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# Nominal Exchange System Design Currency Rupiah's Using Image Pattern Recognition

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## Abstract

The purpose of this study was to create a system of nominal currency exchange dollars using microcontroller-based image pattern recognition. The process is performed on this system is to detect the authenticity of money using ultraviolet light and a sensor to read the invisible image CMUcam3 rupiah, if the original money then the process is continued and if not then the money dispensed from the machine. Once the authenticity of money detected, the sensor will read CMUcam3 nominal rupiah is then processed by a microcontroller. The output of this system is that users can redeem their money from big to small nominal par. The method used to detect the authenticity of money and reading are nominal rupiah and fuzzy logic to select the nominal rupiah using a greedy algorithm. Results from this study is that it can implement a system of nominal currency exchange dollars using image pattern recognition.

Keywords: Patterns of Imagery, Microcontroller, Sensor CMUcam3, Fuzzy Logic, Greedy Algorithms.

## A. Introduction

The needs of people with technological development are inextricably linked, it is used to facilitate the work of man. Users of any variety, one of the business units that are very dependent on the technology is that virtually all banking transactions must be connected to the communications network.

There are several banks financial services, such as escrow services, loan services / credit, the provision of ATM services and others. However, a small money exchange services using ATM machines still used for public services.

Lack of services for small money exchange makes public trouble finding money changers, be it diwarung-stalls, supermarkets, friends and so on. One exchange service to manual trading services exchange is small money, when someone needs a small money exchange providers then sell them at a nominal price of money is greater than the amount of money being exchanged.

Based on the problems the authors have described an initiative to examine the money changers in the field of automation with intelligent systems and lifting the title "Systems Nominal

Exchange Currency IDR Using Image Pattern Recognition". Hopefully with this research will provide benefits to the community, state and nation.

## B. Problem Formulation

1. How to create a System Nominal Exchange Currency IDR Imagery Using Pattern Recognition.
2. How to make use of ultraviolet light to detect the authenticity unag and sensors to detect patterns of imagery CMUcam3 currency.
3. How to use the microcontroller as the central data processing.
4. How to use the Fuzzy Logic method to detect the authenticity of money and nominal currency and greedy algorithm to process the exchange of currency.

## C. Research Objectives

1. Creating Systems of Nominal Exchange Currency IDR Using Image Pattern Recognition.
2. Make use of ultraviolet light to detect the authenticity unag and sensor to detect patterns of imagery CMUcam3 currency.
3. Using a microcontroller as the central data processing.
4. Using Fuzzy Logic method to detect the authenticity of money and nominal currency and greedy algorithm to process the exchange of currency.

## D. Overview of Research Findings

Research money exchange system has been conducted by previous researchers, including the "Design Template Matching On Microcontroller-Based Machine Coin Exchange" [1]. In this study using templete matching method which is the application of value of paper currency recognition using sensing technique of color then issued paper money in the form of coint.

Other research is "Automatic Money Exchanger Simulation menggunakan Visual Basic

6.0" [2]. This study discusses the automatic money machine exchangers are designed in the form of a simulation using Visual Basic 6.0.

In the development of this study are still many in the form of a design that has not been implemented, as some posts and blogs that write diwebsite designing vending machines onsite ATM dime. There is also research on the Pens on the introduction of the currency that is the object recognition system money in the vending machine prototype.

## E. Review of Theory and Concepts

### 1. Image Processing Microcontroller

The word image, known widely by the word "image" can be interpreted as a two-dimensional light intensity function, which is expressed by  $f(x, y)$ , where the value or amplitude of  $f$  at spatial coordinates  $(x, y)$  expressed the intensity (brightness) image at that point. Meanwhile, according to Webster's dictionary, the image is a representation, likeness or imitation of an object or objects [3].

Research related to image processing using the microcontroller is "Image Processing System Stand-Alone Microcontroller-Based Economy" [4]. In this study introduced the realization of a complete image processing system is stand-alone and economical.

Other research is "Digital Image Processing Applications For Control Switches Based Layout and Font Color" [5]. In this study discusses the design and manufacture of tools that can control remotely using wireless communication with the position of the image display as a switch so that the switch can be controlled directly know.

Other research is "Design of Microcontroller-Based Robot Runner ATmega8535" [6]. In this study discusses drawing robots built by synergizing capabilities of image processing with electronic hardware and mechanical performance of the robot. Image processing is done by converting true color image into a grayscale image and binary image.

Other research is "Identification of Authenticity Currency IDR Through Invisible Ink Using Fourier Transform-Based Neural Learning Vector Quantization" [7]. In this study discusses about the software that is able to identify the authenticity and currency of nominal dollars through one of the characteristics of currency that is invisible ink.

### 2. Sensor and Transducer

The sensor is a device that serves to detect the symptoms or signals originating from a change of

energy such as electrical energy, physical energy, chemical energy, biological energy, mechanical energy and so becomes the voltage and electric current [8].

The transducer is a device which, when actuated by an energy in a transmission system, will channel the energy in the same form or in a different form of the transmission system to the next. Transmission bias in the form of electrical energy, mechanical, chemical, optical (radiation) or thermal (heat) [8].

### 3. Camera Sensor CMUCam3

CMUCam 3.0 has a color camera sensor and controller integrated processing image data so that data processing operations can be done more quickly. Before it can be used, then the camera sensor CMUCam 3.0 must be programmed in advance.

For reading data from the camera, the camera sensor and microcontroller CMUCam connected in series with TTL voltage levels. After the microcontroller sends a command to the camera sensor to transmit RGB sensor readings [10].

Instruction used in this case is `GM \ r`. This instruction will send the results of the average RGB readings from the major that have on-set. Default of camera sensors for large Frane CMUCam that is sampled from the Cartesian coordinates (0,0) to (88.144). To read the data of an object is required width of the frame is smaller [10].



Figure 1. CMUCam3 Camera Sensor [10]

### 4. Original Money Detector (Ultraviolet)

In this study the technique used to detect the authenticity of the rupiah is using ultraviolet light. There are several related research, including the "Validity and Recognition System Nominal Rupiah Banknotes with Histogram Intersection Method and Integral Projections" [14], the purpose of this study was the introduction of paper money the validity of selection methods using color histogram intersection method and the introduction of nominal money using integral projection method [14]. To determine the validity of paper money, there are several things that must be considered as a security thread, watermarks, different colors and textures, and materials of paper used.

Other research is "Software Identification Nominal Value and Authenticity Rupiah Banknotes Using Artificial Neural Networks" [15]. In this study, the imaging of paper money comes from two sources, namely the image appears (visible image), which is derived from 300 dpi scanner, and invisible (Invisible Image), which uses ultraviolet light [15].

In this study, the value of money is taken by Invisible image to be captured by the camera sensor CMUcam3. Here's an example of a currency that is irradiated by ultraviolet light.



Figure 2. Invisible Image Rupiah [15]

From the picture above it is clear that there are different of contrast between the nominal one another, from sinyl generated will be captured by the camera sensor CMUcam3 to be processed and processed if the money is genuine or fake.

5. Microcontroller

Microcontroller is a microprocessor system in which there already exist a CPU, ROM, RAM, I / O, Clock and other internal devices are already connected and organized (teralamati) with either by the manufacturer and is packaged in a ready-made chips. So we live program ROM contents of a rule use by factory membuatnya [11]. Microcontroller is a computer system that all or most of the elements are packed into a single chip IC, so it is often called Single Chip Microcomputer.

6. Fuzzy Logic and Algoritma Greedy

The method used to recognize the authenticity and the nominal rupiah is Fuzzy Logic. This method is used because at the time the system will take a decision on the nominal rupiah will take

some sample data from the nominal currency based on the color. When this method detects sample almost close or very close to the nominal value of the currency, the system can instantly give a decision of the nominal value of the currency that is detected by the system.

Fuzzy logic if in the Indonesian or Fuzzy logic is a technique / method used to overcome the uncertainty on the problem that has many answers. Basically Fuzzy logic is a much valued logic / multivalued logic that is able to define the values between the conventional state as true or false, yes or no, white or black, and others [17].

The algorithm used to select the nominal rupiah currency to be exchanged is the greedy algorithm. Greedy algorithm is a common algorithm to solve the optimization problem, although the results are not always the optimum solution. Corresponding literal sense, means Greedy greedy. The main principle of this algorithm is to take as much as possible what is available now [18].

F. Design Research

He design of this study is to focus on Nominal Exchange System Currency IDR Imagery Using Pattern Recognition. There are several stages in the design of this study are:

- a. Mechanical Design
 

In this design is an early stage in the design of a prototype of the machine will be in control of the money changers. Perancangan Elektronika
- b. Electronics Design
 

In designing this is the stage where the load range of electronic components to produce the nominal exchange system rupiah from large to small.
- c. Design of Algorithms, Methods and Programming
 

In designing this is the stage where the existing machine is programmed using Bascom AVR programming language by applying fuzzy logic and Greedy algorithms.

G. System Architecture

In this system architecture, there are 3 main parts: input, process and output. Here's a picture of the architecture of the system.

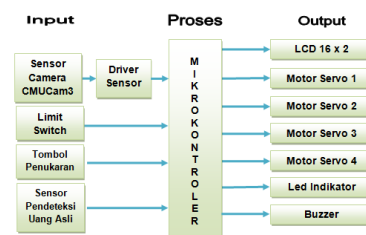


Figure 3, The design of System Architecture



Input of this system is a camera sensor, original money detection sensors and limit switches and buttons. The camera sensor is used to detect the input nominal rupiah currency, real money detection sensors used to detect the authenticity of money, if the original system will process and if not then the money will be spent.

Button on the input function to determine the amount of currency to be exchanged based on the face value and the limit switches function to control the movement of the machine. The process of this machine is to use sensors and microcontrollers ATmega8535 driver. On the microcontroller will be given so that the program can process the system based on those inputs from the sensor.

The output of this machine is able to exchange money based on the number of desired nominal. There are several components that are controlled servo motor is used to drive the mechanical machines, 16 x 2 LCD, buzzer and led indicator serves as a special information from the user machine to the money changers.

**H. Design Layout System**

Here's the layout design system to be built.



Figure 4, Layout Design System

In designing the layout of the above there is a place to put money, after money is inserted, the ultra violet rays will be active and check the authenticity of the money, if the money is genuine then the process is continued, and if money is fake then it will be removed. When money is processed CMUcam3 sensor will read the image from the money, after which the incoming data to be sent to mikrokontroler CMUCam to be compared based on data that have been in the program fuzzy.

If nominal currency is detected then the money will be kept in place and then displayed on the LCD the total amount of money that goes. After that please press the nominal exchange nominal amount of money required, there is a button up, down, ok, cancel and select. If desired nominal amount was sufficient then press ok then the engine will process. At the time of the processing machine, the motor will move to withdraw money that is on the machine then put the box in making money. The following process flow of the system layout.

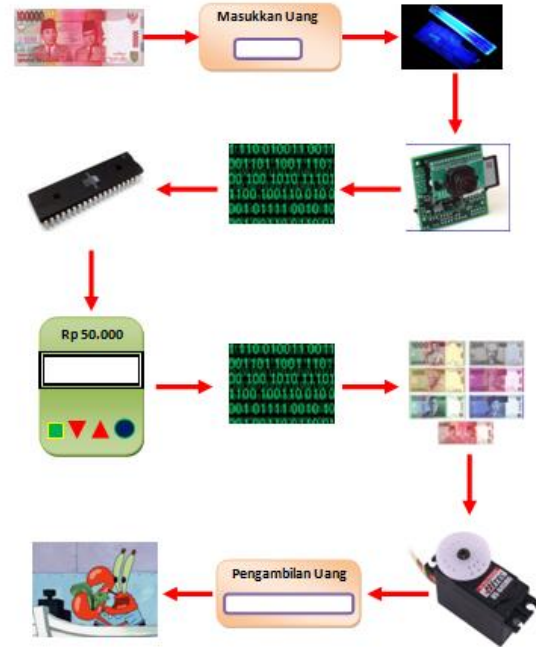


Figure 5, Process Layout System

**I. Stages of Research**

There are 5 stages in the design of the study penialian nominal rupiah exchange are:

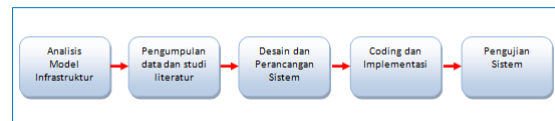


Figure 6, stages of Research

a. Analysis model of infrastructure

At this stage the researchers conducted an analysis of model and infrastructure that will be built in the system. This analysis stiffened so that when researchers do the designing and pembuatans systems and machines did not experience many obstacles and can make sure that the design calculations, models and infrastructure in accordance with the desired.

b. Data collection and study of literature

At this stage, the authors collected data and the existing literature, the goal is to seek input as well as the weaknesses in the system of currency exchange dollars before.

c. Design and System Design

At this stage the researcher doing the design and system design. Based on the studies that have been done before it will generate a new design system based on the currency exchange dollars face value.

## J. Testing System

Testing the overall system gradually in accordance with the modules based on the architecture of the system has been designed. Following the testing stages of a currency exchange system based on nominal dollars.

### 1. Performance

Assessment overall system performance when the user is operating the machine this currency exchange system, ie the user enter the rupiah currency in accordance with the desired nominal, after which it can choose the nominal value of the rupiah who want redeemable for the amount desired by the user.

### 2. Security

Security testing can be done by using real money detection sensors on the engine system. If money is the original detected then the process is continued, if not then there will be a warning buzzer and the message that the money was counterfeit and the money spent. It should also be done periodically testing the safety system so that the possibilities of undesirable unavoidable from the system.

### 3. Reliability

The ability of the system to adapt to the failure of one or more of the equipment in the system. This test can be done by simulating the failure of one system devices. This parameter does not require the system to be constantly running normally for the entire test case. This section is to show the reliability of the system on different levels of interference that may occur.

### 4. Usability

This test will test the ease of system operation. The user or the user can easily use this money exchange system. It can also be assisted by the use of information on the side of the machine specific, so that when there are users who will use the

money changing machine system can be easily and understand in order to use it.

## K. Conclusion

The public need to exchange large to small nominal money is very large when the main religious festivals and particular needs. With the engine nominal rupiah currency exchange is expected to help people who want to exchange money. In this study the authors will gradually develop a research design to a process expected to be completed. Stages in this system is the input, process and output. Input of this system is the sensor readings authenticity rupiah using ultraviolet light and fuzzy logic method for decision making. If the original process continues for detecting nominal currency of dollars, if not the money will be issued and the process is complete. The process of this system is the microcontroller reads the input from the sensor and then process the data. The algorithm used to process the data and choose the nominal currency to be exchanged is the greedy algorithm. The output of this system is the motion of the motor to drive the machine and withdraw the money as desired by the user.

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# Model Distance Learning Programming Web-Based Algorithm for Improving Student Learning Outcomes High School of Information and Computer Management (STMIK) Handayani

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**Abstract.** Research of web-based learning model is bertujuan to obtain results on the system open and distance education (PTJJ) algorithm programming via internet concept of interactive multimedia website in the search for models of distance learning algorithms. The specific objectives are to obtain: (1) To determine the learning model appropriate programming algorithm that is shown in the distance learning using the Internet. (2) To develop a model of learning appropriate programming algorithm with the concept of distance learning using the Internet. (3) To find out how much the effectiveness of distance learning models pemrograma algorithm for faculty through distance learning website. The research method is digunakan development (Research and Development), which was adopted on Bord & Gall, (2003)<sup>1</sup>. The results showed that student achievement increased STMIK Handy after using this model.

Keywords: Pmbelajaran, Distance, algorithms, web.

## I. Introduction

The learning process is a process of interaction with learners and educators learning resources in a learning environment. Effective learning course will give good impact in teaching and learning so that lessons can diajarkanpun well accepted by learners. But apparently receipt of subjects with each other may be different during the learning process, there are subjects that can be accepted easily by the students, but there are also subjects that difficult to accept. Call it learning algorithms and programming that are the basis of further lessons like learning about programming languages.

Algorithms are the heart of computer science or informatics. Many branch of computer science that leads to in terms of algorithms. But do not assume the algorithm was always synonymous

with computer science course. In everyday life there are too many processes are expressed in an algorithm. How to make a cake or a dish that is expressed in a recipe can also be referred to as an algorithm. In each recipe there is always a sequence of steps to make dishes. If steps are not logical, it can not be produced cuisine desired. In general, the (objects) are working on a process called processors (processor). The processor may be a human, a computer, robot or other electronic devices. Processors perform a process to carry out or "execute" the algorithm which outlines the process.

Based on the results of our interviews to programming course lecturers say that 65% of students studying languages is difficult due to the poor knowledge of the algorithm. Therefore, the College of Information and Computer Management (STMIK) Handy as one of the universities in the field of informatics algorithms to make the course as a prerequisite for all programming languages.

Therefore we need an alternative learning model that students not only get the theory of logic, but also a visualization of the logic so that the lessons can be easily understood. It is based on the tendency of the human brain is more sensitive to the visualization of the only reading and listening. Alternatives that can be given in this case is the application of distance learning site that contains interactive multimedia content on the sidelines of learning, so the learning process is not too monotonous, because the monotony of learning can certainly make a student which in this case is an object lesson would be easily bored . Distance Learning Web is a web-based application that can be an alternative on the sidelines learning in the

classroom so that teaching and learning are not too monotonous.

Distance Learning using the website is a model of distance learning with a focus on students and learning through the internet (Samamora, 2002)<sup>2</sup>. Students use the lab facilities to access material or messages over the Internet (website). This study will not address all the issues of learning, but only on the issue of making software distance learning using the Internet. The learning process is a process of interaction with learners and educators learning resources in a learning environment. Effective learning course will give good impact in teaching and learning so that lessons can diajarkanpun well accepted by learners. But apparently receipt of subjects with each other may be different during the learning process, there are subjects that can be accepted easily by the students, but there are also subjects that difficult to accept. Call it learning algorithms and programming that are the basis of further lessons like learning about programming languages.

Algorithms are the heart of computer science or informatics. Many branch of computer science that leads to in terms of algorithms. But do not assume the algorithm was always synonymous with computer science course. In everyday life there are too many processes are expressed in an algorithm. How to make a cake or a dish that is expressed in a recipe can also be referred to as an algorithm. In each recipe there is always a sequence of steps to make dishes. If steps are not logical, it can not be produced cuisine desired. In general, the (objects) are working on a process called processors (processor). The processor may be a human, a computer, robot or other electronic devices. Processors perform a process to carry out or "execute" the algorithm which outlines the process.

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## II. Problem Formulation Research

Based on this research question can be formulated the following issues.

1. How does learning model appropriate programming algorithm with the concept of distance learning using the Internet?
2. How does learning algorithms Model Development programming in accordance with the concept of distance learning using the Internet?
3. What is the effectiveness of distance learning models pemrograma algorithm for faculty through distance learning websites?

## III. Research Objectives

The general objective of this study was to obtain results on the system open and distance education (PTJJ) algorithm programming language via the Internet concept of interactive multimedia website in the search for models of distance learning algorithms. The specific objectives are to obtain:

1. To find out the Learning Model appropriate programming algorithm that is shown in the distance learning using the Internet

2. To develop a model of learning appropriate programming algorithm with the concept of distance learning using the Internet
3. To find out how much the effectiveness of distance learning models pemrograma algorithm for faculty through distance learning website

#### IV. Review of Literature

##### A. Learning Outcomes

Achievement is the result of an activity that has been done, created, either individually or in groups. Achievement will never be produced without a good effort in the form of knowledge and skills. Furthermore Nasrun Harahap et al (1991)<sup>3</sup> provides that the limitation is the assessment of educational achievement on the development and progress of students with regard to mastery learning material presented to them and the values contained in the curriculum. From some of the achievements noted above, visible differences in emphasis, although the same essence, which is equally the result of an activity and effort. For it can be understood that the achievement is the result of an activity that has been done, is created, which is pleasing to those obtained with the tenacity of work, both individually and in groups in the field of a particular activity.

Learning is a process of change in behavior as a result, the interaction between the individual and his environment. The ability of people to learn is an important feature that distinguishes the type of the types of creatures.

##### B. Learning Model

Arens (in Trianto 2010)<sup>4</sup> suggests that the learning model is a plan or a pattern that is used as a guide to plan for learning in the classroom. The learning model refers to the learning approaches will be used including the teaching objectives, the stages in the learning activities, the learning environment and classroom management. This illustrates that a teacher or Tutor should mempelajari first learning objectives to be achieved and the next steps that will be passed.

Joyce & Weil (Rusman 2010)<sup>5</sup> provides a reinforcement learning model that is a pattern or plan that can be used to mebentuk curriculum

(lesson plans long-term), merencanakan learning materials and implement in the classroom or other learning. Their opinions are in line with Brady (in Rusman 2009)<sup>9</sup> that the learning model can be interpreted as a blueprint that can be used in preparing and implementing teacher learning. To understand further the learning model he put forward four premise of learning models, namely: a) the model gives directions for the preparation and implementation of learning activities. Because it is loaded with practical implementable rather than theory-laden. b) although the learning model is different but the separation between one model to the other is not deskrit, but have relevance. c) none of the learning model is better than other learning models. Not satupu learning model that can realize various types and different levels of learning objectives. d) the teacher's knowledge of the learning model has significance in realizing the efficiency and effectiveness of learning.

Joyce (in Trianto 2010)<sup>4</sup>, argued that "Each models guides us as we design instruction to help studens actieve various objectives". The quote makes clear that a faithful model chosen to direct the teacher in making instructional design, so that lead learners achieve the learning objectives. Kardi and Nur (in Trianto 2010)<sup>4</sup> suggests four specific characteristics of learning models, namely: (1) rational logical theoretically designed by the creators and developers (2) the rationale of what and how students learn (3) tingka behavior of teachers needed to the model can be implemented successfully (4) learning environment necessary for learning objectives can be achieved.

##### C. Algorithm Programming

According to Muhammad Sjukani (2010)<sup>6</sup> algorithm is a train of thought to complete a job, as outlined in the written form that can be understood by others. Asperk is emphasized here is the train of thought. The

flow of one's mind can be different from the flow of the thoughts of others to complete the same job.

Meanwhile, according to Rosa A. S (2010)<sup>7</sup>, the algorithm is the solution of a problem that must be broken down through the computer. The algorithm must be made sequentially so that the computer can understand and execute. The algorithm is the foundation that must be mastered by every student who solve a problem in a structured, effective, and efficient, again especially for students who wish to develop a computer program to solve a problem (Suarga, 2006)<sup>8</sup>.

Based on some opinions about algorithm terms, it can be concluded that the algorithm is a step by step procedure or langkah-step sequence or finite instructions from start to finish are arranged in a logical and systematic way to get a solution to a problem, solving both correct or wrong.

#### D. Model Distance Learning

By CARL 2005 (in Tri Darmayati, 2007)<sup>9</sup> that the web is a convenient means for remote pembelajaran in offering courses and students find the information needed. For example, by telephone, voice mail or melalui teleconference and videoconferencing. Developments in information technology have a positive impact on educational innovation, both in terms of services and thus potentially give media learning models that give the effect of a more meaningful learning experience so that the goal can be achieved pembelajaran.

Distance Learning Model to be a trend with the creation of various carrying capacity for a learning process that can be monitored remotely with a wider range and more flexible time. Model of distance learning can not give a solution to learn with time and space barriers that must be fulfilled in the activities during this tutorial.

Encyclopedia of Distance Learning (Steven Baxendale in hasbi 2009)<sup>10</sup>, namely: "The acquisition of knowledge and skills through mediate information and instruction, Encompassing all technologies and other forms of learning at a distance. Distance education and training technologies result from the separation of teacher and learner sandwich then frees the student from the necessity of traveling to a fixed place at the fixed time, fixed to mean a person, in other to be trained".

Munir (in Sri Rahayu, 2010: 7)<sup>11</sup> mengemukakan that distance education as a model of distance learning is not new. From the start of the simple technology of data used for the process of developing distance learning so that information technology contributes to the system and the lesson that way. Web-based distance learning model is expected to contribute effectively to the achievement of learning programs such as intellectual competence, which will be measured in this study.

#### E. Model Learning Algorithm

Distance Learning web learning model provides considerable benefits both for students and for faculty as custodian of the course. For students can improve learning motivation in learning and teaching materials given to understand easily because students enough me-click navigation buttons that have been provided, coupled with the view that comes with interesting images and animations make the students excited to learn. Besides, students can study the course materials anytime and anywhere he is. Furthermore, for teachers / lecturers, can provide easily manage teaching materials, either add material, add or replace exercises can easily be done because all the material has been well documented in a place without having to search in multiple locations, updating of the material can be done easily with a standard format.

Based on the exposure of the aspects of goals or objectives that need to be developed in the form of learning programming algorithm, the programming model of learning algorithms that will be developed is in the form of a live streaming. That is live streaming be learning model selected programming algorithms to be developed at the School of Information Management tigggi Handy

Makassar. This model is expected to create attractive and young learners remember such events to hear, see, read, act, observe and describe and solve the problem. There sages Konfosius (Silberman, 2004) <sup>12</sup> said that I hear, I see I remember, I do I understand, then, if these activities are done jointly result will be maximum.

Among the various models of teaching does not contradict each other, but are complementary. The difference is only on the selected strategy, which is adapted to teaching purposes. Joyce and Weil (1980 Rusman, 2010: 7) <sup>12</sup> defines the learning model as a conceptual framework used to guide the conduct of learning. Thus, the learning model is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve learning objectives. According to Joyce, Weil, (1980 in Rusman, 2009: 7) <sup>13</sup> There are five essential components as a description of a learning model, ie (i) syntax, which is a sequence of events is usually called phase, (ii) a social system, ie the role of teachers and students as well as the types of rules are required, (iii) the principles of reaction, ie, to give an idea to the teachers on how to view or respond to queries of students, (iv) support system, the device and the conditions required by the model, and (v ) instructional impact and effects of accompaniment, the results will be achieved after following the learning of students. According to Arends (1997 in Trianto 2010) <sup>14</sup>, characteristic of the learning model are: (i) the theoretical rational logical danbersumber of its design, (ii) the rationale of the learning task to be achieved and how students learn to achieve these objectives, (iii) teachers teaching activities necessary for the learning model can be implemented effectively, and (iv) the learning environment needed to achieve the goal.

#### V. Methods

This research is a development (research and development) adopted on Bord & Gall, 2003 (in Anif Gufron, 2011) consists of a Preliminary Study Iyang (initial literature review and survey), Research Planning, Product Development, Field Test enjoy unlimited (freliminary field test), Revised Limited field test results, field Test Area (main field test), Revised results of field Test Area, Eligibility test

(operational field test), Revised Eligibility test Results, Dissemination and Dissemination of Final Product.

#### VI. Research Results

To determine the level of effectiveness of the model Distance Learning, then the user is given the faculty questionnaire assessing the effectiveness of Distance Learning models that include aspects of validity, reliability, objectivity, systematic and practicality with the total number of items as many as 20. Each statement aspect assessed with alternative assessment: highly well (scored 4), good (scored 3), less (given a score of 2) and very less (given a score of 1) .menyajikan summary of teacher ratings of learning user models in general algoritma.Secara lecturer considered that the long distance learning models has validity, reliability, objectivity, systematic and good practicality. This is illustrated by an average score of 3.1 each (valid), 3.3 (reliable), 3.4 (objective) and 2.7 (practical). Thus far the model Distance Learning can be said generally considered effective by the faculty in assessing the level of performance on learning mahasiswa STMIK handayani programming algorithm. Assessment results of student performance on the cognitive domain is done by giving a written test (description / open) to measure the level of student understanding. Assessment of performance of students in the affective domain is done by lecturers using the observation sheet of the attitudes and behavior of the students during the learning algorithms. Assessment in this realm include aspects of a discipline, attitude suitability, appropriateness of behavior and loyalty / commitment. Assessment of performance of students in the domains of psychomotor aspects of the work step accuracy, precision finish about pascal programming lab. Product assessment includes aspects of timeliness workmanship. and suitability of the results with the specification. The final results



showed that an increase in student achievement of the three shutter (cognitive and psychomotor afrikti), this indicates that the model of distance learning using the web is very effective.

## VII. Conclusion

Development of distance learning models using the web in this study has four (4) main characteristics: (1) cover the entire realm of learning objectives, namely cognitive, affective and psychomotor, (2) integrating the assessment with the learning process, (3) bring the charge and assessment processes in the workplace (industrial) with the assessment process at high sperguruan and (4) a process-oriented nature of formative assessment. Based on the research results, the following are the principal conclusions into the findings of this study.

1. Learning Model based distance learning web programming algorithm consists of a number of the instrument on the aspects of affective, cognitive and psychomotor. The instrument has been shown to have high levels of validity, reliability, objectivity, good practicality and effectiveness.
2. Application of Long-distance learning models applied in the learning algorithms to provide accurate information about the performance of students covering aspects of attitudes and behaviors, understanding of the learning log programming algorithm
3. Information on the assessment results of Distance Learning models are mainly used as feedback to students and reflection for faculty has been successful in increasing the effectiveness of the learning process.
4. The level of feasibility and effectiveness of distance learning models in the learning algorithm is quite high. This is evident both from hasilpengamatan direct and empirical results.
5. Based on the test results, either jointly or alone alone treatment groups using a model

Distance Learning has provided the achievement significantly better on cognitive, affective and psikomorotik compared with the group that uses conventional assessment.

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# Analysis Of Energy Use On The Computer And Design Of Supply Using Solar Power For Remote Schools

Abdul Muis Mappalotteng<sup>1</sup>

**Abstract** - Most of the computer users may not be aware, that opens up more application programs will increase the electrical energy consumption for the computer. One side of the many users who behave thus, on the other hand there are still many users who cannot enjoy the energy. This is because there are many remote areas that have not drained electrical energy. For this school its own of problems. They cannot use the computer in administrative activities and learning in schools,

This paper aims to analyze the use of energy at the time of running the application programs, and designing a solar power plant, for the purposes of the power supply for a computer at a remote school. The analysis is based on the energy usage of hardware and software that operate. The hardware used and the software that operate these greatly affect energy needs.

The results showed that the use of the hardware that is too much, and operate the software greatly affect energy usage. Another finding is the amount of power needed to run the PC with CRT monitor is 279 Watt. With that much power, needed for 5 x 100 Wp solar panels, batteries 2 x 100Ah and inverter 1000 Watts.

**Keywords** - Energy, Computer hardware and software, solar power.

## I. INTRODUCTION

The computer is one of the electronic devices, which can work if given electrical energy. Son said that the Information Technology (IT) needs to be powered electrical energy [1]. The use and utilization of IT tools by the community resulting in increased demand in the use of electrical energy. One of the considerations in finding the IT devices, such as computers is performance. People do not realize that with the high performance, resulting in the use of electrical energy as

well. Power consumption is a large unfavorable impact for the user. Users need to spend a large part of the energy it uses. According to the Son, is the energy used is wasted and not fully utilized [1]. This resulted in futility in energy use.

On the other hand many people in remote areas who do not yet enjoy the energy. Especially in the electrical energy supply by PLN. Based on the ratio of national electricity, electricity condition in Indonesia is still felt not to meet the principles of justice and equity. This is understandable because of the availability of electricity from time to time is always smaller than the growing need. In addition, other constraints are seemingly still set on the status of management of electricity as a basic infrastructure (such as public infrastructure like-roads, bridges, ports, etc.) or the status of electricity as a commodity [2]. Several initiatives have been proposed, one option is to specify that the power plants that use natural resources to recover or renewable (without particular fuel), should be treated as a basic infrastructure for the community, while the power plant is built on islands and major cities established and quality should be established as a commodity.

Electrification ratio in Indonesia until 2009 reportedly reached an average of 66%, but in Eastern Indonesia region has not reached 45% [2]. The level of use of electricity for the people who commonly expressed in per capita electricity consumption, also was still far from adequate. For comparison, the data of 2005's in the United States with a Gross Domestic Product (GDP) in the community an average of about US \$ 35 000, - per year it reached 10,000 kWh of electricity consumption; The European Union with an average GDP of US \$ 18,800 communities, - electricity consumption is about 5,700 kWh; Singapore and Malaysia with an average GDP communities above US \$ 6000, - electricity consumption is about 3,000 kWh; while in Indonesia, if divided by the average population of only 500 kWh, even this with a note that in fact the people who already enjoy this quality power only around 65% of Indonesia's population.

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Unequal distribution of electric energy utilities, the impact on the schools that cannot take advantage of IT devices, especially computers. They have not been able to enjoy the full potential of electricity, especially that supplied by PLN.

The best way to cope with the demand for electricity in remote areas is to utilize the natural resources, such as wind power, water power, or solar power. The latter sources are available everywhere, but not every time can be utilized. Wind power or hydropower, is only available in certain areas only. Therefore, in this study, computer power supply design using solar energy, with consideration of solar light available everywhere. Indonesia is one country that has the resources in sufficient quantities solar energy abundant. Management of energy resources appropriately in turn will improve the welfare of society in general. Location of Indonesia that is at the equator is at latitude  $6^{\circ}$  -  $11^{\circ}$  N latitude and  $95^{\circ}$  E -  $141^{\circ}$  E, and having regard to the circulation of the sun in a year in the region of 23.50 N and 23.50 LS then Indonesia will be always exposed to the sun for 10-12 hours a day [7].

Due to the location of Indonesia is at the equator, Indonesia has a solar radiation level is very high. According to the measurement from the center of the Meteorology and Geophysics Agency estimated the radiation falling on the surface of the Earth Indonesia (especially in Eastern Indonesia) on average approximately 5.1 kWh / m<sup>2</sup> day the monthly variation of about 9%. Since the last few years, researchers began to change his opinion on the use of existing energy sources in Indonesia.

Reference is used as the basis for calculating the energy needs of the power computer is the hardware used and the power used by the software during the exercise.

## II. LITERATURE

### A. Solar Panels

Photovoltaics (PV) is a module that directly convert solar light into electric current [5]. Certain materials, such as silicon, naturally release electrons when they are exposed to light, and these electrons can then be used to generate electric current. PV panels produce direct current (DC), which must be converted to AC current (Alternating Current), An inverter is used to convert DC power into AC power to run household appliances are generally standard voltage of 220 Volts. The amount of electricity produced by the inverter is measured in watts (W).

The operation of the solar cell is highly dependent on [8]:

- a. Ambient water temperature

- b. Solar radiation (insulation)
- c. Speed wind blowing
- d. The state of the earth's atmosphere
- e. Orientation panels or PV array
- f. Position where the solar cell (array) to the sun (tilt angle)

### B. Controller

Equipment Controller serves to protect the battery from charging and excessive use (discharging) the battery resulting in excessive battery quickly broken. To protect the battery so that is not easily damaged controller disconnects between solar modules and batteries before the batteries reach the stage of evaporation of water batteries (casing) which indicates a full battery and when the battery is almost empty water batteries which will change the nature of sulfuric acid into the water, controller disconnects the battery to the load (light). The selection is determined by the capacity of Controller Nominal Voltage and current Input / Output openness. Battery Control Unit (BCU) usually called the Controller or the regulator [8].

The controller serves to protect the battery from charging too full or exceed the capacity of the battery and protects the battery from excessive consumption or capacity of the battery becomes discharged. Controllers must break the link between the load and the battery before it runs out of battery capacity. Making Controller in order to function properly depending on the design of the manufacturer.

Controller input current is the minimum amount of current coming from the solar module to the controller. In general, the planning controller has a maximum limit of allowable input current. For example, for charging stations 50WP Solar modules produce a short circuit current  $\pm 25$  A so that the controller is 30 A, so that the safety controller

### C. Battery

Battery on a more appropriate centralized solar power plants system serves as electrical energy storage chemical in the day and serves as a power supply at night. The battery consists of a number of electronic cells and will produce an electric current when a load between the two electrodes.

### D. Inverter

The inverter has a function to convert the DC voltage of the panel and a battery into AC voltage which can be used to supply the computer. By users who previously channeled through the distribution network before it gets to the house residents.

### E. Computer Power Supplies

Fakhar (2012) in the journal entitled "Level Green Computing Software For Large Scale Systems", concluded that the optimization of the energy savings can be seen in terms of hardware and software. Energy optimization in terms of hardware implementation of a process derived from a smaller silicon geometries, detection auto idle, and active well biasing techniques. In terms of the software implemented in the operating system by analyzing the techniques that are currently active process energy requirements [6].

Energy can also be saved by developing software that do the analysis and make the design. Saving energy use of an optimization software on the computer can produce.

To calculate the power requirements on the computer, the author cites the use of the computer power of the research that has done by Ananda [3]. The results of the research that has been done shows the average electrical energy consumption to 10 units of computers using a CRT monitor is at 2790 Watt and 1854 Watt with computers using the LCD monitor. When averaged for a single unit of a computer with LCD monitor means for 185.4 Watt, and 279 Watt for computers using CRT monitors.

For efficient use of energy, running application programs affects the energy consumption by a computer. Results of research conducted by Crown [1], find the amount of electricity savings when using certain software applications, and running one application at a time only. The savings that can be made for 53.6%. This needs to be considered in designing a solar power plant for the computer rationing.

Furthermore, from measurements taken, a portable computer (laptop), requires power 65Watt. If the computer is being used, the specification required a smaller device.

## III. DISCUSSION

### A. Calculation of solar power plants

To get solar power resources are reliable, careful analysis of the needs of the plant equipment is needed. This analysis is based on the installed capacity of the panel, taking into account the power requirements of computer to be used.

#### 1. Need Solar Panels

There are basically two ways to calculate the need for solar panels, the first by knowing in advance how much load to be connected to solar power, the second is to first determine the power of solar panels that will be used.

In this design, the solar panels to be used with a capacity of 100 Watts Peak (WP). Time effective solar radiation in a day is 5 hours. Thus the solar panel is capable of supplying electrical energy at  $100 \times 5$  hours = 500 Watt hours. The solar panels used are capable of producing a maximum power of 100 WP, with the maximum power voltage of 17.4 volts, the current at the maximum power of 5.76 amperes, has a short circuit current of 6.28 amperes, and the open-circuit voltage by 21.4 Volt.

#### 2. Load Power

After knowing the capacity of the solar panels are installed, the next step is to determine the maximum power that can be used load. From the amount of power generated solar panels can know how much power the maximum amount of usable load [4]. The solar panels installed can produce a maximum power of 500 watts for 5 hours of solar radiation. SPP is designed to supply 100% of the overall energy. Because losses (losses) are considered 15%, so that the energy supplied by the solar load is capable of [4]:

$$\begin{aligned} EB &= EP - \text{system losses} \\ &= EP - (15\% \times EP) \end{aligned}$$

$$\begin{aligned} \text{Watt hours} &= 500 - (15\% \times 500 \text{ Watt hours}) \\ &= 425 \text{ Watt hours} \end{aligned}$$

Remarks:

EB = energy load (Watt hours)

EP = Energy solar panels (Watt hours)

So the total energy of the system that can be used for 425 Watt hours.

#### 3. Need Batteries

To calculate the battery needs (as a store of energy if there is no solar light), then do the conversion of energy (Watt hours) to ampere hour capacity of the battery in accordance with the unit. So the battery capacity can be calculated:

$$AH = \frac{EB}{Vs} = \frac{425 \text{ Wattjam}}{12 \text{ Volt}} = 35,4 \text{ Amper hours}$$

The unit to store and transfer energy to the load is one day, so the battery only store energy and distribute it on the same day. The magnitude of the deep of discharge (DOD) of the battery is 80% [4]. The capacity of the batteries required are:

$$Cb = \frac{AH \times d}{DOD} = \frac{35,4}{0,8} = 44,2 \text{ Amperhours}$$

Based on the calculation above, it takes a battery with a minimum capacity of 44.2 Ah. Battery capacity is not found in the market, therefore the capacity of the battery used in it, for example, 50 Ah 12 Volt or 12 Volt 65 Ah. The bigger the selected battery capacity, increase the reliability of the system. If you select a battery with a capacity of 50 Ah closest that the battery can only store energy for 50Ah x 12V = 600 Watt hours. If it is used to supply a load of 425 watts, the battery is able to serve the electricity for 600Watt hours / 425Watt = 1.41 hours (1 hour and 24.6 minutes). But if you use the battery with 65Ah capacity battery can store power for 65Ah x 12V = 780 Watt hours. If it is used to supply the load for 425 Watt hours able to serve the electricity for 780 Watt hours / 425Watt hours = 1.83 hours (1 hour and 49.8 minutes).

The maximum amount of electric power is not all used by electrical equipment due to approximately 20% will be used to operate the inverter [4], so that the electrical energy from the battery that can be used by a computer is equal to 780 - (20% x 780) = 624 Watt hours.

#### 4. The need for Solar Charge Controller

To set the battery charging from solar panels, it takes a piece of equipment called a solar charge controller (SCC), or often called battery Control Regulator (BCR). To determine how the capacity of the BCR is required, it should be calculated taking into account the maximum capacity of Solar Panels divided by the charging voltage.

$$I_c = \frac{W_p}{V_{max}} = \frac{100}{21,4} = 4,67 \text{ Ampere}$$

Thus it takes a BCR of 4.67 or higher fit on the market. In this case, use the BCR 10A, because the BCR is the lowest in the market.

#### 5. Needs Inverter

Specifications inverter must be in accordance with the working voltage of the system and the voltage at the AC load. Based on the system voltage input voltage of 12 VDC inverter. The output voltage of the inverter connected to the load is 220 VAC. Another thing to note is the ability to use the power of the inverter. If the load is only 425 watts, it can be used with a power inverter 500 Watt or greater.

#### B. Analysis of Computer Power requirements

As already described in the previous section, that a set of computer with a CRT monitor requires a 279 Watt power, and for the use of the LCD screen of 185.4 Watts. In the case of use is also a printer with power 55

Watt. Thus a minimum of 334 Watt power needed. If the average daily use for 6 hours, then the energy required in a day of:

$$W = 334 \text{ Watts} \times 6 \text{ Hours}$$

$$W = 2004 \text{ Watt hour}$$

From the previous discussion, one of 100 Wp solar panels, capable of supplying 425 watt hour, thus to the use of energy in 2004 watt hour, it takes solar panels of 100 Wp as:

$$N_s = \frac{2004}{425} = 4,72 \text{ the solar panels}$$

Rounded to 5 solar panels (100 Wp).

Battery required can be calculated using the equations that have been presented in the above discussion, the

$$AH = \frac{EB}{V_s} = \frac{2004 \text{ Wattjam}}{12 \text{ Volt}} = 167 \text{ AmperJam}$$

Thus it takes a battery of 12 V DC, with a minimum capacity of 167 Ah, 200 Ah can be used or the fruits (as there is in the market of 100 Ah x 2).

Assuming using a 12V battery, 200Ah, then the maximum energy that can be supplied by this plant by 2400 Watt hours. Greater energy can improve the reliability of the system.

If the calculated for 2 days of continuous overcast, so the sun is not enough to fill the solar system, the devices required above must be multiplied by 2 times.

Based on the above analysis, to be able to turn on a PC computer with a CRT monitor and a printer with a 55 Watt power for 6 hours continuously, it takes 5 solar panels of 100 Wp, 2 pieces battery 12V, 100Ah, BCR 30 A, and a minimum of 1000 Watt Inverter. If this energy is used to distribute a laptop with a 65 Watt power, then the usage time can be calculated:

$$T = \frac{2004 \text{ Wattjam}}{65 \text{ Watt}} = 30,1 \text{ Jam}$$

Thus a laptop, it can be operated for 30 hours continuously using this system.

#### IV. CONCLUSION

Based on the analysis conducted above, it can be concluded that the energy consumption of a computer depends on the hardware it uses, especially the type of monitor. CRT consumes less power than the LCD. The use of software, and the many applications that are run affects the amount of electrical energy used.

Solar power can be used for computer power supply isolated schools are not reached by the electricity. To be

able to run a PC computer with a CRT monitor and a printer with a 55 Watt power for 6 hours continuously, it takes 5 solar panels of 100 Wp, 2 pieces battery 12V, 100Ah, BCR 30 A, and at least 1000 Watt Inverter .

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# Designing the Stable Infrastructure for Kernel-based Virtual Machine using VPN-tunneled VNC

Berkah I. Santoso<sup>1</sup>

**Abstract**—The key aspect of cloud computing is virtualization that aimed to achieve stability, scalability and flexibility in a cloud infrastructure. Many solutions have been proposed to enable the monitoring and deployment Virtual Machines (VMs) in computational resource pool of cloud infrastructure. The shared computing resources such as processor, memory, storage and network have important roles for operating the cloud infrastructure. These computing resources must be managed and monitored carefully for providing the sufficient resource in accordance to VMs operation.

In conjunction of sufficient computing resources, many open-source-based virtualization have meet for general users to provide the cloud services. The physical host which VMs installed takes important attention by the system administrator. The virtual machine management (VMM) tools were played important role in giving real computing resources information to the system administrator. The VMM, Virtual Private Network (VPN) and Virtual Network Computing (VNC) approach could be used for helping the users to get the stable, secure cloud services.

We proposed novel implementation of stable infrastructure for Kernel-based Virtual Machine (KVM) on Red Hat® Enterprise Linux and its network security using libvirt management library and VPN-tunneled VNC. The results show that the models are functioning stable, secure and correctly in a high-consumption VM computational resource. The critical event for providing the shared computing resources is the VM's booting processes. The system administrator should consider to the memory resource and storage system for meeting the VMs operation. Moreover, the increase in the number of VMs does not affect the working of the physical host that indicates its practicability in a flexible environment..

**Keywords**—virtualization, virtual machine, VNC, VPN.

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## I. INTRODUCTION

THE cloud computing can be defined as providing resources and capabilities of Information Technology (e.g., applications, storages, communication, collaboration, infrastructure) via services offered by cloud computing providers. A cloud computing service has ubiquitous access through a Web browser or mobile device with APIs or special desktop applications developed by cloud service provider [1].

The computing resource virtualization was widely adopted in the cloud computing environment. Most of the characteristics of computing resources related to physical host are hidden, but the cloud computing management system needs to help the users to find the proper computing resources. The challenge of cloud environment is to manage and monitor both physical computing resources and virtual machines. The monitoring of virtual machines could be used for billing the shared computing resource usage [2].

Migrating an enterprise's computing resources to a virtualized environment not only brings with it all the inherent security threats and vulnerabilities of a running service or an operating system running as a guest but also introduces new-virtualization specific security threats and vulnerabilities that need to be addressed. The virtualized environment consists of the Virtual Machine Monitor (VMM) or hypervisor. The VMM or hypervisor is aimed for allocating the physical resources which consist of Central Processing Unit (CPU), memory, network and storage to each virtualized Operating System (O/S). Once the hypervisor is configured, it emulates a hardware device for each virtual O/S and handles each virtual O/S' communications with physical resources [3].

There are two different forms of virtualization architectures. The first form of virtualization architectures known as bare-metal virtualization which exists no host O/S because the VMM sits just above the underlying physical hardware. The bare-metal virtualization intercepts the communication between the multiple VMs and the physical hardware. The bare-metal virtualization exists a main management VM for managing the guest VMs and their communication with the physical hardware. The second form of virtualization architectures known as hosted-virtualization, which the VMM sits just on top of the host O/S and runs as application. The host O/S is responsible for providing Input/Output (I/O)

drivers and managing the guest VMs [4]. We may refer to Figure1 for the difference of virtualization architecture.

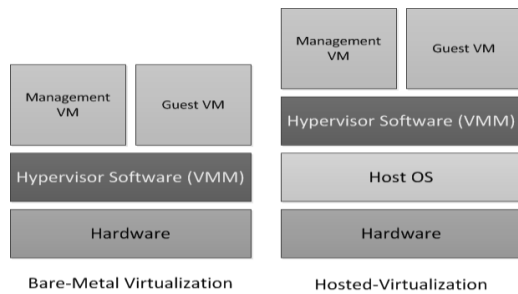


Fig. 1 Types of virtualization architecture

The main characteristics of the VMM is that it removes the traditional physical hardware dependency of an O/S on its physical hardware resource. The physical resources are directly controlled by the VMM and not by the host O/S or the physical hardware. So that multiple different O/S(s) can run on the same physical hardware at the same time while being isolated from one another. As a result, the physical hardware is partitioned into one or more logical units known as VMs which can run any x86-class physical host system [5].

One open-source solution that has been widely adopted is using Linux Kernel-based Virtual Machine (KVM) as a hypervisor to drive each VM running on top of the cloud platforms. The role of KVM is to virtualize each device, such as CPUs, RAM, storage, network interface cards, system timer, and virtual networks. On the host, every VM is running as a KVM process. This mechanism enables the VMM to deploy debug tracing tools and VM device monitors, e.g. qemu-monitor. The VMM has the ability to check both static and dynamic status of VMs and take actions online on VMs when malicious or abnormal behaviors are observed. The VMM should be able to not only protect hosts from potential attacks, but also it provides a new security service to guest VM users, detecting whether the VMs have been compromised[6].

Two hypervisors, Xen and KVM are the most widely used open source hypervisors in the recent Infrastructure as a Services (IaaS) providers [12]. KVM is a full virtualization solution for Linux on x86 hardware containing virtualization extensions (Intel®-VT or AMD®-V). It consists of a loadable kernel module, kvm.ko, which provides the core virtualization infrastructure, and a processor specific module, kvm-intel.ko or kvm-amd.ko. KVM requires a modified version of qemu, a well known virtualization software. The kernel component of KVM is included in mainline Linux, while for xen only external support is available. KVM supports I/O para-virtualization using the virtio subsystem consisting of several kernel modules[7].

Virtual Network Computing (VNC) is a desktop sharing system which uses the Remote Frame Buffer (RFB) protocol to remotely control another computer. It transmits the user events from one computer to another relaying the screen updates back in other direction, over a network using buffered I/O stream[8].

Virtual Private Network is a computer network in which some of the links between nodes are carried by open connections or virtual circuits in some larger networks, such as the internet, as opposed to running across a single private network. The link layer protocols of the virtual network are said to be tunneled through the transport network. It provides private network connections over a publicly accessible shared network [9].

The VPN services provides the protection, encryption and privacy for connected network. The VPN server is the underlying component in a VPN access server that does all of the background work ; routing, tunneling, encryption, user management, authentication [10].

In this paper, we present the stable and secure hosted-virtualization and present a case study of deployment of private virtualized infrastructure using Kernel-based Virtual Machine (KVM). The KVM runs on Red Hat® Enterprise Linux ver. 6.5. We installed the Linux and Unix variant for the VMs with the minimal installation option. We also configured the boot loader for each VM's O/S as the default configuration. We diagnose the VM's processor and memory usage using the GNU top, qemu-kvm and libvirt. Libvirt is library toolkit for interacting with the virtualization capabilities to Linux[2]. The VMs could be authenticated using Virtual Private Network (VPN)-tunneled Virtual Network Computing (VNC) so that the user could administer VMs. The rest of the paper is organized as follows. In section 2, we discuss related work. We design the proposed stable and secure-private hosted-virtualization according to the topic in section 3. Implementation and diagnosis are presented and discussed in section 4. Section 5 summarizes and concludes the paper.

## II. RELATED WORKS

There has been a lot of research effort carried out to solve the stable and security for cloud computing environment. The Papaya[2] management platform which based on Eucalyptus and Snooze[11] private cloud management framework have been developed in order to monitor and manage the private cloud. Whereas the growing computing power demands, they need to scale up with the increasing number of resources and continue the operation. The Papaya proposed the centralized monitoring and management for the cloud computing resources which based on Eucalyptus. The Papaya using the web interface for managing and monitoring VMs. The Snooze proposed the self-organizing hierarchical and distributed cloud management using Java programming language. The Snooze resulted that the fault tolerance features of the framework do not impact application performance and the system remained highly scalable with increasing amounts of resources.

The paper proposed the combination of virtual machine manager which is build using Python programming language. It supports distributed cloud management, virtual machine migration, etc. The virtual machine manager using the intuitive graphical user interface related to VMs monitoring. We added



the VPN-tunneled VNC feature for the VMs authentication.

### III. PROPOSED SYSTEM

We proposed the design, implementation and evaluation of stable and secure-private hosted-virtualization using the KVM (qemu-kvm ver.0.12.1.2-2) and libvirt ver.0.10.2-29, running on Red Hat® Enterprise Linux ver.6.5 kernel 2.6.32-431.el6.x86-64 stable.

In this scenario, the network has five components located in the Computer Network Laboratory: Quad core Intel-based servers, the Cisco® Catalyst 2960 access switch, the Cisco® Router 2801 and desktop PCs for accessing the VMs services. There are five components which constructs the private cloud infrastructure using KVM. The components consist of :

- The tower server for constructing the hosted-virtualization KVM. We are using the Quad core Intel® Xeon CPU E3-1220 V2 @3.10 GHz-based processor, 8 GB RAM, 1 TB RAID 10 local disk, dual 1 GB Network Interface Card.
- The tower server for constructing the VPN services and Domain Host Control Protocol (DHCP) services. We are using the Quad core Intel® Xeon CPU E3-1220 V2 @3.10 GHz-based processor, 8 GB RAM, 1 TB RAID 10 local disk, single 1 GB Network Interface Card.
- The Cisco® Catalyst 2960 - 1 Gbps 24 port Layer-2 switch. The switch has also Virtual LAN (VLAN) configured.
- The Cisco® Router 2801 for connecting the internal network to the external networks. The router has also access control list configured.
- The desktop PCs (HP® Compaq 5700) for accessing the VMs services.

We added authentication mechanism using the second tower server installed OpenVPN ver.2.1.32-2, DHCP ver.4.1.1 application which run on Debian Linux 6.0 O/S, kernel ver.2.6.32-0.42stab084.12. The version of OpenVPN, DHCP and Debian Linux O/S and usable kernel.

Configuring VLANs on the network is designed to improve network performance, has a good network management, and enhanced security.

We configured the bridge technique for VMs network configuration in first tower server. The bridge technique separated the private network for VMs system administration and service network for VMs. The VLAN 2 (TrustNet-VM) is designed for the VMs administration which network address is 192.168.122.0/24.

We created five VMs which installed Linux and Unix O/S. The description of every VM can be defined as shown below :

- VM2 is installed the Unix FreeBSD 9.0 and the IP address is 192.168.122.3/24.
- VM3 is installed the Fedora Linux 18 and the IP address is 192.168.122.4/24.
- VM4 is installed the Ubuntu 12.04 Long Time Support (LTS) Server and the IP address is 192.168.122.5/24.

- VM5 is installed the Debian Linux 7.5 and the IP address is 192.168.122.6/24.
- VM6 is installed the Unix OpenBSD 5.5 and the IP address is 192.168.122.7/24.

We installed virtual machine manager (virt-manager-0.9.0-19.el6.x86-64) for creating the VMs using graphical interface in the first tower server. The VMs have assigned VNC's port related to their administration services. The graphical monitoring for every VM was shown such as VM's CPU usage, host CPU usage, disk I/O, network I/O.

We also configured the Security Enhanced (SE) Linux for securing (masquerading) the physical host and VMs when they're connected to the trusted or un-trusted network.

The router manages inbound and outbound traffic using its access control list (ACL) and Network Address Translation (NAT) configuration and makes secure connection for both VMs users. Whenever the VMs users have requested for private connection, the authentication system challenged VMs users with the log on page. The authentication system permits registered VMs users who response the correct challenges represented by their username and password.

We evaluate the virtual machine operation using libvirt, GNU top, virtual machine manager which physical host installed the virtual machine. The processor and memory utilization was extracted from the GNU top output command to evaluate the relation of physical host average load, physical CPU and memory usage, libvirt daemon process and VMs' qemu-kvm processes.

We proposed the network design using five components that was mentioned above. The TrustNet-VM was configured for internal system administrator related their VMs. The physical host for VMs is installed the hosted-virtualization KVM which run on Red Hat® Enterprise Linux 6.5. It consists of two network interface card (NIC) for implementing the bridge technique. The ethernet0 interface was configured as a bridge to br0 interface, so that the IP address 192.168.122.2/24 is configured in br0 interface. The ethernet1 interface was configured as a bridge to br1 interface, so that the IP address 192.168.9.60/24 is configured in br1 interface. The br0 interface was connected to Layer2-Switch VLAN 2 to have VMs private network. The br1 interface was connected to FastEthernet0/3/0 interface on Router for network address translation and access-list mechanism. Some VMs run the web services and name services which accessed from the public IP.

The Layer2-Switch VLAN 2 is configured with its VLAN IP address : 192.168.122.1/24 and its IP default-gateway is 192.168.122.254/24 in Router's interface. The proposed design with their components can be summarized as shown in Figure 2.

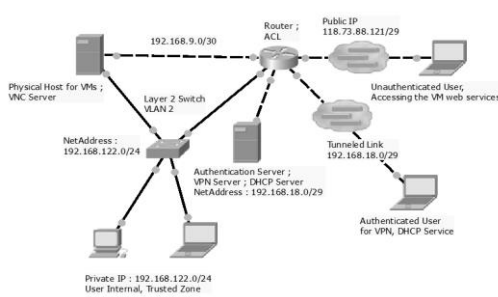


Fig. 2 The proposed network design

We added the signature algorithm SHA1 with RSA encryption mechanism on OpenVPN established connection. The client certification was generated from the second tower (authentication) server for connecting the router to client with their authorized VM.

We diagnose the computing resource usage both physical host and virtual machines using the GNU top, libvirt, qemu-kvm and virtual machine manager. The measurement related to physical host average load, CPU usage, memory usage, CPU and memory usage for libvirtd process and virtual machines.

IV. IMPLEMENTATION AND DIAGNOSIS

A. Implementation

We implemented all of the components which previously described using the Figure 2, in computer network laboratory. The libvirt daemon acts a service which run on start up process. The virtual machine manager monitors and manages the VMs on cloud environment. We run the five VMs using the virtual machine manager queue mechanism and started the VM2 to VM6. We made a pertinent record related to both experiment until the log on form of every O/S has viewed.

B. Diagnosis

We make a sufficient record related to the execution time, processor utilization, memory utilization related to every VM for both experiment. The physical average load in 1 minute, 5 minutes and 15 minutes may conclude in Figure 3. We obtained the physical CPU and memory usage in Figure 4. We also obtained the CPU and memory usage for libvirtd process in Figure 5. The CPU and memory usage for every qemu-kvm process that related to virtual machine may conclude in Figure 6 to Figure 10. The CPU and memory usage of physical host versus virtual machines may represent in Figure 11 to Figure 12. The list of running VMs may conclude in Figure 13. The log on form of VNC to VM5, may represent in Figure 14. And the successful VNC for VM5 (Debian Linux v7.5) may represent in Figure 15.

The measurement of average load for physical host in Figure 3 has started in 14:28:54pm to 15:20:18pm. The average load increased when the virtual machines started up (14:29:24pm to 14:30:00pm). The peak average load for last 1 minute load is 5.91 in 14:44:29pm, last 5 minutes is 5.4 in 14:46:14pm and last 15 minutes is 3.97 in 14:48:53pm.

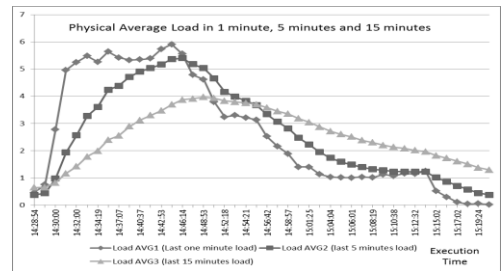


Fig. 3 The average load of physical host

The graph of physical CPU and memory usage in Figure 4 has showed us that the memory usage increased from 10.16% to 59.99%. The physical CPU usage remained stable from 0.02% to 1%.

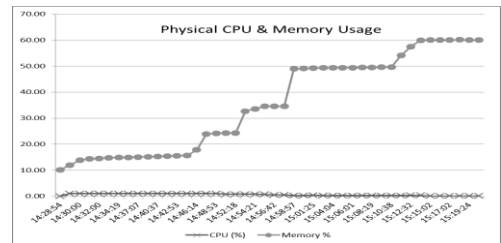


Fig. 4 The physical CPU and memory usage (%)

The graph of CPU and memory usage for libvirtd in Figure 5 has showed us that the memory usage increased from 0.2% to 0.4% and the CPU usage was from 1% to 1.7%.

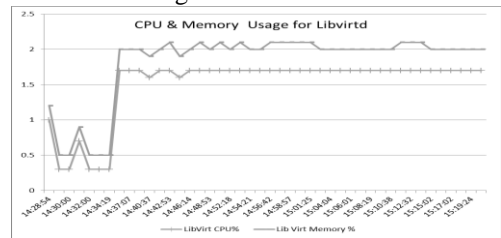


Fig. 5 The CPU and memory usage (%) for libvirtd

The graph of CPU and memory usage for VM2 (Unix FreeBSD v.9 installed) in Figure 6 has showed us that the CPU usage increased from 0% to 100.2% and the boot up process started from 92.6% usage in time 14:29:24pm to 100.1% usage in time 14:58:57pm. The memory usage remained stable for boot up processes in 0.4% usage to 0.7% usage, but it increased for console login process in 15.1% in time 15:00:06pm.

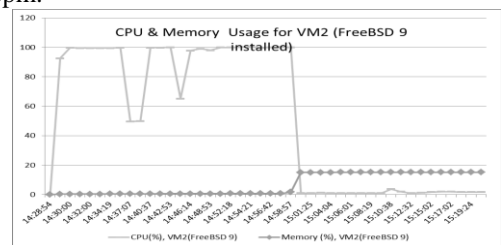


Fig. 6 The CPU and memory usage (%) for virtual machine 2 (Unix FreeBSD v.9 installed)

The graph of CPU and memory usage for VM3 (Fedora Linux v.18 installed) in Figure 7 has showed us that the CPU

usage increased from 0% to 100.2% and the boot up process started from 80% usage in time 14:29:24pm to 100.2% usage in time 15:12:32pm. The memory usage remained stable for boot up processes in 0.5% usage, but it increased for console login process in 8.3% usage in time 15:11:29pm.

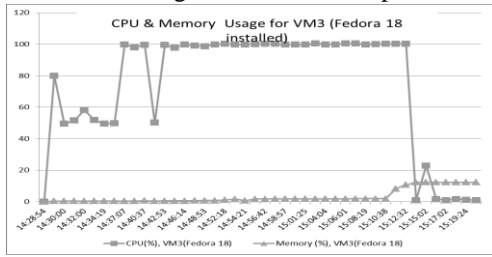


Fig. 7 The CPU and memory usage (%) for virtual machine 3 (Fedora Linux v.18 installed)

The graph of CPU and memory usage for VM4 (Ubuntu Linux v.12.04 installed) in Figure 8 has showed us that the CPU usage increased from 0% to 100.1% and the boot up process started from 97.2% usage in time 14:29:24pm to 75.9% usage in time 14:54:21pm. The memory usage remained stable for boot up processes in 0.4% usage to 1% usage, but it increased for console login process in 8.5% in time 14:53:18pm.

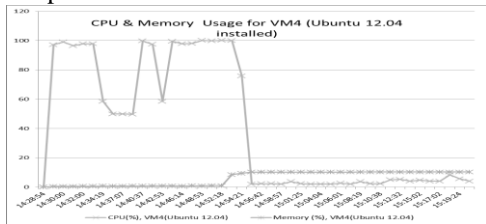


Fig. 8 The CPU and memory usage (%) for virtual machine 4 (Ubuntu Linux v.12.04 installed)

The graph of CPU and memory usage for VM5 (Debian Linux v.7.5 installed) in Figure 9 has showed us that the CPU usage increased from 0% to 97.5% and the boot up process started from 77% usage in time 14:29:24pm to 97.5% usage in time 14:47:26pm. The memory usage remained stable for boot up processes in 0.4% usage to 0.9% usage, but it increased for console login process in 6.9% in time 14:48:53pm.

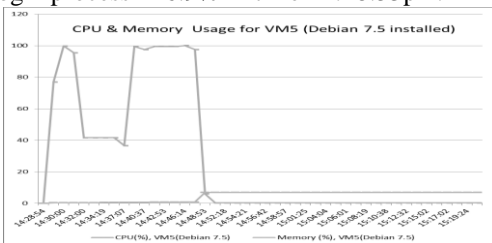


Fig. 9 The CPU and memory usage (%) for virtual machine 5 (Debian Linux v.7.5 installed)

The graph of CPU and memory usage for VM6 (Unix OpenBSD v.5.5 installed) in Figure 10 has showed us that the CPU usage increased from 0% to 99.8% and the boot up process started from 46.8% usage in time 14:29:24pm to 49.9% usage in time 14:44:29pm. The memory usage

remained stable for boot up processes in 0.4% usage to 2.7% usage, but it increased for console login process in 4.4% in time 14:46:14pm.

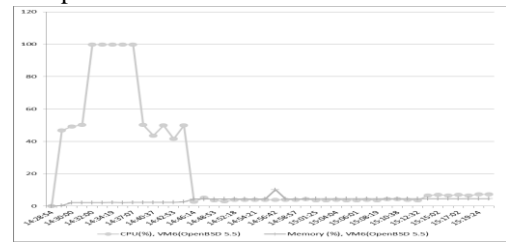


Fig. 10 The CPU and memory usage (%) for virtual machine 6 (Open BSD v.5.5 installed)

The graph of memory usage for physical and virtual machines in Figure 11 has showed us that the physical memory usage was consumed for virtual machines boot up processes more than virtual machines' memory usage. The physical memory usage increased for console login process started from 17.82% in time 14:46:14pm. The VM2 (Unix FreeBSD v.9 installed) was consuming the most amount of memory resource (15.2%) for boot up process. The VM5 (Debian Linux v.7.5 installed) was consuming the least amount of memory resource (6.9%) for boot up process.

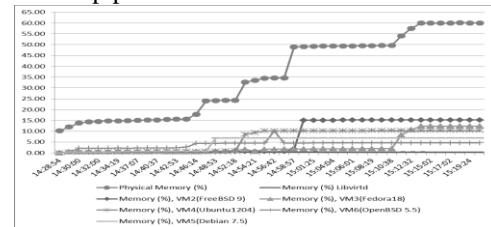


Fig. 11 The memory usage (%) of physical and virtual machines

The graph of CPU usage for physical and virtual machines in Figure 12 has showed us that the physical CPU usage was consumed for virtual machines boot up processes less than virtual machines' CPU usage. The physical CPU usage increased for boot up process started from 2.10% in time 14:28:54pm to 99.90% in time 14:48:53pm. The VM3 (Fedora Linux v.18 installed) was consuming the most amount of CPU resource (100.5%) for boot up process. The VM6 (Unix OpenBSD v.5.5 installed) was consuming the least amount of CPU resource (99.8%) for boot up process.

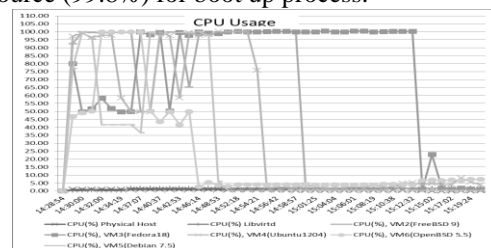


Fig. 12 The CPU usage (%) of physical and virtual machines

The fastest boot up process came to VM6 (Unix OpenBSD v.5.5 installed) which took the time 14:28:54pm to

14:44:29pm or 15 minutes and 35 seconds. The slowest boot up process came to VM3 (Fedora Linux v.18 installed) which took the time 14:28:54pm to 15:12:32pm or 43 minutes and 38 seconds.

```
[root@engeurhel2 network-scripts]# virsh list
Id      Name                                State
-----
2       freebsd9-vm2                       running
3       fedora18-vm3                       running
4       ubuntu1204serv-vm4                running
5       debian75-vm5                       running
6       openbsd-vm6                        running
```

Fig. 13 The list of running VMs

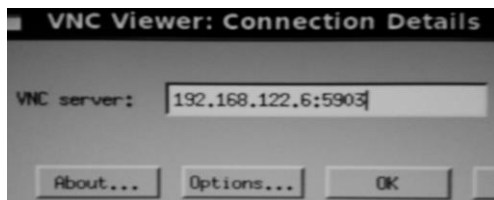


Fig. 14 The log on form of VNC for VM5

```
TigerVNC: QEMU (debian75-vm5)
Debian GNU/Linux 7 vm4 tty1
vm4 login:
Debian GNU/Linux 7 vm4 tty1
vm4 login: _
```

Fig. 15 The successful VNC for VM5 (Debian Linux 7.5 console)

## V.CONCLUSION

Deployment of stable and secure private hosted-virtualization could be done effectively whereas the users concern to monitoring and virtual machine management. The physical host is affected by the booting process of several VMs such as processor and memory resources. However, the physical host continued to decrease the computing resources whereas the VMs have finished their booting process to O/S log on form. Moreover, the computing resources of physical host remain stable after the VM's boot processes.

The physical host memory usage was consumed more resource than VMs' memory usage for VMs boot up processes. The CPU and memory usage for libvirtd remained stable in conjunction with VMs' boot up process (CPU usage : 0.3% to 1.7% and memory usage : 0.2% to 0.4%). The VM2 (Unix FreeBSD v.9 installed) was consuming the most amount of memory resource (15.2%) for boot up process. The VM5 (Debian Linux v.7.5 installed) was consuming the least amount of memory resource (6.9%) for boot up process. The VM3 (Fedora Linux v.18 installed) was consuming the most amount of CPU resource (100.5%) for boot up process. The VM6 (Unix OpenBSD v.5.5 installed) was consuming the least amount of CPU resource (99.8%) for boot up process.

The smallest execution time was VM6 (Unix OpenBSD v.5.5 installed) in 15 minutes and 35 seconds. The VM6 followed by the VM5 (Debian Linux v.7.5 installed) in 18 minutes and 32 seconds, VM4 (Ubuntu Server LTS v.12.04 installed) in 25 minutes and 27 seconds, VM2 (Unix FreeBSD

v.9 installed) in 30 minutes and 3 seconds. The biggest execution time was VM3 (Fedora Linux v.18 installed) in 43 minutes and 38 seconds. The VPN-tunneled VNC was designed for protecting the VMs resources. Thus, the main goal of presented prototype is managing effectively the technological needs using the open source virtualization platform.

In future, we will analyze the conjunction of security testing for the private cloud environment and its impact to computing resources usage. Moreover, we will also perform the analysis of its security vulnerabilities related to computing resources monitoring and management.

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# ANDRIOD-BASED MOBILE ACADEMIC PORTAL APPLICATION

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**Abstract**—The academic portal application that the authors created, which is available on Android phones, is an open source operation system with Java platform that can be easily developed by anyone. This application is created for the students who use Android phones as information accessing media so that they can use this application to keep track of their academic progress and information. In addition, the lecturers can also input students' grade points and approve the study plan of the students who are under the same academic advising service directly from the apps. The academic information system used by Andalas University at the moment is in the form of website page. Due to the high interest in the development of mobile technology, the authors decided to create a mobile application as the client for this academic information system.

**Keywords**—Mobile technology, Android Application, Academic portal.

## I. INTRODUCTION

The fast-paced development of cell phone technology has affected the entire world. Regardless of age and life experience, even ten years old teenagers and elderly people own cell phones. Almost everyone owns a cell phone, and for some people one cell phone might be

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insufficient. This kind of development can be used for an advantage in education field.

Academic portal functions as the source of information related to students' course progress, such as students' coursework plan and grade points. Academic portal has become an important part as the information exchange media in a university system. The students can access the information through a website page. There is no other alternative for accessing the students' course result and for inputting the coursework plan. However, with the technological advancement of mobile phones that students widely use nowadays, there is a possibility of developing an alternative application for accessing academic information on Android phones. This alternative is expected to facilitate lecturers, students and other related parties who use Android phones in accessing academic related information through the portal.

The purpose of this research is to develop an Android-based mobile academic portal that will be used as an alternative in accessing academic related information effectively and efficiently. This academic information application that runs on an Android mobile is mostly similar with web version, and they both function as clients. The only difference is the means of data access. Data access on the website is done through an internet browser, while data access using an application can be done directly through a specifically developed application that is installed on the cell phone and is connected to the server. The data needed to generate information is from the same storage and the data is also processed by the same server.

## II. RELATED WORKS

Internet and cell phones are two technologies that keep progressing and influencing the lives of millions of people worldwide. Internet provides ease of information access with less cost and it also does not depend on location. Cell phones enable people to connect and communicate over great distance. The integration of the two technologies enables people to communicate regardless of the sources of information and the location access.

The development of information technology highly affects the education field, as seen from the various android-based applications developed by students, such as the application used for helping the teaching and learning process between a lecturer and the students [1]. This application functions as a media in learning mathematics in which the learning materials and quizzes on the related subject are uploaded by the lecturer. The students then access the material and the quiz on their android phones with the application installed. Figure 1 shows the interface of the Andromath.



Figure 1. Interface of the Andromath

Mobile Learning (M-Learning) development through the implementation of Personal Extreme Programming method was introduced by Rizal H, et al [2]. For this application, the authors designed an android application that provides information on the courses that students completed, the learning materials, downloadable assignment, and discussion forum.

The authors [3] introduced a waterfall model on the android system design. The application is developed to promote Indonesian culture and it is also equipped with multiple questions on Indonesian culture. The authors had performed a test on several cellular devices. Based on the simulation, this application can successfully run on Android version 2.3 and higher. Figure 2 shows the feature of cultural products on the designed application.



Figure 2. A Feature of Cultural Products on Android

The authors [4] created a prototype of academic portal system application that runs on an android-based operation system. Based on the

simulation, the features that have been developed are able to be implemented on android-based operation system using waterfall method. Figure 3 shows the main menu of SIT Unsrat.



Figure 3. The Main Menu of SIT Unsrat

### III. PROPOSED METHOD

In developing this application, the methodology used is waterfall model, “a classic, systematic, and sequential model” (Sudarmawan, 2007:154) [5]. Figure 4 shows Waterfall Model.

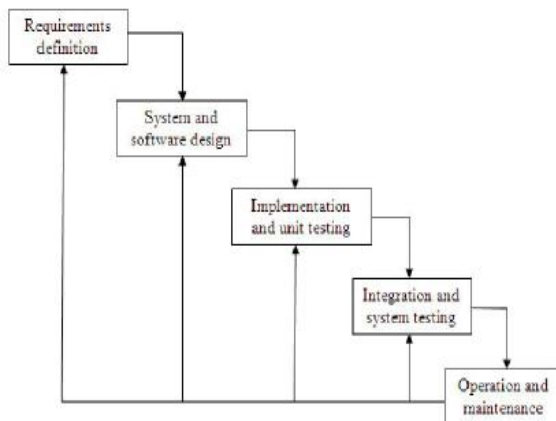


Figure 4. Waterfall Model Information:

#### 1. Requirements Definition Analysis

This phase completely collects the necessary data to be analyzed in order to define the needs that should be met by the program being developed. This phase should be done accurately to create a well-equipped design.

#### 2. System and Software Design

After all necessary data have been collected and completed; the process of designing can be started.

#### 3. Implementation and Unit Testing

The design of the program is interpreted into codes using a pre-determined programming language. The program that is being developed will directly undergo unit testing, to examine whether it can operate well or not.

#### 4. Integration and System Testing

Integration and System Testing is the integration of program units that will be tested together later (system testing).

#### 5. Operation and Maintenance

Program operation and maintenance are in the form of adjustments and changes made to adapt with the real situation.

The system is divided into two sub systems: the system that runs on the server-side and the system that runs on the client-side. Server is a sub system run by web server that provides mobile service that can be accessed and run on another sub system. Below is flowchart illustration of the client and the server systems on a mobile portal application:



Figure 5. Server Activity Flowchart

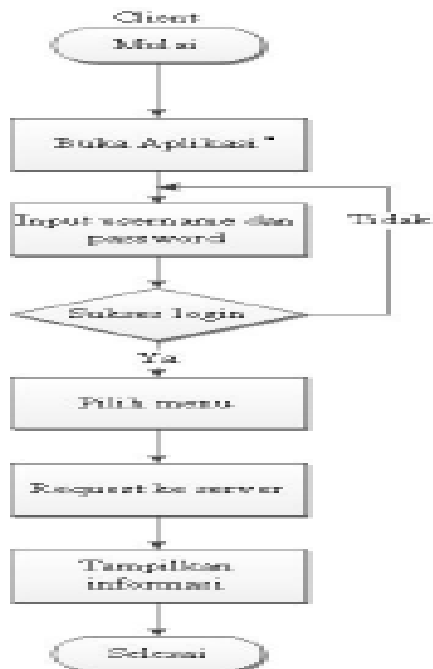


Figure 6. Client Activity Flowchart

A. Hardware and Software Specifications

<b>Hardware</b>
<ul style="list-style-type: none"> <li>- Processor : Intel Core i3</li> <li>- RAM DDR3 Memory 2 GB</li> <li>- Harddisk / HDD 500 GB</li> </ul>
<b>Software</b>
<ul style="list-style-type: none"> <li>- Eclipse-java-indigo-SR1-win32</li> <li>- ADT 20.0.0</li> <li>- SDK 19</li> <li>- Add on Android 4.0 (API 14)</li> <li>- Notepad++ (Editor)</li> <li>- Cordova</li> <li>- node-v0.10.30-x86</li> <li>- npm-1.4.9</li> <li>- Xampp-win32-1.7.3 (Localhost, MySql)</li> </ul>

B. Design of Use Case Diagram

1. Use Case Diagram Database

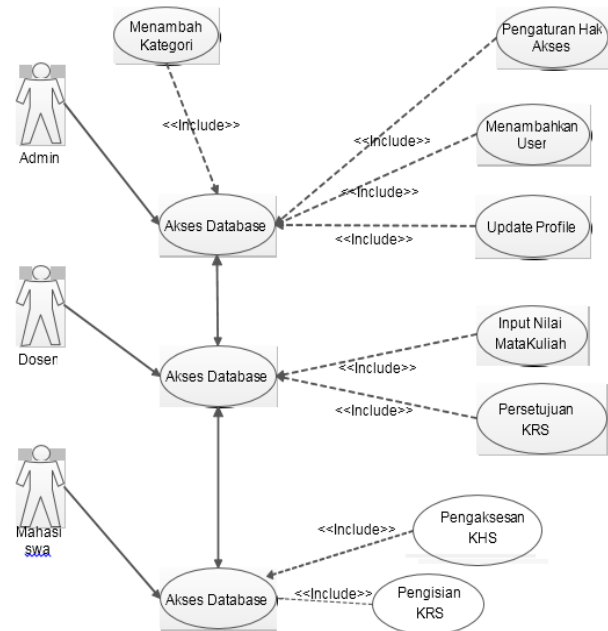


Figure 7. Use Case Diagram Database



2. Use Case Diagram Portal Application

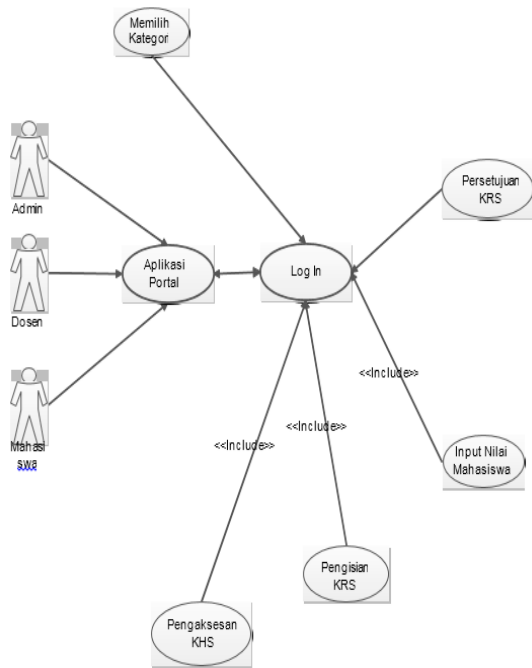


Figure 8. Use Case Diagram Portal Application

Information:

1. Administrator

In this administrator area, there are several kinds of access that can be done either in the database part or the portal application itself. For the database access part, the administrator has the right to access the page, for example to add categories, create access rights policy for other users, add users and update user profile.

2. Lecturer

This lecturer area is an area in which academic advisors or the responsible lecturers control their courses. The control is done through the database, for example in inputting data of students' grade point, which is based on the

courses taken, and approving the coursework plan chosen by the students.

3. Student

For the student area, the students can access information about their course results (Course Progress Card) and input their choice of courses during coursework plan entry period.

C. Design of Sequence Diagram

Sequence Diagram illustrates the interaction between objects within and surrounding the system in the form of messages being exchanged over time. Messages are illustrated in lifelines with each of its arrowhead representing movement from one object to another. The messages will be mapped into operation/method from its class. Sequence Diagram consists of a vertical dimension (time) and a horizontal dimension (related objects). The sequence diagram can also be used for illustrating a scenario of a response to an event that generates a certain output. The sequence diagram for this portal consists of the administrator's sequence diagram, the lecturer's sequence diagram, and the student's sequence diagram.

1. Design of Administrator's Sequence Diagram

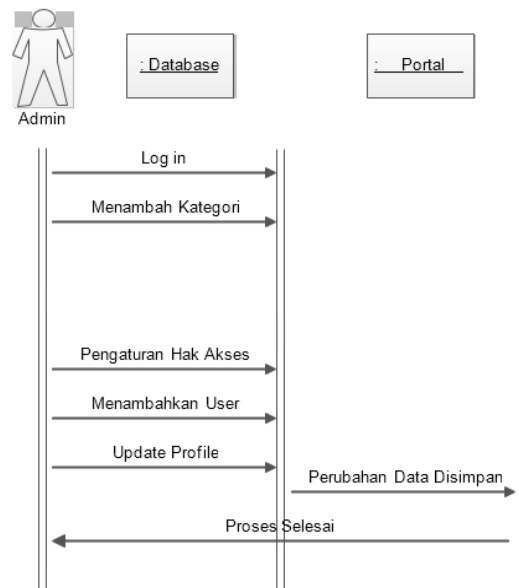


Figure 9. Administrator Sequence Diagram

2. Design of Lecturer Sequence Diagram

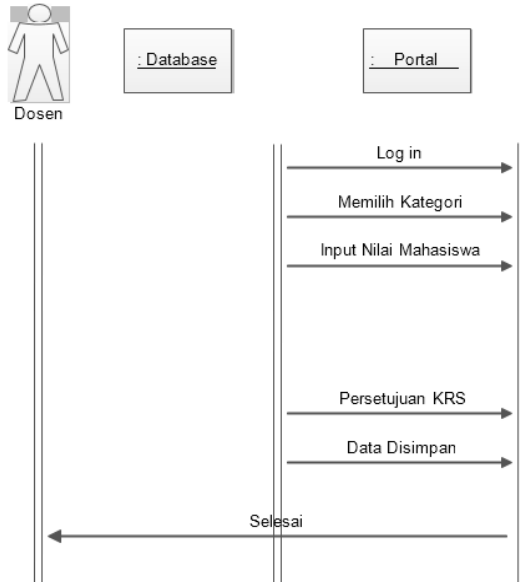


Figure 10. Lecturer Sequence Diagram

3. Design of Student Sequence Diagram

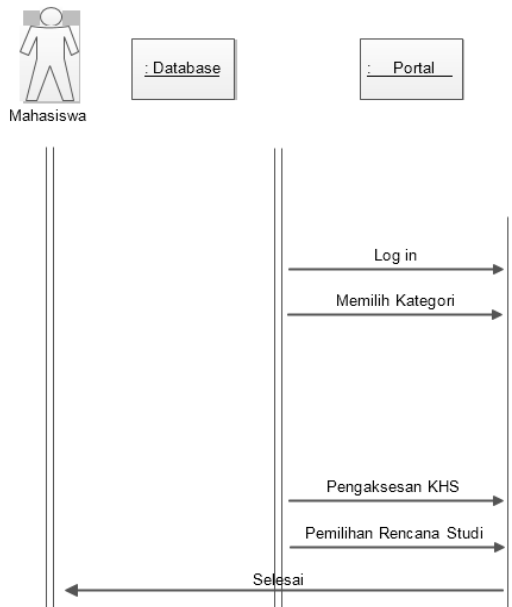


Figure 11. Student Sequence Diagram

D. Interface Design

One of the important things to be considered in designing a system is that the design should ease users in using the application; therefore, it is necessary to arrange the position of the buttons, textfield, menus, or other visual components as not to confuse the users.

1. Log in Page

Once the system starts running, users are directed into an authentication page. Users can log into their accounts by typing their username and password. Figure 12 shows the interface of menu authentication.

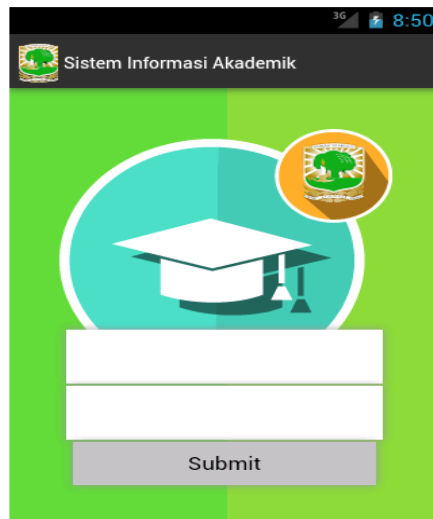


Figure 12. Authentication Interface

2. Main Page

After logging in, users can see a display of the main menu as in the picture below. The main menu consists of Coursework Plan Card and Course Progress Card. Figure 13 shows Student Web Page Interface.

Figure 14. Academic Advising Service List

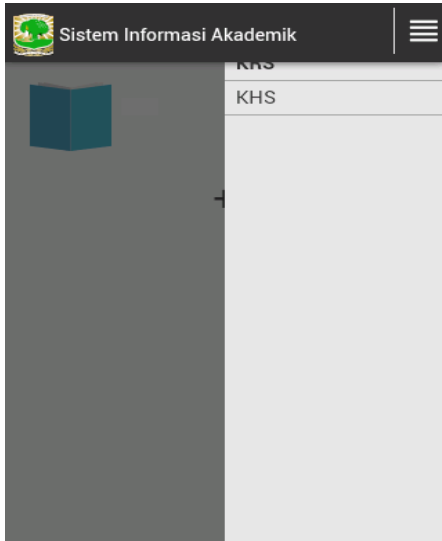


Figure 13. Student Web Page Interface

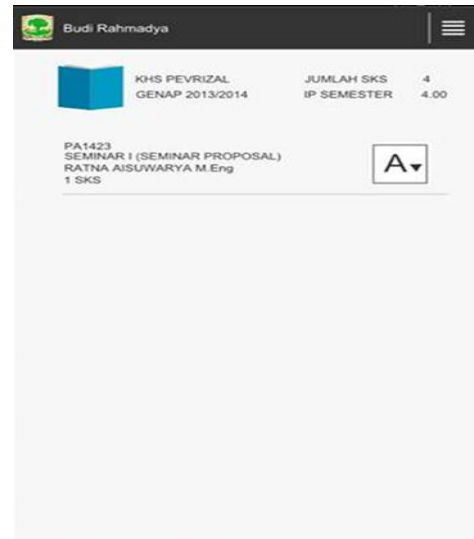


Figure 15. Students' Grade Point Entry

### 3. Lecturer Web Page

After logging in, users (lecturers) can see the main web page interface as illustrated below, with the choice of menu that consists of Academic Advising Service List form, Students' Grade Point Entry form, and Coursework Plan Approval form.

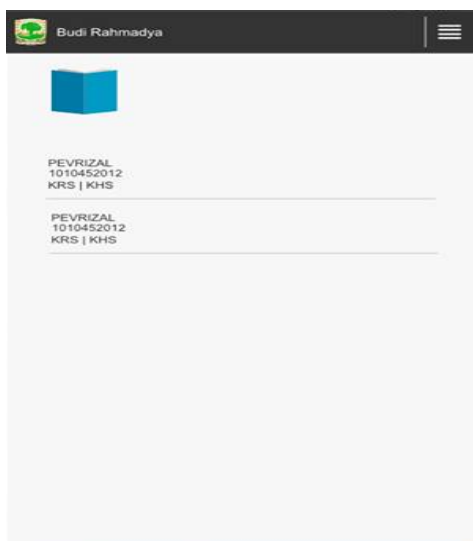


Figure 16. Coursework Plan Approval

## IV. CONCLUSIONS AND FUTURE WORK

Based on the simulation, it can be concluded that the Android based academic portal mobile application could run on Android version 4.1.2. The students can log on to their accounts and type in their academic entry. Lecturers can also authorize students' grade point using the same Android version.

Further application development will include adding an online final project consultation on Android phones, comparing the operating system with higher Android operation system and testing the system with other vendors such as Blackberry and iOS.

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# COSTUMER RELATIONSHIP MANAGEMENT (CRM) TO ENHANCE COLLEGE COMPETITIVENESS

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## ABSTRACT

Students satisfaction in academic lectures has become a necessity when the college plans to increase its competitiveness in order to get more students. Customer Relationship Management (CRM) is an integrated function of the sales strategy, marketing, and service that aims to increase revenue from customer satisfaction. Hence, to improve students satisfaction is necessary to establish a college CRM prototype. The methods used in analyzing external business model is the five competitive forces methodology (FCF), internal models using the value chain business methodology, and to improve the business processes used methods of work-centered analysis (WCA). The design of the prototype with the method of object-oriented analysis and design using the unified modeling language (UML). Validation testing is done with a focus group discussion (FGD) while the quality of the resulting prototype is tested based on four characteristics of software quality model of ISO 9126, namely: functionality, reliability, usability, and efficiency using questionnaires. The result is the formation of a research prototype of CRM colleges that have good quality and serves to support the college's competitive advantage so that students can obtain the desired information quickly, can be accessed anywhere and anytime

Keywords: CRM, Prototipe, Competitiveness, Value Chain, Five Forces Analysis, ISO 9126

## I INTRODUCTION

Increasing the number of new colleges make competition among universities to seek new students become more intense. Active student satisfaction with the college services is a major factor to improve competitiveness. Dissatisfaction with one of the students could be the beginning of the emergence of another students dissatisfaction.

### 1.1 CRM

CRM is defined by Handen <sup>(Handen, 2000)</sup> as the process to obtain, retain and develop profitable customer. CRM is not a concept but a project or business strategy that aims to understand, anticipate and manage the organizational needs of current and potential customers. Another definition is also proposed by Robinson <sup>(Robinson, 1999)</sup> which mentions CRM as an integrated function of the sales strategy, marketing, and service that aims to increase revenue from customer satisfaction.

According to O'Brien <sup>(O'Brien, 2003)</sup>, CRM uses information technology to create a cross-functional enterprise system that integrates and automates the process of customer service in the areas of sales, marketing, and services related to the products or services of the company. The CRM system also creates a framework that links IT processes with business operations.

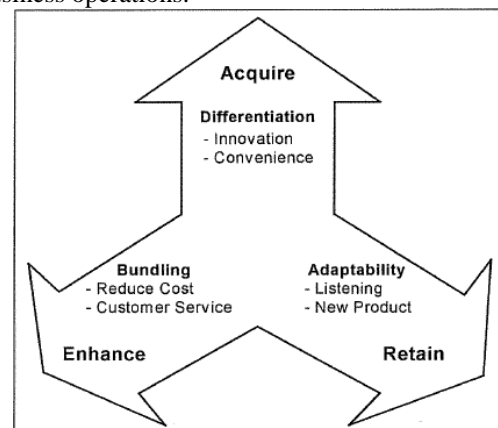


Figure 1 CRM circle <sup>(Robinson, 1999)</sup>

There are three phases of the cycle of CRM customers according to Robinson (Robinson, 1999), namely customer acquisition, increase value-added services to customers, and retain customers. Each phase gives a different effect on the relationship with the customer and will be even closer relationship between the company and the customer.

### 1.2 Five Competitive Forces (FCF)

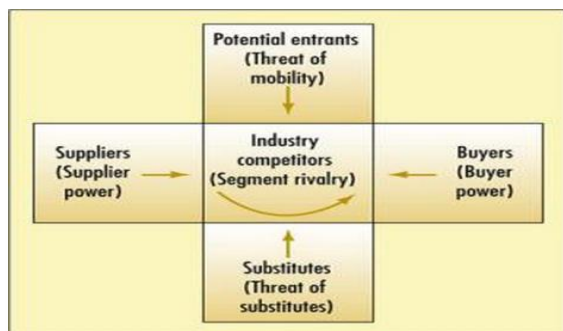


Figure 2 Five Competitive Forces Methode (Porter, 1985)

Michael Porter (Porter, 1985) in his book "Competitive Strategy" explains the five forces of competition. Competition in an industry is not only limited to the existing conventional players. Product replacement, buyers, suppliers, as well as potential new entrants, all of which are competitors for firms in the industry.

### 1.3 Value chain

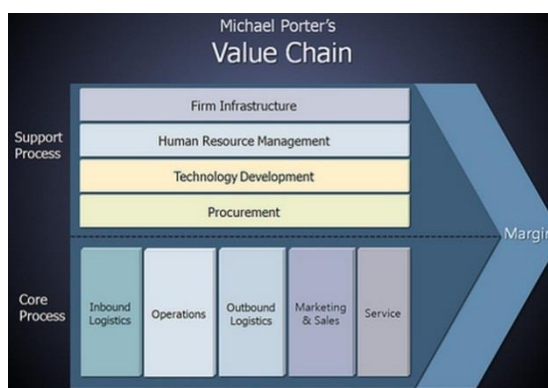


Figure 3 Value Chain Methode (Porter, 1985)

The concept of value chain popularized by Michael E. Porter in 1985 (Porter, 1985) in the book 'Competitive Advantage, Creating and Sustaining Superior Performance'. The main activities include:

- Sign Logistics (Inbound Logistics), is the activity or activities associated with the receipt, storage and distribution of inputs / raw materials
- Operations (Operations), is an activity that is associated with changing inputs or raw materials into final product form
- Exit Logistics (Outbound Logistics), is an activity that is associated with the collection, storage and distribution of products to the buyer.
- Marketing and Sales (Marketing and Sales), is in persuading or activity to attract buyers to buy

### 1.4 Work Centered Analysis (WCA)



Figure 4 Work Centered Analysis Methode

Step in the WCA is expressed by Alter (Alter, 1996) there are four steps:

- Determining the scope and purpose of the analysis. This provides a limitation to the problems are analyzed and solved.
- Describing the current situation. The second step is a description of the conditions that have been running in the enterprise from the point of view of the six elements of the WCA.
- Designing a process improvement potential. The third step is done by identifying the business processes in the second step can be improved by using information technology.
- Conducting elections of alternative solutions exist. This step is done in the third step when there is more than one solution.

### 1.5 Focus Group Discussion

FGD is a research method by Irwanto (Irwanto, 2006) is defined as a process of collecting information about a very specific issues through group

discussion. Beyond its function as a method of scientific research, Krueger & Casey (Krueger, 1998) states, essentially FGD can also be used in a variety of domains and goals, such as decision-making, product development or program, determine customer satisfaction, and so on. According Koentjoro (Koentjoro, 2005) FGD uses include: as a data collection tool, as a means to ensure collection of data (researcher) as well alat-checkterhadap various statements / information obtained through a variety of research methods used or previously acquired information, both similar description and to the contrary.

### 1.6 Testing Model ISO 9126

According Simarmata (Simarmata, 2010) external quality characteristics are those parts of a product related to the wearer, while the internal quality characteristics are not directly related to the wearer. ISO 9126 standard has been developed in an attempt to identify key quality attributes for computer software. The quality factor according to ISO 9126 includes six quality characteristics as follows: functionality (functionality). The ability of the software to provide functions according to user needs ; reliability (reliability). The ability of the software to maintain a certain level of performance ; usability (usability). The ability of the software to be understood, learned, used and attractive to users, efficiency (Efficiency). The ability of the software to provide appropriate performance and relative to the number of sources; maintainability (Maintenance). The ability of the software to be modified; portability (Portability). The ability of software to be transferred from one environment to another environment.

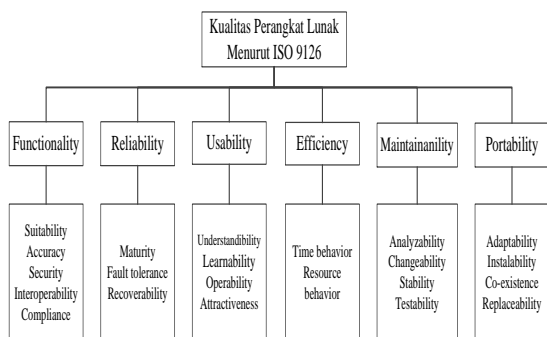


Figure 5 Testing Model ISO 9126 (Al-Qutaish, 2010)

## II RELATED WORK

Research conducted Lundy (Lundy, 2003) resulted in the implementation of CRM to optimize Reviews their business processes in a one stop service to support performance Biznet. CRM implementation to optimize business processes manually by digitizing deliver results effectively and efficiently with high data accuracy value, based on FCF analysis showed bargaining power of buyers, suppliers, and the rivalry is intense pressure and must be considered by Biznet in terms of improving its position, a factor of integration between applications and databases is very important in the development of a CRM system is mainly for service "one stop service", created to support CRM with webbase Biznet performance.

Natalia (Natalia, 2010) conducted a study that resulted in a models for the creation of an integrated CRM call center at PT SNS. It is known that the main problem developed is less than the maximum service to customers because many run by salesmen, companies are less responsive to customer complaints, should be made CRM integrated in the value chain business activities. To be more harmonious relationship with the customer call center needs to be provided so that customers can make transactions easily and improve brand image.

Bernard (Bernard, 2010) conducted a study that resulted in the CRM models shaped communication network and integrated database for improving services to customers. Problems in cooperation with a company deciding factors other than the price of the product as well as the reliability factor needs to be considered employees. The main problem with the company is on time delivery. From a strategic analysis of a known weakness lies pad inadequate handling of customer information, incomplete, and not terkomunikasi between management and customers. Designing an appropriate CRM model is done by making the communication network technology and database integration which supports communication processes and services to customers.

Montana (Montana, 2010) conducted a study that resulted in a models of CRM-based e-commerce system for back office and front office. Development CRM E-Commerce systems are split between front office and back office to address the issues of purchasing and customer service to the manual, the user can obtain the desired information quickly, reducing operational costs, so time efficient, accessible anytime and anywhere.

### III DESIGN AND METHODOLOGY

#### 3.1 Sample Selection Methods

The population of this study is the college student who has always held academic activities and academic staff in the service of academic activities. Sampling with purposive sampling is a sampling technique by taking a well selected respondents by the researchers according to the specific characteristics possessed by the sample. (Nasution, 2009)

#### 3.2 Data Collection Methods

- Methods of observation, or by doing fieldwork and direct observation of the object of research.
- Interview method, which is done by involving the parties relating to research using techniques focus discussion group.
- Methods Study Library.

### IV ANALYSIS

#### 4.1 Business Model Analysis

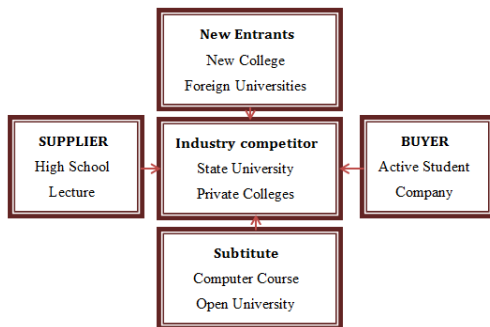


Figure 6 Five competitive forces

From the discussion above on the external factors, one factor that gives the greatest pressure comes from prospective students and active student. In internal business model analysis, from the identification of the problem it is known that there are several processes that constitute the academic process most often get complaints and taking time students are: logistics into registration; lectures operation, short-term preparation, management of student grades, leave college preparation, preparation UAS UTS, practical implementation, student information services. In

an aspect of the WCA will be shown the process to be improved, the technology is implemented and information management strategy that will be used in the business process to deliver a product in the form of transaction and information services to the academic activities of major customers such as students.

#### 4.2 Making CRM Model Design



Figure 7 CRM Model Design

Making college CRM prototype is intended to maximize the role of the website and CRM applications for the students in providing data and information that is important and can be updated and distributed to students as soon as possible. Here is a list of the required system functional requirements:

- Websites are categorized according to the user.
- Management of academic information system for students.
- E learning management system for students and faculty.
- Management faculty assessment index system

The design of the system determines how the system will meet these objectives, in this case: hardware, software, network infrastructure; user interface, forms and reports; as well as special programs, databases, and files that will be needed. In the design of the infrastructure architecture will describe the shape or design of architectural infrastructure that will be developed, in terms of hardware and software.

#### 4.3 Interface Construction

This section will describe the implementation or construction of a prototype display in college customer relationship management.





Figure 8 Display Web Main Page

In this web main page, with the separation of the user based on categories such as prospective students, active students, alumni, and visitors will automatically be speeding up the user in exploring the campus website. Display website created concise and easily understood by the user, but it aims to put the system functions.

## 4.4 System Testing

### 4.4.1 Validation Testing of FGD

Focus Group Discussion was attended by the respondents representing the universities concerned. Researchers do presentations and demos showing the new website that has been created and CRM prototypes made and explains every function that is based on the instrument that had been prepared. Having watched and knew how to operate the prototype of CRM's college, then respondents were given the opportunity to try to direct use. Furthermore, FGD participants providing information, feedback and approval form that has been provided by the researcher before the respondent tried on each computer. Based on tests conducted by the respondent, it will obtain the test results of the functional system based on the needs of each user is an administrator, faculty, and students.

### 4.4.2 Quality Testing

Respondents in the implementation of quality testing are some of the chief part, academic staff, faculty, and students with as many as 50 people total respondents.

#### a. Validity testing using Moment Pearson

Validity test was to assess the validity of each of the questions in the questionnaire. Correlation technique used is the Pearson product moment correlation with the two-way

test (two-tailed test). Validity of test results is known that all values  $r_{count}$  greater than  $r_{tabel}$  (0.273). This means that each statement is correlated with the total score and the correlation values obtained for other items worth more than 0.273, it can be concluded that the items correlated significantly with the total score and it can be concluded that all items are valid instruments.

#### b. Reliability testing using Alpha Cronbach

Reliability test is used to measure the consistency of the constructs / variables of the study. Reliability can be interpreted as a characteristic associated with the accuracy, precision and consistency. From the reliability test result that  $r_{count}$  is greater than the value 0,6 This means research instruments for all variables in the form of questionnaires are valid and reliable.

### 4.4.3 Quality Testing ISO 9126

The results of quality testing consists of two parts, namely: the level of quality of each aspect according to four karakteristik ISO 9126, and the overall quality level of the four characteristics of ISO 9126.

Tabel 1 The results of the calculation of ISO 9126

Aspect	Actual Score	Ideal Score	% Actual Score	Criteria
Functionality	1657	2000	82,85	GOOD
Reliability	1038	1250	83,04	GOOD
Usability	1690	2000	84,50	GOOD
Efficiency	618	750	82,40	GOOD
<b>Total</b>	<b>5003</b>	<b>6000</b>	<b>83,38</b>	<b>GOOD</b>

Based on the above table it can be concluded that the level of quality of the software prototype of CRM college overall in the criteria of Good, with a percentage of 83.38%. The highest quality is based on usability aspects with a percentage of 84.50%, hereinafter reliability aspects with 83.04%. Aspects functionality with a percentage of 82.85%, while the lowest is the quality aspect of the efficiency aspect with a percentage of 82.40%.

## V CONCLUSION

Based on the discussion of the research can be summarized as follows:

- a. Prototype CRM colleges are built to suit the needs for the management of academic information system for students, e-learning management system for students and faculty as well as faculty assessment index system management.
- b. The results of the validation testing of the prototype of CRM college with FGD method that has been implemented by the participants of the representatives of administrators, faculty and students all stated that the overall specification of functional requirements are acceptable.
- c. Measurement of quality testing of a prototype of CRM college generated using the ISO 9126 are as follows:
  1. The level of quality is based on four characteristics to test the quality level of the software prototype of CRM college overall in the criteria of Good, with a percentage of 83.38%.
  2. Aspects of the highest quality is based on usability aspects with a percentage of 84.50%, hereinafter reliability aspects with 83.04%. Aspects Functionality with a percentage of 82.85%, while the lowest is the quality aspect of the efficiency aspects with a percentage of 82.40%.

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# A Comparative Study between Two Hybrid Medical Image Compression Methods

Clarissa Philana Shopia Azaria<sup>1</sup>, and Irwan Prasetya Gunawan<sup>2</sup>

**Abstract**—This paper aims to compare two hybrid medical image compression methods by applying them into the same data set and then objectively evaluate the results. The hybrid medical image compression methods were DCT-based subband decomposition and modified SPIHT data organization (DCT-SPIHT) and vector quantization with variable block sizes in wavelet domain (VQ-wavelet). Simulation results showed that DCT-SPIHT is the better method which is supported by low value of entropy, fast computation time, lower mean square error (MSE), higher peak signal to noise ratio (PSNR), and high value of image quality index.

**Keywords**— discrete cosine transform (DCT), hybrid medical image compression method, set partitioning in hierarchical trees (SPIHT), vector quantization (VQ), wavelet transform.

## I. INTRODUCTION

Medical images have been widely known for their large amount of size. It can be seen from Table I the common size of medical images based on modality. Some modalities produce small dimension of medical images, thus small size, but great number per one examination. In contrast, modalities like digitized X-rays and digitized mammography generate few medical images per one examination, but with relatively large dimension and size. Imagine how huge repository is required to accommodate the multiplication between the number of medical images, the size of each image and the number of patients per hospital. Fortunately, the capacity of storage has been continuously increasing while the cost is decreasing.

Even if there was such an infinite storage, transmitting those images is still a problem. For example, teleradiology which has been applied in advanced hospital. In this technology, medical images are transmitted from one place to another [6]. The patient, with assistance of basic radiologist, is examined by using medical imaging modality. Then, the acquired medical images will be sent to the specialist doctor. It is important to receive them as soon as possible to decide whether those images are sufficient for diagnosis. Moreover,

there is certain limit of how much the patient can be exposed to radiation. Thus asking the patient to repeatedly scan by medical imaging modality is not an ultimate option.

TABLE I  
THE SIZE OF MEDICAL IMAGES [4] [8]

Modality	Image Dimension (pixels)	Gray Level (bits)	No. of Images/ Examination	Images Size/ Examination (MB)
Positron emission tomography (PET) – whole body	128 × 128	12	500	28
Magnetic resonance imaging (MRI)	256 × 256 or 320 × 320	12	100-1000	8-60
Single photon emission Computed tomography (SPECT) – whole body	512 × 512	12	10	5
Ultrasound (US)	512 × 512	8	30 f/s video	5-10
Computed tomography (CT)	512 × 512	12	10-1000	20-40
Digitized color microscopy (DCM)	512 × 512	8	1	0.8
Digital subtraction Angiography (DSA)	512 × 512 or 1024 × 1024	12	20-40	8-10
Digitized X-rays	2048 × 2048	12	1	8
Digitized mammography	4096 × 4096	12	4	68-160

Medical images must be kept in storage for following reasons [7]:

- to diagnose diseases,
- to understand living things,
- to determine the effectiveness of treatment, and
- to serve as medical records of patients for future use.

Moreover, keeping original patient data for a number of years is advisable for legal reasons [8]. Therefore, one way to solve the increasing size of medical images is by applying compression method.

The medical community has different opinions whether to apply lossy or lossless compression. Lossy compression (irreversible) is resulted from high compression rate causing some discarded information by the process of repeatedly compressing and decompressing the original image. In contrast, lossless compression (reversible) takes advantage of redundancy characteristic within the original image, thus the data are reduced but the information is totally preserved.

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However, lossless compression ratio is limited from 2:1 to 3:1 (bit rate = 4.0-2.67 bpp) [2].

The rest of medical community came up with the idea of combining both lossy and lossless and called it hybrid method. Hybrid compression utilizes the advantages from both lossy and lossless methods in expect to generate better one. This research is conducted to compare and then objectively evaluate two hybrid methods for medical images that have been proposed by previous researchers:

1. DCT-based subband decomposition and modified SPIHT data organization (DCT-SPIHT), proposed by Yen-Yu Chen [2], and
2. Vector quantization with variable block sizes in wavelet domain (VQ-Wavelet), proposed by Huiyan Jiang [5].

Those two hybrid medical image compression methods were applied to different modality. The data sets of DCT-SPIHT method were angiogram, ultrasound, and X-ray. In contrast, the VQ-wavelet method was applied into computed tomography (CT) images only. Thus, to fairly compare them, both methods are implemented to the same type of medical images and then objectively evaluated by using predefined metrics.

This paper is organized as follows. Section II presents an overview of hybrid medical image compression methods. Section III will discuss our proposed modifications that were introduced to the hybrid methods in the Section II, along with the chosen objective evaluation. In Section IV, descriptive tables, figures, and graphs will be provided to support analysis. Finally, conclusions and future works will be described in Section V.

## II. HYBRID MEDICAL IMAGE COMPRESSION METHODS

### A. DCT-Based Subband Decomposition and Modified SPIHT Data Organization

This hybrid compression method was submitted by Yen-Yu Chen in 2007 [2]. It was applied into angiogram, ultrasound, and X-ray. Generally, it consists of a translation function and a combine function. First, an image is transformed by using  $8 \times 8$  DCT and the resulting spectrum is stored in  $k$ . Then, the translation function  $T$  is applied to  $k$  resulting first level of  $LL$ ,  $LH$ ,  $HL$ , and  $HH$ . The  $LL1$  is transformed back by using  $4 \times 4$  inverse DCT function and is stored in  $k'$ . After that, the same  $8 \times 8$  DCT and translation function are implemented to  $k'$  resulting second level of  $LL$ ,  $LH$ ,  $HL$ , and  $HH$ .

1) *The Translation Function*: The purpose of translation function is to re-arrange DCT coefficients into subbands based on frequency. It is designed as such so that it chooses DCT coefficients on  $8 \times 8$  block processing. The chosen DCT coefficients are then stored in four different subbands (see Figure 1). The algorithm of translation function is as follows:

$$\begin{aligned} &\text{for } (l = 0; l < 8; l++) \\ &\text{for } (m = 0; m < 8; m++) \\ &\text{for } (i = 0; i < N/8; i++) \\ &\text{for } (j = 0; j < N/8; j++) \\ &T: \eta_{i,j}^{l,m} = k_{l+i \times 8, m+j \times 8} \end{aligned} \quad (1)$$

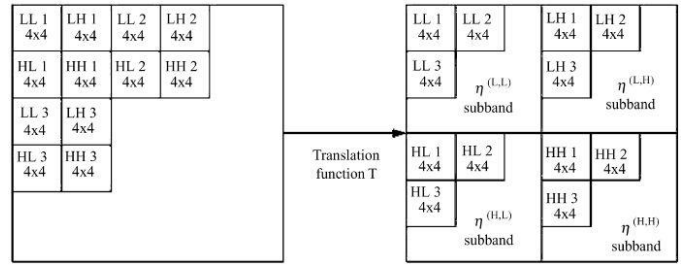


Fig. 1: The Translation Function [2]

1) *The Combine Function*: The combine function is inspired by original SPIHT algorithm [1] with improvement in highlighting the correlation among the same level subbands. It aims to remove the redundancy in the  $LH2$ ,  $HL2$ ,  $HH2$ ,  $LH1$ ,  $HL1$  and  $HH1$  subbands. First, those subbands are divided into three partitions  $Q_t$ , with  $t=1-3$  as follows:

- $Q_1 = (LH_2 \cup LH_1)$
- $Q_2 = (HL_2 \cup HL_1)$
- $Q_3 = (HH_2 \cup HH_1)$

$S_u$ , with  $u = 1 - 3$ , is initiated as correspond matrices of each partitions. After that, several rules were applied into  $Q_t$  to determine the significance of those partitions.

- $S_1(I, J) = 1$ , if pixel value ( $PixVal$ ) of  $LH_1(x, y) = 1$ ,  $I = \lfloor \frac{x}{2} \rfloor$ , and  $J = \lfloor \frac{y}{2} \rfloor$ .
- $S_1(I, J) = 1$ , if pixel value ( $PixVal$ ) of  $LH_2(x, y) = 1$ ,  $I = x$ , and  $J = y$ .
- otherwise,  $S_1(I, J) = 0$

The same rules are also applied into  $Q_2$  and  $Q_3$  as well.

Finally, a function ( $D$ ) is also initiated to determine whether those subbands have significant coefficient:

$$D(m, n) = S_1(m, n) || S_2(m, n) || S_3(m, n) \quad (2)$$

Since the above equation uses OR logical operation, if one of the partitions contain value of 1, then the value of  $D(m, n)$  is also 1. When  $D(m, n) = 1$ , it means there is at least one significant coefficient in the partitions. Otherwise, if the value of all  $S_1$ ,  $S_2$ , and  $S_3$  is 0, the final value of  $D(m, n)$  is also 0, hence it can be removed.

### B. Vector Quantization with Variable Block Sizes in Wavelet Domain

VQ-Wavelet was proposed by Jiang et al. in 2012 [5] and was applied into computed tomography (CT) images only. It focuses on compressing medical images based on wavelet transform, variable block-size and improved vector quantization (VQ). Wavelet transform methods are widely used in image compression because its ability to analyze image in multi resolution [5]. The basic principle of VQ is composing vector based on several scalar data group. However, the weakness of VQ is edge degradation. Therefore, variable block-size was introduced. Area with high complexity is divided into small blocks, while area with low complexity is divided into large blocks [5].

The process of VQ-Wavelet method can be described as follows [5]:

1. The original medical image is decomposed into multi resolution sub-images by using two-level biorthogonal 4.4 wavelet transform, generating 1 low frequency sub-image and 6 high frequency sub-images (see Figure 2).

2. Huffman's coding is applied into the lowest frequency sub-image ( $A_2$ ).
3. Vector quantization encoding is applied into each high frequency subbands.  $K$ -means clustering algorithm is used to generate codebook with several sub-codebooks.

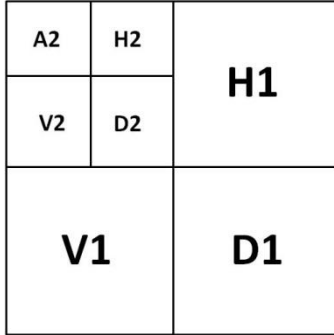


Fig. 2: The Results of Two-Level Wavelet Transform

### III. THE PROPOSED MODIFIED HYBRID METHODS

#### A. DCT-Based Subband Decomposition and Modified SPIHT Data Organization

1) *The Translation Function*: The proposed method modifies the translation function as such to enhance the computing time by copying the block processing principles. It is designed as such so that it chooses DCT coefficients on  $8 \times 8$  block processing. The chosen DCT coefficients are then stored in four different subbands as follows:

- **LL** – low frequency details  
The low frequency details are acquired by selecting the first  $4 \times 4$  DCT coefficients from the  $8 \times 8$  DCT block. It contains the most important DCT coefficients.
- **LH** – horizontal frequency details  
This subband is generated by selecting the next four columns and the same four rows from the  $8 \times 8$  DCT block.
- **HL** – vertical frequency details  
The next four rows and the first four columns of DCT coefficients are selected from the  $8 \times 8$  DCT block to create subband containing vertical details.
- **HH** – diagonal frequency details  
The high frequency subband is created by selecting the last four columns and the last four rows from the  $8 \times 8$  DCT block.

Several thresholds are made based on the significance rules to generate different results.

1. If  $PixVal < 1$ , then  $S_1(I, J) = 1$ .
2. If  $PixVal = 1$ , then  $S_1(I, J) = 1$ .
3. If  $[PixVal] = 1$ , then  $S_1(I, J) = 1$ .
4. If  $[PixVal] = 1$ , then  $S_1(I, J) = 1$ .
5. If  $PixVal \geq 1$ , then  $S_1(I, J) = 1$ .

The same rule of thumb is also applied to  $Q_2$  and  $Q_3$  as well. The complete diagram of modified DCT-SPIHT can be seen in Figure 3.

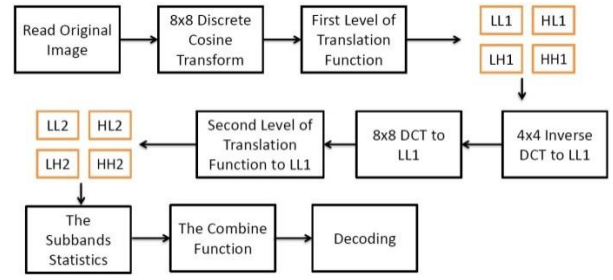


Fig. 3: The DCT-SPIHT Diagram [2]

#### B. Vector Quantization with Variable Block Sizes in Wavelet Domain

In the VQ-Wavelet method, the  $K$ -means clustering algorithm is applied to produce random codebook. The size of block ( $L$ ) and the size of codebook ( $K$ ) act as threshold, thus are modified to generate different results.

1.  $L = 4$  and  $K = 16$ ,
2.  $L = 4$  and  $K = 4$ ,
3.  $L_1 = 16$ ,  $L_2 = 4$  and  $K = 16$ , and
4.  $L_1 = 16$ ,  $L_2 = 4$  and  $K = 4$ .

where  $L_1$  is the block size for first level subbands, and  $L_2$  is the block size for second level subbands. When the initiated  $L$  is 4 and 16, it means that the block size is  $2 \times 2$  and  $4 \times 4$ , consecutively. The modified VQ-Wavelet method can be seen on Figure 4.

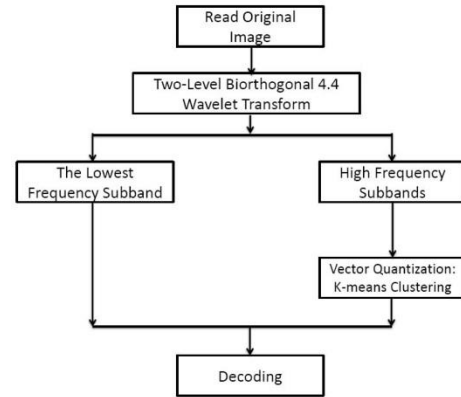


Fig. 4: VQ-Wavelet Diagram [5]

#### C. Data Set

The data set of medical images consist of 5 types: X-ray, computed tomography (CT), magnetic resonance image (MRI), and angiogram (angio) taken from The Cancer Imaging Archive. The sample image can be seen in Figure 5.

#### D. Objective Evaluation of Image Compression

The performance of hybrid methods above is evaluated by using several metrics such as; entropy, computation time, mean square error (MSE), peak signal to noise ratio (PSNR), and image quality index [9].

1) *Entropy*: Entropy is a number that indicates the minimum bits per pixel required to represent an image [3]. In this research, firstly, the entropy of each subband is calculated. There are 7 subbands (3 first level subbands and 4 second level subbands) from each hybrid methods. Then, the formula to count the entropy of whole image is defined as follows:

$$H = \left(\frac{1}{4}\right)^2 \sum_{n=1}^4 H_n^2 + \left(\frac{1}{2}\right)^2 \sum_{m=1}^3 H_m^1 + \quad (3)$$

Where:  $H_n^2$  is the entropy of subband n on second level, and  $H_m^1$  is the entropy of subband m on first level. The coefficient for level 1 and level 2 are  $(1/2)^2$  and  $(1/4)^2$ , respectively, because we have image width and heights.

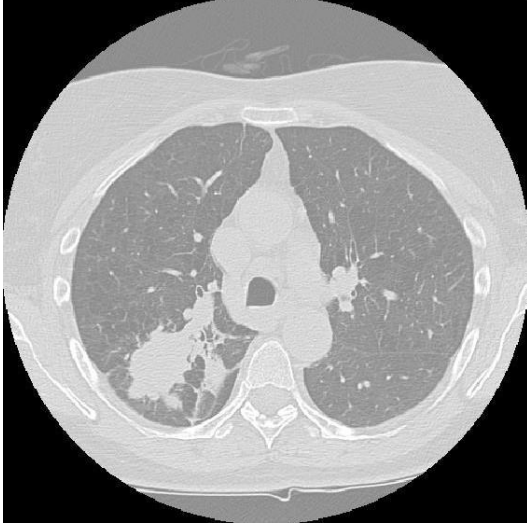


Fig. 5: Original Image of Computed Tomography

2) *Computation Time*: Computation time is defined as the time taken to compress (encode) and reconstruct (decode) the input image. It depends on the complexity of the algorithm. The more complex the algorithm, the longer the computation time.

3) *Mean Square Error (MSE)*: MSE is the cumulative squared difference between the compressed and the original image. The error is defined as the subtraction between the original image and the compressed image. The lower the MSE, the better the quality of the image.

4) *Peak Signal-to-Noise Ratio (PSNR)*: PSNR is the ratio between the maximum possible power of the input image and the power of noise (error) resulted from image compression that affect the fidelity of images [3]. The higher PSNR value means that an image reconstruction has better quality, though in some cases that rule may not apply.

5) *Image Quality Index*: Image quality index is a relatively new objective evaluation of image compression proposed by Zhou Wang and Alan C. Bovik in 2002. The difference between the original image and the compressed image is seen as a combination between loss of correlation, luminance distortion, and contrast distortion [9]. The value of image quality index is between -1 to 1.

#### IV. RESULTS AND ANALYSIS

##### A. DCT-Based Subband Decomposition and Modified SPIHT Data Organization

The objective evaluations of DCT-SPIHT method with various thresholds can be seen on Table II – V. Overall, all the modified thresholds generate compressed images with low entropy (0.187137-2.127891 bpp). Therefore, the ultimate goal of image compression has been achieved. The MSE

values of this method are very low, within range of 0.000020-0.002814. It leads to the high value of PSNR (25.506193-47.096407) dB. The computation time of DCT-SPIHT method is very fast, within range of 0.443978-10.893486 seconds. It is concluded that the computation time depends not only on the coding complexity, but also on the dimension of the input image. Small dimension images, such as MRI (256 × 256) requires short computation time. In contrast, large dimension images need approximately 7-10 seconds of encoding and decoding, such as in XRay1. Lastly, the image quality index of DCT-SPIHT is ranged between 0.429694-0.951394.

TABLE II  
THE OBJECTIVE EVALUATION OF XRAY1

XRay1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	PixVal<1	1.481590	7.271572	0.000037	44.279854	0.946574
2	PixVal=1	0.206101	7.478452	0.000222	36.538372	0.599606
3	floor(PixVal)=1	1.519209	7.598871	0.000020	47.096407	0.951394
4	ceil(PixVal)=1	1.482733	10.893486	0.000026	45.895515	0.950433
5	PixVal≥1.1	0.202472	7.361769	0.000020	36.378190	0.599047

TABLE III  
THE OBJECTIVE EVALUATION OF CT1

CT1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	PixVal<1	1.903993	3.154564	0.000221	36.550029	0.889933
2	PixVal=1	0.238594	3.820370	0.001221	29.132381	0.429694
3	floor(PixVal)=1	1.964459	2.906361	0.000150	38.231183	0.893398
4	ceil(PixVal)=1	1.918374	1.844025	0.000150	38.240800	0.892669
5	PixVal≥1.1	0.294542	1.487686	0.001146	29.407431	0.431460

TABLE IV  
THE OBJECTIVE EVALUATION OF MRI1

MRI1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	PixVal<1	2.070456	1.861724	0.000236	36.269289	0.893205
2	PixVal=1	0.226752	1.875715	0.002814	25.506193	0.581166
3	floor(PixVal)=1	2.127891	1.894312	0.000239	36.219591	0.896772
4	ceil(PixVal)=1	2.073547	0.443978	0.000236	36.271039	0.893626
5	PixVal≥1.1	0.299949	0.462378	0.002628	25.804540	0.587268

TABLE V  
THE OBJECTIVE EVALUATION OF ANGIO1

Angio1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	PixVal<1	1.282707	3.005285	0.000097	40.142476	0.855733
2	PixVal=1	0.211188	1.533872	0.000297	35.266704	0.631043
3	floor(PixVal)=1	1.337795	1.473639	0.000031	45.090745	0.860792
4	ceil(PixVal)=1	1.310235	5.582555	0.000033	44.870550	0.862659
5	PixVal≥1.1	0.187137	1.460784	0.000305	35.157996	0.627809

The results of objective evaluation method are taken into account in order to decide which threshold generates the best compressed images. The most interesting results are the lowest MSE, the highest PSNR, and the best image quality index are all gathered on the  $[PixVal] = 1$  threshold, followed by  $[PixVal] = 1$ .

**B. Vector Quantization with Variable Block Sizes in Wavelet Domain**

As seen on Table VI – IX, the VQ-Wavelet hybrid method with all the modified threshold generates compressed images of low entropy (0.638189-1.654465). Meanwhile, there is a wide range between the minimum and the maximum computation time of this method. The shortest computation time is 3.648792, while the longest one is 116.956802. The computation time is gradually decreasing as the next thresholds are applied. Then it can be concluded that there are two factors that influence the computation time of this method; the image dimension and the chosen threshold.

**TABLE II**  
THE OBJECTIVE EVALUATION OF XRAY1

XRay1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	L=4, K=16	1.234750	116.956802	0.000061	42.180296	0.813471
2	L=4, K=4	0.991764	106.908946	0.000149	38.276401	0.697301
3	L1=16, L2=4, K=16	1.033914	50.825809	0.000064	41.936075	0.757591
4	L1=16, L2=4, K=4	0.710675	45.199499	0.000114	39.444028	0.662528

**TABLE III**  
THE OBJECTIVE EVALUATION OF CT1

CT1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	L=4, K=16	1.654465	29.222520	0.000587	32.314081	0.624268
2	L=4, K=4	1.274771	25.351479	0.000867	30.619424	0.504492
3	L1=16, L2=4, K=16	1.423795	13.079213	0.000669	31.742930	0.548611
4	L1=16, L2=4, K=4	1.387997	14.609643	0.000702	31.539215	0.533324

**TABLE IV**  
THE OBJECTIVE EVALUATION OF MRI1

MRI1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	L=4, K=16	1.582598	9.003575	0.000967	30.143821	0.624415
2	L=4, K=4	1.472762	6.654199	0.001530	28.152562	0.529946
3	L1=16, L2=4, K=16	1.372077	3.648792	0.001169	29.321825	0.558482
4	L1=16, L2=4, K=4	1.411278	3.800441	0.001088	29.633527	0.559750

**TABLE V**  
THE OBJECTIVE EVALUATION OF ANGIO1

Angio1						
No	Threshold	Entropy	Computation Time	MSE	PSNR	Image Quality Index
1	L=4, K=16	1.071398	30.662780	0.000178	37.501320	0.521073
2	L=4, K=4	0.638189	25.573067	0.000264	35.786026	0.459587
3	L1=16, L2=4, K=16	0.862792	13.639390	0.000181	37.420498	0.490017
4	L1=16, L2=4, K=4	0.884315	14.647050	0.000186	37.313777	0.470450

Another similar trend occurring on this hybrid method is when the best threshold is supported by a group of metrics. In this case, it is  $L=4$  and  $K=16$ . Despite its longest computation time, this threshold is supported by the lowest value of MSE, the highest PSNR, MSSIM, NCC and image quality index. The other threshold that produces the compressed images with high value of PSNR and image quality index is  $L_1=16, L_2=4,$  and  $K=16$ . Therefore, those two are labeled as the best threshold for VQ-Wavelet method.

**C. DCT-SPIHT vs VQ-Wavelet**

As seen on Figure 6, the thresholds of VQ-Wavelet

produces compressed images with lower entropy compared to the other hybrid method. It also can be concluded that the entropy of compressed images are influenced by the image dimension. MRI1, the small dimension image, has higher entropy compared to images with large dimension.

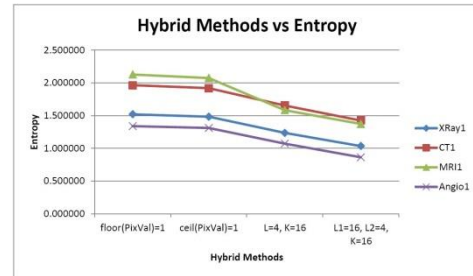


Fig. 6: The Graph of Hybrid Method vs Entropy

It can be seen on Figure 7, that the VQ-Wavelet methods require more time to compute. The longest computation time is in one of its threshold with value of almost 2 minutes for XRay1 image. In contrast, the DCT-SPIHT method requires only few seconds to finish the computing processes.

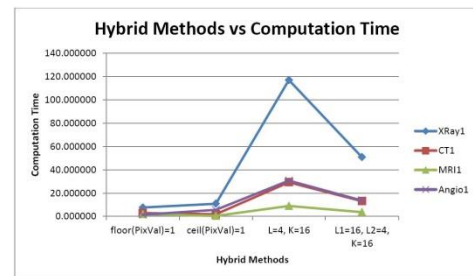


Fig. 7: The Graph of Hybrid Method vs Computation Time

MSE and PSNR are inseparable objective evaluation (see Figure 8). Thus it is best to analyze both metrics at the same time. The DCT-SPIHT method generates compressed images with low MSE, thus the PSNR value is high. In contrast, the VQ-Wavelet method produces the compressed images with higher MSE, hence the PSNR value of them is lower. It can be concluded that, according to PSNR, the best method is DCT-SPIHT.

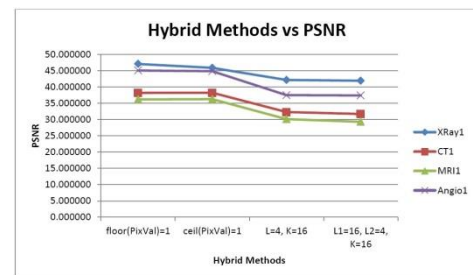


Fig. 8: The Graph of Hybrid Method vs PSNR

As seen on Figure 9, there is a significant result between the DCT-SPIHT and the VQ-Wavelet method in term of image quality index. The former has compressed images with value approximately 0.8-0.9. In contrast, the VQ-Wavelet method has wider range of image quality index of more or less 0.5-0.8.

Therefore, it can be concluded that the DCT-SPIHT generates better value of image quality index.

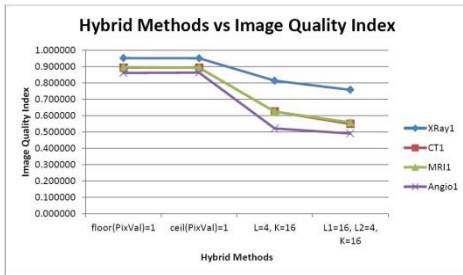


Fig. 9: The Graph of Hybrid Method vs Image Quality Index

## V. CONCLUSION AND FUTURE WORKS

Based on the results in previous section, conclusions are made to answer the problems. Moreover, several suggestions are also given for future works related with this research.

### A. Conclusion

The reconstruction and comparison have been made to two hybrid medical image compression methods. Therefore, it can be concluded that:

- 1) VQ-Wavelet method generates compressed images with lower value of entropy. However, it also requires longer computation time, produces higher value of MSE, lower value of PSNR and image quality index. Moreover, VQ-Wavelet is not suitable when compressing image with small dimension (MRI) because the edge degradation of the compressed image is highly visible.
- 2) On the other side, the quality of DCT-SPIHT compressed images is supported by the fastest computation time, the lowest value of MSE, the highest value of PSNR, and the almost perfect value of image quality index. The DCT-SPIHT is the best method to compress either small or large image. The chosen threshold helps to eliminate the blocking effect when it is applied into small image.

### B. Future Works

There are some suggestions for the future works related to this research

- 1) Since medical image consists of object and background (black), separating those areas and then compressing them differently would be a great addition into DCT-SPIHT method. Because in this research, there are some thresholds that consider the background area as significant.
- 2) For the VQ-Wavelet method, exploring other methods to generate codebooks and adding various block size are worth to try.
- 3) It is necessary to see whether DCT-SPIHT and VQ-Wavelet method is applicable for medical video, such as ultrasound (USG).

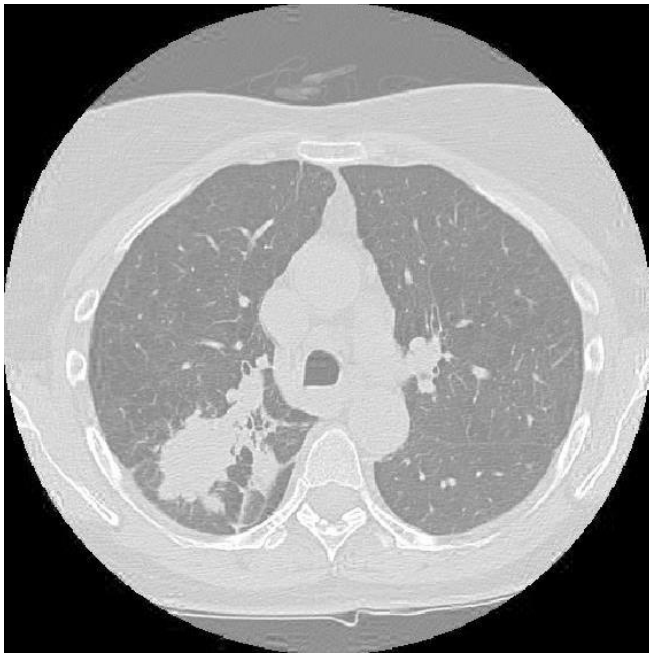
## ACKNOWLEDGMENT

Image data used in this research were obtained from The Cancer Imaging Archive (<http://cancerimagingarchive.net/>).

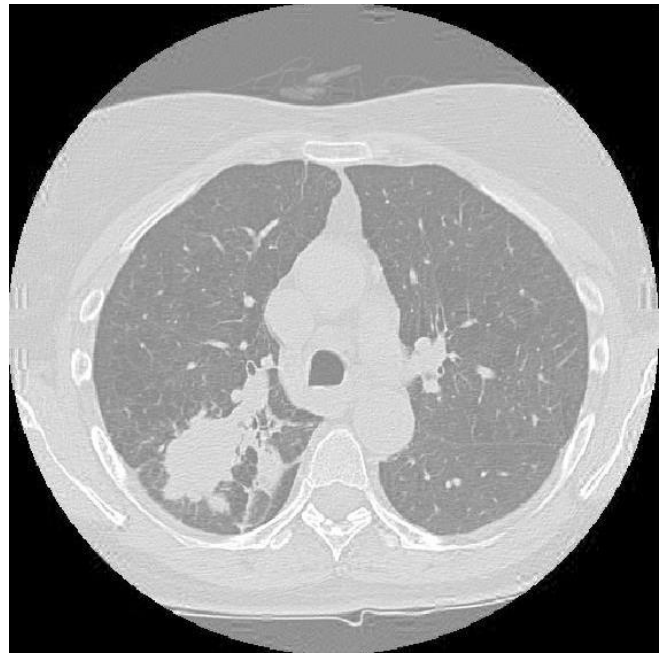
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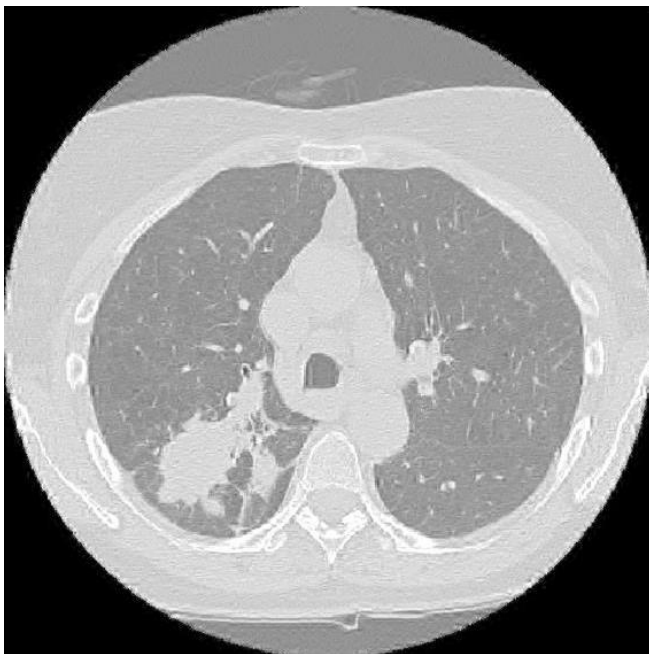


(a) DCT-SPIHT: Threshold floor( $PixVal$ ) = 1

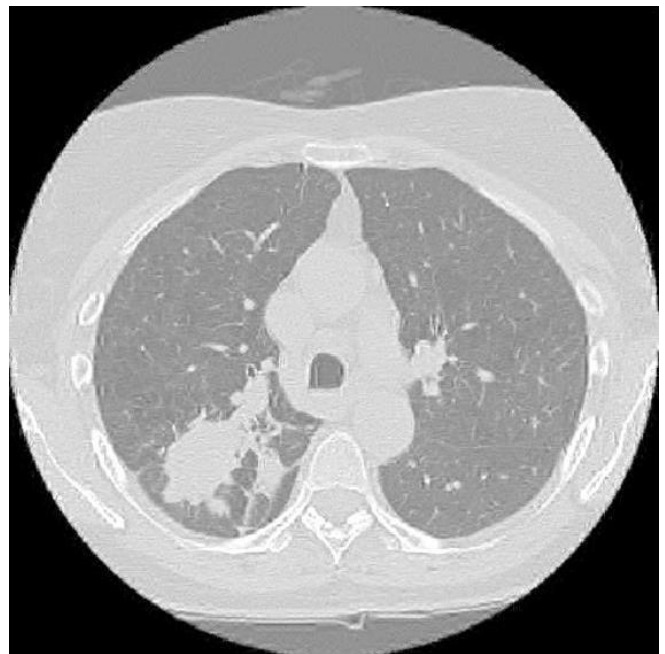


(b) DCT-SPIHT: Threshold ceil( $PixVal$ ) = 1

Fig. 10: The Compressed Images of DCT-SPIHT



(a) VQ-Wavelet: Threshold  $L = 4$  and  $K = 16$



(b) VQ-Wavelet: Threshold  $L_1 = 16$ ,  $L_2 = 4$  and  $K = 16$

Fig. 11: The Compressed Images of VQ-Wavelet

# The Implementation Of Post Editing Method On The Translator Application To Identify The Ambiguous Sentences

Dewi Soyusiawaty

**Abstract**— In the daily life, there are many words or sentences having ambiguous meaning. The word 'jatuh' could have two different meanings in different sentences. It could mean 1) movement from an upright position to a lower position 2) bankrupt. Ambiguous meaning in the sentences such as 'Pendaftaran anggota baru akan dilaksanakan minggu depan' could mean 1) new member (The new member registration will start next week), and 2) will just start (The member registration will just start next week). The translation system, which is available now, hasn't been able to automatically produce a valid translation output. It needs a collaboration between human and machine. This research discusses the implementation of post editing method to produce a translation as a user means. The research starts by collecting data consisting of basic vocabularies, which have ambiguous meaning, and part of speech both from the source language and the target language. Then, a system need analysis is conducted. This research emphasizes on designing necessary database and user interface related to the interaction between a user and system by post editing process. The implementation is the application produced. The result of the research is the implementation of post editing strategy on the translator application to identify ambiguous sentences to produce valid output sentences as the user means.

**Keywords**— ambiguous meaning, post editing, translation

## I. INTRODUCTION

The Concept of Translation Today, there is no machine-assisted translation system (TMe) that provides fully automatic and valid translation. The one which exists now is translation system involving collaboration between human and machine. The collaborative translation system could be in form of machine-assisted human translation (TMaBMe) or human-assisted machine translation (TMeBMa). In TMaBMe, translation is done by human with computer assistance in form of: (1) the computer dictionary gives the term's meaning based on the context or the topic of the text; (2) the general dictionary computer which is always updated based on the recent terminology; and (3) the computer which could analyze sentences particularly in form of word morphology (often completed with spelling correction).

In the translation, there are two main processes: (1) receive, understand or analyze a source text, and (2) produce, express or synthesize the target text or translation result. Without correctly understanding the source text, what will be

expressed could not be correct. In other words, the translation result doesn't represent the source text or it's not correct. Therefore, the most essential process is correctly understand and analyze the source text. By correctly understanding the source text, the main demand of translation, which is the content or meaning equivalence between the source and the target text, could be achieved. Collaborative translation system which is commonly experimented and got attention of the researchers is TMeBMa system. There are two TMeBMa systems, which are: (1) pre editing type and (2) post editing type. Pre editing type could be described as follows:

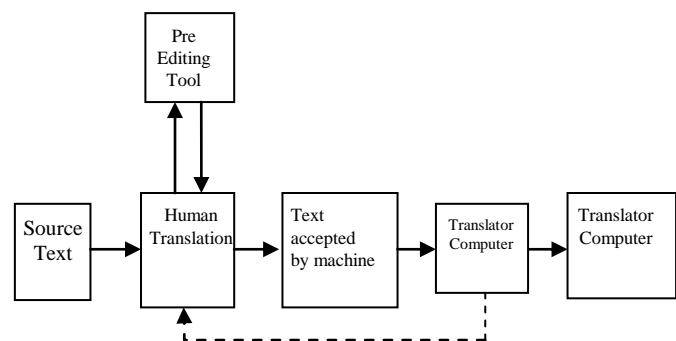


Fig. 1 Pre Editing Type

In this system, a pre editing actor revises the source text to be understandable and acceptable text for the computer as an input, which is then processed to produce the translation result.

In the post editing type, the source text is processed by the translator computer to produce the translation result which has a lot of mistake. This translation result is examined by human translator, and then is edited to be a common translation result. The process could be described as figure 6. In the raw translation result from computer, there are a lot of mistakes which are especially caused by ambiguity in the source text. [1][3][4][5]

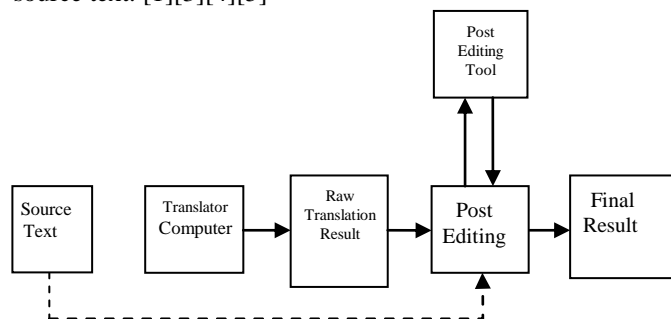


Fig. 2 Post Editing Type

**The Ambiguity in the Natural Language**

The ambiguity in the natural language could be differentiated, at least, into three kinds, which are (i) category ambiguity, (ii) semantic ambiguity, and (iii) syntactic ambiguity. The category ambiguity is an ambiguity related to parts of speech, as represented by the word ‘water’ in English language; Look at the example below:

- The **water** is boiling. [noun] (1)
- They **water** the plant twice a day. [verb] (2)

An example of semantic ambiguity in Indonesian language is the word *genting*. The meaning of *genting* in phrase (3) is different to the meaning in the phrase (4).

- Peristiwa **genting** (3)
- Atap **genting** (4)

Another example is the word *kali* which in Indonesian language has three meanings: (1) river; (2) frequency; dan (3) multiply (mathematic operation). The word *kali* in the sentences together with words such as *dalam (deep)*, *lebar (wide)*, etc, we will know that *kali* means ‘river’. Therefore, the language context of the word ‘*kali*’ avoids or solves the ambiguity (disambiguate). Likewise, if the word *kali* comes together with numbers, the word ‘equal’, etc, we will know that *kali* means ‘multiply/ relates to mathematic operation’. From the perspective of providing ambiguity, it needs certain ways to solve the ambiguity/ disambiguate. In case of lexical ambiguity, disambiguating could be done by marking the meaning with a symbol, for example subscript. For instance the word ‘*kali*’ in the sentence “*Bukan tiga kali, tetapi empat kali*”, the three meaning mentioned above could be possible. Therefore, it can be given ambiguity solving mark as follows:

- a) *Bukan tiga kali<sub>S</sub>...* [‘sungai’] (river)
- b) *Bukan tiga kali<sub>F</sub>...* [‘frekuensi’] (frequency)
- c) *Bukan tiga kali<sub>M</sub>...* [‘perlakuan matematik’] (multiply/ mathematic operation)

The example of syntactic ambiguity could be found in the Indonesian sentences using the word ‘*baru*’[8], which could be translated as an adjective describing the noun ‘*anggota*’, also could be translated as an adverb which is related to *minggu depan*. *Pendaftaran anggota baru akan kami lakukan minggu depan* [8]

However, the ambiguity as shown in (3), (4), and also the following example, could be solved by the computer because there are different characteristic that could be revealed. The word *genting* (3) is an adjective while *genting* (4) is a noun. The word *memerah* (9) is a transitive verb while *memerah* (10) is an intransitive verb. The word *mengandung* (11) together with human subject, while *mengandung* (12) relates to non-human subject (thing).

- Pekerjaannya memerah susu sapi.* (9)
- Wajahnya memerah ketika ia dimarahi.* (10)
- Ibu sedang mengandung enam bulan.* (11)
- Garam mengandung potassium dan sodium.* (12)

The same case could be found in the potential ambiguous phrase such as : ‘wanita dan laki-laki yang tua itu’, which could mean ‘those old woman and old man’ or ‘ those woman and an old man’. This phrase is ambiguous because it can be analyzed by both constituent composition and immediate constituent structure:

- a) (((wanita dan laki-laki) yang tua) itu) (those ((woman and man) who are old))
- b) ((wanita) dan (laki-laki yang tua) itu) (those ((woman and (old man))))

However, the following ambiguity is still a problem for the computer because it could just analyze a sentence, not context. The ambiguity such as the example (9) – (12) could be solved only using a sentence analysis.

In an interactive system, there is an interaction between computer and human who uses the computer. In this system, (1) a user types a sentence in the source language, (2) the computer asks some necessary questions, (3) the user answers the questions and (4) the computer produces the sentence in the target language without any necessary post editing. The questions and answers solve the ambiguous words or sentence. [2] [6]

**Discussion**

- A. Data
  - Core Data needed consisting of :
    - a. Basic Vocabularies from a to z. A physical dictionary is a word collection which is arranged and translated to the target language.
    - b. Part of Speech. There are 12 parts of speech, which are nominal, adverbs, verbal, verbs, adjectives, pronouns, numbers, articles, question words, etc. [12]
    - c. Compound words. Words are combined and have one new meaning. As identified, there are more than 300 compound words in Indonesian language and the translation in the target language. For instance *rumah makan, kapur sirih, air mancur, air mata*, etc.
    - d. Homonym. One part of ambiguous varieties is lexical ambiguity, which is a word that is written and spelled the same way but has different meaning. As identified, there are more than 250 homonym words. For instance, the word ‘tahu’ could mean understand or a food name made of soy bean. ‘Apel’ could mean a fruit or a ceremony. Bisa could mean able to do something or snake’s poison, etc.
    - e. Polysemy. A kind of ambiguous word which represents a same meaning of a word but different in the context. As identified, there are more than 150 polysemy words. For example the word ‘jatuh’ in the sentence ‘Nilai rupiah jatuh’ doesn’t mean something which physically falls from an upright position to a lower one, but it means decrease.

TABLE I  
Homonym Words

No	Word	Category	Meaning
1	Atlas	Nominal	Map Book
2	Atlas	Nominal	Madras (cloth)
3	Atlas	Nominal	Neck Bone Segment

4	Apel	Nominal	Fruit
5	Apel	Verbal	Ceremony
6	Asal	Verbal	On conditions
7	Asal	Verbal	Careless, random
8			A place (like a basket) made of webbing
9	Bakul	Nominal	Seller
10	Guling	Nominal	Long pillow
11			Going back and forth
12	Guling	Nominal	Baked food
13	Guling	Nominal	Roll over

B. ERD

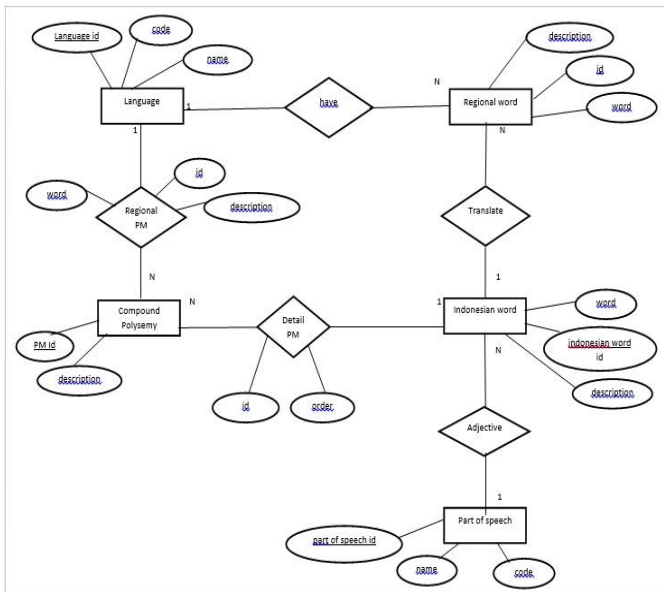


Fig. 3 ERD

Mapping table

1. Language

TABLE II  
Table of Language

Couloumn Name	Data Type
Language_id	Int
Code	Char(10)
Name	Varchar(30)

2. Part\_of\_Speech

TABLE III  
Table of Part\_of\_Speech

Couloumn Name	Data Type
Part_of_Speech_id	Int
Code	Char(10)
Name	Varchar(30)

3. Table of Indonesian\_Word

TABLE IV  
Table of Indonesian\_Word

Couloumn Name	Data Type
Indonesian_Word_id	Int
Part_of_speech_id	Char (5)
Word	Varchar(25)
Description	Varchar(255 )

4. Table of Regional Word

TABLE V  
Table of Regional\_Word

Couloumn Name	Data Type
Id	Int
Language_id	Int
Indonesian_Word_id	Int
Word	Varchar(25)
Description	Varchar(255)

5. Table of Compound\_Polysemy

TABLE VI  
Table of Coumpound Polysemy

Couloumn Name	Data Type
PM_id	Int
Description	Varchar(255)

6. Table of Detail\_Compound\_Polysemy

TABLE VII  
Table of Detail\_Compound\_Polysemy

Couloumn Name	Data_Type
Id	Int
PM_id	Int
Indonesian_Word_id	Int
Order	Int

7. Tabel of Regional PM

TABLE VIII  
Table of Regional\_PM

Couloumn Name	Data Type
Id	Int
Language_id	Int
PM_id	Int
Word	Varchar(25)
Description	Varchar(255)

II. IMPLEMENTATION

1. Data Inputing Page

Data Inputing Page is prepared to input data of Indonesian words both homonym and not homonym with the regional language translation, polysemy words or compound words of Indonesian language, also, with their translation.

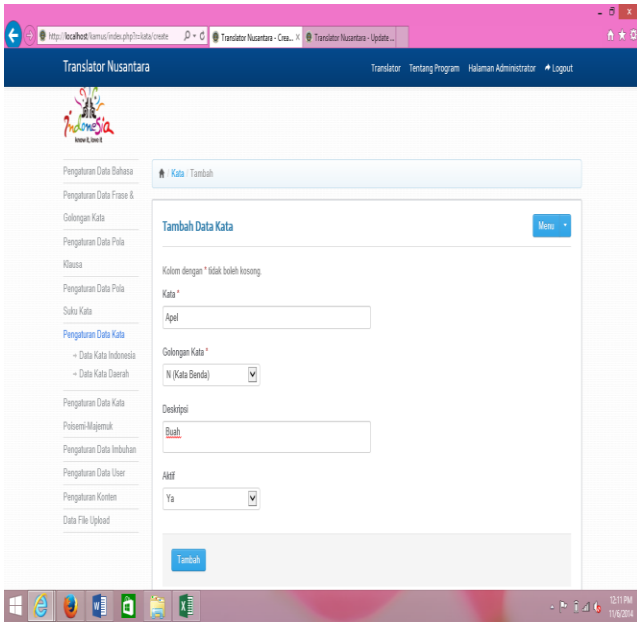


Fig. 4 Data Inputing of Indonesian Words

The following figure shows the setting of ambiguous words data or homonym. For example, the word 'Apel' could mean a noun (N) or a verb (V) with description of 'buah' (fruit) and 'upacara' (ceremony).

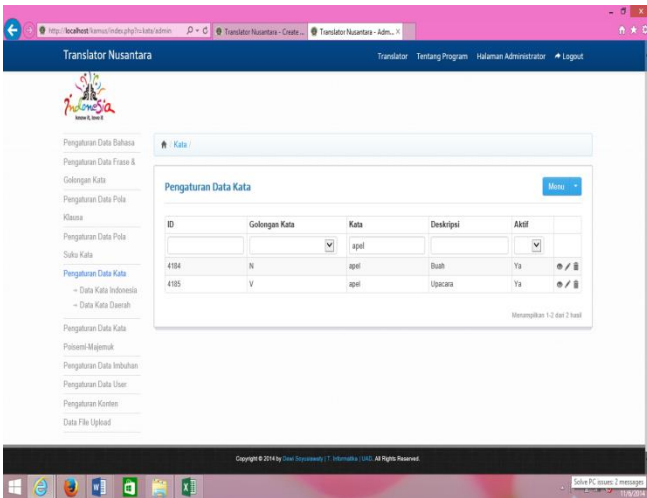


Fig. 5 The Data setting of Ambiguous Words

Figure 6 shows the regional words data from Indonesian words.

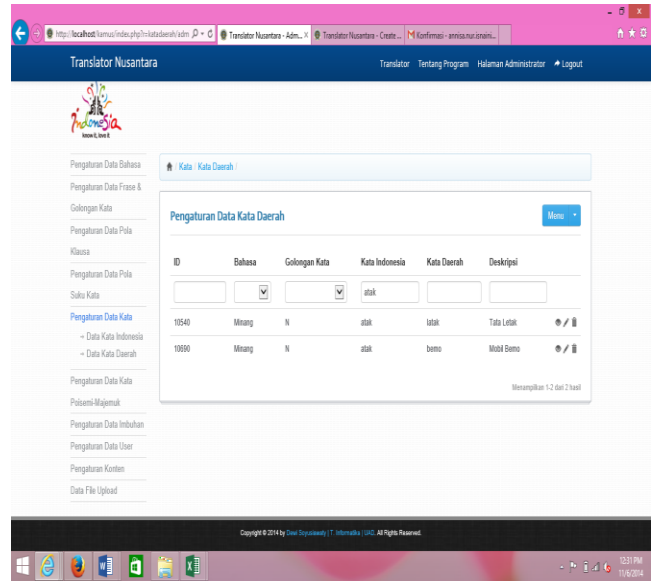


Fig. 6 The setting of Regional words

To input polysemy data or compound words is shown as following figure. A compound word could be inputted if only each word combined in that compound word has already been inputted on the inputting page in the previous Indonesian words data.

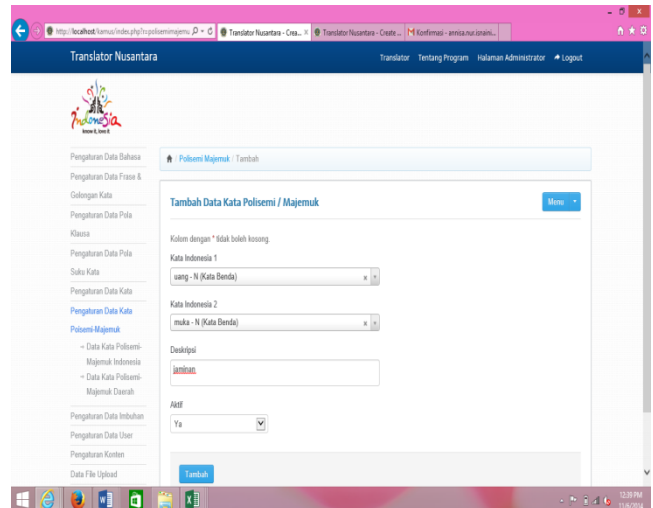


Fig. 7 The Data setting of Indonesian Polysemy/Compound

After the data of compound words is inputted on the compound word page, then the translation of regional language words could be inputted. The following figure shows the page where regional language compound words are inputted.

different sign on the translation page showing that word could have more than one alternative translations or ambiguous. For example the word ‘tahu’ as a verb and a noun.

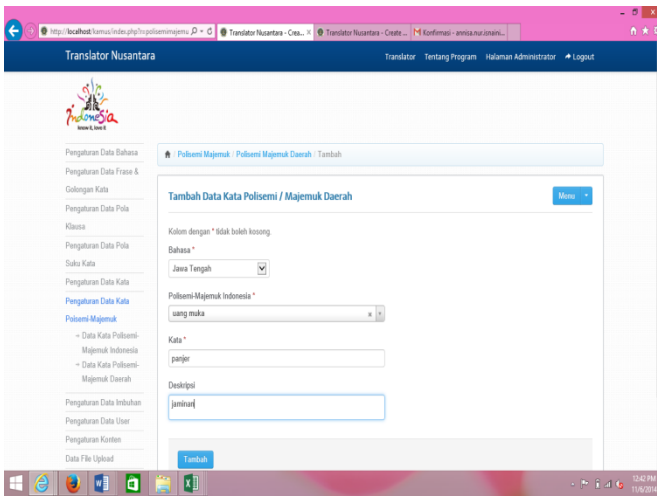


Fig. 8 The Data setting of Regional Compound Polysemy

The page below shows the list of compound words of the regional language.

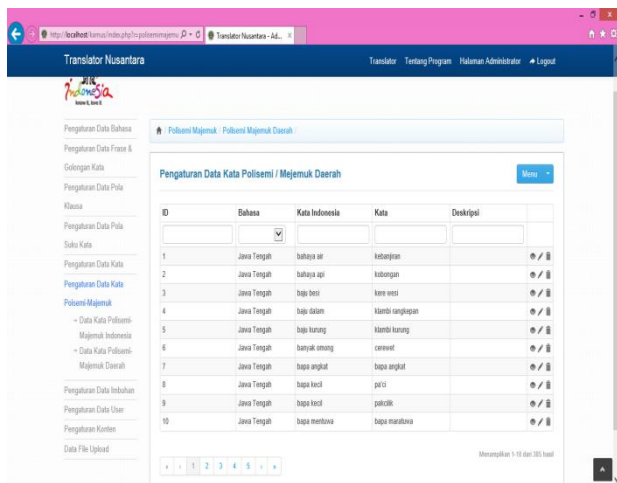


Fig. 9 The Setting of Regional Compound Words

## 2. Translation Page

The implementation on the translation page is as follows:

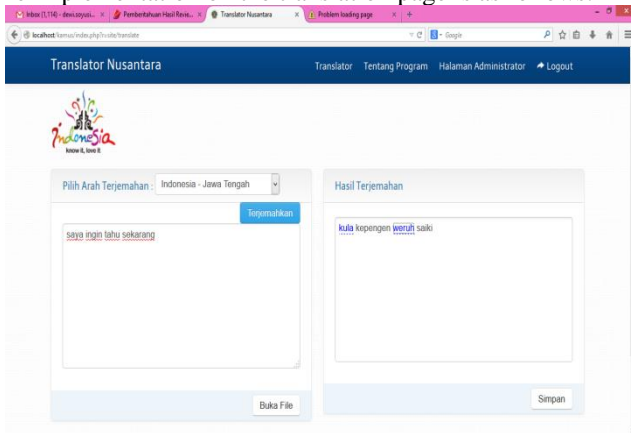


Fig. 10 Translation Page of Homonym Word

The word ‘tahu’ is one of homonym words. The implementation of post editing method is system gives a

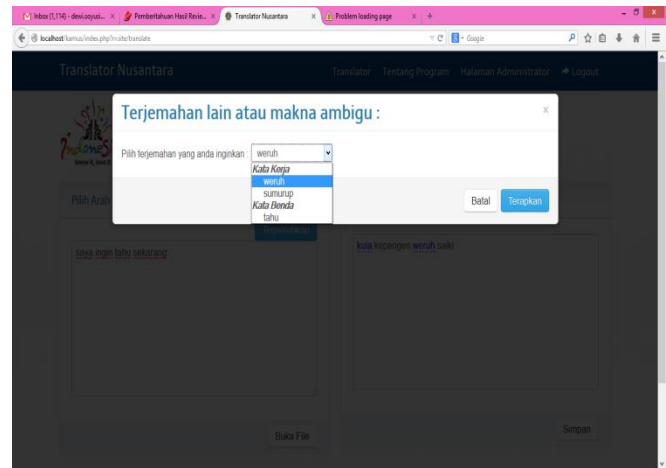


Fig. 11 Alternative translation or Ambiguous meaning

A user could select a translation option based on what he/she actually means. After the editing process, the system will apply the option in the translation result. The same thing happens in ambiguity example in the compound words, as shown on the following figure :

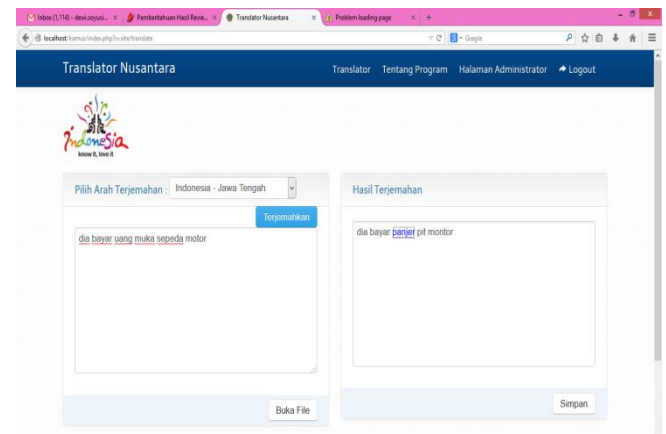


Fig. 12 Translation of Compound Words

The word ‘panjer’ is the first alternative shown by the system as the word ‘uang muka’ inputted. On alternative translation page or ambiguous meaning, there are two optional translations which are 1) panjer and 2) ‘dhuwit’ dan ‘muka’. On the second option, the system shows translation of each word if they aren’t actually a compound word but independent words.

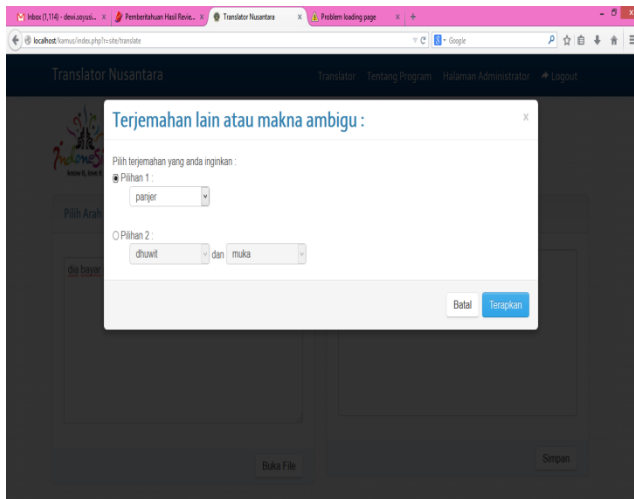


Fig. 13 Alternative Result

A user could determine the meaning as he/she means. The system will show the translation as selected.

### III CONCLUSION

- a. Post editing method is one of solutions on developing translator application from one language to another to identify ambiguous sentences.
- b. The implementation of post editing method on the translator application aims to get translation result as a user means.

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# Enhanced Oriented Bounding Box Method Implementation in Distributed Virtual Environment

Elfizar<sup>1</sup>, Sukamto<sup>2</sup>, and Gita Sastria<sup>3</sup>

*Abstract*—This paper aims to implement the Oriented Bounding Box (OBB) in Distributed Virtual Environment. This method is used to do the collision detection between objects. Collision detection is one of important aspects in three-dimensional (3D) applications. Currently, most DVEs only use simple methods in objects collision detection. It influences the accuracy of DVE itself.

This research begins with developing the suitable DVE. It should make many users collaborate with each other. The DVE should also meet the real world requirements, such as gravity pole and object movements. To detect the collision between objects, this research uses OBB. There are two scenarios used in the experiment: using OBB in common DVE, and using it in object-based simulators architecture as an improvement of this research. Further, runtime and frame rates of application are two parameters used to evaluate the performance of DVE.

The experiment results show that the second scenario has higher performance than the first one, either in runtime or frame rates of application.

*Keywords*—Collision detection, OBB, Distributed Virtual environment.

## I. INTRODUCTION

VIRTUAL environment (VE) imitates the real environment so that it should meet the real world requirements such gravity pole, kinetics, etc. As VE is used by many users who are geographically distributed, it is known as Distributed Virtual Environment (DVE).

DVE has been used in many applications such as education, training, games, etc. Even, DVE is used as a

powerful training tool for autism children [1].

An aspect in a real world influencing VE is a constraint that two objects are not able to occupy the same point in a space at the same time. Generally, object representation in VE does not allow penetration between objects. Therefore, to develop a simulation environment that represent a real world this constraint should be satisfied. One of important tasks is to detect collision among objects. Collision detection is a mechanism that is able to detect when and where the objects will collide [2].

Collision detection can be classified into two categories, i.e. discrete and continue. Discrete collision detection is a method that just detects the collision at a certain time, for instance at time  $t$ . Its consequence is this method misses many collision detections between two consecutive configurations. It is called tunneling problem. Discrete collision detection does not require many computations so that the process is faster.

Continue collision detection can address the tunneling problem because it uses interpolation algorithm to examine the collision in a continue movement. It yields accurate solution for collision detection. Unfortunately, this method is slower than discrete method [3]. One of approaches used in continue collision detection is bounding volume that can be done by using box, sphere, etc. Axis Aligned Bounding Box [4] and Oriented Bounding Box (OBB) [5] are two methods included in this category.

Actually, many researchers have yielded better methods in collision detection. These methods contain enhanced algorithm to provide more accurately methods [6],[7]. Besides that, several methods have been generated that can be implemented by using multi-processor (CPU) [8], Graphics Processing Unit (GPU) [9], or hybrid of them [10].

Unfortunately, those enhanced methods are not implemented in DVE. Most DVEs only use simple method for collision detection such as AABB.

OBB is a better method than AABB but it has more computation cost. If OBB is used in DVE then it affects

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the performance of DVE [11]. To address the problem, this paper uses object-based simulators architecture to reduce the workload of DVE.

The rest of the paper describes the OBB methods, object-based simulators architecture, experimental design, results, and conclusion.

## II. OBB METHOD

OBB is a smallest rectangular parallelepiped whose axis is arbitrary and it contains a given object. OBB is more accurate than AABB. It is assumed that OBB center is  $c$ . The three orthogonal directions are  $v^1, v^2, v^3$  and the “radius” in three directions are  $r^1, r^2, r^3$ . Thus, the definitive region of OBB is [5]:

$$R = \{c + ar^1v^1 + br^2v^2 + cr^3v^3 | a, b, c \in (-1,1)\}$$

as shown in Fig. 1.

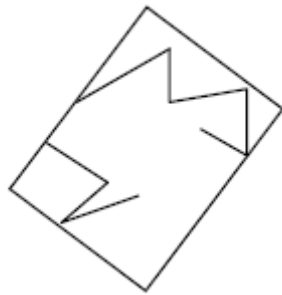


Fig. 1 OBB

The most prominent feature of OBB is the arbitrariness in its direction, which makes it surround the prescribed objects as closely as possible according to the object’s shape. It is different from AABB which has fixed coordinate so that the accuracy of detection process is weak.

Unfortunately, calculation of OBB is more complicated relatively. The key is to find the best direction and determine the smallest size of bounding box which surrounds the object in this direction.

One of methods used to compute the OBB is Separated Axis Theorem (SAT).

**Theorem (SAT):** If two convex objects are not colliding then there exists an axis for which the projection of those objects will not overlap.

Fig. 2 illustrates two shapes are not intersecting. A line is drawn between them to show this. If we choose the perpendicular line to the line separating the two shapes in this figure, and project the shapes onto that

line, we can see that there is no overlapping in their projections. A line where the projections of the shapes do not overlap is called a separation axis.

In Fig. 3 the dashed line is a separation axis. Since the projections are not overlapping, according to SAT theorem the shapes are not intersecting.

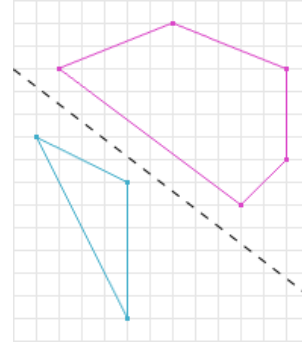


Fig. 2 Two separated convex shapes

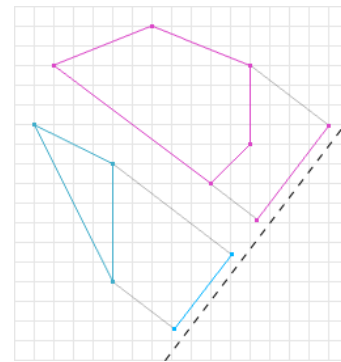


Fig. 3 Projections of both shapes

## III. OBJECT-BASED SIMULATORS ARCHITECTURE

Object-based simulators (OBS) architecture is a DVE architecture where a simulator only simulates an object. It is used to decrease the workload of simulator [12].

This architecture makes each simulator can be run on distributed computer so that it is scalable to additional hardware.

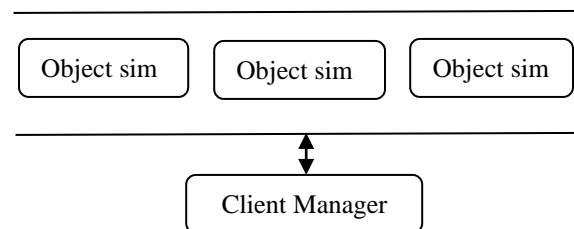


Fig. 4 OBS architecture

Fig. 4 shows the architecture of OBS. DVE comprises several simulators that simulate objects residing in it. Since simulator is independent process, it is more scalable.

#### IV. EXPERIMENTAL DESIGN

The experiment is conducted by using the computers with dual core processor, memory of 1 GB RAM. The experiment comprises two scenarios:

- Scenario 1: Using OBB in common DVE.
- Scenario 2: Using OBB in the OBS architecture.

The DVE used in this experiment is a 3D environment that user can create dynamic objects visible to other users. Users are interconnected in a local area network.

#### V. RESULTS AND DISCUSSION

Fig. 5 shows the interface of DVE. A user can use this interface to view the environment and create objects. Fig. 6 illustrates objects created by users. The objects are boxes with varying sizes and positions falling from a certain high.

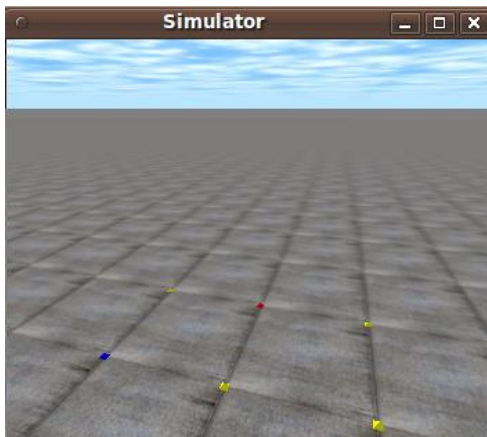


Fig. 5 Initial view of DVE

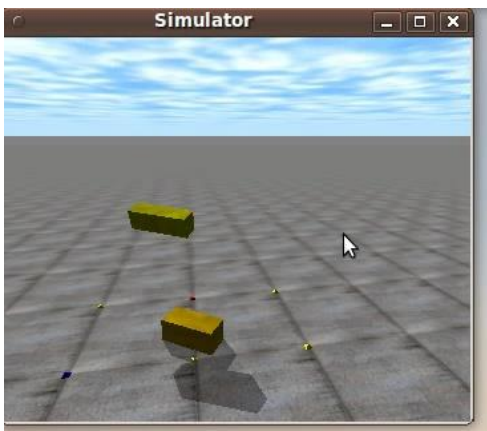


Fig. 6 Objects created by users

The OBB is used in simulation to detect the collision between objects. Fig. 7 illustrates the bounding box created by the application.

From Fig. 7, we note that the bounding box of the object (red circle) covers its own object tightly. Hence, it is difficult to determine each of them.



Fig. 7 Bounding box of object

Fig. 8 shows the runtime of OBB method running on two scenarios. From this figure we note that runtime required by the second scenario is smaller than that of first scenario. It occurs on each varying number of object. There is significant difference on both scenarios.

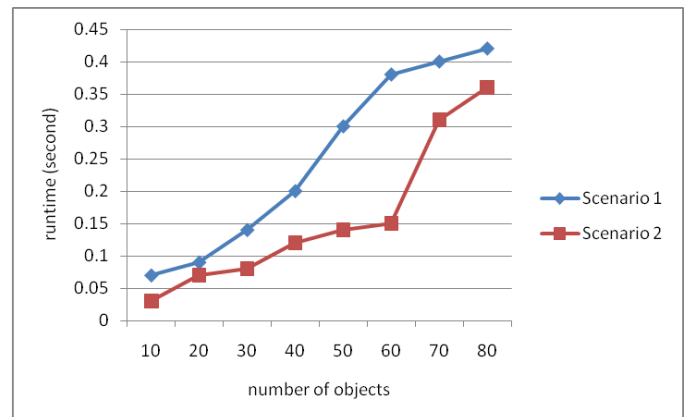


Fig. 8 Application runtime

The positive trend of the second scenario also occurs on the application frame rates as shown by the Fig. 9. The frame rates of the second scenario are always higher than those of first scenario. It means that the DVE using the second scenario has better performance than the first scenario.

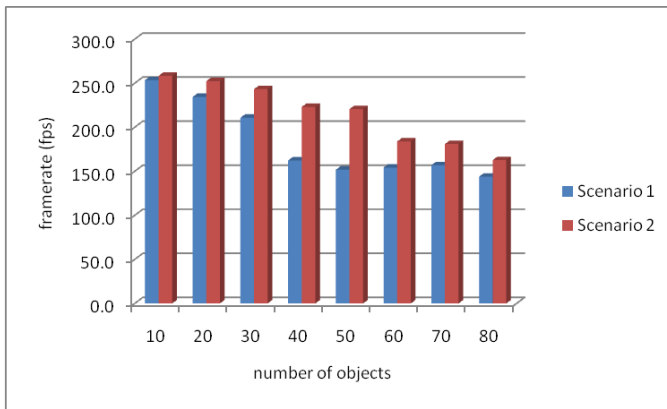


Fig. 9 Application frame rates

## VI. CONCLUSION

As DVE using the simple method of object collision detection, it faces the accuracy problem in the detection process. OBB is better than the simple methods such as AABB. Unfortunately, implementing OBB in DVE is a challenging problem because the complexity of OBB is higher.

With two scenarios used in this research, the results show that implementation OBB in OBS gives better performance than its implementation in common DVE either in runtime or frame rates of application. It concludes that OBB is an alternative method that can be used in DVE to detect the objects collision.

To give comparison with other method, the future work is to compare the results with AABB method using the same infrastructures.

## ACKNOWLEDGMENT

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# Operational CRM at Higher Education

Endah Purwanti

*Abstract*— Customer Relationship Management (CRM) has evolved into a strategy, process, and technology to strengthen the company's relationships with its customers, through the customer life-cycle. Trends in e-business shows a change from a product-centric to customer-centric. Higher education institutions are also beginning to realize the need for change in their interaction with the 'consumers'. University or college can take advantage of CRM through increased student-facing processes. This study aims to build on the operational CRM information systems academic colleges, which provide ease of 'consumer' in getting information.

CRM systems planning activities that were performed on Transactional-Decentralized, ie transactional activities that are managed independently by the faculty. Consumers involved are students, faculty, and academic administrative officer. To integrate the use of academic information system online by leveraging existing university website. Personal communication with the consumer is done also by using SMS gateway. With the proposed system, the academic activities can run smoothly, and easily obtainable information in real time.

*Keywords*—Customer Relationship Management (CRM), operational CRM, Academic Information Systems, college management

## I. INTRODUCTION

Customer Relationship Management (CRM) is a business strategy that integrates internal processes and functions, with external networks, to create and deliver more value to customers who are targeted so that it can provide more profits for the company. CRM has evolved over the last 20 years in the business and corporate activities. At first CRM is simply a collection of electronic databases that are used to provide information to consumers. However, the current CRM has evolved into a strategy, process, and technology to strengthen the company's relationships with its customers, through the customer life-cycle, from marketing and sales, to after sales service [12]. With the customer's CRM system is expected to gain easy access to information, outstanding service, as well as after-sales service guarantee clear. CRM emerged along with the rapid use of electronic business (e-commerce and e-business) in a commercial enterprise.

With the growing number of universities, the level of competition that exists makes managers think how to win the competition. Therefore, the current educational institutions in the world are undergoing changes in how they can operate and interact with their 'consumers'[9]. A best organization in the

world will be less effective if the focus of the organization with the customer is lost.

The college is an educational institution that operates and interacts with the 'consumers', ie learners or students, either actual or potential, the parents of students, faculty, researchers, employees and staff leadership, board of trustees, university type, accreditation bodies, suppliers, businesses and public organizations, foundations, alumni, the local community and the media. When developing the concept of corporate CRM, there is a new phenomenon that shows that CRM began to explore the education sector particularly higher education [3]. Institution of higher education is the organization that is student-centric, which includes a large group of students with counseling activities, ranging from acceptance, academic coaching, career coaching, and so on. The development of CRM in education is still lagging behind with the corporate sector. University or college can take advantage of CRM through increased student-facing processes [2], personalized communication with students [5], to share information between departments [2], and increased student satisfaction [1]. CRM is increasingly required by the university or college to increase student engagement and give the impression or a better experience throughout the student life cycle.

This paper is a continuation of a previous paper [9], [10], aimed at building academic information system at the college by applying the concept of CRM. Attention to systems development CRM elements which share the ability to 'customer' to do the quest for information and online realtime independently, and the ability to perform accurate and comprehensive reporting.

## II. CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

According to [4] Customer Relationship Management (CRM) is a comprehensive business strategy of a company that allows the company to effectively manage relationships with customers. The strategy is carried out with a variety of efforts to keep the customers so as not to run kepesaing by collecting all forms of customer interaction either by phone, email, feedback on the website or discussion with the sales and marketing staff.

Some types of CRM is the strategic, operational, analytical, and collaborative CRM. Strategic CRM focus on the consumer, the target is to win and retain loyal customers. Customer-centric business culture can be achieved by creating and delivering better value compared to competitors. Operational CRM focuses on the automation of customer-facing processes such as sales, marketing or tactical purposes. Analytical CRM has focused on intelligent mining of the data associated with the consumer for strategic or tactical purposes. Analytical CRM berfondasi the information about the

customer (customer-related). Collaborative CRM technology runs throughout the organization with the aim to optimize the value of the company, partners and consumers. Collaborative technologies include the use of different communication media that allows worn by the consumer, such as email, phone, fax and website.

To implement a CRM strategy, required at least three (3) key factors: (1) people who are professional (adequate qualifications), (2) processes are well designed, and (3) adequate technology (leading-edge technology) . Professional staff not only understand how to deal with customers but also understand how to use technology (for CRM). Anything without a good design will fail, as well as CRM. The company CRM users must already know the purpose (business objectives) and the demands of the business (business requirements) desired from this CRM implementation. Completeness of these elements has a positive impact on the customer as the target achievement of CRM.

CRM technology should at least have the following elements:

- a. Business Rules: depending on the complexity of transactions, business rules must be made to ensure that transactions with customers is done efficiently. For example, customers with large purchases that bring big profits to be served by a senior and experienced sales staff, and so on
- b. Data Warehousing: consolidation of customer information should be done in a single integrated system. The results of the analysis must be able to display certain clues about the customer that the sales and marketing staff is able to conduct a campaign focused on a specific customer group. Later, the data warehouse must also be able to increase the volume of sales by cross-selling or up-selling
- c. Site: clear CRM should have a self-service capabilities. Only web-based applications which could support this. Customers can do their own transactions, to know how much should be paid, and so on
- d. Reporting: CRM technology should be able to produce accurate reports and komprehen, will be useful to analyze customer behavior, etc
- e. Help Desk: technology that can integrate customer information to help desk application will demonstrate to customers how serious an enterprise dealing with customers

When the CRM application used, the application will encourage more effective marketing and sales, customer service, providing an enjoyable experience to consumers that increasing customer loyalty. Three phases of CRM is shown in Fig 1. The phases form a cycle, which should be done repeatedly. Three phases of CRM, namely:

1. Acquire

New customers gained by providing easy access to information, new innovations, and exciting services.

2. Enhance

The company seeks to establish relationships with customers by providing good service to their customers (customer service, call center). The application of cross-

selling or up-selling in the second stage the company can increase revenue and reduce costs to acquire customers.

3. Retain

This stage is an attempt to get customer loyalty by listening to our customers and strive to meet the customer's desires.

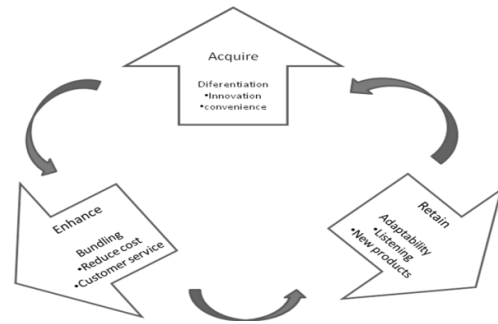


Fig 1. Three phases in the CRM

III. CRM ON HIGHER EDUCATION

Higher education institutions are “student-centric” organizations that encompass a wide range of student outreach and counseling activities such as admissions, academic advising, job placement and more. Implementation of CRM in higher education will be able to increase among student-facing processes, personalized communication with students, sharing information between departments, convenience and student satisfaction.

Viewed from the CRM lens, the concept of customer life cycle can be mapped to the stages that a student progresses through when considering and using the services of a learning institution to form the student life cycle. [7] divides the students progresses in the phases listed in Fig 2.

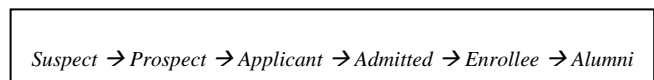


Fig 2. Student life cycle

- Suspect: A suspect is any student who might be a potential candidate for the school
- Prospect: a prospective student is at the information gathering and opinion forming stage
- Applicant: a student is an applicant when he/she makes the decision to join the institution
- Admitted: a student is admitted when the college makes the decision to accept the student
- Enrollee: this is the stage where students become a part of the institution.
- Alumni: at this stage, students who are satisfied with their academic axperience will develop long-term loyalty

In view of the company's CRM activities, college student enrollment management activities of coverting suspects to the admitted represent the marketing components of CRM; the conversion of admitted students to enrollees represent the component of sales; and the continous enrollmnet and participation as alumni represent the retention and support component. However, student life cycle involves more

complex interactions especially during the retention phase as academic programs, advising, and student life play critical role in student retention[10].

IV. DESIGN AND IMPLEMENTATION

The research was done at Airlangga University, especially at Sains and Technology Faculty. Table 1 presents the diverse range of roles between the university and the faculty in terms of student management. This research will plan a CRM system only on decentralized-transactional activity and integrated with existing systems that AUCC (Airlangga University Cyber Campus)

TABLE I  
STUDENT MANAGEMENT

Tugas	Keterangan
<i>Strategic-Centralized</i>	Strategic activities are handled by the university, such as the new admissions policy
<i>Strategic-Decentralized</i>	Strategic activities are handled by the Faculty of, such as determining the academic calendar
<i>Transactional-Centralized</i>	Transactional activity administered by the university, such as the registration of new students, the selection of students, student registration, financial and enrollment graduation
<i>Transactional-Decentralized</i>	Transactional activities managed by the faculty, such as charging a study plan, guardianship, scheduling, academic assessment, and the presence of lectures

V. ANALYSIS SYSTEM

obstacles that are often occur in Transactional-Decentralized activities are:

1. Students are often late with study plan (Kartu Rencana Studi/KRS or Kartu Perubahan Rencana Studi/KPRS) because they do not know the schedule and is located outside the city.
2. Lecturer sometimes forget to do the approval of the KRS which has been filled by student. This can happen when the students fill in the KRS-at expiry KRS / KPRS, and students do not perform offline coaching. As a result of students not enrolled in the presence of lectures
3. The credits that can be taken is limited by the value of the IPS in the previous semester
4. Students do not confirm to the lecturer counsellor when it has filled KRS
5. Lecturer need to be reminded about the deadline for entering values into the system. After the assessment period expires, the portal closed so that the value can not be inserted.
6. The process of making the schedule is very complicated and complex, because the PAA (Pendukung Administrasi Akademik) team should pay attention to the day, hour, and the room is used. Where existing classrooms used by the principle of resource sharing, regarded as common property that can be used by many directions at once.

7. Some of the issues related to the presence of lectures should be noted, that the minimum number of face-to-face in one semester and the number of students in class attendance.

VI. IDENTIFICATION OF CRM SYSTEM

Identification of the functional requirements of CRM systems based on analysis of the existing system can be seen in Table 2. With regard to the integration of end-to-end Business Processes, all activities are recorded in the website. Several functions may utilize channel Short Message System (SMS), to put more emphasis on the importance and personal aspects. Therefore, users have to complete a system of personal data, including phone number (Hp) is currently active.

TABLE 2  
IDENTIFICATION OF THE CRM SYSTEM REQUIREMENTS

Proses	Fungsional	Pengguna	Saluran
KRS/ KPRS	Beginning of each semester, students receive a reminder to KRS / KPRS	Mahasiswa	website, Short Message System (SMS)
	Information subject to be taken adjusted for the current semester, and the terms of existing	Mahasiswa	website
	The system automatically limits the number of credits taken in accordance with the IPS students		website
	The system suggests to take courses that should be taken over because the value of the D / E on the previous semester		website
Persetujuan KRS/ KPRS	Systems provide notification regarding the existence KRS / KPRS that has been filled	Dosen wali	website, SMS
	The system notifies that KRS / KPRS approved	Mahasiswa	website, SMS
	Information KRS students who have not done, the system sends a message or reminder	Dosen	website
Penilaian	The system gives a reminder for the deadline to enter grades	Dosen PJMK	website, SMS
	The system gives a message regarding the value of the course	Mahasiswa	website
	The system displays the value in the ordered position (descending) for a class / course	Mahasiswa	website
	The system automatically performs a recapitulation grades (percentage of each grade) for each subject	Dosen PJMK	website
Kartu Hasil Studi	KHS for all semester has passed	Mahasiswa	website

Proses	Fungsional	Pengguna	Saluran
	KHS scored according to semesters the required	Mahasiswa	website
Jadwal Perkuliahan	The system automatically checks the schedule of the classroom, the hours and days	Tim PAA	website
	The system displays the schedule of lectures	Mahasiswa	website
Presensi Kuliah	System recapitulate any number of face to face courses	Tim PAA	website
	The system gives the number of face-to information that has been done for every course of teaching	Dosen PJMK	website
	System provides information on attendance for each course	Mahasiswa	website
	System recapitulate attendance for each course (attendance is less than 75% can not take the exam end of semester)	Mahasiswa	website

Non-functional requirements

1. System server
2. SMS gateway

VII. SYSTEM DESIGN

The design was done by making use case diagrams, activity diagrams and ER diagrams. Use case shown in Fig 3.

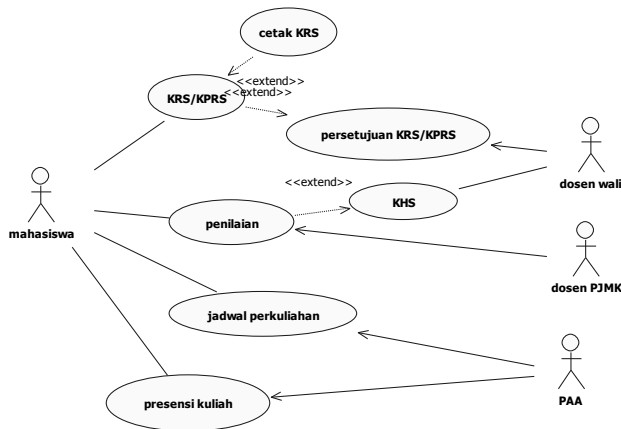


Fig 3. Use Case Diagram

Based on the analysis requirement, users involved in the system are:

1. mahasiswa, Students whose status as enrollee, such as students who have been accepted and have registered
  2. Dosen wali
  3. Dosen Pengajar Mata Kuliah (PJMK)
  4. Pendukung Administrasi Akademik (PAA), was the officer in charge of the administration of the academic, such as lecture schedule, and recaps attendance.
- all the user has a login into the system.

Activity diagram or activity diagram is a diagram illustrating the flow of activity in the system, the commencement of the work flow, determine keputusan of possibility that will happen, as well as the state of completion (end state), which indicates the end of the diagram. Activity diagrams can be used to clarify the use case. Fig 4 shows the activity process KRS / KPRS, Fig 5 shows the presence of students see the process activity, and Fig 6 shows the process of looking at KHS student activity.

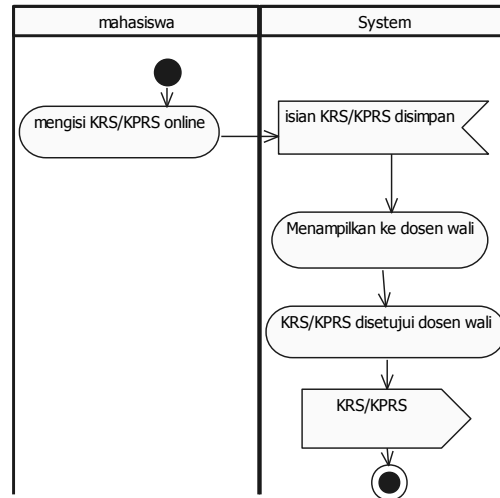


Fig 4. Activity Diagram KRS/KPRS

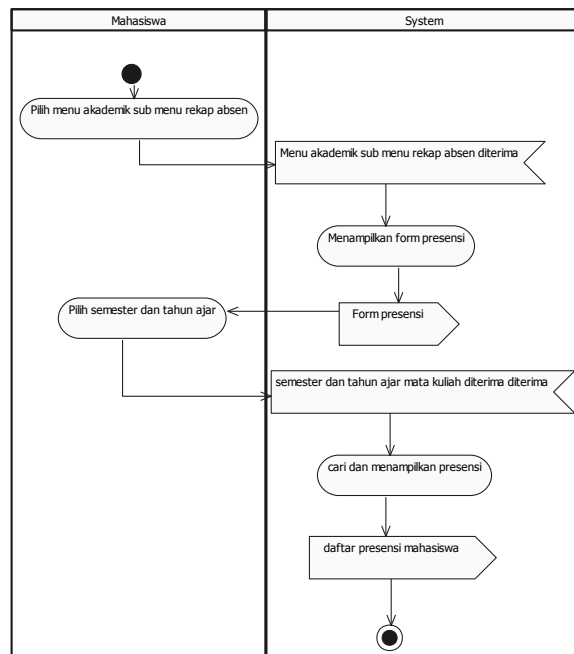


Fig 5. Activity Diagram Presensi Kuliah mahasiswa

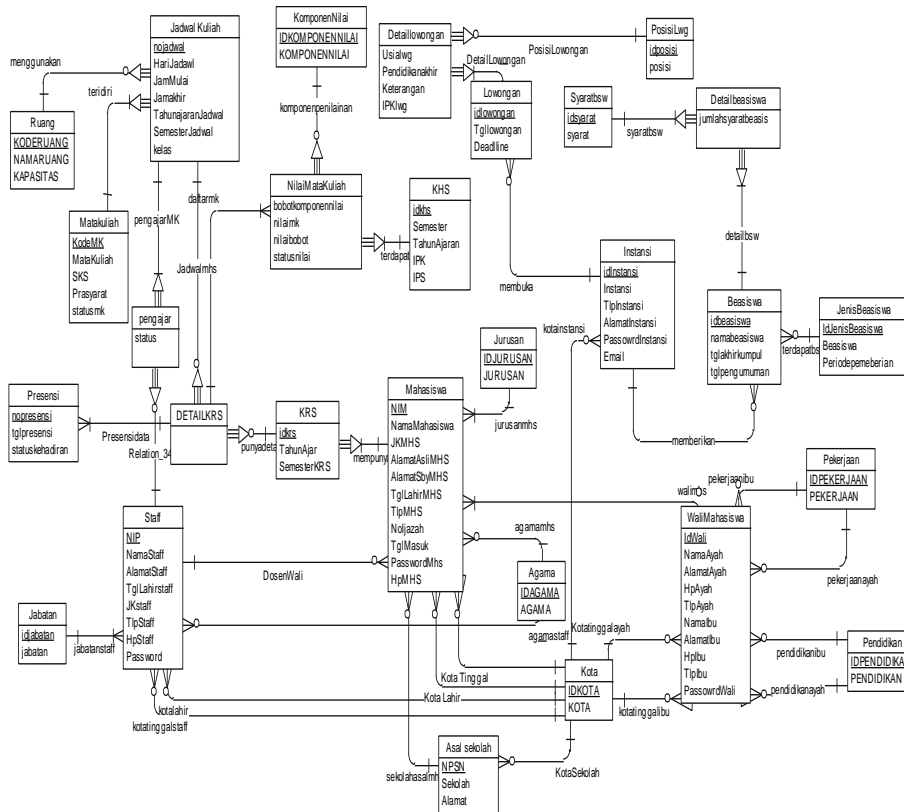


Fig 7. Entitas Relationship Diagram (ERD)

The next stage is to create a class diagram. Class diagram is a description of a group of objects with attributes, the same behavior and the same connectivity with other objects. Class diagrams are no further diterjemahkn into an entity relationship diagram (ERD) in Figure 7.

Operational CRM at the Academic Information System is built with the PHP programming language and MySQL database. Examples of system interface can be seen in Figure 8, and Figure 9.

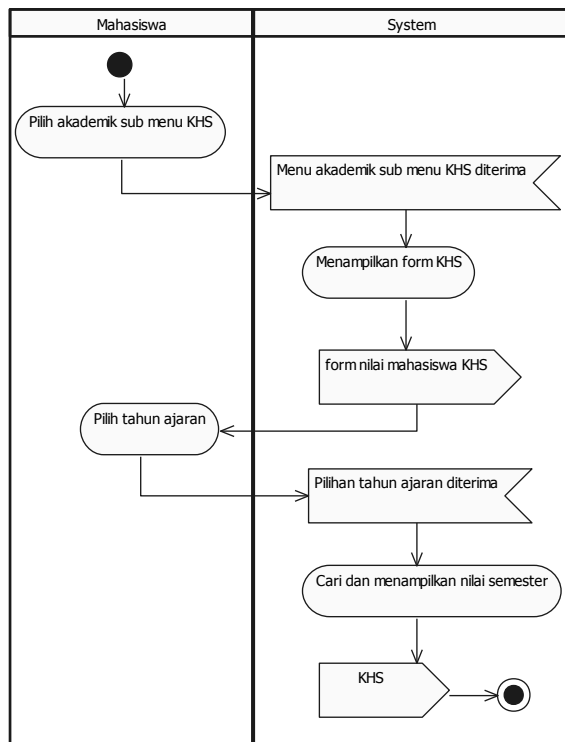


Fig 6. Activity Diagram KHS

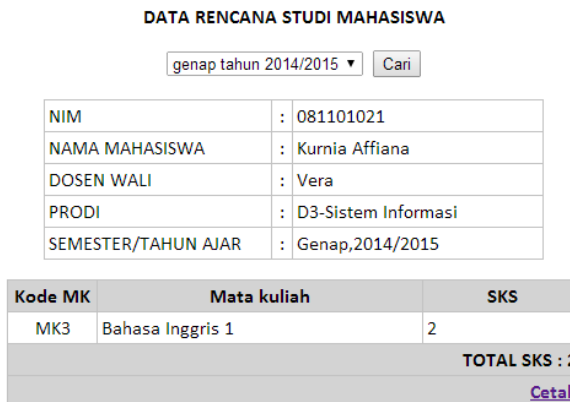


Fig 8. User interface KRS



**DATA PRESENSI MAHASISWA**

NIM	: 081101021
NAMA MAHASISWA	: Kurnia Affiana
DOSEN WALI	: Vera
PRODI	: D3-Sistem Informasi
SEMESTER/TAHUN AJAR	: Ganjil, 2015/2016

Kode MK	Mata Kuliah	Jumlah Pertemuan	Jumlah Kehadiran	Prosentase Kehadiran (%)
MK2	<a href="#">Bahasa Indonesia</a>	1	0	0
MK3	<a href="#">Bahasa Inggris 1</a>	2	2	100

[Cetak](#)

Fig 9. User interface Presensi

Testing of the system is done by using black box techniques. Black box testing technique is test by observing the output is already running as expected. Tests carried out on the system and the interface and functional Accessing.

### VIII. CONCLUSION

Operational CRM on college academic information system there are 7 (seven) process has been identified, which then became the basis for the planning system by taking into account the functional needs of the CRM concept. Users who are involved such as students, faculty trustee, professor in charge of courses and academic administrative officer. The proposed CRM system was divided in accordance with the processes that have been identified previously. To integrate the system to use an existing system that Airlangga University Cyber Campus (UACC), and coupled with the use of SMS gateways to disseminate important information to the users personally. With the proposed system, the academic activities run smoothly, effectively, and efficiently.

This research could be developed, for example, customers who are involved can be extended to parents of students or stakeholders other universities.

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# DESIGN SPEED ESTIMATION OF INDUCTION MOTOR DRIVES WITH DSP (DIGITAL SIGNAL PROCESSING) BASED ON NEURAL NETWORK

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**ABSTRACT**-- Digital signal processors (DSP's) and neural network is becoming more popular in the area of ac and dc motor control, in particular, the induction motor drives. In this paper, adaptive speed control of induction motor using neural network inverse control scheme are proposed. The controller-structure design is based on a vector control scheme that transforms the three phase motor currents into flux and torque generating current components. The experiment results show that the proposed scheme has excellent dynamic and static control performance.

**Keywords**- *Speed Control, Digital Signal Processing, neural network, Induction Motor*

the slip-current or slip-power factor characteristics [3],[5]. A parameter estimation procedure becomes even more

## I. INTRODUCTION

The induction motor is a multi-variable, nonlinear, strong coupled system. Its rotor parameters change very prominently with the time-varying conditions. All unmolded dynamic effects, such as the change of load torque, the existence of disturbance and magnetic saturation make the differential geometry and inverse system method difficult to be applied in practice [7-10].

Control method to tackle nonlinear system with uncertain factor. In order to enhance the dynamic response performance of the induction motor, the differential geometry and the inverse system decoupling control methods are investigated. However, the decoupling and linearization of a multivariate nonlinear system demand exact mathematics model of a controlled objects [1-2].

Much researchers work in this field but less used dsp for media controlling. The proposed algorithm is applied to the described induction motor models and estimates the model rotor parameters using the slip-torque motor characteristic. First, describes the overview of induction motor parameter estimation algorithm that is based on numerical solution techniques [15]. The algorithm is implemented based on the state of the art nonlinear least squares numerical solution techniques. For the estimation of all the motor equivalent circuit parameters the slip-torque characteristic alone is not enough and the slip-current characteristic or the slip-power factor characteristic can be additionally used, to provide extra information. Such characteristics can be most of the times obtained by the manufacturers. Here the characteristics are assumed to be known as a number of discrete points [14].

## II. MOTOR PARAMETER ESTIMATION

The estimation methodology makes use of data that, in general, can become available from the motor manufacturer, or are easily measured, like the slip-torque characteristic, or

important, when a slip-dependent parameter model is used [11].

In this case, the model coefficients of equations (1) are difficult about impossible to be evaluated without the use of an estimation procedure [4].

When the rotor circuit parameters are to be estimated, assuming that the stator and core parameters are known, the slip-torque characteristic of the motor provides adequate information. However, when all the equivalent circuit parameters are to be estimated (6) in total if constant rotor parameters are assumed and (9) if slip-dependent rotor parameters are used, the slip-torque characteristic itself is not enough and some additional information is necessary[12]. Such information can be provided using, for example, the slip current characteristic of the motor along with the slip-torque curve. In this paper, the estimation problem will be formulated in its general form, assuming that all the equivalent circuit parameters are to be estimated [8]. The parameters' estimation problem can be formulated as a least square optimization problem, the objective being the minimization of the deviation between the measured torque and current curves and the model generated curves. These curves are known as a set of discrete measurement points [11-13].

$$\frac{dI_{sd}}{d_t} = -\left\{L^2 a R_R + L^2 a \frac{R_R}{\sigma L_2 L_r^2}\right\} i_{sd} + \left\{n_p \omega_r + \frac{L_m R_r}{L_r \phi_r i_{st}}\right\} i_{st} + \frac{L_m R_r}{\sigma L_2 L_r^2} \phi_r + v_{sl} \quad (1)$$

$$\frac{dI_{sd}}{d_t} = \left\{n_p \omega_r + \frac{L_m R_r}{L_r \phi_r i_{st}}\right\} i_{st} - \left\{L^2 a R_R + L^2 a \frac{R_R}{\sigma L_2 L_r^2}\right\} i_{sd} \quad (2)$$

These equations are used in the estimation procedure because the motor curves and thus the measurement data are obtained under nominal operating conditions. Therefore the estimation is performed under nominal conditions.

$$V_{sd}(t) = R_s \cdot i_{sd}(t) - n_p \omega_m(t) \cdot \lambda_{sq} + \frac{d}{dt} \lambda_{sd} \quad (3)$$

$$V_{sq}(t) = R_s \cdot i_{sq}(t) + n_p \omega_m(t) \cdot \lambda_{sd} + \frac{d}{dt} \lambda_{sq} \quad (4)$$

$$V_{rd}(t) = 0 = R_r \cdot i_{rd}(t) - n_p \omega_m(t) \cdot \lambda_{rq} + \frac{d}{dt} \lambda_{rsd} \quad (5)$$

$$V_{rq}(t) = 0 = R_r \cdot i_{rq}(t) + n_p \omega_m(t) \cdot \lambda_{rd} + \frac{d}{dt} \lambda_{rq} \quad (6)$$

$$V_{rd}(t) \cdot V_{rq}(t) = 0 \quad (7)$$

These equations are used in the estimation procedure because the motor curves and thus the measurement data are

Obtained under nominal operating condition. Therefore the estimation is performed under nominal conditions. A pseudo-linear composite system can be gotten by cascading the inverse system before the original system [8]. And it was equivalent to two second-order integral linear subsystems, so that system control of induction motor which is complex multi-variable and strong coupling was transformed into two second-order integral linear subsystems control, a fully dynamic decoupling was achieved between flux and speed of induction motor [9-10].

$$\lambda_{sd} = L_s \cdot i_{sd}(t) + L_m \cdot i_{rd}(t) \quad (8)$$

$$\lambda_{sq} = L_s \cdot i_{sq}(t) + L_m \cdot i_{rq}(t) \quad (9)$$

$$\lambda_{rd} = L_s \cdot i_{rd}(t) + L_m \cdot i_{sd}(t) \quad (10)$$

$$\lambda_{rq} = L_s \cdot i_{rq}(t) + L_m \cdot i_{sq}(t) \quad (11)$$

$$T_{em} = n_p \frac{L_m}{L_r} (\lambda_{rd} \cdot i_{sq}(t) - \lambda_{rq} \cdot i_{sd}(t)) \quad (12)$$

$$J_{eq} \frac{d}{dt} \omega_m(t) = T_{em}(t) - T_b(t) - T_L(t) \quad (13)$$

$$T_b(t) = B_m \cdot \omega_m(t) \quad (14)$$

$$\frac{d}{dt} \theta_m(t) = \omega_m(t) \quad (15)$$

### III. HARDWARE STRUCTURE OF CONTROL SYSTEM

The DSP-based control system of the three-phase induction motor consists of three interconnected modules: the eZDSP board, 161/08 DSPLINK interface and a Pulse Width Modulated (PWM) output circuit.

The overall system block diagram is shown in Fig.1. TMF28335 DSP is used as the central processor of the control system and implements the corresponding control algorithms - vector control and direct torque control. DC link voltage  $E_d$ , the stator currents  $i_{as}$ ,  $i_{bs}$ ,  $i_c$ ,  $i_h$ , and the speed  $\omega$ , are sampled and transmitted to the DSP through 161/08 DSPLINK interface. With the combination of these Information and control methods, the required PWM gating signals are generated to drive the three-phase induction motor

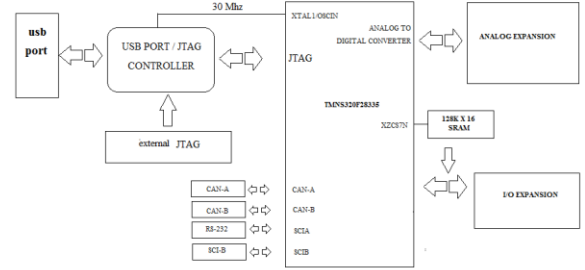


Fig. 1: Overall hardware architecture of control system

The TMS320F28335 DSP used is a 60MHz, 64-bit floating point processor with two on-chip 64 bit timers, an enhanced external memory interface, a two channel DMA controller and a serial port. This arrangement offers a versatile and powerful development tool for motor drives. A detailed discussion of the architecture and programming of F28 is given in [14-15].

All mathematical operations of both processors are preceded at an integer form to insure the high-speed processing. The programs are written in the form of macro instructions. This method permits fast and well-arranged programming of new structures on the base of recently debugged and tested macroinstructions.

The programs are written in the form of macro instructions. This method permits fast and well-arranged programming of new structures on the base of recently debugged and tested Macroinstructions.

### IV. ADAPTIVE SPEED CONTROL OF MOTOR INDUCTION

The adaptive speed controller is derived from the mechanical model of system. The conversion of Eq.(2.5) into its discrete form gives

$$(J_{eq}s + B_m) \cdot \omega_m(t) = T_{em}(t) - T_L(t) \quad (16)$$

$$\omega_m(s) = \frac{T_{em}(s)}{(J_{eq}s + B_m)} = \frac{n_p \cdot L_m (\lambda_{rd} \cdot i_{sq}(s) - \lambda_{rq} \cdot i_{sd}(s))}{L_r \cdot (J_{eq}s + B_m)} \quad (17)$$

$$V_{sd}(t) = ((n_p \omega_m(t) \lambda_{rq} + \frac{R_r}{L_r} \lambda_{rd}) \cdot \frac{L_m}{\sigma \cdot L_s \cdot L_r} + (-\frac{L_m}{\sigma \cdot L_s \cdot L_r} + \frac{R_s}{\sigma \cdot L_s}) \cdot i_{sd}(t) + \frac{d}{dt} i_{sd}(t) \cdot \sigma \cdot L_s) \quad (18)$$

$$V_{sd}(s) = n_p \cdot \frac{L_m}{L_r} \omega_m(s) \lambda_{rq} + \frac{R_r L_m}{L_r^2} \lambda_{rd} + (\frac{L_m}{L_r} + R_s + \sigma \cdot L_s \cdot s) i_{sd}(s) \quad (19)$$

$$\frac{\omega_m(s)}{V_{sd}(s)} = \frac{\frac{n_p L_m (\lambda_{rd} i_{sq}(s) - \lambda_{rq} i_{sd}(s))}{L_r (J_{eq} s + B_m)}}{n_p \frac{L_m}{L_r} \omega_m(s) \lambda_{rq} + \frac{R_r L_m}{L_r^2} \lambda_{rd} + (\frac{L_m}{L_r^2} + R_s + \sigma L_s s) i_{sd}(s)} = \frac{\frac{n_p L_m (\lambda_{rd} i_{sq}(s) - \lambda_{rq} i_{sd}(s))}{L_r}}{J_{eq} \sigma L_s s^2 i_{sd}(s) + ((R_s + \frac{L_m}{L_r^2}) i_{sd}(s) + \frac{R_r L_m}{L_r^2} \lambda_{rd}) J_{eq} s + \frac{n_p^2 L_m^2}{L_r^2} (\lambda_{rd} i_{sq}(s) - \lambda_{rq} i_{sd}(s))}$$

$$\frac{\omega_m(s)}{V_{sd}(s)} = \frac{1.78}{0.72 \times 10^{-3} s^2 + 0.0157 s + 3.168} \quad (20)$$

$$\frac{\omega_m(s)}{V_{sd}(s)} = \frac{2470}{s^2 + 21.79 s + 4400} \quad (21)$$

$$G(s) = \frac{2470 K (K_p + K_D s)}{s^2 + (21.79 + 2470 K_D) s + 6870 + 2470 K K_p} \quad (22)$$

$$G(s) = \frac{435.8 (K_p + K_D s)}{s^2 + (21.79 + 435.8 K_D) s + 6870 + 435.8 K_p} \quad (23)$$

(26)

$$K_V = \lim_{s \rightarrow 0} s G(s) = \frac{435.8 K_p}{21.79} = 20 K_p \quad (24)$$

Finally, the algorithm of controller computation task can be outlined as follows:

1. Initialization: select a reference model.
2. Select the initial values of gain matrix  $K$  and covariance matrix  $P$
3. Read the  $\mathbf{k}''$  value of rotor speed obtained from encoder.
4. Compute the required control signal from the updated plant parameters along together with the information from the reference model.
5. Record the control signal  $u(k)$  given to the power module. Calculate and update the information vector.
6. Calculate and update the gain and covariance matrices.

## V. Experimental System

The hardware components used in this experiment consist of Digital Signal Processor (DSP) TMS320F28335 dedicated motor controller that is equipped with analog inputs, encoder inputs and PWM output channels. The PWM output channels of the DSP id fed to a power module directly linked to the induction motor. The analog inputs of the DSP are used to read the phase motor currents that are required by the inner loop current controllers.

The software components consist of DSP programming tools and motor control development environment that can be used as Human Machine Interface (HMI). Estimation and control signal computation are implemented using Mat lab in the Development Tool Environment. The program is compiled on DSP compiler software and then the resulted object is downloaded to the

DSP board using eZDSP subsystem. In the implementation, the value of measured Variables must be scaled and formatted to fixed-point representation because of the use fixed point type DSP.

Scaling for the speed signal is made according to the properties of the motor encoder and DSP's encoder input ports, where the signal is represented in bits in which one bit equivalent to 15 rpm. Under 2ms sampling time, the speed error will be 2 bits such that the speed response of the motor control system will have 2 bits of noise.

## VI. EXPERIMENTAL RESULT

In the experiment, the speed control of the induction motor will be tested under conditions: step input set point, set-point changes as well as disturbance changes. The induction motor used in this experiment is 4poles, 60 Hz, 280V and 1.8A rating



Fig 2. Digital Signal Processor (DSP) TMS320F28335



Fig3. Inverter of connection

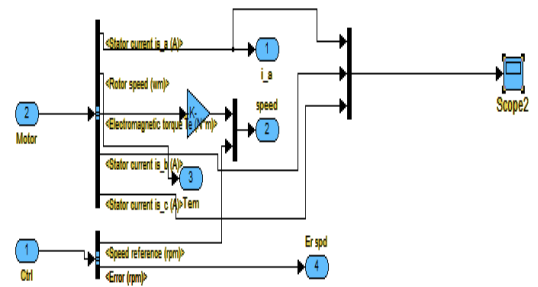


Fig 4: Circuit of Stator Controlling

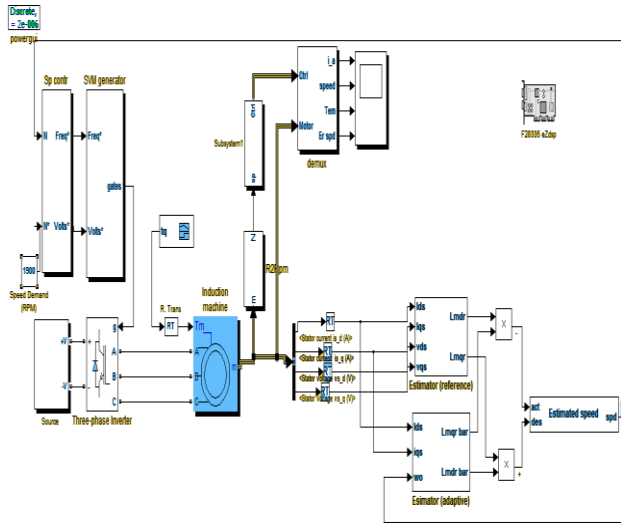


Fig5. Circuit Diagram for controlling Induction Motor

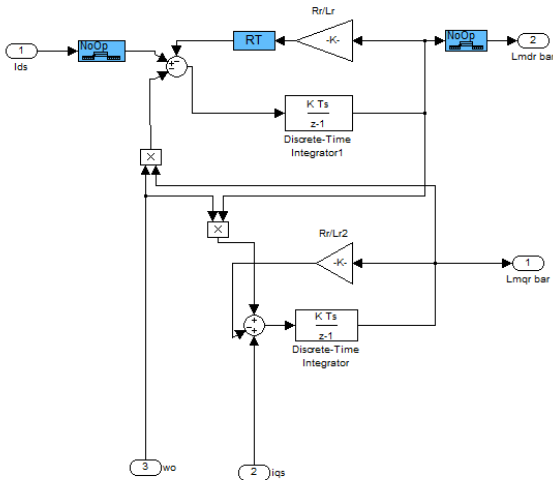


Fig 6. Estimators Adaptive in controlling

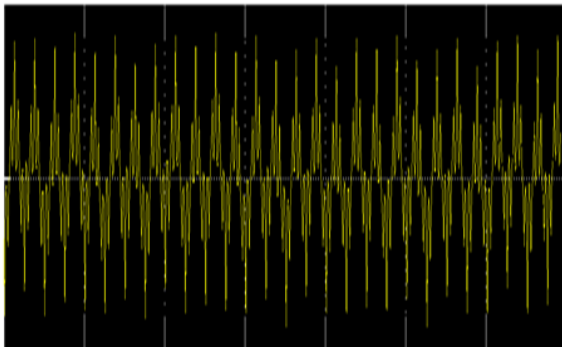


Fig 7. Experimental Result of current used DSP for Controlling

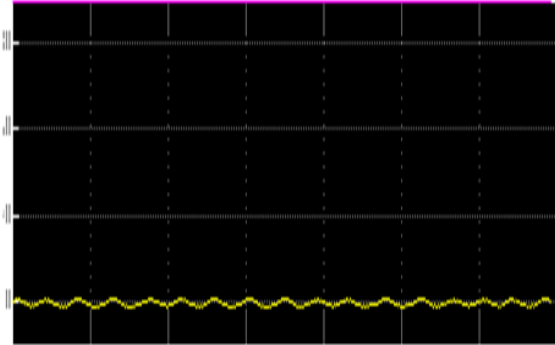


Fig 9. Experimental Result of Speed Used DSP for Controlling

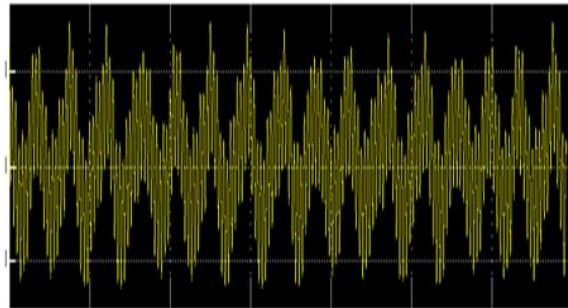


Fig 10. Experimental Result of Torque Used DSP for Controlling

Comparing the simulated responses (Fig.4 - Fig.6) and measured responses (fig.7 - Fig.10), it can be stated that the simulation gives relatively exact results. Some differences at the current response or Control voltage response may be caused for example by the actual properties of the real sensors which are not of course ideal. Nonlinearity of the current sensors and their dynamic behavior or no concentricity of the increment sensor and motor may appear. Generally it can be stated that the correspondence between measured and simulated responses is acceptable to Carry out sufficiently exact analysis of the drive processes

## VII. CONCLUSION

The paper has demonstrated the implementation of this high performance direct torque control technique utilizing the floating point TI DSP, TMS320F28335. The experimental results show that an excellent torque response is achieved and agree with the theoretical and simulation results. In the end, the system is implemented on Mat lab-Simulink and DSP TMS320F28335.

Simulation and experiment results show that the system has good dynamic and static properties and excellent characteristic of speed tracking, and the decoupling effect between controlling Induction. For all experimental (speed responses for step set point input, increasing and decreasing set point changes as well as disturbance changes), the adaptive speed control of induction motor can give good tracking and disturbance rejection performance, where it yields zero steady state error and quick response time (most of responses have response times less than 200 ms).

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# Major Determination Using Artificial Neural Networks For New Prospective Collegian

Heny Pratiwi<sup>1</sup>

**Abstract**—Determining process to the major concentration using artificial neural network applications, the data will be divided into two parts, the first data for training and the second data for testing process. The training process aims to identify or search the goals that are expected to use a lot of patterns, so it will produce the best pattern to train the data. After the training reaching the goal based on the best pattern we can tested with new data to look at the accuracy of the target using Matlab 6.1 and Visual Studio software.

**Keywords**—Major, Determination, Artificial Neural Networks, Collegian.

## [1] INTRODUCTION

Major concentration are important for the universities, because the concentration offer specific skill or specs for each new collegian. Majors of Computer Engineering, Software Engineering, and Managements are the popular major in College.

Nowdays, college has implemented a system of determining the major of the new students, then new students which directly determine the major at the time of signing up without any spesific training and testing, it makes the prospective collegian feel difficulties attends the subjects in the field of computer engineering.

Predictions in the context of computing is one of the mathematical activity. This prediction has been done many years before computer literacy, using tools such as calculators count. Prediction of concentration courses can assist students to develop specialized skills in accordance with their respective skills. Students attending private colleges in determining the major concentration for prospective new students. To determine the major concentration is done by conducting training on some lesson that will serve as criteria for each concentration, having acquired a target or goal of the training is in want it done testing (testing) for prospective students who apply.

Artificial Neural Networks is one of the information processing system that is designed to mimic the way the human brain works in resolving a problem with the process of learning through sinapsisnya weight change. There are many techniques that can be used for the implementation of Artificial Neural Networks are Perceptron, Backpropagation and Fuzzy.

The purpose of this study is to apply artificial neural networks for determining the major of a new collegian.

Limitations Problem:

In this research, the authors limited the problem as follows:

- Determination of the concentration in this study only discusses the courses S1.
- Input data for training (training) and testing (testing) in this study was taken from national test scores of new students whose high school for science (IPA).

## [2] THEORY

Artificial Neural Networks is one of the artificial representation of the human brain is always trying to simulate the learning process of the human brain. Artificial Neural Network was created as a generalization of a mathematical model of human understanding (human cognition) that is based on the following assumptions:

- Information processing occurs in simple elements called neurons.
- Cue flowing between nerve cells / neurons through a hub connection.
- Each connection has a weight corresponding connector.
- Each nerve cell activation will be a function of the weighted sum of cues that go to determine signaling output.

Neural networks consist of multiple neurons and there is a connection between these neurons. Neuron is an information processing unit on which the operation of neural networks. Neurosurgery is an information processing unit with three basic elements, namely:

- A set of links that are connected.
- An adder for calculating the increase in the input signal.
- An activation function for limiting the number of outputs on the nerve.

Most of the neural network to adjust the weights during weight-training. Training can be either supervised training (supervised training) where the required input-target pairs for each pattern drilled. The second type is unguided training (unsupervised training).

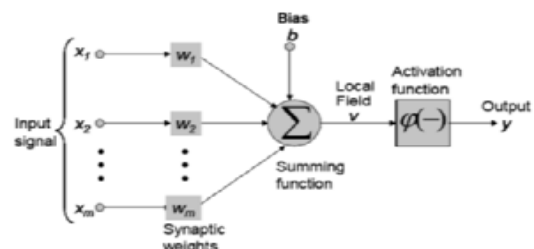


Figure 1: The artificial neural network model

Basic Concepts of Artificial Neural Networks

Each of the patterns of input and output information is given into the ANN is processed in neurons. Neurons are accumulated in layers called neurons layers [4]. The layers making up the neural network can be divided into three, namely:

1. Input layer, the units in the input layer are called input units. The units accept input data from external input patterns that describe a problem.
2. Hidden layer, the units in the hidden layers are called hidden units. Where the output can not be directly observed.
3. The output layer, the units in the output layer are called units of output. The output of this layer is a neural network solution to a problem.

Architecture Artificial Neural Network (ANN)

ANN has some network architectures that often used in various applications. The ANN architecture, are :

1. Single Screen Network (Single Layer Network)

Network with a single layer consisting of one input layer and one output layer. Each neuron / unit contained in the coating / layer input is always connected to each neuron contained in the output layer. This network receives input only then it will directly process them into outputs without go through to the hidden layer. Examples of ANN algorithms that use this method are: ADALINE, Hopfield, Perceptron.

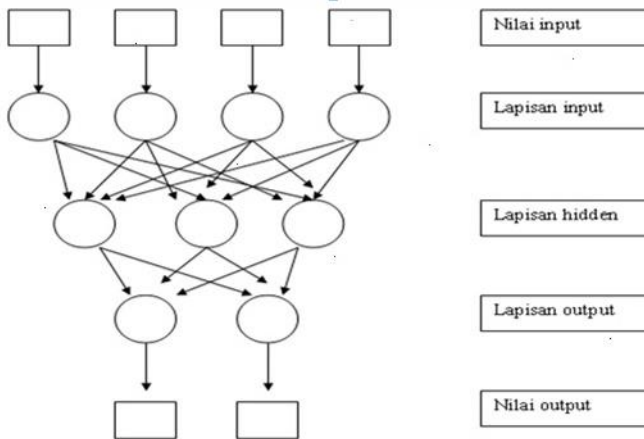


Figure 2: Architecture Single Layer Neural Networks

2. Multi Layer Network

Network with multiple layers which have certain characteristic features 3 types of layers namely input layer, output layer, and hidden layers. Network with many layers can resolve more complex problems than a network with a single layer. However, the training process often takes a long time tend. Example Neural Network algorithm that uses this method are: Madaline, backpropagation, and Neocognitron.

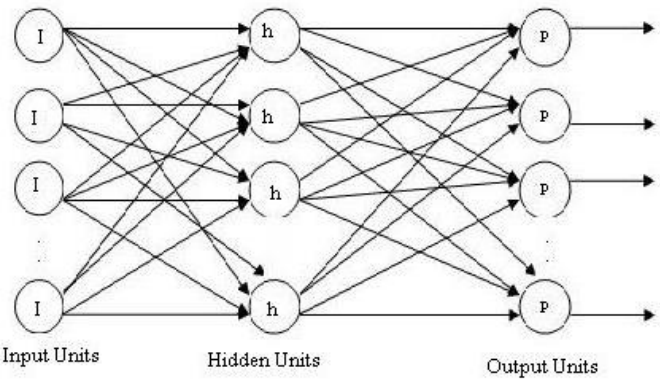


Figure 3: Multilayer Network

3. Competitive Layer

In this network a set of neurons compete for the right to be active. Examples of this algorithms that use this method is LVQ.

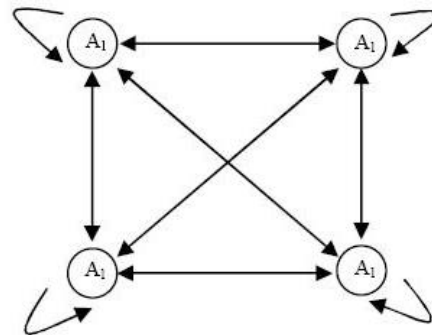


Figure 4: Competitive Network

[3] RESEARCH RESULTS

To determine a major of new collegian can use the form of assessment criteria that used national test results at the time of high school. The data of the national exam (UN) will be processed to find the total value associated with the range of values of each study program using neural networks.

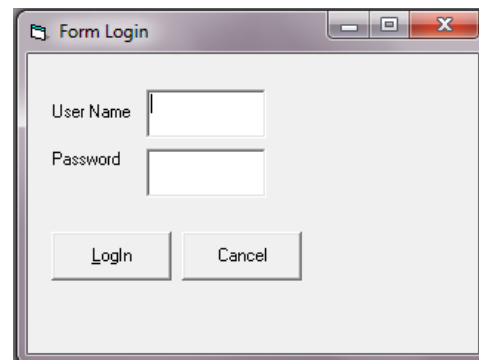


Figure 5: Login Form



The image shows a graphical user interface for a major determination application. The window title is "Major Determination Using Artificial ...". The form is organized as follows:

- Data Pendaftar:**
  - No Pendaftaran:
  - Nama Pendaftar:
  - Asal Sekolah:
- Penilaian:**
  - Nilai UN:
  - Nilai Tes Matematika:
  - Nilai Tes Komputer:
  - Nilai Pengetahuan Umum:
- Hasil Penentuan Program Studi:**
  - A large empty text box for the result.
  - Buttons: "Proses" and "Simpan".

Figure 6: Major Determination Form

#### [4] CONCLUSION

Neural network application is to determine the major for prospective collegian. This system can help the prospect collegian to choose their major in accordance with their interest.

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# ARTIFICIAL NEURAL NETWORK FOR MEASURING THE VALUE ADDED PRODUCTS USING ALGORITHM BACKPROPAGATION (CASE STUDY IN CV. SAPO NATA DE COCO Durin Langkat)

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**ABSTRACT:** Artificial Neural Network Backpropagation usually to measure the value -added products based on the Nata de Coco with production , raw materials , labor , average product prices - average , wages , prices of raw materials , capital contributions and the value of the product of other inputs . By using Backpropagation finally found the best architectural patterns yatu architectural 9 - 7 - 1 of 5 architecture has been tested . MSE obtained for Training by 0.0001000609 and 0.0027164812 and MSE of testing Epoch obtained is 46 290 of the pattern is then predicted value -added products in the year 2014 in the amount of IDR 486.061.765 and of variables - variables that serve as inputs measurements obtained Capital variables into variables that most influence the Added Value Nata De Coco products in CV Sapo Durin Langkat .

**Keyword's:** Neural Network, Backpropagation, value product, Nata De Coco

## I. Introduction

Neural Networks (Artificial Neural Networks or Artificial Neural Network) is a soft computing and data mining are widely used to clasification perform and predictions. Artificial Neural Network (ANN) has been developed into a form of ANN are wide - range. These shape changes may include changes in Activation Function, Topology, Learning algorithm and others. This research uses an Artificial Neural Network Back propagation, Back propagation are training algorithm backward error propagation neural network consists of two steps, namely the propagation of forward and backward.

Artificial Neural Network an artificial representation of the human brain is always trying to simulate the learning process of the human brain. One area where the ANN can be applied is the field of forecasting or prediction and forecasting or prediction techniques used are Back propagation. Prediction techniques used for planning and decision-making processes.

Develop Back propagation algorithm is very much applicable to the world of Health, Economy, agriculture and others. For example in the world economy is the implementation of algorithms in predicting Back propagation bank rate (Anwar, 2011), prediction visitors Scholastic (Sangaji, 2009), in agriculture are used to predict the outcome product. (Kusuma, 2011), in the field of water to predict production water taps (Septiarini, 2012), the health sector is used to predict respiratory tract disease (Pradasari et.all, 2009) and predicts cardiovascular disease (Sonang et.all, 2013). In 2014 the conditions of competition in the

economy at this point in particular is quite tight and Agro-industry complex. Each company is required to always know and understand what is happening in market and what the consumer desires. For example, the production of coconut water is quite abundant in Indonesia, reaching more than 900 million liters per year (BPS.go.id). Coconut plantations in Indonesia's economy is one of the strategic commodity due to a very large role, both as a source of income as well as a source of industrial raw materials. Data from the Directorate General of Plantation indicate that Indonesian palm planted area reached 3.7286 million ha, about 92.40% of which is oil in that in trying as smallholders with limited land ownership, utilization is not optimal, and the application of technology that has not been intact. Indonesian palm diversified new program capable of producing 22 varieties of coconut derived products. This figure is far below the Philippines, which has produced more than 100 types of diversification of coconut-based products. Byproducts and waste not used optimally, so that can't be produced significant added value in the economy, both at the farm level and at the level of professor. There are still high levels of poverty as a result of his alleged income received by farmers due to the low value added of oil produced. In some places coconuts has also developed as a refined product of oil and byproducts, such as desiccated coconut, nata de coco, coir fiber, and activated charcoal (Patty, 2011).

There are various methods that can be used to perform the analysis, the predictive value of a time series data, namely Artificial Neural Networks, Genetic Algorithms, and Fuzzy Logic. The choice

of method depends on the various aspects that affect that aspect of time, the pattern of data, the type of model of the observed system, the accuracy of the forecast and so on. Utilization of information technology, can be designed in a neural network system (Artificial Neural Network) in predicting the level of added value of a product in a company. With Back propagation method proposed multiple input variables as input, will be predicted and measured variables which will increase and decrease in value added products which variable will be the target of an increase or decrease in value-added products, so companies can take out a policy of increasing the value-added products of input variables are proposed. Based on the phenomenon of the problem as described, the author tries to find a scientific solution and pour it into a thesis entitled "**ARTIFICIAL NEURAL NETWORK FOR MEASURING THE VALUE ADDED PRODUCTS USING ALGORITHM BACKPROPAGATION (CASE STUDY IN CV. SAPO NATA DE COCO Durin Langkat).**"

## II. Problem Formulation.

After the authors describe and understand the background of the problem, the authors then formulate the problem as follows:

1. How Back propagation Neural Network algorithm to measure the value added product of the input variables on Nata De Coco products Sapu Durin CV?
2. How to predict the value added to the product Nata De Coco Back propagation algorithm of input variables are dominant in a CV Sapu Durin?
3. How Good application Back propagation Neural Network algorithm to analyze the input variables and the target value-added products Nata De Coco?

## III. Literature

### III.1 Artificial Inteligent

Artificial Intelligent (Artificial Intelligence) is a part of science that is used for human problem solving by understanding, predicting and manipulating. Artificial intelligence made to the system using a specific algorithm so that the system as if unable to think like a human. Artificial intelligence is also a branch of information technology which seeks to intimidate human intelligence or the way of thinking to be applied to the computer (Anike, 2012).

### III.2. Modelling Artificial Neural Network

According Jumarwanto (2009), the neural network composed of neurons and there's some connection between the neurons. Neuron is an information processing unit on which the operation of neural

networks. Neurosurgery is an information processing unit with three basic elements, namely:

1. A set of links that are connected.
  2. An adder for calculating the increase in the input signal.
  3. An activation function for limiting the number of outputs on the nerve.
- Most of the neural network to adjust the weights during weight-training. Training can be either supervised training (supervised training) where the required input-target pairs for each pattern drilled. The second type is unguided training (unsupervised training).

## III. Analisis Sensitivitas

Sensitivity analysis according to Hidayat MM (2013), aims to look at the change in output of the model is obtained if the amendment to the input of the model. In addition, this analysis is useful to know which variable is more influential or sensitive carabao to achieve accurate output of the model developed. To determine the sensitivity of the model developed. To determine the sensitivity of the  $S_{p/ki}$  where ANN used has one input layer  $Z = (Z_1, \dots, Z_i, Z_i, \dots)$ , one hidden layer  $Y = (Y_1, \dots, Y_i, \dots, Y_I)$ , and one output layer  $O = (O_1, \dots, O_k, \dots, O_K)$  and data trainings is  $P = (P_1, \dots, P_k, \dots, P_K)$  is used:

$$S_{ki}^p = \frac{\partial O_k}{\partial Z_i} = \sum_j \frac{\partial O_k}{\partial Y_j} \frac{\partial Y_j}{\partial Z_i} \dots \dots (14)$$

To obtain the sensitivity matrix of all data training on output can be used:

$$S_{ki}^p \max = \max \left\{ \frac{\partial O_k}{\partial Z_i} \right\}, p = 1 \dots \dots, P \dots (15)$$

Then proceed by calculating the sensitivity of the input matrix as a whole can be used:

$$\Theta_i = \max \{ S_{ki} \}, k=1, \dots, \dots (16)$$

## IV. Design of Artificial Neural Network Modeling System for Measuring Value Added Products Nata De Coco.

At the time of data input (input) we get, then the next can be done to do the design Artificial Neural Network modeling system which will be used to determine and recognize patterns in predicting the level of accuracy of Value Added Products Nata De Coco in CV. Durin Sapu Langkat. In this case the parameters to be used by 10 variable factors - factors that affect the value-added products in the CV. Durin Sapu Langkat each month. Data input is taken based on the analysis of production process 5 years (60 months) in advance.

After a variable determined later if the input data can be recognized by the network can then be processed using Matlab applications the data must be converted first into the matrix or numeric form. To - Ten variable factors that affect the value-added products is based on a factor - the factor product for Measuring value-added products in the form of X1, X2, X3, X4, X5, X6, X7, X8, X9 and X10 where:

- X1: Results / production (Kg / process)
- X2: Raw Materials (Kg / Process)
- X3: Labor (Jko / process)
- X4: Product Price Avg Avg (USD)
- X5: The average wage (USD / kg)
- X6: Raw material prices (USD / kg)
- X7: Contribution of other inputs (USD / kg) \*
- X8: product value (USD / kg) (4x6)
- X9: Capital (USD)
- X10: Added value (USD / kg) (10-8-9)

## V. Analisis and Result

### V.1. Testing 9-7-1 Architecture Data Model (7 neurons)

Training with pattern 9-7-1 architecture model with 7 neurons, then followed by testing with the testing of 25 samples of data Value Added Products CV. Sapo Durin Langkat numbers 36 to 60,

```
>> a = sim (net, PPP)
>> [a, Pf, Af, E, perf] = sim (net, PPP, [], [], TT)
```

The results of testing 25 testing data is testing the 9-7-1 pattern. Data testing results can be seen in Table 5.9 are the results of testing with 25 data is testing the 9-7-1 pattern testing

**Table 1. Comparison of Epoch, MSE**

Model	9-2-1	9-7-1	9-5-3-1	9-9-1	9-9-9-1
Epoch	184997	46290	133781	161238	37753
MSE Pelatihan	0,0001003570	0,0001000609	0,0001000673	0,0000999804	0,0000998966
Tingkat Kebenaran	25/40	29/35	16/30	18/25	15/20
Persentase Keakuratan	62%	82,5%	53%	72%	75%
MSE Pengujian	0,0119015975	0,0027164812	0,0283494123	0,0634438186	0,0067951776
Tingkat Kebenaran	4/20	3/25	9/30	10/35	7/40
Persentase keakuratan	20%	12%	30%	28,5%	17,5%

## V.2 Results Predicted Value Added Products 2014

After the best of five architectural pattern that is 9-2-1, 9-7-1, 9-5-3-1, 9-9-1, 9-9-9-1 that has been trained and tested has been found that the pattern of 9-7-1 with the accuracy of training 82, 5%. The next step is to predict the value-added products in 2014 with 12 data from January to December as many as 12 data. Thus the predicted results obtained the following results: January 2014 = 0.3851 (Rp53.905.263 - Rp31.444.773) + Rp31.444.773= Rp 40,094,307

where:  
 $x_i$  = Value Added Month January 2014  
 The results of the network output  $y = 0.3851$   
 $x_{min}$  = Data with a minimum value Rp31.444.773  
 $x_{max}$  = Data with a maximum value Rp53.905.263  
 So with the above data overall predictable Value Added Products CV. Nata De Coco Durin Sapo in 2014 was USD 486 061 765, -

**Table 2. Predicted Value Add Products 2014**

no	Bulan	Actual Output	Prediksi nilai tambah produk 2013	Hasil Real	Belgian	Persentase Keakuratan %	Prediksi nilai tambah produk 2014
1	Januari	0,3851	Rp 38.096.437	Rp 31.444.773	Rp 6.651.664	78,8	Rp 40.094.307
2	Februari	0,3101	Rp 38.096.437	Rp 35.936.871	Rp 2.159.566	94,0	Rp 38.409.771
3	Maret	0,3851	Rp 39.300.395	Rp 31.444.773	Rp 7.855.622	75,0	Rp 40.094.307
4	April	0,3101	Rp 38.096.437	Rp 35.936.871	Rp 2.159.566	94,0	Rp 38.409.771
5	Mei	0,5064	Rp 38.096.437	Rp 48.413.165	Rp 11.316.728	77,1	Rp 42.818.765
6	Juni	0,3101	Rp 38.096.437	Rp 35.936.871	Rp 2.159.566	94,0	Rp 38.409.771
7	Juli	0,5238	Rp 39.371.432	Rp 53.905.263	Rp 14.533.830	73,0	Rp 43.209.577
8	Agustus	0,5064	Rp 39.300.395	Rp 48.413.165	Rp 10.112.770	79,5	Rp 42.818.765
9	September	0,3101	Rp 38.096.437	Rp 35.936.871	Rp 2.159.566	94,0	Rp 38.409.771
10	Oktober	0,4596	Rp 39.371.432	Rp 44.921.067	Rp 5.548.634	87,6	Rp 41.757.614
11	November	0,3101	Rp 38.096.437	Rp 35.936.871	Rp 2.159.566	94,0	Rp 38.409.771
12	Desember	0,5238	Rp 39.300.395	Rp 53.905.263	Rp 14.604.868	72,9	Rp 43.209.577
Total			Rp 463.319.106	Rp 484.131.819	Rp 30.812.713	93,34	Rp 486.061.765

**Table 3.** The results of the sensitivity analysis of repeated iterations

no	Analisis Sensitivitas ( Iterasi Berulang )				
	input	performance	output	Rangking	epoch
1	Hasil Produksi	0,0344	0,6295	3	8848
2	Bahan Baku	0,0289	0,6503	2	20876
3	Tenaga Kerja	0,0000	0,0000	9	0
4	Harga produk rata-rata	0,0017	0,5173	8	22496
5	Upah Rata-rata	0,0015	0,5649	5	1000000
6	Harga Bahan Baku	0,0173	0,5341	7	1000000
7	Sumbangan Input Lain	0,0090	0,5609	6	24432
8	Nilai produk	0,0146	0,6174	4	22378
9	Modal	0,0282	0,6772	1	1000000

Sensitivity on all variables showed a large enough so that the iteration process is stopped learning. From the results that have been obtained, the output of the measurement value added products Nata De Coco CV. Sapu Durin 9 input variables that result / production, X2: Raw Materials, X3: Labor, X4: Product Price score score, X5: The average wage, X6: The price of raw materials, X7: Contribution of other inputs, X8: Value products X9: Capital, can be seen in Table 3 Sensitivity In all showed variable results is quite high unless Labor. Therefore, the iteration process is stopped learning because of all the variables showed that the sensitivity and the effect is quite high.

## VI. Conclusion and Suggestion

### VI.1 Conclusion.

Test results obtained by the authors with Artificial Neural Network Back propagation method to measure and predict the value of Nata de Coco Products Added to the CV Sapu Durin Langkat, with the following conclusion:

1. Artificial Neural Network Algorithm Back propagation can measure the value added products of input variables that result / production, Raw Materials, Labor, Product Prices score, average wages, prices of raw materials, other inputs contribution, value products, capital , value-added products. Showed that the variables that most affect the value-added products Nata De Coco CV. Sapu Durin using sensitivity analysis by repeating the first iteration is the capital, second and third are the raw materials of Products. So if the value-added products is to increase the capital, raw materials and products must also be increased.

2. Predict the Value Added At Nata De Coco products in 2014 using Artificial Neural Network algorithm Back propagation based input variables determined from the data for 60 months ie from 2009 to 2013 which showed that in 2014, the Value Added Nata De Coco products will decreased to Rp 486 061 765 of the year 2013 amounting to Rp 494 131 819 or down to Rp 8,070,054 (1.36%).  
3. Artificial Neural Network algorithm Back propagation analyze and test the input variables and the target value-added products Nata De Coco uses 5 network architecture is the architecture of 9 - 2 - 1, 9 - 7 - 1, 9 - 5 - 3-1, 9-9 - 1, 9-9 - 9 - 1. the five architectures that have been trained and tested with Matlab application obtained the best architecture is the architecture of 9 - 7 - 1 with the epoch 46 290, MSE training and MSE 0.000100060p9 0.0027164812 testing.

### VI.2. Suggestion

Suggestion can be written for this study are as follows:

1. It is expected to further research in order to try to measure the value-added products and products of different variables according to a case study taken.
2. It is expected to further research to try with other architecture models and use matlab with higher versions like version 7.1 and others - others.
3. It is expected to further research to try with different learning rate, momentum is different, different goals and different epochs.

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# The Design Of Virtual Class Android-Based Mobile Video Streaming Using The Real Time Streaming Protocol

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**Abstract.** Virtual classroom technology (virtual class) that is part of the learning models simplify the process of teaching and learning that is constrained by time and distance. Android as the operating system that is widely used at this time, utilized to create mobile applications for virtual class by using the Real Time Streaming Protocol (RTSP) as the controller of the course (playback) media on a device which receives the flow of the streaming server.

The development of technology in Indonesia an internet speed that have entered the next-generation 4 g, add to the quality of the video live streaming on mobile devices so that by utilizing wowza server then allows everyone access to learning anytime anywhere application only with the help of mobile devices.

**Keyword :** virtual class, android, Real Time Streaming Protocol, wowza server

## I. Introduction

The process of teaching and learning in Indonesia continue to under go development. One form of the development of e-learning which is a form of learning through digital media. Virtual classroom technology (virtual class) that is part of the model of learning e-learning facilitates the process of teaching and learning that constrained distance (Tri, 2007). One form of virtual class that uses video streaming is still constrained the mobility problems so it's a little hard to use anywhere. Virtual device class that uses streaming videos are generally still take advantage of the large sized monitor

Android as the operating system that is widely used nowadays in Indonesia has the ability to make every human needs to be informed. The open source nature of Android capable of internally developed more broadly to help teaching and learning in Indonesia. Virtual classroom (virtual class) in the form of file sharing class content is already accessible

via the Android devices while using only a web browser on your Android device.

## II. Discussion

### A. Virtual Class

virtual class is a form of application of information technology in education, is the conventional teaching and learning change into digital form. The learning process can be run in a virtual classroom is supported by the utilization of information technology as a means of support.

The role of the teacher in the learning process that integrates information technology as a facilitator is expected (providers), collaborators, mentors, coaches, directors and friends learn and can give you a choice and a big responsibility to the students to experience the actual teaching and learning process.

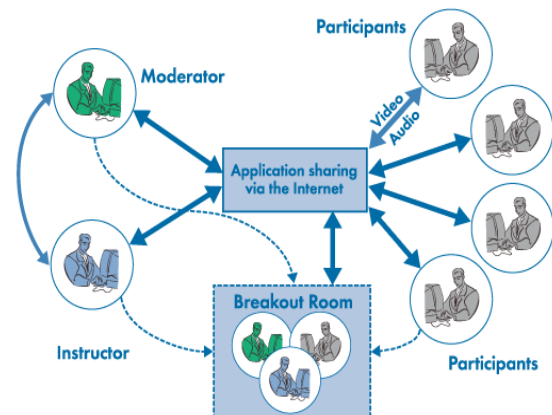


Figure 2.1: Illustrated Virtual Classroom

### B. Real-time Transport Protocol (RTP)

Real-time Transport Protocol (RTP) is a package format for transmitting audio and video media that has been encoded (encoding) and various jenispenyandi (encoder) via internet or local network. RTP is used widely in communications that involve streaming media, such as telephone, video teleconference applications, services and television services push-to-talk that is web based

RTP is used in conjunction with RTP Control Protocol (RTCP). While RTP carries media streams (audio and video, for example). RTCP is used to monitor transmission statistics and the quality of service (quality of services) and synchronization tool multiple streams (streams).

Distribution of video files as well as audio that is on-demand and live performed by the media server using different protocols. This customized distribution protocol with the codec of video and audio that is produced and developed by the company and the developer community.

In the outline of the two protocols that support streaming video that goes by:

- 1) Transport Protocol that provides connectivity for end-to-end network for streaming applications. Transport protocol is divided into User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).
- 2) Session Control Protocol which defines the messages and procedures to regulate the delivery of data from the server during the media session was formed. That includes the session control protocol is the real-time Transport Protocol (RTP), Real Time Streaming Protocol (RTSP), and real-time Control Protocol (RTCP).

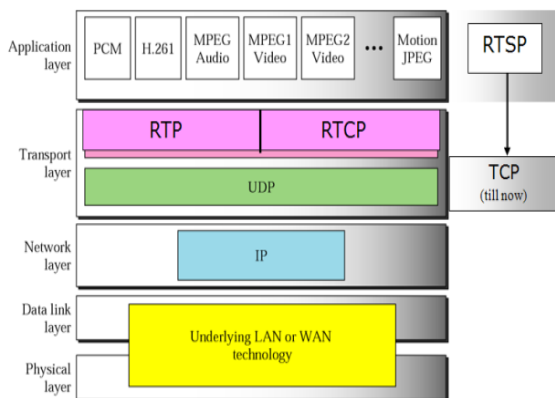


Figure 2.2 : protocol used in Streaming

### C. Real Time Streaming Protocol (RTSP)

Real Time Streaming Protocol (RTSP) is used to control the course of the stream in RTP. RTSP Server allows the user (client) to receive RTP packets are sent through a device. RTSP is a network control protocol designed for use in entertainment and communications systems to control streaming media servers. Client media server issue commands like Play and Pause to facilitate playback controls media files from the server in real time. Specifically RTSP can be said to be a remote control network on a server that is streaming (streaming) media

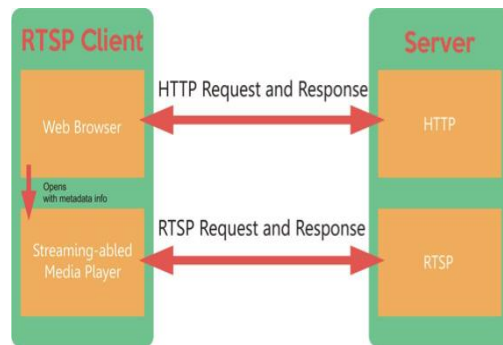


Figure 2.3 : an overview of RTSP

### D. Android Devices

Android is an operating system for cell phones, especially smartphones and tablet-based Linux as the kernel. Android provides an open platform (open source) for developers to create their own applications. Simply put, Android is a combination of three components, namely:

- 1) The operating system is open source for mobile devices.
- 2) An open source platform for creating mobile applications.
- 3) Cellular phone Devices, especially those running the Android operating system and the application for it.
- 4) Android Software Stack (figure 2.4) simply put is a Linux kernel which leads to a framework application that provides services, management, run time, and the application



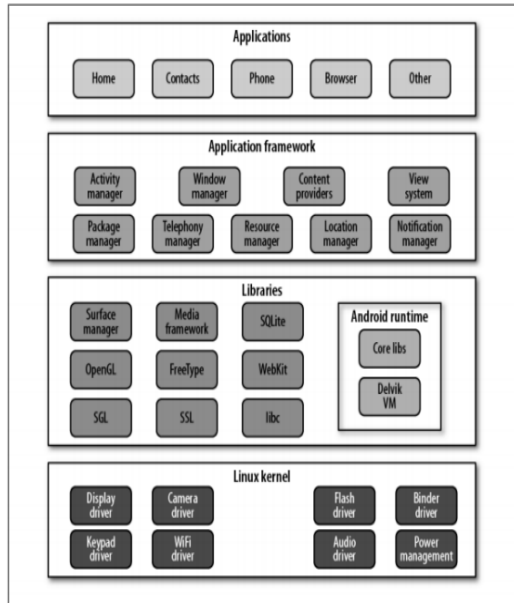


Figure 2.4 : Android Software Stack

### E. Wowza Streaming Engine

To use RTSP streaming server is a required. One of the streaming server that can be used is Wowza Streaming Engine ([www.wowza.com](http://www.wowza.com)) which is a server technology to address the needs of video and streaming audio from a device. In this study, the Wowza server used as a video that received from the Android device and provide streaming services will be used by other devices

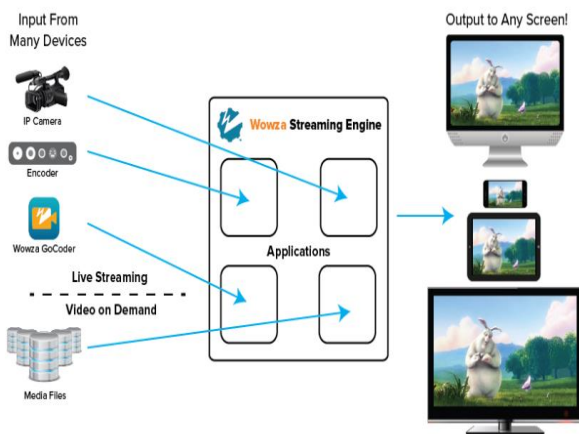


Figure 2.5 : the Wowza Streaming RTSP Engine

### F. The Architecture Of Mobile Virtual Class

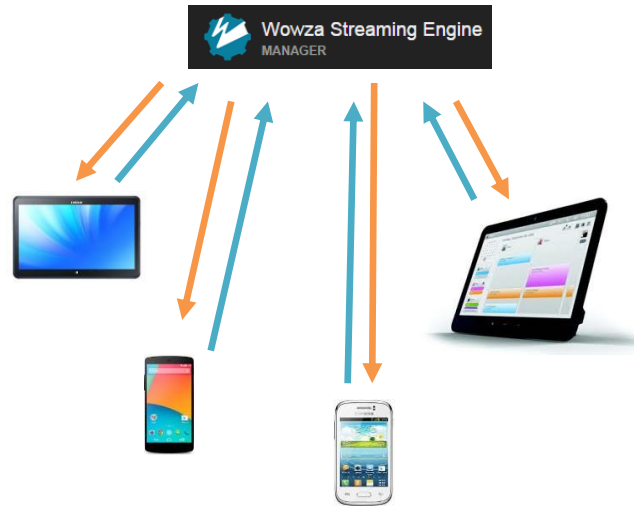


Figure 2.6 : Architecture of mobile virtual class

Create virtual classes that make use of Android devices as mobile video streaming using the Real Time Streaming Protocol (RTSP) is created by using a form of server-client by leveraging the Wowza Streaming Engine as a streaming server. The client in the form of Android devices that are connected to the internet, as seen in Figure 2.6

The difference with the virtual classroom to among others, by adding features – new features such as:

1. The streaming video conversation will be visible in the display screen amounts to more than three or number of live video steaming while deployed
2. Recording streaming video data will be stored in the database so that it is possible the student or students can repeat again the discussion is already taught in the virtual classroom
3. Virtual class mobile application which is designed utilizing a variety of low-power mobile devices but it does reduce the quality of the video streaming

In Figure 2.6, there is server unit (minimum intel corei7) with operating system windows 8.1 and the application has been equipped with installed Java Development Kit (JDK) 7 and Android and the

Eclipse will also be used as a database or data storage media video streaming

Take advantage of the technology of Real Time Streaming Protocol (RTSP) streaming video on the virtual classroom via the Android devices, provides convenience to conduct teleconferences simultaneously without any barriers of distance and time

### III. Conclusion

The design of this research is focused on the creation of a virtual class in the form of mobile video streaming using an Android device. Streaming video that will be used will be through the media server streaming a Wowza Streaming Engine by using the Real Time Streaming Protocol (RTSP).

The design of this application is expected to help the students, college students, teachers, and professors in developing and utilizing the virtual virtual classroom teaching and learning so that it can continue to be carried out without the existence of barriers of distance and time

The authors take advantage of the development of the Android-based Mobile device because the operating system is open source so it can be developed more easily, as well as the market share of android-based phone controlled 60% of mobile phones in Indonesia

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# Analysis of User Experience Quality at IT Telkom's Digital Library Based on Intrinsic Motivation Inventory (IMI) Method

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**Abstract**— Almost all university have digital library, including IT Telkom. The existence of digital library in IT Telkom really helps people to find the ebook, final project, thesis, papers, tutorials, etc. IT Telkom's digital library should have a good quality of the user experience because user experience is an important indicator in determining service quality. To determine the quality of the user experience of IT Telkom's digital library, needed a method to measure the quality of user experience. This measurement of the user experience quality based on the IMI method's criteria, that are interest / enjoyment, perceived competence, effort / importance, pressure / tension, perceived choice, value / usefulness, and relatedness. Measurement of user experience is done through questionnaires to the users. Then the result of the data questionnaire will be processed and analyzed to know the quality of the user experience of IT Telkom's digital library. The quality of user experience in IT Telkom's digital library will be improved by the design of website aspect through the implementation of the proposed design. After that the implementation will be tested through a questionnaire to the same respondents. The results of the design proposals questionnaire will be compared with the results of IT Telkom's digital library questionnaire. The result of this research is a recommendation for improvement of quality of the user experience of IT Telkom's digital library based on design of website aspect grouped by IMI subscale.

**Keywords**— design of website, digital library, IMI method, User Experience

## I. INTRODUCTION

As quoted by Dianti (2013), digital library in Indonesia can be accessed in 2010. But now many universities have a digital library. One of the university that has a digital library is IT Telkom that can be accessed using the Internet at URL: <http://www.digilib.itelkom.ac.id>. The existence of a digital library in IT Telkom is helpful to look for the ebook, thesis, journals, tutorials, etc. by online.

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Zhong-hua Deng and Qin Li (2008) stated that now to build a man-centered information society is a challenge that must be faced in the 21st century. User experience becomes the focus of information system development, from traditional design to user centered. As well as digital libraries should consider to the user experience in construction. As a result, the goal of a traditional library shifting from provide the great service to the reader by using as few resources as possible to provide the best service to the reader referring to the user experience.

But according to an UX professional and designer named Krisnanda as written on his blog (2013), in Asia, especially Indonesia, people are still unfamiliar with the term of user experience, even for people who work in the IT field though. It is estimated that the user experience will be popular in Indonesia in the next 3 years so it's estimated that not many websites (digital library is a website) that implement the concept of user experience. Whereas, now user experience is the focus of the information systems development, including digital libraries.

In addition, from the search that has been done, there has been no study-related publications in the field of user experience of digital libraries in Indonesia, so it is not known how the user experience quality of digital libraries in Indonesia. According to Zhong-hua Deng and Qin Li (2008), the user experience is an important indicator in determining service quality. So it can be assumed that the digital library in Indonesia built with no attention to aspects of the user experience well. Therefore it is necessary to do research on the user experience quality of digital libraries in Indonesia so that it can be seen the quality of the user experience.

The user experience quality can be measured by several UX methods. There are many methods that have been found by researchers. One method that can measure the user experience is the method of Intrinsic Motivation Inventory (IMI). This method is the most appropriate to the condition of the resources (time, effort, and cost) of the author. In addition, the accuracy and validity of the IMI method has been tested. Therefore, in this study used the IMI method for measuring the quality of user experience in IT Telkom's digital libraries.

## II. LITERATURE REVIEW

### 2.1 USER EXPERIENCE (UX)

According to Knemeyer and Svoboda (2007), User experience or commonly abbreviated as UX is the quality from one's experience when interacting with a particular design. In

ISO 9241-110 (2010) also defines the user experience, which is as a person's perception and response resulting from the use or anticipated use from a product, system, or service.

There are many definitions of the user experience, but all of these definitions are basically have the same concept of user experience. User experience is a feeling, perception, and response from a person who uses a system that is human computer interaction (HCI). The user experience is subjective, it is based on each user's feelings towards a system.

2.2 IT Telkom's Digital Library

IT Telkom's digital library is a digital form of UPT Perpustakaan IT Telkom's library beside the physical library. To improve the quality and service, IT Telkom's library provides catalog service, paper, ICT, research, and cafeteria. In IT Telkom's digital library there are three major service namely:

1) Online Journal

IT Telkom's library has service to acces Internasional Journal consisting of IEEE, GALE Cengage Learning, ProQuest, Emerald, Springer, EBSCO Host, and The Wall Street Journal. Those facility has the goal to improve education quality as World Class University

2) Scientific Work

IT Telkom's digital library has a complete collection of scientific papers resulting from students and lecturers research. This research can be a bachelor thesis (TA), final project (PA), and a master thesis.

3) Online Catalog

Catalog of IT Telkom's digital library consists of variety books, dictates, and digital media.

2.3 Intrinsic Motivation Inventory (IMI)

IMI is a method that is often used to measure the user experience quality on the website. According to Gamal Ali (2011), Intrinsic Motivation Inventory method (IMI) is a method that is theoretically quite convenient for online study and questionnaire, providing precise quantitative approach to the study, without the need for special software or equipment so as not to incur additional costs, the validity and reliability results of this method do not need to worry anymore because it tested. In addition, IMI method is also flexible in its use because it can adapt to the case studies used without affecting the validity and reliability.

2.4 IMI Scale

According to University of Rochester (as quoted by Houssam Ali, 2011), in its implementation, IMI uses 7 scales namely:

- 1) Interest/enjoyment
- 2) Perceived competence
- 3) Effort/importance
- 4) Pressure/tension
- 5) Perceived choice
- 6) Value/usefulness
- 7) Relatedness

For each scale in IMI is given 7 scale of questionnaire measurement:



Figure 2.1 Calculation Scale of IMI Questionnaire (Source: Solercanto,2012)

From IMI questionnaire's result, then did the calculation of quantitatives of questionnaire result by calculate the value of mode, mean, median, range, variance, deviation standard, max, min,etc. All of these values are defined on each IMI aspect.

III. RESEARCH METHODOLOGY

Flow processes and steps that will be carried out in this study is described as follows:

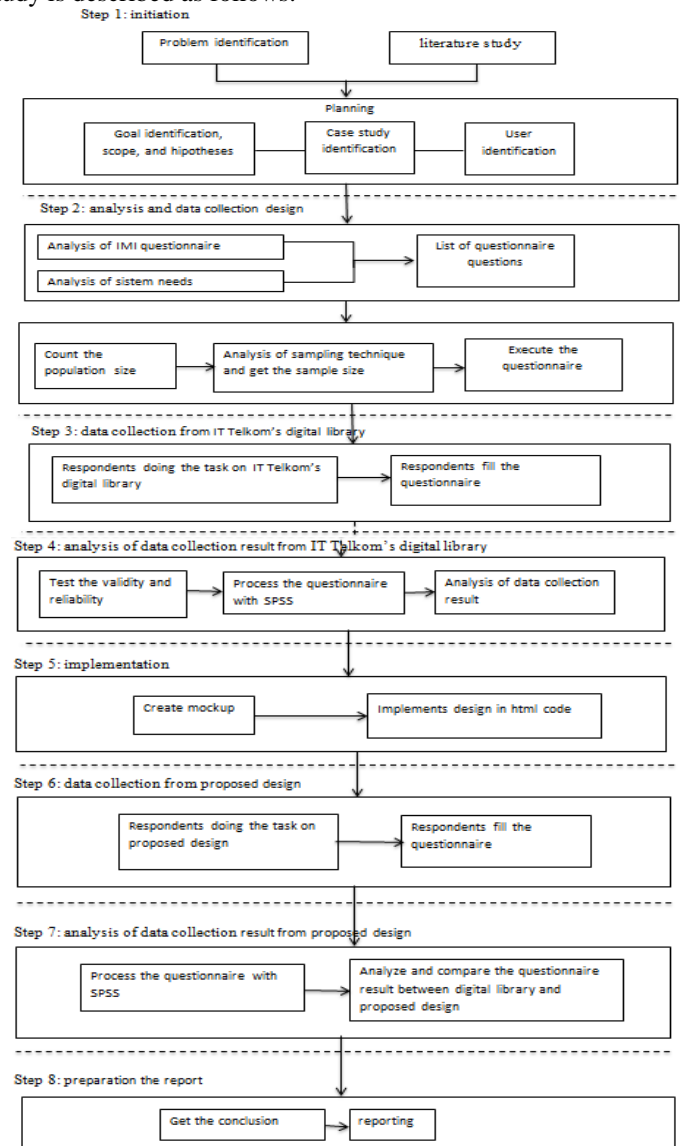


Figure 3.1 Research Flow Process

IV. IMPLEMENTATION AND ANALYSIS RESULT

At IMI subscale, positive statement indicates that the level

of interest, enjoyment, perceived choice, perceived competence, importance, value/ usefulness, and relatedness with the user when interacting with IT Telkom's digilib is not bad, but also not too good. This means that the value achieved can still be improved. IT Telkom's digilib has not been so good in the seventh subscale of the positive statements, because when they are both supposed to mean values obtained in the top 5 which means justify the given statement.

Based on the results of the questionnaire shows that 48.485% of respondents said that they were satisfied with the IT Telkom's digilib in general. This value shows that less than half of respondents were satisfied with the current IT Telkom's digilib.

#### 4.1 Implementation

Based on the analysis of the questionnaire result of IT Telkom's digilib. Here is the analysis design improvement:

- 1) The colors on the digilib web still use the blue color which is the color theme of old campus: IT Telkom. Because digilib will be developed for Telkom University campus, web color must be changed to follow the theme of the current campus: red, gray, and white.
- 2) On the homepage there is panel located on the left side of the page. The panel contains the login menu and place ads that are still empty, but the two functions are not needed on the web because for accessing the web can be done without login. So it was decided to remove the panel.
- 3) On the homepage there is a web logo and logo of the institution. Only institutions logo clickable and go to the page of the institution. Therefore, it will be added to the web link on the logo to go to the homepage.
- 4) On the homepage, page long enough to use the scroller. Whereas according to the basic theory said that the homepage, if possible length should be limited to one screenful so that no information is lost and the user can see all the information without scrolling. So it was decided to make a change in the arrangement of items on the homepage to be one screenful without scroller.
- 5) Based on the theoretical basis of avoiding a cluttered look. On the IT Telkom's digilib there are some parts that look messy, that are:
  - The search results on the menu book catalogs > books and catalogs > dictate: picture books are hanging and not aligned with the book details..
  - In the catalog menu> media: CD list that is displayed in tabular form is not clear, the margin is too close to the right side.
  - On the scientific papers menu: margin of a list of TA / PA / Thesis is approaching to the right side of the page. Column categories can not be chosen but still displayed.
  - On the video tutorial menu: The image could not be loaded.
  - On the encyclopedia menu: margin is too close.
  - there are several items at the bottom of which lies outside the frame page and inconsistent.

- On the menu of curriculum: there is a space / empty part that's too much in the middle of the page.

From the seven points above, will repair / tidied of the page so as not to look messy, set appropriate margin, clear tables, set the empty part (white space) so that not too much or too little, to make sure the image can be loaded and adjust the position of the image aligned with text.

- 6) Needs to placement an important item consistently. On the IT Telkom's digilib there are some items that location inconsistent such as labels go to top, page selection, and more articles. Then it should be improved by determining the position of the item consistently.
- 7) Doing improvements in curriculum menu with to set the empty space between information so is not too wide.
- 8) The use of a flexible display needs to be considered because that statement is in the basic theory. Flexible display will also facilitate users in the use of the web without losing important information. So it was decided to improve the web interface so it looks flexible.
- 9) required the use of a list of content that can be clicked on long pages. But on the web there are some content that too long. So it was decided to cut the content to the function read more.
- 10) Cuts on some page that is too long into several shorter ones.
- 11) The use of labels on a web page especially on page that displays a list of TA / PA / Thesis is less clear. The links are used instead of the title of the TA / PA / Thesis but NIM students. So that the links can not explain the information contained in the label category / link above. There will be a change of the links, it will use title label TA / PA / Thesis to be more relevant.
- 12) It should be done by served users with a good way of reducing choice as efficiently as possible in order to generate options that actually needed by the user. On the web seen that in every page there are choices to login and advertisement. This is not option that is really needed by the user. So for future improvements will be deleted.
- 13) Link should to the appropriate content. But on the video tutorials menu, if video tutorial link clicked will go to the campus web, doesn't to the expected video.
- 14) Differentiate the links that have been accessed by color change in the link. On the web does not meet the statement so that needs to be improved for the links that have been accessed.
- 15) It should be given a mark on the menu that are cascading. But in the catalog menu there is no cascading menu that has a sign like the drop-down or other, so that the user does not know if the cursor is not directed to the menu. So, it to be improved by adding a sign that known as cascading menu.
- 16) Doing the distinction of internal and external links.
- 17) The use of background color that helps the user in understanding the grouping of information is needed. But on the digilib, all information is displayed without using a different background color.

18) Make sure all images that clickable are labeled and easy to read by the user. This is because there are some users who have difficulty understanding the meaning of an image rather than text. But on the web there is image as a link but does not have a label. So for the next stage would be improved by adding a label to an image which is a link.

#### 4.2 Questionnaire Results of Proposed Design

At positive statements of IMI subscale in the proposed design questionnaire indicates that the level of interest, enjoyment, perceived choice, perceived competence, importance, value/usefulness, and relatedness with the user when interacting with the web has been good. The result value of seven IMI subscale for positive statement of questionnaire design proposal has been good because user justify the positive statements.

The mean value that obtained for each subscale for negative statements mostly was approaching 3 which means that:

At IMI subscale of negative statements in the questionnaire of proposed design indicates that the level of disinterest / boredom, at least perceived choice, incompetence, pressure, and disrelatedness with the user when interacting with the web quite low. The result value of the six IMI subscale for negative statement is quite low because user does not justify the negative statement is given.

Based on the results of the questionnaire for satisfaction question, shows that 89.10% of respondents said that they were satisfied with the proposed design in general. This value shows that almost all respondents were satisfied with the proposed design is given.

#### 4.3 Comparison Between Questionnaire Results IT Telkom's Digilib and Design Proposal

Comparison of the results of the questionnaire can be seen from the IMI questionnaire statement and user satisfaction question given to respondents as many as two (2) times that of the digilib questionnaire and a questionnaire on the proposed design. From tables comparison the questionnaire results between IT Telkom's digilib and design proposal, indicate that the user experience quality perceived by the user increased after the implementation of the proposed design.

### V. CONCLUSION

Based on the data collection process, testing, and analysis in this study. The conclusion of this study are: 1) The results of the analysis of user experience quality at IT Telkom's digital library based on IMI's methods shows that the quality of the user experience of the digilib still be on average scale of 4, which means that the user has not enjoyed any activity in digilib well. 2) After the comparison of the user experience quality in IT Telkom's digital libraries before and after the improvements based on the results of measurements of user experience quality with IMI method, found that the user experience quality of IT Telkom's digital library increased after the implementation of the proposed improvements to the

design. 3) This study provides recommendations for the improvement of the user experience quality of IT Telkom's digital library based on design of websites aspects grouped by IMI subscale.

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# Developing the Game Design Document for An Educational Game Named “Bank Sampah”

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**Abstract**— The development of the trend in today’s information technology results in the higher need for it for educational purposes and tends to be varied. Especially for early childhood education. As we know, nowadays children are more familiar with how to use their smartphones, tablets and other gadgets that they often use to play games. Therefore, educational elements that we need to give to the children should be more varied and innovative. One way that we can use is the educational game. In this paper, we are going to develop a game design document or which we can call as the blueprint of a game named “Bank Sampah” or the Bank of Waste in English. This game design document already includes all the necessary things in designing a game. It can be said that with the existence of a game design document means that the game has been ready to be implemented. This “Bank Sampah” game serve as a learning medium for children in order that they become aware of the importance of not littering while at the same time fostering their awareness regarding the benefits of not littering.

**Keywords**— —“Bank Sampah”, Game, Game Design Document, Educational Game.

## I. INTRODUCTION

Currently, the development of the trend in information technology increases rapidly in any aspects including the aspect of education. The aspect of early childhood education is no exception. Today’s children prefer learning in ways that are fun, not boring, entertaining but which still educate them. They tend to enjoy learning through games using their smartphones, tablets and other gadgets. Varied and creative education but which still contains educational elements tends to be chosen by them. This is evidenced from a substantial number of applications or games with educational elements in android and iOS platforms. The theme “Bank Sampah” or the bank of waste in English is taken considering the lack of awareness of waste, especially that most people have less concern for the environment and litter anywhere. It concerns us greatly that this might happen for generations and children might lose their awareness of this waste as well. This is what underlies the authors to write this paper.

Based on the foregoing, there is one problem that this paper can formulate, which is “How to develop the Game Design Document for an Educational Game under the Theme of

“Bank Sampah” ?”.

There are a considerable number of definitions to define the meaning of a game. Nevertheless, there are hardly any formal definitions. However, from several literature, the authors finally have found one fairly comprehensive definition of games. In the book entitled *The Art of Game Design*, a game is defined as an activity to solve problems using the approach of playing or a playful situation [1].

One of the games that is now being seriously developed is educational games. Educational games is a new breakthrough in the world of gaming, where games that have the primary duty as a problem-solving activity with recreational purposes, self-entertaining, are combined with the elements of education. This type of game is intended to encourage students to learn while playing. Educational games are a new breakthrough in the world of education because they combine the aspect of playing with the the aspect of learning [2].

According to Andrew Rollings and Ernest Adam, game design is a process of imagining a game idea, defining how the game works, describing the elements that build the game (in terms of the concept, the function, the artistic aspect and so on) and presenting the information about the idea of the game to the game development team [3].

Meanwhile, according to Jesse Schell (2008), game design is the action to define how a game should be [1].

According to Adams, Ernest (2010), a game design document is a collection of documents used by game designers to inform about the designed game, this process changes the idea that at first is abstract into a written plan [4]. There are various kinds of game design documents, each has its own characteristics and different functions. Here they are :

a. *High Concept Document.*

It functions to inform the producer or publisher about the game to be developed. This document consists of the key ideas of the game.

b. *Game Treatment Document.*

It functions to present the game in an outline form to those who wish to know about the game that we are going to develop. This document also aims to develop a more in-depth design, a prototype that later will be developed into a finished game. This document is still simple, may take a form of brochures containing all the basic ideas of the game is to be develop.

c. *Character Design Document.*

It is specifically used for recording the designs of the characters that appear in the game that is going to be developed, which often take a form of avatars.

d. *World Design Document.*

It serves as the basis for all the graphic arts and audio that describe the game world of the game that is going to be created. This document contains information about the background of miscellaneous objects in that world.

e. *Flowboard.*

It is a cross between a flowchart and a storyboard, where the storyboard is a linear document used to plan a series of illustration according to the storyline, while the flowchart is used by programmers to document algorithms.

f. *Story Level and Progression Document.*

This type of document records the large-scale story of the game to be develop and how the progress of each one level to the next level. This document contains an overview of the experience of the gamers after playing the game to be develop.

g. *Game Script.*

Game script records the rules and the core game mechanics. It can make us know how to play the game and specify rules of the game in detail.

The authors began this research with reviews of literature on theories relevant to the preparation of a game design document. Once the authors have reviewed the literature and found the theoretical reference for the preparation of this game design document, the authors then started to arrange the game design document in accordance with the theories that the authors have learned. Based on the literature reviews on the types of game design documents, the authors combined the existing types of game design documents and used the result as a reference to arrange a more complex game design document. The types of game design documents that the authors have crossed among others are high concept document, game treatment document, character design document, story level and progression document as well as game script. Using them as the benchmark, the authors started developing a game design document of the game overview, gameplay and mechanics, screen flow, physical character, level dan design artificial intelligence (AI).

II. DISCUSSION

A. *Game Overview*

1. *Game Concept*

“Bank Sampah” is a game with an emphasis on educating children about the waste that surrounds them as its background. By introducing an educational concept

related to waste, this game tries to educate children to dispose of waste into the dustbin. based on the type of the waste. Gamers are required to collect the waste around them either at home or in the neighborhood to be thrown into the dustbin.

The main tasks of the gamers of this game are to find as much waste as possible and to be able to distinguish the waste according to its category, i.e. organic waste, inorganic waste, and glassware. These gamers will be given a time limit so that they can focus on their own tasks.

2. *Genre Game*

In accordance with the concept of the game, the genre of this game therefore is social education and serious games.

3. *Target Audience*

The target audience of this “Bank Sampah” game is early-age children, especially elementary school students and kindergarten students. However, adults can also play this game and get educational and fun values so that it is optional for them and still the main target audience is early-age children.

4. *Look and Feel*

To make it easier to play this game based on the isomatrik perspective, a camera is placed on the top of the game interface.

The dominance of different colors at each location, color adjustments based on the dominant colors in each location.

There is additional animation on particular locations, for an example if one of the characters is at home, the audience can hear the voice of the character’s parents/ mother calling the character’s name to clean up the room. Meanwhile, if one of the characters is visiting the park for an example, there will be people walking in the streets while littering anywhere.

5. *Feature Set*

The feature set or the features of this “Bank Sampah” game are presented in Table 1 below.

TABLE 1  
FEATURE SET GAME “BANK SAMPAH”

NO	FEATURE
1	Timer
2	Scoring Board
3	Pause (II)
4	Close (X) Game Auto Save
5	Graphic Setting
6	Audio Setting
7	Point
8	Triple Point
9	Load Game, Last Auto Save
10	Change Point To Buy Character and Upgrade
11	Customize Character

6. *Project Scope*

The project scope describes the number of locations that can be played, the number of NPCs (Non-Playing Characters) in the game which have particular roles. The figure below presents a number of locations that gamers can play.





FIGURE 1. LIST OF LOCATION

Based on the figure above, we can see a list of locations that can be played. The first location is at home. If a gamer completes one location and get a star as a sign of having completed the mission, this gamer can move to another location.

**B. Gameplay and Mechanic**

**1. Character**

There is a variety of characters in this game that can be played, each with their own strengths and different physical appearance. There are some characters that must be purchased in advance using a number of points which a gamer collects and there are also characters that can be played directly or default game characters. To see all the characters of this game, look at the figure below.

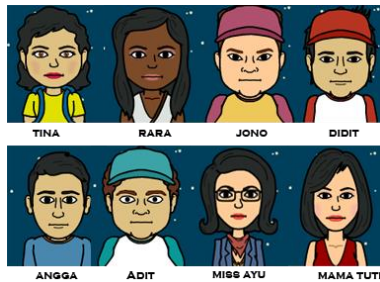


FIGURE 2. LIST OF CHARACTERS

In the initial version of this game, we have made a total of eight characters with 5 playable characters and 3 NPC.

There are 3 NPC in this game :

- a. Mama Tuti. A mother who always tell his son or daughter to always clean up his or her room house.
- b. Jono. A naughty boy character who always littering. Indirectly the enemy AI for player.
- c. Miss Ayu. Character that directs the player through the in-game tutorial.

The specification for playable character described in Table 3. Details and specifications of the five playable characters can be seen in the following table.

TABLE 3  
LIST OF PLAYABLE CHARACTER

NO	NAME	ABILITY	PHYSIC
1	Adit	Speed : 35%	Height : 90cm Skin : Light Brown Face : Round Accessories : Blue Hat
2	Didi	Speed : 50%	Height : 100cm Skin : Light Brown Face : Round Accessories : Red Hat

3	Angga	Speed : 60%	Height : 90cm Skin : Light Brown Face : Oval
4	Rara	Speed : 70%	Height : 110cm Skin : Black Face : Round Accessories : Hand Bag
5	Tina	Speed : 80%	Height : 90cm Skin : Light Brown Face : Round Accessories : Blue Backpack

**2. Gameplay, Game Progression**

The first time a gamer start this game, it will be in an area in a park, with a selection of the difficulty level such as a bit dirty (“agak kotor”), dirty (“kotor”), and extremely dirty (“sangat kotor”). After successfully completing the mission in one map location, the gamer will be allowed to choose another map location. Therefore, the next map location will open only if the gamer has successfully complete the mission in the previous location. Each level has its own highest score.

**3. Mission Chalange**

Mission challenges or challenges in each mission that every gamer has to pass are usually similar depending on the level chosen by the gamer. Despite different locations, challenges that a gamer receives to complete each level tend to be similar. However, differences in the location will definitely have a direct impact for the gamer to complete each challenge. Here are the details of the challenges that a gamer have to complete at each location based on the selected level.

- a. A Bit Dirty “agak kotor”. The game lasts for 3 minutes with a target score by 100 and a little amount of waste. This level is not too complex.
- b. Dirty “kotor”. The game lasts for 2 minutes with a target score by 200 and more waste that is more complex (more varied) and Jono, which is AI’s enemy, is going to litter twice in this level
- c. Extremely Dirty “sangat kotor”. The game lasts minute, with a target score of 200 and more waste that is more complex (more varied) and Jono, which is AI’s enemy, is going to litter twice in this level

**4. Playflow**

It describes the flow of the game for gamers or we can also say it as some sort of the game tutorial. Here is the display of this game tutorial.



FIGURE 3. PLAYFLOW

Gamers starts with selecting the only location that have been unlocked, to unlock another game location, gamers are required to complete the mission on the first playable location and so on to unlock another location.

After clicking the play button, then the timer will automatically run. At first, there is a tutorial directing gamers to pick up waste and put it in a dustbin as shown in the figure below.

Waste is dragged into the right dustbin or click the waste and then click the appropriate dustbin. At the time the waste is put into the right dustbin, the point earned will automatically increase. However, if the waste is put into the wrong dustbin, the point earned will not increase. The mission will be successful if the points collected reach the minimum target.

### 5. Mechanic Game

Mechanic game is a set of rules set for the game related to interactions between the gamer and the game. This mechanic game requires gamers to follow the rules of the game to be able to interact with the game.

The first time a gamer begins the game, a screen containing the title of the game with a background of art environment game will appear (the game is loading) or which can be called the splash screen.



FIGURE 4. SPLASH SCREEN

Once the game loading completes, appear game menus (play, setting, help, exit).



FIGURE 5. GAME MENU

If gamers click the “setelan” button, they then will be able to set the audio and the screen. Here are the displays for the audio setting and the screen setting.

In this menu, gamers can set the background music and the audio effect. They can click the setting button to check or uncheck the background music “music latar” or the sound effect “suara efek”.

In graphic menu, gamers can choose the quality of the screen that they wish to use in this game. They can click the

setting button to check or uncheck to select either the high quality “kualitas tinggi” or the low quality “kualitas rendah” for the game screen

If gamers click the scoreboard button, the the scoreboard will appear to see who has obtained the highest score.

By the time the play button is clicked, the play screen will appear. Gamers can choose the location, replace the characters, continue to play and see the scoreboard.



FIGURE 9. PLAY SCREEN

When gamers select the game location, the difficulty level of the game will be by default will in a normal position. After that, gamers will be directed to a screen of the chosen location and the start menu will appear to begin the game. After clicking the start button, time will run and gamers must choose the waste and put it into the dustbin. Once the start button is clicked, the waste is strewn around the location that gamers have selected. The amount of the waste will depend on the difficulty level chosen by gamers (read the mission/ challenge and structure). The time scale of this game is adjusted to the actual state, i.e. 1 minute = 60 seconds.

In the early stages of the game, AI will teach gamers (tutorial) how to take out the waste and put it in the right dustbin. When the game starts, music will play to entertain gamers so that they do not get bored. The waste is drageble. By the time the cursor leads to the waste, a small cloud containing three types of dustbin will appear.

There are two ways to put the waste into one of the dustbin, by dragging the waste into the dustbin in the cloud or by clicking on the waste and then clicking the dustbin. Each time the waste has been put into the dustbin, gamers can hear a typical sound indicating that the waste has been put into the right dustbin, (the of people clapping their hands) and vice versa, if the waste has been put into the wrong dustbin, a typical sound indicating that the waste has been put into the wrong dustbin will also be made that is not similar to the sound made when the waste is put into the right dustbin (the sound of the cartoon). Time information is in the right position at the bottom, in the left at the bottom there are 3 types of dustbins to collect each point; to the right of the dustbins, the total score can be found, which collect the points earned in the three dustbin.

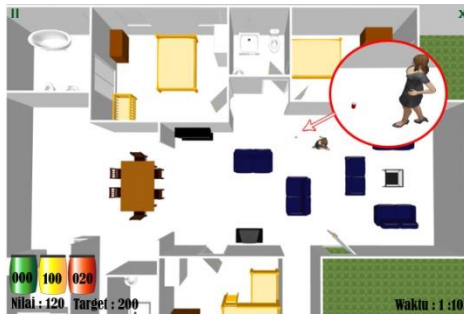


FIGURE 10. GAME PLAY

In the right position at the top, there is a close button and on the left of it, there is a pause button to pause the game. The dustbins are made in three different colors, namely yellow for inorganic waste, blue for organic waste and red for glassware. To the right of the target point, gamers can see the total score that they must meet.

If the waste is put into the right dustbin then the dustbin on the lower left corner will automatically increase the score. Each waste put into the dustbin will give the gamer a 10-point score, and each point is collected to reach the specified target. For certain types of waste, there is a triple point that will be awarded to gamers after they manage to find triple-point waste with a score of 30 points. A three-star reward will be earned if gamers can collect points that exceed the target points in a short time. One-star and two-star rewards will be awarded if gamers hit the minimum target. If all the waste in the location has been successfully cleaned, gamers will get a green reward label and gamers can earn this label in each location provided that they have cleaned all the waste. To purchase other characters, each character costs a different amount of points since each character has a different speed level.



FIGURE 11. CHANGE CHARACTER

At a normal level of difficulty “kotor” and a hard level of difficulty “sangat kotor”, gamers will have to deal with a stubborn boy named Jono who keeps littering anywhere, this child’s intensity in littering at the normal level of difficulty is different from this at the hard level of difficulty. At the hard level of difficulty, this stubborn kid litter more often while at the normal level of difficulty, he only litters a few times.

6. *Physic*

a. *General Movement*

Not all objects can be controlled by gamers, the control can be moved using a swipe on smartphones, tablets or other touchscreen gadgets. To move a

character, gamers can swipe at the control that appears on the screen or click a coordinate on the screen and the character will move towards the direction of the location clicked.

b. *Other Movement*

There are some other movements or a secondary visual element in this waste-bank game, i.e. the appearance of the character named Mama Tuti to remind and advise another character to clean the house. A character named Jono, a stubborn kid who likes to litter also appears. Jono will always appear in any locations except at home.

C. *Screen Flow*

1. *Screen Flow Chart*

The figure below describes the hierarchy of the screen flow of this waste-bank game.

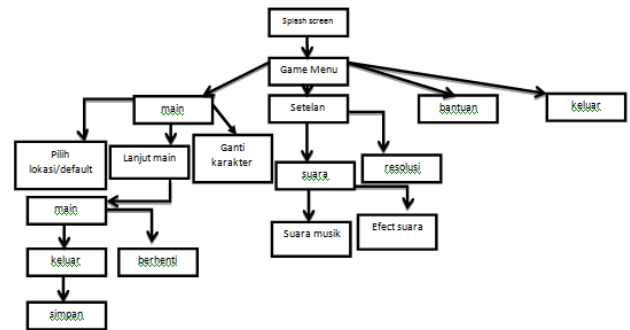


FIGURE 11. SCREEN FLOW

At the beginning of the game, the characters will be displayed in a splash screen while the game continues loading. After that, the game menu will appear which consists of 4 menus, namely main (play), setelah (setting), bantuan (help), and keluar (exit). In this menu, games can select the features of the game.

D. *Level*

1. *Level Design*

At this stage of level design, we make the design of each level of this game, i.e. the physical description of each level and specification of each difficulty level of each level of difficulty. The physical description of each level can be seen in the table below.

TABEL 4 PHYSICAL DESCRIPTION OF LOCATION LEVEL

NO	TYPE LOCATION	PHYSICAL DESCRIPTION
1	“Taman” / Garden	There are trees, garden lighting, green grass and stone walkways
2	“Rumah” / House	There are dining table, kitchen, bathroom, living room bedroom and family room
3	“Perumahan” / Housing	There are trees, street lights, home lawns and houses
4	“Halaman Rumah” / Home Yard	There are trees, flower garden and fish pond
5	“Gang Dalam Kota” / Alley in Town	There are road alley, trash cans and walls of the city
6	“Gang Sekitar Rumah” / Alley	There are a road alley, power poles and fences

	around house	
7	“Dekat Sungai” / Near River	There are flowing river and bridge
8	“Lapangan Bola” / Soccer Field	There are field and goal
9	“Pasar” / Market	There are people selling and street market

While for specifications of each difficulty level, see the table below.

TABEL 5 DESCRIPTION OF DIFFICULTY LEVEL

Difficulty Level	Time	Target Score	Number of Trash	Complexity Trash	Enemy AI
Agak Kotor	3 Minute	100	150	Sedikit	-
Kotor	2 Minute	200	250	Sedang Variasi	2 Times
Sangat Kotor	1 Minute	200	250	Banyak Variasi	2 Times

#### E. AI (Artificial Intelligence)

Artificial Intelligence (AI) as the name implies is an intelligence created by people using specific algorithms that have a special role in a game. In this game, there are 3 AI that are classified according to their respective role, namely Enemy AI, Friendly Characters and Support AI.

##### 1. Enemy AI

Enemy AI in this “Bank Sampah” game is composed of 3 elements, namely:

- a. Time. At a particular level of difficulty with a very short time limit and a substantial number of challenges will definitely be an enemy for every gamer
- b. Waste. Waste which is the main object of this game is regulated by a specific algorithm that makes waste random and varied depending on the level will be the main enemy for gamers
- c. Jono. This kid is the enemy AI that is responsible for littering at a certain level of difficulty will be an enemy gamers for other characters when they attempted to collect the waste

##### 2. Friendly Character

There are two friendly characters in this game, namely :

- a. Miss Ayu. who provides a tutorial to gamers.
- b. Mama Tuti. who encourages gamers to always keep the room clean. Motivating them.

##### 3. Support AI

Complexity of the waste at each level of difficulty is different and random in nature. However, particular waste contains a triple point that gamers possibly do not expect and this triple-point waste will support them to collect more points.

### III. CONCLUSION

Based on the discussion of this paper, we come to the conclusion that develop the game design document of the

educational game “Bank Sampah”, there are several steps to follow. First, it requires an understanding of the scope of the game to be develop along with a collection of ideas about the game. Secondly, it takes an understanding of the theories about the game design document and its types. Third, determine the type of game design document to be develop based on the understanding and ideas of the game and the theories about the game design document. Fourthly, those understanding and ideas about the game should be developed into a game design document in accordance with the type of the game design document that has been specified in step 3. In this paper, we have developed the game design document by performing a hybrid using the types of game design documents as a reference for developing the game design document. The resulting hybrid of this game design document that we use is resulted from a hybrid of a variety of game design documents, namely high concept document, game treatment document, character design document, story level and progression document as well as game script.

In this research paper, there are a couple of things that the authors have not examined further. And, it is expected that other researchers investigate further the area which we have not examined further. For examples, directly implementing this game design document into the prototype of an educational game named “Bank Sampah” or examining the algorithms for the determination of the amount and types of waste that appear randomly depending on the level of difficulty.

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# A Proposed Framework for Accounts Receivable Information System (ARIS) Development

Magdalena Karismariyanti<sup>1</sup>

**Abstract**—This paper presents system development framework using two way Waterfall Model for accounts receivable information system. This framework includes sales process break down by considering internal control, data and reporting requirement. Each Waterfall's phase used structured-systems analysis and design method (SSADM). Accounts receivable is form of short-term debt in credit sales activities. Indonesia's new government wants to increase citizen entrepreneurship movement for small and medium enterprise. Streamline process to get business license permit makes new-business owner speed up to start their business. In order to survive in business, business owner have to make sure operating cycle runs well. One activity in operating cycle is managing receivable. Uncollected receivable will be disaster for company. Company needs application to help them manage its sales activity through monitoring accounts receivable. As a legal company approve by the law, company must reporting its business based on accounting principal.

**Keywords**—Accounting Information System, Accounts Receivable Write-Off, Aging Schedule, System Analysis and Design

## I. INTRODUCTION

THE president of Indonesia concern is building entrepreneurship among Indonesia citizen. A country can be prosperous if it has at least 2% of entrepreneur of the total population [14]. In order to support new entrance of business, some of the programs are bureaucracy system reform and streamline process to get business license permit [11]. Indonesian's institutions have offering program to support entrepreneurship such as entrepreneurship program for unemployed young citizen by Kemenakertrans [12], Mandiri Young Entrepreneur Program for university student segment by Bank Mandiri [15] and IndiPreneur Program by PT.Telkom [13].

There is possibility that business went bankrupt. Internal and external factor can cause bankruptcy. Sample of Internal factors are funding, marketing etc. External factor includes subsidized fuel reduction government policy, increasing of Regional Minimum Wage (UMR), etc.

Company must ensure that operating cycle runs well, because this is critical problem in business. Operating cycle consist of the following activities: recognition of revenue, recording of receivable, and subsequent collection of cash.

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Revenue recognition related to account receivable recognition. Revenue is recognized when the earning process complete and payment satisfied. One activity to create revenue is sales. On credit sales, revenue cannot directly recognize when sales occur, recognition of revenue happen when account receivable collected on the promised period [9].

Collections of account receivable generate cash that affected operating activity section of the statement of cash flows[6]. Company, which able to collect account receivable during the promised period, has good liquidity ratio. This liquidity ratio can be evaluated from Receivable Turnover. Effectiveness Account receivable collection can be concluded from average days to collect should not exceed 1.5 times the credit term [4].

Recent researches analyze correlation between Receivable Turnover and Net Profit Margin (NPM). NPM is key financial indicator used to asses the profitability of the company. Based on data collected form 2000-2011 in fiduciary industry sector, Receivable Turnover has significant effect on company profitability [7]. In food and beverage industry sector based on data from 2008-2010, Receivable Turnover and inventory turnover have significant effect on company profitability, and Receivable Turnover is the independent variable that has dominant effect [10]. Receivable Turnover needed to assure that company's cash always available. Accounts Receivable must be well maintained.

In order to support company to maintain accounts receivable as the result of credit sales activities, this paper propose a framework to develop Accounts Receivable Information System (ARIS).

## II. ACCOUNTS RECEIVABLE

Accounts receivable happens when company has sold goods or service to customer but has not received amount of money right to collect. Accounts receivable has short-term credit generally due 30 to 90 days [9] or maximum one year credit due or within one fiscal year. Accounts receivable application use two optional approaches which are process open item and process balance forward [3].

- a. Process open item, customers' payment compared to unpaid invoice.
- b. Process balance forward, customers' payment compared to customers' balance.

On the worse case, some accounts receivable are uncollectible. Methods to recognize the loss from uncollectible

accounts receivable are direct write-off method and allowance method [9].

Journal entry comparison for a. Direct write-off method and Allowance method shown in Table 1 [9].

TABLE 1  
JOURNAL

Transaction	Direct Write Off Method	Allowance Method
Credit sales	Dr. Accounts Receivable Cr. Sales	Dr. Accounts Receivable Cr. Sales
Collection of Accounts	Dr. Cash Cr. Accounts Receivable	Dr. Cash Cr. Accounts Receivable
Uncollectible Account Receivable	No journal entry available	Dr. Bad Debt Expense Cr. Allowance for Bad Debt
Write off an Uncollectible Account	Dr. Bad Debt Expense Cr. Accounts Receivable	Dr. Allowance for Bad Debt Cr. Accounts Receivable
Collection of Write-off Accounts	Dr. Accounts Receivable Cr. Bad Debt Expense  Dr. Cash Cr. Accounts Receivable	Dr. Accounts Receivable Cr. Allowance for Bad Debt  Dr. Cash Cr. Accounts Receivable

Allowance percentage estimated from percentage of sales or outstanding receivable balance. Commonly used method for estimating allowance based on outstanding receivable is aging receivable [9]. Receivable analysis illustrate in Table 2.

TABLE 2  
ANALYSIS OF RECEIVABLE

ICO Product. Inc Analysis of Receivable December 31, 2015			
Customer	Amount	Not Yet Due	31-60 Days Past Due
A.B.Andrews	\$ 450		\$450
L.B. Devine	\$2100	\$2100	
M.A.Young	\$1400	\$1000	\$400
Total	\$3950	\$3100	\$850

Percentage estimated uncollectible accounts illustrate in Table 3 [9].

TABLE 3  
ESTIMATED AMOUNT OF UNCOLLECTIBLE ACCOUNTS

ICO Product. Inc Estimated Amount of Uncollectible Accounts December 31, 2015			
Classification	Balance	Percentage	Amount
Not Yet due	\$3100	2%	\$62
31-60 Days Past Due	\$850	10%	\$85
Total	\$3950		\$147

Aging receivable groups into not yet due and overdue receivable. It use classification based in due period e.g. not yet due, not more than 30 days past due, 31-60 days past due, 61-90 days past due, 91-180 days past due, 181-365 days past due, and more than one year past due [9]. On each

classification, management estimated probability of debt loss rate [4].

Table Estimated Amount of Uncollectible, Bad Debt Expense estimated \$147. Amount of Allowance for Bad Debt is \$147. It balances bad debt expense on credit side [9].

### III. MONITORING ACCOUNTS RECEIVABLE

Managers need to monitor its receivable. In order to monitor Accounts Receivable, there are two measurement methods which are *Receivable Turnover Ratio (RTO)* and *Average Age of Receivable* [9]. This is formula to calculate RTO given in equation (1) and Average Age of Receivable given in equation (2). Illustration to calculate RTO [6].

$$Receivable\ Turnover\ (RTO) = \frac{Net\ Credit\ Sales}{Average\ Net\ Receivable} \quad (1)$$

*Net Credit Sales* provided by Profit and Loss Statement in the current year. *Average Net Receivable* calculated based on average Receivable provided by Balance Sheet in the current year and previous year. Number of days in a year is 365 days.

$$Average\ Age\ of\ Receivable = \frac{Days\ in\ a\ Year}{Receivable\ Turnover\ (RTO)} \quad (2)$$

Monitoring reports illustrated in table 4 based on [4].

TABLE 4  
ACCOUNTS RECEIVABLE MONITORING COMPARISONS OVERTIME

Comparisons Overtime Timberland			
Year	1998	1999	2000
<i>Receivable Turnover (times)</i>	11.1	11.6	11.8
<i>Average Age of Receivable (days)</i>	32.8	31.5	30.9

### IV. RESEARCH METHODOLOGY

This research software development is using Waterfall model System Development Life Cycle (SDLC) approach. Waterfall model focuses on complete and correct planning to guide large projects and predictable results. This model is one of the oldest models [1] and according to a VersionOne survey (2007), nearly 70% of software development organizations are still using the Waterfall Method [18]. This model best used for reasonably well understood problems, such as adaptation accounting software to government regulation [5]. As this model emphasizes planning in early stages, it ensures design flaws before they develop. It reinforces good habits: define-before-design and design-before-code [1]. In the waterfall itself, there are various steps used [1] [2] [18] [19]. Waterfall model phases in this research uses five steps which are analysis, design, implementation, testing and maintenance [2]. In order to solve its disadvantage of original waterfall model, which is limitation to unable to previous phase, two way waterfall proposed to overcome the limitation [8].

Analysis Phase also known as Software Requirements Specification (SRS) [2]. Various tools and techniques [8] for analysis phase: 1) BPM Business Process Modelling; 2) DFD Data Flow Diagram (DFD Sets, Data Dictionary, Process Description); and 3) UML Unified Modelling Language (Use

Case, Class Diagram, Sequence Diagram, Transition Diagram, Activity Diagram

Design Phase is the process of planning and problem solving for a software solution. It implicates software developers and designers to define the plan for a solution which includes algorithm design, software architecture design, database conceptual schema and logical diagram design, concept design, graphical user interface design, and data structure definition [2] [8].

Implementation Phase converts the whole requirements and blueprints into a production environment such as concrete executable program, database, website, or software component through programming and deployment. [2].

Testing Phase is verification and validation process for checking that a software solution meets the original requirements and specifications and that it accomplishes its intended purpose. Verification is the process of evaluating software to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase; whereas, validation is the process of evaluating software during or at the end of the development process to determine whether it satisfies specified requirements [2].

Maintenance Phase is the process of modifying a software solution after delivery and deployment to refine output, correct errors, improve performance and quality, adapting software to its environment, accommodating new user requirements, and increasing software reliability [2].

V. RESEARCH FRAMEWORK PROPOSAL

A. Analysis Phase

First step of developing research is analysis phase. Analysis phase is a complete and comprehensive description of the behaviour of the software to be developed. It implicates system and business analysts to define both functional and non functional requirement is needed [2].

1) *Non Functional requirement:* Finding criteria, constraints, limitation and requirement; literature study and survey are performed. The needs of literature study are finding the regulation on Accounts Receivable and its related activities. In developing an accounting information system, needed to accommodate the needs from audit point of view. In order to overcome potential loss to company, internal controls is needed. One assurance that described in the control activities is separation of duties [3]. The separation of duties affect the design of actor / entity that can access the system proposed in this study. The figure 1 shows sequential Accounts Receivable activities. Figure 1 omitted decision process to emphasize on main activity from the activity that triggers Accounts Receivable to Statement.

2) *Functional requirement:* Output of functional requirement is DFD. It's common information on Accounting Information System's Books about revenue cycle. Reference [3] write about business process in accounts receivable using document flowchart. Document flowchart illustrates the flow of documents through an organization and it's useful for analysing internal control procedures. Whereas [3] explain a

lot from sales activity through accounts receivable, Reference [20] add different approach to model revenue cycle sales to cash collection using DFD.

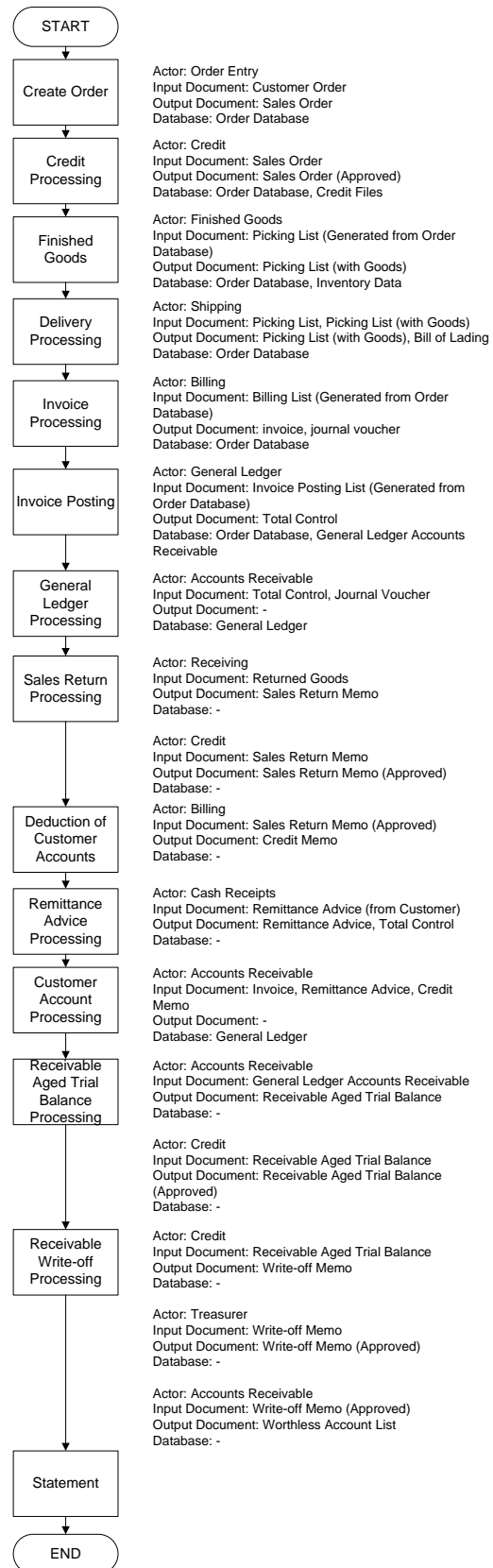


Fig. 1 Credit Sales Activity

Context Diagram is shown in Figure 2. The diagram provides a summary-level view of the system. External entities become source of its input and destination of its output. External entities, read in clockwise direction, are Sales Order Entry, Credit Officer, Billing Officer, Receiving Officer, Treasurer, Cash Receipt Officer, Accounts Receivable Officer, Shipping Officer, and Warehouse. External entity symbol is rectangular. There should be Customer as external entity as source of input. In the figure 2, customers are omitted from process model because given external entities replace Customers on the interaction to the system e.g. Sales Order Entry.

A level 0 diagram is projected from context diagram. This diagram has the same external entities as context diagram. There are nine sub-processes of ARIS. Process is represented by circle and labeled with verb.

1) *Process 1.0 Process Order* allows Sales order entry to process orders and simultaneously inventory availability checked. Sales order entry will receive responds from Credit approval process. Sub-process exploded from this process would be: Process 1.1 Take Order, Process 1.2 Check Inventory Availability, and Process 1.3 Respond Customer Order.

2) *Process 2.0 Credit Approval* allows Credit Officer to approve the credit limit of orders.

3) *Process 3.0 Shipping* allows shipping officer to process delivery and shipment. Based on picking list from approved sales order, shipping officer do the picking and packing, and generate picking slip and bill of lading. Bill of lading used to deliver goods to customers which done by other party apart from the company. Sub-process exploded from this process would be: Process 3.1 Picking and Packing, and Process 3.2 Ship Goods.

Sub-process exploded from this process would be: Process 4.1 Invoicing, and Process 4.2 Update A/R.

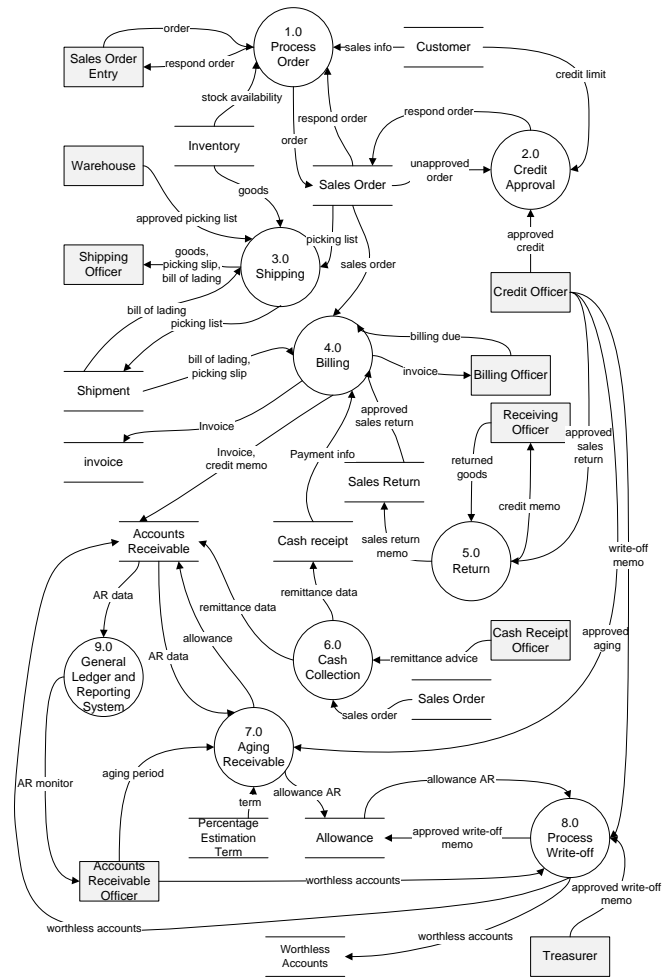


Fig. 3 Level 0 of Data Flow Diagram

5) *Process 5.0 Return* accommodates customers that unsatisfied on certain delivered goods. This process allows receiving officer to process return and process credit memo. This process needs approval from credit officer. This process affected invoice and Accounts Receivable. Sub-process exploded from this process would be: Process 5.1 Process Return, and Process 5.2 Return Approval.

6) *Process 6.0 Cash Collection* allows cash receipt officer to process payment that had been made by customers. Cash receipt officer will check opening balance and processing the payment. This process affected cash receipt data and Accounts Receivable. Sub-process exploded from this process would be: Process 6.1 Check Open Balance, and Process 6.2 Payment Processing.

7) *7.0 Process 7.0 Aging Receivable* allows Accounts Receivable Officer to process receivable analysis using aging schedule and process estimation uncollectible accounts. Based in estimation accounts, each accounts receivable will be calculated to determine the amount of possibility being write-off. The calculation of estimated uncollectible accounts needs approval from Credit Officer. Sub-process exploded from this process would be: Process 7.1 Receivable Analysis, and 7.2 Calculating Estimation Uncollectible Accounts.

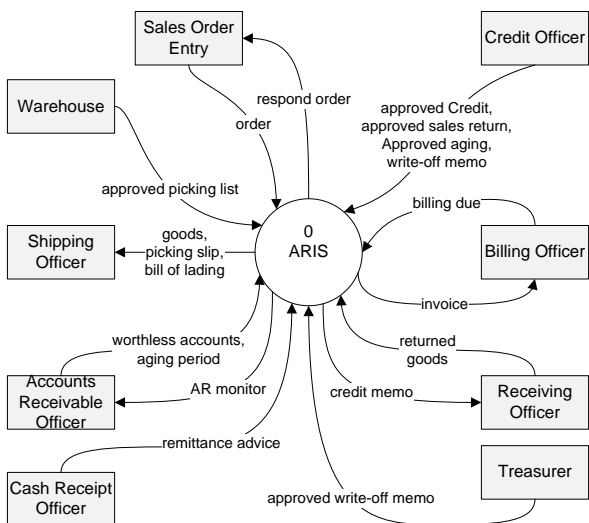


Fig. 2 Context Diagram

4) *Process 4.0 Billing* allows billing officer to process invoices based of billing due list. Officer will receive information if there are any sales returns and submit payments. The information generate amount that customers must pay in invoice document. This process affected Accounts Receivable.



8) *Process 8.0 Process Write-off* allows Treasurer to approve write-off list and create worthless accounts. This process affected Accounts Receivable. Sub-process exploded from this process would be: Process 8.1 Submit write-off, Process 8.2 Write-off Approval, and Process 8.3 Process Worthless Account.

9) *Process 9.0 General Ledger and Reporting System* allows accounts receivable officer to monitor all reports related to accounts receivable. In this process, formula to generate Profit Loss statement, Balance Sheet and cash flow needed. Model for financial reporting architecture can be adapt form [16]. After all statements provided automatically by the system, accounts receivable dashboard use formula to generate Receivable Turnover Ratio (RTO) and Average Age of Receivable. Sub-process exploded from this process would be: Process 9.1 view GL, Process 9.2 view PL Statement, Process 9.3 view Balance Sheet, Process 9.4 view cash flow statement, and Process 9.5 Dashboard AR Monitoring Process Order.

**B. Design Phase**

In this part, the concept design of this software development proposal is presented using database design. Figure 4 represent database design using Entity relationship diagram. There are 14 entities, which are percentage, customer, credit term, allowance, sales order, inventory, worthless accounts, cash receipt, shipment, sales return, invoice, accounts receivable, chart of account, and transaction. From the 14 entities and many-to-many (m-n) relationship, 18 table will be implemented (14 table from entity and the other four are from many-to-many type relationship).

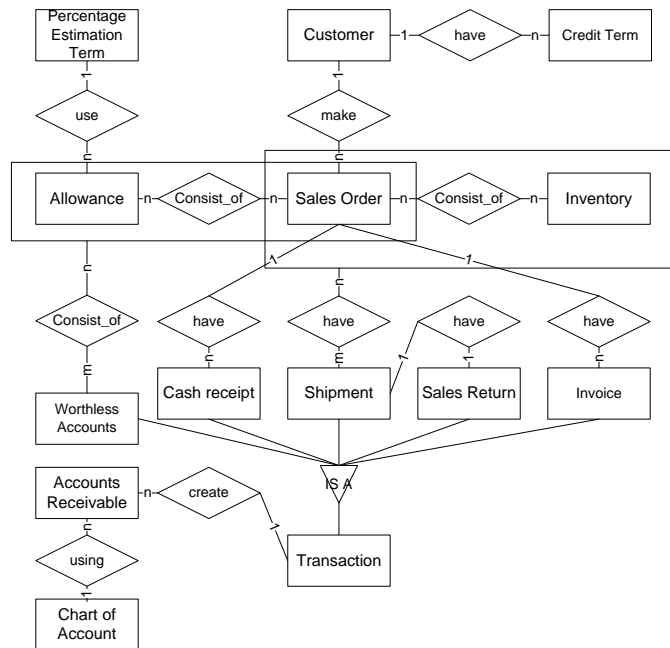


Fig. 4 Entity Relationship Diagram

**C. Design Phase**

In this part, the concept design of this software development proposal is presented using database design. Figure 4 represent database design using Entity relationship diagram. There are 14 entities, which are percentage, customer, credit term,

allowance, sales order, inventory, worthless accounts, cash receipt, shipment, sales return, invoice, accounts receivable, chart of account, and transaction. From the 14 entities and many-to-many (m-n) relationship, 18 table will be implemented (14 table from entity and the other four are from many-to-many type relationship).

**D. Implementation Phase**

In the implementation phase, design is converted into production environment. The design will be implemented using web application. Web application used because of its convenience of using web browser as a client, easy to maintain without distributing and installing software to clients computers, and compatible for cross-platform.

Web application development will be divided into three major groups as illustrate in Figure 5. Process in design phase implement through delivery groups, collect group and report group. Application development can be divided into several groups, database development implement by one group.

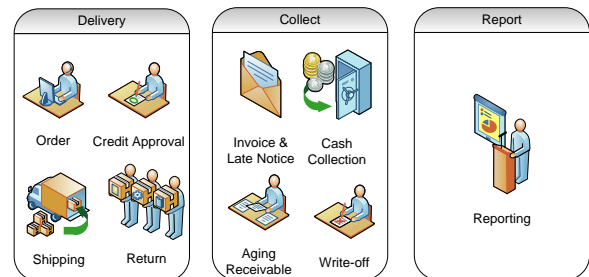


Fig. 5 Development Plan

**E. Testing Phase**

These two techniques, which can be conducted to test the application, are testing application control and substantive testing. Black box testing and white box testing are two general approaches in testing application control. Two commonly used in substantive testing are embedded audit module and generalized audit software (hall).

White box testing techniques are test data method, Integrated Test Facility (ITF) and parallel simulation (hall). All of three techniques are automated technique for auditor, whereas in test data and integrated test facility techniques are based on simulated data, parallel simulation technique uses actual data [17].

**VI. CONCLUSION**

Application, which developed, called ARIS (Accounts Receivable Information System). The proposed ARIS' framework consist of analysis phase, design phase, implementation phase and testing phase. Based on analysis, this research proposed nine (9) users to access process. There are nine sub-processes of ARIS. Processes will be develop in three groups, which are delivery, collect and report. Database development needs further study to determine the exact data recorded and the needs of reporting as analyze before. Testing phase require both testing application control and substantive testing.

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# SMALLTALK APPLICATION - LEARNING PROGRAMMING ON MICROCONTROLLER FOR BEGINNER

Meyhart Sitorus<sup>1</sup>, Saptadi Nugroho<sup>2</sup>, Deddy Susilo<sup>3</sup>

**Abstract**— Nowadays the embedded systems such as microcontroller are used to control electrical instrument. To learn microcontroller a student as beginner need a programming knowledge which can be learned easily using an attractive learning method. In this paper we proposed an application which can be used to help students who are interested in learning microcontroller. They can arrange tasks consisted of commands which have to be performed by microcontroller into the column contained the objects of task.

The application will read the objects consisted of tasks, perform the animation of a movement of a stepper motor and make codes of task formatted in String. These codes of task will be sent to the microcontroller to run the stepper motor. The running stepper motor and the animation of running stepper motor can be performed at the same time. The commands which are sent to microcontroller are “turn right”, “turn left”, “turn degree”, “turn to”, “if”, “for” and “delay”.

**Keywords**— Animation, Microcontroller, Smalltalk Application, Stepper Motor.

## I. INTRODUCTION

THIS paper proposed the application developed using Smalltalk language that can send codes of task formatted in String to microcontroller. This application specifically designed for students who will learn to program microcontroller. The objective of developing the smalltalk application is that the students become interest in learning programming and microcontroller.

Many students in school have lack of knowledge in programming and have no interest to learn it because they know that it is difficult to learn a basic programming language. The Smalltalk application that was developed is easy to use for the beginner who will learn programming and microcontroller. The user can use the commands which can run a stepper motor. The Smalltalk application displays the animation of the movement of stepper motor. By pressing the “Start Button”, the commands which will be sent to microcontroller are

animated on the computer screen. When the student presses the “Download Button” the commands are sent to microcontroller. The commands will be animated on the computer screen and the stepper motor will perform the tasks at the same time.

The students can make script by clicking and dragging the object of task. The type of task objects are morph objects (morph object is an image). The morph object can be duplicated by clicking the left mouse. The duplicate object can be drag into the script column. There is a parameter of integer type in task objects. The number of rotation of stepper motor will be performed based on parameter of integer type given by student.

## II. MATERIAL AND METHODS

The Smalltalk application used to learn programming on microcontroller can be called *AvrObject* application which has *Main Menu Object*, *Task Object*, *Drag Object*, *Script Layout*, *Animation Screen*, *Arrow*, *Start Button*, and *Download Button*.

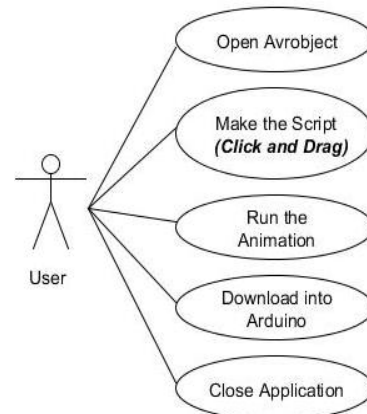


Fig. 1 Use Case Diagram of *AvrObject* Application

Fig. 1 shows the use case diagram of the application. User can open the application, make a script by clicking and dragging, make the script, run the animation, download the script into Arduino and close the application. *AvrObject* application is developed using Squeak development tool and morph project [1]. The following pseudo code is used to initialize global instance variables which can be used by other class.

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```
Morph subclass: #Avrobject
instanceVariableNames: 'mainMenu taskMenu
scriptLayout animationScreen startButton
downloadButton trashCan'
classVariableNames: ''
poolDictionaries: ''
category: 'Avrobject-Main'

Morph subclass: # ScriptLayout
instanceVariableNames: 'label'
classVariableNames: ''
poolDictionaries: ''
category: 'Avrobject-Main'

Morph subclass: # DownloadButton
instanceVariableNames: 'port'
classVariableNames: ''
poolDictionaries: ''
category: 'Avrobject-Main'
```

A new instance variable is declared as private instance variable which cannot be accessed directly by other class. The *accessor* functions can be used to access the instance variable from other class [1]. This function is similar to the *getter* and *setter* method used in programming with Java language.

The electronic devices which are used in learning programming of microcontroller are Arduino Uno R3, stepper motors 28BYJ-48 5 Volt and driver stepper motors ULN2003. The USB cable is used to send the task formatted String from personal computer to Arduino Uno R3. The following figure of Fig. 2 is the system which consist of *AvrObject* application Arduino, driver motor and stepper motors.

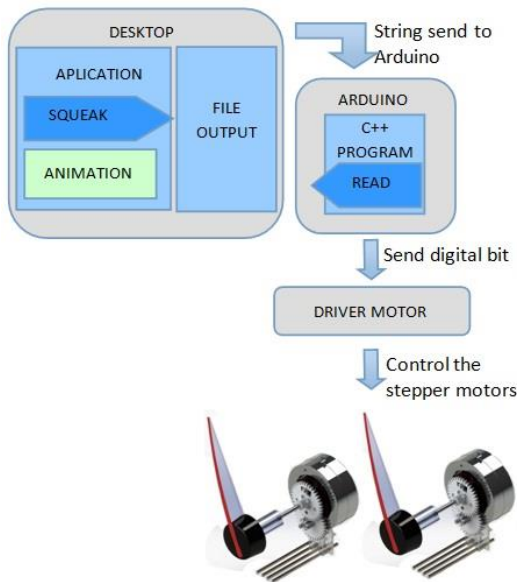


Fig. 2 Diagram of the System

Library of functions used to move the stepper motors based on the command given by the user are embedded in the microcontroller. These functions will be run when the microcontroller retrieve the sequence of characters which represents the task made by user. These characters indicate the tasks such as *rotateRight*, *rotateLeft*, *turnDegrees*, and *turnTo*[2].

Arduino will send the binary codes to driver motor as shown in Fig. 3. The binary codes will be forwarded by driver motor to the stepper motor to rotate motor. All objects which was made will be added into *AvrObject*. The command in the source code program shown in Fig. 4 is used to open *AvrObject*. This code is written in Smalltalk language [3].

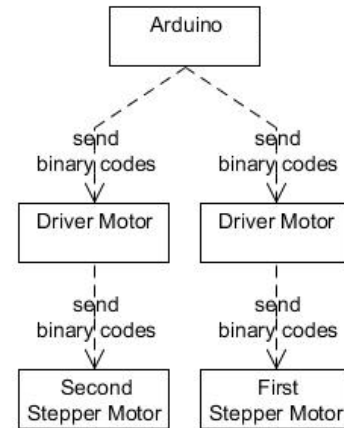
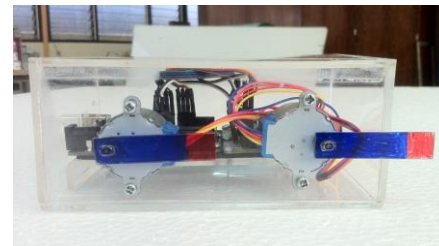


Fig. 3 Command to open *AvrObject*



Fig. 4 The command used to open *AvrObject*



(a)

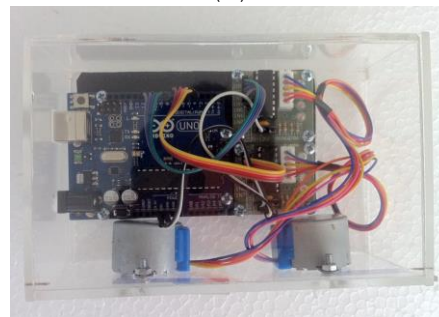


Fig. 5 The learning module (a) front – side (b) top – side

Fig. 5 shows the module of Arduino, driver motor and stepper motor which was implemented to support the *AvrObject* application in learning programming on microcontroller.

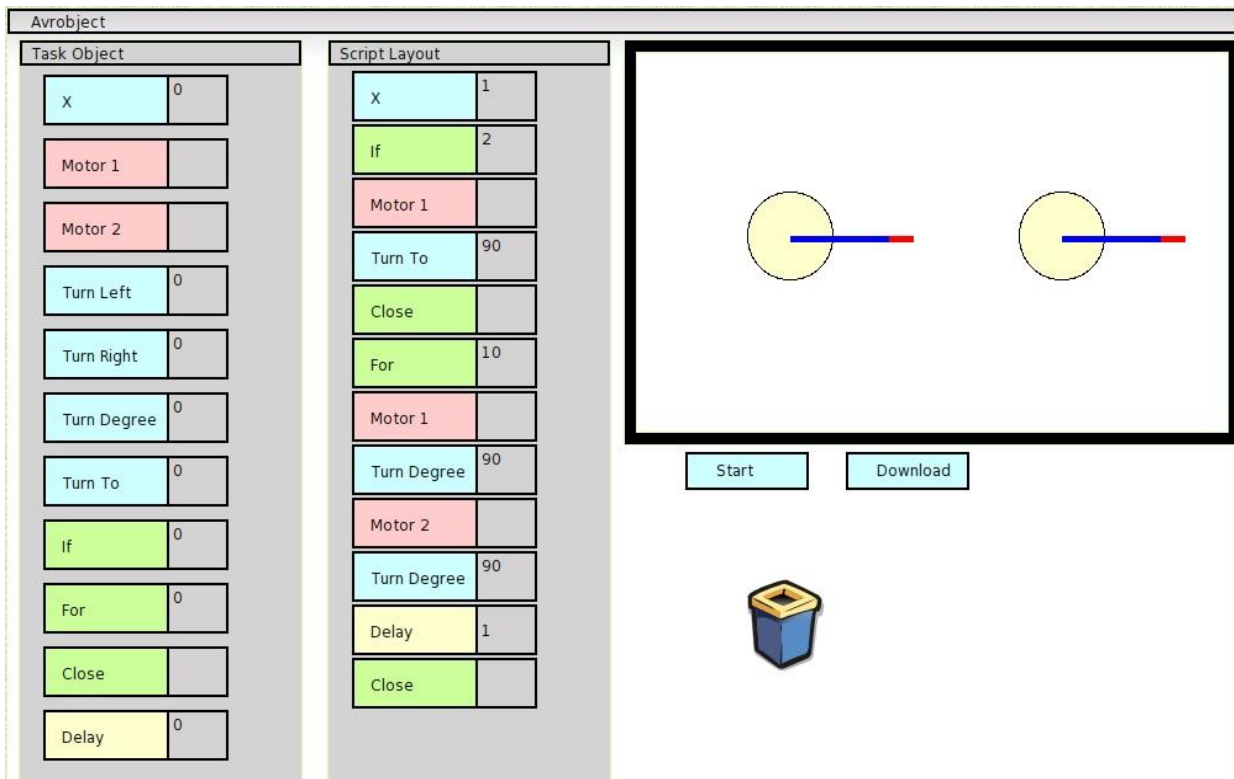


Fig. 6 Avrobject User Interface

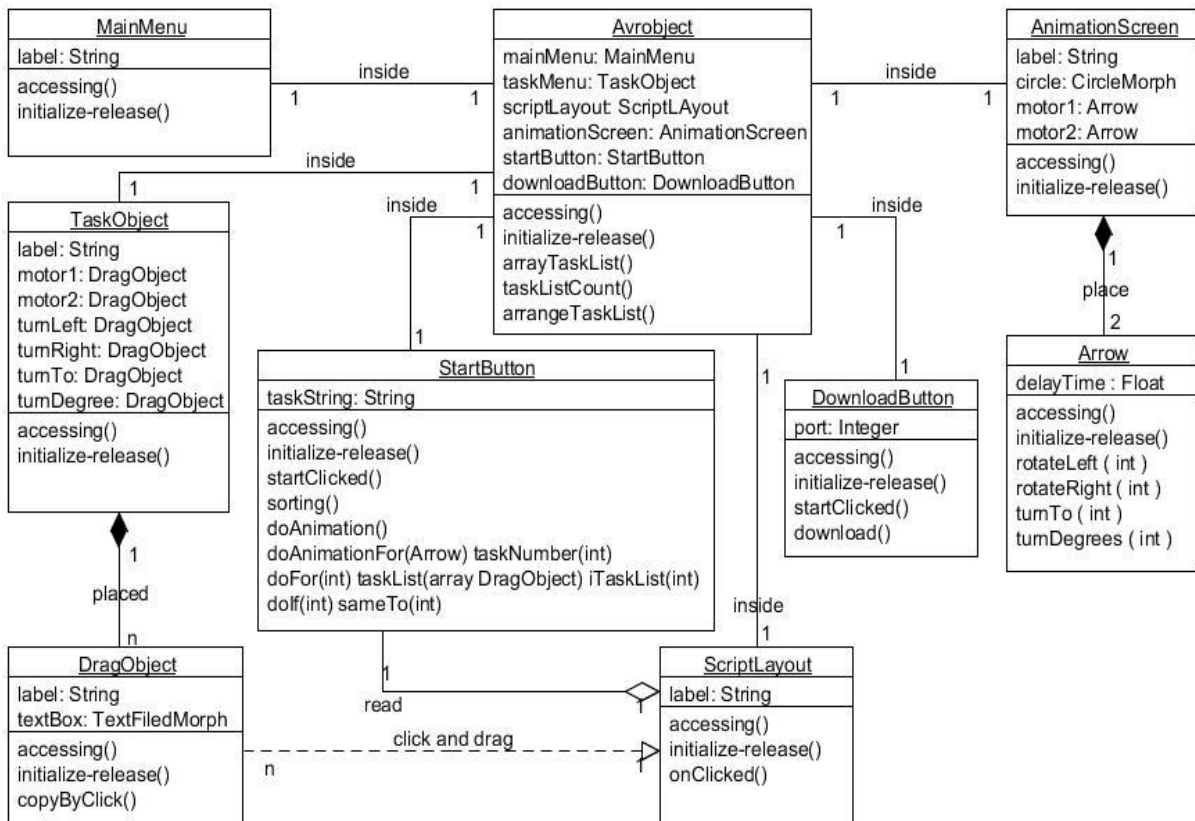


Fig. 7 Avrobject Class Diagram

Fig. 6 shows the user interface of the *AvrObject* application. The task objects consist of *X*, *Motor1*, *Motor2*, *Turn Left*, *Turn Right*, *Turn Degree*, *Turn To*, *If*, *For*, *Close*, *Delay*. The script layout in Fig. 6 is used to put the tasks object made by user.

Fig. 7 shows the class diagram of the *AvrObject* application and association between classes.

Fig. 8 shows the learning module which is connected to the personal computer that has the installation of *AvrObject* application.



Fig. 8 The learning module and personal computer

### III. RESULT AND DISCUSSION

The *Avrobject* application and module are tested by giving a single command to display the animation of stepper motor. The initial degree of application and stepper motor hardware is set to 0°. Two objects of *DragObject* are place inside the *ScriptLayout*. The objects describe the motor object and the task object. The Table I show the result of the testing of the application. The tasks Turn Right, Turn Left, Turn Degree and Turn To were performed successfully by the animation.

The sequence of characters is transmitted from personal computer to microcontroller using tool of “Serial Monitor”. The data is transmitted when stepper motor hardware is set to 0°.

The tasks Turn Right, Turn Left, Turn Degree and Turn To were performed successfully by the motor stepper as shown in Table II.

TABLE I  
TESTING OF AVROBJECT APPLICATION

Motor	Given DragObject	DragObject Parameter	The Testing result
1, 2	Turn Right	1	1
1, 2	Turn Right	10	10
1, 2	Turn Right	100	100
1, 2	Turn Left	1	1
1, 2	Turn Left	10	10
1, 2	Turn Left	100	100
1, 2	Turn Degree	90	90°
1, 2	Turn Degree	-90	270°
1, 2	Turn Degree	180	180°
1, 2	Turn Degree	-180	180°
1, 2	Turn Degree	360	0°
1, 2	Turn Degree	-360	0°
1, 2	Turn To	90	90°
1, 2	Turn To	180	180°
1, 2	Turn To	360	0°

TABLE II  
TESTING OF THE AVROBJECT MODULE

Motor	Given DragObject	DragObject Parameter	The result String	The testing result
1, 2	Turn Right	1	m1a	1
1, 2	Turn Right	10	m2a	10
1, 2	Turn Right	100	m16a	100
1, 2	Turn Left	1	m1b	1
1, 2	Turn Left	10	m2b	10
1, 2	Turn Left	100	m16b	100
1, 2	Turn Degree	90	m90c	90°
1, 2	Turn Degree	-90	m-90c	270°
1, 2	Turn Degree	180	m180c	180°
1, 2	Turn Degree	-180	m-180c	180°
1, 2	Turn Degree	360	m360c	0°
1, 2	Turn Degree	-360	m-360c	0°
1, 2	Turn To	90	m90d	90°
1, 2	Turn To	180	m180d	180°
1, 2	Turn To	360	m360d	0°

The application of wiper and analog clock can be implemented using this application. The sequence of characters which are transmitted from personal computer to microcontroller is used to run the wiper to the top position and the bottom position. The following figure of Fig. 9 (a) shows the script layout of the wiper application. This wiper application is used to test the branching task which is done successfully.

X	2
If	1
Motor 1	
Turn To	30
Close	
If	2
Motor 1	
Turn To	210
Close	
For	10
Motor 1	
Turn Degree	120
Turn Degree	-120
Delay	1
Close	

(a)

Motor 1	
Turn To	90
For	60
Motor 1	
Turn Degree	-6
Delay	1
Close	
Motor 1	
Turn To	0

(b)

Fig. 9 (a)The script layout of wiper application and (b) the analog clock application

The Fig. 9 (b) shows the script layout of the clock application. This analog clock application is used to test the looping function that is done successfully.

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# The Encryption Application Description Image On Mobile Phone Based On Android

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**Abstract**— The purpose of this research was to provide data security solutions in the form of images in order to avoid data theft on android smartphone by using cryptographic algorithms in image i.e. AES to generate master key encryption from the RSA algorithm for image and generate slave key results of AES key. The results of this research indicate that this application can provide solutions and proven ease safeguards information picture with JPEG, GIF, PNG and others by using RSA and AES algorithm method.

**Keywords**— *Android, Kriptografi, Enkripsi, Dekripsi, AES, RSA.*

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## I. INTRODUCTION

Technological developments are increasingly rapid one of which is a mobile phone. Starting from a phone that is only used to talk and sms to "smart phones" (Smartphone) which has various functions such as data transfer, browsing, video streaming and others. In addition to being one of the communication devices, the smartphone also has become one of the tools that can help users to exchange data, either in the form of video, voice, image and others.

But based on observations researchers, more than 50 percent of mobile phone or smartphone circulating in Indonesia now has not furnished with the application of safety data, especially the image of data. This time, especially manner of doing an exchange of data on cell phone image of the most common use is by means of telecommunication network through sends the data provided by provider telecommunication network provider [1].

The encryption app. dekripsi image on mobile phone is one dna-based android application that can help us in securing information or data esp. data shaped a picture or image in doing process data exchange [2]. In writing next will be explained about the methodology and the design of the application of encryption of the description of image on the phone



cellular and the results of research experiments .

## II. METHODOLOGY

In a term of cryptography is defined as the science and art to keep the secrecy of a message ( data or information which have the sense or value , by means of menyamakannya ( scrambles ) into a form not understandable use of a particular algorithm .A message which will be kept secret or encoded for in the science of cryptography called plaintext , while a message that has been encoded so that having no value and meaning again with the aim that the message could not be read by the party is not entitled called chipertext [3].

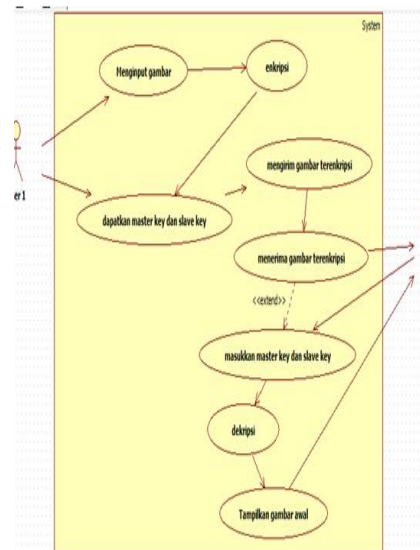
There are also in the science of cryptography dekripsi and encryption of the term .The encryption process plaintext ciphertext is encrypted using algorithms to be certain .While the process of restoring chipertext dekripsi plaintext be called as [2].

an algorithm Simetrik who take one key.Besides aes is also algorithms cryptography algorithm that can mengenkripsi and decrypting data with long alreadyin varying namely. bit, 128 192 bit, and bits of 256 [5].

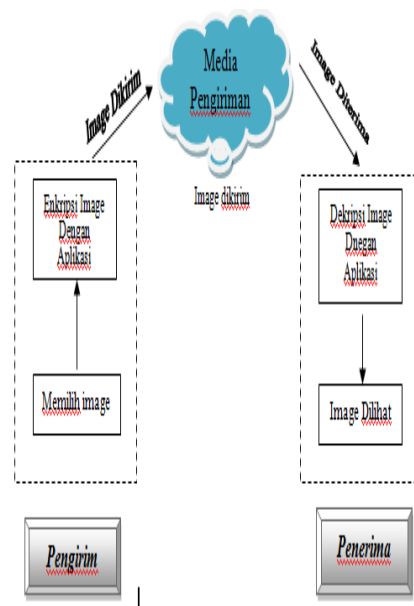
## III. DESIGN OF APPLICATION

The encryption application design stage image on a description of mobile phone can be seen from figure 1 and picture 2 .A diagram use case shows that user 1 mengenkripsi menginput pictures can then image and get a master key and slave key , then the user 1 sent a picture that has been encrypted .The user 2 receive encrypted images are then put a master key and slave decrypting the key and the picture after picture that the user 2 can display an encrypted was already beginning .Displayed at the same process the application of architectural

design , encryption and diskripsi user to perform the process on the stage of delivery and acceptance of a picture using the encryption application dekripsi image in the mobile phone to see a picture with clear .



**Picture 1. Use case diagram an application**



**Picture 2. The application of design architecture**

Explanation of the script method and description enrkipi can be seen in method to aes AndRsa in the third 3. Script Coding Method encryption and AES+RSA,description

```

private void
encryptAESKey(String key)
throws Exception{
KeyPairGenerator kpg =
KeyPairGenerator.getInstanc
e("RSA");
Cipher cipher =
Cipher.getInstance("RSA/ECB
/PKCS1Padding");

kpg.initialize(256);
KeyPair keyPair =
kpg.generateKeyPair();
PrivateKey privKey =
keyPair.getPrivate();
PublicKey pubKey =
keyPair.getPublic();

// Encrypt
cipher.init(Cipher.ENCRYPT_
MODE, pubKey);
byte[] encryptedBytes =
cipher.doFinal(key.getBytes
());

//hasil enkripsi key AES
AESkeyBase64 =
Base64.encodeToString(encry
ptedBytes, Base64.NO_WRAP);
//encode ke base64
Log.i("encrypted AES key",
AESkeyBase64);

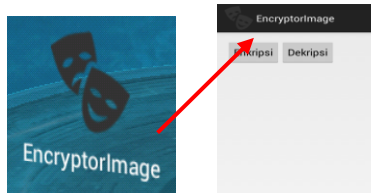
//private key RSA
RSAkeyBase64 =
encodePrivateKey(privKey);
Log.i("RSA Base64 key",
RSAkeyBase64);
Log.i("method",privKey.getF
ormat());
}

```

**Picture 3. Script Coding Method Enkripsi And Deskripsi AES + RSA**

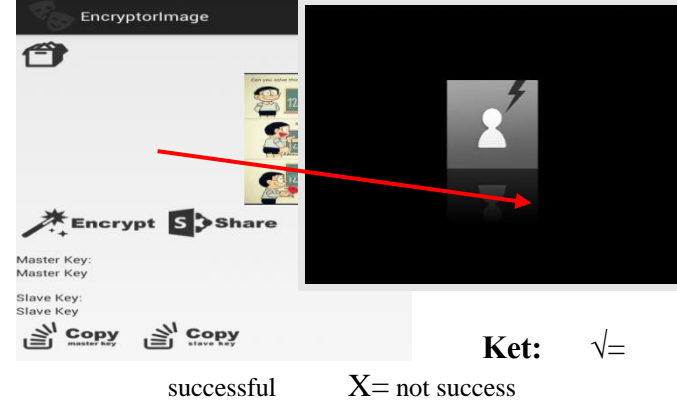
#### IV. RESEARCH RESULT

Testing system was done using a method of testing technique directly based on the black box with test functionality of application, Buttons and conformity of logic with a method of calculation the encryption and rsa and aes dekripsi kriptografi in image.

Test Factor	results of the	Description
Pressing icon application	√	Succeeded in showing home application pemilihan a menu
<b>Screenshot</b>		
		
<p><b>Ket:</b>     :   √= successful X= not success</p>		

**Picture 4.** The show home application

In a picture of 4 .Display the icon is pressed home the application of visible when then home applications To signify functionality icon functioning properly.

Test Factor	results of the	Description
Insert a picture with browse image and pressing encrypt	√	Rsa managed to generate a master key , slave aes encryption key and images into unknown
<b>Screenshot</b>		
		

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## V. THE CONCLUSION

Based on previous discussion , can be inferred that this application can improve the safety data or information with the testing system that use a method of the original image where the process of testing blackbox converted into a picture that can be read with the exception not the picture can be read when in dekripsi beforehand on the application.

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# Design Development Vending Machine With System Rupiah's Currency Returns

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## **Abstract**

The purpose of this study was to design a vending machine with system development return on currency. The process is performed on this system is to detect the authenticity of money using ultraviolet light and TCS230 color sensor to read the invisible image on the rupiah, if the money is genuine then the process is continued, and if not then removed money from a vending machine. After that TCS230 sensor will read the nominal rupiah rupiah color. The algorithm used to detect the authenticity of money and nominal rupiah is using fuzzy logic algorithm. The process of this system are the microcontroller, the incoming data from the sensors is then processed by a microcontroller to generate outputs in the system. The output of this system is that consumers can choose the appropriate type of item price, if greater nominal price of goods it can restore the vending machine in accordance with the nominal price of goods. The results of this study are able to design a vending machine with system development return on currency.

Keywords: Vending Machine, Sensor TCS230, Fuzzy Logic, Microcontrollers, currency dollars.

## **A. Introduction**

Automated electronic sales system has been developed in countries both developed and developing, One is the Vending Machine. Vending machine is a machine tool or sell goods automatically. Vending Machine operator does not need power to sell the goods, the consumer can choose the desired item [6]. Vending Machine is a vending machine that can operate as a standalone purchase transaction to serve drinks or snacks [1].

Indonesia country can be said the use of vending machines are new, where exactly on March 21, 2013, PT. METEC Semarang is a Vending Machine manufacturing company - only to be in Indonesia has launched the first product Vending Machine which sells beverage cans and PET bottles in Indonesia [7].

One of the obstacles in the sale of used vending machine is not a system of refund if the consumer does not have currency in accordance with the nominal price of goods sold in vending machines,

so the consumer must provide the exact change in order to buy goods that exist in the vending machine.

## **B. Problem Formulation**

1. How to design a vending machine with a return of currency.
2. How to design a system based on RGB sensor to detect and classify the nominal value of the rupiah.
3. How to design a system based on ultraviolet light to detect the authenticity of currency.
4. How to implement this method of Fuzzy Logic to detect the authenticity of money and nominal rupiah and refund dollars.

## **C. Research Objectives**

1. Designing a vending machine with a return of currency.
2. Designing RGB sensor-based system to detect and classify the nominal value of the rupiah.
3. Designing a system based on ultraviolet light to detect the authenticity of currency.
4. Implementing Fuzzy Logic method in detecting the authenticity of money and nominal rupiah and refund dollars.

## **D. Overview of Research Findings**

Research in the field of vending machine has been done by some previous researchers, including the "Embedded Internet Applications on Vending Machine Using Rabbit RCM3200 Microprocessor" [1]. In that study discusses the development of models of vending machine equipped with an Internet connection.

Other research is "Development Of Vending Machine With Prepaid Payment" [2]. In this study, the author discusses how the operation of vending machines using prabyar system combined with a code system to conduct transactions.

The other study was a "Consumers' Experiences, Opinions, Attitudes, Satisfaction, Dissatisfaction, and Complaining Behavior With Vending Machine" [3]. In these studies the authors

conducted a study of consumer behavior in terms of experiences, opinions, attitudes, and behaviors in using vending machines by using quantitative data collection techniques, in which consumers are given the questions in order to determine the level of satisfaction from the use of vending machines.

Subsequent research is "based Finite State Machine Controller Vending Machine with Auto-Billing Features" [4]. In this study developed a vending machine that already exists, which has been developed in countries such as China developed, malaysia and singapore. Increased use of vending machines in the developed countries due to the demanding lifestyle and fast-paced practical as well as with the quality of food quality. By him that the researchers developed a vending machine in the form of outo billing features. The model proposed in this study is a model of a machine mealy.

Other research is "Vending Machine Food Environment Assessment" [5]. In this study, researchers conducted a survey on the type of food being sold environments using vending machines, where the average of the food sold is fast and direct to be eaten by consumers.

Based on the above research, there are still some shortcomings, namely the lack of researchers who mebahas automated refund system of the vending machine. It is not only found in some vending machines that already exist, but for the territory of Indonesia no vending machines that implement automated refund system based on nominal currency.

**E. Review of Theory and Concepts**

**1. Devinisi Vending Machines**

According Resmana Lim, Vending machine is a vending machine that can operate standalone purchase transaction to serve drinks or snacks [1]. According to Sutopo Graduated, Vending machine is a vending machine, which can distribute the goods to the buyer the goods are automatically [7].

Based on history, believed vending machine invented by Hero of Alexandria in the first century inventor. Modern vending machines introduced in London in the early 1880s that distribute postcards. In the US alone, vending machine was made in 1888 by the Thomas Adams Gum Company, it is used to sell chewing gum on the platform-train platform. Over time, the presence of vending machines it is growing rapidly in Japan where almost all kinds of daily necessities if you can divending machinekan, then the product will be available in vending machines [8].

The use of vending machines in Indonesia is still quite rare, which can only be found in certain places such as airports and on the Mall. Purchasing

system offered with money still to be fitted so that when consumers want to shop fitting should be putting money into the machine and did not serve a refund. Here's an example of an existing image vending machine at the airport Sultan Hasanuddin Makassar.



Figure 1. Hasanuddin Airport Vending Machines [9]

**2. Color Sensor TCS-230**

The sensor is a sensor TCS230 color light-to-frequency converter. At TCS-230 has two main components, namely a photodiode and a current-to-frequency converter according to the figure below [17].

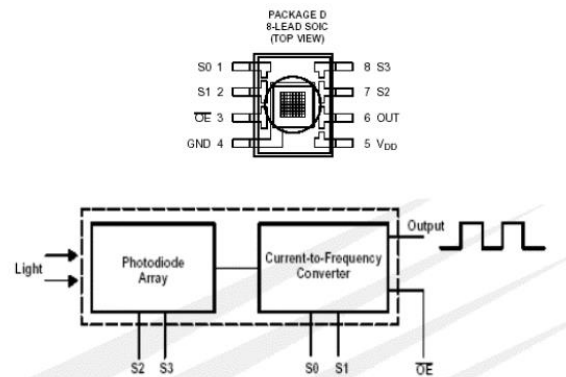


Figure 2. Sketch TCS230 Sensors [17]

TCS Photodiode on IC 230 are arranged in a 8x8 array configuration: 16 photodiode as a red color filters, 16 photodiodes as green color filters, 16 photodiodes as a blue color filter, and unfiltered photodiode 16.

### 3. Complementary and Primary Colors

The color white is a combination of seven colors of the spectrum. However, white light can also be generated simply by combining three light, color with the right intensity. The colors that can not be generated by combining other colors, and so-called primary colors. The primary colors are blue, green, and red. Mixing primary colors called mixing Additiv. [17] To facilitate recall the result of mixing these colors, a color can be expressed with the triangle as in the figure below.

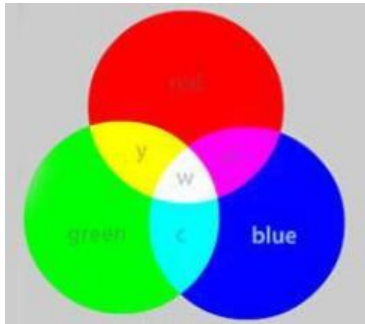


Figure 3. Color Triangle [17]

### 4. Original Money Detector System

The means used to detect the real money is with the ultra violet rays. There are several other methods that can be used to detect the authenticity of money, among which the LVQ-based methods [12], histogram intersection method and integral projection [14] and the Canny method [15].

Ultraviolet radiation (UV often abbreviated, of the English language: ultraviolet) is electromagnetic radiation of a wavelength shorter than visible light region with, but longer than X-rays is small. The term ultraviolet means "exceeds violet" (from Latin ultra, "exceeds"), while the word purple is the color of the shortest wavelengths of visible light. Ultraviolet (UV) is an invisible rays that are part of the energy derived from the sun [16].

One of the benefits of ultraviolet light is able to detect counterfeit money or not. The technique used is to put money under ultraviolet light, if the money is genuine then there will be a hidden image is invisible and can only be seen when using ultraviolet light, as well as with several other marks. Here's an example image of ultraviolet light to detect counterfeit money [16].



Figure 4. Ultraviolet light to detect counterfeit money [16]

### 5. Microcontroller

Microcontroller is a microprocessor system in which there already exist a CPU, ROM, RAM, I/O, Clock and other internal devices are already connected and organized (teralamati) with either by the manufacturer and is packaged in a ready-made chips. So that the microcontroller can be filled at the factory ROM based rules that make it [10].

### 6. Fuzzy Logic

The method used to identify the nominal rupiah in this study is the use of Fuzzy Logic. This method is used because at the time the system will take a decision on the nominal rupiah will take some sample data from the nominal currency based on the color.

Fuzzy logic if in the Indonesian or Fuzzy logic is a technique / method used to overcome the uncertainty on the problem - a problem that has many answers. Fuzzy logic provides a way to describe definitive conclusions from the information vague, ambiguous and imprecise. Fuzzy logic first developed by Lotfi A. Zadeh in 1965 [11].

There are three main process if it is to implement fuzzy logic on a device, namely fuzzification, rule evaluation, and defuzzification.

- Fuzzification**, is a process to convert an input from form firm (crisp) become fuzzy which is usually presented in the form of fuzzy sets of a function kenggotaannya respectively [13].
- Interference System (Evaluasi Rule)**, is a reference to explain the relationship between input variables and output variables which are processed and produced in the form of fuzzy. To explain the relationship between inputs and outputs usually use "IF-THEN" [13].
- Defuzzification**, Is the process of changing the shape of the fuzzy variables into data of certain (crisp) that can be transmitted to the control equipment [13].

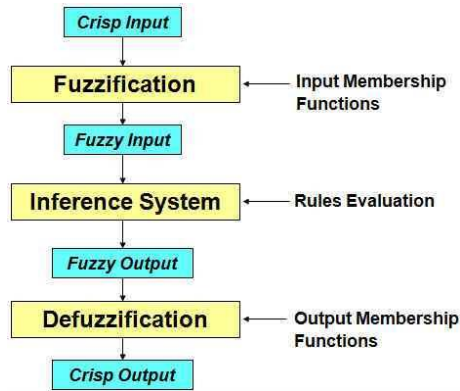


Figure 5. Fuzzy Logic Process Flow Diagram [13]

**F. Research Design**

The design of this study is to focus on the return on the vending machine system is Indonesia with nominal currency. There are several stages in the design of this study are:

1. Design of Mechanical  
In this design is an early stage in the design of a prototype of the vending machine to be in control.
2. Electronic Design  
In designing this is the stage where the load range of electronic components resulting in system rupiah nominal return on the vending machine.
3. Design of Algorithms, Methods and Programming  
In designing this is the stage where the existing machine is programmed using the Basic programming language by applying fuzzy logic method to detect the authenticity of money, the nominal rupiah and refund system.

In designing this study are interconnected system architecture that is input, process and output. Here's an overview of the system architecture:

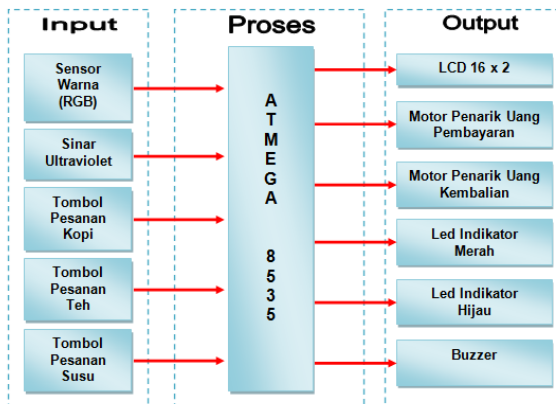


Figure 6. Block Diagram of System Architecture

In the architecture of the system, there are three parts: input, process and output. The input of the machine is a color sensor, original money detection sensors using ultraviolet light, button orders coffee, tea and order button order button milk. The color sensor is used to detect the input nominal rupiah currency based on the color and the sensor detection function detects the authenticity of the original money in rupiah.

Button on the input function to determine the type of beverage that will message based on existing prices, so there will be some items to be priced options selected by the consumer. The process of this machine is to use sensors and microcontrollers ATmega8535 driver.

The output of this machine is that it can put out the goods in accordance with the orders of the consumer may return the nominal price and nominal money nominal rupiah currency if the currency is greater than the price of the goods. There are some devices that are controlled servo motor is used to drive the mechanical vending machine, 16 x 2 LCD, buzzer and LED indicators function as specific information from vending machines to consumers.

**G. Design Layout System**

Here's the layout design system to be built.



Figure 7. Layout Design System

In the layout design of the above it can be seen that there are 3 types of ready-to-drink sold at different prices. In this system instead of focusing on the sale of goods but the focus on the return of the currency system of the nominal rupiah if nominal

currency is greater than the price of the goods / beverages to be purchased.

The process of design above is the consumer puts money into the cash payment, the system will detect the authenticity kemuadian and nominal dollars. Then consumers choose beverages according to the price listed on the vending machine, if you want a hot drink then press the red button, if you want a cold drink press the green button. After that the system will process, if nomial of money is greater than the price of the drinks and the money will be refunded and can be taken on the return of the money box.

Here's a flowchart of system design.

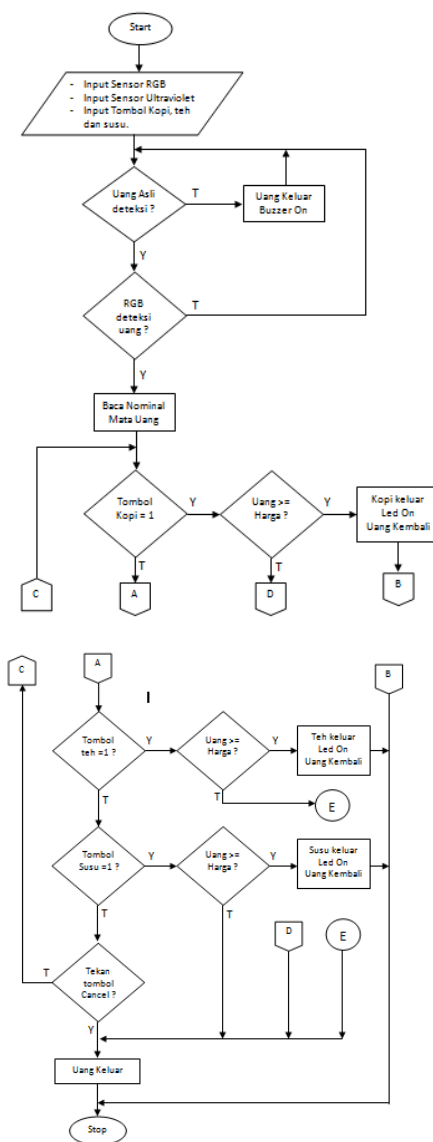


Figure 8. Flowchart of system design

### H. Testing System

Testing the overall system gradually in accordance with the modules based on the architecture of the system has been designed. The main focus on this test is how vending machine that can work with the customer may return the nominal money currency nominal dollars when the currency is greater than the price of goods purchased by consumers. The following stages of system testing vending machine refunds the nominal currency.

#### 1. Performance

Overall system performance assessment is when consumers operate vending machine, which consumers see the type of goods that exist and the price listed on the item. Then the customer put money in accordance with the desired. If the nominal money is less than the price of the goods there and the money will come out automatically, if the nominal price of the goods in accordance with the sale process to continue, and if the nominal currency is greater than the price of the goods, the sale process is continued then the machine will return the nominal eye rupiah to the consumer.

#### 2. Security

Security testing can be done by using a sensor detecting real money on the vending machine. If money is the original detected then the process is continued, if not then there will be a warning buzzer and the message that the money was counterfeit. In addition perku also conducted periodically testing the safety system so that the possibilities that can be avoided from walkin desired the vending machine.

#### 3. Reliability

The ability of the system to adapt to the failure of one or more of the equipment in the system. This test can be done by simulating the failure of one system devices. This parameter does not require the system to be constantly running normally for the entire test case. This section is to show the reliability of the system on different levels of interference that may occur.

#### 4. Usability

This test will test the ease of system operation. The customer or the user who will use the vending machine can easily operate it. This is aided by the use of existing manual instructions on the vending machine, where the consumer before the transaction must read the manual to avoid mistakes when buying or selling at the vending machine.



## I. Conclusions

The use of vending machine in developing countries such as Indonesia is still very limited, the placement is still in certain places such as at the airport, railway station and hotel campus. Goods sold at the vending machine is still in the form of beverage cans and bottles that fast. One of the constraints on the use of vending machines is Indonesia is not able to return the money if the nominal money is greater than the price of the goods that the consumer must provide the exact change. There are methods that can be applied to existing vending machines can be developed in order to restore the nominal rupiah. The algorithm can be used are fuzzy logic algorithm is used to detect the authenticity of money, the nominal rupiah and determining the nominal returns from vending machine. Stages of the research will continue to be developed until the expected results will be achieved.

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# Implementation Modeling Certainty Factor Determination Of Expert System To Death Victim Not Fair

Muliadi

**Abstract**—Death is a definite life cycle traversed by everyone. When death occurs, then the event will have an impact on the family and the surrounding community. In the medical cause of death could result from disease, old age, violence (involuntary) or poisoning. Judging from the way, the death of death can be divided into natural and unnatural deaths. Natural death is death that occurs as a result of aging or disease. Unnatural death is a death that occurs as a result of murder, suicide, and accidents. How the death of the victim is not there some kind of fair and necessary to recognize him as an expert forensic specialist. Because not all law enforcement nor the doctor is a specialist forensic it requires an expert system that can help them to recognize how the death of the victim. Certainty Factor is a method that can assist in dealing with the problems mentioned above. With this method implemented in an expert system that can estimate the forensic doctor unnatural manner of death of the victim.

**Keyword**—*Certainty Factor, Expert System, how unnatural deaths*

## I. INTRODUCTION

The legal basis underlying why general practitioners need to know about the forensic contained in the Criminal Code Article 133, paragraph 1, in the interest of judicial investigators to handle a good victim injury, poisoning or death allegedly because of the events that constitute a criminal offense the victim's family filed a request for information from authorities medical experts, judicial or doctors or other experts, which means that if the investigators ask the expert testimony, the general practitioner must be able to conduct

examinations and explain it in the form of a post mortem.

In the medical cause of death could result from disease, old age, violence (involuntary) or poisoning. Judging from the way, the death of death can be divided into natural and unnatural deaths. Natural death is death that occurs as a result of aging or disease. Unnatural death is a death that occurs as a result of murder, suicide, and accidents [5].

A so-called natural death if the person is in the care of a doctor, and the diagnosis of the disease has been known to death allegedly due to his illness. On the deaths that occurred in hospitalization or in the care of a doctor, the doctor can usually ensure that the deaths were natural deaths through medical records of these patients [5].

How the death of the victim is not there some kind of fair and necessary to recognize him as an expert forensic specialist. Because not all law enforcement nor the doctor is a specialist forensic it requires an expert system that can help them to recognize how the victim's death with certainty factor method.

The end result can produce an intelligent application that is capable of providing approximate decisions about how unnatural death of the victim. This application will be able to assist law enforcement and physicians recognize how unnatural death of the victim. Then after recognizing variable unnatural manner of death of the victim system and then release the victim's manner of death is unnatural.

Based on the above the importance of the formulation of the problem is how to implement the model certainty factor on Expert System

Determination Method Victims Unnatural Death, which in this case is able to provide forecast information unnatural manner of death to the victim's death.

The objectives of this research are: menerapkan certainty method factor on the smart application to estimate how unnatural death in the victim's death.

## II. THE MECHANICS OF THE MODEL

In general, the expert system is a system that is trying to adopt human knowledge into a computer that is designed to model the ability to solve problems like an expert. With the making of an expert system, a layman can solve the problem or just looking for a real quality information can only be obtained with the help of experts in the field. Expert system determination of the victim's death unnatural way it will be able to help the activities of the expert as an experienced assistant, and also have the knowledge needed. In its formulation, the expert system determining how the victim's death was not natural to apply the method certainty factor according to its rules. In conclusion (inference rules) with the specific knowledge base provided by one or more experts in the field forensik. The combination of both of these are stored in the computer, which is then used in the decision-making process to determine how the victim's death was not natural.

### Characteristics of Expert Systems

Good expert system must meet the following characteristics:

1. Having reliable information.
2. Easy to modify.
3. Can be used in various types of computer.
4. Have the ability to learn adapt.

Expert System are programs that behave like a human expert or experts (human expert). Expert systems or knowledge-based system is the most widely application in helping to resolve the problems in the real world.

Examples of the application of this program were:

- (1) Delta of General Electric locomotives damage

to the consultation.

- (2) Prospector of the Stanford Research Institute for valuation of mineral prospects.
- (3) Xycon of Digital Equipment Corp.'s to configure the computer parts.
- (4) MYCIN was developed at Stanford University in 1970, to help the experts in diagnosing certain bacterial diseases.

Destination Expert System is to transfer expertise from an expert to a computer, then to someone else (who is not an expert). This process is covered in engineering knowledge (knowledge engineering) which will be discussed later [2].

### II.1. Forensic Medicine

Definition Kodekteran Forensic Science is science that uses a multidisciplinary science with the goal of making light of a criminal case and prove the existence of a crime or offense with checking the evidence (Physical Evidence) in the case.

Specialist branch of medical science that studies the use of medicine for the benefit of law enforcement and justice.

Synonyms:

1. Medical Justice
2. Legal Medicine
3. Medical Jurisprudenc
4. Forensic Medicine
5. Clinical Forensic
6. Forensic Pathology

Forensics is not the same as the Legal Medicine (Medical Law). Forensic is law enforcement not only used for autopsy examination but also with the other sciences that play a role in law enforcement. Forensic medicine is the study of the body, body parts, cells, DNA and others for the benefit of law enforcement.

### II.2. wound

[1] The wound is a state of loss / interruption of tissue continuity. Wounds are distinguished based on the cause:

- a. Excoriation or abrasion
- b. Vulnus scisum or cuts

- c. Vulnus laseratum or lacerations
- d. Vulnus punctum or stab wounds
- e. Vulnus Morsum or injuries due to animal bites
- f. Vulnus combotio or burns
- g. Wound or bruise contusion due to blunt impact

### II.3. Certainty Factor

Certainty factor is a way of combining belief (belief) and ketidakpercayaan (unbelief) in a single number. In certainty theory, qualitative data are represented as the degree of confidence (degree of belief).

Stages of representing qualitative data:

- (1) the ability to express the degree of confidence.
- (2) the ability to place and combine the degree of confidence in expert systems.

Used to express the degree of belief in a value called on certain factor (CF) to assume a degree of keyakinan an expert to the data.

Formula for certain factor :

$$CF[H,E] = MB[H,E] - MD[H,E] \text{ Where:}$$

- (1) Certain Factor = CF (certainty factor) in the hypothesis H influenced by the fact that E

Certainty factors provide an expert to state the value of the trust without the express distrust

Formula :

$$CF(H,E) + CF(H',E) = 0 \quad (4)$$

Mean, the facts support a hypothesis and reduce support for the negation of the hypothesis with the same number, so the number is always zero. example:

- (1) Students pass if you get an A for a course.

### II.4. Determination of Death How the Certainty Factor

Initially the system will accept data input from

- (2) MB = Measure of Belief (confidence level), is a measure of the increase of trust hypothesis H influenced by the fact E.
- (3) MD = Measure of Disbelief (the level of uncertainty), is the increase of distrust hypothesis H influenced by the fact E.
- (4) E = Evidence (event or facts)

The incorporation of trust and distrust in a single number that has two functions, namely the certainty factor is used to level the hypothesis in order of importance, for example if a patient has certain symptoms that indicate some likelihood of disease, the disease with the highest CF become the first in the sequence of testing. Size of trust and distrust in the probability defined as follows:

$$CF(\text{Rule}) = MB(H, E) - MD(H, E) \quad (1)$$

$$MB(H|E) = \begin{cases} 1 & \text{if } P(H) = 1 \\ \frac{\max[P(H|E), P(H)] - P(H)}{1 - P(H)} & \text{otherwise} \end{cases} \quad (2)$$

$$MD(H|E) = \begin{cases} 1 & \text{if } P(H) = 0 \\ \frac{\min[P(H|E), P(H)] - P(H)}{-P(H)} & \text{otherwise} \end{cases} \quad (3)$$

$$CF(H,E) = 0,70 \quad CF(H',E) = -0,70$$

- (2) How your belief that getting an A will help you pass?

Answer: I am 70% sure that I would pass if I get an A for this course.

- (2) How you distrust that gets an A will help you pass?

Answer: I am sure -70% that I will not pass if I earn an A for this course.

experts. Input data such unnatural manner of death, death variables and also of course the expert system knowledge systems. Then when the data has been input then the user can use it as an expert system

estimates how unnatural death. Where the user will be prompted to enter the data of victims first, then the variable data of death and then the new user an estimate on how unnatural death victims can be seen in Figure 1.

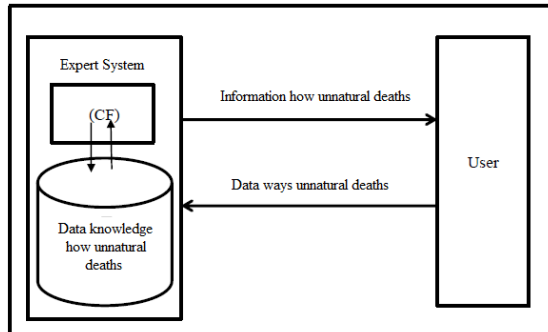


Figure 1. Implementation of the Expert System CF determination of unnatural deaths

The program begins with an expert system data entry victim. After the user input data on these variables are queried by the system. Then the system will process any variables entered by the user. Then the system to process data on these variables, the system will calculate the value of the variable certainty to know how to estimate how unnatural death of the victim.

### III. DISCUSSION

#### Module Compiler Expert System

According Staugaard (1987), an expert system is composed by three main modules, namely:

1. Acceptance of Knowledge Modules (Knowledge Acquisition Mode) System is in this module, at the time he received the knowledge of experts. The process of accumulating knowledge-knowledge that will be used for the development of the system, carried out with the aid of a knowledge engineer. The role of the knowledge engineer is a link between an expert system experts.
2. Module Consultation (Consultation Mode) When the system is in a position to provide answers to the problems posed by the user, expert systems are in consultation module. In this module, the user interacts with the system by answering the questions posed by the system.

#### 3. Module Explanation (Explanation Mode)

This module describes the process of decision-making by the system (how a decision can be obtained).

Structure of Expert System, the main component in the structure of the expert system according to Hu et al (1987) include:

##### 1. Knowledge Base

The knowledge base is the core of an expert system, namely in the form of expert knowledge representation. The knowledge base composed of facts and rules. The fact is information about an object, event, or situation. Rule is a way to generate a new fact of facts already known.

##### 2. Inference Engine

Inference engine acts as the brain of an expert system. Inference engine serves to guide the process of reasoning to a condition, based on the available knowledge base. In a process of inference engine to manipulate and redirect rules, models, and facts stored in the knowledge base in order to achieve a solution or conclusion. In the process, the inference engine uses reasoning strategies and control strategies. Reasoning strategy consists of reasoning strategies definite (Exact Reasoning) and uncertain reasoning strategies (inexact reasoning). Exact reasoning would do if all the data needed to draw a conclusion available, while inexact reasoning are performed in a state of control sebaliknya. Strategi serves as a guide to the direction in performing procedural reasoning. There are three commonly used control techniques, namely forward chaining, backward chaining, and a combination of both these control techniques.

##### 3. Database

The database consists of all the necessary facts, which facts are used to meet the conditions of the rules in the system. The database stores all the facts, whether the facts early on when the system starts operating, or facts obtained during the process of drawing conclusions being implemented. The database is used to store data on observations and

other data required for processing.

4. User Interface

This facility is used as an intermediary for communication between computer users.

III.1. Engineering Knowledge Representation

Knowledge representation is a technique for representing the acquired knowledge base into a schematic / diagram can be determined such that the relationship / connection between the data with other data. This technique helps in understanding the structure of the knowledge engineer knowledge expert system that will be created. There is some knowledge representation techniques commonly used in the development of an expert system, namely

a. Rule-Based Knowledge

Knowledge is represented in a form of facts (facts) and rules (rules). Shape representation consists of a premise and a conclusion.

b. Frame-Based Knowledge

Knowledge is represented in a form of hierarchical or network frames.

c. Object-Based Knowledge

Knowledge is represented as a network of objects. The object is an element of data that consists of data and method (process).

d. Case-Base Reasoning

Knowledge is represented in the form of the conclusion of cases (cases).

Inferencing with Rule: combined with the certainty factor method, Inference with an implementation of the rules Ponen mode, which is reflected in the mechanism of search (search). Can also check all the rules in the knowledge base in the strength of the uncertain value or the uncertainty of the results of the calculation of weighted certainty factor value. The search process continues until there are no rules that can be used or to a destination (goal) is reached. There are two methods

of inferencing with rules, namely forward chaining or data-driven and backward chaining or goal-driven, but in this study inferencing method using certainty factor, certainty factor can be seen in the application of the inference engine in Figure 4.

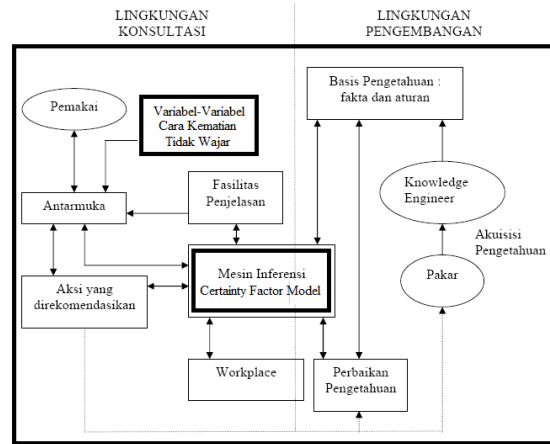


Figure 4. Architecture of Expert System Determination Method Unnatural Death Victim

A so-called natural death if the person is in the care of a doctor, and the diagnosis of the disease has been known to death allegedly due to his illness. On the deaths that occurred in hospitalization or in the care of a doctor, the doctor can usually ensure that the deaths were natural deaths through the patient's medical record, while the victim's death unnatural way there are several kinds, and required an expert to recognize it as a specialist forensics. There are several variables that have been determined by forensic experts to determine how victims of unnatural death [6], as shown in Table 1.

Table 1. Variables Way of Death

Variabel	Observation
whether any wound site	Yes
whether the wound site was chosen (affordable)	No
whether the wound site exposed	No
whether the number of injuries many	Yes

whether the number of single wound	No
is there any puncture wounds	Yes
whether there is a laceration	No
whether there are cuts	No
whether there is a bruise	Yes
whether the exposed clothing	Yes
whether there is a parallel slices	No
whether there is a random slice	Yes
whether there are cuts	No
whether there is a legacy letter	No
whether the scene a neat	No
whether the scene is hidden	Yes
whether there is any defense cuts	Yes
whether there is injury trial	No

With Formula :

New to MB = MB I + MB II +...+ MB n \* (1-MB I)  
 New to MD = MD I + MD II +...+ MD n \* (1-MD I)

(a) Calculation of the murder

New to MB

MB I = 0.6 MB II = 0.8 MB III = 0.8 MB IV = 0.8 MB V = 0.7  
 MB VI = 0.6 MB VII = 0.8 MB VIII = 0.8

Then all the selected MB (Yes) is calculated. :

$0.6 + 0.8 + 0.8 + 0.7 + 0.8 + 0.6 + 0.7 + (0.8 * (1 - 0.6)) = 5.32$

For New MD

MD I = 0.3 MD II = 0.2 MD III = 0.2 MD IV = 0.3  
 MD V = 0.2 MD VI = 0.4 MD VII = 0.3 MD VIII = 0.2

Then all the selected MD (Yes) is calculated. :

$0.3 + 0.2 + 0.2 + 0.3 + 0.2 + 0.4 + 0.3 + (0.2 * (1 -$

$0.3)) = 2.04$

(b) Calculation of Suicide

The new MB = 2.58  
 The new MD = 4.68

(c) Calculation of Accident

The new MB = 3.76  
 The new MD = 3.76

Calculating the new MB CF formula - a new MD. CF values for each way of death:

(a) Murder

CF = 3.28

(b) Suicide

CF = -2.1

(c) Accident

CF = 0

Based on the above calculation, the highest CF values held by murder. Implementation of variable selection method of determining the victim's death was not natural [6] on the system can be seen in Figure 2.

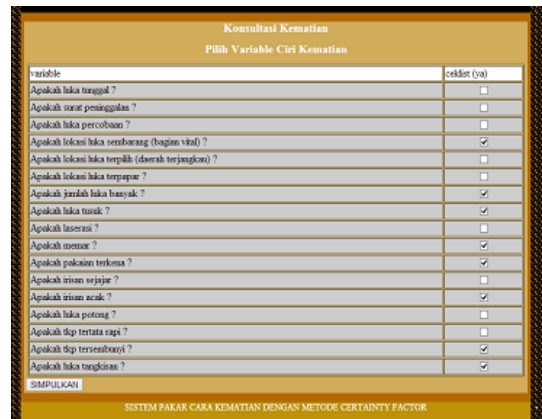


Figure 2. Implementation of Variable How unnatural Death Victim

Then after the election variable unnatural manner of death victims are then processed according to the rules calculation methods certainty factor, and will

result as shown in Figure 3.

HASIL PEMERIKSAAN	
Nama Korban	Idex
Umur (tahun)	35
Tinggi (cm)	180
Jenis Kelamin	pria
kep	cermpakan sisi
warna kulit	perah
beratak wajah	bulat

Variable pada korban

- 1 lokasi luka sembarang (bagian vital)
- 2 lokasi luka terpapar
- 3 jumlah luka banyak
- 4 memar
- 5 paksaan terkenas
- 6 sisaan anak
- 7 dip tersembunyi
- 8 luka tangkisan

HASIL PAKAR CARA KEMATIAN BERDASARKAN SISTEM PAKAR CERTAINTY FACTOR

berdasarkan data variable jadi kematian korban disebabkan: Pembunuhan

SISTEM PAKAR CARA KEMATIAN DENGAN METODE CERTAINTY FACTOR

Figure 3. Results of Implementation of certainty factor method on Expert System Determination Method unnatural death toll

#### IV. CONCLUSION

Based on this study it can be concluded below:

1. The certainty factor method can be implemented in the expert system of determining how the victim's death unnatural
2. This method can only handle uncertainty / certainty only 2 data alone, there should be several times the data processing for data more than 2 pieces

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# Development of Authoring Tool Flash in the Making of Animation Learning Media

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*Abstract - In the e-learning world, Authoring tool is also called as learning authoring tool or e-learning authoring software. E-learning Authoring tool enables teachers to develop interactive and professional digital contents. Nowadays, the needs and demands of teachers regarding a multimedia-based teaching material are significantly high, for instance in curriculum system in Indonesia in which teachers are obligated to prepare a good learning material to be shown in the classroom and to be given to students in order to make them learn independently. By utilizing the flash program and designing an appropriate and interesting tool and template that have been equipped with action script, navigation buttons, and other supporting library components, teachers can thus design a multimedia learning material based on curriculum and the teachers' needs.*

*Keywords: component; authoring tool; flash; learning media*

## I. INTRODUCTION

The needs and demands of teachers regarding a multimedia-based teaching material are significantly high, for instance in curriculum system in Indonesia in which teachers are obligated to prepare a good learning material to be shown in the classroom and to be given to students in order to make them learn independently.

Nowadays, teachers are expected to make multimedia-based learning materials they can use in classrooms and as an independent learning for students.

Many teachers have used Power Point application in making the learning material or teaching presentation. However, limited features presented in Power Point that do not fully support the multimedia learning material become a particular obstacle. By using flash as a program to make learning materials, teachers can make a more interactive multimedia learning material which can both be integrated via LMS and web.

Difficulty of program flash application is on the used action script. Not all teachers can understand its program language. Moreover, the interface has not also been familiar for the teachers. Therefore, the appropriate solution for this is to make a tool that can be combined with Adobe Flash program that is easy to use by the teachers and can make an interactive animation learning material, and most importantly, can be accessed easily in a web or LMS.

By utilizing the flash program and designing an appropriate and interesting tool and template that have been equipped with action script, navigation buttons, and other supporting library components, teachers can thus design a multimedia learning material based on curriculum and the teachers' needs.[1]

## II. THEORETICAL BACKGROUND

### A. Authoring Tool

In the e-learning world, Authoring tool is also called as learning authoring tool or e-learning authoring software. E-learning Authoring tool enables teachers to develop digital contents from various media to create interactive and professional digital contents.

Teachers can also use digital elements that have been previously applied in a certain lesson to make another lesson. This really supports the development of the contents in order to follow the changing dynamics of learning-teaching system.

With the authoring tool, return on investment of components that have been made by programmers outside or inside the graphic design sources will be acquired in a short time. Authoring tool is more compatible if used as e-learning course creation tool rather than just authoring tool, as what it is usually called, because the meaning is too wide.[2]

### B. Learning Media

#### 1) Definition of Learning Media

Learning media or learning material is all forms of material used to help teachers/instructors in performing learning and teaching activity in classrooms. The referring material can be both written and unwritten.

#### 2) Types of Learning Materials

- Visual learning material consists of printed materials such as handouts, books, learning materials, students' working papers,

brochures, leaflets, wallcharts, photos/pictures, and non-printed materials such as model/mockup.

- Audio learning materials, such as cassettes, radios, phonographs, and audio compact discs.
- Audio visual learning materials, such as video compact discs, films.
- Interactive multimedia learning materials, such as CAI (Computer Assisted Instruction), compact disc (CD) of interactive learning multimedia, and web-based learning materials).[3]

3) Significances for Teachers

- They will acquire learning materials that are appropriate according to the curriculum and suitable with the students' learning needs,
- They will no longer depend on text books which sometime use many references,
- Enrich their knowledge and experience in compiling learning materials,
- Develop an effective learning communication between teachers and students, because students will trust their teachers,
- Give additional credits if it is collected as a book and published.

4) Significances for Students

- Learning activity will be more attractive,
- Opportunities to learn independently and decrease dependency on the presence of their teachers,
- Easiness in learning every single competency that needs to be mastered. [4]

C. Animation

- Animation is derived from English word *animate* which means to make alive, to give a soul and to move a thing. Animation is a process of making an object which is originally a dead thing, and arranging it in a different position in order to make it looks like alive.
- Basic principal of animation is found from the character of human's eyes: persistence of vision. Paul Roget, Joseph Plateau and Pierre Desvigen, through optical equipments they invented, they successfully proved that human's eyes tend to catch order of pictures in a certain range of time as a pattern.
- Animation can commonly be defined as: an order of pictures shown in a particular range of time that thus creates a moving picture illusion. The basic definition of animation is to move an object in order to make it appears more dynamic.[5]

D. Adobe Flash

Adobe Flash is a program used to make a very popular animation for teachers and has become an obligatory program in one of curriculum in vocational schools, because there many contents of multimedia learning materials that use Adobe Flash program.

Adobe Flash (formerly named as Macromedia Flash) is one of computer software that becomes an excellent product by Adobe Systems. Adobe Flash is used to make vector pictures and animation pictures. Files produced by this software has a file extension.swf

In Flash, there are techniques for making animation, action script, filter, custom easing and importing videos, and equipped with playback FLV. Advantages possessed by Flash is that it can be given a little programming code either for the automatic one to manage the animation inside it or that is used to communicate with othe rporgrams such as HTML, PHP, and Database with XML approach.[6]

II. DESIGN

Although there are many media and methodologies practiced by e-learning practitioners in undertaking the designing of e-learning materials, there is a process called ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), in which this model is commonly used in Instructional Design. In short, ADDIE model can be described in the Authoring Tool system design that will be made as follows:

1) Analysis Stage

Basically, analysis stage aims to identify the goals, teachers, students, and contents:

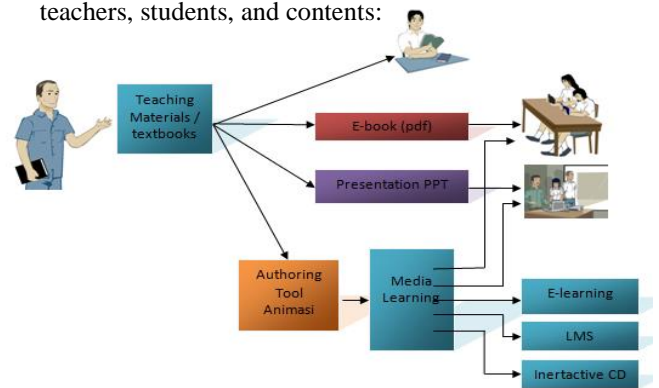


Figure 1: Analysis Description of system in general

In figure 1, learning material that comes from teachers can be in the form of lesson books which will later be used as an e-book read by the students through computer media and presentation file for learning materials in the classroom.

By using Authoring tool, teachers can design a multimedia learning nmaterial that can later be applied by the students for their independent learning, as presentation media, e-learning media, importing to Learning Management System (LMS) media such as Moodle, and can be in the form of interactive CD, so the learning can be performed anytime and anywhere.

2) Design Stage

There are many stages need to be undertaken in making multimedia learning materials using Adobe Flash, starting from making the file, creating a various type of frames form animation timeline, making slides by using Action Script, making the navigation and additional audio, video, and animation. If quizzes are needed, teachers should firstly make the slides that are equipped with action script. While if authoring tool design is used, the stage can be simpler because teachers will just only choose the template, add the number of slides and then choose the library by clicking and dragging to add quizzes by importing those slides in the XML data that have been previously prepared.

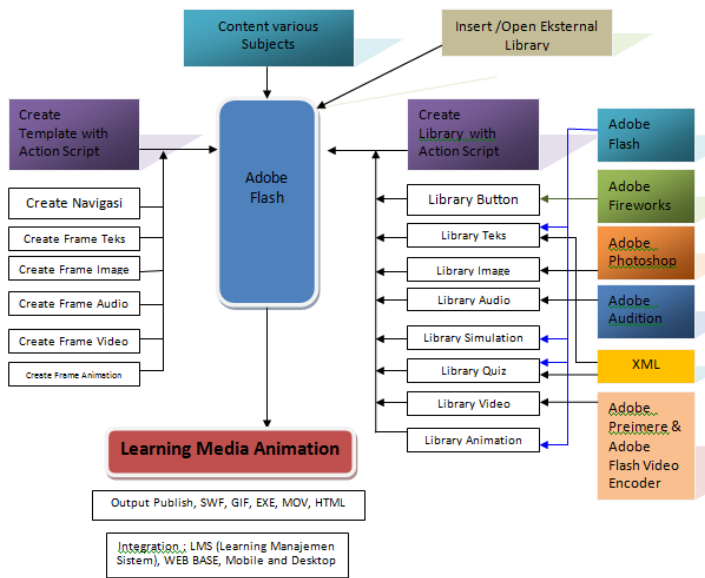


Figure 2. System Design

- The plan is started by designing various types of templates using action script through making the navigation, frame for texts, frame for images, frame for audios, frame for videos, and frame for animations.
- Making various types of Library by using some programs that will be integrated into Adobe

3) Development Stage

In this stage, both input and output media selection which is based on the design stages above, input from this authoring tool is in the form of multimedia content based on learning materials which can be in the form of texts, pictures, audios, videos, and animation, whereas resulting output is in the form of document files with extension of .fla, animation file with extension of .swf, video file with extension of .mov, other files with extension of .html and .exe.

4) Implementation Stage

In this stage, design model of implementation appearance from Authoring Tool system that has been made:

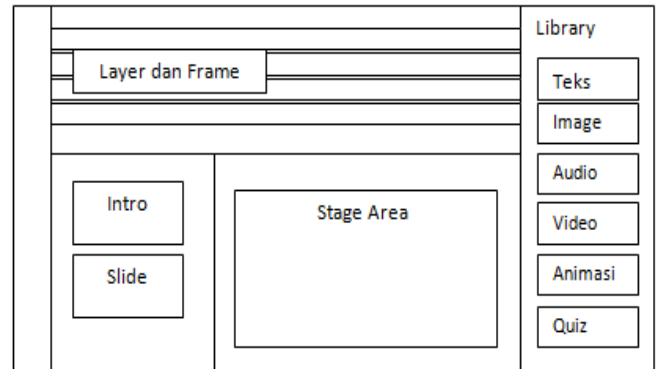


Figure 3. Template and Library Design

In Figure 3, the template design used is by dividing it as follows:

- Making the frame that will be placed for Texts, Images, Audios, Videos, and Animation.
- Creating the navigation buttons in order to manage the number of slides and the intro for learning materials.
- Stage area the working area used to design the learning material that is specially created using the action script.
- The group of action scripts where teachers will only drag and drop the library depend on the need of learning materials that are going to be made.

5) Evaluation Stage

At this stage, there will be an evaluation towards all previous stages started form the system Analysis Stage, Design Stage, Development Stage and Implementation Stage, thus in this stage the system can be examined by directly performing the implementation to the teachers as users of Authoring tool.

In this Evaluation Stage, there will be an examination and making the questionnaires for teachers as the users.

III. EVALUATION OF EXISTING E-LEARNING ANIMATION

In its development, Authoring Tool is divided into two parts, namely the making of templates and library. Both makings are made based on the results of researches from several learning media that existed before, and from those researches, it is clear to conclude some basic forms of template as shown in this below table:

TABLE 1. TYPES OF NAVIGATION

NO	TYPES OF NAVIGATION
1	Navigation Menu of Animation is located on the top with Drop Down

2	Navigation Menu of Animation is located on the left
3	Navigation Menu of Animation is located on the right
4	Navigation Menu of Animation with the Next Button
5	Navigation Menu of Animation with the Menu Selection in the beginning of animation
6	Navigation Menu with Index

Whereas, from studies related to types of simulation and animation used from some learning media existed before, it can be concluded about Animation types that can be used to make some Library, based on the table below:

TABLE 2 TYPE ANIMATION / MATERIALS

NO	TYPE ANIMATION / MATERIALS
1	The material in the form of text
2	The material in the form of text + image
3	The material in the form of text area
4	The material in the form of text + image area
5	The material in the form of text + animation
6	The material in the form of text + animation area
7	Objects moving from left to right
8	Objects moving from left to right
9	Objects moving from top to bottom
10	Objects moving from bottom to top
11	Rotating Objects to right (CW)
12	Rotating Objects left (CCW)
13	Objects move while spinning to right
14	Objects move while spinning to the left
15	Objects change size of small greatness
16	Objects change size from large to small
17	Objects changed from elongated short
18	Objects changed from long to short
19	Objects change color
20	Object appears not to be Visible
21	seems to be no Visible Objects
22	Animated Objects change shape

A. Template Making

The making of template which is based on the results of research related to e-learning and multimedia learning materials existed before, it can be concluded that:

1. There are some e-learning design models that have been divided into three parts:
  - Menu/Navigation Model is based on the order of material with menu placement on the top or side
  - Menu/Navigation Model appears with slide model in which the intro appears on the front page.
  - Model of Learning Material which follows the curriculum structures or learning tools owned by teachers.
  - Color composition and design of appearance are really important in creating the learning materials because

they are related to the attractive appearance of a learning material.

2. Design of Learning Material should be user friendly, so that the users will easily utilize the learning materials. From several conclusions above, the writers make a template design that will be used in animation development software for the making of multimedia-based learning materials. The making of those various types of templates is undertaken in order to make teachers have many choices based on the needs and lessons they teach. In the making of template, the order of step making can be clearly seen in the making process as follows:

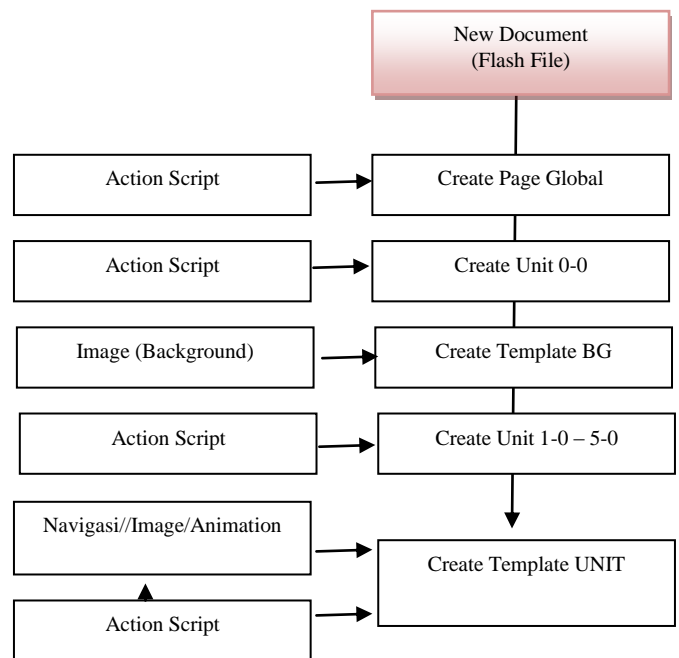


Figure 4. The Process of Template Making

In the Figure 4 above, Template is made based on the following orders:

- a) Create a new Flash file
- b) Make a Global Page that loads Script from template
- c) Make 0-0 Unit as the Intro Page
- d) Make Template Page BG in order to import the Background Template
- e) Make Unit 1-5 and can be added if needed
- f) Make the Navigation on Template Page UNIT

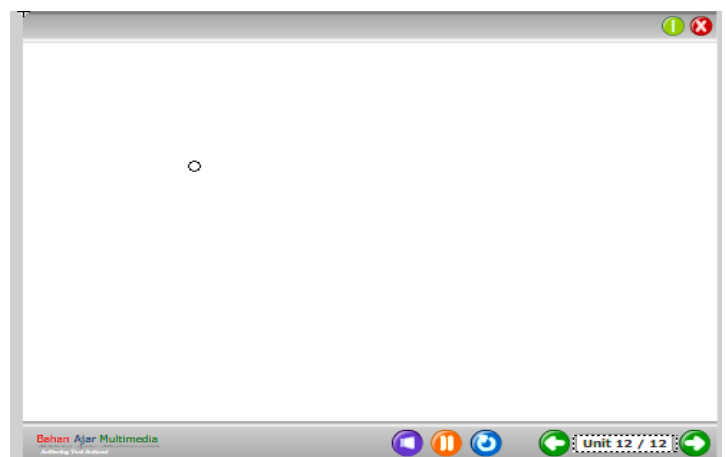


Figure 7 Library

Figure 5. Template Design

In the Figure 5, it shows the result of Template design that has been made

**B. Library Making**

In the making of Library, it needs many applications of graphic and multimedia designs. Pictures and animations are mainly made with two types of library, namely still pictures and moving pictures (animation). The order of steps in library making is shown as follows:

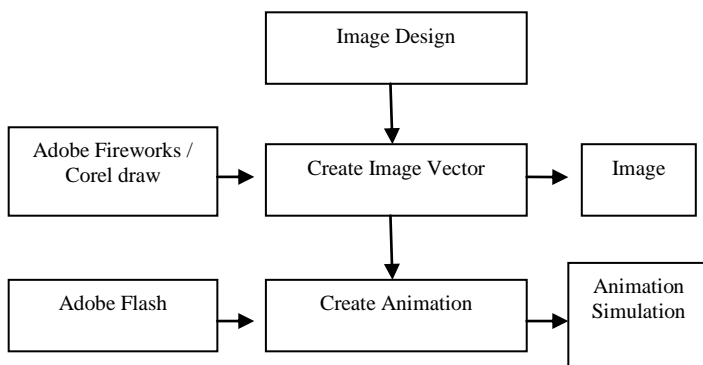
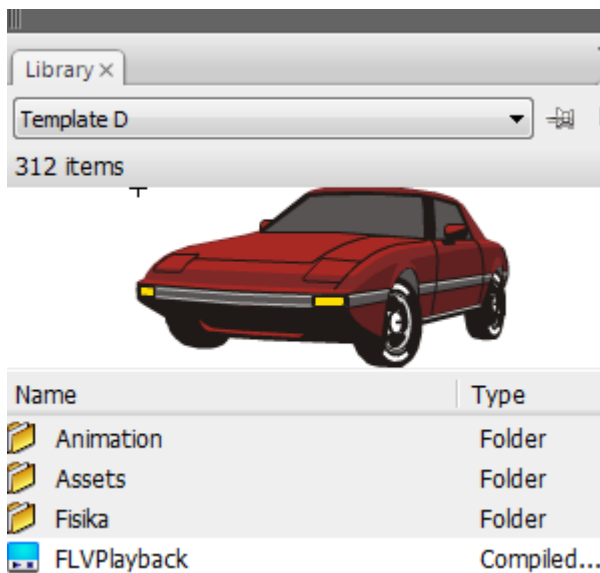


Figure 6. Process of Library Making

In the Figure 6, Library Image is made through vector-type image by combining Adobe Fireworks and Corel Draw program. While for Animation, the vector picture is taken to be made as library. The library display is shown below.



**C. Implementation**

Implementation of Authoring Tool Flash System in the making of animation learning media can produce an Interactive Learning Material based on the lessons needed. At this stage, template and library file that have been made are integrated with Adobe Flash by Menu File → New → Templates → Learning Material → Select Template

The final result of Animation Learning Media Design can be seen in Figure 8.

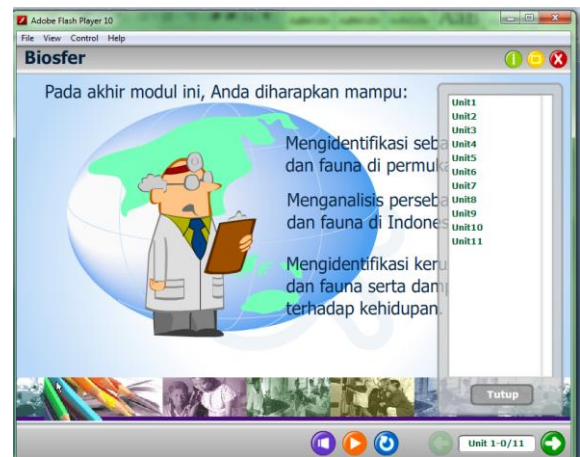


Figure 8. Animation Learning Media

**V. CONCLUSIONS**

By using Authoring tool, teachers can design a multimedia learning nmaterial that can later be applied by the students for their independent learning, as presentation media, e-learning media, importing to Learning Management System (LMS) media such as Moodle, and can be in the form of interactive CD, so the learning can be performed anytime and anywhere.

Solution for easing the making of multimedia-based learning materials is by utilizing the template and library based Adobe Flash program in order to ease the teacher in creating a learning media without having to know more about the application of Adobe Flash program

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# File Sharing Data Security Implementation using Access Control List, Screening and Quota

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**Abstract**— Abstract—In the organization, sharing file is requirement for business operation. Corporate address this need by implement file sharing server. Every user on the corporate network have their identity on centralized authentication servers and can be access file and folder based on ID. Access right for file and sharing folder granted by Access Control List (ACL) in the file systems NTFS.

In order to prevent users from saving unauthorized type of files, users must be restricted using screening methods. Users allowed only saving authorized file type. Also for preventing user from taken space as fast as possible, the volume must be restrict from uncontrolled growth. With these three feature, organization can secure and optimized their file server sharing.

**Keywords**— Active Directory, Access Control List, Quota, Screening.

## I. INTRODUCTION

There are so many resources on the network that must be managed, such as file server, print server, intranet server etc. all resource can be managed by using Active Directory. Whom accessed the resource and when the resources allowed to access. Who is managed the resource also can be controlled, for example who can reset user password can be granted right to do that. Active Directory can help Administrator to do their job easily.

Object is a basic things on the Active Directory. Every object belongs to a class. Every object own its property. Example of objects are user, groups, computers, computer, contacts, printers etc.

User object represents every user on the Active Directory networks. Every user have certain name that is use to login to the network. User must supply name and password when login to network. If succesfully authenticated by server, then user can perform what is they authorized for. User can access file and folder in file sharing, can sending and receiving e-mail, access internet connection or use printer for printing a document.

Group object represents group of users on the network. If user have similar access right for the folder and file they can

grouping on the same group. Managing network resource will be easier for member of group. If Access Control List (ACL) granted for a group, then every member of a group have equal access rights. If a user member of group remove from membership of group then he or she will not be denied from accessing the resource.

Domain is a security and administration boundary on directory services. Domain Naming Systems (DNS) is a naming systems on the active directory. Sample of domain name is uniat.ac.id. object and organizational unit are member of domain. Domain also boundary for policy implementation. Policy in Active Directory known as group policy. Every domain have a central server known as domain controller. At least one domain controller exist on every domain and one or more replica for load balancing and high availability purposes. Also there is a administrator for every domain that manage the domain.

Domain structure on active directory is a hierarchical structure. They can have parent and child domain. For example uniat.ac.id is parent domain and teknik.uniat.ac.id is a child domain. This is a sample of contiguous name space. Fully qualified domain name (FQDN) is complete name space for domain. for example nakula.teknik.uniat.ac.id is FQDN for a host named nakula on sub domain teknik in the uniat.ac.id domain.

Site represents physical structure of active directory network. Site is a Local Area Network (LAN) on Office or Plant area. LAN speed at least 100 Mbps or higher such as 1 Gbps. These LAN known as Ethernet or Fast Ethernet. If two location spread by high speed Wide Area Network (WAN), it can be categorize as one site. Active Directory created Default First Site Name as site name and administrator can change its name later.

Subnet is sub network in TCP/IP networking concept. Computer located on one subnet can communicate each other without router. Subnet differ ecah other by using subnet mask. On site can be one subnet or multi subnet belongs to one site..

## II. THEORI

Data security can be accomplished by using feature Access Control List (ACL) of file systems. NTFS can be secure access

of file and folder on file server. Local access and remote access of file or folder can be secure by NTFS.

Below table summarize Access Control List (ACL) on NTFS file systems.

Table 1. List of Access Control List

No	Permissions	Descriptions
1	Full Control	Granted unlimited access
2	Traverse Folder / Execute File	Explore the folder or execute file
3	List Folder/Read Data	Show folder list or read data
4	Read Attributes	Read attributes of file or folders
5	Read Extended Attributes	Read extended attribute of file and folders
6	Create Files / Write Data	Create a files or write data
7	Create Folders / Append Data	Create a folder or append data
8	Write Attributes	Write attributes of folders or files
9	Write Extended Attributes	Write Extended attributes of folders or files
10	Delete Subfolders and files	Remove sub folders and files
11	Delete	Remove file or folders
12	Read Permissions	Read permission of folder and files
13	Change Permissions	Change permission of files and folders
14	Take Ownership	Taking ownership

File Server Resource Manager (FSRM) is feature on Windows Server 2012 which can be used for restrict user from storing unauthorized type of files, restrict uncontrolled growth of file sharing space and create report for file sharing usage.

File Screening management is feature for file server administrator to controll what type of files can be save by users. Unauthorized type of file is not allowed to save on the server, such as mp3 or another type of files that is not needed on the business operation.

There are three stage for file screening implementation. First is created file groups or using built in file groups. There are some built in file groups available. After created file group then we created file screen template. File screen template is a template that we can use for create screening. For example on the template we specify to restrict user to save audio and video files. On the template we choose file groups audio and video and not allowed action. The third or last stage is apply the template to folder on file server.

File Groups is group of file type used by file screening management. There are built in File Group which provided by File Server Resource Manager such as Audio and Video Files, Backup Files, Compressed Files, E-mail Files, Executables Files, Image Files, Office Files, System Files, Temporary Files, Text Files dan Web Pages Files. Also we can create own file groups for special needs.

Below table display built in file groups.

Table 2. File Groups

No	File Groups	Extensions
1	Audio and Video Files	*.aac, *.aif, *.aiff, *.asf, *.asx, *.au, *.avi, *.flac, *.m3u, *.mid, *.midi, *.mov, *.mp1, *.mp2, *.mp3, *.mp4, *.mpa, *.mpe, *.mpeg, *.mpeg2, *.mpeg3, *.mpg, *.ogg, *.qt, *.qtw, *.ram, *.rmi, *.rmv, *.snd, *.swf, *.vob, *.wav, *.wax, *.wma, *.wmv, dan *.wvx.
2	Backup Files	*.bak, *.bck, *.bkf, *.old.
3	Compressed Files	*.ace, *.arc, *.arj, *.bhx, *.bz2, *.cab, *.gz, *.gzip, *.hpk, *.hqx, *.jar, *.lha, *.lzh, *.lzx, *.pak, *.pit, *.rar, *.sea, *.sit, *.sqz, *.tgz, *.uu, *.uue, *.z, *.zip, *.zoo.
4	E-mail Files	*.eml, *.idx, *.mbox, *.mbx, *.msg, *.ost, *.otf, *.pab, *.pst.
5	Executables Files	*.bat, *.cmd, *.com, *.cpl, *.exe, *.inf, *.js, *.jse, *.msh, *.msi, *.msp, *.ocx, *.pif, *.pl, *.scr, *.vb, *.vbs, *.wsf dan *.wsh.
6	Image Files	*.bmp, *.dib, *.eps, *.gif, *.img, *.jfif, *.jpe, *.jpeg, *.jpg, *.pcx, *.png, *.ps, *.psd, *.raw, *.rif, *.spiff, *.tif dan *.tiff.
7	Office Files	*.doc, *.dot, *.mad, *.maf, *.mda, *.mdb, *.mdm, *.mdt, *.mdw, *.mdz, *.mpd, *.mpp, *.mpt, *.pot, *.ppa, *.pps, *.ppt, *.pwz, *.rpy, *.rtf, *.rwz, *.slk, *.vdx, *.vsd, *.vsl, *.vss, *.vst, *.vsu, *.vsw, *.vsx,



		*.vtx, *.wbk, *.wri, *.xla, *.xlb, *.xlc, *.xld, *.xlk, *.xll, *.xlm, *.xls, *.xlt, *.xlv, dan *.xlw.
8	System Files	*.acm, *.dll, *.ocx, *.sys, *.vxd
9	Temporary Files	*.temp, *.tmp dan ~*.
10	Text Files	*.asc, *.text, *.txt.
11	Web Page Files	*.asp, *.aspx, *.cgi, *.css, *.dhtml, *.hta, *.htm, *.html, *.mht, *.php, *.php3, *.shtml, dan *.url.

There are built in file screen template provided by File Server Resource Manager. Built in File Screen Templates are Block Audio and Video Files, Block E-mail Files, Block Executables Files, Block Image Files, Monitor Executable and System Files.

Below table summarize built in File Screening template.

Table 3. File Screening Template

No	Template name	Screening Type
1	Block Audio and Video Files	Active
2	Block E-mail Files	Active
3	Block Executable Files	Active
4	Block Image Files	Active
5	Monitor Executable and System Files	Passive

Quota Management is feature for control of storage volume usage on the file server. User will be restrict to save or store the data if reach the quota. There are two kind of quota, hard quota and soft quota. User can not save data anymore if reach setting on hard quota. On the soft quota setting, user can save data event ereach the quota, but user still under monitoring.

When implement quota management there two step must be perform. First is create a quota template. On quota template, size of quota must be specify. Also how to report is specify. Full of quota can be report by e-mail, event log, or trigger a command.

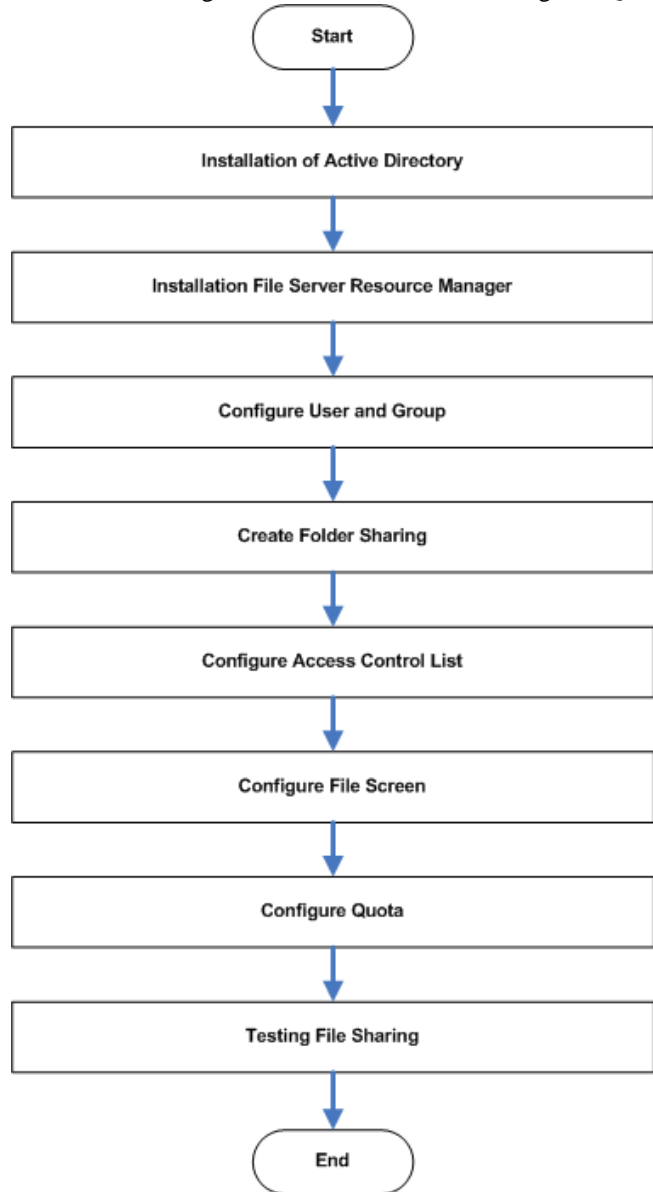
After quota template created, then we apply a quota for specific folder or volume on file server. Windows Server 2012 provide 6 built-in quota template, as shown on below table.

Table 4. Quota Template

No	Quota Template	Limit	Quota Type
1	100 MB Limit	100 MB	Hard
2	200 MB Limit Reports to User	200 MB	Hard
3	200 MB limit with 50 MB Extension	200 MB	Hard
4	250 MB Extended Limit	250 MB	Hard
5	Monitor 200 GB Volume Usage	200 GB	Soft
6	Monitor 500 MB Share	500 MB	Soft

### III. METHODOLOGY

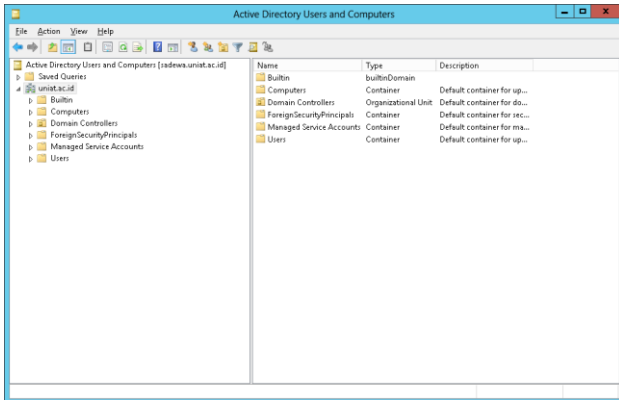
Below flow chart display steps for implement data security on file server using Access Control List, Screening and Quota.



Picture 1. System Implementation Flow Chart

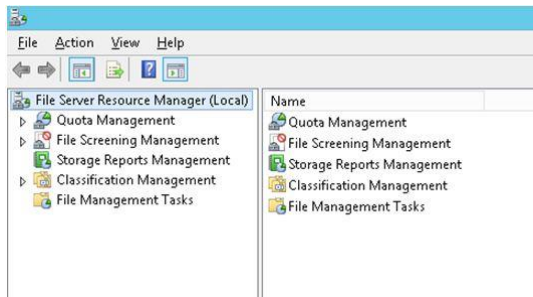
IV. RESULTS

Picture 2 below displayed result of installation Active Directory



Picture 2. Active Directory

Picture 3 below displayed result of installation File Server Resource Manager



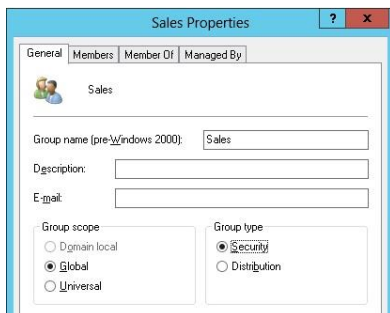
Picture 3. File Server resource Manager

Picture 4 below displayed result of user configuration



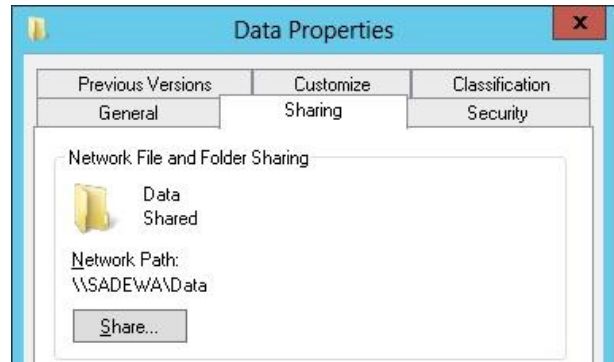
Picture 4. User Account

Picture 5 below displayed result of group configuration



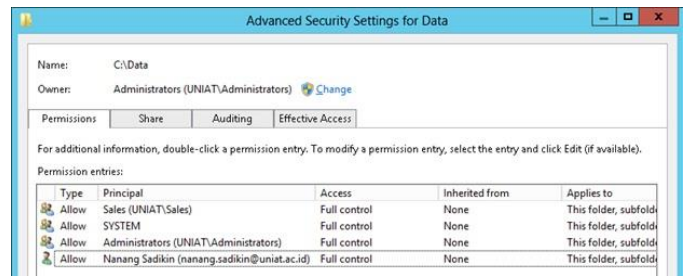
Picture 5. Groups

Picture 6 below displayed result creation of folder sharing



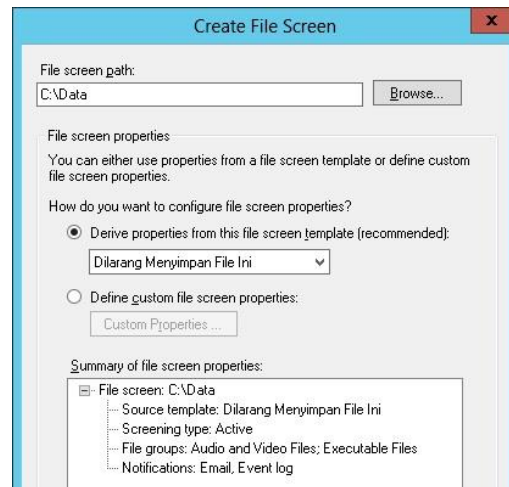
Picture 6. Folder Sharing

Picture 7 below displayed result of configuration access control list



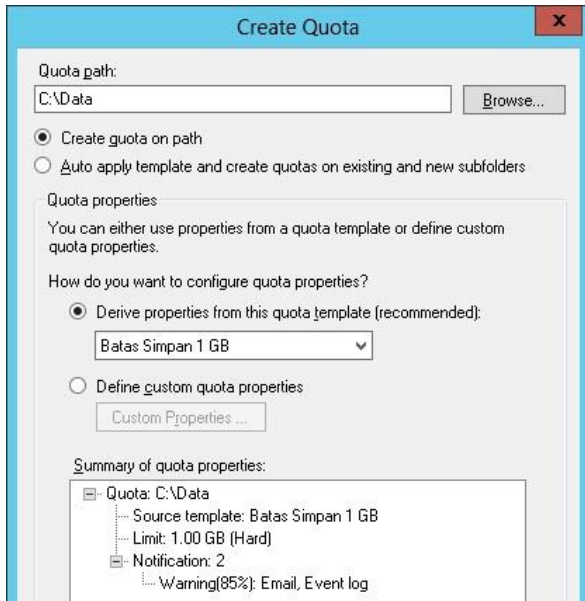
Picture 7. Access Control List

Picture 8 below displayed result of configuration file screen



Picture 8. File Screen

Picture 9 below displayed result of configuration quota.

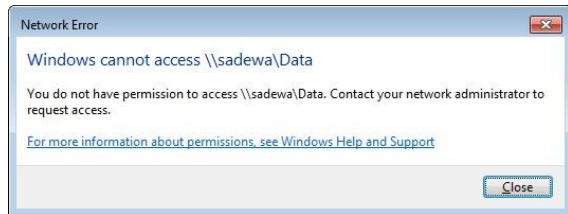


Picture 9. Quota

### V. TESTING

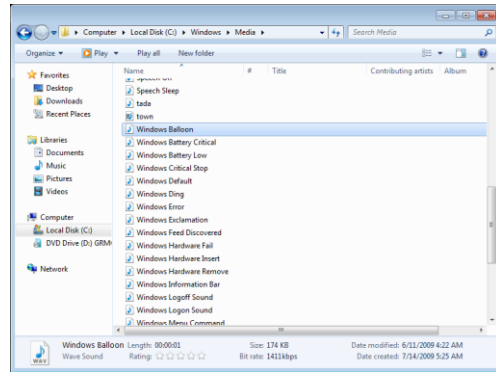
In this section we will testing the system after installation and configuration. In this test we will examine how the system will denied access if non authorized users trying to open sharing folder, the users trying to save unauthorized types of files and reach the quota.

If unauthorized user trying to access, system will be rejected as shown below.



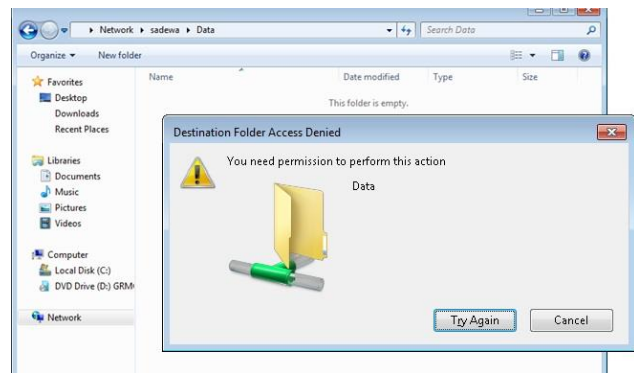
Picture 10. Access denied for unlisted user

We will copy file types way from user local workstation to file server



Picture 11. Copy unauthorized types of files

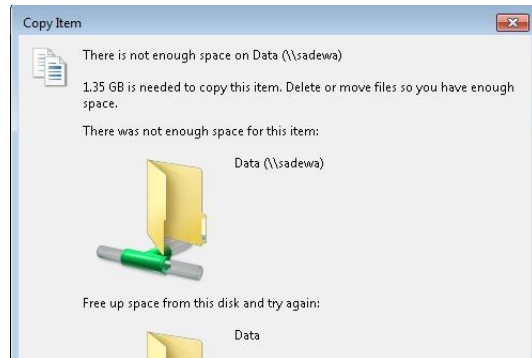
After copy unauthorized type of files then trying to save on file server sharing.



Picture 12. Save on a file server sharing

Due to policy enforcement, the user will be denied from save unauthorized type of files on file server as shown on picture 12 above.

Next we tested copy big files more than allowed quota, the result is below.



Picture 13. Quota exceeds

### VI. CONCLUSION

In this paper we show how to secure data on file sharing server using access control list, file screen and quota. We can give access rights for file sharing data to only active directory users

and groups. Also in order to restrict user from save unauthorized type of files we use file screen. For controlling usage of storage volume we can use quota management. Although one feature can be implement standalone, in this work we implements all of these feature together. For the future works, we can improve feature not only to prevent users to save unathorized type of files to the file server, but also denied user when getting important files from server to local computer.

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# The Role of Information and Communication Technology Achieve Transparansi and Public Accountability

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## Abstract

Public transparency is an openness in earnest, thorough, and allow for the active participation of the whole society in the management of public resources. Every policy issued by state officials must publicly accessible by giving enough space for people to participate widely in it.

Public accountability is only known in a country that accepts the concepts of democracy that people regard as a very important factor. The principle of accountability requires that each activity and the final results of the activities of the state administration must be accountable to the people as the supreme sovereign of a country.

Digitization was instrumental in bringing about transparency and public accountability. Digitization means a process of storing all the properties and information from text, voice, images or multimedia electronics in a string of zero and one bits. Digitization allows everything into a form that can be stored in a variety of digital media (CD, HDD, Flash Disk) and can ditransper to various places around the world at the speed of light through a telecommunications network. Applications that can connect around the world through a complex network of telecommunications today is the internet. Internet (international network) is a network of a set of network (network of networks), which consists of over millions of computers around the world connected to the transmission control protocol / internet protocol (TCP / IP) can communicate with each other.

**Keywords:** Internet Network, Transparency, Public Accountability

## 1. Introduction

In the last two decades the development of information and communication technology (ICT) is growing rapidly. Utilization penetrated into almost every field. Cruising almost unstoppable ability to penetrate the boundaries of the state, the nation, even the most traditional cultures. His influence has important implications, reaching behavior and lifestyle in various areas of life, from the office, the mall, the campus, to the home.

How ICT in Indonesia? So far, Indonesia has become a potential market for producer of electronic products, including ICT-based products, such as those promoted by Sony, Sharp, Sanyo,

Fujitsu, Samsung, LG, GE, Sanken, and others. Not only that, the various brands of computers also membajiri Indonesian market, such as: IBM, Sony, Acer, Lenovo, Toshiba, Dell, HP, Appel, and others. With the full support of advanced ICT capabilities of the computer as a means of processing information for decision making can be optimized so as to facilitate its users to communicate through the Internet with its partners without knowing the time and distance that separates them. Similarly, the presence of industrial manufacturers of mobile phones (mobile phone) further adds to the traffic activity information and communication between people.

Seeing this phenomenon, seems to understand and take advantage of ICT is no longer an option or choice, but a necessity. Inevitably, in the banking sector, from accounting problems to the technology, packed with ICT. Similarly, the country's defense system, which includes the working intelligence system, is also rich in shades of ICT. Flat world that is all around us now is connected by pipes network (networking) with the IT system. Therefore, anyone who did not participate in the wave of ICT, will be left behind, and the sinking of the socially marginalized people of the world.

## 2. Discussion

### a. Critical Questions

A wave of ICT development and utilization anywhere, including in Indonesia, is inseparable from the role of human resources (HR). HR professional, expert, and has a high reputation in the field of ICT on a global scale does not come suddenly. They are the product of a higher education institution or university. The question is, how far the institution of higher education or a college or university contributes to the development of ICT in Indonesia?

### b. Conditions of ICT in Indonesia

Indonesia is relatively underdeveloped in the area of ICT, even far left India, a poor country that is known for not having adequate human

resources. However, India has stunned the world, and even make the United States upset. A company in Bhaviya, Bangalore, India, has been providing manpower such as call center operators, typists, accountants, to the computer programmer, who all work for developed countries to keep doing it in his own country, India. They work as an integral part of global business, such as Dell American On-Line (AOL) and Microsoft.

Indonesia is lagging behind can be seen from the availability of information technology infrastructure, the number of computers owned by the company, or internet access. World Bank report pamanfaatan profile information and communication technology (ICT) in Indonesia with a 9.9 ratio of the number of computers per 1000 population, 91 telephone lines per 1000 population, the number of Internet hosts per 10000 population 0.8 with Internet users as many as two million people. Moreover, the value of Networked Readiness Index (NRI) as the degree of a community ready to participate in the networked world only 3.24 and ranks 59th out of 75 countries surveyed. If using ICT development index developed by UNCTAD-United Nations (2003), Indonesia occupied the number one spot to 77th of 171 countries. For Southeast Asia, Indonesia is far below Singapore which ranks 14th, 40th sequence Brunei, Malaysia ranks 43rd, and 59th Philippine sequence.

The use of the large Internet disebabkan by the existence of the internet that has the ability to: e-mail (electronic correspondence), usenet newsgroups (on-line discussion groups), listserv (e-mail discussion using the mailing list server), chat, telnet (go to certain computer in the network and work on the computer), FTP (File Transfer Protocol), gophers (putting the information stored on the web server by using a hierarchy of menus), and the www (World Wide web). By having a telephone network and a set of PC (Personal Computer) with a modem that anyone can enjoy the Internet using the services of an Internet Service Provider (ISP).

These facts indicate that Indonesia is the largest internet users in the region. Ironically, the ability and readiness of technologies Indonesia is still low or relatively low compared to neighboring countries in Asia. With these conditions, the Indonesian people remain positive and avoid the impact of ICT negatif. The positive impact, among others:

a. Internet as a medium of communication, is a function of the most widely used Internet

where any Internet user can communicate with other users from around the world;

- b. media data exchange, using email, newsgroups, ftp and www (world wide web - a network of web sites) of Internet users around the world can exchange information quickly and cheaply;
- c. media to search for information or data, the rapid development of Internet, making www as one important source of information and accurate;kemudahan memperoleh informasi yang ada di internet sehingga manusia tahu apa saja yang terjadi;
- d. land can be used as information for education, culture, and others; and
- e. ease of doing business in the field of trade and commerce that do not need to go to the place offers / sales.

While the negative effects, among others:

- a. pornography, possessed the ability to deliver information internet make pornography is rampant;
- b. too much cruelty and sadism displayed;
- c. fraud, internet fraud is not spared from attack;
- d. carding, due to its 'real time' (live), how to shop using a credit card is the most widely used in the Internet world. The Internet was the most criminals commit crimes in this field;
- e. gambling, the Internet network, the gamblers do not need to go to a special place to fulfill his wish.

### c. Public transparency

Budget transparency is defined as openness to the community in terms of function and structure of government, fiscal policy objectives, the public finance sector, and projections. This means that the information mengenai government activity should be accessible and widely credible and timely. Albert van Zyl in Andrianto Nico (2007) state budget transparency refers to the extent to which the public may obtain information on the financial activities of the government and its implications in a comprehensive, accurate, and timely. Further Nico Andrian (2007) states important mamfaat adalanya budget transparency are as follows: prevent corruption.

- a) Younger identify weaknesses and strengths policy.
- b) Improving government accountability so that people will be able to measure the performance of the government.

- c) Increasing confidence in the government's commitment to a particular policy decision.
- d) Strengthening social cohesion, because public confidence in the government will be formed.
- e) Creating a good investment climate and increase business certainty.

**d. Public Accountability**

Phenomena that occur in the development of the public sector in Indonesia today is the strengthening demands for accountability for public institutions, both at central and local levels. Accountability can be interpreted as a form of obligation to take responsibility for the success or failure of the mission of the organization in achieving its goals and objectives that have been set previously, through a media accountability is carried out periodically. Accountability is the provision of information and the disclosure (disclosure) for delivering public services to the parties-parties who berkepentingan<sup>4</sup>. Institutions at the central and local governments should be able to be a conduit of information subject to the fulfillment of public rights, namely the right to know, right to information, right to be heard and the right aspiration to obtain the services of a government mandate holders.

Dimensions include the accountability of public accountability of public services, accountability and honesty legal, managerial accountability, program accountability, accountability policy and financial accountability. Accountability of public services is an important part in creating kridibilitas government. Non-fulfillment of the principle of accountability can lead to far-reaching implications. If the public thinks the government is not accountable, people can demand change of government, change of officials and so on. Low levels of accountability also increases the risk of investing and reduce the ability to compete and operating efficiency.

In the public service, accountability of public services should pay attention to more than just a market, should also be legal and constitutional, community values, political norms, professional standards, and the interests of citizens. Accountability of public services must be built that goes together with the development of multi-cultur community. Endang Laraswati (2010) development of a democratic society with the New Public Service Paradigm, accountability of public services must be built on the following principles: Serve citizens, not customers: the public interest is not the aggregation of individual interests, but the dialogue on shared values; not only meet consumer demand, but building trust and collaboration with citizens. Accountability

of public services built on shared values to develop their confidence and collaboration with community citizens.

1. Meet the needs of the public: the administrator must establish a shared understanding of the public interest, creating responsibility and shared interests. Accountability of public services built with the understanding of the value of the above.
2. Value exceeds entrepreneurial citizenship: The public interest is better served by public servants and citizens who have komtmen together to build a better society, rather than by entrepreneurial managers do if public money available to him
3. Think strategically, act democratically: Policies and programs for mmenuhi public needs can be achieved through collective efforts and collaborative process.
4. Understand that accountability in the public service is not simple: Public servants should pay attention to more than just a market, should also be legal and constitutional, community values, political norms, professional satandar, and interests of citizens.
5. Serve rather than steer: helping citizens to articulate common interests, instead of controlling and mendekte residents

**e. The Role of Higher Education**

It is inevitable that that ideas from the world of education has given rise to modernization in all fields of science and technology that have an impact on aspects of the life of the world community. The presence of technology has improved the quality and efficacy of education in upholding the four pillars of education, which is proposed UNESCO, among others: learning to know, learning to do, learning to be, and learning together (Delors, et al., 1996). Learning to know is to learn to know gained through understanding; learning to do is learn to do so that learners are able to respond creatively to the environment; learning to be is learning to be (her) in order to participate and collaborate with others; and learning to live together is to learn to live together as a result of the three essential learning.

The condition has positioned the college acts as a consumer user of ICT to support the management and activities of the college and as a professional manufacturer of human resources. In relation to the position of universities as a consumer, and especially with globalization, emerging new perspectives in education. Educational strategies, from conventional face to face education, now transformed into a more open direction. In fact, education in the future will be optimized by information network that allows interaction and

collaboration. It was supported by the fact that the proven reliability of the information network and its benefits. The information revolution has changed the communication systems of the world today. The distribution network of the information stored in the Internet proves that the world is now increasingly narrow, no geographical boundaries that hinder human beings to interact with the global world. Access to the global world becomes very easy, efficient, and flexible. Ease it is one of the benefits gained from globalization involves the integration in various fields, especially education and technology.

For manufacturers, universities can produce a formidable field of ICT human resources, reliable and able to face the global challenges. To that end, the college needs to provide the power or faculty of education specialists / experts in the field of IT and non-educational personnel reliably wherever arising. Teachers or lecturers need to be constantly upgraded knowledge and expertise in the field of ICT in stages and sustainable. From the lecturers that can be compiled and provided appropriate curriculum and addresses the needs of the real world of work in the ICT industry. In addition, through the hands of the education and non-education personnel can be prepared and provided laboratory facilities or ICT workshop for students so that they can easily learn and perform scientific research activities in ICT, wherever they are. Through e-learning systems such as e-learning, distance learning, virtual learning, it all becomes possible.

Current concepts indicate that the virtual university is a new application in the internet world. This technology has the characteristics of a product that can provide a lot of education that is accessible to people, by anyone, and from anywhere. Currently, the virtual university is not effective because of the lack of technology. It is expected that within the next decade a virtual university can develop and make the Internet as Infrastructure important in the field of education. Results of studies in America (Ursula 2007) shows that the implications of the adoption of these technologies is the result of better education (30%), shorter length of education (40%), and relatively lower costs (30%).

Thus, in the world of education in the future, there will be some fundamental paradigm shift, especially those caused by the application of information technology

menpercepat knowledge transfer. The paradigm shift is among others are:

1. 1. Distributed knowledge (knowledge that is distributed), which means that the future of knowledge is no longer concentrated in institutions of formal education but also distributed in all corners of the world, and very conducive to life long learning (lifelong learning).
2. Resource sharing (sharing of resources). This includes the ability to produce information and knowledge and resource sharing that do rely on information technology, which in turn will greatly benefit producers of knowledge and the public in general.
3. Collective wisdom (collective wisdom). In this case, the lecturer does not have an answer for everything. Lecturer to be a mediator in the group so important in building knowledge. Therefore, learning-based (learning) is more prominent than based teaching (teaching).
4. Training for trainers (training) becomes very important to maintain the ability of the lecturer as a mediator in the three main processes carried in education (Tridharma college), namely: education, future of information technology research and community service.
5. The public and the professionals who will ultimately provide an assessment (audit and accreditation) in one's abilities. Therefore, school diploma does not necessarily guarantee one's ability.
6. The process of cultural transformation. Weak and passive culture will be affected by a strong culture and an aggressive, high reading habits, the ability to absorb a lot of science and knowledge and fast, opening a wide range of innovations, even always trying to find new things, dimensional view of life locally, nationally and universal, able to predict and plan for the future, which is constantly evolving and technology is used.

### 3. Conclusion

Based on the results of research and thought teoritisasinya, this study suggests the importance of information technology and computer devices in constructing accountability of public services with a regulation that is responsive to local norms were chosen as apply and develop the local community. Public service accountability model that responds to the demands of society are expected to be able to resolve the various practical problems governing



procedures, costing, time and complaint mechanisms and the establishment of service facilities.

Public service accountability model composed constructively and more responsive, inviting public participation, it is necessary for further processing, so it is no longer intangible central normative decision. Accountability model constructed theoretically and conceptually when supported by information technology and computer software that is reliable, reflecting the pattern and accountability model that is not only responsive but also progressive and democratic.

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# UJARwayfinding: Sign Direction with Augmented Reality Approach

Nelly Oktavia Adiwijaya<sup>1</sup>, Achmad Maududie<sup>2</sup>

**Abstract**—The sign direction is needed to help people find their route to the intended destination. UJARwayfinding is mobile Augmented Reality based application which provides route information about the buildings stand apart in University of Jember (UJ). 3D object tracking method applied in this application use a poster as a real 3D object. This poster is used as a marker to be translated into a 3D virtual map of UJ. This virtual map contains the building, name and the path to reach on it. User can take the advantage of using this application to get the path from the main gate of UJ to the destination building. It can save the time especially for the new visitor about wayfinding problems. The result of this research also in line with supporting the smart campus development.

**Keywords**—Augmented Reality, sign direction, wayfinding.

## I. INTRODUCTION

RESEARCH on navigation or sign direction in a location have been carried out in the field of transportation management, human behavior and in terms of the technology used. Several studies about wayfinding problems taken in public places such as airports, terminal building, or in searching the public building like hospital. The main purpose of directional (wayfinding) is to find a path from one place to another.

In the airport terminals, passenger orientation (wayfinding) is one of the important factors for the layout design of it. It is common that some people have difficulties in locating their destinations in spite of availability of wayfinding aids. In order to maximize the visibility index, needs the solution to determine the exact location to place directional signs at the airport terminal (Tam 2011).

Wayfinding is the methodology of arranging indicators to guide people to their destinations. Signs are tools that aid in wayfinding. Architectural indicators such as light, color, materials, and pathways also play a large role in wayfinding. A successful wayfinding program is intuitive and self-navigable, and it protects the overall visual integrity of the site. Wayfinding is specific to its place and visitors. Signs improve and are most times integral to a clearly designed wayfinding program. The function of a sign is to identify, inform, direct, honor, restrict or permit. A good sign system recedes into the background while providing clear information when needed. In

addition, sign codes, life safety issues and disabled access guidelines need to be included to meet national and state requirements. Successfully designed signage helps visitors find their way, makes information accessible, provides an enhanced experience and honors donor recognition. In addition, an inclusive assessment of the environment and issues that affect orientation for first time visitors is imperative to a successful signage and wayfinding program. People tend to use landmarks, entry portals and pathways to help orient themselves and navigate public spaces. Most buildings have clearly designed pathways to destinations. In complex environments and when floor plans are discontinuous or confusing, signage may not always be sufficient (Beneicke, Biesek and Brandon 2003).

This study tries to build the sign of wayfinding to reach the buildings in University of Jember (UJ) area. UJ has 13 faculties, 2 Studies Program and several units department with the buildings stand apart over an area of 1,120,508.5 m<sup>2</sup>. The directions available are an arrow-shaped guide board at every intersection. The goal of the development of these sign directions (UJARwayfinding) is to develop a mobile service platform for tourist information based on the AR technology. Several navigation AR based technology has been developed at this time. In UJ, AR research can be said about this new one. UJARwayfinding targets users who are willing to discover a destination building in UJ area with 3D virtual location based information.

## II. RELATED WORK

So far, much work has been done in AR navigation to provide information about finding a path to the destination location. Nowadays, there are several so-called Mobile AR browser AR applications. Layar, Acrossair and Wikitude are probably the most well known. Layar, is an Android and iPhone based mobile AR browser that was launched in 2009 ([www.layar.com](http://www.layar.com)). Mobile AR navigation system for pedestrians also been made in London, UK. This system switch from an AR view to a conventional 2-dimensional view that covers a user's entire route. This application provide linear spatial data, particularly route information, in mobile augmented reality applications (Jang & Hudson-Smith, 2010). Another mobile navigation also been developed by vision-based localization as a navigation system AR android based. Image data of interest object and handset position are acquired by the users, however GPS position is not required for the

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system operation. (Möller, Kranz, Huitl, Diewald, & Roalter, 2012). The use of GPS and Compass signals of recent Android-based mobile devices has also been developed as an AR application to navigation (Wojciechowski, 2012).

### III. APPLICATION OVERVIEW

This application runs on the mobile devices with android operating system. Being a mobile based AR application, UJARwayfinding uses Metaio free version (www.metaio.com) and 3dsmax as a graphics rendering. This application can provide directional information from the main entrance of UJ (Fig.1) to the destination building inside.



Fig. 1 The main Entrance of Jember University

The used concept of AR technology works based on image detection. The image recognized by the camera integrated on a mobile device as a marker. Then the program will calculate whether the marker according to the database owned. If the marker has appropriate marker information then it will be used to display the virtual objects that have been created as an outcome of the application. This study uses a 3D object tracking method that recognizes all forms of real objects around, such as tables, boards, and others through the camera. Then the object detected will be translated and generate virtual objects to be added in real time to follow the state of the environment in the real world. 3D object as a marker on this application is a billboard that lists the name of the building located on the UJ campus area. Representation of the virtual objects in the form of route directions of the building uses a mobile device that has an integrated camera. Users who want to know the route of the buildings in the UJ area can obtain virtual route by pointing the camera on a mobile device to the billboard as a marker. The design of billboard building name as shown in figure 2.



Fig.2 Design (left) and the Billboard (right) as the marker

Outcomes of virtual objects that appear on the screen of mobile device can be viewed and used as a guide map to get to the destination building from the main entrance of UJ.

### IV. APPLICATION IMPELEMENTATION

This section will discuss the steps to develop UJARWayfinding applications. The first step is to make the design of billboard contain the buildings name of UJ. Layout design is made using the software CorelDraw Graphics Suite X5. These designs are then printed in large sizes into a billboard. This poster can be placed on the side of the main entrance of UJ. There are 11 buildings name written on poster as the image of X. This billboard as a real object used as a marker for UJARWayfinding application.

Next is the analysis and measurement of each route from the starting point to the location of each building. The data from google maps is not valid, so we have to collect the data using GPS, so it must be the real representation of UJ maps. The results of the measurement and mapping of UJ is shown by Figure 3.

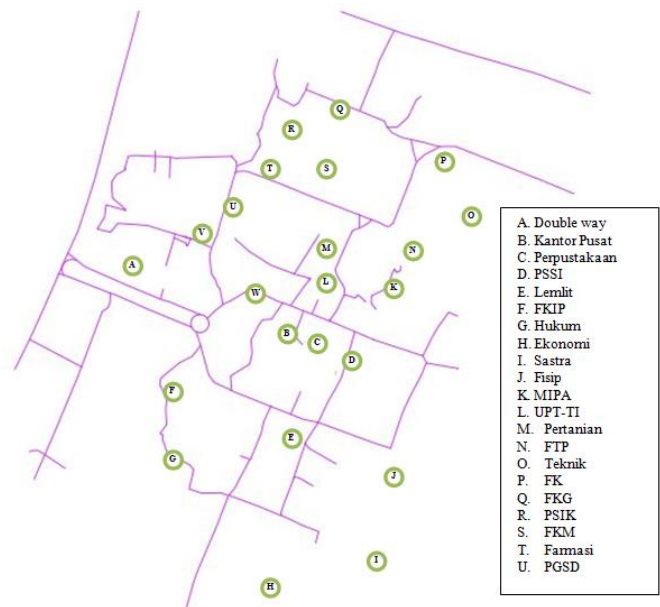


Fig. 3 UJ building site map taken by tracking with GPS

After creating a map of the UJ environment, then a 3D virtual object UJ environment is created complete with the location of the buildings in it. This virtual object creation uses 3dsMax software as .obj file extension exported into .FBX file extension. Result of the virtual objects shown as figure 4.

Next up is the mobile AR-based application development using eclipse editor. Application developed using the free version of the Metaio software. The downside of this version is a metaio's watermark on the outcome. The program translate marker into a 3D direction virtual object displayed on the mobile device screen. Figure 5 is the initial view when the application is running. And Figure 6 is the outcome of 3D directional virtual objects of UJ on the mobile device screen.

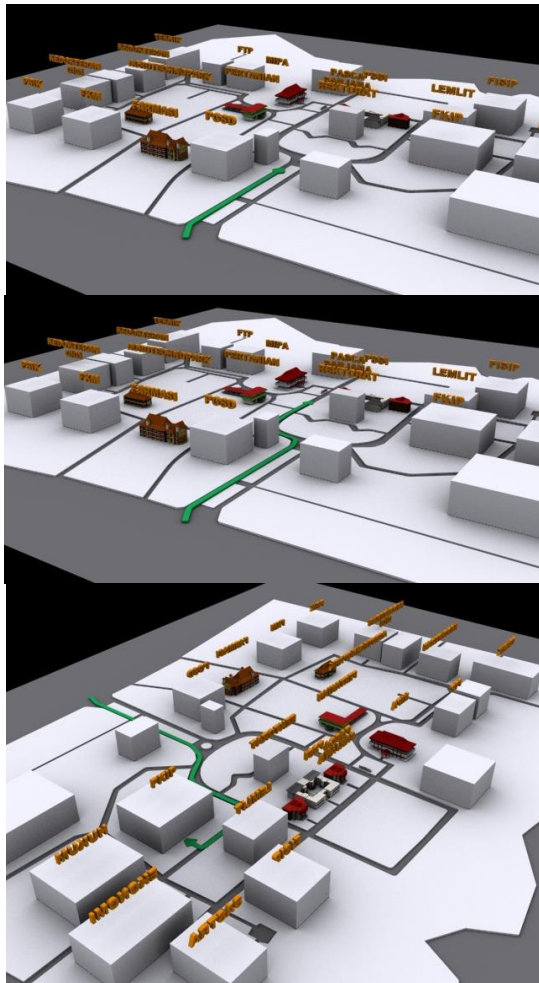


Fig. 4 3D virtual object of UJ environment

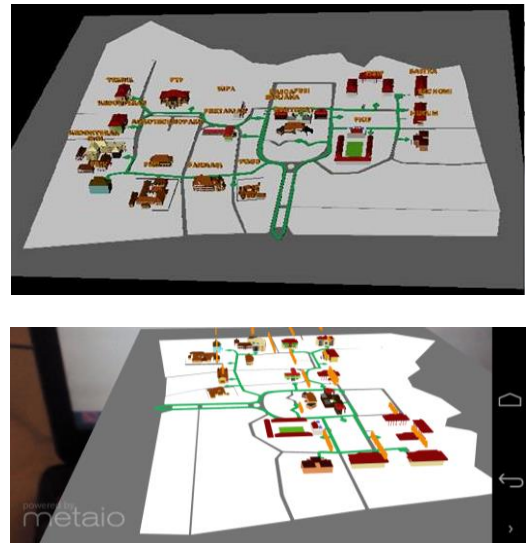


Fig. 6 The virtual object as the route information

This result being a first prototype of UJARwayfinding application which can be used as one way to support the development of smart campus. UJARwayfinding as the direction using mobile AR approach can be the first step of the AR research in UJ. The implementation of this research hopefully can be a signpost resource for the tourist within UJ. In addition, this research is also expected to be a pilot study for the next AR research at UJ as a part of developing UJ as a smart campus especially about AR field.

#### V. CONCLUSION AND FUTURE WORK

UJARwayfinding is a mobile Augmented Reality application oriented towards the UJ visitor. It allows user to find the destinations through information that combine reality and multimedia content. The application provides the route from the main gate entrance of UJ to the buildings around UJ area. The platform is Android based, detected the billboard as the marker to be translated become a 3D virtual object as the route information. This application can be the user guide or to replace the common sign direction to be more sophisticated. This application is also the first prototype in developing a smart campus concept with AR technology approach. Once the content is just 3D Object, future work will focus on using GPS data tracking and animation representation of the route visualization.

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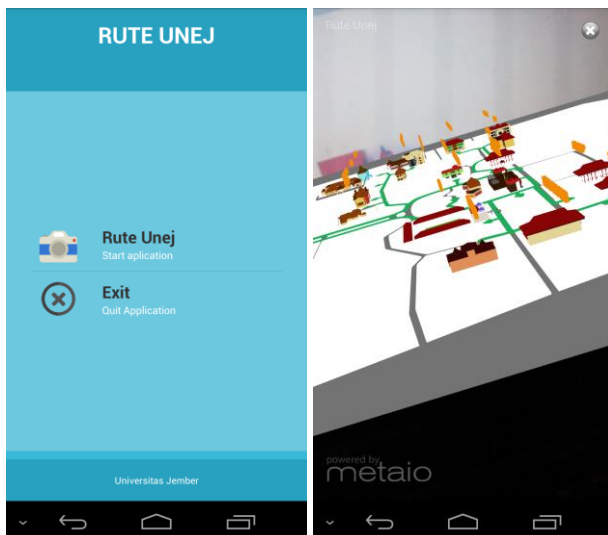


Fig. 5 Initial view of Application (left) and the outcome (right)

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## Simulation Saccharomyces Cerevisiae consumption rate and the Ethanol Formation in Batch Fermentation Process

Ni Ketut Sari<sup>1</sup>, Basuki Rahmat<sup>2</sup>, Awan Setyono<sup>3</sup>, I Nyoman Abdi<sup>4</sup>, Sutyono<sup>5</sup>

**Abstract** — Development of the biotechnology science application is not only based on biology alone, but also on other applied sciences such as computer microbiology, molecular biology, and so forth. Seeing this took researcher of issues on which the Saccharomyces Cerevisiae consumption rate and the ethanol formation or yeast genus, has the ability to ethanol formation by fermentation processes. Cerevisiae Saccharomyces consumption rate in the form graphs and provide information about the characteristics nature in batch fermentation process or bait-bulk. In the graphic representation the rate consumption Saccharomyces cerevisiae, there are several stages of the process such as by entering the initial value of the concentration biomass, key in the initial substrate concentration, volume broth enter the initial, put come value substrate concentration during the fermentation process, and begin value. Results graphic microorganisms rate consumption and ethanol formation in batch fermentation process is 50 grams/liter and 6%. From the simulations that have been conducted, obtained by the above chart rate consumption microorganisms and formation ethanol, can be used as an overview and breed actual comparison, so as to facilitate researchers in microorganisms test breed in the laboratory.

**Keywords** — *Saccharomyces Cerevisiae*, *growth microorganisms*, *batch fermentation*.

### I. INTRODUCTION

The development of the application of the science of biotechnology is not only based on biology alone, but also in the pure sciences and applied, such as computer microbiology, molecular biology, genetics, chemistry, mathematics, and so forth. Saccharomyces cerevisiae is yeast or yeast genus has the ability to convert glucose into alcohol and CO<sub>2</sub>. Some advantages of Saccharomyces cerevisiae in the fermentation process that is rapidly proliferating microorganisms, resistant to alcohol content, resistant to room temperature, nature has held steady and rapid adaptation, several species of Saccharomyces cerevisiae capable of producing up to 13:01% ethanol, this result is better than other genus such as Candida and Trochosporon[1].

Fermentation techniques that will be used in this study is the fed-batch, fed-batch which itself is a method that adds new media on a regular basis in a closed culture, without removing the culture fluid that is in the fermenter so that the volume of the culture was increasingly growing [7]. The process of

microorganisms proliferation of Saccharomyces cerevisiae fermentation with glucose as carbon source (food) given in liquid form, other variables that can affect the pH and temperature. Through the fermentation process, the proliferation of microorganisms can multiply in stages, so it takes a lot of food as well as longer periods of time. In the field of information technology science, biomass growth simulation applications that were originally developed manually then computerized. One technique that is often used is the fermentation of bio-fermentation process for the growth of Saccharomyces cerevisiae with a bait-bulk technique (fed-batch) method in which the bait-bulk (fed-batch) itself is a new method that rnenambahkan media regularly on culture closed, without removing the culture fluid that is in the fermenter so that the volume of the culture was increasingly growing to a certain extent [7]. Based on the study's predecessor made application graphical representation Saccharomyces cerevisiae growth of microorganisms that can be used to see the growth of microorganisms from the beginning to the end of the time limit specified in the form of a web-based growth charts using PHP (Hypertext Preprocessor) as a scripting language, inserted into the HTML to create dynamic web.

### II. STUDY LITERATURE

The flow rate of the substrate that is inserted into the fermenter is entered for growth microorganisms, the process begins with the initial determination of the concentration of microorganisms, the initial concentration of the substrate in the form of glucose and substrate concentrations that fall into a certain amount during the fermentation process. The growth of the fed-batch process requires aeration with a stirrer, a pH controller and temperature controllers. The fermentation process for the growth of Saccharomyces cerevisiae is modeled by a state equation as follows [5]:

$$\dot{x}(t)=f[x(t), u(t), p]+\xi(x), x(o)]=x_o \quad (1)$$

Where,  $x(t)$  = state solution at time  $t$  ( $0 \leq t \leq T < \infty$ ) and  $x(t) \in \mathfrak{R}^5$  where  $\mathfrak{R}$  space of positive real numbers, the control signal at time  $t$  is expressed in  $u_1(t)$  and  $u_2(t)$ , expressed as a critical parameter vector  $p_r$  and the dynamics of the process are not model its exact form is not known, expressed as  $\bar{\xi}_1$  and  $\bar{\xi}_2$ . Process starts at time  $t = 0$  and ends at time  $T$ , where  $T$  is generally of the order of hours or days. In this study,  $T$  is assumed to be 44 hours. Mathematical model for the fed-batch fermentation of *Saccharomyces cerevisiae* is growth, described using the following differential equation [5]:

$$\dot{x}_1 = \mu_m \frac{x_1 x_2}{k_s + x_2} \frac{1}{1 + x_3^2} - \frac{x_1}{x_5} u_1 + 0.48 x_1 \bar{\xi}_1(x) \quad (2)$$

$$\dot{x}_2 = -\frac{\mu_m}{k_y} \frac{x_1 x_2}{k_s + x_2} \frac{1}{1 + x_3^2} + \frac{u_2 - x_2}{x_5} u_1 - k_m x_1 - \frac{1}{0.51} x_1 \bar{\xi}_2(x) \quad (3)$$

$$\dot{x}_3 = 0.0023 x_1 + 0.007 \mu_m \frac{x_1 x_2}{k_s + x_2} \frac{1}{1 + x_3^2} \frac{x_3}{x_5} u_1 \quad (4)$$

$$\dot{x}_4 = x_1 [\bar{\xi}_2(x) - \bar{\xi}_1(x)] - \frac{x_4}{x_5} u_1 \quad (5)$$

$$\dot{x}_5 = u_1, \quad (6)$$

Where,

$x_1$  = microorganisms concentration

$x_2$  = substrate concentration

$x_3$  = inhibitor concentration

$x_4$  = ethanol concentration

$x_5$  = volume broth

$u_1$  = substrate flow rate

$u_2$  = concentration of the incoming substrate

$\bar{\xi}_1$  = magnitude related to ethanol consumptions

$\bar{\xi}_2$  = quantities related to the rate ethanol formations

From the above formula is written as a critical process parameters:  $\mu_m$ ,  $k_s$ ,  $k_y$  and  $k_m$  assumed as elements of a vector parameter  $p_r$  ( $p_r = [\mu_m, k_s, k_y, k_m]^T$ ). Formula used to determine the parameter vector  $p_r$  is assumed to vary with time as follows [5]:

$$\mu_m(t) = 0.41 + 0.01 \cos\left(\frac{2}{5}\pi t\right) \quad (7)$$

$$k_s(t) = 0.03 - 0.005 \cos\left(\frac{2}{15}\pi t\right) \quad (8)$$

$$k_y(t) = 0.4 + 0.1 \cos\left(\frac{2}{10}\pi t\right) \quad (9)$$

$$k_m(t) = 0.04 - 0.01 \cos\left(\frac{2}{20}\pi t\right) \quad (10)$$

In a qualitative relationship, the purpose of control is to determine  $u_1(t)$  and  $u_2(t)$  to maximize biomass production on interval  $[0, T]$  for assurance that  $x_4(t)$  concentration of ethanol, which has the effect of removing the final product is low. The second difficulty is the control problems that are caused by the nonlinear state of the plant and by the emergence of dynamics not termodelkan ( $\bar{\xi}_1(\cdot)$  and  $\bar{\xi}_2(\cdot)$ ) can be resolved. The problem can be increased in accordance with the fact that the values of the parameters (the elements of  $p_r$ ) may be unknown and the initial value  $x_0$  may be different from the desired initial conditions  $x_{0^*}$ . Dinamika tak termodelkan yang bersifat nonlinier,  $\bar{\xi}_1(\cdot)$  and  $\bar{\xi}_2(\cdot)$  as described above are each associated with ethanol consumption and ethanol formation rate. Based on a common known fact that ethanol production is formed after the value of the substrate concentration, before information as  $\bar{\xi}_1(\cdot)$  and  $\bar{\xi}_2(\cdot)$  known [5]. From the description above it is known that some problems arise when the dynamics is not models  $x_2(t)$  is greater than the critical value. As it has been used by [5], for the process was discussed  $x_2^* = 0.28$ . Where as if  $u_2^* = 200$ , vector parameters chosen as  $p = p^* = [0.52 \ 0.025 \ 0.5 \ 0.03]^T$  and the initial value of the state vector chosen as  $x(0) = x^*(0) = [10 \ 0.28 \ 0 \ 0 \ 10]^T$  then the resulting trajectory of the state  $x(t)$  (write as  $x^*(t)$ ) performasi showed satisfactory process. The process described using the equation (2)-(6) dengan  $p = p^*$ ,  $x(0) = x^*(0)$ ,  $u_2^* = 200$  and

$$U_1(t) = u_1^*(t) = \frac{x_5^*(t)}{200 - x_2^*(t)} \left[ 0.03 x_1^*(t) + \frac{0.42}{0.5} \frac{x_1(t) x_2^*(t)}{0.025 + x_3^*(t)} \frac{1}{1 + x_3^*(t)} \right] \quad (11)$$

Referred to as the nominal models, variables and parameters with an asterisk stating that the corresponding nominal value, and the system is said to be operated in the nominal regime. Website or the site can be defined as a collection of pages that are used to display text information, still or motion picture, animation, sound, and or a combination of these, both static and dynamic form of a series of interconnected

buildings, each of which connected to the networks page [2].

PHP: Hypertext Preprocessor is a programming language that is widely used for handling the manufacture and development of a website and php script can be implanted or inserted into the HTML. PHP is widely used to program dynamic web sites. PHP can be used to build a CMS. Integer data type is a data type that is useful for storing negative and positive integers, and not without a decimal or fractional value. This type can also be expressed in the form of an octal (base 8), decimal (base 10), hexadecimal (base 16). Object data type created with the aim that the programmer familiar with OOP, object data type can be a number, a variable or function, data can be inserted into program code that summarizes some of the functions and reduce the file size. Array or an Array of Primitive Types Compound, found in other languages program. Array data type is used to store a lot of data in a single variable. Null is a data type that can not load anything, how to set the variable to null is to insert a null value to the variable in question. Special data type that is devoted to saving resource, source or address. These variables can only be created by a special function that returns the value of a resource such as the use opendir function, mysql\_connect, mysql\_query and the like [4]

Data flow diagram (DFD) is a diagram that uses notasi- notation to describe the flow of the system. DFD is often used to describe sustu existing system or a new system that will be developed logically without considering the physical environment in which the data flows (eg by telephone, letter, etc.) or the physical environment in which the data is stored in a file card, hard drive, tape, diskette [6].

CDM or Conceptual Data Model is a model that is based on the assumption that the real world consists of a collection of basic objects called entities (entities) and relationships (relationship) between the entities. CDM is usually represented in the form of an Entity Relationship Diagram. While PDM or phsical also called data model is a model that uses a table to describe the data as well as the relationship between these data. Each table has a number of columns where each column has a unique name. In making a good application, a database design is usually done first. Using a data conceptual modeling, the database that will be made will be seen more clearly grooves and picture [3].

### III. RESEARCH METHODOLOGY

In the graphic representation of the growth of microorganisms, substrate flow rate incorporated into the fermenter equipped with tools to control the growth of microorganisms. The process begins with the initial data entry of biomass concentration, substrate concentration and the initial concentration of substrate, such as glucose in a certain amount, then initial volume value and broth value, ks, km, and ky. The growth of the fed-batch process is also influenced by earasi with a stirrer, a pH controller and temperature controller. System design graphic depiction of the growth of microorganisms *Saccharomyces cerevisiae* in fed-batch fermentation process is described in the flowchart in Fig. 1.

*Saccharomyces cerevisiae* in the picture above when the user access the web user will immediately be on the home page which is the beginning of the web page. Then the user can choose an existing category like reading an article that has been provided by the admin of the microorganism in question and an explanation of the techniques used in the fermentation of *Saccharomyces cerevisiae* growth microorganisms. Users also can use the graphic representation of the growth of microorganisms *Saccharomyces cerevisiae* are provided on the simulator menu, by entering some initial values of the factors needed growth of microorganisms and after the application is processed by the system user to get the results of calculation of the growth chart and its influential factors. User can also send criticism or suggestions as well as questions regarding the application graphical representation of growth of microorganisms *Saccharomyces cerevisiae* contact us page of which has been provided.



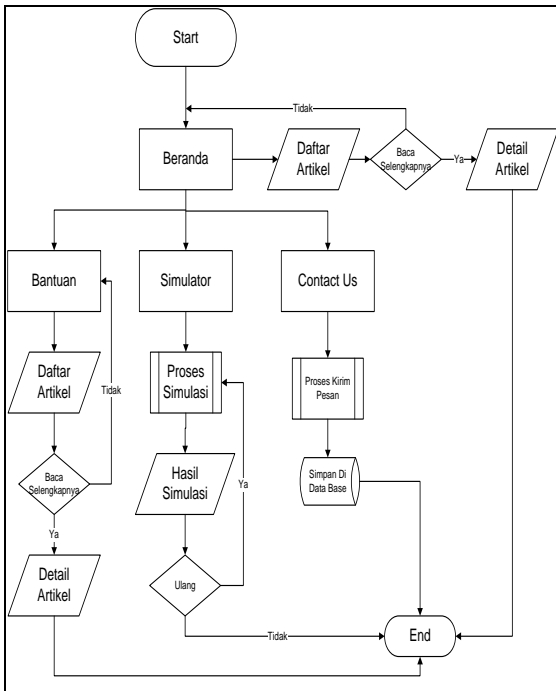


Fig. 1 Flowchart depiction systems growth charts

#### IV. RESULTS AND DISCUSSION

After the user enter the start and mesakkan value in the program, immediately perform calculations automatically and display the results of a calculation in the form of line graphs highchart.



Fig. 2 Graph results of the first experiment from Saccharomyces cerevisiae consumption rate

In the graph it can be seen the development of biomass concentration at the time of 44.1 to 75 g / l from an initial value of 10 g / l and has the highest value for 81gr / l at the 23rd hour later entering the substrate concentration was fixed 200 g / l to the time

limit for the experiment. The volume of broth which initially has a value of 10 g / l continues to increase until the end of the time limit of up to 288 g / l which indicates an increase in volume in the fermenter as a result of increased concentrations of biomass and substrate concentrations were entered.

#### V. CONCLUSION

System is a graphical representation of web-based Saccharomyces Cerevisiae consumption rate and the ethanol formation can help to illustrate the graph corresponding user enter the initial value, there are several articles on microorganisms Saccharomyces cerevisiae and some fermentation techniques as well as the usefulness and benefits. Designing a graphical representation of Saccharomyces Cerevisiae consumption rate and the ethanol formation can be used as an overview and comparison of the actual breeding, so as to facilitate researchers in testing the breeding of microorganisms in the laboratory.

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# Object Relational Mapping Method in Designing Database Structure for Mosque Management Information System

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**Abstract**—Mosque for Muslims actually not just for prayers and other rituals of worship, but it's the center of all activities of Muslims. Prosperity of the mosque is a noble thing in Islam, so the mosque has many activities to be undertaken, like praying, da'wah, education, healing conseling, Qur'an club, Islamic youth and student club, Islamic arts, and so on. Besides praying, many other activities sometimes can not informed easily to the community without coming directly to the mosque. This paper contribute how to build mosque activities management information system, especially the database structure, to support data recording, scheduling of activities, as well as providing a good display is essential to attract the attention of external users to access information and also engage in the mosque activities. This paper focus in designing database structure using object-oriented method and then ORM (object Relational Mapping), that will be able to simplify both system developers that use the OODB (Object Oriented Database) or RDBMS (Relational Database Management System) to build this system.

**Keywords**— Object Relational Mapping, Mosque, Database

## I. INTRODUCTION

Mosque for Muslims actually not just for prayers and other rituals of worship, but it's the center of all activities of Muslims. At the time of the Messenger Muhammad, the Prophet's Mosque serves as a place of worship, education center, information center, place for settling disputes, economic center, and also social and political center [1]. So, the mosque for Muslims has huge potential to build all aspects of human life.

Prosperity of the mosque is a noble thing in Islam, so the mosque has many activities to be undertaken, like praying, da'wah, education, healing conseling, Qur'an club, Islamic youth and student club, Islamic arts, and so on. Praying is a usual activities in the mosque, but many other activities can not informed easily to the community without coming directly to the mosque.

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From the observations and interviews, most of data in mosque are still in the papers, that make difficult to look for. Any difficulties are found when make a schedule, sharing the exact composition of the schedule preacher, and determining the appropriate title or theme of sermon/lecture that has been done or not. Manual content documentation of the sermon, sometimes are difficult to search as well as slow down the performance time. Besides, the presence of preachers sometimes can't be controlled by mosque committee because it's not recorded in a neat yet available. Eventhough the management of the mosque want to know the responsibility of the preacher concerned to meet the schedule of the mosque, and also need decision-making regarding the performance of the preachers.

Mosque management information system in this paper helps to manage the activities carried by mosque, include: First, the system can be recording data; such as activities and type of activities, imams, preacher/speaker, title and content of the sermon/lecture. Second, scheduling activities of mosques, both routine activities, such as praying 5 times, 5 minutes speach, sermon on Friday, Eid, Eid al-Adha, etc; and additional activities such as assemblies of science, religion consulting, area of youth activities, education, healing conseling, Qur'an club, Islamic arts, and so on. Third, providing attractive and good display to internal and external users to access information and also engage in the mosque activities.

In 2013, Ministry of Religious Affairs of the Republic of Indonesia inaugurated The Mosque Information Systems called *Sistem Informasi Masjid (SIMAK)* [2]. This information systems can facilitate the process of data inventory mosques and prayer rooms in Indonesia. Mosque Information System which can be a tool of work units to plan, manage and monitor the management of assistance and data management mosque/prayer rooms in Indonesia.

Different from the above, this article regarding how to design management information systems to handle activities in the mosque, particularly to design database structure. Because of many activities will be held in mosque, it's suitable when used object oriented design method .

Currently, information and communication technology is growing rapidly, so it can be a reference for system developers to buiild this system both in web based system [3] or mobile based system; by using the OODB (Object Oriented Database) or structural pattern with RDBMS (Relational Database Management System). This paper contribute how to

map object oriented design method to structural pattern in relational database, in terms of mosque activities, with still maintaining the performance of the database.

II. BASIC THEORY

Object Relatioal Mapping is how domain model are mapped to structures in the relational database [4]. Mainly, there are patterns and techniques for mapping of object-oriented structures, such as inheritance hierarchies, aggregations, relations. While coping with relations we will consider different kinds of relations by cardinality and orientation.

Strategies for mapping of inheritance, there are 3 ways:

- a) Hierarchy to a single table, this is probably the simplest approach for mapping of inheritance structures. Whole inheritance hierarchy is mapped to a single table, which should be named after most general class in the hierarchy. The table is equal to union of attributes of all classes in a hierarchy.

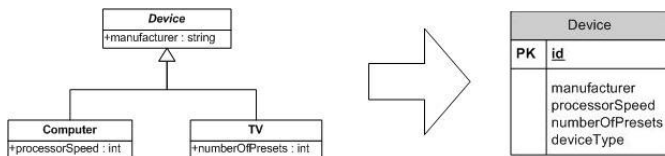


Figure 1. Hierarchy to a single table

- a) Each class to its own table, every class in inheritance hierarchy is mapped to its own table. Note that also abstract classes have their tables. Every table has attributes of its corresponding class. There are no attributes inherited from super classes here.

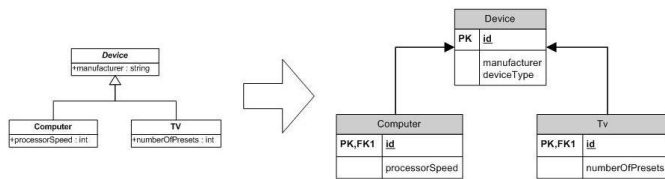


Figure 2. Each class to its own table

- b) Concrete class to its own table. By this pattern we map every concrete class from inheritance hierarchy to its own table. Attributes of this class as well as attributes of all parent classes are mapped to this table.

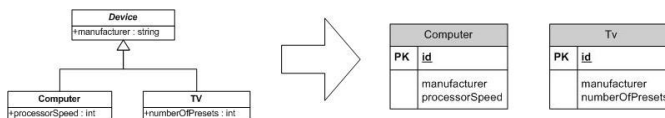


Figure 3. Concrete class to its own table

Objects can be connected together and can reference each other. These connections are called associations, shows in Figure 4-6. Special cases of association are composition and aggregation. Associations have some attributes. We will

examine these attributes and explore association types by these attributes.

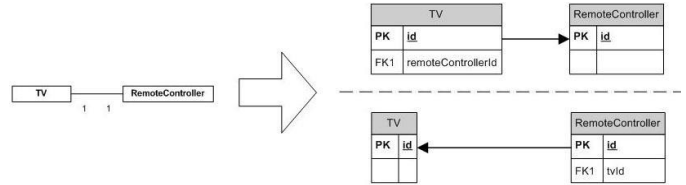


Figure 4. 1:1 association mapping

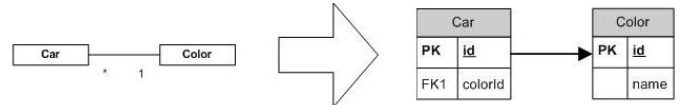


Figure 5. 1:n association mapping

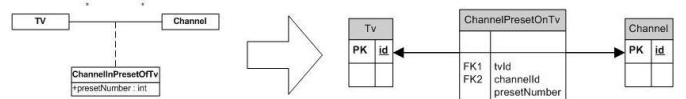


Figure 6. m:n association mapping

We can divide object associations into groups by criteria such as multiplicity, orientation or order. We will examine all of these criteria from the view of object-relational mapping. We will not consider deeply how multiplicity, orientation or order could be implemented in object-oriented environments. Instead, we will look how we can map these to relational database.

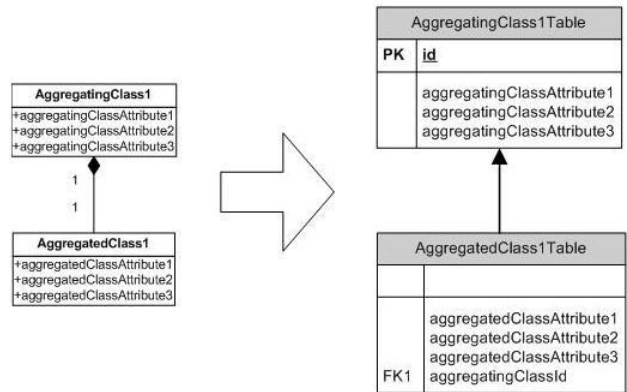


Figure 7. Foreign key Aggregation

For mapping aggregation, we can join the two class, becoming 1 table, both 1:1 aggregation or 1:n aggregation. We can join the table As we need no database join operations, this approach brings good performance. On the other hand, maintainability of such solution is very poor. Imagine, if there is a change in the database schema, will change the structure of the table. For example, the addition or subtraction of attributes, then we will increase or decrease the amount of columns in the table.

When using the Foreign key solution of aggregation pattern, we create separate database table for aggregated object type. Of course we have database table for aggregating object type. We add foreign key attribute to this table.

III. DISCUSSION

A. Usecase Diagram

These are the highest level of business requirements model of the system, pictured by usecase diagram in Figure 1 and 2. This usecase diagram shows the interaction between actors and system. Actors in this systems are head of mosque management who view reports and control activities of mosque and the daily operational management who enter data and manage data in the system.

In general, the capabilities of system are :

- 1) Manage Activities
- 2) Manage Person in Charge
- 3) Scheduling Activities
- 4) Documenting lecture/sermon material
- 5) Manage Rooms
- 6) Create Report
- 7) Print Documents



Figure 9. Use Case Diagram (2)

B. Class Diagram

Figure 10 shows the class diagram of The Mosque Management Information System. The structure of the pattern of the strategies used in class diagram using inheritance mapping strategy pattern 'Each class to its own table'. Because it has several advantages, among others:

1. Can observe a heavy load on the root class table.
2. The use of this pattern is convenient in this situations where there is a significant overlap between the types.
3. The relational model is very flexible so maintainable (treatment) and an almost ideal space consumption.

But he downside of this pattern is a poor performance, because we need many join table to get full information about the object, roughly equal to the depth of the class inheritance hierarchy.

Why we didn't use the 'Hierarchy to a single table' or 'Concrete class to its own table' for mapping inheritance? If we use 'Hierarchy to a single table', drawback of resulting database schema is its space consumption. There are lots of NULLs and we can observe that with bigger amount of classes we have bigger amount of wasted space. Mosque has many types of activities, if the becoming only one table, there will be lots of NULLs when it's not a type of activity. Eventhough this structure has good performance because we need only one select to get particular object with all its properties. We need no additional joins. It has has maintenance of resulting scheme

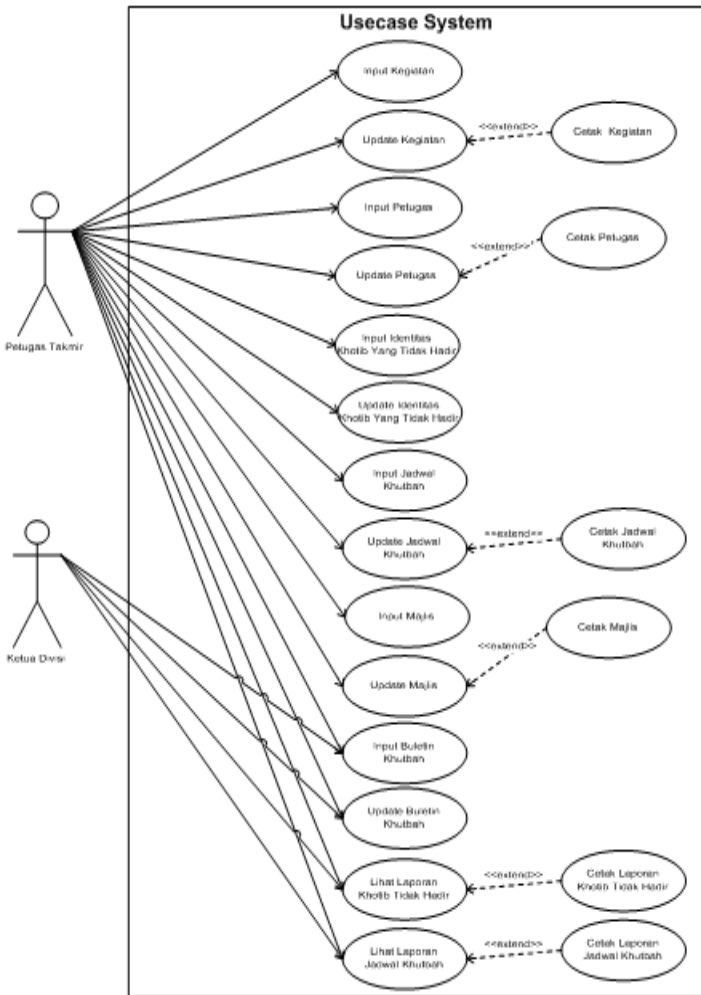


Figure 8. Use Case Diagram(1)

is very easy.

We also didn't use 'Concrete class to its own table', because we can also observe that even a small change causes a change in the object model of the whole object of the child tables turned. The use of this pattern is suitable in a situation where we assume that the object model will not change very often, while it could be activities in the mosque is often change

Figure 11 .Generic Table Structure

C. Generic Table Structure

Then generic table structure can be displayed in Figure 11. This section will explain the relationship table database created in this system, indicating the primary key that is marked with PK symbol, and foreign key marked with FK symbol that connect with other tables.

IV. CONCLUSION

Object Relatio Mapping is how domain model are mapped to structures in the relational database. Each type of mapping strategies above has positive and negative impact for the performance of database. We have to consider what the best solution for mapping.

The mapping strategy that used for mapping inheritance in this system is 'Each class to its own table'. Because mosque has many activities and many types of activites that also can change anytime, so we have to choose the flexible model to maintain the data without changing the database structure and wasted a lot of space consumption.

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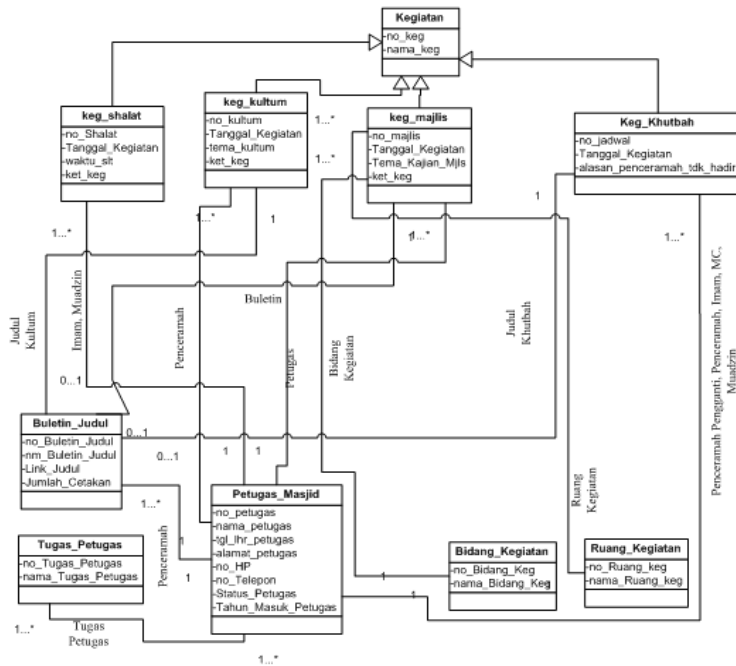
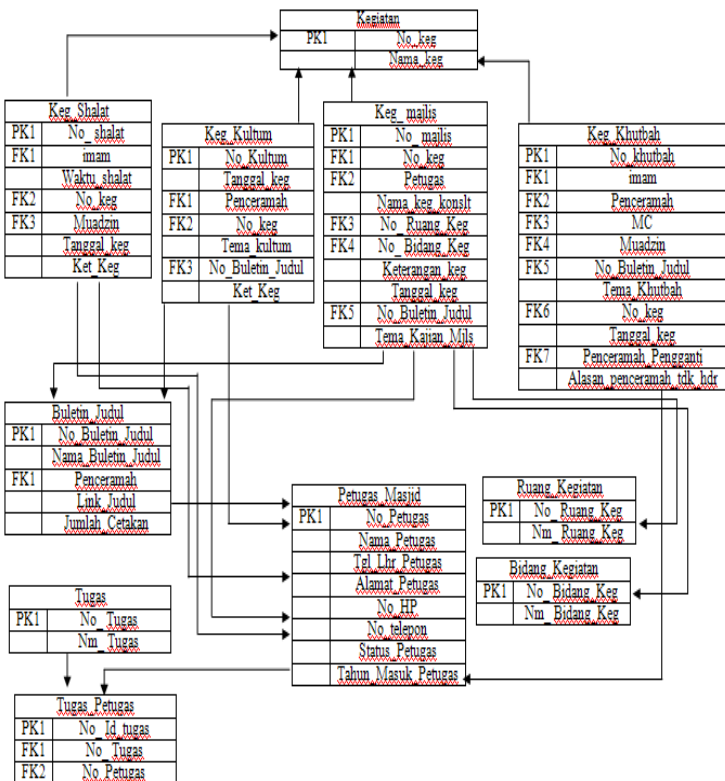


Figure 10. Class Diagram Mosque Management Information System



# Mobile Web-Based Training (Case Study: Vocational of Education Development Center (VEDC))

Nurhayati<sup>1</sup>, Ariani Indrawati<sup>2</sup>

**Abstract**— A conventional education and training between educators or trainers and training participants in the classroom has limitations. Moreover, the process of learning which almost entirely done in the classroom allow for delays in delivery learning material or even cannot be delivered if the meeting is canceled. To resolve the issue, many educational and training institutions implement a web-based training. But the development of technology, web-based training is considered no longer sufficient, because they are not entirely compatible with mobile devices. Moreover, there is significant growth in the use mobile technology by people around the world, especially in developing countries. The citizens of the world use mobile technology to complete everyday task and to socialize with friends and colleagues. In addition, according to data from Vocational of Education Development Center (VEDC), there are huge amount of training participants who have not been accommodated. Hence, education and training should be deliver learning materials on mobile devices. Therefore, the author felt the need to provide solutions to this problem by creating a mobile web-based training application in order to fulfill the training necessity. Development of mobile web-based training is designing by using Unified Modeling Language (UML) and Rapid Application Development (RAD). For the construction process we use HTML5, PHP, jQueryMobile, and MySQL. To test the application running on different devices, author will test on 40 user's mobile devices.

**Keywords**— Mobile web, Mobile learning, Mobile web-based training.

## I. INTRODUCTION

A Conventional education and training between educators or trainers and training participants in the classroom has limitations. Moreover, the process of learning which almost entirely done in the classroom allow for delays in delivery learning material or even cannot be delivered if the meeting is

canceled. To resolve the issue, many educational and training institutions implement a web-based training. But the development of technology, web-based training is considered no longer sufficient, because they are not entirely compatible with mobile devices. Moreover, there is significant growth in the use mobile technology by people around the world. In 2010, more than 63 million people in the United States accessed the Internet from a mobile device, as shown in Figure 1 [4].

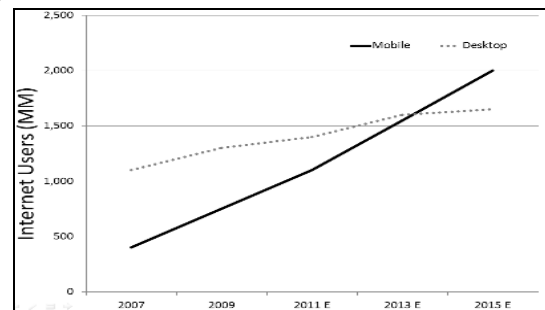


Fig 1. The increase in the number of mobile internet users

In addition, there are huge amount of training participants who have not been accommodated. According to data from VEDC until March 2013, the number of vocational school teachers of business and tourism approximately 42.360 teachers, while in the last 5 years, VEDC can only accommodate about 660 participants each year [7]. Otherwise, PP No. 74 Year 2008 mandates that teachers should keep doing their duties, despite being followed improvement teachers competencies activities. On the other hand, Permendiknas No.16 Year 2007 about qualifications standards and teacher competencies mandates the teacher must comply the qualifications standards and teachers competence.

Under such conditions, education and training should be deliver learning materials on mobile devices. Therefore, the author felt the need to provide solutions to these problems by creating a mobile web-based training in order to fulfill the training necessity.

Mobile learning through the use of wireless mobile technology allows anyone to access information and learning materials from anywhere and at anytime. As a result, learners have control of when they want to learn and from which location they want to learn. Learners do not have to wait for certain time or go to a certain place to learn. With mobile

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learning, learners will be empowered since they can learn whenever and wherever they want. Workers on the job can use the mobile technology to access training materials and information they need it. Educators and trainers are empowered since they can use the mobile technology to communicate with learners from anywhere and at anytime. At the same time, educators and trainers can access learning resources from anytime and anywhere to plan and deliver their lessons.

Rather than acquiring another technology to receive learning materials, people will want to access learning materials on their existing mobile devices. As a result, educators and trainers must design mobile learning technology which can be accessed on different types of mobile devices. This paper show how to design a mobile web-based training.

## II. RELATED WORK

### A. VEDC

VEDC is a government agency engaged in development and empowerment of teachers and educators as well as community in the field of business and tourism through education and training [7].

### B. Mobile Learning

ADL describes mobile learning as [6]:

“Leveraging ubiquitous mobile technology for the adoption or augmentation of knowledge, behaviors, or skills through education, training, or performance support while the mobility of the learner may be independent of time, location, and space.”

Unlike other learning technologies, mobile learning is unique in that it can accommodate both formal and informal learning in collaborative or individual learning modes. Based on ADL’s view of mobile learning it could be presented within any of the following learning scenarios [6]:

- blended learning
- classroom augmentation
- contextual learning
- game-based learning
- just-in-time learning
- media learning
- personal learning networks
- search-based learning
- training courses
- simulation-based learning
- social media-based learning
- spaced learning

### C. The FRAME Model

The Framework for the Rational Analysis of Mobile Education (FRAME) model describes mobile learning as a process resulting from the convergence of technologies, human learning capacities, and social interaction. In the FRAME model, mobile learning experiences are viewed as existing

within a context of information. Collectively and individually, learners consume and create information. The interaction with information is mediated through the complexities of this kind of interaction that information becomes meaningful and useful. Within this context of information, the FRAME model is represented by a Venn diagram in which three aspect intersect (Figure 2) [5].

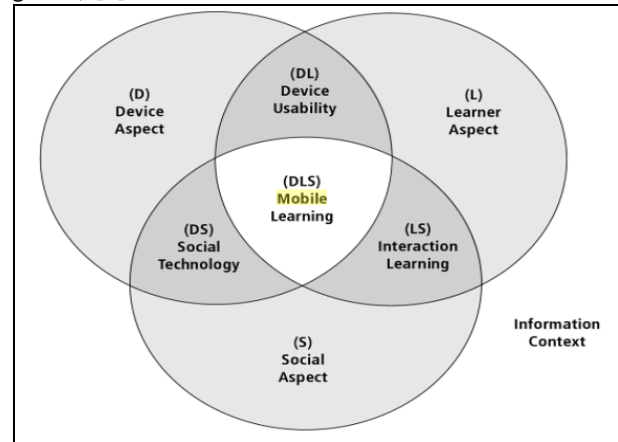


Fig 2. The FRAME Model

The circles represent the characteristics of the device, the learner, and the social. The Device Aspect (D) takes into consideration the physical characteristics, input and output capabilities, file storage & retrieval, processor speed, and error rates. If using this model for other technologies, other characteristics might come into play. The Learner Aspect (L) focuses on the characteristics of an individual such as prior knowledge, personal history, memory, emotions, learning styles (if you subscribe to a belief in learning styles), and ability to transfer skills and knowledge from context to context. The Social Aspect (S) takes into consideration processes of conversation and cooperation, the sharing of signs and symbols, as well as social and cultural beliefs and values [5].

### D. Mobile Web

The mobile web, from user’s perspective is basically just web content accessed from a mobile device [2]. From a developer’s perspective, however, the mobile web definitely exists, and it’s a group of best practices, design pattern, and even new code [2].

## III. PROBLEM FORMULATION AND SOLUTION

Most education and training institute have a web-based training, but many do not compatible very well to a mobile device. Hence, education and training should be deliver learning materials on mobile devices with many benefits, are:

- minimize the cost of education and training
- reach more participants
- operational cost of mobile devices is affordable
- allows anyone to access information and learning materials from anywhere and at anytime



- a mobile web presence takes the desktop site content and renders the information to be easily consumed on a mobile device.

In order to develop mobile web-based training, we use three methods of data collection: interview with the stakeholders on VEDC, observation is done by looking how the current system at VEDC, and literature review by collecting data and information related to the research through books, electronic media, and so on. Designing by Unified Modeling Language (UML) and Rapid Application Development (RAD) model for system development methods, which has the following stages:

1) Plan Requirement

On this stage, authors will directly observe training activities at VEDC, and also interviewed the stakeholders who related to training activities. In the end, the authors will conclude the needs of users and system from observations and interviews.

2) Design Workshop

This stage divided into two phase, namely:

- Design

For system’s design, the authors will use UML. UML is used to describe the design process of applications, which includes use case diagram, activity diagram, sequence diagram, and class diagram. Authors will conduct database design, to create class diagrams and structure of the database and also create relation between the tables. Authors will also design the application interface.

- Construction

For construction stage, authors use HTML5, PHP version 5.0.5, jQueryMobile version 1.3.0, and MySQL version 4.1.14.

3) Implementation

On this stage, authors will run mobile web-based training on simulator opera mobile for pc, and three mobile devices with different platform. Authors will also conduct test by running the application on 40 user’s mobile devices.

IV. ANALYSIS AND SIMULATION RESULT

A. Plan Requirement

As the operational events and user wishes mobile web-based training to be made are as follows:

- Application can be run on different types of mobile devices.
- Computerized data management, from registration to print certificate.
- Discussion facility

B. Design Workshop

This stage is divided into two phases, namely:

1. Design

- System Design

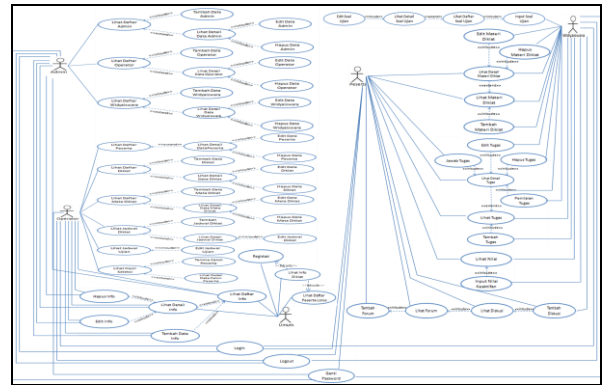


Fig 3. Use Case Diagram

- Database Design

The database required on mobile web-based training is as follows:

TABLE I. DATABASE REQUIRED

No.	Table Name	Function
1.	Department	Store id and department name
2.	Employee	Store personal data of employees
3.	Department_Employee	Store employee and department relation
4.	Courses	Store id and courses name
5.	Courses_Department	Store courses and department relation
6.	Courses_Employee	Store courses and employee relation.
7.	LearningMaterials	Store learning materials data.
8.	LearningMaterials_Courses	Store learning materials and courses relation.
9.	Assignment	Store id, order, and deadline of a assignment.
10.	Assignment_Courses	Store assignment and courses realation.
11.	ExamQuestions	Store questions, multiple choice, and answer from a exam
12.	ExamQuestions_Courses	Store exam data and courses relation
13.	Participants	Store personal data of training participants.
14.	Participants_Courses	Store training participants and courses relation.
15.	Assignment_Participants	Store training participants data and assignment data relation.
16.	ParticipantsGrade	Store training participants grade in a course.

- Interface Design

Figure 4 is a few sample of the mobile web-based training interface design.

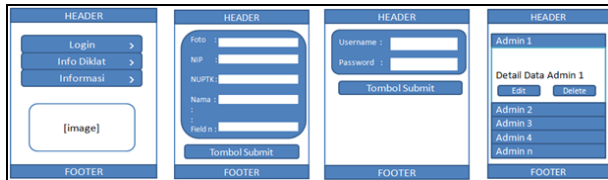


Fig 4. Interface Design

2. Construction

Encoding process is done using HTML5, PHP version 5.0.5, jQueryMobile version 1.3.0, and MySQL version 4.1.14.

C. Implementation

Figure 5 is a few sample of display the mobile web-based training on opera mobile simulator for pc.



Fig 5. Interface display on opera mobile simulator.

Figure 6 is three output format tested on three device with different platform.

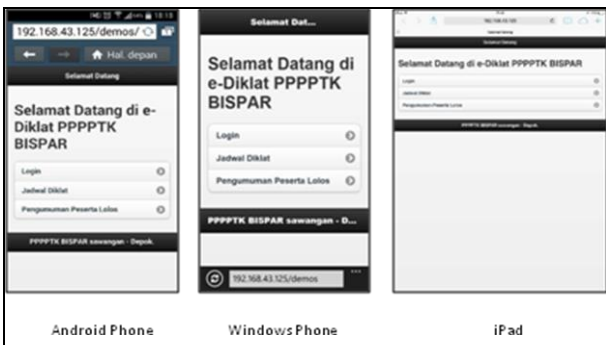


Fig 6. Interface display on mobile devices.

D. Testing

After the mobile web-based training is successfully executed, the next step is testing the mobile web-based training. Testing done by user running the application on their mobile phone. The result of the test, mobile web-based training can run on 37 of 40 mobile devices.

V. CONCLUSION

System development methods model of Rapid Application Development (RAD) with three stages, namely plan requirements, design, and implementation. The plan requirements of a mobile web-based training at VEDC begins with the collection of data by 3 methods, namely interviews, observation, and literature study. The tools system design used is the Unified Modeling Language (UML). While the development of mobile web-based training using HTML5, PHP version 5.0.5, jQueryMobile version 1.3.0, and MySQL version 4.1.14. As for testing application of the results

obtained features can work well, as well as mobile web-training can run on 37 of 40 mobile devices or 92.5% of testers.

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# Maps Dynamic Collaborative Learning In Indonesia Integrated and Open Online Learning (PDITT)

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## Abstract

The development of the education system in Indonesia is one of the significant priorities because there is still a gap between the level of community participation and the opportunity to acquire learning resources and integrated easily. Indonesia government has implemented Integrated and Open Online Learning (PDITT), which would bring fresh air to the wider community, not just for colleges and universities, but also citizens are able to participate actively in this policy. In practice, PDITT still need an outstanding development of the methodology as well as architecture. Dynamic Collaborative Learning is one of the workflow execution can promise PDITT will able to run better and qualified above average compared to other learning systems architecture model. The study produced a map that can be used as a reference for developing business processes PDITT system.

**Keywords:** Dynamic Collaborative Learning, Online Learning, Workflow

## 1 Introduction

In the National Medium Term Development Plan (RPJMN) 2010-2014, the Government of the Republic of Indonesia has set the development of education became a national priority. In the Strategic Plan, it is stated that education is important and urgent instrument in economic and social development. Education is expected to support efforts to alleviate poverty, improve gender equity and equality, and strengthening cultural values.

Based on the data of the working population in 2001, which is nearly 100 million, more than 60 percent of educational background in elementary school (SD) or did not complete primary school. In fact, nearly ten years later in 2010 the Indonesian labor is still dominated by graduates from high school (SMA) and Vocational School (SMK) as much as 50%.

This condition is not without reason, because one of the major problems faced by this nation is because only a small fraction of them are able to continue their education to the college level. In addition to funding constraints, the limited capacity of the college is also a

strategic issue for secondary education graduates to achieve the dream as a scholar. The total number of students from public and private universities, as well as including the Open University students (UT) in 2010 alone was approximately 5.2 million. While the number of Indonesian population aged 19 to 25 years (the age of the potential for learning in college) to 21,184 million, meaning there are about 16 million people in Indonesia have not been able to get an education in college [1].

In 2009, the number of registered universities within the Directorate General of Higher Education is composed of as many as 3,016 83 State Universities (PTN) and the 2933 Private Higher Education (PTS). The existence of such colleges spread across the major cities, provinces, and parts of Indonesia. However, the distribution of colleges in each city, region, or the region where there is uneven or the city very much and college populations elsewhere are very limited and may not even exist.

In line with the distribution of colleges based Kopertis/PTN, and regional as described above, where the college has spread throughout the province. That is, in every province in Indonesia has established a college of varying amounts.

**Table 1. The number of colleges in the Higher Education environment based on the province where the organization of educational activities**

	NAMA PROVINSI	JUMLAH		NAMA PROVINSI	JUMLAH
01	DKI JAKARTA	323	18	SULAWESI TENGAH	29
02	JAWA BARAT	381	19	SULAWESI SELATAN	203
03	JAWA TENGAH	242	20	SULAWESI TENGGARA	35
04	D I YOGYAKARTA	124	21	MALUKU	22
05	JAWA TIMUR	327	22	BALI	52
06	NANGROE ACEH DARUSSALAM	95	23	NUSA TENGGARA BARAT	45
07	SUMATERA UTARA	239	24	NUSA TENGGARA TIMUR	36
08	SUMATERA BARAT	107	25	PAPUA	39
09	RIAU	69	26	BENGKULU	17
10	JAMBI	37	27	BANTEN	102
11	SUMATERA SELATAN	106	28	MALUKU UTARA	15
12	LAMPUNG	72	29	KEPULAUAN BANGKA BELITUNG	14
13	KALIMANTAN BARAT	40	30	GORONTALO	11
14	KALIMANTAN TENGAH	22	31	IRIAN JAYA BARAT	17
15	KALIMANTAN SELATAN	40	32	KEPULAUAN RIAU	27
16	KALIMANTAN TIMUR	62	33	SULAWESI BARAT	17
17	SULAWESI UTARA	49		<b>Grand Total</b>	<b>3.016</b>

Moreover, the existence of the college has spread in 300 cities / districts across Indonesia. These data show that when the number of cities / districts across Indonesia as much as 471 cities (Ministry of Home Affairs in the National Conference III APEKSI in Solo, 2008), then 64% have had college. However, college is not spread evenly and not even proportional to the number of existing students.

Advancement of information and communication technology currently carries a variety of changes in human life. Role of Information and Communication Technology (ICT) is increasingly felt in various sectors, particularly in education. The role of ICT in education is expected to improve the quality of education as one of the pillars of nation building. Improving the quality of education to be a priority with the realization that success in the future of a nation depends on the quality of education. Therefore, the Ministry of Education and Culture was seriously put the pillars of education through the mission, known as 6 K, for instance: Availability, Affordability, Quality, Relevance and Culture, Equity and Certainty [3].

Learning resources is one of the aspects of education that must be available, affordable, high quality, relevant to the needs of society, and are accessible to all, with no discrimination based on sex, age, religion, race, and is guaranteed certainty in accessibilities. Currently the achievement of these goals can be accomplished with a single word that is "technology". The development of information and communication technology has been so rapid, those has an impact on the ease of social networking, and have access to information, as well as interacting directly with no limits of space and time.

In order to carry out its mission to achieve the vision of the Ministry of Education and Culture has attempted to open up access using network technology and communication technology. The presence of Electronic School Books, and Home Learning is a powerful tool for students to learn without knowing their existence and time. Learning is very efficient, because the same learning resources that can be used by thousands of people at the same time.

Learning will appeal particularly to students, if the information is presented in easy to understand these facilities, please, make the participants learn more and more curious to know, and cheap. Content that is complete, clear, growing interest in learning, will be favored to the growing community of intelligent, knowledge-rich, even capable of developing science through experiments, research, studies that will ultimately empowered with the development of competence.

Achievement of the above mission, especially at the college level has not been encouraging with the

facts that: the limited capacity of the college; PT is low affordability due to the uneven distribution thereby increasing the cost of tuition and accommodation; most PT yet have adequate resources and quality education, quality PT more concentrated on the island of Java; Have not been able to achieve higher education and equal quality; Have not been able to guarantee the fulfillment of the needs and demands of higher education quality. Therefore, special strategies are needed to be able to provide high-quality education that is affordable for the whole Indonesian nation in a short time and low cost.

Through Online Learning program Indonesia Open and Integrated (PDITT), Directorate General of Higher Education (Higher Education) with several participating universities to organize lectures online as real action to resolve these issues over the long term. In the short term we strive to improve the quality of lectures at universities is carried out through a network to be realized as an online college. Improving the quality of lectures in the network is achieved through the application of process standards and content standards in the development of courses held in PDITT platform. Content standards and process standards is based on national standards of education and ISO 19 796 and ISO 29163 [3].

## **2 Literature Review**

### **2.1 Collaborative Learning**

Collaborative Learning method refers to a method of learning that focuses on the success of the process. Unlike the cooperative learning methods, which focus on results. In language both mean the same work. Collaboration comes from the Latin, while the cooperative from English (United States). Collaboration refers to the philosophy of interaction and personal lifestyle, whereas a more cooperative interaction illustrates a structure designed to facilitate the achievement of a particular outcome or goal. The importance of collaborative learning methods assumes cooperative collaboration, working together in the community. In one community or group competition does not occur, but rather to work together to achieve a common goal. In the classroom, when a teacher does this, it is called collaborative learning [4].

### **2.2 Learning Architecture**

Another approach to instructional models adjusted based learning architecture. Learning can be modeled into four different learning architectures, which is presented in Table 2.

Table 2. Instructional Architecture Model

Learning Model	Description
<b>Receptive</b>	This model puts students in a passive role as listener or observer. The presentation in the form of a long exposure without questioning or row of the display on the screen without interactivity. In this model the student is completely passive and not able to determine the sequence and duration of events.
<b>Directive</b>	This model puts students on a more active role. Learning directive presents the material in the form of small sections were immediately followed by an opportunity to interact and exercises to apply the knowledge that is being studied. Although the students more active role, but they are not in control of the sequence and duration of learning.
<b>Guided discovery</b>	Guided discovery learning models, its main base is problem solving. Ideally, the problem given to students is a replica of the type of problems to be faced in the world of work. Learners also receive support materials in the form of techniques, methods or ways can be used to solve these problems.
<b>Exploratory</b>	Exploration model study provides a collection of materials in bulk and complex for students to learn something new. In this model, learning is not guided or directed in a way. Learners are free to choose from the many learning experiences provided for the control of a new knowledge.

### 3 Collaborative Learning Maps

#### 3.1 PDITT Reference Framework

The embodiment of the design principles mentioned above as well as how to answer these questions pursued through the development process KDITT based on ISO 19 796: Part 1, which includes the process of developing learning systems, education & training. Stages or steps recommended development are illustrated in Figure 1 [4].

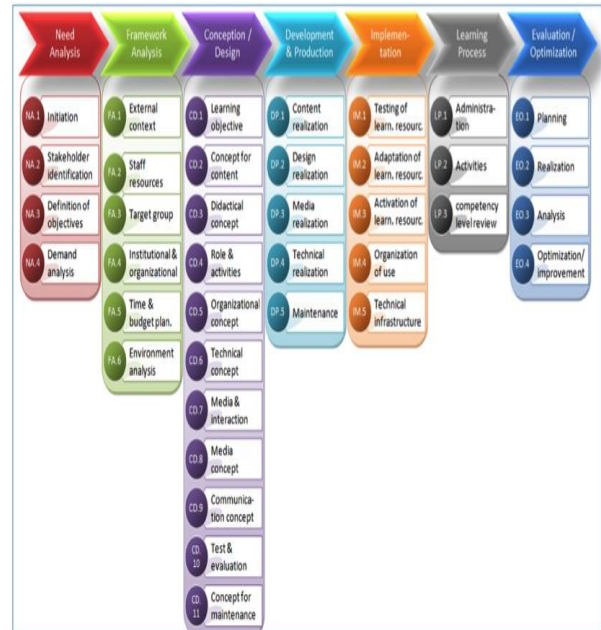


Figure 1. Reference Framework for Description of Quality

#### 3.2 Maps Dynamic Collaborative Learning

Maps are a visual collaboration will produce content rich and interesting, because it is designed specifically for the advanced aspects of the dialogue in small teams through coaching activity based on a sequence of self-facilitated occurrences. In this methodology, the communication between entities or actors learning will be accommodated based on the deconstruction of a business solution in an interactive and effective. Interactivity takes place during the process, participants will perform the development and understanding of the material based on real time, and use the learning scenarios are realistic [4, 5, 6].



Figure 2. Maps Dynamic Collaborative Learning

In the picture above can be seen that each indicator has a level of interactivity in a comprehensive entity [7]. Business solutions offered by this model promises a high level of participation among the participants. For further descriptions for each variable, can be seen in Table 3 below:

**Table 3. Maps Dynamic Collaboration Learning Description**

<b>Maps Variable</b>	<b>Description</b>
<b>Effective</b>	Dynamic Collaborative Learning based on adult learning methodologies, and proven to help participants more easily to translate concepts and new information more quickly. The model will also open in the open perspective due to the better aspects of knowledge absorption.
<b>Easy to Roll Out</b>	Due to the method of Dynamic Collaborative Learning is independent and is designed to allow participants to facilitate themselves, they can use the service group with a limited number of participants at different times and locations. This is certainly going to make a different atmosphere when using other similar methods of learning.
<b>Engaging and Fun</b>	One of the unique characters of this method is the learning process that uses a model of discussions in small groups to do a disagreement that will create a solid group.
<b>Versatile</b>	Another advantage of the method is Collaborative Learning Maps have proved successful in the implementation of some of the topics, and the topic can be designed to achieve the learning objectives.
<b>Experiential</b>	Collaborative Learning Maps method allows participants to dissolve in the learning process so as to create harmonious conditions among participants and educators.

## 4 Summary

Developing the capacity and capability of the education system in Indonesia cannot be simply a way to develop the infrastructure and information systems of learning in it alone. There needs to be a great plan contained in the grand design of the learning system so that all the people of Indonesia without exception can enjoy a better learning system. This research has produced a map in which the Dynamic Collaborative Learning into the core framework is shown to accommodate the needs of local and indigenous of Indonesia society.

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# Design of Application Framework for Multi-Tenant Asset Management System

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**Abstract**—A software framework is an abstraction in which software providing generic functionality can be selectively changed by additional user-written code, thus providing application-specific software. It is a universal, reusable software environment that provides particular functionality as part of a larger software platform to facilitate development of software applications that suit for customer needs. An application framework consists of a software framework used by software developers to implement the standard structure of an application. An application framework can facilitate development of specific application in a domain problem. An application framework for problem domain of asset management system, enables software developers to create a variety of specific applications based on the that an application framework, such as chemical plant assets management system or asset management system for managing telecommunications assets (eg. base transceiver station).

This paper explains steps of application framework design for multi-tenant asset management system. Feature Oriented Domain Analysis (FODA) is used in analysis activity, and design patterns are implemented when creating class diagrams in design activity. The result of the design are artifacts as guidance to write codes for an application framework in development activity. These artifacts also provide information for software developers to know reusable parts (common spots) and parts that can be modified (hot spots) to develop a multi-tenant asset management system that specific to their needs. Applications that are developed base on this an application framework can be applied in Software as a Service environment.

**Keywords**— Application framework, asset management system, design pattern, FODA, SaaS, software framework.

## I. INTRODUCTION

SOFTWARE development process consists of these activities : Specification & analysis, design, development, validation and evolution [1]. Generally, after getting the user requirements in specification activity, then continue with design activity, artifact of this activity are classes, user interface and database design. The next activity is software development, in this activity program codes is written based on the results of the design. generally program codes is written from scratch. If there are many softwares that had been developed in same problem domain, then software developers

should know there are patterns that can be reused so that the design and development activities should not be done from scratch. And they can decrease time and cost in software development.

Asset management system is one of the software which is widely used, because its function is essential to many companies or organizations. Asset management system is software to help keep records of assets, recording the condition of each asset and determine financial cost for management to ensure that assets are in the good condition. This system is needed by many organizations or institutions to manage their assets. Types of assets that it managed by each company or organization may vary, depend on their core business. Assets are managed by the telecom company will be different from assets are managed by the chemical production company. That is why there are many variations of a software of asset management system.

Although software can help business processes in an organization or company, procurement and operation of the software requires a huge cost for purchase hardware and software, they also must pay salary for people those who manage both software and hardware. Today, there is new kind of software, that is called Software as a Service (SaaS) that has been widely used. SaaS is part of the Cloud Computing. This kind of software are not owned by users, they only can rent and pay what they had used. SaaS can reduce the cost for purchase hardware, software and salary for people who had to manage. Multi-tenant is one of SaaS's characteristics, it is mean this software can be used by a lot of organizations, companies or users.

This research is based on some of the problems outlined above. Purpose of this research is designing an application framework for problem domains those are mentioned above : asset management systems and SaaS. As well as software development in general, development process for an application framework also consists of these activities : (1) specification and analysis, (2) design, (3) development, (4) validation and (4) evolution. This paper only describes the specification activity, then continued with design activity. For specification activity will use Feature Oriented Domain Analysis (FODA) method to analyze those two problem domains to get an application framework's requirements. In the design activity, class diagrams are designed with the concept of design pattern. This activity is also designing a sequence diagrams to describe the interactions between

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classes. In this paper will be described in detail what was done on each activity and any artifact that must be made.

## II. THEORETICAL FOUNDATIONS

This section describes the theoretical foundations of this research and provides general knowledge about the main aspects of this research.

### A. Application Framework

Application framework or frameworks are generally targeted for a particular application domain, such as user interfaces, business data processing systems, telecommunications, or multimedia collaborative work environments. A framework is more than a class hierarchy. It is a semicomplete application containing dynamic and static components that can be customized to produce user-specific applications [2].

The benefit of application framework are [2]:

1. *Modularity*, framework modularity helps improve software quality by localizing the impact of design and implementation changes. This localization reduces the effort required to understand and maintain existing software.
2. *Reusability*, framework reusability leverages the domain knowledge and prior effort of experienced developers in order to avoid re-creating and re-validating common solutions to recurring application requirements and software design challenges. Reuse of framework components can yield substantial improvements in programmer productivity, as well as enhance the quality, performance, reliability and interoperability of software.
3. *Extensibility*, a framework enhances extensibility by providing explicit hook methods [Pree:94] that allow applications to extend its stable interfaces. Hook methods systematically decouple the stable interfaces and behaviors of an application domain from the variations required by instantiations of an application in a particular context. Framework extensibility is essential to ensure timely customization of new application services and features.
4. *Inversion of Control*, enables canonical application processing steps to be customized by event handler objects that are invoked via the framework's reactive dispatching mechanism. When events occur, the framework's dispatcher reacts by invoking hook methods on pre-registered handler objects, which perform application-specific processing on the events. Inversion of control allows the framework (rather than each application) to determine which set of application-specific methods to invoke in response to external events.

Four activities in framework development process is illustrated in this figure [3]:

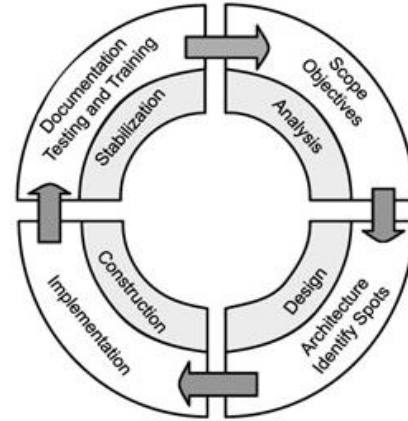


Fig. 1 Framework development process [3].

These are explanation of each activity that is shown at the figure above [3]:

1. *Analysis*, identify the key features that are to be included in the framework.
2. *Design*, after we have set the objectives for the application framework, the next phase is the design phase. The design phase for framework development involves two major tasks. First, we need to identify the common spots and the hot spots in both the domain-specific layer and the cross-domain framework layer. Second, we need to devise an architecture for the framework that will be used as a blueprint during the construction phase.
3. *Construction*, write code the application framework.
4. *Stabilization*, focuses on testing, bug fixing, developer feedback, documentation, and knowledge transfer.

### B. Asset Management System

Asset management system is a system to record assets, recording the condition of assets at regular intervals and determining the burden financially of any assets that are managed to meet certain conditions. Recording of any assets under management is done in a systematic record. This system also define a planning for asset maintenance, repair and replacement if asset damaged [4].

There are two techniques that can be used to handling and recording assets : (1) In financial context, assets are viewed from the sale price, purchase price, and asset management in order to maintain or increase the price of the assets. (2) if viewed from physical context, assets are viewed from in order to operate and maintenance.

Asset management that were examined in this research is viewed from the physical context.

### C. Software As A Service

Software as a service (or SaaS) is a way of delivering applications over the Internet as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing user/customer from complex software and hardware



management [5].

SaaS applications are sometimes called Web-based software, on-demand software, or hosted software. Whatever the name, SaaS applications run on a SaaS provider’s servers. The provider manages access to the application, including security, availability, and performance[5].

SaaS customers have no hardware or software to buy, install, maintain, or update. Access to applications is easy: user/customer just need an internet connection. These are SaaS characteristic [5] :

1. *Multitenant architecture*, a multitenant architecture, in which all users and applications share a single, common infrastructure and code base that is centrally maintained. Because SaaS vendor clients are all on the same infrastructure and code base, vendors can innovate more quickly and save the valuable development time previously spent on maintaining numerous versions of outdated code.
2. *Easy customization*, the ability for each user to easily customize applications to fit their business processes without affecting the common infrastructure. Because of the way SaaS is architected, these customizations are unique to each company or user and are always preserved through upgrades. That means SaaS providers can make upgrades more often, with less customer risk and much lower adoption cost.
3. *Better access*, improved access to data from any networked device while making it easier to manage privileges, monitor data use, and ensure everyone sees the same information at the same time.

**D. Feature Oriented Domain Analysis (FODA)**

Successful software reuse requires the systematic discovery and exploitation of commonality across related software systems. By examining related software systems and the underlying theory of the class of systems they represent, domain analysis can provide a generic description of the requirements of that class of systems and a set of approaches for their implementation [6].

Feature-Oriented Domain Analysis (FODA) is method that used to identify of prominent or distinctive features of software systems in a domain. These features are user-visible aspects or characteristics of the domain [6].

FODA can determine common features and variations of the features that found in a problem domain. With FODA can define mandatory features, optional features and alternative features [6].

Figure 2 illustrates phases and products of domain analysis with FODA.

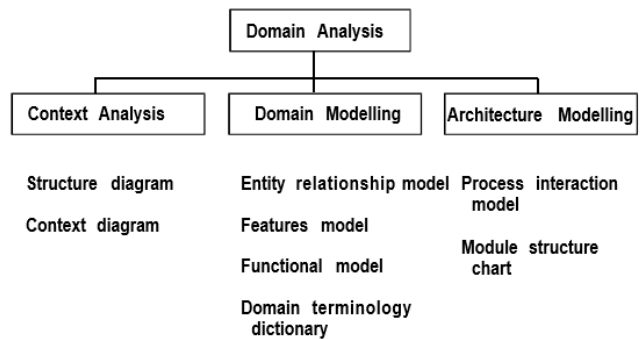


Fig. 2 Phases and Products of Domain Analysis [6]

For each of the three phases of the domain analysis process there will be a separate set of representations of the domain. These are description of each phase [6] :

1. *Context analysis*, the results of this phase provide the context of the domain. This requires representing the primary inputs and outputs of software in the domain as well as identifying other software interfaces.
2. *Domain modelling*, the products of this phase describe the problems addressed by software in the domain. They provide : features of software in the domain, standard vocabulary of domain experts, documentation of the entities embodied in software, generic software requirements via control flow, data flow, and other specification techniques.
3. *Architecture modelling*, this phase establishes the structure of implementations of soft- ware in the domain.

The information can be made to perform domain analysis. are [6] :

1. Textbook.
2. Reference of domain standards.
3. Existing applications that relevant with domain.
4. Domain expert.

Here is an example of a model feature diagram and description of each notation that is used in that diagram

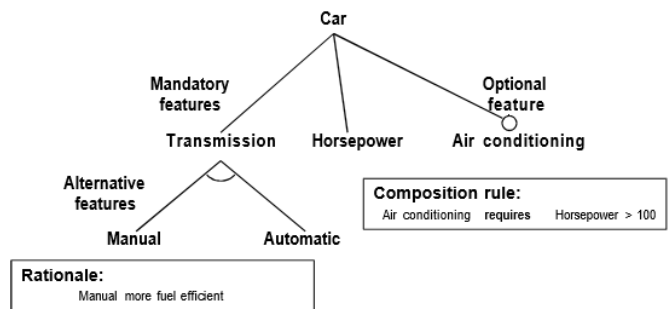


Fig. 3 Feature model diagram.

E. Design Patterns

Design patterns are solutions to software design problems you find again and again in real-world application development. Patterns are about reusable designs and interactions of objects. There are three groups of design pattern [7] :

1. *Creational patterns.*
  - *Abstract Factory*, creates an instance of several families of classes.
  - *Builder*, separates object construction from its representation.
  - *Factory Method*, creates an instance of several derived classes.
  - *Prototype*, a fully initialized instance to be copied or cloned.
  - *Singleton*, a class of which only a single instance can exist.
2. *Structural patterns.*
  - *Adapter*, match interfaces of different classes
  - *Bridge*, separates an object's interface from its implementation.
  - *Composite*, a tree structure of simple and composite objects.
  - *Decorator*, add responsibilities to objects dynamically.
  - *Façade*, a single class that represents an entire subsystem.
  - *Flyweight*, a fine-grained instance used for efficient sharing.
  - *Proxy*, an object representing another object.
3. *Behavioral patterns.*
  - *Chain of Resp*, a way of passing a request between a chain of objects.
  - *Command*, encapsulate a command request as an object.
  - *Interpreter*, a way to include language elements in a program.
  - *Iterator*, sequentially access the elements of a collection.
  - *Mediator*, defines simplified communication between classes.
  - *Memento*, capture and restore an object's internal state.
  - *Observer*, a way of notifying change to a number of classes.
  - *State*, alter an object's behavior when its state changes
  - *Strategy*, encapsulates an algorithm inside a class.
  - *Template Method*, defer the exact steps of an algorithm to a subclass.
  - *Visitor*, defines a new operation to a class without change.

III. ANALYSIS

This section contain results of the analysis activity that had been done. Method that we use in this activity is Feature-Oriented Domain Analysis (FODA).

A. Domain Analysis

In this section, we report the results of domain analysis for asset management system domain and SaaS domain.

Information source for this activity are applications of each domain.

There are two applications that had been chosen to represented asset management system domain :

1. Plant Maintenance Information System (Plamis), This application is owned by PT Mitsubishi Chemical Indonesia (MCCI). This application serves to recording equipments (assets) data, reporting of damage equipments (assets), recording equipment (assets) repair and maintenance activities at the plant / factory.
2. Telecommunicatoin Infrastructures Maintenance System (TIMS), TIMS is owned by PT Rekatama Global Dimension (RGD). This application serves to manage telecommunications assets such as Base Transceiver Station (BTS).

There are two applications that had been chosen to represented SaaS domain:

1. Sales Cloud, This application serves to enhance sales productivity, and as a communication tool with customers or Customer Relationship Management (CRM).
2. Office 365 is an online version of Microsoft Office is used by way of rent. This application has a all features of Microsoft Office plus features for file sharing, collaboration and communication.

The first phase in FODA is context analysis and the following result of context analysis are :

1. Structure diagram.

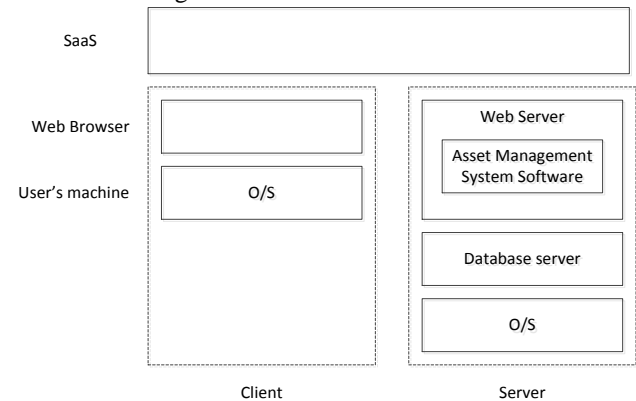


Fig. 4 Structure diagram.

2. Context diagram.

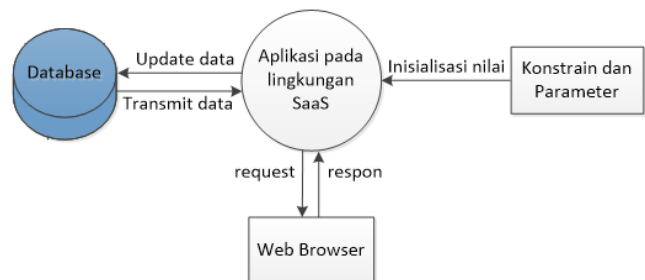


Fig. 5 Context diagram.

The second phase in FODA is domain modelling and the result of this phase are feature model diagrams. This diagram is used to obtain feature model, these models provide an

overview of similarities and differences features of the application domain. There are six feature model diagrams those have been produced. Here are some feature model :

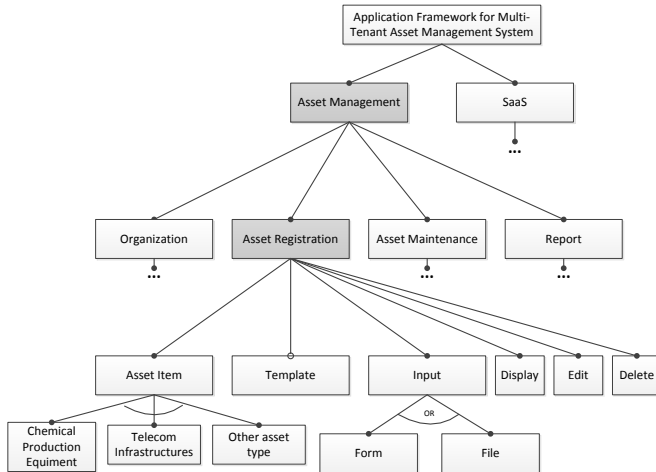


Fig. 6 Feature model diagram for asset registration (Asset management system domain).

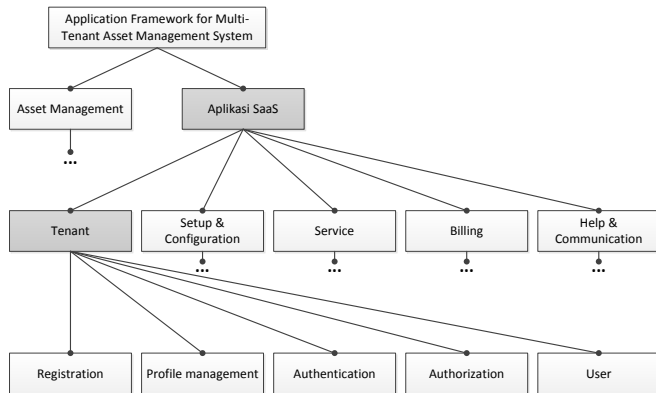


Fig. 7 Feature model diagram for tenant (SaaS domain).

From the feature model diagrams those have been made, we can determine the common spots (features which are mandatory) and hot spots (features which are optional and alternative). These are common spots of this application framework:

1. User Authentication and authorization.
2. Data management that support multi-tenant characteristic.
3. Audit trail.
4. Tenant registration.
5. Organization management.
6. Service management.

These are hot spots of this application framework:

1. Asset item.
2. Asset item input.
3. Notification sending procedure.
4. Provision of reports.
5. Calculation of using service.

**B. Hot-spot Cards**

Each hot-spots that have been obtained are analyzed by using the hot-spot cards. Hot-spot cards provide information

about flexibility degree of hot-spots. This information is needed to design classes and to determine which design patterns to be used in each hot-spot.

In this activity, we had produced five hot-spot cards, here are some examples of those hot-spot cards :

Input Item Aset	Tingkat fleksibilitas <input checked="" type="checkbox"/> Adaptasi tanpa <i>restart</i> <input type="checkbox"/> Adaptasi oleh pengguna akhir
Deskripsi : aktivitas untuk input property-property aset.	
Variabilitas : Perbedaan sesuai dengan cara input dan sumber data untuk input.	
Plamis : Input dengan form yang telah disediakan dan import dari file.	
TIMS : Input dengan form yang telah disediakan.	

Fig. 8 Hot spot card for asset item input.

Penyediaan Data Laporan Aset	Tingkat fleksibilitas <input checked="" type="checkbox"/> Adaptasi tanpa <i>restart</i> <input checked="" type="checkbox"/> Adaptasi oleh pengguna akhir
Deskripsi : Menyediakan data laporan aset sesuai dengan kebutuhan untuk keperluan ditampilkan pada halaman aplikasi.	
Variabilitas : Perbedaan sesuai dengan algoritma atau logika yang digunakan.	

Fig. 9 Hot spot card for asset report service.

**IV. DESIGN**

Products or artifacts that has been made at analysis activity are used to design application framework . The following are the results of design activity for application framework.

**A. Application Framework Architecture**

Architecture design of application framework provides an overview of the overall framework, which can be seen in the figure below. That figure explain as follow:

1. Microsoft .NET Framework is used as foundation framework.
2. Cross-Domain Component consist of generic functions that are often used in domain-specific component or application-specific.
3. Domain-Specific Component is a component that has the functions of the domain of asset management and SaaS applications. Hot-spots are on this layer.

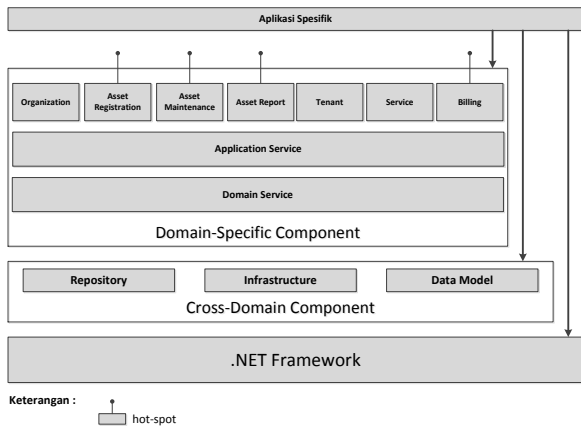


Fig. 10 Architecture of Multi-Tenant Application Framework for Asset Management System.

B. Package Diagram

Diagram showing packages contained on this application framework and their relationship between package to one another package.

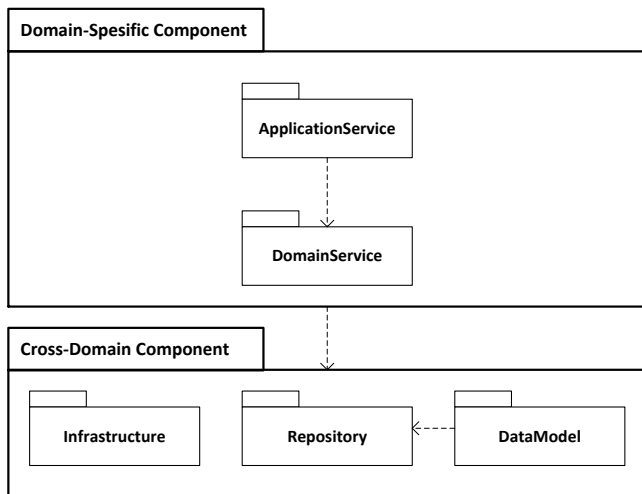


Fig. 11 Package diagram of application framework for multi-tenant asset management system.

Cross-domain component consist of these packages :

1. *Infrastructure*, in this package contains classes for managing the security, such as authorization and authentication.
2. *DataModel*, contains entity classes those are database's tables representation.
3. *Repository*, contains data access classes those are used to execute database's operation functions.

Domain-specific component consist of these packages :

1. *DomainService*, contains entity classes for domain.
2. *ApplicationService*, contains classes those are used to display data on user interface.

C. Class Design for Common Spots

These are classes common spot's classes :

TABLE 1  
COMMON SPOT'S CLASSES

No	Class Name	Description
<b>Infrastructure Package</b>		
1	IAuthenticationAdapter	Control
2	IAuthorizationAdapter	Control
3	AuthenticationDefault	Control
4	AuthorizationDefault	Control
5	SecurityFacade	Control
<b>Repository Package</b>		
1	AMSaaSDataContext	Control
2	GenericRepository	Control
3	UnitOfWork	Control
<b>Paket DataModel</b>		
1	Tenant	Entity
2	Service	Entity
3	Billing	Entity
4	Organization	Entity
5	Asset	Entity
6	AssetPropertyValue	Entity
7	AssetReport	Entity
8	AssetReportPropertyValue	Entity
9	AuditTrailLog	Entity
<b>DomainService Package</b>		
1	OrganizationService	Control
2	AssetRegistrationService	Control
3	AssetMaintenanceService	Control
4	AssetReportService	Control
5	TenantService	Control
6	ServService	Control
7	BillingService	Control
<b>ApplicationService Package</b>		
1	OrganizationAppService	Control
2	AssetRegistrationAppService	Control
3	AssetMaintenanceAppService	Control
4	AssetReportAppService	Control
5	TenantAppService	Control
6	ServAppService	Control
7	BillingAppService	Control

The design of the interaction between classes can be seen in the sequence diagrams below :

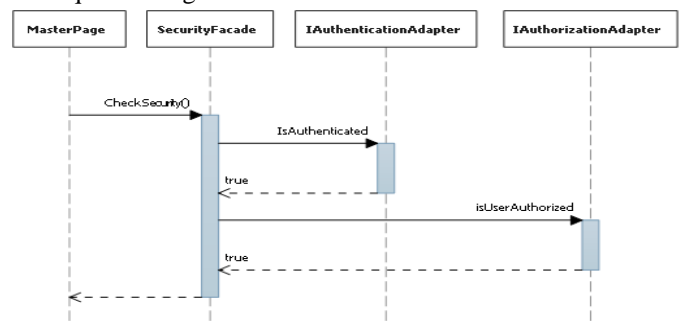


Fig. 12 Security process.

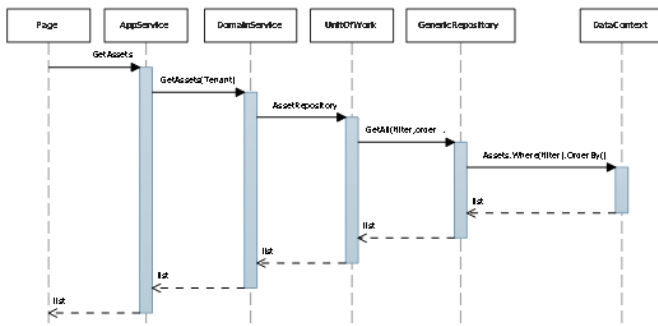


Fig. 13 Data operation process.

D. Class Design for Hot Spots

The result of the design of hot-spots described by the class diagram. There are six class diagrams that had been made. Each class diagram using a design pattern so the flexibility of hot-spots that have been determined in the previous stage is reached. Here is the class diagram for some hot-spots.

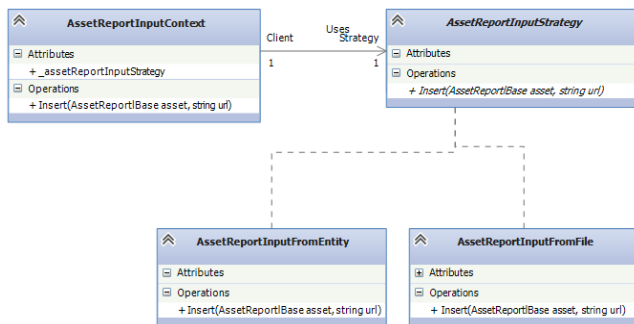


Fig. 14 Class diagram for asset item input hot-spot.

Design pattern which is used in the design class diagram above is the strategy pattern. This design pattern is selected for its ability to select the desired algorithm dynamically at run time. Fig. 15 show, there are two methods that can be use to input data (input from application’s form or upload data in file).

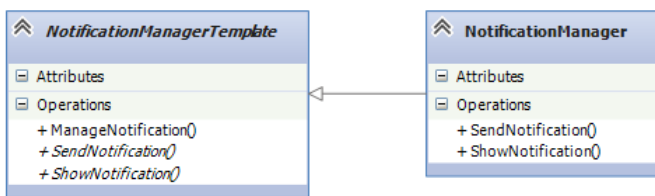


Fig. 15 Class diagram for notification sending procedure.

Design pattern which is used in the design class diagram above is the template method. This is in accordance with the needs of a hot-spot, in order to deliver a notification can be easily adapted.

V.CONCLUSION

This work has provided steps that had to followed to develop application framework. In this work, application framework built for the domain of asset management systems and SaaS to make application framework for multi-tenant asset management system. From the description above, FODA can be used to help determine requirements of the application framework. FODA also help determine which features those became common spots and hot-spots. Design pattern can be used to produce hot-spots in accordance with a predetermined degree of flexibility that had been determined in analysis. If the number of applications that are used quite a lot, it is possible to produce application framework with complete features and more flexible to fit to customer’s requirements.

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# The Embedded Real Time Video Streaming for Controlling Carrier Robot

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**Abstract**— The real time video streaming implemented on an embedded system which has limited in hardware resource must have minimum delay time of transmission and high quality video in order to avoid a mistake on controlling a Carrier Robot from a central control. This paper presents an implementation of a real time video streaming using an open source of GStreamer tool installed on embedded system of Raspberry Pi. The video data which is transmitted to the control system of Carrier Robot has resolution of VGA 640 x 480. The average time delay of video data transmission is between 180 and 350 millisecond. The strength of signal condition is between -70 dBm up to -50 dBm at 30 frames per second.

**Keywords**— Carrier Robot, Embedded System, Raspberry Pi, Video Streaming, GStreamer.

## I. INTRODUCTION

THE embedded real time video streaming installed on Carrier Robot helps a user to see the paths and obstacle in front of Carrier Robot and navigate Carrier Robot to reach a destination. In this paper we proposed a design of a robot vision system using real time video streaming implemented in an embedded system for remotely controlled Carrier Robot. There are many designs used to perform video streaming, such as a video streaming capture and transmission system based on Servfox [1], the design of video streaming implemented on Python [2]. Greco et al proposed a protocol for delivering a video stream in a mobile ad-hoc environment [3]. The performance comparisons of video data formats were conducted. Rao et al compare the computational speed performance of Dirac Video Codec to the computational speed performance of H - 264 / MPEG - 4 AVC [4]. Seeling et al compare the quality performance of VP8 to the quality performance of H - 264 SVC [5]. Mok, R.K.P et al measure the quality of HTTP video streaming [6]. The frequency of rebuffering affects the variations in the quality. Swaminathan et al described the live latency can be reduced using the

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chunked encoding approach [7]. The video streaming used for remotely controlled vehicle must have a minimum delay time of transmission and high quality video which is received in a central control of Carrier Robot. The user in a central control of Carrier Robot needs an accurate video streaming so the Carrier Robot can be controlled properly.

The system of remotely controlled Carrier Robot and the central control of Carrier Robot which are implemented in the labs are shown in Fig. 1. The embedded system of Raspberry Pi and camera installed in the remotely controlled control are used to perform video streaming via wireless local area network.

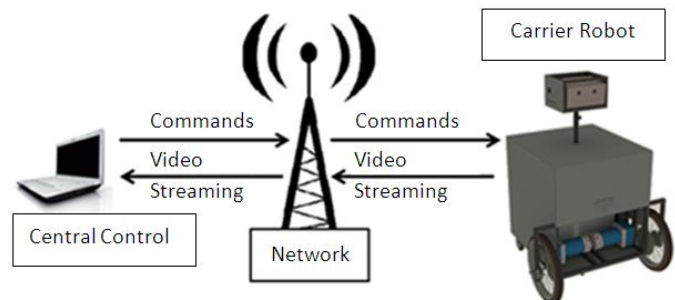


Fig. 1 The Carrier Robot and the central control of Carrier Robot

## II. THE EMBEDDED REAL TIME VIDEO STREAMING

Fig. 2 shows the video streaming architecture. The data captured from the camera is transmitted directly to a media player installed on the client device [8, pp.140-145]. The raw video data captured from camera is processed using Motion Picture Experts Group - 4 Advanced Video Coding (MPEG - 4 AVC). The video data is compressed by reducing the unchanged data that repeat from frame to frame [8, pp. 167-168]. The video data is sent from a streaming server to a client computer which has a media player. The media player is used to receive and decompress the video streaming

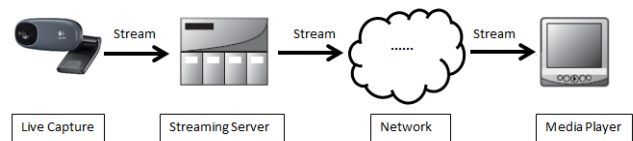


Fig. 2 The Video Streaming Architecture

The GStreamer based on Glib Object System is a framework which is used to process the audio and video data and perform video streaming, record video streaming, play and edit the audio and the video file. This framework is developed using C by the community of GNOME Project.

The GStreamer SDK version 1.0 is installed on the embedded system of Raspberry Pi to control the Carrier Robot. There are tools such as MJPG-Streamer, Netcat, VLC and Motion which can be used to perform the video streaming. Compared to the other tools, the GStreamer SDK tool has minimum delay to perform the video streaming. Fig 3 shows the Carrier Robot that was implemented.

The video streaming application using the GStreamer tool that is implemented on embedded system of Raspberry Pi can transmit the video data using H-264 format which has resolution of VGA 640 x 480. This application is run on Linux operating system. The H-264 formatted video data is transmitted from Raspberry Pi located in Carrier Robot to the computer at the central control of Carrier Robot using User Datagram Protocol (UDP).

Fig. 3 shows Carrier Robot which has implemented. This Carrier Robot consists of an embedded system which is used to perform video streaming.



Fig. 3 Carrier Robot

Fig. 4 shows the application program of video streaming. When the user presses the 'Stream' button the video streaming process will start.

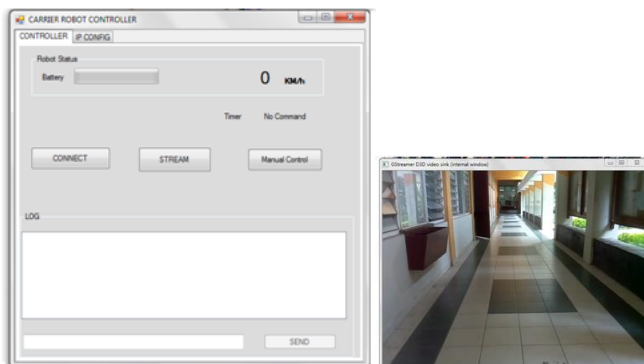


Fig. 4 The application program of video streaming

### III. EXPERIMENT AND RESULT

One empirical testing factor that need to be tested is time delay between the factual and stream as seen on the screen. Testing is done by directly comparing the captured image between digital stopwatches that instantly seen by camera and the image that displayed on the monitor. There is a factual time delay as shown in Fig. 5. Fig. 5 displays a 180 ms delay between the factual image 4:14.82 and 4:14.64 as seen on the monitor.



Fig. 5 a 180 ms delays between the factual and from the receiver on the monitor.

Twenty times experiments have been conducted in the labs to find the relation between signal strength and the time delay. The signal strength was arranged from -50 dBm, -60 dBm, -70 dBm, and -80 dBm. The relationship between signal strength and the time delay is shown in the Table 1.

TABLE I  
THE EXPERIMENTAL RESULTS OF TIME-DELAY TO THE SIGNAL STRENGTH

Signal Power (dBm)	Frame per Second (fps)	Delay (ms)					Avg.
		1	2	3	4	5	
-50	30	160	180	180	180	200	180
-60	30	180	220	200	190	180	194
-70	30	390	320	200	230	220	312
-80	30	6,290	8,150	10,158	200	200	4,999

From the experiments, the good results are obtained at the average time delay between 180-350 ms and signal strength between -70dBm up to -50dBm at 30 fps. The good results are defined as the ongoing stream video shows video that looks similar to the factual. At the testing number-4 the time delay was 5 seconds in average. This result is not relevant if implemented in the real time robotics. Besides the delay, the quality of the image is degraded sharply.

To test the system in real mode, the Carrier Robot that hold the camera and a real time embedded have been design and made real. Carrier Robot that was implemented in the C Building area, need to know the signal strength condition of the path that will be passed. The measurement results and the

location of power strength are shown in the Fig. 6. The driver need to be careful when through an area with a signal strength less than  $-70$  dBm since the noise is very annoying the streaming video.

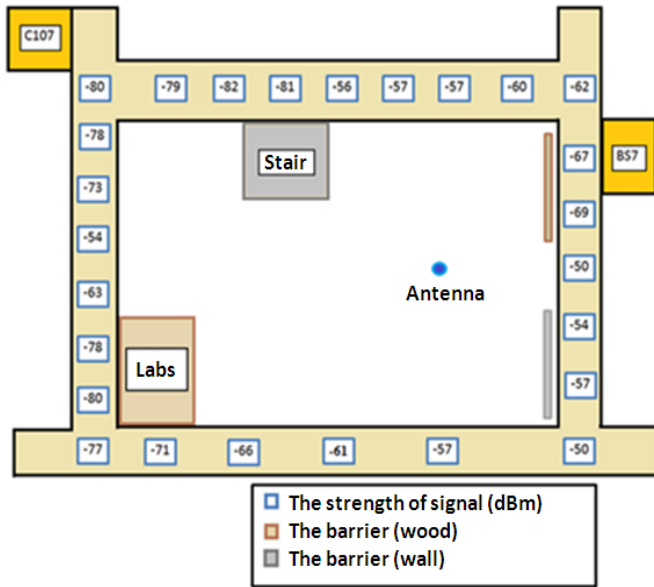


Fig. 6 The signal strength at some points in the C Building.

From the measurement results, points that in the position line of sight with the antenna have a relative better signal strength ( $-70$  dBm up to  $-50$  dBm) than points that hindered by fence or wall ( $< -70$  dBm). In this experiment, the better signal will be rewarded with less delay ( $< 350$  ms). On the other hand, when the signal strength below than  $-80$  dBm, controlling robot wirelessly got so much noise thus some commands may be missed, increasing the delay, and broken the running images. Fig. 6 shows a capture image from video streaming that was obtained when the robot out of line of sight. The image was fall apart because not all data packets arrive at the receiver (UDP stream) at a period of time. When the less data constructed again by the decoder, decoder will yield a fractured images.



Fig. 6 The weak signal strength produces the fracture video.

#### IV. CONCLUSION

In this paper, the embedded real time video streaming for controlling Carrier Robot has been implemented and tested to the time delay and the signal strength. The video streaming is used to be a feedback in the control system for Carrier Robot. The real time video is implemented using open source software GStreamer as a module in the Embedded Raspberry Pi.

Two results have been obtained from the experiments. First of all, the streaming video needs signal strength between  $-70$  dBm up to  $-50$  dBm to get a good quality of video at 30 fps and delay time below than 350 ms. Secondly, the signal strength less than  $-70$  dBm would significantly reduce the quality of the video and hardship in controlling the Carrier Robot.

#### ACKNOWLEDGMENT

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# Haversine and Heron Method Collaboration To Calculate The Area Of A Square Of Irregular Land

Supriadi Syam<sup>1</sup> and Suryani<sup>2</sup>

**Abstract**— This research aims to find out how the implementation of Haversine method and Heron method to calculating land area in square-shaped irregular. Haversine method is a method to find out approximately a 2 point is indicated by coordinates of latitude and longitude on Earth. Whereas the method of Heron is a method to calculate the area of irregular polygons by dividing objects into multiple triangles. Results calculation method used to calculate the Haversine area of a triangle. Area of each triangle will be summed up to obtain extensive polygon. The result obtained is the Haversine method and method of Heron can collaborate well in calculating irregular square land area.

**Keywords**—Heron's method, method of Haversine, broad, polygon.

## I. INTRODUCTION

Research on the calculation of the area of the field has been widely performed by a variety of methods. Haversine method is not a method to calculate the area, but to measure the distance between 2 points. This method is widely used in systems that function find the nearest distance from a given location.

Some of the research that uses methods like Haversine<sup>1</sup>utilization of geolocation and Haversine in the design of geographical information systems, where the methods used to calculate the distance Haversine 2 point without ignoring the the Earth. <sup>2</sup>utilization of next is looking for the nearest lodging range from a campus. Its use is fairly accurate because it ignores the depth and height of the Valley. <sup>3</sup>further Research is pemubatan application directions to a particular place. And <sup>4</sup>the making of applications to Blackberry device-based assignments.

Heron is a method the method used for measuring the area of irregular polygons by dividing the polygon area into multiple triangles. Results of measurements of the Haversine later used to calculate the area method using Heron.

## II. MATH

Haversine's formula is:

$$\Delta lat = lat2 - lat1$$

$$\Delta long = long2 - long1$$

$$a = \sin^2(\Delta lat/2) + \cos(lat1) \cdot \cos(lat2) \cdot \sin^2(\Delta long/2)$$

$$c = 2 \cdot \text{atan}^2(\sqrt{a}, \sqrt{1-a})$$

$$d = R \cdot c$$

Description :

R = the Earth's radius of 6731km

$\Delta lat$  = quantity changes in latitude

$\Delta long$  = quantity change of longitude

c = calculation intersecial of axial

d = distance ( km )

Heron's formula for the Method is

$$L = \sqrt{s(s-a)(s-b)(s-c)}$$

Description :

a, b, c = the length of each side of the triangle

$$s = \frac{1}{2}(a + b + c)$$

Because the land that will be measured in the shape of a square, means the number of triangles that will be set up there are 2. The triangle in the second are initialized with the L1 and L2. The length of the sides will be counted as much as the 5 in the line are initialized with the d1, d2, d3, d4 and d5. Then the formula for calculating L1 is:

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$$s_1 = \frac{1}{2}(d_1 + d_2 + d_3)$$

$$L_1 = \sqrt{s_1(s_1 - d_1)(s_1 - d_2)(s_1 - d_3)}$$

$$s_2 = \frac{1}{2}(d_3 + d_4 + d_5)$$

$$L_2 = \sqrt{s_2(s_2 - d_3)(s_2 - d_4)(s_2 - d_5)}$$

Then  $L = L_1 + L_2$

### III. UNITS

1 degree latitude = 111 km  
 1 degrees longitude = 111 km  
 d in km  
 L in m2

### IV. HELPFUL HINTS

#### A. Figures

The image below is an image that represents land that will be measured. Point a, b, c and d is the point of coordinates (latitude, longitude). Haversine method will look for the distance ab, bc, ca, cd, and da's in the formula is expressed as d1, d2, d3, d4 and d5.

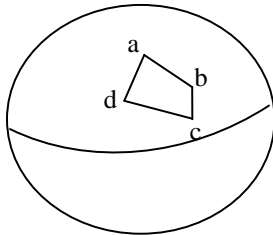


fig 1. Example of determination of coordinates

The picture is further divided into 2 triangles.

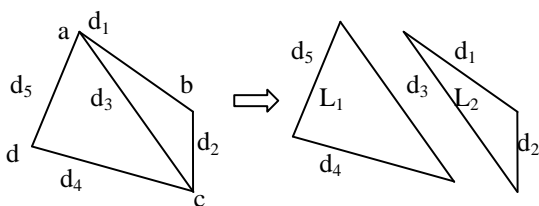


fig 2. Haversine method and heron Method

Results of calculations are initialized in the Haversine as d1, d2, d3, d4 and d5 will be the length of the sides to perform calculations on the methods of Heron. So vast that generates the calculation result two triangles can be combined into rectangular polygons.

#### B. References

A position on the earth can be represented by the position of latitude (latitude) and longitude (longitude). Estimating the distance between two points on Earth based on the location latitude and longitude can be done with some equations used. all equations that are used based on the shape of the Earth is round (spherical earth) by eliminating factors that the Earth is slightly elliptical (elipsodial factor). For possible errors haversine method reaching only 0.5%. This formulation uses the Haversine as the basis equation [1].

Haversine formula is an equation important in navigation, giving great circle distances between two points on the Earth's surface based on longitude and latitude. The use of this formula is accurate enough for most calculations, also ignoring the height and depth of the Valley hills on the surface of the Earth [2].

This algorithm is used to calculate the distance between two GPS points. GPS point in this regard is the latitude and longitude [4].

The following example implementation of haversine method in the form of javascript.

```
function getDistance(lat1,lat2,lon1,lon2){
    var R = 6371;
    var dlat = toRad(lat2-lat1);
    var dlon = toRad(lon2-lon1);
    var a = Math.sin(dlat/2)*Math.sin(dlat/2)
    +Math.cos(toRad(lat1))*Math.cos(toRad(lat2))
    *Math.sin(dlon/2)*Math.sin(dlon/2);
    var c = 2*Math.atan2(Math.sqrt(a),Math.sqrt(1-a));
    var d= R*c;
    return d;
}
Function toRad(Value){
    return Value* Math.PI /180
}
```

#### C. Other Recommendations

In order for this method to be able to collaborate well, preferably units used primarily to measure length and area, identified in advance.

The implementation of this method in the form of a web-based geographic information System or mobile device.

### V. CONCLUSION

Haversine and Heron Metho Collaboration can be an alternative method of many methods commonly used for measuring land area. To translate it into any programming language is fairly easy.

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# Finding student learning pattern using cross join Pearson correlation test

Tekad Matulatan<sup>1</sup>, Martaleli Bettiza<sup>2</sup>, and Nerfita Nikentari<sup>3</sup>

**Abstract**—Student's academic records could be used to analyze the student's learning behavior on the current curriculum. A novel simple way is introduced by using association rule approach with cross join combination between courses in two consecutive semester and then counting the number of occurrences of the same group values based on student's academic achievement. This counting number is later used as parameter in Pearson R correlation test to see if the change in academic achievement is strong positive correlation or not. This finding could be used to revise the curriculum if there is any.

**Keywords**—Educational Data mining, Cross product association rule, Pearson R correlation test, Student learning pattern.

## I. INTRODUCTION

FINDING student learning pattern in academic records is a challenge where the condition is different with finding purchase behavior in market base analysis. In market base analysis, buyers purchase records are purely random in each transaction that consist of many purchase items. Student academic records consists of student's choosing course and the result grade in each semester which depends on curriculum. In specific semester, courses selected by students in one curriculum could be same or in some semesters there are a lot of similarities among students. In this situation, processing the data in student's records would be different approach with purchase records but with the same basic principle using combination among item set.

## II. RELATED RESEARCH

The development of research in the field of data mining is very rapid in the last 15 years where as the demand for data space is also increasing. This happens due to the declining costs of storage media, faster network connection and the rising of ubiquitous devices. Mining of data becomes very attractive with diverse data mining research model have been performed,

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such as increasing the efficiency of data processing done by [1], efficiency using THUI (Temporal High Utility) [2] claims done the information mining efficiently in the data stream which can significantly reduce the processor load and is an efficient use of time and space compared to other experimental models.

Some studies were also conducted to improve the problem in an association rules, where the process is deeply costly to processing performance. Reference [3] claimed finding a technique that is more efficient to extract the information with a high degree of confidence by association rules, which apply the model of upper bounds and lower bounds in determining the sub-rule apply in data mining. Detailed attempt to find a relationship in data mining has also been done [4] which first put forward a new algorithm in detail the data search. A survey of the changes in the approach undertaken by the association rules technique over the last few years is describe in [5].

While the application in the field of education, where data mining is used as tools in curriculum analysis as applied to college in [6] where each student in each semester that has been in undertaken, using the following data: courses, credits, grades, student id, results as a set of data pairs  $p = \{[s1, l1], [s2, l2], \dots, [sn, ln]\}$ .  $s$  is the set of subjects which is taken by students and  $l$  is the value of the results obtained after the courses. The study found the results of the adaptive data mining due to the historical results of the student and the updating of the data that is still ongoing.

Several other studies conducted on the issue of education data mining: in [7] using Decision Tree and more to the application system, [8] using multiple selection, [9] uses clustering K-Mean, while in [10] using data mining to predict a person's GPA student and the student fails possibilities through the application of regression analysis and C5.0.

Reference [11] using a non-linear correlation techniques in analyzing the course management system to find the necessary information from a given dataset. Student activity on the system becomes input for EDM to design items that match the student's ability. Nguyen [12] proposed matrix factorization method for predicting student performance.

## III. THE PROCEDURE

The procedure introduced here will assume that the data needed in the process are already set up or been handled previously, so preparing the phase for preparing the data including removing the noise or combining multiple table is

not discussed here. It is assuming that the data is clean and ready in a table with minimal the following attributes: course name, grade result in numeric, semester of course taken, related student id from one study program/curriculum as showed in table I.

TABLE I  
MINIMUM ATTRIBUTES NEEDED TO BE PROCESS

StudentID	CourseID	CourseName	Grade	Semester
Xxxxx	Xxxx	Xxxx xxxxx	#	#
⋮	⋮	⋮	⋮	⋮

A. Cross product

In each semester, odd and even semester, student took number of courses depends on the last semester’s average grade points. Successful student on last semester could took more courses than student’s that did not do well in last semester. From this requirements finding learning behavior could be done by comparing the courses took in one semester and the next semester including the grade achieved by student in each courses. The item set will be student courses, course results, semester and student ID which in final item set, student ID will not be considered.

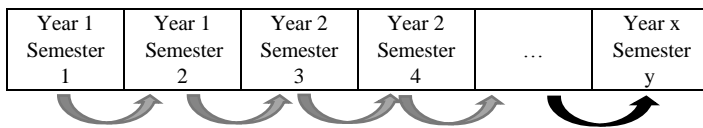


Fig. 1. Comparing the sequence pattern of courses taken by students based on semester and the next semester

This comparison implements cross product of courses in both semester for each students. So for example student A on semester n ( $S_n$ ), takes 3 courses:  $C_1, C_2, C_3$  ( $C_1S_n, C_2S_n, C_3S_n$ ) and do well, so in the next semester  $n+1$  ( $S_{n+1}$ ) has 4 courses:  $C_1, C_2, C_3, C_4$  ( $C_1S_{n+1}, C_2S_{n+1}, C_3S_{n+1}, C_4S_{n+1}$ ), despite of the credits of the courses, will make the comparison on both semester  $3 \times 4$  combination (figure 2). The information of courses including name of courses and the result grade for each courses in numeric value.

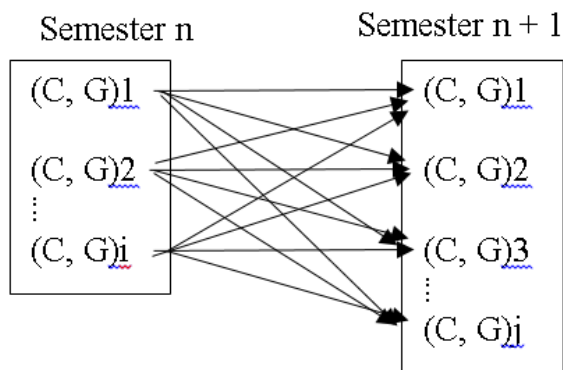


Fig. 2. Cross join combination  $i \times j$  of one student’s courses in

semester n and the next semester (n+1) where C is course and G is grade result of the course

The process repeated to whole student of the same study program that share the same curriculum, resulting the table containing the information on combination courses and grades on both semester n and n+1, where n is the semester passed by student concerned. The number of possible combination would  $m \times C_{iS_n} \times C_{jS_{n+1}}$ , where m be number of all student of same study program/curriculum,  $C_{iS_n}$  and  $C_{jS_{n+1}}$  is the number of courses in semester n and number of courses in semester n+1 of related student. So it will satisfied the association rules form  $A_i \rightarrow B_j$ , where  $A_i = C_iS_n$  is the course and grade of semester n, i is the number of course taken in semester n,  $B_j = C_jS_{n+1}$  is the course and grade of semester n+1, j is the number of courses taken in semester n+1.

B. Finding differences grade value

We could said for a moment there are correlation between course combinations  $A_i \rightarrow B_j$ . For each tuple from the cross product operation, we subtract the grade value from the semester n+1 with the semester n to find the differences as layout in table II.

$$\delta_{C_i \rightarrow C_j} = G_{C_jS_{n+1}} - G_{C_iS_n} \quad (1)$$

Where C is course, S is semester, G is grade of related course and  $\delta$  is differences grade value on  $C_{jS_{n+1}}$  and  $C_{iS_n}$ . The result  $\delta$  may show positive value that showing there is increasing value which the grade of course taken in the next semester is better compare to the grade of course taken in previous semester. If the result showing zero value, it means there is no differences on the result of both courses in both semester, and if it shows negative value, simply show that the grade on course taken on next semester is lower than the grade on course in previous semester. At this point we cannot yet conclude anything as it is too early.

The difference values from all students will be used later to test correlation between both courses.

C. Grouping and counting the data

With these information, now we can create group and count the frequent of similar appearance based on differences grade value ( $\delta$ ) on each combination of courses ( $C_i \rightarrow C_j$ ), regardless to semester. For example Student A receive A (4.0 points) in  $C_iS_n$  and B (3.0 points) in  $C_jS_{n+1}$ , is in same group with Student B who receives B (3.0 points) in  $C_iS_n$  and C (2.0 points) in  $C_jS_{n+1}$ , and with Student C who receives D (1.0 points) in  $C_iS_n$  and E (0 points) in  $C_jS_{n+1}$  where all of them has same differences value: -1.0.

TABLE II  
DIFFERENCES GRADE VALUE ON CROSS JOIN COMBINATION OF ALL STUDENTS IN SAME STUDY PROGRAM

Course 1 Semester n of student 1	Course Grade i Semester n of student 1	Course 1 Semester n + 1 of student 1	Course Grade 1 Semester n + 1 of student 1	(Course Grade 1 Semester n + 1 ) – (Course Grade 1 Semester n ) of student 1
Course 1 Semester n of student 1	Course Grade i Semester n of student 1	Course 2 Semester n + 1 of student 1	Course Grade 2 Semester n + 1 of student 1	(Course Grade 2 Semester n + 1 ) – (Course Grade 1 Semester n ) of student 1
⋮	⋮	⋮	⋮	⋮
Course i Semester n of student 1	Course Grade i Semester n of student 1	Course j Semester n + 1 of student 1	Course Grade j Semester n + 1 of student 1	(Course Grade j Semester n + 1 ) – (Course Grade i Semester n ) of student 1
⋮	⋮	⋮	⋮	⋮
Course i Semester n of student m	Course Grade i Semester n of student m	Course j Semester n + 1 of student m	Course Grade j Semester n + 1 of student m	(Course Grade j Semester n + 1 ) – (Course Grade i Semester n ) of student m

$$\forall(C_i \rightarrow C_j): \text{Count}(\delta C_i \rightarrow C_j) \quad (2)$$

We can then plot the result of each combination  $C_i \rightarrow C_j$  for testing the possible correlation using the frequent count value in x-axis and differences in y-axis.

IV. SAMPLE RESULT

We pick up one combination  $C_i \rightarrow C_j$  in the sample data to be example of the implementation of the algorithm. In the following table shows the counting result of sample data of courses: Mathematic Discrete and Probabilistic and Statistic, that been offered on sequence semester. So the learning pattern on Mathematic Discrete  $\rightarrow$  Probabilistic and Statistic will be tested to see if there is a strong positive correlation or not.

TABLE III  
SAMPLE DATA OF COUNTED OCCURRENCE OF SIMILAR GRADE OF MATHEMATIC DISCRETE  $\rightarrow$  PROBABILISTIC AND STATISTIC

Course i	Grade i	Course j	Grade j	Freq.
MATHEMATIC DISCRETE	0	PROBABILISTIC STAT,	2	2
MATHEMATIC DISCRETE	0	PROBABILISTIC STAT,	3	6
MATHEMATIC DISCRETE	1	PROBABILISTIC STAT,	0	1
MATHEMATIC DISCRETE	1	PROBABILISTIC STAT,	2	2
MATHEMATIC DISCRETE	1	PROBABILISTIC STAT,	3	18
MATHEMATIC DISCRETE	2	PROBABILISTIC STAT,	0	3
MATHEMATIC DISCRETE	2	PROBABILISTIC STAT,	1	2
MATHEMATIC DISCRETE	2	PROBABILISTIC STAT,	2	4
MATHEMATIC DISCRETE	2	PROBABILISTIC STAT,	3	29
MATHEMATIC DISCRETE	2	PROBABILISTIC STAT,	4	8
MATHEMATIC DISCRETE	3	PROBABILISTIC STAT,	0	1
MATHEMATIC DISCRETE	3	PROBABILISTIC STAT,	2	9

DISCRETE				
MATHEMATIC DISCRETE	3	PROBABILISTIC STAT,	3	33
MATHEMATIC DISCRETE	3	PROBABILISTIC STAT,	4	22
MATHEMATIC DISCRETE	4	PROBABILISTIC STAT,	0	2
MATHEMATIC DISCRETE	4	PROBABILISTIC STAT,	2	1
MATHEMATIC DISCRETE	4	PROBABILISTIC STAT,	3	13
MATHEMATIC DISCRETE	4	PROBABILISTIC STAT,	4	17

TABLE IV  
SAMPLE DATA SHOWING COUNTING NUMBER BASED ON GRADE DIFFERENCES

differences	Count
3	6
2	28
1	53
0	54
-1	25
-2	4
-3	1
-4	2

From this data, we could test the correlation using Pearson R test, which in result show 0.172 which mean there is weak positive correlation between Mathematic Discrete  $\rightarrow$  Probabilistic and Statistic. The following graph show the data being plotted in Cartesian coordinate.

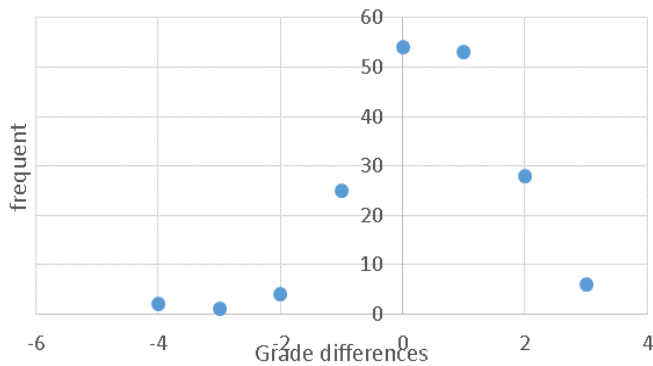


Fig. 3. The graph result of sample data show correlation between Mathematic Discrete → Probabilistic and Statistic.

## V.CONCLUSION

By using Cross join Pearson correlation test, we could find a learning behavior that could be used to revise the curriculum. If there is a strong positive correlation, simply means that  $C_i$  and  $C_j$  are in ideal sequence of learning path. While the opposite may suggest that  $C_j$  should be learn before  $C_i$ , Other conditions may also interfere with the result, for example not sufficient data to give valid result.

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# Database Design for Final Project Monitoring System in Information Management Study Program of Telkom University

Wardani Muhamad

**Abstract**—Final Project Monitoring System is an information system that constructed by Information Management Study Program to monitor progress construction of Final Project course. This information system involves at least two major entities namely faculty and students Information system play an important role for the achievement of each phase present information that must be done by the student in accordance with the contract agreed. Through the presentation of accurate information, lecturers can monitor and provide appropriate feedback to the reported achievement. Therefore, a database was needed to support the data processing and presentation of accurate information. To produce qualified database, database development should be follow planned and measured processes. Database development process is divided into 4 (four) stages, namely: requirements elicitation, conceptual modeling, logical modeling and physical modeling. Requirements gathering produce requirements specification the data and information needs Conceptual model in this research is described using the Entity-Relationship (ER) Diagram. In logical modeling stage, E-R diagram translates into a relation schema and tested using normalization techniques. Testing is done primarily to avoid any duplication of information and test data as well as ensure functional dependencies relation satisfy the normal form. To be sure, every table was tested starting from the 1st Normal Form (1NF) until stage Boyce-Codd Normal Form (BCNF). In the final stage, the database is implemented in MySQL DBMS.

**Keywords**— BCNF, Entity-Relationship (E-R) Diagram , Final Project, Normalization.

## I. INTRODUCTION

TO support the effectiveness of business processes in an organization or company required a system of data storage and information. The system can assist management in formulating policies in accordance with the acquired information. The file system can be an alternative for companies to store information, but this system has various drawbacks, including: possible occurrence of redundancy and

inconsistency of information, data isolation, and difficulty in accessing information. The weakness is mainly due to the diversity of formats that can be accepted by the file system and the limitations of the application that can be used to access files.

Database comes as a solution to solve the problems in the file system. Relational database which contains a set of tables that are related offering data storage and information free of anomalies. Coupled with support Database Management System (DBMS), data is stored in tables can be presented into the right information for the company and requires a relatively faster when compared with the file system. However, the use of databases to support the business processes can be useless if the data stored in each table does not actually represent the data in the real world. Likewise, if it turns out that the relationship is defined between tables did not represent the relationship between objects in the real world.

Database design plays an important role to develop the correct database. If the design is done properly it will produce a database that can store all of the data required by the business process as well as to present the right information in the manner intended and actual data representing the real world. Development of a database is done through several stages that are performed sequentially, starting from the requirements elicitation, conceptual modeling, logical modeling, and concludes with physical modeling. The conceptual model is commonly used to describe the database design is Entity Relationship (E-R) Diagram or Unified Modeling Language (UML).

This study aims to produce a database design that will be used to support the Final Project Monitoring System in Information Management Study Program of Telkom University. The conceptual model used in this study is the ER diagram notation by adopting the model Chen. Results of database design translated into a physical model using the MySQL DBMS. To avoid the occurrence of anomalies, the structure of the tables stored in the database must be ensured in the normal form. To be sure, each table resulting from the translation of logical models should be tested using normalization techniques up to the Boyce-Codd normal form.

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II. LITERATURE REVIEW

Literature review section provides a summary of the theory or concept that refers to the list of libraries used. Summary of the theory to be presented in this paper are: database systems, database development, conceptual and logical database modeling, functional dependencies, and normalization.

A. Database Development

Questions relating to the structure of the database becomes an important fundamental thing in a database system. A database usually contains a set of interrelated properties, namely: data sharing, data integration, data integrity, data security, data abstraction, and data independence [2].

To develop a proper database, there are several steps that can be followed as presented in Fig. 1 Database Development Stages [2].

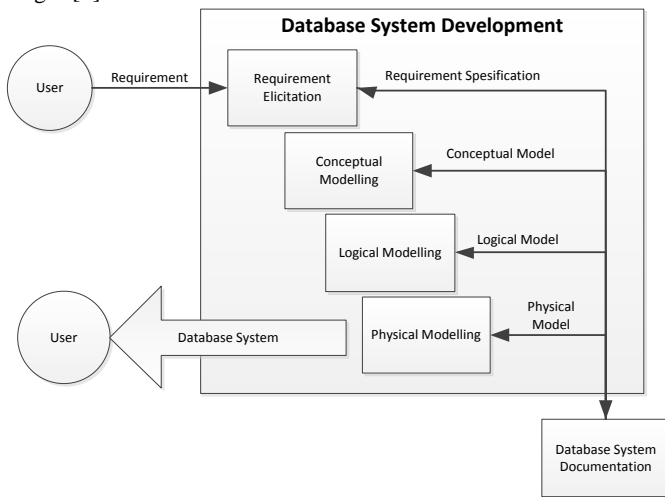


Fig. 1 Database Development Stages [2]

Steps being taken to develop the database, also called the Life Cycle Database, which is done with common stages, starting from the determination of information needs to be stored in database up to the logical schema translation in a particular DBMS.

B. Conceptual Modelling and Logical Modelling

Conceptual and logical modeling the second and third stages of database development. The conceptual model is described using the E-R Diagram, while the logical model of the database will generate the relation schemes are translated from the E-R Diagram using standard algorithms or rules of transformation of E-R Diagram to relational model.

1) E-R Diagram Model

E-R Diagram model is very useful for mapping the real-world requirements of the company into a conceptual model. An ER diagram is a graph that represents the entity sets, attributes, and relationships as the main component. Until now there are 3 (three) common methods that are used to describe the ER diagram, namely: the model Chen, Information Engineering (IE or crow's feet), and UML. Each component is described using in ER diagram notation within their particular

methods used [3] - [6].

**Error! Reference source not found.** explain the notation (graphs) which are used for each component of the ER diagram in Chen models.

TABLE 1  
E-R DIAGRAM COMPONENT NOTATION

Component	Notation
Entity Set	
Relationship	
Non Key Simple or Single-Valued Attribute	
Key Attribute	
Multivalued Attribute	
Composite Attribute	
Derived Attribute	
Connector Line	

To show the relationship of a number of objects in an entity set with another object in entity set pairs, in ER Diagram need to be added cardinality (cardinality ratio). Cardinality in one or several entity sets are connected through a relationship have one of the following types [1]:

- a. One to One (1-1) Cardinality
- b. One to Many (1-M) Cardinality
- c. Many to One (M-1) Cardinality
- d. Many to Many (M-N) Cardinality

2) Translating E-R diagram Into Relational Model

The algorithm used to translate the ER diagram into a relational model is as follows [5]:

- a. Translate each entity set becomes a table. Column in the table is an attribute that is attached to the entity set. Key attribute is translated as a primary key in the table,
- b. For each relationship has 1-1 cardinality, select one of the more dominant entity set, then add the primary key in the table become the dominant foreign key in related table,
- c. For each relationship has cardinality of 1-M or M-1, add the primary key for the table's cardinality 1 (one) becomes a foreign key in the table that has the cardinality of M (many),
- d. For each relationship has M-N cardinality, translate role as a new table. Translate each descriptive attribute in relationship to be a column in new table, then add the

primary key in each table that are related into a foreign key to the new table.

- e. For each multivalued attribute M which appears in entity sets A, translate a new table B that has a column of M, then add the primary key in the table A as a foreign key in table B.

### C. Functional Dependency

Functional dependency is defined as the relationship between the attributes (columns) in a relation (table). Functional dependencies present formal mechanism to express boundaries between columns. To express the functional dependence in a table use the notation  $A \rightarrow B$ , where [5]:

1. A determines B
2. B is functionally dependent on A
3. A is called as determinant
4. B is called as object of determinant

### D. Normalization

Tables in a relational database, which is translated from the ER Diagram or UML, are often not able to avoid serious problems mainly to do with performance, integrity, and maintenance. [3].

Database design is not proper or bad can lead to several problems, such as a repeat of the same information and database inability to produce the required information. Issues such as the repetition were found when forced inserting records in enormous quantity of in a table called anomaly[6].

The main objective of normalization is to produce a normalized database structure that can store information without redundancy found at the same time can present information easily. The approach taken is through a database design that meets the normal form (NF) [1].

A table can be considered normal if it meets a number of the normal form. In most cases, a table can be considered normal if it is able to meet up to with 3rd NF [4].

## III. RESULTS AND DISCUSSION

Final Project Monitoring is an information system that was built to monitor the progress of settlement of final project courses (FP). The end result of FP in Information Management Study Program (IMSP) consists of 2 (two) products, which is software or models and reports. To complement the software, students prepare a document that follows the FP report systematic writing in accordance with the FP report formats that have been defined. Both products should ideally be completed by students in one semester. During the FP completed, students must perform guidance by the supervisor in accordance with the agreed schedule and follow a series of evaluations, which is: evaluation of the feasibility of titles, FP proposal seminar, pre-assembly, FP assembly, and the FP revision (if any).

The primary role of Final Project Monitoring is to monitor the progress of settlement of each product FP can be completed within a predefined. Students are required to report

on the progress of each part of the product resolution and obtain approval of faculty mentor. In keeping with its role, monitoring the FP can provide notification to students and lecturers to meet the timeline that has been set. Storage of data in a database and submission of information relating to the progress of settlement of the PA, is the key to support a major role Final Project Monitoring.

### A. Requirement Elicitation

Defining the data requirements and information is done through the analysis of documents used to support the implementation of the FP. In every activity or evaluation made by students for doing the FP, there are supporting documents that must be completed by students and faculty mentor. The documents used are as below:

#### 1. Submission Title Document

This document is used by students to apply for the title of the FP. Besides filling the FP title, the student must enter additional information in the form of:

- a. Description of products (software or models) that will be develop,
- b. Tools to build the product, and
- c. Product functional requirements.

The information loaded on the submission title document would be a contract that must be completed by the student.

#### 2. Guidance document

Guidance document is a log book used by students to record any consultation activities undertaken to faculty mentors.

#### 3. Seminar document

Seminar document is used to record evaluation result of FP proposal by the examiner. The examiner have the right to give the evaluation score and improvements that need to be done by the student. Proposed improvements approved by students and faculty mentors will repair contracts that have been submitted through the submission title document.

#### 4. FP report

FP report template contains report writing guidelines. In addition to building software or models, students are required to prepare the documentation for the product (software or models) produced. Overall, there are five (5) chapters to be written by the student in the FP report, which is:

- a. Introduction
  - b. Review of Literature
  - c. Analysis and Design
  - d. Implementation and Testing
  - e. Conclusion
- #### 5. Pre-assembly Document

Pre-assembly documents used by faculty mentors to give a score of FP. Pre-assembly activity is also used by faculty mentors to evaluate student readiness to follow the FP assembly.

#### 6. Assembly Document

At the final stage of the implementation of the FP, the student will be tested on the FP assembly. At the assembly of the FP, the examiner assigned to explore student mastery in products that have been produced. FP contract be the main

parameter by the examiner. At the end of the assembly, the examiner is entitled to give a score to the results of exploration that has been done.

Those six documents used as a reference for defining the data and information needs to be supported by the database.

Through the analysis of these documents, the required data is formulated as follows:

- a. FP description.
- b. Faculty mentors assignment.
- c. Product functionality requirements (software or models) to be generated.
- d. Systematics of FP report.
- e. FP consultation log book.

While the information will be processed and presented from the database are as below:

- a. Information about FP progress of settlement products, including software or models and FP reports.
- b. Notification to students and faculty mentors related to the achievement of the completion of the contract in accordance with the implementation FP schedule.

*B. Conceptual Modelling*

After defining the data and information needs from real world, the next step is conceptual modeling. The conceptual model is described by adopting the model of Chen notation. **Error! Reference source not found.** Fig. 2 describes the relationship that occurs between entity sets that represent relationships between objects on the real world.

*C. Logical Modelling*

Conceptual model in the form of ER diagram is then translated into a relational model. Translation of the relational model through the relation schema describes the structure of a table and column in it. Column defined as a primary key is added a "#" on front of the column name, whereas for the specified column as a foreign key, added the "@" on front of the column name. Translation of E-R Diagrams in Fig. 2 produces the following relation schema:

- a. SocMedAccount (#SocmedID, socmedName)
- b. hasSocmed (@SocmedID, @username, socmedAccountName)
- c. UserAccount (#username, password, role)
- d. Faculty (#FacultyID, @username, FacultyName, emailAddress, phoneNumber, JFA)
- e. FacultySpeciality (@FacultyID, #specialityNum, speciality)
- f. Student(#studentID, @FPID, studentName, gender, concentration, phoneNumber, emailAddress)
- g. FinalProject (#FPID, FPTitle, FPDescription, legalDate)
- h. FacultyMentors (@FPID, @FacultyID, mentorNum)
- i. ReportSystematics (#reportSystematicsID, @FPID, chapter, weight, startDate, endDate)
- j. ReportCompletion (#reportCompletionID, @reportSystematicsID, reportDate, reportDetail,

completionPercentage, feedback, feedbackDate, mentorApproval, reportFile)

- k. FunctionalRequirement (#functionalID, @FPID, functionalName, functionalDetail, weight, startDate, endDate)
- l. FunctionalCompletion (#functionalCompletionID, @functionalID, functionalDetail, completionPercentage, reportDate, feedback, feedbackDate, mentorApproval)

*D. Normalization*

To ensure every table produced meets the normal form, each table must be tested using the normalization technique. Before testing the "normal form", each table must be specified its functional dependency. **Error! Reference source not found.** describes the functional dependency in each table in the database that is built.

TABLE 2  
FUNCTIONAL DEPENDENCY ON EACH TABLE

Table Name	Functional Dependency
SocMedAccount hasSocmed	SocmedID → socmedName SocmedID, username → socmedAccountName
UserAccount Faculty	Username → password, role FacultyID → username, FacultyName, emailAddress, phoneNumber, JFA
FacultySpeciality	FacultyID, specialityNum → speciality
Student	studentID → FPID, studentName, gender, concentration, phoneNumber, emailAddress
FinalProject	FPID → FPTitle, FPDescription, legalDate
FacultyMentors	FPID, FacultyID → mentorNum
ReportSystematics	reportSystematicsID → FPID, chapter, weight, startDate, endDate
ReportCompletion	reportCompletionID → reportSystematicsID, reportDetail, reportDate, completionPercentage, feedback, feedbackDate, mentorApproval, reportFile
FunctionalRequire ment	functionalID → FPID, functionalName, functionalDetail, weight, startDate, endDate
FunctionalComple tion	functionalCompletionID → functionalID, functionalDetail, completionPercentage, reportDate, feedback, feedbackDate, mentorApproval

Table 7 describes the results of normalizing test performed on each table. Each table was tested up to BCNF stages to ensure there will be no anomaly.

TABLE 3  
NORMALIZATION TEST RESULT

No	Table Name	1 <sup>st</sup> NF	2 <sup>nd</sup> NF	3 <sup>rd</sup> NF	BC NF
1	SocMedAccount	√	√	√	√
2	hasSocmed	√	√	√	√
3	UserAccount	√	√	√	√
4	Faculty	√	√	√	√
5	FacultySpeciality	√	√	√	√
6	Student	√	√	√	√
7	FinalProject	√	√	√	√
8	FacultyMentors	√	√	√	√
9	ReportSystematics	√	√	√	√
10	ReportCompletion	√	√	√	√
11	FunctionalRequire ment	√	√	√	√
12	FunctionalCompleti on	√	√	√	√

E. Physical Modelling

As a final step to implement the design of databases, each table that already meet the normal form must be translated into a physical model. Data Definition Language (DDL) is used to construct physical models on DBMS.

IV. CONCLUSION

Database development activities starting from analyzing the documents is used in the implementation of the FP to formulize the data needs to be stored and the information that must be presented to support the implementation of FP

business processes. Furthermore, data requirements and information are modeled into a conceptual model using E-R Diagrams. Through the analysis of the document as the basis for E-R diagram, it is certain that the model developed is representative of the data requirements (object and its relationship) and information in the real world.

The next steps are done is to translate conceptual models into logical models to produce a relation schema. Initial relation schema is a description from the tables which will be the main component from database. To ensure avoid anomalies, each relation schema tested its normal form up to BCNF stage. As a result, twelve relation schemes produced meets the normal form.

As a final stage, logic models translated in the physical models implemented into the MySQL DBMS. DDL is used to define the structure of the database and each table on the database. DDL is also used to define constraints such as primary key and foreign key attached to each table. By defining the tables and constraints, obtained a set of tables that relate to each other and in accordance to relations contained in the E-R Diagram.

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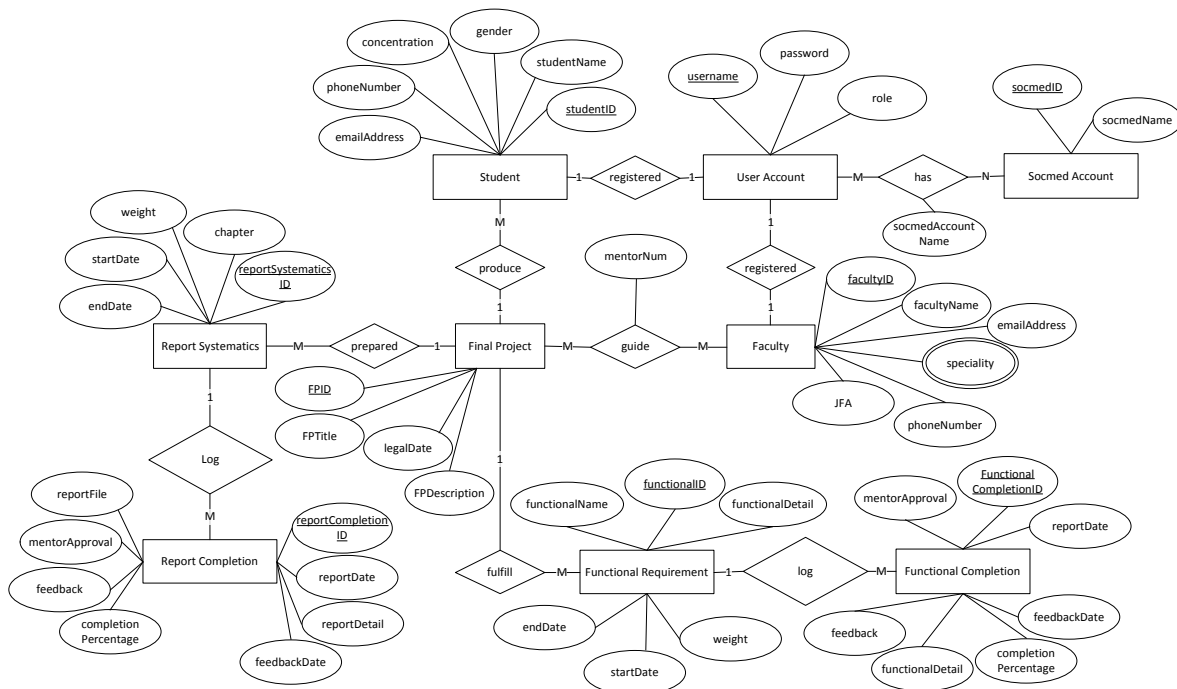


Fig. 2 E-R Diagram as Conceptual Model

# B-Tree Indexed-File for Genomic Sequence Data Searching

Winangsari Pradani<sup>1</sup>, Endang Ripmiatin<sup>2</sup>

**Abstract**— Genomic data sequences obtained from the NCBI GenBank stored in a flatfile, which is a text file format. Keyword search directly from flatfile that has an average of 9 million lines will certainly take a very long time. One of the best ways to search keywords faster is by indexing the data that serves as the catalog in the library. With the data index, keywords are searched indirectly. The data index size is much smaller than the size of the entire data. It has been sorted by a specific sequence as well.

In this study, B - Tree will be used as an index structure in search of genomic sequences of data. B - Tree has been widely recognized as an abstract tree structure which is very efficient in managing the index. The mechanism of dynamically data update ( insert , delete ) that makes the tree always in the balance condition causes B - Tree structure is ideal for keywords searching on huge data.

**Keywords** : GenBank, genomic data sequence, B-Tree index

## I. INTRODUCTION

In 2011 the UAI Bioinformatics Research Center has been established as a form of research partnership between Informatics Engineering Study Program and Biological Study Program in Faculty of Science and Technology, University of Al Azhar Indonesia. Beginning with research on Hepatitis Vaccines and some Final Projects for students in both of these study programs, Bioinformatics Research Center slowly but surely began to show progress, along with the increasing interests among lecturers and students to do some researches in this field.

At this time, the sequence data are stored in the GenBank (managed by the National Center for Biotechnology Information, NIH, USA); DDBJ (managed by the Center for Information Biology, NIG, Japan); and EMBL (managed by the European Bioinformatics Institutes, UK). The third-party – the researchers and research institutions all over the world share their recent data to these storages. Sequence data can be accessed by anyone who need. One final project of students of Information Engineering in 2012 has been tried taking sequence data from GenBank FASTA format from NCBI server using the FTP protocol. Now hundreds of thousands of sequence data has been able to put on the server Bioinformatics Study Center and ready to be used as research objects for both biologists and informatics researchers.

The format of the text or sequence data is known as flatfile. This format is chosen because of its simplicity and freedom from certain database processing software. With this format,

researchers can directly see the sequence data with a very minimal application (like notepad). However, because of the relatively big size of this sequence data, without support of special access applications the search for a particular sequence data required will be taking too long.

Flatfile is a text file, but what's inside is not as simple as plain text files (such as the article). Flatfile sequence data has a format with certain attributes, however, researchers are not always complete fill these attributes. In other words, the characteristics of sequence data flatfile is between free text files and organized database files.

In the realm of the file system, there are several ways the preparation of data to support a random search data. One of the best ways is by indexing the data that serves as a catalog in the library. With the index of the data, searchable keywords do not directly search from this data file, but from the index file. Index file is much smaller than the size of all of the data, and has been ordered by a particular sequence.

B-Tree has been widely recognized as an abstract structure tree (trees) which are very efficient in managing indexes. Dynamically updating data mechanism (insert, delete) causing B-Tree structure ideal for data storage that is not stored at sorted manner. B-Tree structure are always in a balance state at all times, it also led to a relatively the same search time for any keywords.

With all the advantages of the B-Tree, hundreds of thousands of sequence data that already exist in the server Bioinformatics Study Center will try to be indexed using this structure. The hope was that the researchers can access the required sequence data more quickly.

This research aims to:

- a. Analyze the flatfiles at Bioinformatics Study Center.
- b. Study the B-Tree indexed file
- c. Do preparation (design) to building a B-Tree indexed-file
- d. Study the Python programming language to implement the B-Tree indexed-file

II. LITERATURE REVIEW

2.1 The GenBank sequence data

GenBank genetic sequence database which is managed by the National Institutes of Health (NIH). GenBank is a collection of annotated nucleotide sequences and proteins (having annotations) publicly accessible. Today, all records in GenBank is a contribution of the researchers who voluntarily provide research note and distributed to the public. GenBank is managed by the National Center for Biotechnology Information (NCBI) which is part of the International Nucleotide Sequence Database Collaboration. Figure 1 is an example of data drawn from a database of gene sequences from NCBI GenBank.

```

LOCUS       AF111785 5925 bp mRNA PRI 01-SEP-1999
DEFINITION Homo sapiens myosin heavy chain IIx/d mRNA,
            complete cds.
ACCESSION  AF111785
VERSION    AF111785.1 GI:4808814
KEYWORDS   .
SOURCE     human.
ORGANISM   Homo sapiens
....
.....

Source     1..5925
            /organism="Homo sapiens"
            /db xref="taxon:9606"
            /chromosome="17"
            /map="17p13.1"
            /tissue type="skeletal muscle"
            CDS 1..5820
            /note="MyHC"
            /codon start=1
            /product="myosin heavy chain IIx/d"
            /protein id="AAD29951.1"
            /db xref="GI:4808815"
            /translation="MSSDSEMAIFGEAAPFLRKSERERI
            EAQNKPFDAKTSVVFVDPK
            ESFVKATVQSREGGKVTAKTEAGATVTVKDD
            QVFPMPNPPKYDKIEDMAMMTHLHEPAV
            LYNLKERYAAWMIYTYSLFVCVTNPNYKWL
            VYNAEVVTA YRGKKRQEAPPHIFSISD
            NAYQFMLTDRENQSILITGESGAGKTVNTRVI
            QYFATIAVTGEKKKEEVTSGKMQGT
            LEDQIISANPLLEAFGNAKTVRNDNSSRFGKFIR
            IHFGTTGKLASADIETYLEKSRV
            RRIQHELEEAERADIAESQVNKLRVKSREVT
            KIISEE"
    
```

Figure 1. Genbank Data

2.2 B-Tree

In computer science, a B-tree is a tree data structure that maintains the data remain in the ordered (sorted) and has a level of complexity of the search, sequential access, insertion and deletion of data in logarithmic time. B-tree is a generalization of a binary search tree (binary search tree) in which a node can have more than 2 children. (Comer, 1979, p. 123) In contrast to the binary search tree that is self-balancing

(self-balancing binary search trees), B-tree is suitable for systems that require read-write data in large blocks. This structure is commonly used in database and file system.

B-tree has fundamental advantages compared to other implementations of data structures, especially when applied to the conditions in which the data access time on the node is much larger than the data processing time. This usually happens when a node's data is stored in the secondary storage such as disk drives. By maximizing the number of child nodes within each internal node, then the tree height is reduced significantly and the number of access nodes is reduced, the need for rebalancing process from tree is greatly reduced too. The maximum number of child nodes is dependent on the information that must be stored and disk block size in secondary storage.

A B-Tree grows in line with the entry of new entries are added. The addition of a new entry to the structure of the B-Tree to follow the rules as follows: [HAR1988]

- a. Each node can accommodate a maximum of 2d pairs of data entry and address, and 2d + 1 is a pointer to a child node
- b. All nodes except the root node has a minimum number of d entries
- c. All leaf nodes are at the same level (in other words: the perfect balance)

The following is an explanation of how the index B-tree is created, added and deleted.

Suppose we want to insert data in the order of arrival of 17, 0, 99, 543, 12, 84, 30, 7, 28, 52, 9, 63 to the B-tree order 2. The data is considered as the number of key values (key ) of records-records that exist in a data file. The values of these keys will be incorporated into the B-tree that later on when reading back, the result has been sorted. For ease of explanation, suppose that the order of the B-tree is determined equal to 2.

Under the rules, node B-tree of order 2 has:

- a. Node consists of 4 free places for entry (key) and 5 pointers
- b. All nodes except the root node contains at least two entries (key)
- c. All leaf nodes are at the same level

**Create B-Tree**

B-Tree at first is nothing, and will be established when the value of the first entry appears, namely 17. When the value of the second entry comes, namely 0, the location of the entry in the node adjusted to the ordered. So, 0 will be placed in the first place, while 17 shifted into 2nd place. Then, figure 99 occupies the 3rd place, followed by lifting 543 in 4th place. This process is in figure 2.

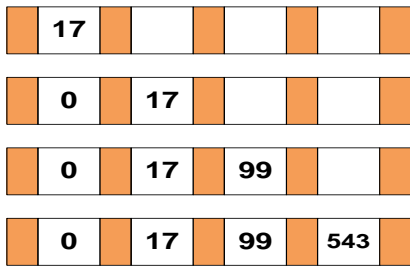


Figure 2 Create Root of B-Tree and Add entries 17, 0, 99, 543

**Add Entry, Split**

Next, the value of the key that will go is 12. Conditions of the last B-tree is a node that is fully charged so that the value of the number 12 can no longer be added to that node. With this situation, it is necessary to accommodate the additional node value of 12. The trick is, all entries in a node that is full of new value added with structured sequences to 0, 12, 17, 99, 543. The value is in the middle, ie 17 will be placed the new root, 0 and 12 remain in the old node, while the 99 and 543 placed on the new node. Pointer in front of the number 17 will be pointing to the old node, pointer behind the number 17 refers to the new node. Value-adding processes resulting in the distribution of tree-level value and the addition of B-Tree can be seen in Figure 3.

0, 12, 17, 99, 543

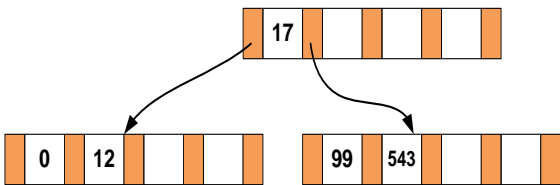


Figure 3 Adding value 12 Cause of split node and the addition of Level B-Tree

The addition of the numbers 84, 30 and 7 of additions that do not alter the structure of the tree. How to insertion into the 3rd is the same. For example, the insertion figure 84. At first look at the numbers in the root, then find the right position to 84. In this case, 84 must be entered after the number 17, follow the pointer to the right of the number 17 that points to a node. If this is already in the leaf node, then the number 84 is inserted in this node with regard to the order. The process of adding 84, 30 and 7 can be seen in Figure 4.

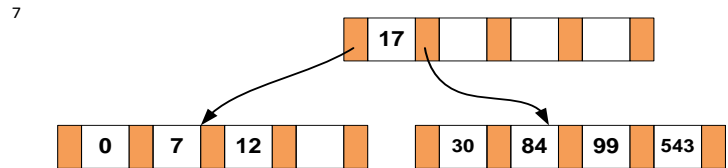
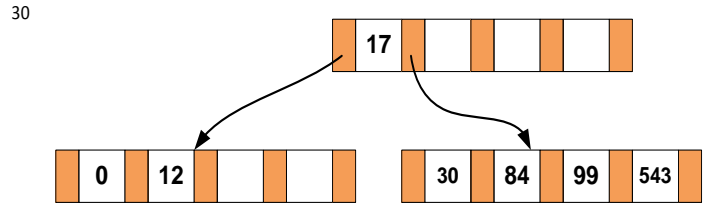
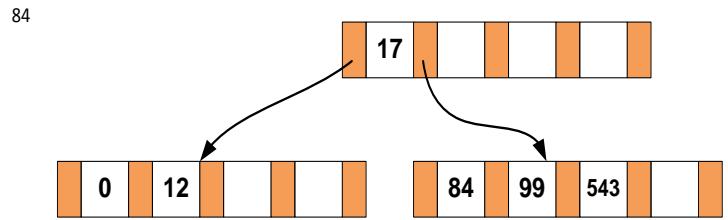


Figure 4. Adding value entries 84, 30, 7 did not change the structure of the B-Tree

Next, the addition of 28 led to the split vertex and redistribution values of the entry. This process is in Figure 5.

SPLIT : 28, 30, 84, 99, 543

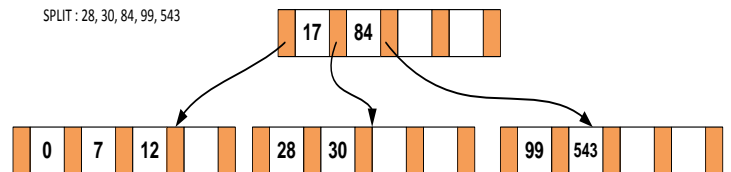


Figure 5 Adding value 28 entries cause split and redistribution of value

The addition of 52, 9, 63 took place without changing the structure of the tree. Figure 6 shows this process.

52, 9, 63

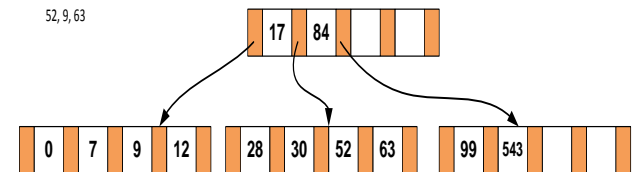


Figure 6 Adding value entries 52, 9, 63

**Delete Posts**

The process of removal of the value of the B-tree is preceded by a search value will be removed from the roots. Suppose the value 52. Then will be removed from the root node will be sought in which the value 52 is located. In this situation, 52



exist between values 17 and 84, then by following a pointer to the node below it didapatkanlah number 52 on that node. 52 removed from the node, and 63 slides forward to maintain sequence of. Figure 7 shows this.

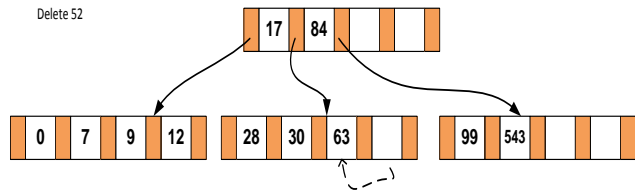


Figure 7 Removal of entries without changing the structure

Next, if the value of 99 is removed, there will be the contents of the node that is less than half full. If this occurs, refer to the contents of the node siblings (sibling), then write back in sequence the contents of the left sibling node, the numbers on the root node and the numbers on the original node without value are removed. Take the middle value, put the middle value in the root, a smaller number than the root figure is placed in the left sibling node, the rest on the original node. This process can be seen in Figure 8.

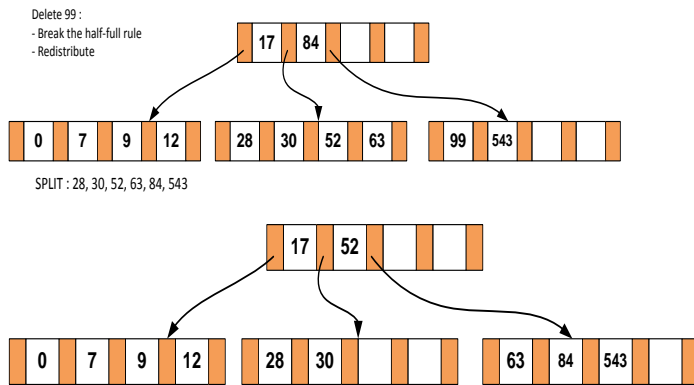


Figure 8. Removal of 99 led to a redistribution of value entries

**Delete entry and Merge**

Here is an example of the abolition of entry that cause the deletion of a single node. If the initial condition B-tree as in Figure 2.8 above. Suppose entry to be deleted is 30, then the node containing the number 30 will be less than half full. The rule is if it happens so is seeing sibling (for redistribution). It turns left or right sibling have content that barely fit half full so that no one can be shared. There will be merging the contents of two vertices into a knot so that there is a node that is abolished. See figure 9.

Kondisi Awal

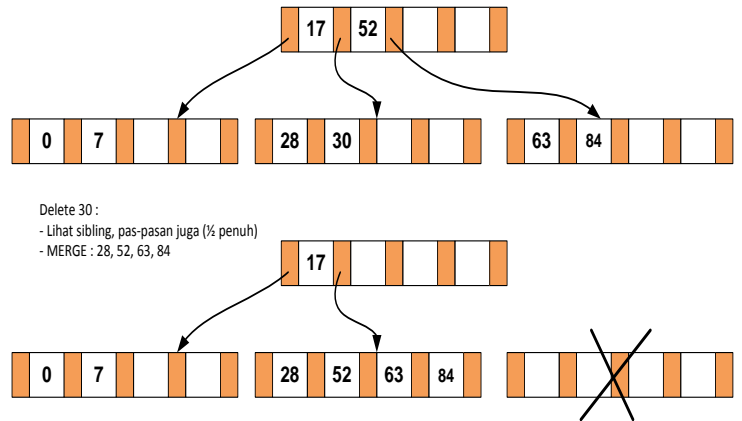


Figure 9 Removal of 30 causes the Merge the contents of 2 vertices

On the elimination of the value of B-tree 17 unconditioned early as in Figure 10, the merge process not only lead to two vertices deleted but also makes the level of the tree B-Tree is reduced 1.

Kondisi awal

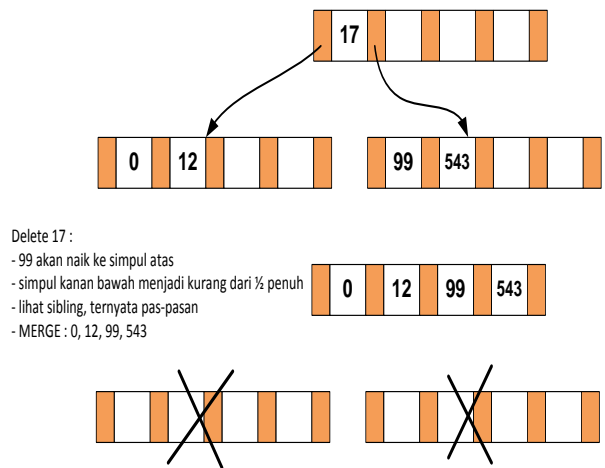


Figure 10. Removal of 17 led to a reduction in the level of B-Tree

**III. THE DESIGN OF B-TREE INDEXED-FILE**

**3.1 The Architecture**

There are three main parts of the B-Tree indexed file : (1) The flatfiles, (2) The B-Tree Index, and (3) The user interface.

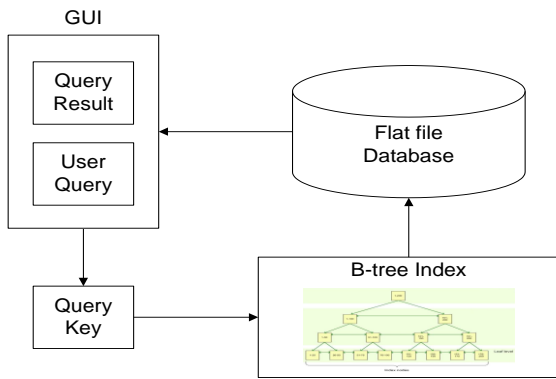


Figure 11. The B-Tree Indexed File System

**3.2 Characteristics and Volume of FlatFile**

On the server there are 100 files of bioinformatics gene sequences obtained from the NCBI GenBank. It has been read 11 files as outlined in Table 4.1. The average file size is 509 406 Kilobytes (500 MB), has an average number of lines 9,658,432, has a record number of locus on average 167 213, and the average size of temporary file is 5,785 KB.

TABLE I  
THE FLATFILES AND THE TEMPORARY FILES

No	File Name	Size (KB)	Number of Lines	Number of LOCUS record	Size of Temp File (KB)
1	gbbct67.seq	244.129	3.763.250	61	3
2	gbest1.seq	512.004	9.778.366	158.932	5.463
3	gbest2.seq	512.002	9.719.389	161.860	5.564
4	gbest3.seq	486.038	9.231.818	153.644	5.276
5	gbest4.seq	512.001	9.806.331	170.812	5.878
6	gbest5.seq	512.002	9.757.757	168.996	5.814
7	gbest6.seq	512.001	9.775.661	171.504	5.903
8	gbest7.seq	512.001	9.709.010	169.838	5.842
9	gbest9.seq	512.004	9.677.526	168.560	5.798
10	gbest15.seq	512.004	9.496.439	168.614	5.960
11	gbest16.seq	512.002	9.632.024	179.370	6.355

**3.3 Temporary File for Building B-Tree Indexed-File**

Before the B-Tree index is created, temporary file is made to simplify the development process. The temporary file contain only the key value along with the address of the record at the origin flatfile. Python language programming has been selected to implement the system in accordance with the recommendations of bioinformatics experts who say that most of the genes data processing programs using the Python language.

Here is a text file reader program:

```
# The program reads the flat file
# Input: flat files have the extension '.seq'
# Output: a file that contains records locus results
# Author: Winangsari, December 31, 2013
```

```
filebaca = open ('gbest16.seq', 'r')
filetulis = open ('hasilgbest16.txt', 'w')

filetulis.writelines ('file which read:' + filebaca.name + '\n')

jumlahlocus = 0
a = 0
for y in filebaca:
    a = a + 1
    if y.startswith ("Locus"):
        jumlahlocus = jumlahlocus + 1
        filetulis.writelines (str (jumlahlocus) + '\t' + y [12:20] + "
+ filebaca.name + " + str (a) + '\n')

filetulis.writelines ('\n')
filetulis.writelines ('Number of rows' + str (a) + '\n')
filetulis.writelines ('Total locus' + str (jumlahlocus) + '\n')

filebaca.close ()
filetulis.close ()
```

This is an example of temporary file generated from file reading procedure :

LOCUS file contains the number of records, LOCUS id, filename, and line number in the source file. Examples LOCUS file contents:

```
File yang dibaca : gbest1.seq
1 AA000001 gbest1.seq 10
2 AA000002 gbest1.seq 74
3 AA000003 gbest1.seq 141
4 AA000004 gbest1.seq 207
...
158929 AA162201 gbest1.seq 9778119
158930 AA162202 gbest1.seq 9778173
158931 AA162203 gbest1.seq 9778240
158932 AA162204 gbest1.seq 9778301

Jumlah baris 9778366
Jumlah locus 158932
```

**3.5 Implementing System in Python**

If B-Tree structure is implemented using C or Pascal programming, a datatype called pointer usually used to form the tree data structure. Python does not have pointer datatype; however Python has a list structure, which should be more naturally accommodate the structure of the tree. In its list structure can contain the list structure in it. However, there are some constraints:

- a. capacity of a List. In this case it will be tested how much a list can hold data. In C or Pascal, which are using pointer datatype, this is not a problem because the tree can be broken down into individual nodes. But in Python, the tree contains all of nodes.
- b. There are some very useful functions for data processing in python, for example, 'sort' (sorting) and search. This function

is already exist (built-in) in Python. Supposedly this is the advantage, but the programmer does not know the sort or search method being used. There are many sort methods and certainly not all of them are suitable for the problems encountered, but in Python when asked to do 'sort' it all done in one way.

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#### IV. CONCLUSION

Here are some of the conclusions that can be drawn up at this time

1. In this study, flatfiles have an average size of 509 MB, have an average number of record of 160 thousand, and have the number of lines around 9 million. This is a very large file size.
2. Temporary files should be built to simplify the Index-System development process
3. Python has a list structure, which should be more naturally accommodate the structure of the tree.

#### ACKNOWLEDGMENT

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# Developing Battle Of Etam Earth Game Agent With Finite State Machine (FSM) And Sugeno Fuzzy

Reza Andrea<sup>1</sup>, Rufman Iman Akbar<sup>2</sup>, and Magit Fitroni<sup>3</sup>

**Abstract**— The Battle of Etam Earth is one of the games which is developed by Bibir Design Studio for the PC platform, Android tablets and arcade machines. A modern rock-paper-scissors game is packaged in a duel battle robots, where there are two players who will hone their skill, strategy and luck to be able to come out as a winner

AI technology is needed for this game in order to be played by one player only. The role of rival players are replaced by the existences of games agent. Game agents were constructed by transferring knowledge from the master game in the form of a Finite State Machine (FSM). The research in this game agent has attracted the attention of researchers in the field of Artificial Intelligence (AI). Every action-reaction that will be possibly happened toward the games which are played, applied into a form of “states” which will be the behavior of the agent game.

In this research will show us about the strategy model of the Battle of Etam Earth, which to design the behavioral of the Agent that was used Finite State Machine, and to determine the behavioral response to change the conditions. So that to achieve it , we use the Sugeno fuzzy logic. The test results through simulation battle, was concluded that FSM and Sugeno fuzzy could be properly functioned as a pattern of behavior as an intelligence agent game.

**Keywords**— The Battle of Etam Earth, Game Agent, Finite State Machine, Sugeno Fuzzy

## I. BACKGROUND

**B**attle of Etam Earth is one of the games which was developed by Bibir Design Studio for the PC platform and Android tablets. A modern rock-paper-scissors game was packaged in a duel battle robots, which is there are two players who will hone their skill, strategy and luck to be able to come out as a winner.

AI technology is needed for this game in order to be played by one player only. The role of rival players are replaced by the existences of games agent. Game agents were constructed by transferring knowledge from the master game in the form of a Finite State Machine (FSM). Research on this game agent has attracted the attention of researchers in the field of

Artificial Intelligence (AI).

Model agent strategies that will be used on this game can be various, for example, a strategy to strike quickly, then in certain circumstances the behavior turns into collecting a large force to attack. Each of agent strategy, generally has the final goal to defeat the enemy (player). In this research will show us about the strategy model of the Battle of Etam Earth, which to design the behavioral of the Agent that was used Finite State Machine, and to determine the behavioral response to change the conditions. So that to achieve it, we use the Sugeno fuzzy logic.

It is known that a system that uses fuzzy logical is able to handle the uncertainty problem which the input obtained is a value of separately right [10]. The basis of this research, fuzzy logical was used in order to obtain the type of attack that changes the various responses of the agents based on input variables owned. Furthermore, in determining of changes the Sugeno fuzzy model was used, where each output behavior of agents were represented by fixed specified constants which was decided on the rule.

## II. BASIS OF THORIES

### A. Game Agent

Game Agent is a software agent. Software Agent is a system that the whole or the part of an environment which it can respond it that is located and acted every time, to do its job and to be able to effect what will be done next.

On this game, the game agent is usually called NPC (Non-Player Character). Autonomous character is kind of autonomous agent which is intended for the use of computer animation and interactive media such as games and virtual reality. These agents represent a character in a story or a game and has the ability to improvise their actions. This is the opposite of a character in an animated film, the action is written in advance, and for **avatar** in a game or virtual reality, action directed by the player in real time.

### B. Finite State Machine

In designing the game for AI, a state machine is the most widely used techniques for decision making problems and, at the same time with scripting is widely used to design the

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system in-game decision making. State machine is widely known as a technique for modeling the phenomenon or event-based conditions, including dissociation, and interface design. Finite State Machine (FSM) or also known as Finite State Automata, regarded as a technique that is widely used in designing the AI in the game.

On the FSM, the term state is a fundamental concept for presenting information relating to the current state of the system before. In a periodically time, the system is on one state, each of state has its characteristics and behavior of specific actions. The states are inter-connected through a transition state, then each direct transition to the state (**condition**) hereinafter as the target state. There will always be the initial state which serves as the starting point, then the condition of the **current state** which stores the previous state information. Input **events**, which are externally and internally triggered by system, functioning as a trigger, which directs the evaluation process of the **rule**. If the conditions are possibly fulfilled, then there is a transition from the current state to the next state in accordance with the existing rules [1]. The principle of the components are integrated on the FSM as shown in figure 1

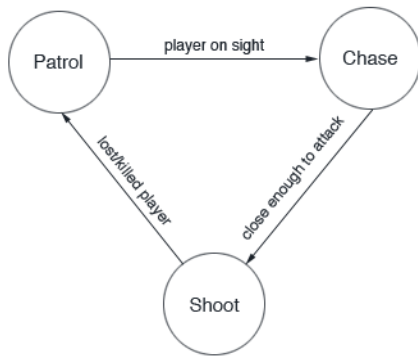


Fig. 1 Simply diagram of finite state machine on character AI

C. Logika Fuzzy

Fuzzy logical is a way to describe an input space into an output space. Fuzzy logical is very flexible, can tolerate data that is not appropriate. Fuzzy logical has a degree of relationship in the range of 0 (zero) to 1 (one), in contrast to digital logical which has only two values: 1 (one) or 0 (zero).

In understanding the fuzzy systems, it's better for knowing the fuzzy variables, fuzzy set, the universe of discourse and domain. Fuzzy variable is a variable that will be covered in a fuzzy system. Fuzzy Association is a group that represents a particular condition of fuzzy variables. The Universal talk is a whole of values that are allowed to be operated in a fuzzy variables. Domain is the overall value allowed in the universe of discourse and can be operated in a fuzzy set [10]. There are many models of fuzzy rules that can be used in the inference process but there are two models of the most commonly used rules are:

1. Mamdani Model

The form of rules which is used on Mamdani models as follows:

$$\text{IF } (x_1 \text{ is } A_1) \text{ o } (x_2 \text{ is } A_2) \text{ o } \dots \text{ o } (x_n \text{ is } A_n) \text{ THEN } z = k \quad (1)$$

A1, ..., An, k is the linguistic values, and "x1 is A1" states that the value of the variable x1 is a member of A fuzzy set

2. Sugeno Model

Reasoning on Sugeno method is similar to the reasoning mamdani, but the output (consequent) system is not in the form of fuzzy sets, but in the form of a constant or linear equations

$$\text{IF } (x_1 \text{ is } A_1) \text{ o } (x_2 \text{ is } A_2) \text{ o } \dots \text{ o } (x_n \text{ is } A_n)$$

$$\text{THEN } z = p_1 \cdot x_1 + \dots p_n \cdot x_n + q \quad (2)$$

Z can be any function of the variable input whose value is within the interval output variables.

III. CONTENT OF ANALYSIS

The Battle of Etam Earth Game has the type of game mode : VS mode, the mode which is each of player must choose one type of **Etam robot** to fight until one robot players come out as the winner and the game ends. Each character has 4 levels of category types of attacks, which is named as ATK Lv1 (quick attack), Lv2 ATK, LV3 ATK, and ATK Lv 4 (full charge attack). In each level of this type of attack also has an attack value of points of different combo attacks Each type has a move list (attack code) that is different, so that these types of attacks can only be issued if the attacking player with the correct code. Code move list for a combo attack consists of some combination of the symbols rock-paper-scissors game, that is R (rock), S (scissors), and P (Paper) refer to the table I

TABLE I  
VARIETY OF ENGGANG BOT'S ATTACKS

	ATK Lv 2	
	<i>Moon Attack</i>	
	ATK damage	<i>Melee</i> 510
	Move list	R, S
	ATK Lv 3	
	<i>Torpedo Rain</i>	
	ATK damage	<i>Range</i> 580
	Move list	P, P, P
	ATK Lv 4	
	<i>Destroyer</i>	
	ATK damage	<i>Range</i> 650
	Move list	S, P, S, R

Combo attacks can occur when the player does move list (attack code) correctly. If a player does not perform the properly move, then the combo attacks will not happen (Lv.1 attack will happen), combo-attack would not been happened if the player lost switched (**combo broke**)

A. Design of Finite State Machine

Designing of FSM is based on the events that occur in the activity log and the player attacks the opponent agent. Combo attacks would be carried out by opposing players is a priority framework of FSM state behavior of agents.

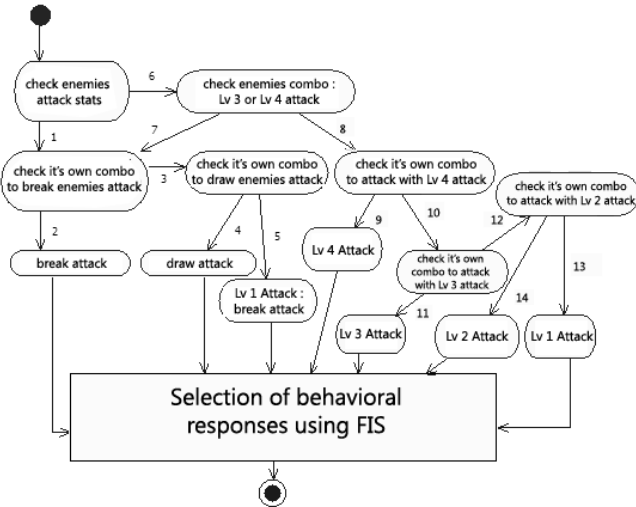


Fig. 2 Designing of FSM Agent

Remarks of Fig 2 :

- |                                     |                               |
|-------------------------------------|-------------------------------|
| 1. Enemies control attack in freeze | 8. No Enemy Combo             |
| 2. Combo Lv 2 / 3 / 4 will happen   | 9. Level 4 attack will happen |
| 3. No combo                         | 10.No level 4 attacks         |
| 4. Combo Lv 3 / 4 will happen       | 11.Level 3 attack will happen |
| 5. No combo                         | 12.No level 3 attack          |
| 6. Enemy of ATK is'nt freeze        | 13.No level 2 attack          |
| 7. Enemy Combo will happen          | 14.Level 2 attack will happen |

FSM designed starts from state up to check the status of enemies attack (see in Figure 2, event No. 1), which for certain conditions, an effect of special combo attacks can make the enemy attack into a freeze control (random and can be seen by the other players).

This is the right conditions for agents to launch attacks. Generally, the designing of the FSM at the agent level is shown in figure 2

On the final stage, each of FSM behavior of the agent is a decision that has been given by a fuzzy inference system (FIS). When the health input FIS points (HLT) and attack enemy agents fail to be combo. By Using Sugeno fuzzy output will be produced four attacks which are used include ATK Lv1, Lv2, LV3, and Lv4.

A. Design of Sugeno Fuzzy Inference

Variation of attacks were used by the agency, which is designed using fuzzy logical. The model is used the Sugeno fuzzy, by considering the output of Sugeno fuzzy model is a strict constant. The Health Point of HLTM enemies, COMB is

the number of failures that do combo attack agents, and ATK\_Lv is the level of attacks that will be made by the agent. The sets the number of ATK\_Lv = {1, 2, 3, 4}, which is a subset of level of attack. There are 15 rules that have been set up as in the example rule below:

R1 : IF HLTM = Verry Low AND COMB = Low THEN  
ATK\_Lv = 1

R2 : IF HLTM = Verry Low AND COMB = Normal THEN  
ATK\_Lv = 1

R3 : IF HLTM = Verry Low AND COMB = Hight THEN  
ATK\_Lv = 1

...

R15 : IF HLTM = Verry Hight AND COMB = Hight THEN  
ATK\_Lv = 2

FSM is integrated with fuzzy logical to agents. And the purpose is the agent can select the appropriate variation of the attack on the right conditions anyway. FIS overall design can be seen in Figure 3 below.

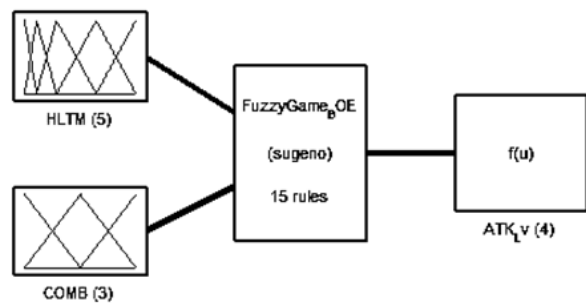


Fig. 3 FIS to bear the behavior of agent

IV. SYSTEM VALIDATION

A. Desain Fuzzy Callibration

The tests on Sugeno fuzzy logical designing is performed using FIS software. In order to test the behavior of agents on the level of the attacks, several parameters were tested to determine the variation of the resulting behavior. Parameters testing such are some of the health variables of enemy players (HLT) ranging from minimum to maximum and also some of the variable combo break agent (COMB) ranging from minimum to maximum.

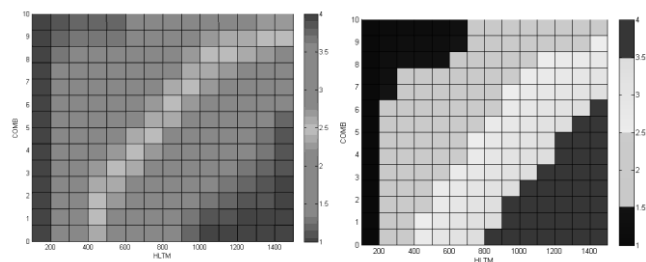


Fig. 4 The results of testing the behavior of agents by using different variable input parameters

From the variation of the input variables as shown in Figure 4 (left) explains the output behavior in the form of varied color patterns, which subsequently grouped into four models of the behavior of agents in terms of changes in the level of attack types (ATK\_Lv) based on a exactly constant value that around Lv1, Lv2, LV3, and Lv4 as shown in Figure 4 (right). Rounding is done due to there is nothing the type of output levels attacks do not in the form of integer numbers, so that the output in the form of partial numbers of ATK\_Lv with the faint color block will be rounded to the nearest rounding to round numbers 1, 2, 3, and 4.

**B. Battle Simulation**

Testing in battle simulations was conducted to see the effectiveness of FMS agent framework. Tests carried out 2 battles with the implementing agency FSM-FIS and is not (random attack), by looking at the number of the agent’s wins.

Battle simulation was performed on the first agent (COM1) against the second agent (COM2). In this test was using a robot Hornbill Bot COM1 COM2 against the using of robots were same as in Figure 5. Where discovered both of robots have the same power.



Fig. 5 Battle stage agent against agent

Battle simulation testing performed 10 times and counted the number victory of agents that implement FIS (COM1).

TABLE II  
RESULT BATTLE AGEN VS AGEN

Bout to-	The Result	
	COM1	COM2
1	Win	Lose
2	Win	Lose
3	Win	Lose
4	Lose	Win
5	Lose	Win
6	Lose	Win
7	Win	Lose
8	Win	Lose
9	Win	Lose
10	Win	Lose
Total of Wins	7	3

On table II, COM1 with the same type of robot battle won 7 times. It proves COM1 is superior than COM2. Tests were also done in the form of simulated battle against the user

(player). Tests carried out on the fight agents that implement FSM-FIS against 10 players.

TABLE III  
RESULT BATTLE AGEN VS PLAYER

Player	The Result	
	COM1	Player
1	Lose	Win
2	Win	Lose
3	Lose	Win
4	Lose	Win
5	Win	Lose
6	Win	Lose
7	Win	Lose
8	Win	Lose
9	Win	Lose
10	Lose	Win
Total of Wins	6	4

Table III showed that the agent won six times against a human player. The simulation proved that agent is hard to be defeated by the players.

**V.CONCLUSION**

From the test results of this study can be obtained several conclusions such as:

1. To make the game Battle of Etam Earth can be played with 1 player only, then make the game agent as a second player which implements the FSM as a pattern of thinking.
2. Implementation of Sugeno fuzzy incorporated into the FSM starts with the identification phase to the game environment by FSM, where the input variables are used HLTM value (the value of the lives of the enemy) and COMB (value of combo attacks that broken agent), then the decision was given by the FSM processed to the rule, to be defuzzification output process agent behavior in the form of attacks LV 1 to 4.
3. The test results was done by the level of intelligence agencies battle simulation. Simulation between agents against the other agents and the agent proves that by applying of FSM and FIS is superior than the agent who was randomly attacked and also better than the human player.

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## The Application of C4.5 Method in Determining the Passing of English Proficiency Test (EPT)

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### Abstract

English Proficiency Test or EPT is the test that is mandatory for all students of the University of Potensi Utama before completing their studies. This test is intended to measure the level of the students' mastery of the English that has been taught during their studies. This test measures their English proficiency both spoken and written. The test consists of some sections, namely grammar, vocabulary, reading, listening and speaking. All this time, the process of the test results are still done manually and if there is a lot of data to be processed, it will certainly take a long time to determine the results of the test and find out who passed or not. Therefore, the writer is interested in developing a system that can help the process of the EPT test results quickly and accurately. In this study, there are several criteria used to determine students' passing, namely Grammar, Vocabulary, Reading, Listening and Speaking by using C4.5. The results of the study indicate that the value of the test Grammar is in the top Gain. Therefore, it can be concluded that the higher the value of a grammar the test taker has, the more likely s/he is to pass. The writer also used WEKA software in completing the process of this study.

**Keywords:** EPT, English, C4.5, Decision Tree, WEKA

### I. Introduction

English is one of the international languages which widely used in many countries around the world. Mastery of English is also one of many crucial factors both for job competition or job promotion. Considering the importance of English nowadays, Universitas Potensi Utama feels the need to prepare graduates to be able to master this language. One of the program that has already been implemented is inserted English as the mandatory subject in each semester of a student during the study period. Hopefully, by the teaching of English in each semester, there will be significant improvement on student mastery of the English, both oral and written. So that after they graduate, they are ready to compete in the world of work both nationally and internationally.

To measure the students' mastery of English and as the instrument of evaluating the success of this program, an evaluation test is needed to be made. For this purpose, a test which refers to the American Council on the Teaching of Foreign Languages (ACTFL) is developed. ACTFL is an international organization consisting of professionals that includes teachers, researchers and all who care about improving English language proficiency. This organization provides a clear indication of the scale and level of English proficiency descriptions candidates.

This test is called the English Proficiency Test (EPT). This test measures students' English proficiency both spoken and written. This test consists of written test which consists of grammar, vocabulary, and reading sections. Listening Comprehension Test and Speaking Test.

All this time, the process of the students' scores or the results of the test are still done manually and when there is a lot of data to be processed will certainly take a long time to determine the results of the test and find out who passed or not. For that, it is necessary to develop a system which

can process the test results of the which can process a lot of data quickly and accurately.

C4.5 method is a method that can calculate the results of the test with the vast amounts of data and provide accurate results. Therefore, the authors use this method with the help of Weka software for data processing EPT. The criteria used to determine student graduation EPT, is Grammar, Vocabulary, Reading, Listening and Speaking. Indri in explaining the data mining research and comparison methods C4.5 and CART can be very helpful at all to determine the students' scores in the first half in order to determine whether the student passed or not in the first half at the Computer Engineering Program at the Polytechnic of Padang [5].

By using data mining classification algorithms can help students to determine who will be elected department so that students choose majors based on ability, talent and background and the methods applied are C4.5 [6].

C4.5 algorithm has a high level of accuracy in generating a decision, accuracy is up to 94% on the training phase and 93% in the test phase is done and can be applied with a lot of data [7]

### II. Research Methodology

The method used in this study is the interviews, data collection, data processing given, the test data with the manual and its application with the help of software WEKA.

The data in this study were collected from the section that organizes the EPT test is then processed by the method of C4.5 and Weka software.

III. Analysis and Discussion

a. Data Analysis

The data in this study based on the results of interviews with the part related to the amount of data to 20 people. Such data can be seen in Table 1.

Table 1. Results The EPT test

NIM	Name	Grammar	Vocabulary	Reading	Listening	Speaking
102000462	Nurida Hafni	85	90	77	80	86
102000311	David Aryanto Siagian	80	84	85	95	80
102000172	Juliantari AlRahmi	98	86	85	80	77
101000333	Jabaru Silaban	82	94	95	85	77
102000212	Wirana Putra	80	76	75	95	70
102000151	Sni Rahayu	86	82	75	80	73
102000293	Indah Ariani	80	80	75	95	70
101000071	Yoky Frianda	84	76	85	85	70
101000363	Ananda Syahputra	60	60	75	85	70
092000271	Rosdina Hutagalung	60	60	75	75	80
101000281	Anief Brayanta	44	76	70	95	65
101000279	Anwar Siddiq Angkat	44	76	65	95	70
102000113	Harry Soesanto	40	56	35	95	50
113000033	William Flabianus M Shombing	12	68	52	85	60
101000219	M. Reza Yudani	76	94	95	85	75
101000108	Tri Sandi	76	88	80	85	70

b. Data Transformation

Transformation is going to process the data in some class or classification, as for the data to be classified is the grammar, vocabulary, reading, speaking and listening. The process of sharing data based on some of the following variables :

Table 2. Classification of Grammar

Grammar	Classification
$x < 60$	Less
$60 < x \leq 70$	Enough
$71 < x \leq 78$	Medium
$x > 79$	Good

Table 3. Classification Vocabulary

Vocabulary	Classification
$x < 60$	Less
$60 < x \leq 70$	Enough
$71 < x \leq 78$	Medium
$x > 79$	Good

Table 4. Classification of Reading

Reading	Classification
$x < 60$	Less
$60 < x \leq 70$	Enough
$71 < x \leq 78$	Medium
$x > 79$	Good

Table 5. Classification Speaking

Speaking	Classification
$x < 60$	Less
$60 < x \leq 70$	Enough
$71 < x \leq 78$	Medium
$x > 79$	Good

Table 6. Classification of Listening

Listening	Classification
$x < 60$	Less
$60 < x \leq 70$	Enough
$71 < x \leq 78$	Medium
$x > 79$	Good

Table 7. Classification of Result

Result	Classification
$x \leq 299$	Failed
$301 < x \leq 350$	Novice
$351 \leq x \leq 400$	Intermediate
$x > 400$	Superior

EPT test test score  $\geq 300$  then passed if below that value it did not pass. After transformasi on predetermined criteria, the obtained result data in Table 7.

Data transformation results that have been obtained will be used as data to be processed using the C4.5 algorithm in making a decision tree.

Table 7. Results of Transformation

No.	NIM	Name	Grammar	Vocabulary	Reading	Listening	Speaking	Result
1	102000462	Nurida Hafni	Bagus	Bagus	Sedang	Bagus	Bagus	Superior
2	102000311	David Aryanto Siagian	Bagus	Bagus	Bagus	Bagus	Bagus	Superior
3	102000172	Juliantari AlRahmi	Bagus	Bagus	Bagus	Bagus	Sedang	Superior
4	101000333	Jabaru Silaban	Bagus	Bagus	Bagus	Bagus	Sedang	Superior
5	102000212	Wirana Putra	Bagus	Sedang	Sedang	Bagus	Cukup	Intermediate
6	102000151	Sni Rahayu	Bagus	Bagus	Sedang	Bagus	Sedang	Intermediate
7	102000293	Indah Ariani	Bagus	Bagus	Sedang	Bagus	Cukup	Intermediate
8	101000071	Yoky Frianda	Bagus	Sedang	Bagus	Bagus	Cukup	Intermediate
9	101000363	Ananda Syahputra	Cukup	Cukup	Sedang	Bagus	Cukup	Novice
10	092000271	Rosdina Hutagalung	Cukup	Cukup	Sedang	Sedang	Bagus	Novice
11	101000281	Anief Brayanta	Kurang	Sedang	Cukup	Bagus	Cukup	Novice
12	101000279	Anwar Siddiq Angkat	Kurang	Sedang	Cukup	Bagus	Cukup	Novice
13	101000174	Eka Pratama	Kurang	Cukup	Cukup	Bagus	Cukup	Novice
14	113000044	Keni Pramudia	Kurang	Cukup	Kurang	Bagus	Cukup	Failed
15	101000366	Sni Rahayu	Kurang	Kurang	Bagus	Cukup	Cukup	Failed
16	101000216	Hendra Fransisco Sinag	Kurang	Cukup	Kurang	Cukup	Cukup	Failed
17	102000113	Harry Soesanto	Kurang	Kurang	Kurang	Bagus	Kurang	Failed
18	113000033	William Flabianus M Shombing	Kurang	Cukup	Kurang	Bagus	Cukup	Failed
19	101000219	M. Reza Yudani	Sedang	Bagus	Bagus	Bagus	Sedang	Superior
20	101000108	Tri Sandi	Sedang	Bagus	Bagus	Bagus	Cukup	Intermediate

c. Algorithm C4.5

Data transformation results then analyzed to generate a decision tree using C4.5 algorithm, in general algorithm C4.5 to build a decision tree is as follows :

1. Calculation of Entropy and Gain
2. Selection of the highest gain as root (Node)
3. Repeat the calculation process Entropy and Gain to search for branches until all cases the branches have the same class, namely when all variables have been part of the decision tree or each variable has a leaf or a decision.

4. Create Rule based decision tree.

To select attributes as root, based on the highest gain value from existing attributes. To calculate the gain used following the formula:

$$Gain(S, A) = Entropy(S) - \sum_{i=1}^n \frac{|S_i|}{|S|} * Entropy(S_i) \quad (1)$$

Where :

1.  $S$  : Association of Case
2.  $A$  : Attribute
3.  $n$  : Number of Partition Attribute  $A$
4.  $|S_i|$ : Number of Cases on Partition to- $i$
5.  $|S|$  : Number of Cases in  $S$

Calculation of entropy values can be seen in the following equation [1] :

$$Entropy(S) = - \sum_{i=1}^n p_i * \log_2 p_i \quad (2)$$

d. Discussion

1. Application of C4.5 Algorithm

Data resulting from the transformation or further data preprocessing algorithms implemented in C4.5. The results of the implementation C4.5 algorithm on First Iteration As stated in table 8 :

Table 8. Iteration Results

Node		jmlh Kasus	Failed	novice	itermediate	Superior	Entropy	Gain
Total		20	5	5	5	5	2	
Grammar								1,118
	Kurang	8	5	3	0	0	0,95	
	Cukup	2	0	2	0	0	0	
	Sedang	2	0	0	1	1	1	
	Bagus	8	0	0	4	4	1	
Vocabulari								1,118
	Kurang	2	2	0	0	0	0	
	Cukup	6	3	3	0	0	1	
	Sedang	4	0	2	2	0	1	
	Bagus	8	0	0	3	5	0,95	
Reading								1,0797
	Kurang	4	4	0	0	0	0	
	Cukup	3	0	3	0	0	0	
	Sedang	6	0	2	3	1	1,4591	
	Bagus	7	1	0	2	4	1,3788	
Listening								0,3244
	Kurang	0	0	0	0	0	0	
	Cukup	2	2	0	0	0	0	
	Sedang	1	0	1	0	0	0	
	Bagus	17	3	4	5	5	1,9713	
Speaking								0,7490
	Kurang	1	1	0	0	0	0	
	Cukup	12	4	4	4	0	1,585	
	Sedang	4	0	0	1	3	0,8113	
	Bagus	3	0	1	0	2	0,9183	

In accordance with the results obtained in the first iteration of the highest value in the variable gain Grammar and Vocabulary, then that becomes the root of the Grammar is variable, because the value of the variable gain Grammar is the highest gain. Grammar variable has five criteria: Less, Pretty, Medium and Nice. At criteria Less decision still can not be obtained and should be done to find the search process gain selanjunya branch. Simply having Novice decision criteria. Medium has a Superior decision criteria. And criteria Good still needs to be done to find the search process gain branch and subsequent decisions. The resulting decision tree on the first iteration seen in Figure 1 below :

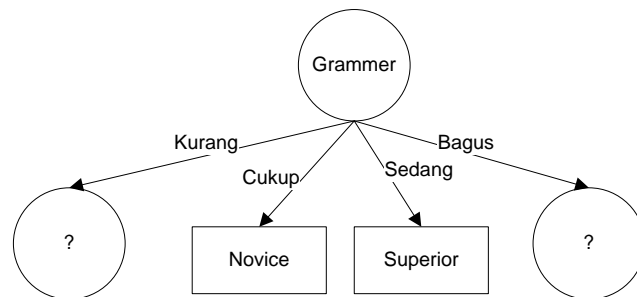


Figure 1. Decision Trees At First Iteration

In the next stage is to seek subsidiary of two criteria is less and Less good. The search process gain value will continue until all the branches have a decision. Tree resulting from the use of C4.5 algorithm can be seen in figure 2. The following :

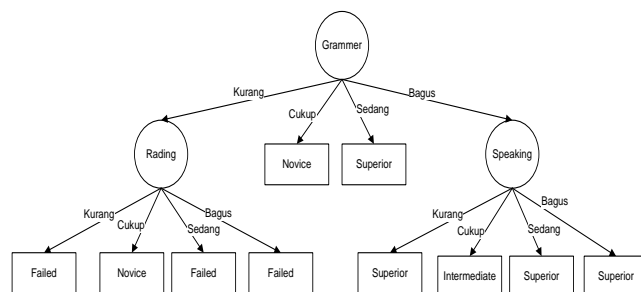


Figure 2. The Decision Tree is generated on for the implementation of the C4.5 algorithm

b. Implementation Using Weka Applications

Application of C4.5 algorithms using Weka application, the data used are set out in the amended table.7 in .csv form, while the results of the test application Weka seen in figure 3. following :

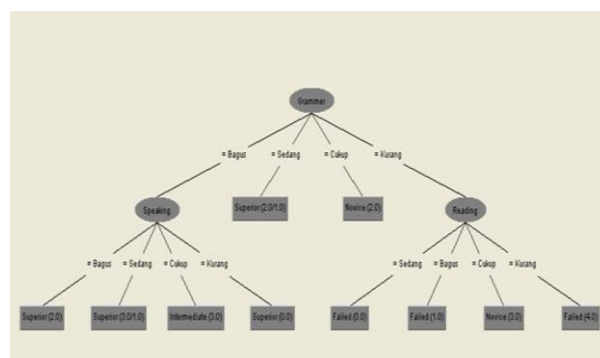


Figure 3. Decision Tree is generated using Weka application

Figure 2 and Figure 3 is based on calculations using the C4.5 algorithm manually and using application weak, have the same result. Knowledge or rule resulting from the decision tree contained in figure 2 and figure 3 is as follows :

1. If value of the Grammar = Enough Then Result = Novice

2. If value of the Grammar = Medium Then Result = Superior
3. If value of the Grammar = Less and Reading = Less Then Result = Failed
4. If value of the Grammar = Less and Reading = Enough Then Result = Novice
5. If value of the Grammar = Less and Reading = Medium Then Result = Failed
6. If value of the Grammar = Less and Reading = Good Then Result = Failed
7. If value of the Grammar = Good and Speaking = Less Then Result = Superior
8. If value of the Grammar = Good and Speaking = Quite Then Result = Intermediate
9. If value of the Grammar = Good and Speaking = Medium Then Result = Superior
10. If the value of the Grammar = Good and Speaking = Excellent Then Result = Superior

e. Testing

Tests conducted on the results of EPT seen in table 9. following :

Table 9. Data Testing

No.	Grammar	Vocabulari	Reading	Listening	Speaking	Result
1	Cukup	Cukup	Kurang	Bagus	Kurang	Novice
2	Cukup	Kurang	Cukup	Bagus	Cukup	Novice
3	Cukup	Kurang	Bagus	Kurang	Cukup	Novice
4	Sedang	Bagus	Bagus	Bagus	Sedang	Superior
5	Kurang	Kurang	Kurang	Bagus	Kurang	Failed
6	Kurang	Kurang	Kurang	Bagus	Cukup	Failed
7	Kurang	Cukup	Kurang	Bagus	Cukup	Failed
8	Cukup	Kurang	Cukup	Kurang	Cukup	Novice
9	Kurang	Cukup	Bagus	Kurang	Cukup	Failed
10	Bagus	Bagus	Bagus	Bagus	Cukup	Intermediate
11	Bagus	Bagus	Sedang	Bagus	Cukup	Intermediate
12	Bagus	Bagus	Sedang	Bagus	Cukup	Intermediate
13	Cukup	Kurang	Kurang	Bagus	Cukup	Novice
14	Kurang	Cukup	Kurang	Cukup	Cukup	Failed
15	Kurang	Cukup	Cukup	Cukup	Cukup	Novice
16	Kurang	Kurang	Cukup	Cukup	Cukup	Novice
17	Kurang	Kurang	Cukup	Bagus	Cukup	Novice
18	Kurang	Kurang	Bagus	Cukup	Cukup	Failed
19	Bagus	Bagus	Bagus	Bagus	Sedang	Superior
20	Kurang	Cukup	Cukup	Bagus	Kurang	Novice

table 9 show about result the testing the knowledge generated in the table C4.5 algorithm implementation in accordance with the data in the table testing.

IV. Conclusion

The resulting of the conclusions are as follows :

1. Results of testing the knowledge generated from the decision tree have compatibility in all trial data.
2. The test result data manually and with the use Weka applications generate the same decision tree.
3. Occurs of Pruning Variable data on Listening, because the decision has 3 variables can be generated.
4. The amount of data used will influence the decision tree and the knowledge generated, the greater the amount of data used will result in an increasingly complex decision trees.

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# APPLICATION OF COMPUTER VISION FOR DETERMINATION OF SYMMETRICAL OBJECT POSITION IN THREE DIMENSIONAL SPACE

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## Abstract

*This research aimed to make an application of capturing and processing pictures that captured by webcam and process using grayscale image and binary image to determine the position of object. The application was made using Delphi program and planned to classify object pixels to become regions which represent the object and could distinguish between object and digital background. The method used was design method. The data were obtained from the results of system test. They were then analyzed using use-case model and operation sequence. Based on the analysis, design and implementation models were done. The result show that the application built can be used to capture pictures and process them to determine the position of symmetrical object in three dimensional space*

*Key words : computer vision, grayscale image, binary image*

## 1.INTRODUCTION

The use of computers today is one of the world's needs in science and technology, business and personal needs because basically computer is a tool in solving problems that are routine in all aspects of human life. The development of today's computers very rapidly along with the development of technology hardware and software. The development is followed by the more widespread use of computers in various fields. Computer graphics is a field of computer science that studies on ways to improve and facilitate communication between man and machine (computer) with a street generate, store and manipulate images, using a computer model of an object. Computer graphics allow users to communicate through pictures, charts, diagrams which show that computer graphics can be applied to many fields (Insap Santosa, 2004). One area that is developing is the field of image processing. With an assortment of textures and colors, an image or picture can be present information as you wish. In the real world, a person's ability to absorb the information easier to

read or analyze images compared with a set of words or figures presented (Soendoro Herlambang, 2004).

Computer Vision try to mimic how the human visual (human vision). Human Vision is actually a very complex man looking at objects with the sense of vision (eye), then the image of the object is transmitted to the brain for a range of interpretation so that people understand what the object looks in the eye. The result of this decision is used for decision making, for example, to avoid an existing object or determine the position of an object, especially a symmetrical object. Symmetrical object is an object that has the distance and the same angle when viewed from different directions in space. Symmetrical balance can be figured as a mirror balance, meaning, the opposite sides must be exact to create a balance. When the straight line drawn in the middle of it, part of which one will be a reflection of the other. Computer Vision is the techniques to estimate the characteristics of the object in the image, measurement characteristics associated with the object geometry and interpret the geometry information such as determine the position of the object, which is represented by the horizontal position of the X axis, the vertical position represented by the Y axis and the distance from the camera to an object point is represented by the Z axis which are in three-dimensional space. In Computer Vision process can be divided into three activities, namely:

- a. Obtain or acquire digital images
- b. Perform computational techniques for processing or modify the image data (image processing operations).
- c. Analyze and interpret the image and use the results of such processing with the specific purpose guide the robot, control equipment (Rinaldi Munir, 2004).

## 2.LITERATUREREVIEW.

### 2.1 Computer Vision

Computer Science is the systematic study of algorithmic processes that describe and transform information, whether it relates to theories, analysis, design, efficiency, implementation, or applications that are available to him. One area of

computer science is Computer Vision. Computer Vision is an automated process that integrates a large number of processes for visual perception, such as data acquisition, image processing, classification, recognition (recognition), and make decisions (Adrian Low 1991). Computer Vision are techniques to estimate the characteristics of the object in the image, measurement characteristics associated with the object geometry and interpret the geometry information (Jain, Rames1995). Computer vision is a branch of artificial intelligence (artificial intelligence) that is focused on the development of algorithms to analyze information from the image into the form of the actual information in the real world .. The role of computer vision is as one of the input data for the computer to be able to understand the circumstances around him. Then the input data that has been obtained, will be processed in a way that computers can provide the desired response to determine how the presentation of the results of the input data.

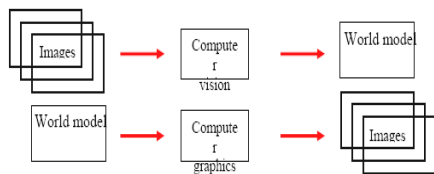


Figure 1. Comparison of Computer Vision and Computer Graphics

The function of computer vision is to present real-world information into the image information. Here are some problems in computer vision which is the main focus:

1. Sensing, How sensors acquire images of the outside world (World View) including the property of the world such as material, shape, and illumination. Even in 3D, including the geometry, texture, motion, and the identity of the objects in it is stored so that it can be used by a computer.
2. Decoded Information, How to open up and take any information that is in the image so that the computer can obtain all information as complete.
3. Using the information, Choosing what information is really needed and should be prioritized over the other. It should also be selected what information is in the image that it must be discarded because it can disrupt the system. Algorithm what is needed to process the information of the image and how to use it. Some of the subjects of science that utilizes computer vision, among others:
  - a. Face recognition (face recognition)

- b. 3D reconstruction (reconstruction of three-dimensional structure)
- c. Motion tracking (tracking movement)

Computer Vision is another application that is associated with artificial intelligence, which is a tool of analysis and evaluation of visual information by using a computer. Artificial techniques Integensia allows computers to get to know a picture and identify objects. By using tracking and matching techniques, the computer can choose a special key and search for and identify the information that the human eye can not miss. To help users solve a problem or make a decision, computer vision software Artificial Intelligence had learned through visual information. A visual system has the ability to improve the useful information from an image. To improve the knowledge and information required projection geometry of the object from an image. Science that is concerned with the visual system since it was first developed to date, generating new techniques are constantly being developed both for the purpose of improvement of accuracy and to improve the speed of the process. One is the development of image processing which is a separate field that is developing since people understand that the computer does not only deal with text but also the image data (image). Image processing techniques are usually used to make the transformation from one image to another image, while the task of information lies in the human improvement through the development of the algorithm. This field includes image enhancement, protrusion of certain features of an image, image compression and image correction. Instead visual system uses image as input but produce other types of output such as the representation of the object contours in the image, or produce a movement of a mechanical device that is integrated with the visual system. So the emphasis on the visual system is improved and retrieval of information automatically with minimal human interaction. Image processing algorithms are very useful in the early development of the visual system, usually used to sharpen certain information in the image, before it is processed further.

Computer graphics through graphical programming produces images of primitive geometric shapes such as points, straight lines and curved lines, circles and forms the basis of other geometry. Computer graphics play an important role in the visualization. While the visual system works in reverse, suspect primitive geometric shapes and other characteristics that a simplification of the original image that is more complex. So computer graphics combines elements of image forming to shape or synthesize images while the visual system to analyze the image and sometimes

break them down into a simple form that can be assessed quantitatively.

## 2.2. Image Processing

Image (Image) is a two-dimensional image on a plane (two-dimensional). Judging from the mathematical point of view, the image is the successor function of light intensity on the two-dimensional plane. The light source illuminates an object, the object reflects back some of the light and captured by optical instruments like the human eye, camera, scanner (scanner) and so on, so the shadow of the object called this image recorded (Rinaldi Munir, 2004). Image processing step is used to improve the image of the disorder to be easily interpreted either by human or by a computer that aims to improve the image quality to be better (Rinaldi Munir, 2004). Image processing techniques to transform the image into another image, so the input is the output image and also the image, but the image output has better quality than the input image. Image processing (image processing) is a computational science that allows humans can retrieve information from an image, can not be separated from the field of computer vision. In accordance with its development there are two main objectives, namely:

- (1) Improving the quality of the image The result is that the image information interpreted by humans (human perception).
- (2) extracting salient information in an image The result is a characteristic of image information through massive numerical data that can be clearly distinguished (Achmad Basuki, 2005). Image processing (image processing) is a process filters the original image into another image as needed. For example, if it gets too dark image, the image processing can be processed in order to get a clear picture as illustrated in the block diagram (RJ Sigit, 2005).

Digital image is an image taken by a particular sampling and quantization, formed of pixels whose magnitude depends on the sampling and the value depends on the degree of gray and quantization. Model of digital image expressed in matrix form, the image is defined as a function of  $(x, y)$  where  $x$  and  $y$  stated number row and the column  $f$  declare the value of the degree of gray of the image. Matrix models in digital imagery allows for matrix operations. The image is a spatial dimension that contains the color information and does not depend on time. The image is a set of points of the image, called a pixel (picture element). These points illustrate the position coordinates and an intensity that can be expressed with numbers. This shows the intensity of the color image, through the summation (Red, Green and Blue / RGB).

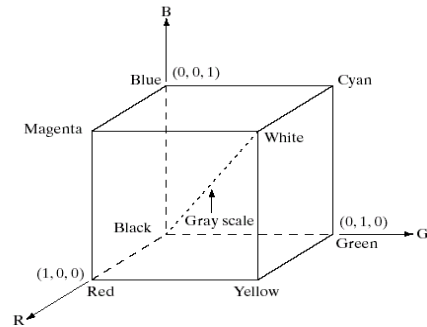


Figure 2. Schematic RGB Color Cube

Coordinates of the pixel color information based; Brightness (sharpness) light colors (black, gray, white) of the source, Hue (hue) caused by the color (red, yellow, green, etc.) and is the dominant wavelength of the source. For example, the image with 8 bits per pixel has 256 colors and images with 24 bits per pixel is expressed by;

- Bits 0 to 7 for red (red)
- Bit 7 to 15 for the green color (green)
- 16 to 24 bits for blue (blue)

Possible combinations of colors that there are 16,777,216, of which the value of 0 indicates black, while the value of 16 777 216 expressed in white. Relationship with the distribution of image processing in the field of computer input and output involving particular can be described in the following table:

Table .1 Relations Image Processing

		Output	
		Image	Description
Input	Image	Image processing	- Pattern Recognition - Computer Vision
		Computer Graphics	Data Processing Other

In the above table it is clear that the image processing (image processing) is a field of knowledge which form the input image and the result is also in the form of images with the process in the form of improved image quality or image information presentation. In order for the results in the form of numerical data or text that states the information contained in the image required knowledge learned in pattern recognition and computer vision.

## 2.3. image Digitization

In order to be processed by a digital computer, then an image to be presented numerically with discrete values. Image representation of continuous functions (continuous) into discrete values is called digitization, the image produced is called a digital image. In

general, the digital image-dimensional rectangular size is expressed as the width or height x width x length. Digital image height N, the width M, and has a degree of gray L can be expressed as a function of:

$$0 \leq x \leq M$$

$$f(x, y) \quad 0 \leq y \leq N$$

$$0 \leq f \leq L$$

### 3. SCENARIO TRIAL

In carrying out this research will be to design tools and systems to make taking pictures to be made in the block diagram designed as follows:

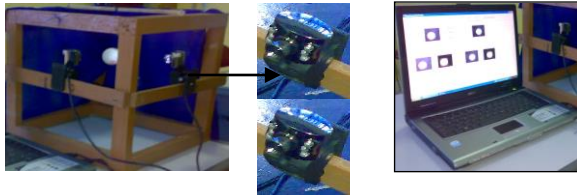


Figure 3 Block diagram of the hardware

Image processing applications are designed aiming to determine the position of the object by using a webcam capture by utilizing Delphi component in image capture and display images that are arranged in a block diagram as follows:

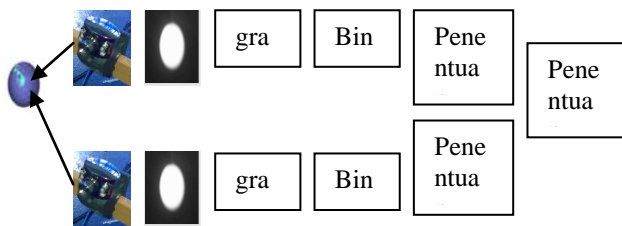


Figure 4 Design Software

- a. Taking pictures with a webcam using an application program that utilizes Delphi component form:
  - 1). TtsCap32 is a component to display images of the moving image
  - 2). TtsCap32PopupMenu is a component to adjust how shooting
  - 3). TtsCap32Dialogs is a component to set the format of the image to be captured.
- b. Changing the image to gray scale and binary image  
Images that have been captured in the form of color images were processed using the application program into a gray image (gray scale) by means of pixel values that exist in the form of image color images are averaged and then divided into three according to the

number of layers in the layer color image is r, the layer b, and layer g into one layer is gray (gray scale). The smallest unit of digital data is a bit, which is a binary digit, 0 or 1. The set of data is a 8 bit data is a data unit called a byte, with a value of 0-255. Pixel (picture element) is a point which is the least element small in the image. Numerical figure (1 byte) of pixels called digital number (DN). Digital Number can be displayed in gray color, ranging between white and black (gray scale), depending on the level of energy is detected. Pixels are arranged in the correct order to form an image. The figure below shows the relationship between the degree of gray and a digital number and degree of gray that make up an image.

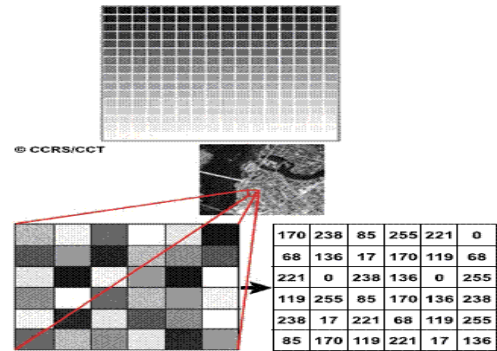


Figure 5 Relationship with the degree of gray Digital Number

### algorithm System

Algorithm for Designing Application object positioning is as follows:

- 1). Creating an image retrieval application program
- 2). Mengcapture picture using the webcam
- 3). Displays images that have been captured in the form of still image
- 4). Changing the color image to grayscale.
- 5). Changing the Gray Scale image into a binary image
- 6). Determine the coordinates of four points.
- 7). Determine the position of the X, Y, Z

### 4. RESULTS AND DISCUSSION

The main function of this system is to determine the position of objects in image processing applications, the procedure is to take a picture (color image) by using a webcam, change to gray image and binary image, determine the coordinates of four points, determines the position of the object. The initial process for determining the position of an object in three-dimensional space is the object which results in capturing color



images, then changed into a gray image (gray scale), the following procedure:

1. Position the object in the desired position
2. Activate the program shooting
3. Connect the webcam one and two with computers
4. Calibrate the camera one and two
5. Showing the screen
6. Capturing images
7. Change the color image into a grayscale image by means of a three-layer adds value is the value of r, g and b values values then divided by three to produce a grayscale image (gray) with the following formula:

$$s = \frac{r + g + b}{3}$$

This process aims to classify pixels into regions that present the object object that distinguish the object with the background.

The image has been converted to grayscale followed by binerisasi only be 0 and 1, In a binary image, the boundary between the object and the background is evident. White object pixels are pixels black background. To determine the binary value of grayscale images that have a degree of gray 256 divided by two, the middle value is 128 so as to convert into a binary image can be written as follows: If the gray values <128 then it is equal to 0 If the gray values >= 128 then the value is equal to 1 The process of converting a color image into a grayscale image and binary image, the next process is to determine the coordinates of the four points of the form x1-y1, x2-y2, x3-y3, x4-y4, with the following procedures:

1. The results of image capture in the form of a binary image subsequently processed to determine the position of a point coordinates x1y1 by tracking pixels are worth 1 starting from the coordinates (0,0) that is located on the top left side of the binary image, which made repeated until the pixel-value 1 first, then becomes the value x1y1. Conditions tracking is if the coordinates of pixels

is 0 then the search is continued until found the coordinates of pixels of value 1.

2. After x1y1 pixel value is found, it will be traceable to find pixels of value 1 which is the pixel coordinates of the nearest column of the image matrix boundary, selanjutnya be X2Y2 value. Conditions tracking is if the coordinates of pixels is 0 then the search is continued until found the coordinates of pixels of value 1.
3. Tracking continued to coordinate matrix of pixels of the binary image to find the pixel value of 1, which is the farthest from the line of pixels, which is subsequently used as the value x3y3. Conditions tracking is if the coordinates of pixels is 0 then the search is continued until found the coordinates of pixels of value 1.
4. After x3y3 pixel value is found, continue tracking to find the coordinates of the pixels of value 1 which is located on the most recent image of the matrix, then used as the value x4y4. Conditions tracking is if the coordinates of pixels is 0 then the search is continued until found the coordinates of pixels of value 1. Once the coordinates of four points is obtained, then proceed with determining the position of the X, Y, Z are processed as follows:
  - a. The results capture the images displayed on the camera in the form of a binary image, and has been processed into a four-point coordinates, then the pixels are the coordinates x1 first discovered during object tracking pixel value 1 further used as the value of x, because it is the first value is obtained that parallel to the x-axis in three-dimensional space.
  - b. The binary image produced by the camera and the camera two, used as the value of y with the value of y1 on camera 1 and camera 2 value y1 at the same, then the value is taken to be the value of y chosen one way, less the value of pixel y4 y1 pixel values to obtain the value of y, because the value of the coordinate parallel to the y-axis in three-dimensional space.
  - c. For the Z value is taken from the captured image on the camera 2 is parallel to the Z axis of the coordinate value x1 x1y1 of the coordinates of four points

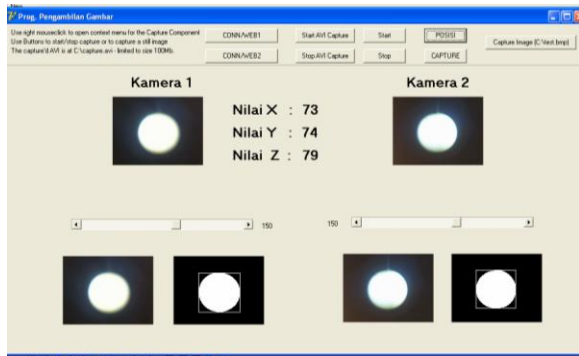


Figure 6 Position Determination Process Objects

## 5. CONCLUSION

1. Composed of an algorithm to process the digital image of the object color image has been captured, processed by using a gray scale image by means of a color image composed of 3 layers matrix by summing the RGB values and then divided by three, and the result is a grayscale image layer with ranges gray values from 0 to 255, from the grayscale image is converted into the form of a binary image where the object value is 1 and the background is 0.
2. It has been successfully designing image processing application program to determine the position of the object.

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# TARGET OBJECT VIRTUALIZATION AND LANDSCAPE IN 3D SPACE TO SIMULATOR SHOOT FOR ARTILLERY MULTI DISPLAY

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Abstract-The success of the entity or organization lies in the knowledge, abilities and skills as well as mastery soldiers platforms (primary equipment weaponry systems). However, the current problem is that not all defense equipment can be practiced freely as possible given the space, the target object is limited, as well as other impacts to the environment and humans. Besides, another problem is the high cost of training required. This study aims to develop a simulator artillery, by designing a virtual cannon controlled using a joystick that functions to process the movement of the x and y axis and the lock and opened fire at the target and then all the simulation objects are displayed on the screen multi-display. In addition, the development of landscape or terrain land in accordance with the model, so in this study aimed to apply the technology of making a game engine as a software simulation and modeling 3D objects with the use of software Unity 3D and 3DS Max. In developing applications Artillery firing simulator is expected to broaden the viewpoint of the target until 180<sup>0</sup> secara horizontal and 60<sup>0</sup> vertical with the position of a target that can move dinamis.Berdasarkan implementation of the 3-screen system for multidisplay.

**Keywords**—Unity3D engine, Artileri, MultiDisplay ;

## I. INTRODUCTION

Artillery is a term that refers to the heavy weapons were designed capable of launching a projectile across long distances or on the crew who operate weapons tersebut.Orang also use the term "artillery" to refer to the study of artillery guns have been used in warfare for many abad.Artileri progress rapidly, especially in the century 20.Tidak all kinds of weapons called artileri.Ada some things that characterizes artileri. The first , artillery guns usually have a special launcher device and often large and thus require multiple people to operate. This is achieved by firing projectiles to form parabola.Sebagai consequence, mathematical calculation that takes precise aiming sasaran.Teknik indirect fire can be used when visibility is limited though, as long as the operator knows the direction of movement of personnel musuh.Umum firing artillery salvo

to estimate the accuracy shoot . evaluate the results salvo, personnel simply adjust a setting on fire a weapon if still not on target[1].

Simulation is a program (software) computer whose function is to mimic the behavior of real systems (reality) specific. The purpose of the simulation, among others, for training (Training), study the system behavior (Behavior), and entertainment / games (Game). Some examples of computer simulation, among others: the simulation of flying (flight simulation), Simulation War (war simulation), simulation of bank service queue (queue serice), real-time simulation (real time) is part of the science of informatics that are being developed at this time [2 ]. With the simulation model is carried out experiments to determine the behavior of the actual system. That requires a development in the target object virtualization and landscape simulator can simulate artillery artillery for more real with the application of technology multidisplay and dynamic movement of the target object can be monitored from several viewpoints.

## II. REVIEW TECHNOLOGY

### A. Multi Display

The concept of multi-screen display is the principle of image segmentation with less 180<sup>0</sup> angle by dividing by the frustum angle, which is identical to how the show pandangkamera corner of the machine simulator on multiple screen display, the efficiency of real-time rendering using graphics software that has been verified [3 ]. The view frustum is a 3D volume that defines how fashion ldiproyeksikan of space camera projection chamber. The object should be positioned in the 3D volume using a framework that looks .XNA projection matrix to calculate the position of a point in the view frustum. Matrix invert y coordinate (so top down) to reflect the origin of the left corner of the screen atas.Setelah matrix applied, homogeneous node (ie, node lists (coordinates x, y, z,) is converted to nonhomogeneous coordinates so they can dirasterized. The most common type of projection is called perspective projection, which makes objects near the camera appear larger than distant objects .pandangan frustum can be

visualized as a truncated pyramid whose top and bottom are defined by the near and far clipping plane as shown in Figure 1. [4].

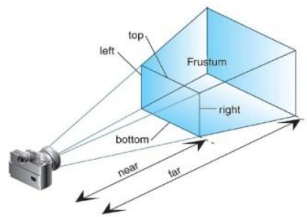


Figure 1. frustum .

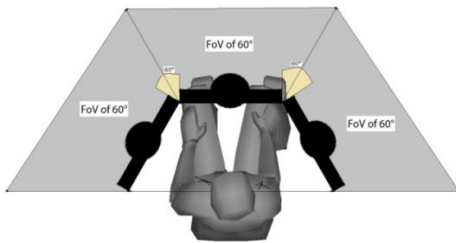


Figure 2. Angle equal to the angle between the monitor FoV (60°) .

**B. Game Engine**

Game engine is a software designed for create and develop a video game. The main functions provided by a game engine includes rendering for 2D or 3D graphics, collision detection, sound, scripting, animation, artificial intelligence, networking, memory management, threading, and a scene graph. Game engines provide tools for visual development with additional software components that can be used repeatedly. These devices generally provide integrated development environment that can facilitate and accelerate pengembangan game. Game engines are also often referred to as "Game Middleware". Game Middleware is software yang didalamnya already contained elements dibutuhkan oleh a game developer, most of the games middleware to facilitate menunjang pengembangan game as easily as graphics, sound and Artificial Intelligence. Some elements of the game engine are:

- ToolsData
- Support
- System
- Renderer/EngineCore
- Console
- GameInterface.

Engine is not an executable program, meaning that the engine can not be run as a stand-alone program. It needs a major program as an entry point or the starting point of the course of the program. In C ++, its entry point is a function 'main ()'. The main program is usually relatively short. Game engine is a program that 'powering' the course of a game program. If the game is illustrated as 'music' coming out of the mp3 player, then the engine is 'mp3 player' and the main program is the 'data mp3' is entered into the mp3 player. With this engine, the time, effort and cost required to make the

game software to be reduced significantly. He is more reactive than procedural. It's hard to describe the engine as a whole in the flow-chart, because the flow of the program can be adjusted according to user desires engine, the game programmers [5].

**C. Unity3D engine**

Unity 3D is a game engine-based cross-platform. Unity can be used to create a game that can be used on computers, smart phones Android, iPhone, PS3, and even X-BOX. Unity is an integrated a tool to create games, simulations and architectural buildings. Unity can be used for PC games and online games. Online games required for a plugin, namely the Unity Web Player, as well as the Flash Player in the Browser. Unity is not designed for a design or modeling process, because unity is not a tool for designing. If you want to design, use of other 3D editors such as 3dsmax or Blender. Many things can be done with unity, there is an audio feature reverb zone, particle effects, and Sky Box to add the sky. Scripting features are provided, supports 3 languages, JavaScript, C #, and Boo. Flexible and EasyMoving, rotating, and scaling objects only need a line code. Begitu also with Duplicating, removing, and changing properties. Visual Properties Variables that are defined by the scripts displayed in the Editor. Can be shifted, in drag and drop, can choose the color with the color picker. Berbasis .NET. Artinya run of the program is done with Open Source .NET platform, Mono [6].

**Architecture And Design**

**D. Architectural Model**

The working process of this system is the user directing artillery cannon position where the user can drive and create pressure range shots. Using the formula will calculate the parabolic motion toward the position of the target with a shot. If the position is the same shot with the target position, the target will explode and simulation otherwise the target will continue to move.

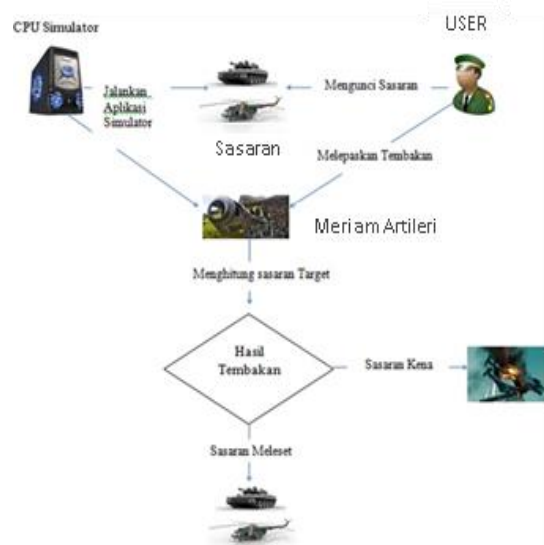


Figure 7. Architecture Simulator artillery

**E. Design Use Case Diagram**

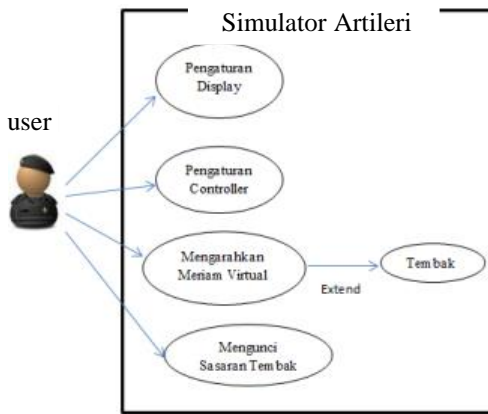


Figure 8. Design Use case

In the picture there are two use case diagrams that each actor each served as follows:

- 1) Application Simulator Artillery.
  - a) Displays the Display settings.
  - b) Displays the controller settings.
  - c) Displaying 3D virtual cannon.
  - d) Display the angular coordinates the movement of the cannon.
  - e) Display a target object.
  - f) Display the distance of the target object and the target object angle coordinate values.
- 2) Users
  - a) Display settings.
  - b) Make arrangements Controller.
  - c) Directing the virtual cannon to the target object.
  - d) Perform the process of firing in the direction of the target.

**F. Design Simulation Artillery Multidisplay**

Virtualization Targets and Landscape Objects In Space 3D For Artillery Training System consists darimeriam Multidisplay virtual 3D training ground (terrain 3D training), a target in the form of tanks and helicopters 3D display screens used consisted of 3 pieces Screen Display function to display the Object simulator Joystick mode Multidisplay modified and used as a controller for determining the direction of movement of a virtual artillery cannon, lock the target and fired a shot towards the target ..

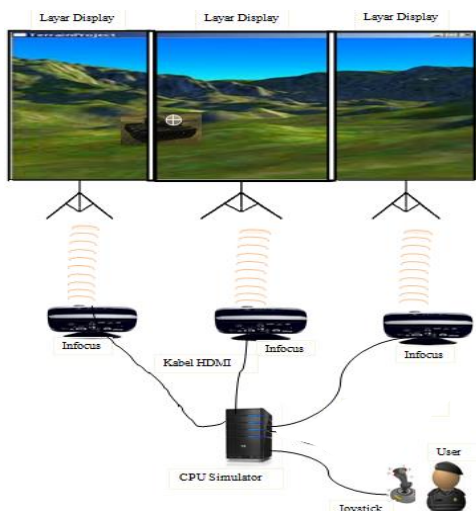


Figure 9 Public Draft Simulation

1) CPU simulator is used to run the simulator applications that will be connected to the monitor screen to be displayed Multidisplay

2) The helicopter is a type of aerial target and the tank is the target type of land, where the process modellingobjek this goal using 3DS Max application that resembles a 3-D model.

3) LCD Projector Used to zoom in Application Simulator. The joystick is used for virtual gun simulator functioned as a joystick controller which generates position data of x and y. X position value is converted to a horizontal angle while the y position value is converted to a vertical angle. At the time of the release button on the joystick artillery cannon will lock the target and fired a shot toward the goal.

**III. RESULTS AND DISCUSSION**

**A. CPU Simulator**

CPU simulation to the user who will conduct artillery firing exercises where the user can control the position and direction of the cannon that will shoot towards the target object, this can be seen in the figure the system architecture. 3D Virtual artillery or cannon can be controlled using the joystick is configured to retrieve the value of any horizontal movement and the value of each movement. The resulting value of the joystick is in the form of the value X to the horizontal, and the value of Y for X vertikal.nilai range between 0 - 180<sup>0</sup> and for the value of Y ranges between 0 - 60 the mouse button to release the mouse is the initial velocity (V0), at the time of release the mouse on the virtual artillery cannon will lock the target and fired a shot toward the goal of X, Y and V0. Target movement information can be viewed at any time by the user because of the joystick can control to view landscape viewing angle up to 180<sup>0</sup>. The working process of the movement of the target that each target will always move according to a waypoint or a race track, be it ground targets or air targets

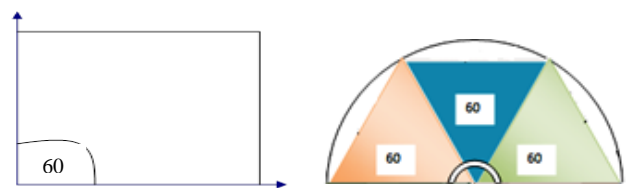


Figure 10. Position viewpoint 3D virtual cannon

**B. Output Simulator**

This study shows the appearance of the design is the application simulator outpunya Landscape (terrain) 3dimensi, target objects such as tanks and helicopters, the distance value of the target object, the value of x and y coordinates of the corner of the target object, information if the target was hit, the object virtual cannon 3D, the value of the angle of the cannon movement of x and y and the last is the multi display.

**C. Application Design Stage simulator**

The design of the application is the preparation of the technical steps to resolve the problem in the form of pictures and words are arranged in a logical and systematic.

The design of the application on the simulator application artillery among other designs to create a landscape (terrain), making the target object, designing a property on the target object, multi-display configuration, create objects cannon, cannon design the properties on the object, the design of the GUI interface for displaying distance information and value point angle of the x and y coordinates on the target object, the design of the GUI interface to display information of value to the movement of 3D virtual cannon x and y axis, GUI interface design for information if the target was hit

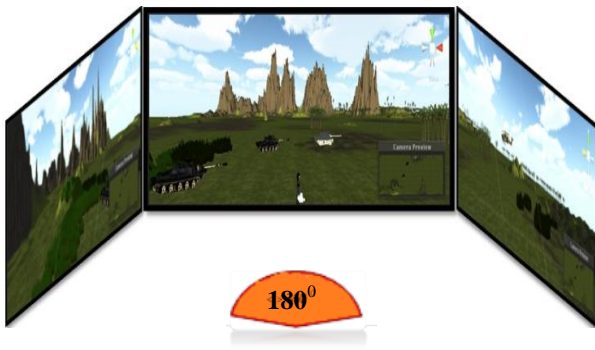


Figure 11. Model simulations position

The working process of the movement of 3D Virtual cannon, shoot targets, namely::

1. Each target will always move according to the specified path or waypoint..
2. Virtual cannon is controlled by the user through the virtual joystick where the cannon user can maneuver or movement, lock the target and fired.

**D. Design Landscape (terrain)**

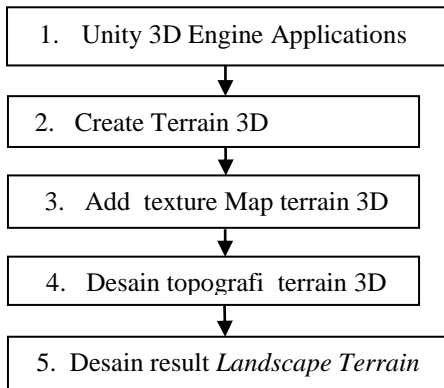


Figure 12. Design terrain in Unity 3D

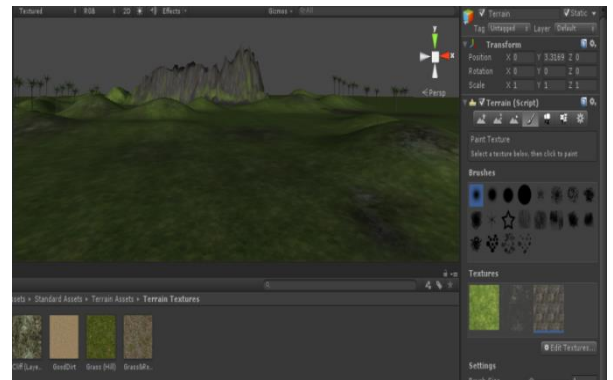


Figure 13. Design Process terrain in Unity 3D

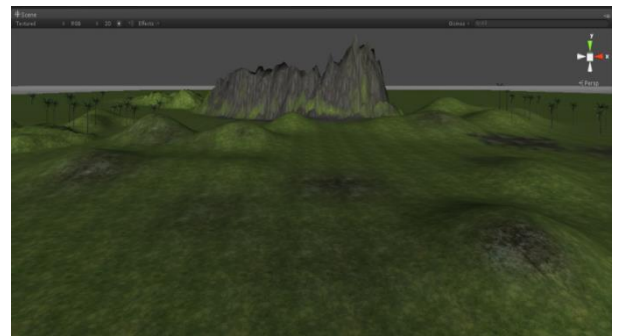


Figure 14. Results terrain in Unity 3D Design

**E. The design of the target object tanks**

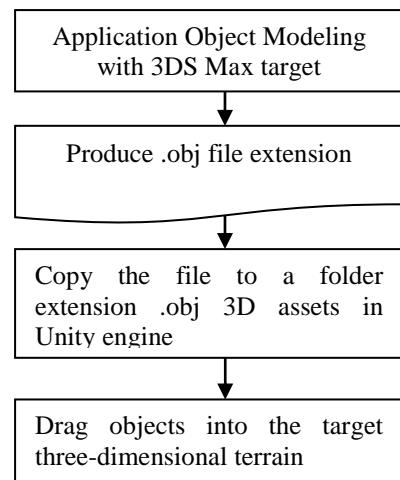


Figure 15 Design for 3D target object

Figure 16 is a step-by-step design the object model targets the tank to insert object into a 3D terrain in Unity 3D engine applications.



Figure 16. Modelling object tanks in 3DS max

Figure 16 is the result of modeling objek target process tanks using 3DS Max application.

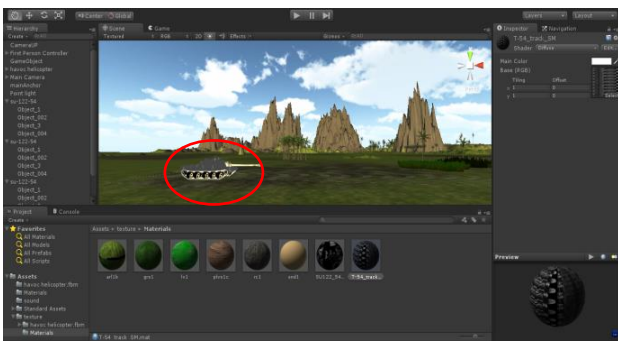


Figure 17. tank drag objects on the terrain

Figure 17. is the result of the drag target object modeling files tanks extensi .obj into terrain in unity 3D.

**F. Pseudo code pergerakan objek sasaran**

Pseudo code is a technique of preparation steps to resolve the problems that are arranged in a logical and systematic. pseudo code is a technique of writing algorithms.

```

Attribut :
Transform waypoint1;
float speed ← 1.0f;
bool operational ← true;

method :
if (operational) {
    var q ←
Quaternion.LookRotation(waypoint1.position –
transform.position);
transform.rotation ← Quaternion.RotateTowards (transform.rotation, q,
speed Time.deltaTime);
transform.position ← Vector3.MoveTowards(transform.position,
waypoint1.position, Time.deltaTime * speed);
}
    
```

**Information**

1. Attributes are objects simulator which will be called and will be given functions.
  - a.) Attribute Waypoint1 on the second line is the attribute waypoints or routes to be traversed by the target object.
  - b.) Attribute Speed on the third line is the movement speed attribute on the target object.

c.) Attributes operational attribute on the fourth line is the target object is in motion or operation.

2. The method is a function that is given to process or execute any GameObject.

a.) **method on the first line** is a function of the target object in a moving condition if (operational) if (operational).

b.) **method on the second line** is a function of the rotational movement of the target object (transform.rotation ← Quaternion.RotateTowards)(transform.rotation ← Quaternion.RotateTowards).

c.) **method on the third line** is a function of the target object position pergerakan follow paths or waypoints in 3D space or 3-dimensional vector dimensi (transform.position ← Vector3.MoveTowards ).

**G. Pseudo code kena tembakan.**

```

Attribut :
bool operational ← true;

method:
CollisionEnter(Collision c){
    if(c.gameObject.tag = "Bullet")
    {
        operational ← false;
        Debug.Log("target kena |
operational status: "+operational);
        (Instantiate(smokePrefab, transform.position,
Quaternion.identity)as
GameObject).transform.parent ← transform;;
        (Instantiate(firePrefab, transform.position,
Quaternion.identity)as
GameObject).transform.parent ← transform;;
    }
}
    
```

**Information**

1. **Attributes** are objects game that will be called and will be given functions.

**Operational attributes** in the first row is the attribute target object is in motion or operation

a.) **Method** is a function that is given to process or execute any GameObject (bool operational ← true;).

2. **Method** adalah fungsi yang diberikan untuk memproses atau menjalankan setiap GameObject.

a.) **method in the first row** is the initialization function for collision / collision objects (bullets) on the target object CollisionEnter(Collision c).

b.) **method on the second line** is if the object a function of the bullet on the target object, if(c.gameObject.tag = "Bullet").

c.) **method on the fourth line** is the function if the bullets hit the target object, the target object will stop moving,, (operational ← false;)

d.) **method on the fifth line** is a function to display status information by a bullet or shot targets, (Debug.Log("target kena | operational status: "+operational);

e.) **method on the sixth line** is a function to display the effects of smoke on the position of the bullets hit the target object, (Instantiate(smokePrefab, transform.position, Quaternion.identity)as GameObject).transform.parent ← transform;;

f.) **method on the eighth line** is a function to display the effects of fire on the position of the bullets hit the target object, (Instantiate(firePrefab, transform.position, Quaternion.identity)as GameObject).transform.parent ← transform;

#### H. Pseudo code the coordinates of the target object.

```

Attribut :
    int tankNumber ← 1;

Method:
    OnGUI() {
    float jarak = Vector3.Distance (transform.position, new Vector3
(0f, 0f, 0f));
    Vector3 referenceForward ← characterAnchor.forward;
    Vector3 referenceRight←Vector3.Cross(Vector3.up,
referenceForward);
    Vector3 newDirection ← transform.position;
    float angle ← Vector3.Angle(newDirection, referenceForward);
    float sign ← Mathf.Sign(Vector3.Dot(newDirection, referenceRight));
    float finalAngleY ← sign * angle;
    referenceForward← characterAnchor.up;
    referenceRight← Vector3.Cross(Vector3.up, referenceForward);
    angle← Vector3.Angle(newDirection, referenceForward);
    sign← Mathf.Sign(Vector3.Dot(newDirection, referenceRight));
    float finalAngleX ← 90 - (sign * angle) ;

    string thisGuiText ← "jarak : " + jarak+"\nsudut Y:
"+finalAngleY+"\nsudut X: "+finalAngleX;
    if (!operational) {
    thisGuiText← thisGuiText+"\n TARGET HANCUR";
    }
    if (tankNumber = 1) {
    GUI.Box (new Rect (10, 10, 200, 80), "Tank A\n" + thisGuiText );
    } else if (tankNumber = 2) {
    GUI.Box (new Rect (220, 10, 200, 80), "Tank B\n" + thisGuiText);
    } else if (tankNumber = 3) {
    GUI.Box (new Rect (330, 10, 200, 80), "Tank C\n" + thisGuiText); } }

```

#### Information

1. **Attributes** are objects game that will be called and will be given functions.

**In the first line** is a declaration or initialization attributes of the target object tanks.

2. **Method** is a given function to process or execute any GameObject.

a.) **In the first line of the method** is a function to show the on-screen GUI interface, OnGUI() .

b.) **method on the second line if the object is** a function of the bullet on the target object ,float jarak = Vector3.Distance (transform.position, new Vector3 (0f, 0f, 0f));

c.) **method on the third line** is a function to display the value of the angle or target coordinates when the object moves forward (Forward) , Vector3 referenceForward ← characterAnchor.forward;

d.) **method on the fourth line** is a function to display the value of the angle or target coordinates when the object moves to the left and to the right, Vector3 referenceRight←Vector3.Cross(Vector3.up,referenceForward);

e.) **method on the fifth line** is a function to display the value of the angle or target coordinates when the object moves back to the starting position , Vector3 newDirection ← transform.position;

f.) **method on the sixth line** is a function to initialize the target coordinates (angle) during the 3-dimensional vector

object moves forward , float angle ← Vector3.Angle(newDirection, referenceForward);

g.) **method in the seventh row** is a function for initialization or marker if the object is moving left then worth (-) minus and worth (+) plus if it moves to the right . float sign←Mathf.Sign(Vector3.Dot(newDirection,referenceRight));

h.) **method on the eighth line** is the calculation of the coordinates of the target function at the time of a moving object on the Y axis coordinates, float finalAngleY ← sign \* angle;

i.) **method in the ninth and tenth lines** are functions when the target object moves forward referenceForward ← characterAnchor.up; and move towards the left and right ,referenceRight ← Vector3.Cross(Vector3.up, referenceForward);

j.) **method in the twelfth line** is a function of the coordinates of the target (angle) Vector of 3-dimensional objects when moving forward, angle ← Vector3.Angle(newDirection, referenceForward);

k.) **method in the thirteenth line** is the calculation of the coordinates of the target function at the time of a moving object on the X axis coordinates, float finalAngleX ← 90 - (sign \* angle) ;

l.) **method in the fourteenth row** is a function to display a GUI interface on the screen that contains the information value of distance and angle value of X and Y angle,(string thisGuiText ← "jarak : " + jarak+"\nsudut Y: "+finalAngleY+"\nsudut X: "+finalAngleX);

m.) **method in the fifteenth line** is the function to display information if the target is hit by a bullet,if (!operational) { thisGuiText← thisGuiText+"\n TARGET HANCUR";

n.) **method in the seventeenth row to row twenty-two** is a function to display the GUI BOX containing the information value of the distance, angle X and Y values padaobjek target,if (tankNumber = 1) { GUI.Box (new Rect (10, 10, 200, 80), "Tank A\n" + thisGuiText );

#### I. The design of virtual 3D objects cannon

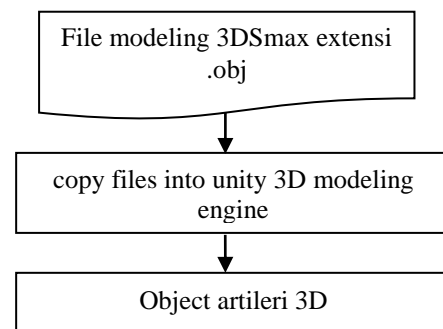


Figure 18. Design of virtual 3D objects cannon

Figure 18 is a step-by-step design a 3D virtual model of the object cannons to insert the object into the Unity 3D engine..



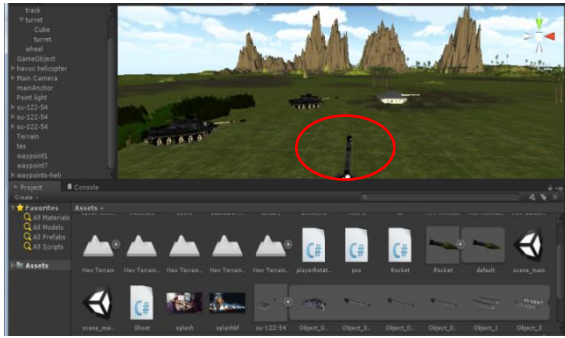


Figure 19 cannon 3D virtual objects

**J. The design of the 3D virtual property on the cannon**

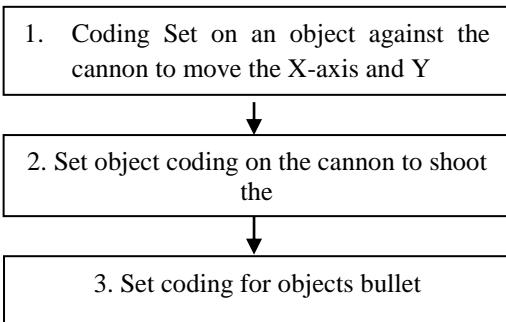


Figure 19. The design of the 3D virtual property on the cannon

Figure 19 is a draft for the steps in the process of 3D virtual cannon to perform the functions of movement, shooting functions and functions on the bullet.

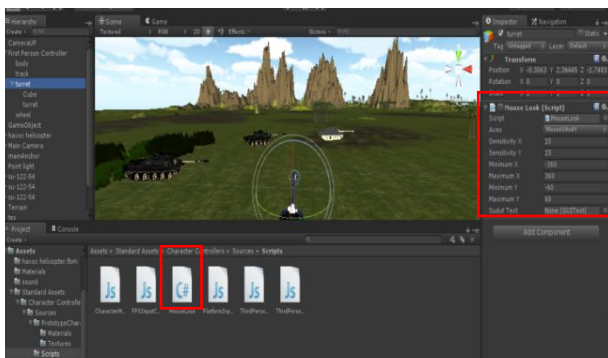


Figure 20. The design of the property is a 3D virtual cannon

Figure 20 is the design of 3D virtual cannon property that contains the function to determine the angle of movement of the cannon, and a function to do the shoot.

**K. Pseudo code cannon 3D virtual movement**

```

Attribute :
RotationAxes axes ← RotationAxes.MouseXAndY;
sensitivityX ← 15F;
sensitivityY ← 15F;
minimum X ← -360F;
maximumX ← 360F;
    
```

```

minimumY ← -60F;
maximumY ← 60F;
GUIText sudutText;
rotationY ← 0F;
    
```

**Method :**

```

if (axes = RotationAxes.MouseXAndY)
{
float rotationX ← transform.localEulerAngles.y +
Input.GetAxis("Mouse X") * sensitivityX;
rotationY ← rotationY + Input.GetAxis("Mouse Y") * sensitivityY;
rotationY ← Mathf.Clamp (rotationY, minimumY, maximumY);
transform.localEulerAngles ← new Vector3(-rotationY, rotationX, 0);
}
else if (axes = RotationAxes.MouseX)
{
transform.Rotate(0, Input.GetAxis("Mouse X") * sensitivityX, 0)
}
else
{
rotationY ← rotationY + Input.GetAxis("Mouse Y") * sensitivityY;
rotationY ← Mathf.Clamp (rotationY, minimumY, maximumY);
transform.localEulerAngles ← new Vector3(-rotationY,
transform.localEulerAngles.y, 0);
}
float sudutX ← transform.eulerAngles.x;
if (sudutX > 180) {
sudutX ← 360 - sudutX;
} else {
sudutX ← -sudutX;
}
float sudutY ← transform.eulerAngles.y;
if (sudutY > 180) {
sudutY ← sudutY - 360;
sudutText.text = "sudutX :"+sudutX+"\nsudutY :"+sudutY;
}
}
    
```

**Information :**

**1. Attribute** is the object of the game will be called and will be given functions.

a.) **attribute on the first line** is the movement or rotation of the x-axis joystick and Y (`RotationAxes axes ← RotationAxes.MouseXAndY;`)

b.) **Attribute in the second row and the third** is the movement of objects cannon sensitivity of the X and Y axis (`sensitivity dan sensitivityY`).

c.) **attribute on the fourth line to line seven** is to attribute the movement of the cannon horizontally (`minimum X ← -360F; maximum Y ← 360F;`), and Vertical movement of the cannon (`minimum X ← -60F; maximum Y ← 60F;`).

d.) **attribute on the eighth line** is attribut to display the value in the form of a GUI or interface to display the value of the angle of the cannon movement X and Y on the display screen (`GUIText sudutText;`).

**2. Method** is a function that is given to process or run any game objects.

a.) **method on the first line** is a function of the rotation of the cannon to the axis of the X and Y (`if (axes = RotationAxes.MouseXAndY)`).

b.) **method on the third line** is a function of the rotation of the X-axis joystick (`float rotationX ← transform.localEulerAngles.y + Input.GetAxis("Mouse X") * sensitivityX;`).

- c.) **method on the fourth line** is a function of the rotation on the Y-axis joystick ( $rotationY \leftarrow rotationY + Input.GetAxis("Mouse Y") * sensitivityY;$ )
- d.) **method on the fifth line** is a function of a set of variables rotationY where its value is always between minimumY and maximumY, ( $rotationY \leftarrow Mathf.Clamp (rotationY, minimumY, maximumY);$ )
- e.) **method on the sixth line to line to sixteen** is a function of the angle of movement of the joystick X and Y in Cartesian vector diagram or 3D vector ( $transform.localEulerAngles \leftarrow new Vector3(-rotationY, rotationX, 0);$ )
- f.) **method on the line to seventeen to twenty-three lines** is a function of the angle of movement joystick on X over  $180^0$  ( $float sudutX \leftarrow transform.eulerAngles.x; if (sudutX > 180) .$
- g.) **method on the twenty-fourth line** is a function of the angle of the joystick on the movement of Y over  $180^0$  ( $float sudutY \leftarrow transform.eulerAngles.y; if (sudutY > 180) .$
- h.) **method on the twenty-seventh line** is a function to display the value of the movement of the joystick to the corner of X and Y on screen display (GUI) ( $sudutText.text = "sudutX :"+sudutX+"nsudutY :"+sudutY;$ );



Figure 21. The movement of 3D virtual cannon

**L. Pseudo code The process of firing**

```

class Shoot {
    Attribute :
    GameObject rocketPrefab;
    AudioClip shotSFX;

    method :

    if(Input.GetButtonDown("Fire")){
    audio.PlayOneShot(shotSFX);
    GameObject g ←(GameObject)Instantiate(rocketPrefab,transform.position,
    transform.parent.rotation);
    float force ← g.GetComponent<Rocket>().speed;
    g.rigidbody.AddForce(g.transform.forward * force);
    }
}
    
```

**Information**

- 1. **Class shoot** : an object class that has the attributes (properties) and methods (functions).
- 2. **Attribute** : Attributes are objects game that will be called and will be a function, ie objects of bullets (*rocketprefab*) and sound effects (*shotSFX*) during the firing process.
- 3. **Method** : method is a function that is given to process or run any game object on an attribute.

- a.) **method on the first line** is a function of when the joystick is pressed to make the process of firing ( $Input.GetButtonDown("Fire").$ )
- b.) **method the second line** is the sound object function when the joystick is pressed ( $audio.PlayOneShot(shotSFX).$ )
- c.) **method the third line, the fourth and the fifth** is a function to display objects bullet ( $Instantiate(rocketPrefab),$  the position of the bullet ( $transform.position,$  rotation bullets ( $transform.parent.rotation).$ )
- d.) **In the sixth line method** is a function of the speed of the bullet ( $GetComponent<Rocket>().speed$ )
- c.) **method in the seventh row** is a function to add a gravity force at the time the bullet was shot ( $g.rigidbody.AddForce(g.transform.forward * force)$ )



Figure 22. 3D virtual cannon firing process

**M. The design of the property to determine the angle at multidisplay**

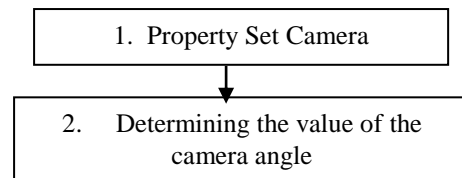


Figure 23. The draft angle multidisplay

To determine the distance of the camera viewpoint to the object it is necessary to set the property on the concept of unity 3D. dimana multidisplay artillery simulator that will be applied is the viewing angle of  $180^0$  horizontally and  $60^0$  vertically.

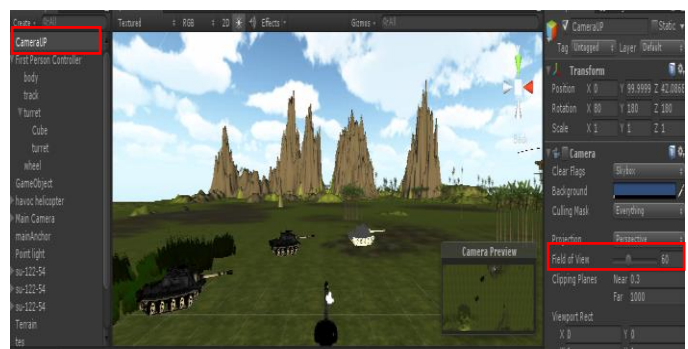


Figure 24. Design corner property multidisplay

Remarks :

1. The object is used to view the camera viewpoint
2. **Field of View** is a property that is used to mmberikan angle values for each screen.

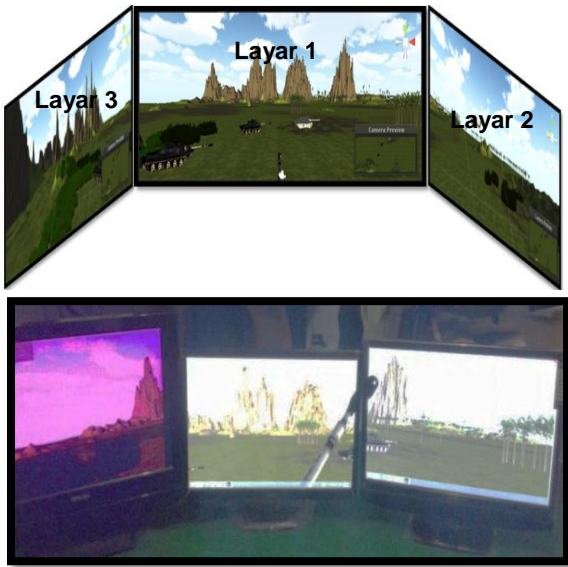


Figure 25. Multidisplay

Based on the results of the study as described, then concluded::

1. Development of an artillery simulator implementation can be done using artillery cannon 3D virtual objects and targets that can move / dynamic 3-dimensional terrain or landscape.
2. Based on the test results, it can be concluded that the simulator can perform a calibration derived from the joystick or 3D virtual artillery cannon to shoot targets without air resistance.
3. Based on the test results, the simulator can be displayed in multi-display with the field angle of up to 180<sup>0</sup> horizontally and 60<sup>0</sup>vertically.
4. The simulator can display the value of the angle of the cannon movement x and y axis..
5. The simulator can display the coordinate values of the angle of the target object and the target object distance value of 3D virtual cannon.

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# THE USE OF HOOK PROGRAMMING TECHNIQUE IN EXECUTING AND CONTROLLING KEYBOARD PRESSES AND MOUSE MOVEMENTS AUTOMATICALLY

Seni Asria \*)

## Abstract

Hook is a mechanism, by which a function can intercept events before they reach an application. The function can act on events, modify or discard them. Functions which receive the events are called Filter Functions, every Filter Function is classified by its type. Hooks provide powerful capabilities: Proceses or modify every message; Record or play back keyboard and mouse events; Prevent another filter from being called; And many more capabilities

**Keywords:** Hook, Hooking, API.

## INTRODUCTION

The diverse uses of computer for various purposes eventually result in many kinds of computer programming techniques which are aimed at developing an application that can make the last users easier in any kinds of needs. One of the facilities expected by the last computer users is an automation system of an event in a computing process. Basically, an automation system is arranged from various events that are designed in such a way, complete with their conditions, and then played back in patterned. The use of a control system for an automation system can be carried out by using either a keyboard or a mouse since both of these devices are main input devices and an activity control of an application or system. All desktop-based applications use either a keyboard or a mouse. At least one of them is used. Moreover, those using a touch screen remain to use a pointer mouse.

Various activities of an automation system can be seen in any kinds of daily computing activities. Moreover, unconsciously an automated system has been running on a computing system. One of examples of an automation system is how a word processor records a document automatically.

This scientific writing is aimed at giving a comprehension in a simple way on how an automation system works by using a hook programming technique to control input devices (keyboard and mouse) so as to create a set of events in sequence which will form an automation system.

In this scientific writing, the writer will describe how to implement a hook technique in controlling a

keyboard and a mouse, and the method applied in this research is by conducting an analysis of the needed automation system, in which there are several things as basis of the control system, such as what events to automate, what things constitute the events, and how the events are executed.

## HOOK

The definition of a hook in a computer programming is a programming technique that puts a piece of program in front of another one. The first piece of program will do tackling, filtering, or deflecting a command before it is executed by the second piece of command.

Such a programming technique is mostly applied for various purposes of a system development, whether the purposes are legal or illegal. In a legal implementation, the hook programming is able to give more contribution to the patterned and repetitive system activities, like how a pattern of keyboard macro runs to perform a series of system processes, for instance, when a person runs a word processing application and often opens the same documents repetitively. It is clearly seen that there are two event processes, namely the first one is running a word processing application and the second one is opening a document. Through a hook programming technique, we are able to summarise the process by defining a new process to perform the two processes above, for instance, by defining Ctrl+T as a process of running a word processing application and then proceeding to open the intended document. This of course will shorten the processing

time on the user side. Besides this, there are still a lot of benefits of using a hook programming technique that can give more valuable effects on the processing time. However, some illegal things are also found in the use of a hook programming technique, like how a computer virus will disable certain buttons on the screen, a virus that can interrupt pressing a certain key to execute a command 'shutdown' on computer or a program when executed will make a mouse movement irregular, and still many more illegal things caused by this kind of technique.

## **APPLICATION PROGRAMMING INTERFACE (API)**

In a hook programming technique, a programming technique is needed by considering some important things like the hook process where it should run faster, lighter, and safer so it requires a bridge that is able to communicate between a hook process and an execution target either in internal or external of the program. Therefore, a hook programming technique requires an Application Programming Interface (API).

API (Application Programming Interface) is a language and message format that is used by an application to communicate with: Operating System, DBMS (Database Management System), communication protocol, Hardware or other programs. API is used through API function calls in the program. API provides functions to connect with the needed subroutine in the program execution. In windows operating system, API functions are contained in Windows API.

## **WINDOWS API**

Windows API (Application Programming Interface) is a collection of external functions contained in the Windows library files (hereinafter often referred to as library windows) or other library files which can be used by our program.

This function is able to handle all the things related to Windows, like accessing disk, interface printer, windows graphic, dialog box (open a file, save a file, select a font, select a color, and so on.), windows shell, computer system settings, handling files, accessing registry system, playing music, etc. This function provides standard features for all windows based programs. All functions of the

windows API is almost contained in the windows system directory (usually found in directory C:\Windows\System dan C:\Windows, depending on the first setting of the Windows installation) and at most extension DLL used by the Windows operating system. Besides that, this function also ensures consistently the use of all resources contained in Windows. Those files are then called as Windows API. Due to the function of Windows API as an external function, using that function is declared at first.

## **IMPLEMENTATION**

In this scientific writing, the writer uses Borland Delphi 7 to implement the hook technique to control the keyboard and mouse and the methods used in this research is by analyzing the needed automation system, where the basis of the control system are such as what events to automate, what things constitute and how those events are executed.

In this research, a case that will be discussed is to build an application that can control the Windows Notepad program in order to perform a periodic storage process automatically. In the next part is to understand how a storage activity occurs on the side of the keyboard or mouse activity. There are several ways of storage activities in notepad application that can be done. The first is by using a keyboard and the second by using a mouse. The following is the steps that must be passed to the process of data storage on a notepad.

### **1. Using a keyboard**

- Pressing the alt key to activate the file menu
- Pressing the down arrow key 3 times in order to select submenu save
- Pressing the enter key to the process of saving

### **2. Using a Mouse**

- Directing the mouse pointer towards the file menu
- Pressing the left mouse button
- Releasing the left mouse button
- Directing the mouse pointer towards submenu save
- Pressing the left mouse button
- Releasing the left mouse button

The selection of which device (a keyboard or a mouse) to use on a hook execution will determine the rate at event execution process to be automated, so that it can be clearly seen where the shortest process by looking at the number of keyboard or mouse activity.

However, any process that is carried out by a keyboard or a mouse from one activity to another activity must be separated with a time lag measured by msec (Micro Second), the use of time lag is intended to avoid the event execution that would occur simultaneously considering the height of the execution process time toward an activity.

In the implementation of this case, there are two main steps to make the process can be done. The first step is to always put the notepad application window in the front before it is executed. The second one is to carry out the process of execution towards the notepad window with a hook programming technique.

Here are functions used to support the hook process:

1. EnumProc function, which is used to display a list of the active windows.
2. EnumWindowsProc2 function, which is used to define the sought window in detail.
3. ForceForegroundWindow function, which is used to force program target window to be on the front window

The linkage of the three functions above can be explained as follows: ForceForegroundWindow function is a subroutine that will force the sought application window in order to be at the level of the front (on top) by entering parameter number of handle windows, where the handle windows number on the ForceForegroundWindow parameter is obtained by running Enumproc and EnumWindowsProc2 function. A process that occurs in Enumproc function is to display a list of active windows, which will be then detailed by handle windows number with WindowsProc2 function. The details of these three functions are as follows:

```
function EnumProc(wnd: HWND; Lines:
TStrings): BOOL; stdcall;
var
buf, Caption: array[0..3000] of char;
```

```
begin
Result := True;
GetClassName(wnd, buf, SizeOf(buf)
- 1);
SendMessage(wnd, WM_GETTEXT, 3000,
Integer(@Caption));
Lines.Add(Format('HWND: %d, ID: %d,
ClassName: %s, Caption: %s',
[wnd, GetDlgCtrlID(wnd), buf,
Caption]));
end;
```

```
function EnumWindowsProc2(wHandle:
HWND; lb: TStringList): Bool; stdcall;
export;
var
Title, ClassName: array[0..3000] of
char;
begin
Result := True;
GetWindowText(wHandle, Title,
3000);
GetClassName(wHandle, ClassName,
3000);
if IsWindowVisible(wHandle) then
lb.Add(IntToStr(wHandle)+':'+string
(ClassName) + ':' + string(Title));
end;
```

```
function ForceForegroundWindow(hwnd:
THandle): boolean;
const
SPI_GETFOREGROUNDLOCKTIMEOUT=$2000;
SPI_SETFOREGROUNDLOCKTIMEOUT=$2001;
var
ForegroundThreadID: DWORD;
ThisThreadID: DWORD;
timeout: DWORD;
begin
if IsIconic(hwnd) then
ShowWindow(hwnd, SW_RESTORE);
if GetForegroundWindow = hwnd then
Result := true
else
begin
if ((Win32Platform =
VER_PLATFORM_WIN32_NT) and
(Win32MajorVersion > 4)) or
((Win32Platform =
VER_PLATFORM_WIN32_WINDOWS) and
(Win32MajorVersion > 4)) or
```

```

    ((Win32MajorVersion = 4) and
    (Win32MinorVersion > 0))) then
begin
    Result := false;
    ForegroundThreadID :=
    GetWindowThreadProcessID(Get
    ForegroundWindow, nil);
    ThisThreadID :=
    GetWindowThreadProcessID(hwnd,
    nil);
    if
    AttachThreadInput(ThisThread
    ID, ForegroundThreadID,
    true) then
    begin
        BringWindowToTop(hwnd);
        SetForegroundWindow(hwnd);
        AttachThreadInput(ThisThread
        ID, ForegroundThreadID,
        false); // bingo
        Result :=
        (GetForegroundWindow =
        hwnd);
    end;
    if not Result then
    begin
        SystemParametersInfo(SPI_G
        ETFOREGROUNDLOCKTIMEOUT,
        0, @timeout, 0);

        SystemParametersInfo(SPI_S
        ETFOREGROUNDLOCKTIMEOUT,
        0, TObject(0),
        SPIF_SENDCHANGE);

        BringWindowToTop(hwnd);
        SetForegroundWindow(hwnd);

        SystemParametersInfo(SPI_S
        ETFOREGROUNDLOCKTIMEOUT,
        0, TObject(timeout),
        SPIF_SENDCHANGE);
    end;
end
else begin
    BringWindowToTop(hwnd);
    SetForegroundWindow(hwnd);
end;
Result := (GetForegroundWindow =
hwnd);
end;
end; { ForceForegroundWindow }

```

When the system executes the function of ForceForegroundWindow and enters the number of handle windows on notepad application, the function will force the notepad application window to be at the front (on top).

The next step is carrying out the hook process by controlling the keyboard to execute the file storage process. Here are the following steps:

1. Pressing the alt key to activate the file menu
2. Press the down arrow key 3 times in order to select submenu save
3. Pressing the enter key to perform the storage process

The implementation of the alt key presses is as follows:

```

keybd_event(VK_MENU, 0, 0, 0);
keybd_event(VK_MENU, 0,
KEYEVENTF_KEYUP, 0);

```

The implementation of pressing the down arrow key 3 times is as follows:

```

For i:=1 to 3 do
begin
    keybd_event(VK_Down, 0, 0, 0);
    keybd_event(VK_Down, 0,
KEYEVENTF_KEYUP, 0);
end

```

The implementation of enter key presses is as follows:

```

For i:=1 to 3 do
begin
    keybd_event(VK_Return, 0, 0, 0);
    keybd_event(VK_Return, 0,
KEYEVENTF_KEYUP, 0);
end;

```

If the hook process is conducted by controlling the mouse, then its steps are as follows:

1. Directing the mouse pointer to the file menu
2. Pressing the left mouse button
3. Releasing the left mouse button
4. Directing the mouse pointer towards submenu save
5. Pressing the left mouse button
6. Releasing the left mouse button

The implementation of directing mouse pointer to the file menu is as follows:

```
setcursorpos (pt.x,pt.y);
```

The implementation of pressing the mouse left button is as follows:

```
mouse_event(MOUSEEVENTF_LEFTDOWN,pt
.x,pt.y,0,0);
```

The implementation of releasing the mouse left button is as follows:

```
mouse_event(MOUSEEVENTF_LEFTUP,
pt.x, pt.y, 0, 0);
```

The implementation of directing the mouse pointer to submenu save is as follows:

```
setcursorpos (pt.x,pt.y);
```

The implementation of pressing the mouse left button is as follows:

```
mouse_event(MOUSEEVENTF_LEFTDOWN,pt
.x,pt.y,0,0);
```

The implementation of releasing the mouse left button is as follows:

```
mouse_event(MOUSEEVENTF_LEFTUP,
pt.x, pt.y, 0, 0);
```

## RESULTS

From the results of the implementation above, the hook process will run after the windows notepad is shown at the top level (On Top), and then the hook process is run by both controlling the keyboard presses and controlling the mouse. The running hook process will not take too long for its processing time as it runs in microsecond measurement but if compared to either pressing keys on a keyboard or moving a mouse by hands, certainly the use of hook is far better in terms of processing time. This occurs because of the fact that although it is implemented using a Delphi 7.0 programming language, a function that is executed uses the default windows

API function, so that the routine processes executed run quickly and efficiently.

## CONCLUSION

A hook programming technique will be very useful to build the systems that are patterned and repetitive in conducting the same execution or process. The things to be done are to only determine the pattern of the process, set up a process and repeat the process. Nevertheless, a hook programming technique requires an adequate understanding in the programming area of APIs (Application Programming Interface) for most of the hook applications always get connected and communicate with other applications.

The understanding of a hook programming technique should also be accompanied with high responsibility because the hook is also always identical to a control mastery of a system, in other words we need a way as well as attitudes in making this technique logic well and correctly, because when we build positive applications with hook, there absolutely comes efficient processes. On the other hand, if hook is not made logical well and correctly, the built hook systems will go worse and look hacking, so those could be detrimental to other people.

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# Licence Plate Recognition based Android Smartphone

Aryo Michael<sup>1</sup>, Nur Ain Banyal<sup>2</sup>, and Syari Rukmana Wahab<sup>3</sup>

**Abstract**—In this paper, plate number recognition (LPR) designed and implemented on the Android mobile phone platform. First, pattern recognition method using vehicle plate viola jones to Second, Indonesia's raw image preprocessing is done using Cropping, Grayscale and thresholding, character segmentation based on contour detection. Recognition of characters on 36 characters (A-Z) and (1-9) using Kohonen Network. Preliminary results show that our system can recognize most of the characters plate nearly 83.6% and character recognition of 86,5%.

**Keywords**—Licence Plate Recognition, Number Plate, Android .

## I. INTRODUCTION

Motor vehicle plate is characteristic of or identification of a vehicle provided by the police. Any motor vehicle have different numbers. Even each region has different police number codes. The number of police per vehicle are usually listed on a plate. Introduction of police numbers listed on the license plate of every vehicle are usually done manually (see and note). This involves the officer (human), which allows the occurrence of errors in terms of record-keeping. Commercial vehicle plate recognition devices require relatively expensive, besides the LPR device does not allow use in dense traffic environments [1]. In addition, every vehicle license plate States have different characters. This encourages widespread research regarding the introduction of a license plate of the vehicle.

Studies have been done in recognition of license plates. In papers written by Rizqi k. Romadhon, Mohammed Nofan, Ilham i. Munawar, Sofyan Tan, and Rinda Hedwig, those applying for car license plate recognition system android-based street parking [2]. Abdul Mutholib, Teddy Surya Gunawan, Mira Kartiwi in his paper applying several stages to pengenalan vehicle license plate starts capturing images, dar image filters, image segmentation, characters recognition with OCR algorithm [3]. In this paper, we propose an LPR can recognize design patterns automatically and plate using

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kohonen network for recognition of characters on the license plate.

With the presence of a plate recognition systems that are more flexible and affordable will hopefully facilitate the parties to identify the vehicle.

## II. LICENCE PLAT RECOGNITION (LPR) UNIT

Licence Plate Recognition (LPR) commercial units use today require high costs. Examples in London, a device mounted above the hood Unit LPR vehicle patrol police who are used to reduce vehicle theft crimes [1].



Fig. 1 Licence Plate Recognition (LPR) commercial units

This device consists of a camera placed on the hood of a car, a laptop device is in a patrol car. The use of this device will be hard to identify the vehicles that are in certain circumstances, for example on the playground or at the parking area of the solid.

## III. ANDROID ARCHITECTUR

Android software architecture designed to simplify the reuse of components. The application can publish its capabilities and other applications, can use the abilities, subject to security constraints have forced by order. The android architecture detail shown in Figure 2. The Android software development kit (SDK) supports authoring applications with rich functionality. Like the iPhone, it can handle touchscreen, accelerometers, GPS and 3D graphics, as well as collaboration between applications such as email, calendar, messaging, social networking and location-based services [4][5].



Fig. 2 Android Architecture

Many studies have been proposed and published the ANPR in several ways, including simulation using Matlab or developed using Java and C as the architecture of android and java support libraries, it is possible to implement the ANPR on android devices. Android should be able to offset all the variables that can affect the ANPR's ability to produce accurate reading, such as time of day, weather and the angle between the camera and plates. Systems of illumination wavelengths can also have a direct impact on the resolution and accuracy of reading in these conditions.

IV. SYSTEM DESIGN

On this plate recognition systems are divided into several stages, the first stage is the detection pattern plate using haar feature, character segmentation and the last character recognition using kohonen network. as for the description of the system can be seen in Figure 3.

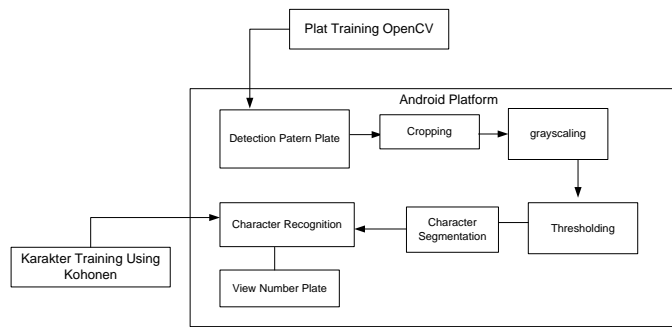


Fig. 3 System Design

A. Training Pattern Of Plate

Many methods are used for pattern recognition, one of the widely used method for pattern recognition plate is Viola Jones [6]. Plate recognition training done on a computer using a method using haar features on the OpenCV. sample used on vehicle license plate image training process by as much as 2000 which is a sample positive and a negative sample 1000 taken from any image As for training sample can be seen in Figure 4. The training plates are stored in an xml file which will be used as the value for android applications. As for

training sample can be seen in Figure 5



Fig 4. Positif Sample Negatif Sample for Plate Detection

opencv\_createsamples:

```
./opencv_createsamples
-info <description_file_name>
-img <image_file_name>
-vec <vec_file_name>
-bg <background_file_name>
-num <number_of_samples = 1000>
-bgcolor <background_color = 0>
-inv -randinv -bgthresh <background_color_threshold = 80>
-maxxdev <max_intensity_deviation = 40>
-maxyangle <max_x_rotation_angle = 1.100000>
-maxzangle <max_y_rotation_angle = 1.100000>
-maxzangle <max_z_rotation_angle = 0.500000>
-show <scale = 4.000000>
-w <sample_width = 55>
-h <sample_height = 50>
```

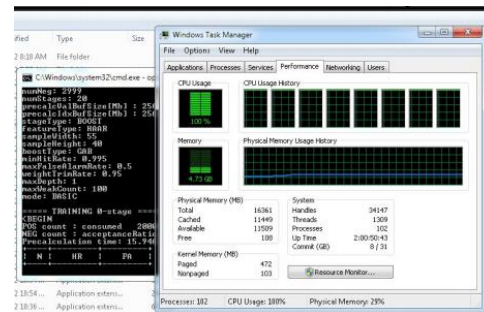


Fig.5 The training plates on OpenCV

B. Character Training Using Kohonen Neural Network

Characters in a training system that uses a 35 character, i.e., A-Z and 1-9 as shown in figure 7. For applications are programs that run on the desktop bebasis Java such as in Figure 6 using Kohonen training on the process of character recognition applications. The character used as the sample is converted to a size 14 x 10 pixels, then to get the value of the threshold method using the otsu threshold. the threshold value in the sample is then inserted into a Kohonen Training, applications only store the value chain into the binary file, binary file will be loaded into an application on android users in the process of identifying the character.

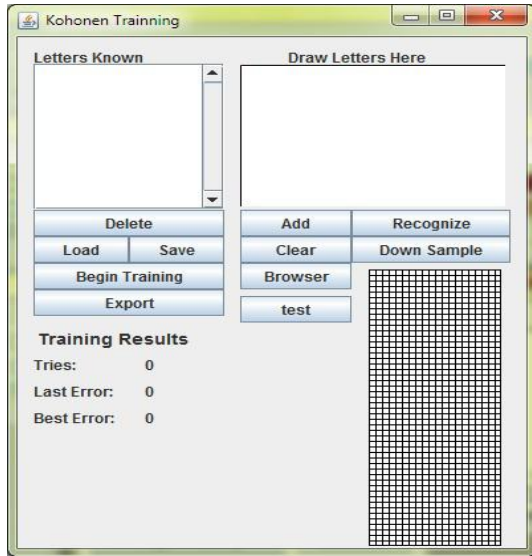


Fig.6 Java Kohonen Training



Fig.7 Character Sample Training

*C. Character Segmentation*

After finding the area containing the license plates, the next problem to solve is separated across the Ocean has been obtained, this brings a big advantage for the final step of the system, identifying the character.

There are many methods that can be applied to accomplish this task. Could say here as a static separation, energy quantization vector (vector quantization), horizontal and vertical projection schemes (vertical and horizontal projection), as noron (neural networks), artificial intelligence (AI), morphology (morphology). This paper chose morphological methods to perform the process of character segmentation

The process of characters segmentation using multiple stages, namely cropping, grayscaling, thresholding, countor detection. cropping aims to remove the parts of the image that is not used for reading the plates. Grayscaling on android is done using function colorfilter provided by android. So any incoming RGB images will be instantly filtered its colour becomes grey.

The process of Thresholding on android is done by finding the average values of the minimum and maximum pixel in the

image. Once obtained the value threshold, then enter into the next process. The first step is to read one by one pixel in the image, if the pixel value is below the threshold value of the pixel is set at 0 and if greater than or equal to the threshold values then the value of the pixel is set to 1. The next process is the character segmentation based on image edge lines.

V. CONSTRUCTION AND IMPLEMENTATION

After the system design has been completed, the system is ready for the construction and implementation. First of all the software design is constructed under android platform using OpenCV 2.4.9 for android. The system environment itself we used eclipse as android editor and JDK 1.6 for the java environment. The construction step consists of graphical user interface (GUI).



Fig. 8 Interface in android phone

VI. EXPERIMEN RESULT

Experiments have been performed to test the proposed system and measure the accuracy of the system. The system is designed in the eclipse IDE, ADT 21.1, Library OpenCV to vehicle license plate recognition Indonesia. The image to the color system of the input to the image with a size of 1600 x 1200. Test images taken under different lighting conditions. The test results are shown in table I.

Indicated that the accuracy for the character segmentation is 83,6% and 86,5% is the percentage of unit recognition accuracy. Overall system performance can be defined as the product level of accuracy of all units (Detection Plate and character recognition).

TABLE I  
TABLE RESULT OF TEST TEST

No.	Units of LPR System	Percentage of Accuracy (%)
1.	Dectcion Plat	83,6%
2.	Character Recognition	86,5%

## VII. CONCLUSION

This paper has been discussed on design and implementation of the introduction of number plate Recognition (LPR) using Haar Featured for the detection pattern plate and kohonen Network for recognition of characters on the android mobile phone platform. In conclusion, we have proposed the design of the LPR can be implemented on the android mobile phone platform. The system is designed for plates and identification system in Indonesia have been tested. Finally, the results show that the proposed system to reach 83.6% accuracy detection pattern plate and 86,5% for characters recognition. In addition, the proposed system can be redesigned to multinational car license plate in front of the study.

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## IMPLEMENTATION METHOD VIOLA JONES FOR DETECTION MANY FACES

Liza Angriani<sup>1</sup>, Abd. Rahman Dayat<sup>2</sup>, and Syahril Amin<sup>3</sup>

*Abstract*— In this study will be explained about how the Viola Jones, and apply it in a lot of face detection system in real time by utilizing OpenCV libraries. Once the system is completed, will discuss how the detection system ranging from image acquisition, image processing, pattern recognition, and image analysis. Then testing on the character's face can be detected. Training data used in this study consists of two (2) parts, ie positive samples and negative samples. Positive sample is a sample image of human, while a negative image of trees and animals. The data used in this research is an image taken at random from the webcam and internet as much as maximum human image and varian distance. The image is used most small-sized dimensions are 640x480 pixels and most greatest dimension is 1600x1200 pixels. Training data is performed using the OpenCV library. Here's a face detection process scheme using Viola-Jones method

*Keywords*— *image recognition, face detection, viola-jones.*

## I. INTRODUCTION

Image processing is a system where the process is done with the input of the original image and also in the form of images. One area that uses image processing which is currently developed a lot of people are biometric applications, ie the field that studies how to be able to identify the unique characteristics that exist in the brain of the human body can determine whether the object seen by the human eye or it is not, face or hands and so on. One of the fields in computer vision that many do is research on face recognition which is the domain of computer vision applications.<sup>1</sup>

Commercial application of this has been implemented, but basically this is not a perfect technology research needs to be developed to achieve the desired result. One thing that can be added or used in the development of facial recognition technology is to increase the level of speed and accuracy in detecting faces. Many of the detection system using the Viola Jones [1] as an object detection method. The Viola Jones Methods is known to have the speed and accuracy is quite high because it combines several concepts (Haar features, Integral image, AdaBoost, Cascade Classifier) became a major method for detecting objects. Several studies using the method Viola

And Jones among others distance between the finger to the camera is within 10-15 cm, the position of the finger is detected at the position of 0 ° and 45 ° in the study concluded Viola Jones method is able to detect in real time and has the accuracy of the high [2]. Game Tic Tac Toe with Finger Gestures which concluded that the more light around the room, resulting in an excellent finger detection [3].

In addition, this method is used also as a method for tracking an object system [4].

## II. IMAGE PROCESSING

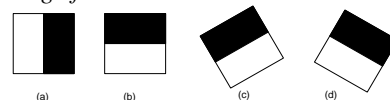
Image processing is an important part of the underlying variety of real applications, such as pattern recognition, remote sensing by satellite and machine vision [5]. Image processing is a method or technique that can be used to process the image with the image or manipulated into the desired image data to obtain specific information [6]. Digital image obtained from the digitized analog image. Image digitization involves two processes, namely sampling and quantization. Sampling shows the number of pixels / block to define an image. Quantization shows the number of degrees of value at each pixel (indicates the number of bits in a digital image, black / white with 2 bits, with 8-bit grayscale, with 24-bit true color). Image processing is done to improve the quality of the image to make it easier to interpret by human / computer. Input and output are also the image of the image, but with a better quality than the input image. Image processing operations associated in face detection: grayscale, neighborhood operations, thresholding, histogram equalization, resizing

## III. VIOLA-JONES METHODS

Viola- Jones method is divided into four main components: Haar Like Feature, Integral Image, Adaptive Boosting and Cascade of Classifier.

*Haar Feature*

Haar feature is a feature that is used to detect an object. Features Haar feature based on Haar wavelet [1]. Haar wavelet is a single square wave having a high interval and a lower interval. Furthermore, combinations of box used for the detection of visual objects better. Each Haar-like feature consists of a combined box - black and white box as follows:

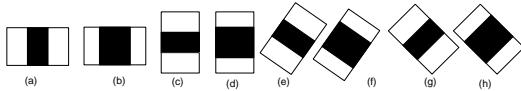
*Edge features*

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Lines Features



Center-Surround

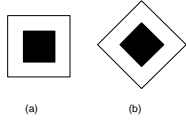


Fig. 1 Various Kinds of Variations Featured on Haar [7]

In the Viola-Jones method, Haar feature known as Haar-Like feature. Haar-Like feature will process the image in boxes containing several pixels of an image. Determination of Haar feature is determined by subtracting the total pixels in the dark areas of the total pixels in the bright areas. Can be written with the formula:

$$f(x) = \text{SumBlackRectangle} - \text{SumWhiteRectangle}$$

To obtain a faster computation can use the integral image.

A. Integral Images

Integral images is a method for calculating the box Haar-like features. This method is used to calculate quickly without calculating the overall value of the existing pixels in the feature. Integral images at location x, y consists of the value of the number of pixels above and left of location x, y.

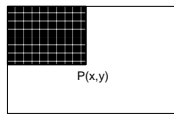


Fig. 2 Integral Images

According to Viola and Jones Integral images at the location x, y, containing the number of the top to the left of x, y calculation using the following formula:

$$ii(x, y) = \sum_{x' \leq x, y' \leq y} i(x', y') = \text{Integral Image is original image}$$

To calculate the integral image by ignoring the original image, using a pair the following formula:

$$ii(x, y) = ii(-1, y) + s(x, y)$$

$$s(x, y) = s(x - 1, y) + i(x, y)$$

Where :

- $i(x, y)$  : Original Image
- $ii(x, y)$  : integral image
- $s(x, y)$  : The cumulative number of rows
- $s(x, -1) = 0$
- $ii(-1, y) = 0$

1	2	3
4	5	6
7	8	9

1	3	6
5	12	21
12	27	45

Fig. 3 Example of calculation of the integral image

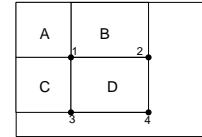


Fig. 4 The integral image calculation

Can be seen in the picture above is based on the calculation of the number of pixels in a square D, can be calculated with reference point array. The value of the integral image at location 1 is the sum of the rectangle A. Value at location 2 is A + B, the value at location 3 is A + C, and at the location 4 is A + B + C + D. summation role in D could be count like 4 + 1 - (2 + 3). Iterative search process is done from the top is now on the image to the bottom right corner of the image.

B. Adaptive Boost (AdaBoost)

Most of boosting algorithms follow a design that adds a weak learner into a strong learner. Weak learner is a classifier that has little correlation with the actual classification. While strong learner is a classifier which has a strong correlation with the actual classification [8]. At each iteration, a weak classifier learn from one exercise, then the weak learner will be added to the strong learner.

Adaboost is an abbreviation of Adaptive Boosting formulated by Yoav Freund and Robert Schapire in 1995. The AdaBoost algorithm is used to perform election-features in large quantities by simply selecting certain features. AdaBoost algorithm is an algorithm that is able to adapt with less weak classifier. According to Viola and Jones [4] one practical method to solve it is to limit the weak learner to the classification of functions, each of which relies on a single feature. For each feature determining thresholds weak learner optimal classification function.

C. Cascade Classifier

Cascade Classifier combination is the final step in the Viola-Jones method. By combining the classification in a multi-storey structure, the speed of the process can be increased is by focusing on the areas in the image that is likely to be. This is done to determine where the location of the object you are looking at an image.

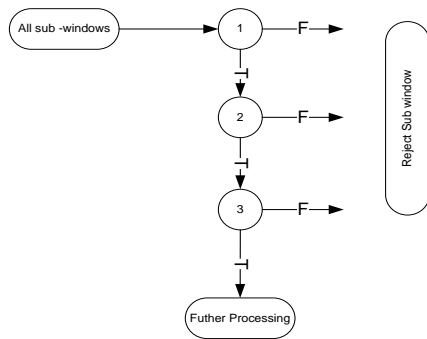


Fig. 4 Flow cascade classifier [1]

At the first level of classification, each sub-image will be classified using the feature. The results of this first classification is T (True) for images that meet certain Haar features and F (False) if not. This classification will be leaving roughly 50% sub-image to be classified in the second stage. The results of the second classification is T (True) for images that meet the integral image and F (False) if not. Along with increasing levels of classification, it would require more specific terms that are used feature becomes more. Sub-image who escapes classification number would be reduced up to a total of about 2% [4]. The results of the latter classification is T (True) for images that meet the AdaBoost and F (False) if not..

IV. CONSTRUCT AND IMPLEMENTATION

The samples used were taken from the images on the internet, which consists of the positive samples and negative samples. Positive samples is that the pattern of the human face, while the negative samples is any image that is not a human face pattern. Each sample using 50 different images with low resolution of 640x480 pixels up to 1600x1200 pixels. After the system design has been completed, the system is ready for the construction and implementation. First of all the software design is constructed under desktop platform using OpenCV. The system environment itself we used Microsoft Visual Studio 2012. The construction step consists of graphical user interface (GUI).

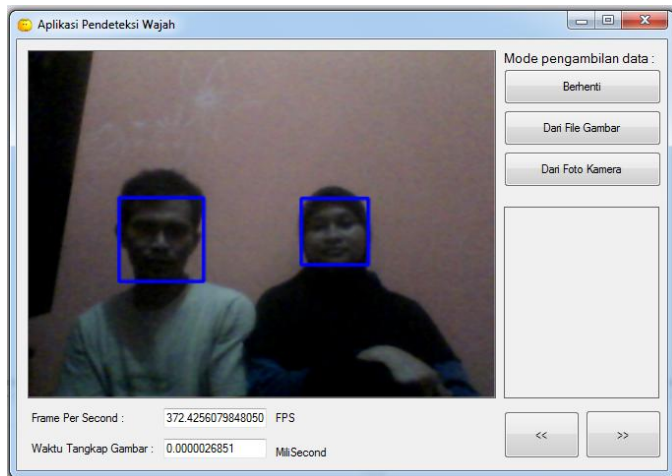


Fig. 5 Implementation of Face Detection with two faces



Fig. 6 Implementation of Face Detection with four faces

Experiments have been performed to test the proposed system and measure the accuracy of the system. The system is designed in the Microsoft Visual Studio 2012, ADT 21.1, Library OpenCV to face recognition. The image to the color system of the input to the image with a size of 640 x 480. Test images taken under different distance conditions with 10 peoples in real time. The test results are shown in table I. Indicated that the accuracy for the character segmentation is 99,6%, 98%, 97,7% and 97,6% is the percentage of unit recognition accuracy. Overall system performance can be defined as the product level of accuracy of all units (Detection face recognition).

TABLE I  
TABLE RESULT

No.	Distance of FR System	Percentage of Accuracy (%)
1.	1 meter	99,6%
2.	2 meters	98%
3.	3 meters	97,7%
4.	4 meters	97,6%

V.CONCLUSION

This paper has been discussed on design and implementation of the introduction of Many Face Recognition (MFR) using Viola-Jones Methods with Haar Featured for the detection face pattern on desktop platform. In conclusion, we have proposed the design of the MFR can be implemented on desktop platform in real time. The system is designed for face and identification system in real time have been tested. Finally, the results show that the proposed system to reach 99.6% accuracy detection in within close and 97,5% for few far distance. In addition, the proposed system can be can be developed for face recognition for tracking people in a public space in the future.

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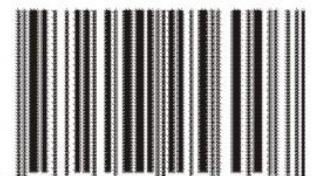
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