DIAGNOSIS OF SKIN DISEASES IN TODDLERS USING NAÏVE BAYES AND FORWARD CHAINING METHODS

Sidik Rahmatullah[1], Rima Mawarni[2]
[1]Departement of Computer Technology, STMIK DCC Kotabumi
[2]Departement of Information system, STMIK DCC Kotabumi
[1,2]Street Negara No. 03 Candimas, Kotabumi, North Lampung

*Corresponding author
sidik@dcc.ac.id
rima@dcc.ac.id

Abstract
The Center for Public Healthis a functional organizational unit that implements health care that is thorough, integrated, evenly acceptable and affordable to the community. The purpose of this research is to create an Expert System Application to detect skin diseases in toddlers according to the data in public health center. The system development method used is Extreme Programing (XP) method with working stages including planning, design, coding and testing. The system is designed using Unified Modeling Language (UML) which includes use cases, activity diagrams, and chart classes, the software used is PHP (Hypertext Preprocessor) with MySQL databases and uses the Naïve Bayes and Forward Chaining methods. The end result of the creation of this App is to make it easier for users or the public in detecting skin diseases for toddlers.

1.0 INTRODUCTION

The development of computers today has undergone many changes very rapidly, along with the increasing and complex needs of humans. Now computer has been widely used in various fields such as Business, Health, Education, Psychology, Gaming and so on. This encourages experts to further develop computers in order to help human work or even exceed human work capabilities[1]. Child under the age of five will be susceptible to skin diseases especially with unhealthy environmental, where it will be easy to attack children especially toddlers. Disease in toddlers becomes a big fear for the elderly, the body of the toddler susceptible to disease becomes one of the contributing factors. In this case, parents as service users need more experts who can facilitate in diagnosing the disease early in order to take early prevention which if it takes time if consulting a doctor, which the cost is not cheap and thearea is not near. Therefore, it takes a tool that can diagnose skin diseases of toddlers is an expert system. One of the implementations implemented by expert systems in the field of child health, namely an expert system to diagnose skin diseases in toddlers.[1]

Cempaka The Public Health Center is the development of Cempaka Sub. The Public Health Center in Ketapang which the Area in Sungkai Jaya District, North Lampung Regency, CempakaPublic Health Center leads 9 villages. At Cempaka Health Center there is no accurate data that has so difficulty in finding skin disease data for toddlers and there is no proper detection system against toddler skin diseases.

In his research explain that: Skin disease is a disease that is quite dangerous and is often found in tropical countries like Indonesia. Lack of knowledge about the types of skin diseases and do not know how to prevent them can cause a person suffering from

acute skin disease. Detection of skin diseases is usually done by a dermatologist but actually the detection of skin diseases can be done alone or with the help of others by observing the diagnoses that arise. The expert system is a solution for using computers to help in the early detection of possible skin diseases. Dipen-ku is a expert system which designed to detect naive skin diseases with Bayes. System output is a type of skin disease which is a diagnosis of this type of disease. This expert system is a new innovation in innovation in drug materials that combines treatment technology and bigdata technology to support the design of smart city development. In his research explained that: The development of technology capable to imitating the process of human thinking and led to a new branch of computer science named the expert system. One of the problem that can be solved by an expert system is selecting hypercholesterolemia drugs. Drug selection starts from find the symptoms and then determine the best drug for the patient. This is consist with the mechanism of forward chaining which starts from searching for information about the symptoms, and then try to illustrate the conclusions. To accommodate the missing fact, expert systems can be complemented with the Bayes theorem that provides a simple rule for calculating the conditional probability so the accuracy of the method approaches the accuracy of the experts. This research uses 30 training data and 76 testing data of medical record that use hypercholesterolemia drugs from Tugurejo Hospital of Semarang. The variable are common symptoms and some hypercholesterolemia drugs. This research obtained a selection of hypercholesterolemia drugs system with 96.05% accuracy.

The purpose of this study was to find out: 1) How to develop an Expert System for Searching and Publishing Scientific Manuscripts on Reputable International Journals for Lecturers in Makassar State University; 2) How can the Expert System with the Forward Chaining method facilitate Faculties in publishing Scientific Manuscripts so that they can be published in reputable international journals; 3) How to design an Expert System for Searching and Publishing Scientific Manuscripts in Reputable International Journals for Makassar State University Lecturers meet valid, practical, and effective criteria.

The first year research is type of research and development. Software development in the form of Expert Systems with Forward Chaining Methods for Searching and Publishing Scientific Manuscripts in Reputable International Journals is carried out with an engineering approach where the stages are: analysis, design, implementation, and evaluation. After generating an Expert System Using the Forward Chaining Method for Searching and Publishing Scientific Manuscripts on Reputable International Journals for Lecturers in Makassar State University. Based on the research that has been carried out in the development of expert system applications for the search and publication of scientific manuscripts on reputable international journals, the researcher can draw several conclusions, namely: 1) Expert Systems for Searching and Publishing Scientific Manuscripts on Reputable International Journals for Makassar State University Lecturers developed with using a linear sequential software development model, also known as the waterfall model. The stages of development in this model include the process of knowledge analysis, design, coding or implementation, implementation; 2) Expert System with Forward Chaining method can facilitate Lecturers in publishing Scientific Manuscripts so that they can be published in reputable international journals; 3) Expert System Design for Searching and Publishing Scientific Manuscripts on Reputable International Journals for Makassar State University Lecturers meet valid, practical criteria. The appropriateness of the application is measured using software eligibility criteria. The appropriateness test of the application by the developer includes aspects of functionality. The functionality aspect based on the testing that has been done, getting the test results very good. All existing functions can work well. Based on the problems above; available the expert system to provide diagnostic information and how to handle it appropriately to parents about skin toddler disease that are often suffered. In this system is the best way to detect skin diseases, so there is no need to guess the skin diseases suffered by their toddlers because the system will provide answers based on existing facts.

2.0 THEORETICAL
2.1. Expert System

Expert systems are one branch of Artificial Intelligence (AI) artificial intelligence. One popular definition of artificial intelligence is "making computers think like humans." When a system succeeds through a test, it is considered strong AI. The term strong AI is used on the

assumption that AI should be based on a strong logical basis rather than what is referred to as weak AI, which is based on artificial neural networks, genetic algorithms, and evolutionary methods. The expert system is an application of excellent artificial intelligence technology [4].

Furthermore, research [5] Expert Systems in general, expert systems are systems that attempt to adopt human knowledge into computers, so that computers can solve problems as experts usually do. With this expert system, laypeople can also solve quite complex problems that can actually only be solved with the help of experts.

2.2. Naïve Bayes

Naïve Bayes is a probabilistic classification technique based on bayes theorem that uses attribute indentation assumptions (no relation between attributes) in the classification process. Naïve bayes can be trained efficiently in supervised learning. The advantage of classification is that it only requires a small amount of training data to estimate the parameters (means and variants of variables) required for classification. Since independent variables are assumed, only variations of variables for each class should be specified, not the entire matrix of kovarians. In the process, Naïve Bayes Classifier assumes that there is or is not a feature in a class unrelated to the existing or other features in the same class [3]. The following calculations in the naïve bayes method with the bayes theorem equation [7] are as follows:

$$P(B|A) = P\frac{(A|B)P(B)}{P(A)}$$

where:
P(B | A) = chance B, if it is known the condition of the type disease A.
P(B | A) = Chance of evidence A, if known hypothesis B.
P(B)   = Probability hypothesis B regardless of any evidence.
P(A)   = chance of evidence of skin disease A.
equation (4) can be written using bayes theorem as follows.

$$Vmap = argmax \in v\ P\ (vj|a1, a2, a3 \ldots an|vj)P(vj)$$

where:
$Vmap$ = Highest Probability
$P(vj)$ = Chance disease type to j
P(a1, a2,..,an | vj) = Input attribute change if known as vj

$$P(ai|Vj) = \frac{nc + m.p}{n + m}$$

where:
nc=count record on data learning v = vj and a = ai
p=1/ the number of types of classes /diseases
m=number of parameters/symptoms
n=number of records in the data learning v = vj/ each class

2.3 Forward Chaining

Forward Chaining is a search technique that starts with a known fact, then matches that fact with the IF section of the IF-THEN rules. If there is a fact that matches the IF section, then the rule is executed. When a rule is executed, a new fact (THEN section) is added to the database. Each time you match, it starts with the top rule. Each rule should only be executed once. The matching process stops when no more rules can be executed. [6]

3.0 METHODOLOGY

The software development method used in this study is the Extreme Programming (XP) method which has a framework divided into four main activity contexts namely Planning, Design, Coding and Testing.
The following is an explanation of the Extreme Programming model:
a.   Planning

Planning has a focus on getting an overview of the features and functions of the software to be built. The planning activity starts by creating a collection of images or stories that have been provided by the client that will be the basic overview of the software. A collection of images or stories will be collected in an index where each point has its own priorities. (Data collection of research objects, Data collection and information)

b.   Design

Design activities in the development of this application, aim to set logic patterns in the system. A good application design is a design that can reduce dependency between each process on a system. If one of the features of the system is damaged, it will not affect the system as a whole (using unified modeling language (UML) among others: use case diagram, class diagram and activity diagram).

c.   Coding

After completing the basic overview of the software and completing the design for the application as a whole, XP recommends the team first create a test unit module that aims to test each story and description provided by the client. Once the various test units have been completed, the team will continue their activities to write coding applications. XP implements the concept of Pair Programming in which each task of a module is developed by two programmers (Interface model design, Design coding design into programming language with PHP, output design).

d.   Testing

Although the trial phase is already done at the coding stage, XP will also perform perfect system testing. At the coding stage, XP will continue to check and fix all the problems that occur even if it is only a minor problem. Each module under development will be tested first with a pre-made test unit module (testing the skin disease diagnosis system in toddlers, evaluation of the design of the expert system for diagnosing skin diseases).

Forward Chaining Flow Chart

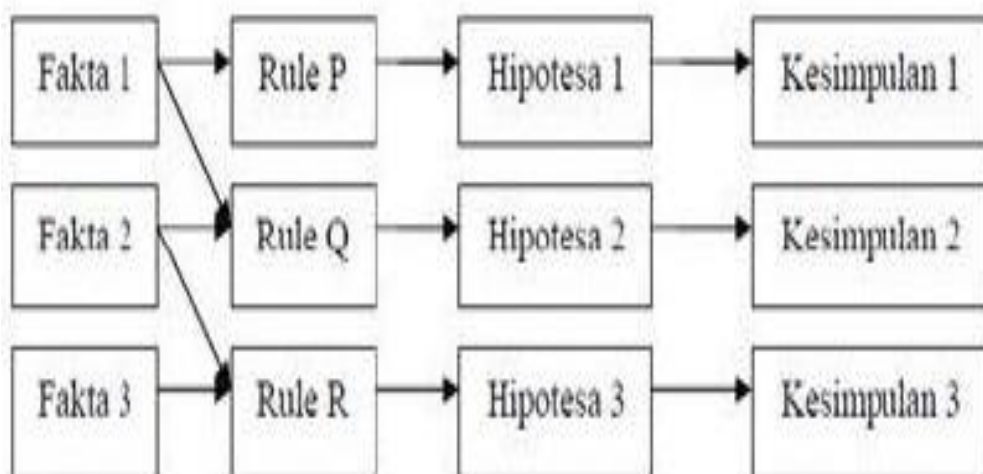The Following is diagram of forward chaining in general in solving a problem [8]

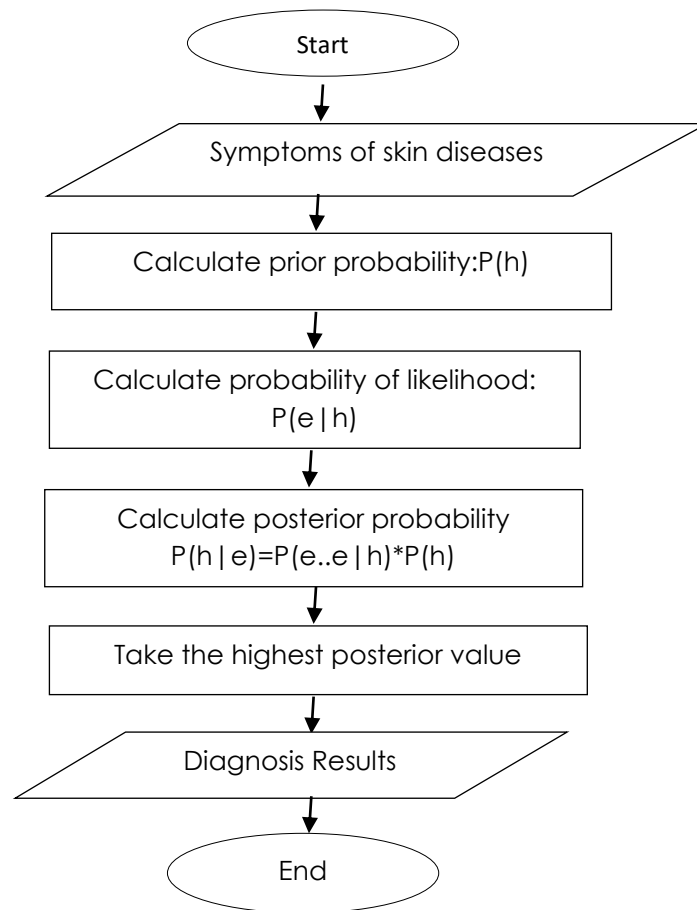Figure 1Diagram Forward Chaining

Flow Diagram naïve bayes method

Figure 2. Flow chart naïve bayes

4.1 Knowledge Base and System Desain
Skin Diseases Knowledge Base
The following data on skin diseases in toddlers and each codescan be seen in the following table 1:

Table 1 Skin Disease Knowledge Base

ID Disease	Disease
P01	*Cradle cap*
P02	Eczema
P03	Measles
P04	Warts
P05	Chickenpox
P06	Biang Sweat
P07	Diaper rash

Skin Disease Symptoms Knowledge Base
Symptoms of skin disease and its code can each be seen in the following table 2:

Table 2. Skin Disease Symptoms Knowledge Base

ID_Symptoms	Symptoms
G01	Mild redness of the skin
G02	Excessive itching of the skin
G03	Oily or dry skin covered in white scales, dark yellow tau
G04	Hormones from mothers move in babies during pregnancy
G05	Skin is allergic to less clean environments
G06	Skin is allergic to food

G07	Flushed skin
G08	Scaly and cracked skin
G09	Skin arises small bubbles containing water or pus
G10	Skin allergy chemicals such as detergents, soaps, and medicines
G11	Allergic skin of plant pollen
G12	Skin is allergic to dust and climate
G13	High fever 4 days before the rash appears
G14	Toddler's eyes flushed
G15	Coughs and colds
G16	White spots visible along the mouth line
G17	Exposed to contact with other measles-affected children
G18	Hard to eat
G19	Daze or constantly delirious
G20	Severe headaches
G21	Complaining of earache
G22	Small lumps appear on the skin
G23	Excessive itching of the skin
G24	Pain when touched on lumps
G25	Throat disorders
G26	The child's body is weakened and does not feel hungry
G27	Red spots appear
G28	Red spots will break and then break and release water
G29	Mild swelling
G30	Skin feels sore and punctured
G31	Lumps on the skin contain pus
G32	Fever or chills
G33	Reddish patches
G34	Dry and blistered skin
G35	Abrasions on the buttocks, thighs, and genitals
G36	Her skin is palpable warm when touched
G37	Moist diapers
G38	Diapers are too tight
G39	Bacterial and fungal infections
G40	Sensitive skin
G41	Irritation of baby hygiene products

Rule of Disease and Skin Symptoms

Table 3. Rule of Disease and Skin Symptoms

ID_Symptoms	ID Disease						
	P01	P02	P03	P04	P05	P06	P07
G01	*	*	*	*	*	*	*
G02	*	*				*	
G03	*						
G04	*						
G05	*						
G06	*	*					
G07		*	*			*	
G08		*					
G09		*					
G10		*					
G11		*					
G12		*					
G13			*		*		
G14			*				
G15			*				
G16			*				

	C1	C2	C3	C4	C5
G17	*				
G18	*				
G19	*				
G20	*		*		
G21	*				
G22		*			
G23		*			
G24		*			
G25			*		
G26			*		
G27			*		
G28			*		
G29				*	
G30				*	
G31				*	
G32				*	
G33					*
G34					*
G35					*
G36					*
G37					*
G38					*
G39					*
G40					*
G41					*

Use Case Design

Here is the use case design which is the flow of the system in the system of experts diagnosing skin diseases in toddlers, presented in the following image:
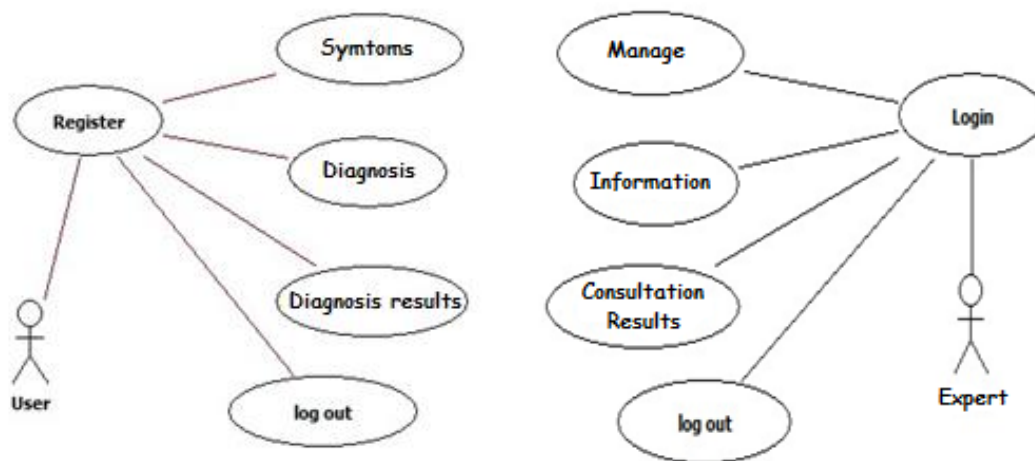
Figure 3. Use case users and experts

4.2 System Implementation

Admin Login

Admin login image on the expert system of skin disease diagnosis in toddlers, presented in the following figure 2.
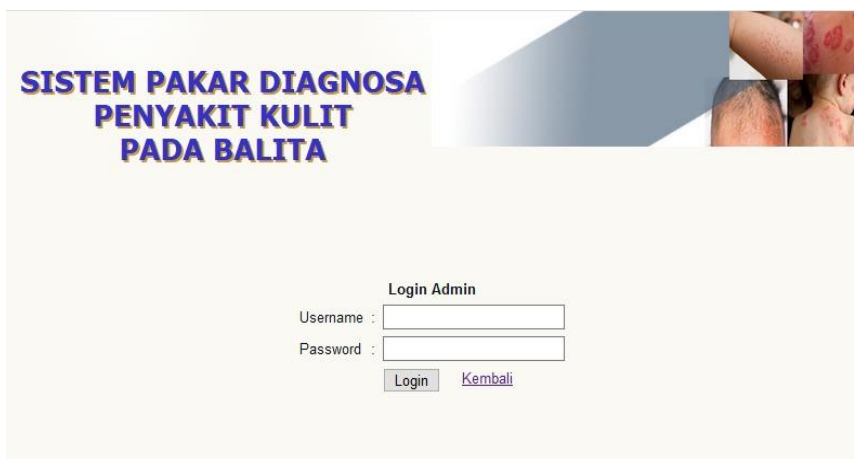
Figure 4. Admin login

Dashboard Display

Here is home Figure/Dashboard on the expert system of skin disease diagnosis in toddlers, presented in the following picture. This home/dashboard view is the front view of the Skin Disease Diagnosis Specialist SystemInToddlers consisting of options menus, inputs and more.

Figure 5. Dashboard display

Manage Data

Here is a picture of Data Manage on the expert system of skin disease diagnosis in toddlers, presented in the following image

Figure6. Manage Data

User Registration Data

Here is a picture of user registration data on the expert system of skin disease diagnosis in toddlers, presented in the following image

Figure 7. User Registration

Symptom Data Input

In the image below is to input the symptom data as in figure 6

Figure8. Symptom Data Input

Diagnosis Results

After the User diagnoses, the results of the diagnosis will be stored in the database and displayed in the diagnostic menu. All user diagnostics and treatment advice data are displayed on this page. This view can be viewed on the

Figure 9. Diagnosis Results

4.3 Black box Testing Scenario

Table 4 Black box Testing Scenario

No	Testing Class	Testing Procedure	Expected Output
1	Authentication Administrator	From the main menu select admin login then type username and password	System login administrator
2	Main Menu Testing	Select the main menu then select disease information	diseaseinformation
3	Consultation form testing	Click the consultation menu and input your name, gender, age, address, mobile number	Displaying the consultation registration form consultation
4	Data Processing of disease and symptoms	selectMain menusymptoms then input symptom code, symptom name	The system can display symptom and diseases, add delete and change

5.0 CONCLUSION

Based on research conducted at the Cempaka Health Center, Sungkai Jaya District. and the discussion concluded that: the researcher used some patient data from the Cempaka Community Health Center, Sungkai Jaya District, Kotabumi, North Lampung Regency, as many as 20 data on patients under five with some common symptoms experienced and determined the type of disease and treatment solutions, so that the accuracy rate of the calculation of ditas was 90%. then with the application engineering "Expert System Diagnosis of Skin Diseases in Toddlers Using the Naïve Bayes Method and Forward Chaining Method". can be implemented so that getting fairly accurate results along with the output of diagnosis and treatment in toddlers is very helpful at Cempaka Health Center.

REFERENCES

[1] Mulyani, EviDewi Sri, and Irna Nur Restianie. Aplikasi Sistem Pakar Untuk Mendiagnosa Penyakit Anak (Balita) Dengan Menggunakan Metode Forward Chaining. " *SEMNAS TEKNOMEDIA ONLINE* 4.1 (2016): 3-4.

[2] Yanto, BagusFery, Indah Werdiningsih, and EndahPurwanti. "Aplikasi Sistem Pakar Diagnosa Penyakit Pada Anak Bawah Lima Tahun Menggunakan Metode Forward Chaining." *Journal of Information Systems Engineering and Business Intelligence* 3.1 (2017): 61-67.

[3] Rismanto, Ridwan, Yoppy Yunhasnawa, and Mauliwidya Mauliwidya. "PENGEMBANGAN SISTEM PAKAR UNTUK DIAGNOSA PENYAKIT KULIT PADA MANUSIA MENGGUNAKAN METODE NAIVE BAYES." *Jurnal Ilmiah Teknologi Informasi dan Robotika* 1.1 (2019): 18-24.

[4] Viviliani, Viviliani, and Radius Tanone. "PerancanganSistemPakar Diagnosis Penyakit pada BayidenganMetode Forward Chaining Berbasis Android." *Jurnal Teknik Informatika dan SistemInformasi* 5.1 (2019).

[5] Maimunah, Maimunah, and Gagas Pandu Wibowo. "Sistem Pakar Pendiagnosa Penyakit Berbasis Mobile. " *Creative Communication and Innovative Technology Journal* 11.1(2018): 69-81.

[6] Ashari, Andi YuliaMuniar. *Penerapan Sistem Pakar untuk Mendiagnosa Penyakit Pencernaan Dengan Pengobatan Bahan Alami.* Seminar Nasional Sains dan Teknologi, Fakultas Teknik Universitas Muhammadiyah Jakarta. P-ISSN: 2407-1846, e-ISSN: 2460-8416. 2016.

[7] Gusman, A. P., and H. Hendri. "Expert system to diagnose child development growth disorders with forward chaining method." *Journal of Physics: Conference Series*. Vol. 1339. No. 1. IOP Publishing, 2019.

[8] H. W. Putra, "Sistem Pakar Diagnosis Penyakit Ginjal Dengan Metoda Forward Chaining," *J. Sains dan Inform.*, vol. 5, no. 1, p. 7, 2019, doi: 10.22216/jsi.v5i1.4081.

[9] Hartatik, Abdul Aziz, Rudi Hartono, Rizal Abdilah "Decision Support System for Detection of Skin Diseases in Smart Health development planning"*,* Informatics Engineering Departement, Faculty of Mathematics and Natural Sciences, Sebelas Maret University,

Surakarta, Indonesia. To cite this article: *Hartatik et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 858 012051.*

[10] Bayes Theorem and Forward Chaining Method on Expert System for Determine Hypercholesterolemia Drugs. Anna Adi Perbawawati[1], Endang Sugiharti, Much Aziz Muslim. Department of Computer Science, Natural Sciences, State University of Semarang. http://journal.unnes.ac.id/nju/index.php/sji.

[11] *Iwan Suhardi, Sapto Haryoko, Hendra Jaya,* "Dissemination of Research Results through Optimizing Love and Intellectual Property Rights" ISBN: 978-602-5554-71-1. PROSIDING OF NATIONAL SEMINAR OF RESEARCH INSTITUTION OF MAKASSAR STATE UNIVERSITY