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# DEVELOPMENT OF AUTOMATIC ESSAY EXAMINATION SYSTEM USING RABIN-CARP ALGORITHM ON ONLINE EXAM APPLICATION IN STATE 4 PANDEGLANG VOCATIONAL SCHOOL

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## Abstract:

*Every learning process requires an evaluation in the form of an exam. Based on the type of exam, it can be done in three forms, namely multiple choice exam, short fill examination and essay examination. Tests in the form of multiple choice and short exam are types of tests that are often used especially in e-learning exam, but the two types of tests have weaknesses especially for certain materials when compared to the test in the form of essays. Exams with an essay system can train to convey information verbally. The essay exam also requires a better understanding of a science and can be used to measure the level of understanding of human knowledge more depth. In the e-learning process the types of tests that widely used are multiple choice exam and short exam. The reason is the ease in the assessment process. Computer devices that are an important component in the e-learning process are easier to accurately assess in multiple choice test and short exam compared with assessing essay exams.*

***Keyword:*** ***Essays, Rabin Karp, Evaluation, E-Learning.***

## I. INTRODUCTION

In E-learning, the process of evaluating learning outcomes is a very important component, because the evaluation results are an indicator of students' understanding of the material being taught. Evaluations carried out by conducting examinations conducted online with one of the types of questions given are in the form of essay questions.

Examination with this system remains the choice of the teacher to evaluate the level of students' comprehension ability even though in reality it is not easy to give an objective assessment on each student's answers. In addition, Teachers need a long time to correct each student's essay answers, the more number of examinations and the greater number of students are taking the exam, the more number of examinations will be corrected and the longer teacher or instructor corrects them. This causes effect the quality of the assessment and it makesthe assessment is not objective anymore.

### I.2 Limitation of Problems

Limitation of the problem in this study based on the background of existing problems are as follows:

1. Research focused on the scope of the assessment of answers to essays in Pandeglang 4 Vocational High School with the aim of facilitating and effectiveness of teachers or teachers in evaluating students.
2. The method used in the development of the automated essay exam assessment system is the Rabin-CARP algorithm

### I.3 Problem Formula

Based on the description that has been conveyed before, which is the scope of the problem in this research is how to develop an automated essay assessment system in Public Elementary School 4 Pandeglang that can facilitate and accelerate the teacher or instructor in the essay answer assessment process.

### I.4 Research Objectives

The purpose of this study are as follows:

1. Designing the development of a multiple choice online exam assessment system and essays automatically that can help in the assessment process at SMK Negeri 4 Pandeglang.
2. Applying Rabin-CARP Algorithm as a method in the process of automatically evaluating answers of essay questions that can facilitate the teacher or instructor in evaluating students' learning through the exam in the form of essay questions.

## II. THEORY BASIS

### 2.1 Rabin Karp Algorithm

Rabin Karp Algorithminvented by Michael O. Rabin and Richard M. Karp in 1978 by using the hashig function to find patterns in the text strings (Fernando, 2009). Characteristics of the Karp-Rabin Algorithm

1. Using a hashing function
2. Preprocessing phase uses time complexity O (m)
3. For the search phase for its complexity: O (mn)
4. Time needed O (n + m)

The hashing function provides a simple method to avoid the comparison of the number of quadratic characters in many cases and situations. Instead of checking each position of the text when checking is only if the text we are processing has similarities to the pattern. To check the similarity of the two-words background hash function is used. (Fernando, 2009). The Rabin-Karp algorithm is most widely used in detecting cheating or dishonesty. When given a source material or document, this algorithm can be quickly search for all papers from each sentence, ignore lowercase or uppercase, dot, exclamation point, question mark and other punctuation marks.

### 2.1 Basic Concepts of the Automatic Essay Assessment System

The basic concept of the automatic essay scoring system, the first step is the selection of what algorithm will be used, the Rabin Karp algorithm, then the admin enters the teachers' answer key, and the student enters the student answer key that will be tested into the system. Then, the system performs a similar percentage calculation (similarity) from the calculation of that percentage will produce a value

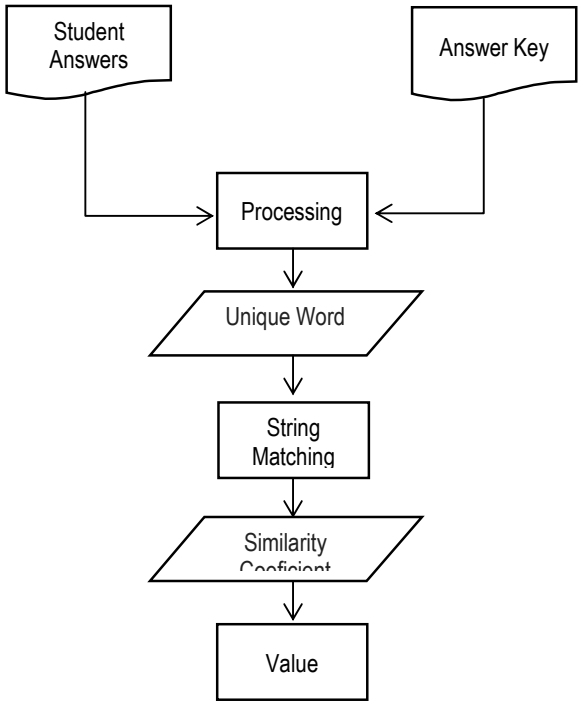


Fig. 2.1 Basic Concept of an Automatic Essay Assessment System

### 2.2 Text Mining

Text mining is one of the special fields of data mining. In accordance with The Text Mining Handbook. Text Mining can be defined as a process of extracting information where a user can interacts with a set of documents using analytical tools that are components of data mining. The purpose of text mining is to get useful information from a set of documents. Data sources used in text mining are a set of text that has a format that is not structured or at least semi-structured. Texts that are processed by

text mining generally have several characteristics including having high dimensions, noise in the data, and text structures that are not well. The method used in studying a text is to first determine the features that represent each word, but before that it is necessary to do a pre-processing stage that is done generally in text mining in documents, namely *case foding, tokenizing, filtering,* and *stemming*

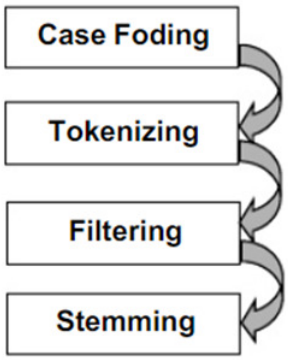


Fig.II.2 Step by StepPrepocessing

## III. METHODOLOGY AND RESEARCH DESIGN

### *3.1 Walking System Analysis Techniques*

The current system analysis technique used in this study uses the Object Oriented Analysis (OOA) by using approach or object oriented analysis with UML. The process of analysis is carried out on the results of the stages of data collection with interviews, observations and literature studies to get the specifications of the system requirements to be developed. In the analysis process, the techniques carried out are as follows:

1. Analysis of data and information on the system running. Analysis is carried out on procedures, documents, files, and printouts of systems that are already running.
2. Analysis of functional, non-functional, and user needs. Functional requirements modeling to describe system functions and users involved and what functions each user can get are modeled with Use Case Diagrams
3. Analysis of system behavior. At this stage, a system behavior analysis is developed and modeled with activity diagrams. Activity diagram to model the use case process that runs within the system to model message delivery (massage) between objects

### 3.2. Steps of Research

In this study the entire process that went through must go through several stages. Stages carried out include: research problems, study reviews, methodology, system design, modeling, and system testing. The steps in the stages of conducting research are as follows:

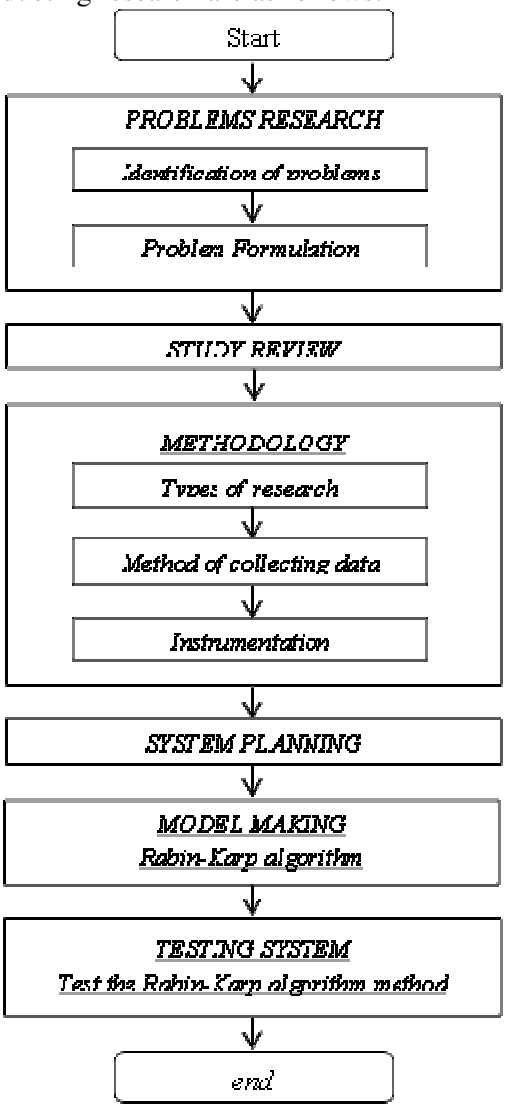


Fig.III-1.Steps Research

### 3.3 Sampling

Population sampling uses simple random sampling technique. According to Fauzi (2009),

simple random sampling is a technique to get samples that are directly carried out by a sampling unit. Determination of the number of samples based on population is done by using Solvin formula with an error limit of 10% with a confidence level of 90% (Sugiyono, 2015). The sample is part of the number and characteristics possessed by the population (Sugiyono, 2010). The sample data that will be used in this study is 978 students, the data is obtained from the 4th SMK Pandeglang.

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Table III-1 Number of Active Students of State Vocational School 4 Pandeglang

Table III-1
Number of Active Students of State Vocational School 4 Pandeglang

| Class | The Number Of Student | | Total |
|---|---|---|---|
| | Male | Female | |
| X | 211 | 147 | 358 |
| XI | 171 | 128 | 299 |
| XII | 183 | 138 | 321 |
| TOTAL | | | 978 |

The sample data that will be used in this study uses the Slovin formula (Sevilla et al., 1960), namely:

$$n = \frac{N}{1 + N(e)^2}$$

Information :

n = sample size

N = population size

e = percent allowance for inaccuracies that can still be tolerated

So if the number of students / e-learning users is 978 students, with an error rate of 10%, then the number of samples to be used is:

$$n = \frac{978}{1 + 978(0,1)^2} = 90,72 = 90$$

Based on the Slovin formula, the number of samples in this study was 99 respondents with a research confidence level of 90%.

### 1.2.Method of collecting data

The method of data collection in this study is by questionnaire, interview and observation. One important factor in the development and development of information systems is understanding the existing system and its problems (Tata Sutabri, 2012).

## *4. RESULTS AND DISCUSSION*

### *4.1.Prepocessing*

Preprocessing stage must be passed to determine the keywords in both documents to be tested, namely the original document and test document. At the preprocessing stage there are several processes carried out by the system on the inputted documents. These processes include folding cases, filtering, tokensizing.

To try this stage, the author gives an input taken from the subject matter of web programming and mobile devices, the problem is as follows:

Problem: Write 3 (Three) Anatomy in Cascading Style Sheet

Teacher's Answer / Answer Key: Selector {property: value}

Student Answers:

SELECTOR{PALUE:PROPERTI}

### 4.2.CaseFolding Process

The Case Folding process is the process of converting all letters into lowercase letters, this is the first process carried out at the preprocessing stage.

The Teacher's Answer Key that has gone through the casefolding stage will be as follows:

selector {property: value}

and student answers that have been done with casefolding will be as follows:

selector {palue: property}

### 4.3 Filtering Process

The filtering process is the most important word retrieval process from tokenizing, we can use the stop list algorithm or the removal of less important words or word lists, storing important words.

From this process the teacher's answer key entered earlier will change to the following:

selector property value
and student answers generated after this filtering process are as follows:
selectorpalue property
In the example of filtering above, it is the process of removing punctuation and
stop the word. In the example of the answer key and the answer to the student punctuation that is omitted is a colon (:) and a curly open and close sign ({}).

### 4.4 Tokenizing Process

Processing next after the filtering process is the Tokenizing process, where in this process the word will be in the form of a pattern, while the word pattern in the form of grams and length k, in this process is divided into two sub-processes, namely k-gram parsing and hashing calculation process.

#### 4.4.1 K-Gram Process

The K-gram process is the process of aligning the pieces of a word, where each piece contains as many characters as k, in this case using parsing k-gram 4.
The k-gram results of the teacher's answer keys that have gone through the tokenizing process are as follows:
Answer key: selector property value:
{sele} {elec} {lect} {ecto} {ctor} {tor} {or p} {rpr} {pro} {prop} {rope} {oper} {pert} {erti} {rti} {ti v} {iva} {val} {valu} {alue}
And k-gram results from the answer of the students who have gone through the tokenizing process are as follows:
Student answer: selector palue property:
{sele} {elec} {lect} {ecto} {ctor} {tor} {or p} {r pa} {pal} {palu} {alue} {lue} {ue p} {e pr} pro} {prop} {rope} {oper} {pert} {erty}

From the k-gram process above, the formation of patterns in both the answer key and student answer is formed in the form of grams with the character length k = 4, so that the contents of the sentence in the original sentence are changed in the form of k-gram.

### 4.5. *Hashing Process*

Setelah proses K-gram, selanjutnyadilakukanperhitungan hash darisetiappolakalimat yang telahdibentuk, iniberfungsiuntukmenconvertsetiap string menjadisebuahbilangan,
Dengancaramengalihkannilai ASCII hasilhuruf k-gram dengan basis bilangantertentu, dimana basis bilanganmerupakanbilangan prima, Denganmenggunakanpersamaan (2.1), makadapatdhiitunghasilhashnya. Metode Rabin-Karp didasarkanpadafaktajikaduabuah string samamakaharga hash valuenyapastisama. Sebagaicontohkitaambil kata darihasil
k-gram yang pertamapadadokumenasli, yaitu kata {sele}.
Contoh proses hashing untukmenghitungnilai hash dari kata {sele}, dengannilai k= 4 dan b=11
Nilai ASCII dari kata {sele}
ASCII (s) = 115
ASCII (e) = 101
ASCII (l) = 108
ASCII (e) = 101
H (C1 ... CK) = C1. b (K-1) + c2.b (K-2) + ...+ C (k-1).b (k) + ck
H = (115,113) + (101,112) + (108,111) + (101,110)
H = (115.1331) + (101.121) + (108.11) + (101.1)
H = 153065 + 12221 + 1188 + 101
H = 166575
From the hash calculation above, from the word (sele) the hash value is 166575. The calculation process for the hash value will continue to be calculated in its entirety until the whole k-gram has been calculated.
The hash value of the answer key like the previous example, namely the word selector property value will produce a hash like this:
166575 148709 157174 147797 147140 169113 161999 156952 57509 164199 166498 162518 162663 149606 166957 167571 145022 58045 170100 143563

The number of hashes in the answer key above are 20 hashes.

And the hash value of the student's answer like the previous example, namely the word "selector value property" will produce a hash like the following:
166575 148709 157174 147797 147140 169113 161999 156935 57319 162114 143563 159048

168412 139649 57509 164199 166498 162518 162663 149622

The hash number of student answers is 20 hashes

As for the same hash between the hash key answers and student answers are as follows:

166575 148709 157174 147797 147140 169113 161999 57509 164199 166498 162518 162663 143563

The same hash number between the answer key hash and the teacher's answer hash is 13 hashes.

After the number of hashes is known, both from the hash of the answer key as many as 20 hashes and the hash of the student answer as many as 20 hashes and the same hash of 13 hashes, the next step is to look for the similarity between the key answers to the questions and answers.

### 4.6. Similarity

After calculating the all words above by using the hashing formula, then the calculation of the same value between the key answers and student answers, this calculation uses the Dice Similarity Coeficient formula.

Where the formula is as follows:

$$S\frac{2.C}{A+B}\ X\ 100$$

Known

S: Similarity

C: Fingerprint (similar to hash values for student answers and key answers)

A: The answer key hash value

B: The answer hash value of the student

From the known hash values of the key hash values of the answers and answers of students, the similarity values can be calculated as follows:

$$S= \frac{2 * C}{A+B} \times 100$$

$$S= \frac{2*13}{20+20} \times 100$$

S= 65

S= 65%

From the above calculation, it was found that the similarity value (similarity) between the answer key and the student's answer was 65%.

### 4.7. Test Results on the System

In this test, the number of questions tested as many as 5 questions with the material being tested were Web Programming and Mobile Device Subjects, while for the number of students participating in this test were 25 students. Below are the results of obtaining average values obtained from the system and subject matter teachers.

Table IV. 2
System Test Results

| No | Name | *Value Rabin Karp* | Value Of Teacher |
|---|---|---|---|
| 1 | AHMAD DAEROBI | 71 | 80 |
| 2 | AI NURAENI | 84 | 90 |
| 3 | ANITA MELIA | 72 | 80 |
| 4 | ANTON | 70 | 80 |
| 5 | ARI HARYANTO YUSUF | 53 | 65 |
| 6. | DESI APRIATI | 91 | 95 |
| 7. | DEVA SILVIANA | 95 | 100 |
| 8. | DEWI SAFITRI | 92 | 100 |
| 9. | DIAH ANDRIANI | 82 | 90 |
| 10. | DINDA WULAN SARI | 34 | 60 |
| 11. | FITRI HERLINA | 15 | 50 |
| 12. | INTAN FATIMAH AZZAHRA | 66 | 75 |
| 13. | JESSI SAFITRI | 54 | 65 |
| 14. | JUMHARIYAH | 65 | 75 |
| 15. | LILIS DIANTI | 56 | 65 |
| 16. | MOHAMAD AGUS | 64 | 75 |
| 17. | MUDIYATULLAH | 99 | 100 |
| 18. | MUHAMAD SURYA PALYADI | 89 | 90 |
| 19. | NOVAL FEBRIAN | 86 | 90 |
| 20. | OKI RESPATI DEWA SAPUTRA | 37 | 60 |
| 21. | RIKI DAMARAN HERMANUDIN | 59 | 65 |
| 22. | SEPTI MIHARJA | 69 | 75 |
| 23. | YULIA FITRI ADININGSIH | 35 | 60 |
| 24. | MEGA MAYA | 70 | 80 |
| 25. | M. BUSTOMI | 45 | 60 |
| Rata – Rata | | 66,12 | 77 |

From the results of the trial above, the difference between the value of the rabinkarp algorithm results and the value of the teacher are 16%.


Fig4.1 Student Answer Assessment Process

## 5. CONCLUSION

Based on the problems, literature study, research review, research object review and research methodology in the automated essay assessment information system using the Rabin Karp algorithm, it can be summarized as follows:

1. An automatic essay scoring system that is created can solve the problem of the essay assessment results.
2. The final value of the research results by using the system is not significantly different from the system of expert assessment results.
3. Words in the answer key are very influential on the selection of words that are considered as keyboards, thus affecting the assessment of the system.
4. The accuracy of the results sought is very influential on the keywords searched, so the results are relevant then the keywords must be in accordance with the rules of writing Indonesian
5. The basic words of dictionary are very important in the stemming processes, the number of vocabulary lists have a large effect on the value of stemming.

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