study, the video clarity level is classified into 5 scales : Good Clarity, Fairly Clarity, Bad Clarity, Worst Clarity and Noisy. Table 1 shows the video clarity level based on the user's visual perception approach. While the characteristics of C_{RT} and V_{RT} parameters are shown in Table 2.

Table 1. Clarity Level of Video and Visual Perception by User

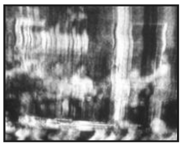
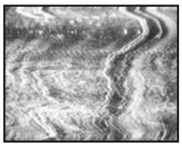
Good Clarity	Fairly Clarity	Bad Clarity	Worst Clarity	Noisy
 Perfect colors & without *ghosting*   Perfect colors & minimum *ghosting*	  Fairly colors & minimum *ghosting*  Fairly colors & fairly *ghosting*	  *Ghosting* looks dominant  Messy colors and *ghosting* very dominant	 Messy colors and *ghosting* extremely dominant   Colorless and *ghosting* extremely dominant	 Extremely blurring and colorless  Formless  Weak RF signal

Table 2. Composite Rising Transition and Vertical Rising Transition Characteristic

Clarity Level of Video	***Composite Rising Transition*** **(C_{RT})**		***Vertical Rising Transition*** **(V_{RT})**	
	Minimum Value	**Maximum Value**	**Minimum Value**	**Maximum Value**
Good Clarity	15171	15687	42	50
Fairly Clarity	13600	15221	42	50
Bad Clarity	8794	12203	42	50
Worst Clarity	2607	6982	0	0
Noisy	0	1182	0	0

In ideal conditions where RF signals are not disturbed by *noise* and *ghosting,* the value of the *composite rising transition* (C_{RT}) parameter is the same as the *rising transition* parameter of 16000. While the value of the *vertical rising transition* (V_{RT}) parameter is the same as the number of fields in the CVBS standard PAL B/G which amounts to 50 fields per second. Thus, if the video clarity is optimal, then the value of the *composite rising transition* (C_{RT}) parameter will be closer to 16000 and the *vertical rising transition* (V_{RT}) parameter value will be closer to 50. Conversely, if the video clarity becomes worse, it will further away from the value 16000, and the value of *vertical rising transition* parameters (V_{RT}) will further away from the value 50.

Good Clarity is the video clarity level desired by the user. While Fairly Clarity is the desired video clarity level if Good Clarity is not possible to obtain. To obtain the clarity level, the DC motor must be able to rotate automatically until the minimum value of C_{RT} parameters obtained reaches ≥13600 and the minimum value of V_{RT} parameters obtained reaches ≥ 42. For that, the value of 13000 on C_{RT} and 42 parameters on the V_{RT} parameter will be entered on the decision making algorithm.

2.2. *The Decision Making Algorithm*

The decision making algorithm put simply sets the timing drive on DC motor rotation. DC motor used in tracking antenna systems does not require speed control. In this case, the PWM control is not required but the *timing drive.* The *timing drive* is used to determine the motor rotation duration which can automatically determine the angle direction of the antenna. The longer the timing drive, the larger the *azimuth rotation.* The shortest duration *timing drive* which include with the *rising transition* parameter change is the ideal *timing drive.*

Therefore, the *optimum drive timing* is the variable sought. In this study, *optimum drive timing* is initialized as a DT_{OPT} parameter. More simply, the decision making algorithm is structured as shown in Figure 6.

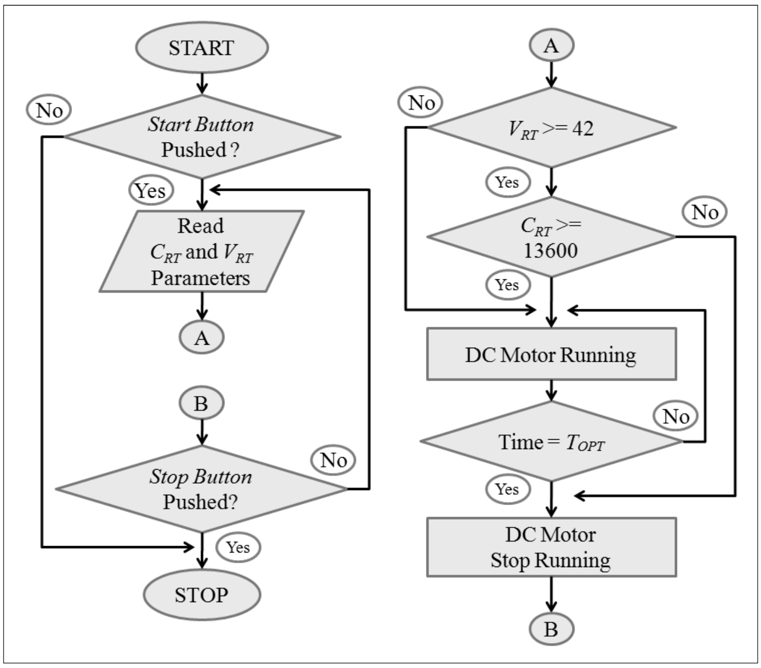


Figure 6. Decision Making Algorithm.

Generally on the tracking antenna system, DC motor rotation is controlled by 2 buttons, namely spin left button and spin right button. But in this study, DC motor rotation is controlled by start button and stop button. When the user presses the *start button,* the DC motor control system will run automatically looking for the directions where the optimal video clarity level can be obtained.

As seen in Figure 6, the details of the decision making algorithm are as follows :

- When the start button is pressed, the system will read C_{RT} and V_{RT} parameters.
- Furthermore, if $V_{RT} \geq 42$, then it describes that video clarity level on TV screen is on 3 possible scales that is, *Good Clarity, Fairly Clarity and Bad Clarity.* To ensure the video clarity level in more detail, the system only checks C_{RT} parameters.
  - If C_{RT} <13600, then it describes that the video clarity level is at *Bad Clarity* scale. In this condition, the DC motor will rotate until the time setting reaches the DT_{OPT} variable. Then, the DC motor stops spinning and the system re-checks the C_{RT} and V_{RT} parameters.
  - If $C_{RT} \geq 13600$, then it describes that the video clarity level on a *Fairly Clarity* or *Good Clarity* scale. In this condition the DC motor does not need to rotate to find the ideal direction of the antenna.
- If $V_{RT} = 0$, then it describes that the video clarity level on the TV screen is in 2 possibilities of *Worst Clarity* and *Noisy.* The DC motor will rotate to find the ideal direction of the antenna.
- Stop button is pressed to turn off the auto tracking function on DC motor controller.

3. RESULTS

In this study, trials were performed on several points including *minimum azimuth rotation, optimum drive timing* and tracking time. The trials of *minimum azimuth rotation* and *optimum drive* are important because the trial results will be used in DC motor controller design process. While trials on tracking time is important because the trial results will describe the overall DC motor controller performance.

3.1. *Minimum Azimuth Rotation*

Minimum azimuth rotation (AR_{min}) is the minimum angle formed by rotating the antenna direction from the starting point to the next point, accompanied by the change in the video clarity level on the TV screen. The trial performed to find the minimum rotation angle of the antenna. Trial perfomed by observing C_{RT} parameters on different *azimuth rotation*. In this trial, *azimuth rotation* is limited from 0^o to 45^o. Figure 7 shows the trial results.

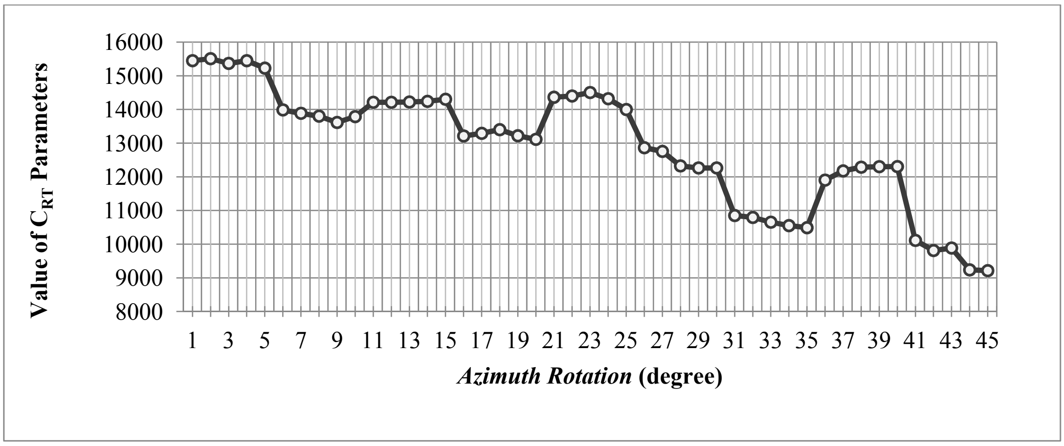


Figure 7. Trial Result of Minimum Azimuth Rotation.

From the test result in Figure 7, it can be concluded into several points, among others are as follows :

- When the *azimuth rotation* reaches 0° to 5°, there is no significant change in C_{RT} parameters. Significant changes occur when the *azimuth rotation* reaches 6°. This occurs also when the *azimuth rotation* reaches 6° to 10°, there is no significant change in C_{RT} parameters. Significant changes occur when the *azimuth rotation* reaches 11°.
- From the trial result, it can be concluded that the *minimum azimuth rotation* is 5°. This can mean a change in the video clarity level on the TV screen occures if the direction of the antenna changes every 5°.

3.2. *Optimum Drive Timing*

Optimum drive timing (T_{opt}) is the time required for a DC motor to rotate to a minimum of *azimuth rotation.* The trial performed by observing the resulting *azimuth rotation* in several different *timing drive* settings. The shortest *timing drive* in the trial is 0.1 second, while the longest is 2 second. The trial results will be used as constants on the DT_{OPT} parameter. Figure 8 shows the results of the trial to determine the *optimum drive timing.*

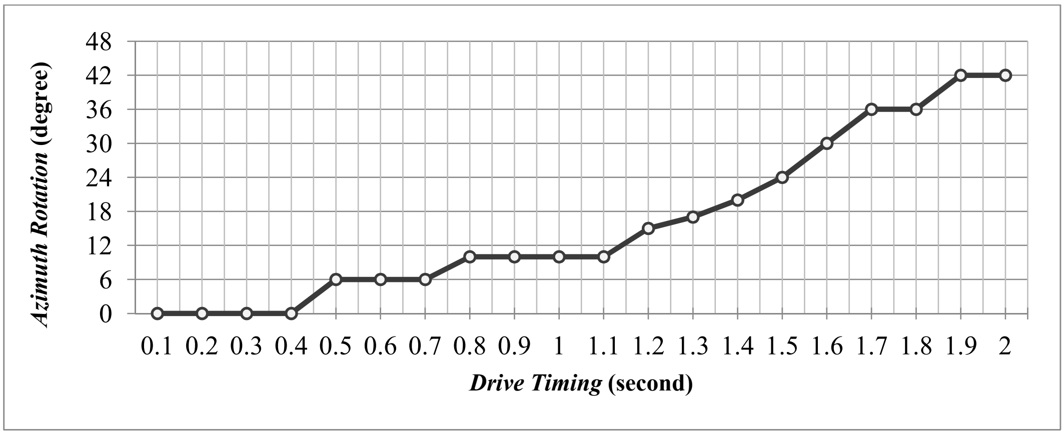


Figure 8. Trial Result of Optimum Drive timing (T_{OPT}).

From the test result in Figure 8, it can be concluded into several points, among others are as follows :

- The DC motor can only rotate when the *timing drive* is ≥ 0.5 second.
- The graph in Figure 8 shows that the DC motor used, has a less linear characteristic.

- When the *timing drive* is arranged 0.5 to 0.7 second, the *azimuth rotation* obtained is 6°. While at 0.8 to 1.1 seconds, the *azimuth rotation* obtained is 10°.
- If the *minimum azimuth rotation* on the previous test result is 5°, then the *drive timing* at 0.5 to 0.7 second is the closest to the *minimum azimuth rotation.*
- *Optimum drive timing* can be determined by taking the average value between 0.5 to 0.7 second ie 0.6 second.

3.3. *Tracking Time Analysis*

The analysis done to estimate the time required by the system in tracking antenna. If the *minimum azimuth rotation* (AR_{MIN}) is 5° (trial result in chapter 3.1), the *optimum drive timing* (DT_{OPT}) is 0.6 second (trial result in sub chapter 3.2), the *maximum azimuth rotation* (AR_{MAX}) is 360° and if the computational time (C_{TIME}) is 1 second, then the tracking time (T_{TIME}) applies the rules as in Equation 1. The results of the analysis if visualized into the graph, then as shown in Figure 9. From the trial results, it can be concluded that the minimum tracking time (shortest) is 1.6 second and maximum tracking time (longest) is 115.2 second.

$$T_{TIME} = \sum_{n=0}^{360/5} (DT_{OPT} + C_{TIME})\, x\, n \quad (1)$$

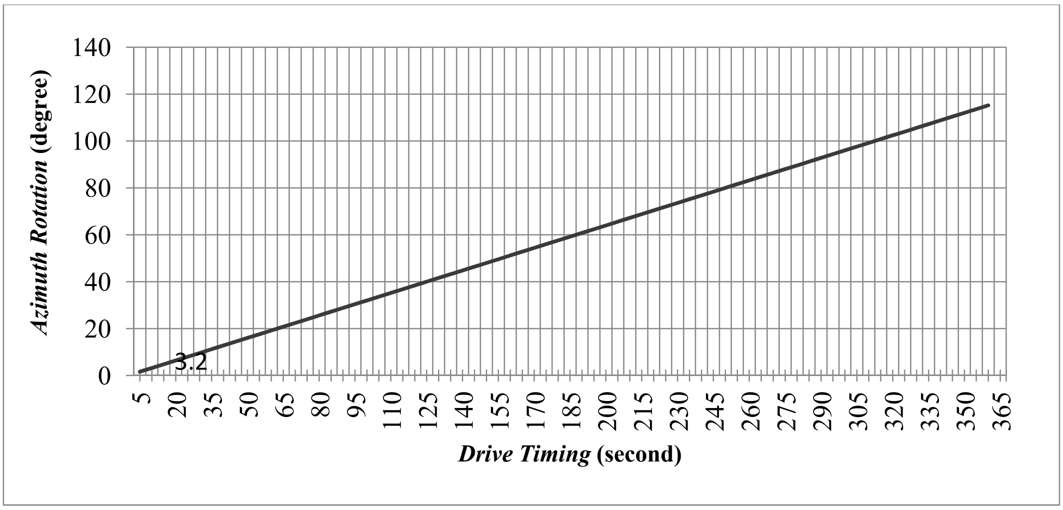


Figure 9. Tracking Time Analysis Result.

4. CONCLUSION & FUTURE WORK

This research is a design and implementation of DC motor controller for tracking antenna system on analog television. Design and implementation includes analog CVBS signal processing and decision making algorithms. Technically, this design produces a minimum tracking time of 1.6° and a maximum tracking time of 115.2° at a minimum of 5° *azimuth rotation* and an *optimum drive timing* of 0.6 second.

Tracking time in this study is still too long, it is necessary to make improvements to tracking time becomes shorter. *Rising transition* is a parameter that obtained after passing the calculation process during1 second or 25 frames, need to be tested where the *rising transition* parameters obtained from the calculation process during 1 frame. In this research has not discussed the method of mixing DC signal with RF signal from antenna to TV. If further research is related to the addition of sensors to the antenna design, then a multiplexer is required that allows a single core coaxial cable to accommodate RF signals, DC supply, and many sensor datas.

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CLASSIFICATION OF SCOUT SKILL USING NAÏVE BAYES CLASSIFIER ALGORITHM

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ABSTRACT

Developing the skill and ability of Scout member often meet some problem, that is the difficulty caused by the error in determining of which skill is owned by the Scout member. The way to solve the problem is to decide the class or classification of the Scout Ability class owned by the Scout member. This research is going to build a system to classify the Scout skill class using Naïve Bayes algorithm to help the Scout master decide the Scout skill class owned by the Scout member. So that, the Scout master could develop the Scout skill suitable with the skill class owned by the Scout member optimally. Criteria used in this research are the scores of General Knowledge, Scouts Knowledge, Sign Languages (Code, Morse, Semaphore), Rope and Knotting, Pioneering, and Handicraft. The type of all of the criteria used are numerical. The result of the classification is the participant involved in Intelligence class, Physical class, or Creativity class. The result of this research is a program which has ability to decide the Scout skill class. The Scout Skill Classification using Naïve Bayes Algorithm program has been tested and the accuracy reached 100%.

Keyword : *Scout, Scout skill, Classification, Naïve Bayes Classifier*

1. INTRODUCTION

There are some skills which are trained in Scout Organization. Those skills can be applied in the social life. In other way, those skills are tested in Scout Competition. Developing the skill and ability of Scout Members often meet the difficulty. It is caused by the error in determining of which skill is owned by the Scout member. Computer program can solve the problem with a classification program using Naïve Bayes classifier algorithm. Bayes is a simple probabilistic based prediction technique with strong independencies(Naïve). The formulation of problem is how to build a system to classify the Scout skill using a Naïve Bayes classifier algorithm. Data needed in this research will be taken from 5 (five) junior high school. They are State Junior High School 1 Tumpang, State Junior High School 2 Tumpang, State Junior High School 1 Pakis, State Junior High School 1 Poncokusumo and Junior High School Diponegoro Tumpang. Each data consist of scores of General Knowledge, Scouts Knowledge, Sign Languages (Code, Morse, Semaphore), Rope and Knotting, Pioneering, and Handicraft. The result of the classification is the participant involved in Intelligence class, Physical class, or Creativity class. Purposes of this research is to facilitate the Scout master to decide which skill is owned by the Scout member. So that the Scout member can developing effectively suitable with their skill.

2. METHODOLOGY

2.1 System Analysis

This step is aims to explain the problem of the system, analyzing the system requirement and elements needed in process of classifying the Scout skills.

2.1.1 Problem Analysis

Scouting activity has now became a part of Indonesian government program to improve the quality of education in Indonesia. One of the ways to measure the ability of Scout member is to organize the competition. The participants of the competition are the Scout member from the educational institutions. Competition organized covers the skill classes that can be classified to intelligence class, physical class, and creativity class. By using the data mining system, specially Naïve Bayes Classifier, then a program for classification was developed to classify the classes of Scout skill.

2.1.2 Data Analysis

Data used in this research are 2015-2016 data of Scout member in 5(five) Junior High School in Tumpang District and around it. Each data consist of scores of General Knowledge, Scouts Knowledge, Sign Languages (Code, Morse, Semaphore), Rope and Knotting, Pioneering, and Handicraft. There are 712 data available which are consist of 447 data for training and 265 data for testing.

2.2 System Design

Designed system consist of two main parts. They are master data process and Naïve Bayes algorithm calculation process.

2.2.1 Master Data Process

Master data process containing data which is going to be used as training data and testing data. In master data process there are function to input data, data editing, and delete the data. The input data needed by the system are participant data for training and participant data for testing.

2.2.2 Naïve Bayes Algorithm Calculation Process

Development of Naïve Bayes model has several steps to do. Those steps explained in following figure.

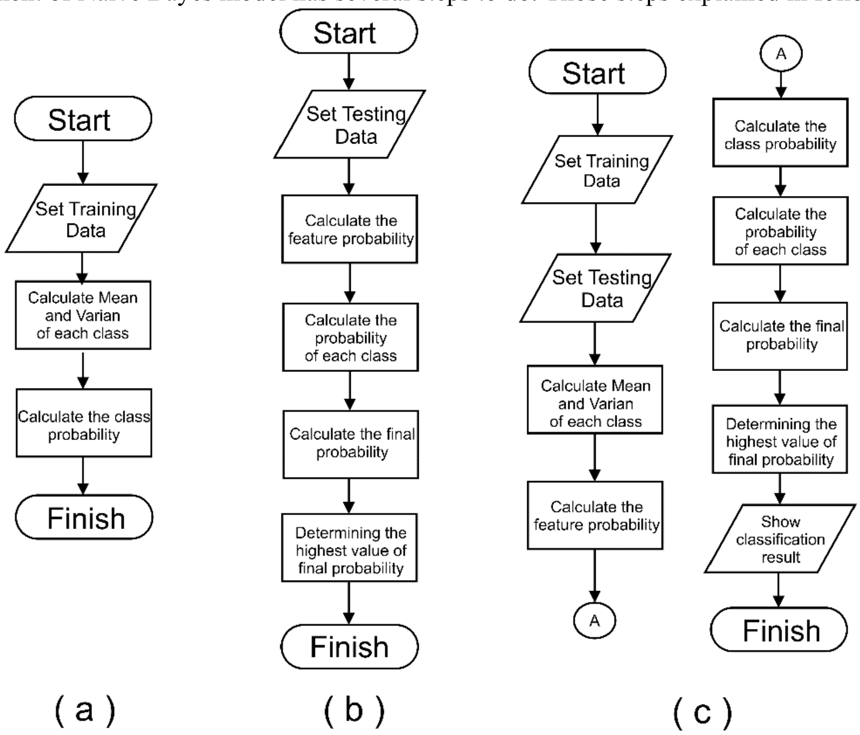

Figure 1. (a) Flowchart of Training Process, (b) Flowchart of Testing Process, (c) Flowchart of Implementation Process

All features are numeric, so that calculation of features probability doesn't exist in training process. But, features probability will be calculated in testing process by involving the value of mean and variance from the training process. The whole process from training process and testing process are involved in implementation process. After highest value of final probability is determined, the system will show the result of classification using Naïve Bayes Classifier algorithm.

2.2.2.1 Calculation Example for Scout Skill Classification using Naïve Bayes Classifier

To do a calculation process of Naïve Bayes Classifier, data for training and testing are needed by the algorithm. These are several data which is going to be used as a training data.

Table 1. Example of Data for Training

NO	NAME	SCHOOL	PU	PK	SMS	SI	PIO	HK	CLASS
1	BAGAS IMAM ABDILLAH	JHS 1 TUMPANG	80	84	86	96	98	78	PHYSICAL
2	RAKA IQBAL RAMADHAN	JHS 1 TUMPANG	88	86	88	76	74	98	CREATIVITY
3	BEBBYTO AYUMI R.E.	JHS 1 TUMPANG	100	100	100	70	60	72	INTELLIGENCE
4	RYAN HIDAYAT	JHS 2 TUMPANG	94	90	90	82	76	78	INTELLIGENCE
5	KHOIRUL DWI ANAM	JHS 1 PAKIS	80	78	74	88	90	80	PHYSYCAL
6	EKO SETIAWAN	JHS DIPONEGORO TUMPANG	76	78	78	88	82	76	PHYSICAL
7	RISKA FANIDHATUS	JHS 1 PONCOKUSUMO	70	78	64	94	88	78	PHYSICAL
8	EKA NUR WAHYUDI	JHS DIPONEGORO TUMPANG	94	84	88	80	70	78	INTELLIGENCE
9	FEBBY ANTI S.	JHS 1 PAKIS	80	78	72	84	76	94	CREATIVITY
10	ROSALIA PUTRI ERLANDA	JHS 1 PAKIS	82	84	76	72	68	90	CREATIVITY

From the example of data for training, average and variance are calculated. Average from each feature calculated based on which class they are involved. For instance, there are 3 data involved in intelligence class. That is mean only the scores of those 3 data calculated to find the average of each features for intelligence class. Averages of the data for training can be seen below.

Table 2. Average Value of Data for Training

CRITERIA	INTELLIGENCE	PHYSYCAL	CREATIVITY
PU	96.00	76.50	83.33
PK	91.33	79.50	82.67
SMS	92.67	75.50	78.67
SI	77.33	91.50	77.33
PIO	68.67	89.50	72.67
HK	76.00	78.00	94.00

Next step is to determine the variance and final variance value of the data for training. They need the average value from data for training. To calculate the variance value, it is decreasing the scores of every single criteria with the average value of the same criteria, and then square it. Do it for the data in the same class. And the count the total summary. After that, divide the total summary with the numbers of the data in the same class decreased by one. And then, the final variance value can be calculated by rooting the variance value. For instance, this is the calculation of variance for General Knowledge(PU) criteria in intelligence class :

$$s^2 \text{ PU} \mid \text{INTELLIGENCE} = \frac{(100-96)^2 + (94-96)^2 + (94-96)^2}{3-1}$$

$$s^2 \text{ PU} \mid \text{INTELLIGENCE} = \frac{24}{2} = 12$$

$$s \text{ PU} \mid \text{INTELLIGENCE} = \sqrt{12} = 3.46 \quad (1)$$

Variance and final variance value can be seen in the table below.

Table 3. Variance Value of Example Data for Training

CRITERIA	INTELLIGENCE	PHYSYCAL	CREATIVITY
PU	12.00	22.33	17.33
PK	65.33	9.00	17.33
SMS	41.33	83.67	69.33
SI	41.33	17.00	37.33
PIO	65.33	43.67	17.33
HK	12.00	2.67	16.00

Table 4. Final Variance Value of Example Data for Training

CRITERIA	INTELLIGENCE	PHYSYCAL	CREATIVITY
PU	3.46	4.73	4.16
PK	8.08	3.00	4.16
SMS	6.43	9.15	8.33
SI	6.43	4.12	6.11
PIO	8.08	6.61	4.16
HK	3.46	1.63	4.00

After average values, variance values, and final variance values have been found, the next step is to calculate the feature probability for numerical features. To do it, a data for testing is needed. This is the data for testing.

Table 5. Example Data for Testing

NAME	SCHOOL	PU	PK	SMS	SI	PIO	HK	CLASS
KHARISMA PRAMISWARA	JHS 1 TUMPANG	86	88	86	80	72	74	

Naïve Bayes algorithm does the calculation the data one by one to classify it based on it's each class through several steps inside it. So, 1(one) data for testing is enough to test the calculation of Naïve Bayes Classifier algorithm. The whole criteria are numerical. This is the formula to calculate the probability of numerical features :

$$P(X_i = x_i \mid Y = y_i) = \frac{1}{\sqrt{2\pi}\,\sigma ij} \exp^{-\frac{(xi-\mu ij)^2}{2\sigma ij^2}} \quad (2)$$

Where :

$P(X_i = x_i \mid Y = y_j)$ = Conditional probability of numerical features in each class.

μ_{ij} = Average of sample X_i ($\bar{x}$) from all data for training belongs to y_j class.

σ_{ij} = Final variance value of sample (s) from data for training.

σ^2_{ij} = Variance value of sample (s^2) from data for training.

These are the values of numerical features probability of participant named Kharisma Pramiswara.

Table 6. Numerical Features Probability Value of Participant Kharisma Pramiswara

CLASS	CRITERIA					
	PU	PK	SMS	SI	PIO	HK
INTELLIGENCE	0.0018	0.0453	0.0363	0.057	0.0453	0.0975
PHYSICAL	0.0112	0.0024	0.0226	0.0019	0.0018	0.0122
CREATIVITY	0.0781	0.0422	0.0325	0.0594	0.0946	0.0000

After numerical features probability found, the next step is to calculate the value of class probability. It is calculated by dividing the numbers of each class of the data for training by the total numbers of data for training. For instances, there are 3(three) data in intelligence class, and the total numbers of data is 10(ten). Then the class probability value for intelligence class are 0.3(point three). These are the values of class probabilities.

Table 7. Class Probabilities Value of Data for Training

CLASS	INTELLIGENCE	PHYSICAL	CREATIVITY
SUMMARY	3	4	3
P	0.3	0.4	0.3

Next step, is to calculate the probability of each class values. This calculation needs the value of numerical features probability of Kharisma Pramiswara. The calculation is doing by multiplying all numerical features probability values in the same class. These are the calculation formula for values of probability od each class.

P (Kelas) = P(PU | Kelas) × P(PK | Kelas) × P(SMS | Kelas) × P(SI | Kelas × P(PIO | Kelas) × P(HK | Kelas) (3)

This is the calculation of intelligence class probability :

P (INTELLIGENCE) = 0.0018 × 0.0453 × 0.0363 × 0.057 × 0.0453 × 0.0975
= 0.0000000007394

This is the calculation of physical class probability :

P (PHYSICAL) = 0.0111 × 0.0024 × 0.0226 × 0.0019 × 0.0018 × 0.0122
= 0.00000000000002649

This is the calculation of creativity class probability :

P (CREATIVITY) = 0.0781 × 0.0422 × 0.0325 × 0.0594 × 0.0946 × 3.718e-07
= 0.0000000000002237

After each class probability found, next step is to calculate the final probability of the data for testing. The calculation needs the value of each class probability and the class probability. Just simply multiply the value of each class probability with the class probability in the same class. Here are the calculation.

Calculation of final probability for intelligence class :

P (INTELIGENSI) = 0.0000000007394 × 0.3
= 0.0000000002218

Calculation of final probability for physical class :

P (FISIK) = 0.00000000000002649 × 0.4
= 0.00000000000001059

Calculation of final probability for creativity class :

P (KREATIFITAS) = 0.0000000000002237 × 0.3
= 0.00000000000006712

The last step of Naïve Bayes Algorithm classification is to compare the value of each final probabilities found. The highest value of final probability means the data is involved in that class. Highest value of final probability from data for testing is the value of intelligence class. This means that participant named Kharisma Pramiswara is involved in intelligence class.

2.3 Data Flow Diagram (DFD)

Data flow diagram is a developed methods of structured data system. DFD describe whole activities inside system clearly.

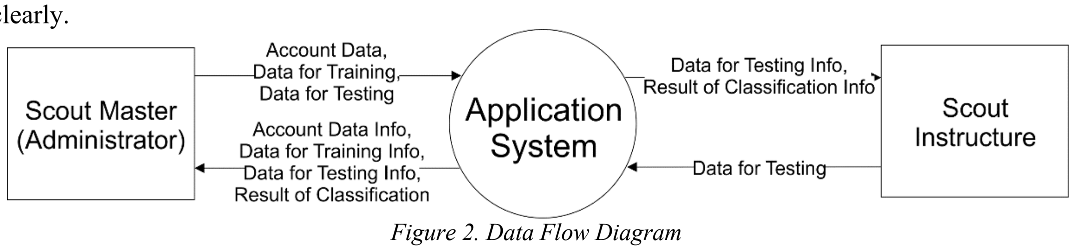

Figure 2. Data Flow Diagram

Based on figure 2, Scout Master is an administrator (Super user) of system, and the Scout Instructure as the user of system. Scout Master has full access of system. It can manage the data for training and data for testing, it also can access the classification process and get the result of classification. But the Scout Instructure as user, it only has access to manage data for testing and see the result of classification.

2.4 Entity Relation Diagram (ERD)

ERD is a main data modelling which help to organize data in a project into entities and determine the relationship between entity. ERD also a model to explain relation between data in a database based on objects which has relation between entity. In this case, ERD design explained the relationship between attribute which used in Naïve Bayes algorithm calculation.

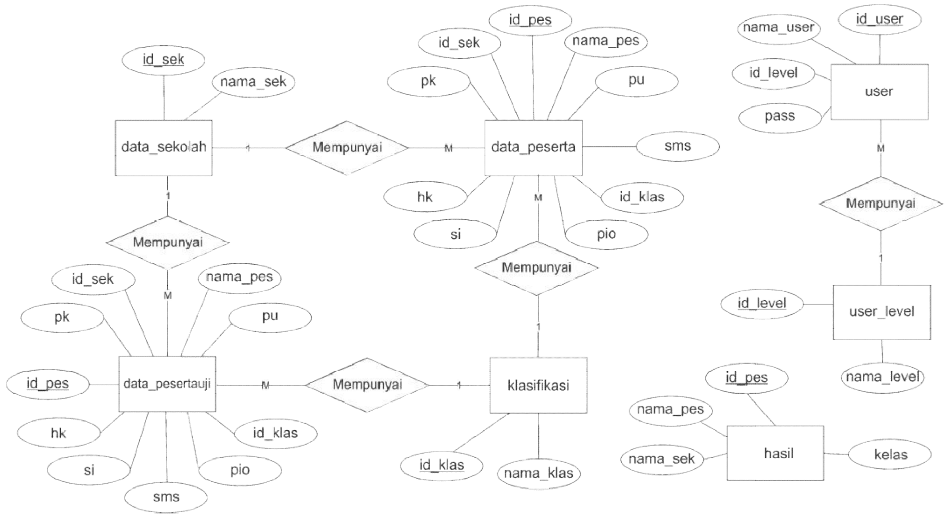

Figure 3. Entity Relation Diagram of System

3. RESULTS

This research resulted a program which has ability to classify the Scout skill owned by the Scout member. The program is Java Programming language based. Interface of the program is shown in figure 4.

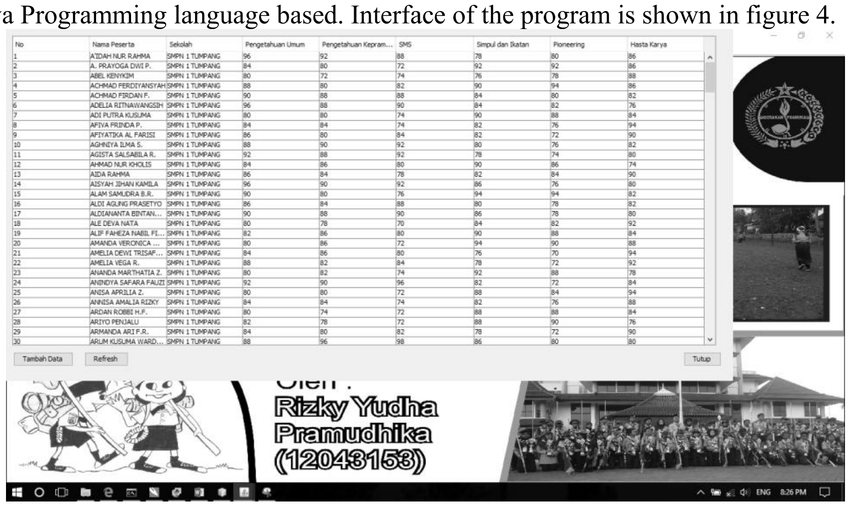

Figure 4. Master Data Interface of the Program

In the Master Data process, administrator can manage the data used by system. By click on the name of data, administrator can edit the details of the data.

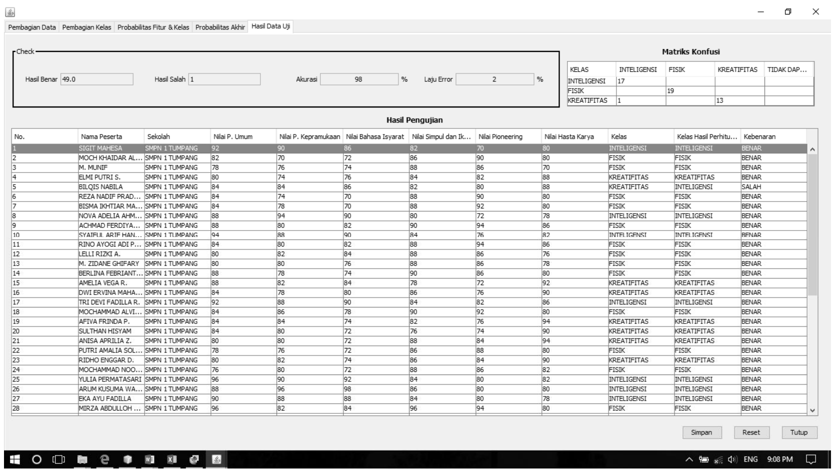

Figure 5. Classification Result in Naïve Bayes Calculation Process

To perform calculation, firstly the user has to set the data for training. The user simply type the number of the data used for training, and then click the “Set Data” button. And then, click “Set Data” button to set the data used for testing. User doesn’t need to set the number of data for testing. Because it is automatically test whole data available in the database. After that, just click the “Next” button and follow the steps. In the last tabbed pane, user will be able to see the result of the classification. There, user may choose if they want to save the result or not. Any unsaved classification result can’t be seen in the report page.

3.1 System Testing

Testing phase is performed to find the accuracy value of the calculation by system using Naïve Bayes Algorithm. Since the calculation of male and female participant are separated, the testing of the system also performed twice for each calculation.

Table 8. Testing Result Analysis

Testing	*Gender*	Numbers of Data for Training	Numbers of Data for Testing	Same Result with Real Class	Different Result with Real Class	Accuracy Value(%)	Error Value(%)
First	Male	150	125	125	0	100	0
	Female	150	140	140	0	100	0
Second	Male	207	125	125	0	100	0
	Female	240	140	140	0	100	0
Average						100	0

Can be seen in the table 8, with a part of data for training used, the accuracy of system calculation reach 100% for both gender. So as the testing using whole data for training available, the result shown that none of testing data classified differently with the real class or original class. This means, the accuracy of the programs reached 100%. The average of Accuracy reached 100% and Error value is 0%.

3.1.1 Analysis of The Effect of Data for Training Class toward Classification Result

From system testing, has been known that system accuracy reached 100%. Next, will be performed analysis toward testing with involving the data which classified inappropriately into the data for training. There are 60 inappropriate data for each gender. The class of the data have been changed into wrong classification. Here are the result.

Table 9. Analysis of The Effect of Data for Training Class toward Classification Result

Gender	Numbers of Data for Training	Numbers of Data for Testing	Same Result	Different Result	Accuracy Value (%)	Error Value (%)
Male	207	125	113	12	90.4	9.6
Female	240	140	134	6	95.7	4.3

As shown in Table 9, there are several different result calculated by the system. For male testing, there are 12 different result. The accuracy value decreased into 90.4%, and the error value increased to 9.6%. While female testing result in 6 different classification. Accuracy value is decreased into 95.7%, and error value increased to 4.3%. This is showing that the deciding of the class of data for training has effect toward the final result of classification using Naïve Bayes Algorithm.

4. CONCLUSION

Naïve Bayes Classifier algorithm has high level of accuracy in classifying the Scout skill. It reached 100% accuracy value while using all data available for training. They are 207 data for male, and 240 data for female.

Based on test results that have been done using accurate data for training, as well involving inappropriate data for training, can be known that variation of the class of data for training can affect the result of classification using Naïve Bayes Classifier Algorithm.

Determining the class when insert a new data for training can affect the variation of class probability in the calculation, so it affect the final result of classification using Naïve Bayes Classifier algorithm.

Since the data for training still picked randomly by system, it is suggested to develop the program with ability to choose the data for training. For the next development, the application developed based on web browser for a larger access by user.

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