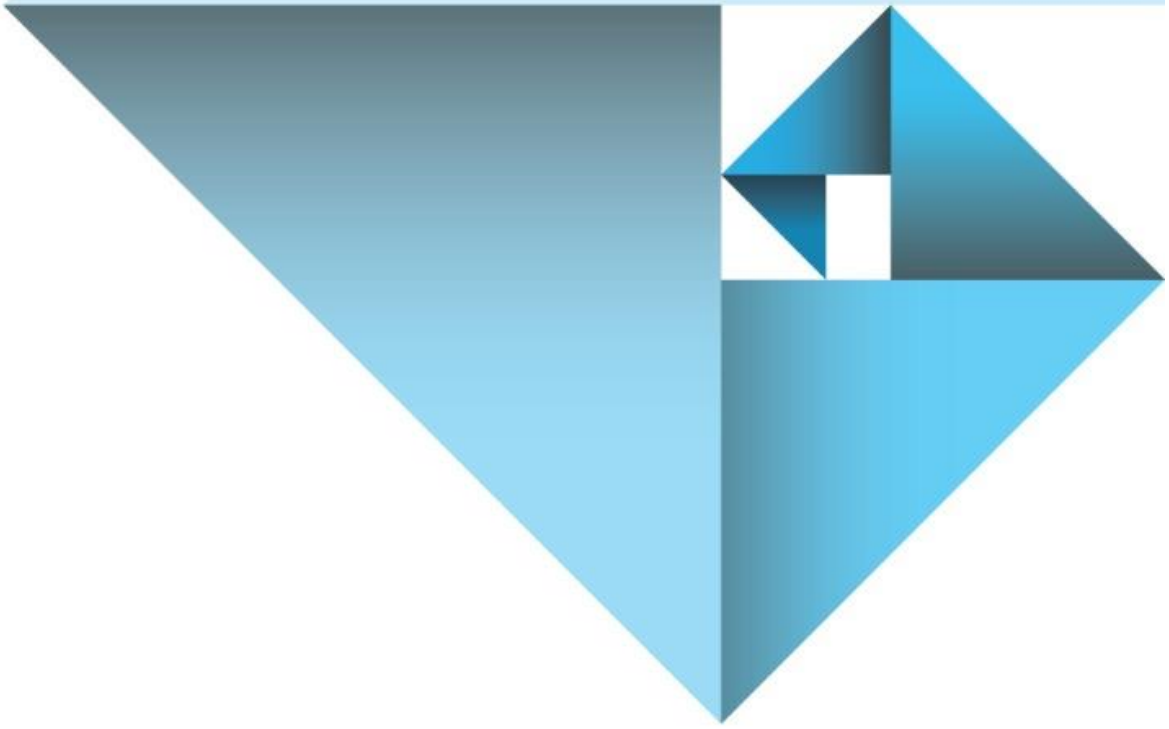
JITU

e-ISSN: 2654-802X

Journal of Information Technology and Its Utilization



The Ministry of Communication and Informatics, Republic of Indonesia
Human Resources Development and Research Agency
BBPSDMP KOMINFO Makassar

Journal of Information Technology and its Utilization

Volume 2, Issue 1, 2019

Journal of Information Technology and Its Utilization is a journal published by the BBPSDMP Kominfo Makassar with the aim of disseminating information on scientific developments in information technology area and its utilization. The manuscript published in this journal is derived from research, scientific study conducted by researchers, academics and information technology expert. Publish with frequency of 2 times a year, namely in August and December.

Alamat Redaksi:
Balai Besar Pengembangan SDM dan Penelitian Komunikasi dan Informatika Makassar
Jl. Prof. Abdurahman Basalamah II No 25 Makassar, 90234, Telp. 0411-4660370 Fax. 0411-4660084
http://jurnal.kominfo.go.id/index.php/jitu

Journal of Information Technology and it's Utilization
Volume 2 Issued. 1, 2019

TABLE OF CONTENTS

Journal of Information Technology and it's Utilization
Volume 2 Issued. 1, 2019

PREFACE

Bismillahirrahmanirrahim,
Assalamualaikum wa Rahmatullah wa Barakatuh.

First of all, we wants to express his thanks to Allah SWT, because of His bless and grace, electronic scientific journal "Journal of Information Technology and Its Utilization (JITU)" can be finished and published in this year. JITU is semester international referred journal with the objectives to explore scientific developments in information technology area and its utilization. Published by BBPSDMP Kominfo Makassar, one of Balitbang SDM Kominfo-Ministry of communication and information units. This June is the first edition of JITU, with interesting topic papers like

Design Web-Based Electrical Control, Monitoring Computer Infrastructure Management Based On Client/Server, Assessment of Essay Quiz System in The LMS Vidyanusa Platform Using the Nazief and Adriani Stemming Algorithms, Benchmarking Mysql And Nosql Database On Egovbench Application, Scheduling Using Genetic Algorithm And Roulette Wheel Selection Method Considering Lecturer Time.

Finally, we expects this edition can be a medium for the reader to develop and deepen the knowledge about information technology and its utilization. look forward to our next edition in December 2019

June 2019
Editorial Team

Journal of Information Technology and its Utilization

Volume 2 Issued. 1, 2019

Keywords is extracted from paper.
Abstract sheet may reproduced without permission and charge.

1DDC 005.12

Dolly Indra, Tasmil, Herman, St. Hajrah Mansyur, Erick Irawadi Alwi
Computer Science Dept. Universitas Muslim Indonesia, BBPSDMP KOMINFO Makassar

DESIGN WEB-BASED ELECTRICAL CONTROL SYSTEM USING RASPBERRY PI

Journal of JITU Vol. 2 Issued, June 2019
page 1-3

Abstract *- The use of current website technology can be applied as a control and monitoring system, which is used to control electrical devices, so that the user can only control the PC or smartphone that has been connected to Wi-Fi or the Internet. In this case the control uses the Raspberry Pi Mini PC which has several advantages such as low power and is relatively easy when connected with a web server compared to a microcontroller. By utilizing the Raspberry Pi Mini PC as a web server, it can replace PC functions in general. The results in this study are the Electric Control System that has been made capable of controlling 4 AC voltage electronics as well as 4 relays with each relay capable of bearing a maximum load of 2200 watts using a power supply on the Raspberry Pi which has a minimum of 0.7 amperes and Control of electrical load can be done within a distance of 0 meters - 15 meters from the wireless router*

Keywords: *Web-design; Electrical control; Raspberry pi*

2DDC 005.12

Musawarman, Muhammad Nugraha
Politeknik Enjinering Indorama, Indonesia

ANALYSIS AND DESIGN OF DISTRIBUTED SYSTEM FOR MONITORING COMPUTER INFRASTRUCTURE MANAGEMENT BASED ON CLIENT/SERVER BY USING WINDOWS MANAGEMENT INSTRUMENTATION TECHNOLOGY

Journal of JITU Vol. 2 Issued, June 2019
page 4-11

Abstract *- This research aims to analyze and develop a system for monitoring computer infrastructure management in real time (real-time monitoring). The developed system was a distributed system that would help IT Administrators work at the Center for Computing and Information Technology Faculty of Engineering Universitas Indonesia (CCIT FTUI) to monitor the computer infrastructure in real-time. The Real-time referred to a system that was able to do direct monitoring to computer infrastructure, and quickly able to transmit the data status of the device. Limitations of the current monitoring process were that the IT Administrator checks directly into the computer lab room if there were problems related to a computer or cable that was not connected from the computer system based on a report from teachers or students. The developed monitoring system was a client/server based system that used network infrastructure so that the computer infrastructure could be optimally monitored. The modules used in this research are computer input and output modules, and installed applications or system services. This research is expected to be able to overcome the problems associated with computer infrastructure's performance, conduct supervision and centralized control in helping the problems that often occur during the learning process or examination.*

Keywords: *Monitoring; Computer Infrastructure Management; Distributed System; Computer Network; Real-time*

3DDC 006.3

Ratih Kusuma Dewi, Mervin Tangguar Hutabarat
Bandung Institute of Technology

ASSESSMENT OF ESSAY QUIZ SYSTEM IN THE LMS VIDYANUSA PLATFORM USING THE NAZIEF AND ADRIANI STEMMING ALGORITHMS "COMPARISON OF TEACHER, EXPERT RUBRIC, AND SYSTEM ASSESSMENTS"

Journal of JITU Vol. 2 Issued, June 2019
page 12-17

Abstract – *This study focuses on the assessment system of the essay quiz answers on the LMS VidyaNusa platform using Nazief and Adriani algorithms. The stemming algorithm is a word cutting process that makes use of basic words using certain rules. This method uses LSA (Latent Semantic Analysis) which determines the similarity values of two documents, to find interaction between sentences using SVD (Singular Value Decomposition) algebraic calculation of each statement then to get the similarity value from each statement using cosine similarity algorithm. This system is followed to assist the teacher in evaluating answers to student essay quizzes because this system is equipped with value weighting so that it reduces subjective assessors and increases accuracy in assessment. The results of this study from 15 students by answering 10 questions and 1 teacher obtained results, that the*

assessment given by the teacher without the vulnerable rubric was 8-10, the value given by the vulnerable system was 0-10, and the assessment of the system with the vulnerable rubric was equal 0 -10. So when viewed from the function of the rubric on the objectivity of the assessment, the value given by the teacher without rubrics is less objective. Correlation or relationship between expert assessment system using rubric with the results of r = 0.82166624 So that both variables have a close relationship and the form of the relationship is linearly positive.

Keywords: *LMS; Essay Quiz; Nazief dan Adriani Algorithms; LSA; VidyaNusa; Rubric*

4DDC 005.74

Nur Aini Rakhmawati, Muhammad Zuhri, Radityo Prasetianto Wibowo, Anwar Romadhon, Herdy Ardiansyah, Olive Khoirul
Institut Teknologi Sepuluh Nopember
BENCHMARKING MYSQL AND NOSQL DATABASE ON EGOVBENCH APPLICATION
Journal of JITU Vol. 2 Issued, June 2019
page 19-24

Abstract - *Egovbench application monitors websites or social media of Indonesia local governments daily. The process of crawling done by Egovbench produces extensive data, which reduced performance in the data processing. Therefore, there is a need for a database solution that has the best performance such as high processing speed and small database size. This study examined the comparison between relational databases and non-relational databases based on selected metrics to obtain the most suitable database solution for Egovbench. The results show that the MySQL database has the advantage of complex query processing and the use of the database with the smallest storage space. MongoDB database has the advantage of low data transfer volumes. Couchbase database has the advantage of short and straightforward query processing with a high number. The evaluation results show that MySQL is more suitable for Egovbench needs, which is the best response time and query per second. MySQL outperformed the other two databases on backup and storage file sizes testing.*

Keywords: *benchmark, database, crawling, E-government*

5DDC 006.73

Herman, Lukman Syafie, Irawati, Lilis Nur hayati, Harlinda
Informatics Engineering Study Program STMIK Dipanegara Makassar, Indonesia
SCHEDULING USING GENETIC ALGORITHM AND ROULETTE WHEEL SELECTION METHOD CONSIDERING LECTURER TIME
Journal of JITU Vol. 2 Issued, June 2019
page 24-28

Abstract – *Scheduling lectures is not something easy, considering many factors that must be considered. The factors that must be considered are the courses that will be held, the space available, the lecturers, the suitability of the credits with the duration of courses, the availability of lecturers' time, and so on. One algorithm in the field of computer science that can be used in lecture scheduling automation is Genetic Algorithms. Genetic Algorithms can provide the best solution from several solutions in handling scheduling problems and the selksi method used is roulette wheel. This study produces a scheduling system that can work automatically or independently which can produce optimal lecture schedules by applying Genetic Algorithms. Based on the results of testing, the resulting system can schedule lectures correctly and consider the time of lecturers. In this study, the roulette wheel selection method was more effective in producing the best individuals than the rank selection method.*

Keywords: *Scheduling; Genetic algorithms; Roulette wheel*

DESIGN WEB-BASED ELECTRICAL CONTROL SYSTEM USING RASPBERRY PI

Dolly Indra[1], Tasmil[2], Herman[3], St. Hajrah Mansyur[4], Erick Irawadi Alwi[5]
[1345]*Computer Science Dept. Universitas Muslim Indonesia,*
[2]*BBPSDMP KOMINFO Makassar*
([1]*dolly.indra@umi.ac.id*, [2]*tasmil@kominfo.go.id*, [3]*herman@umi.ac.id*, [4]*hajrah.mansyur@umi.ac.id*,)

***Abstract*-- The use of current website technology can be applied as a control and monitoring system, which is used to control electrical devices, so that the user can only control the PC or smartphone that has been connected to Wi-Fi or the Internet. In this case the control uses the Raspberry Pi Mini PC which has several advantages such as low power and is relatively easy when connected with a web server compared to a microcontroller. By utilizing the Raspberry Pi Mini PC as a web server, it can replace PC functions in general. The results in this study are the Electric Control System that has been made capable of controlling 4 AC voltage electronics as well as 4 relays with each relay capable of bearing a maximum load of 2200 watts using a power supply on the Raspberry Pi which has a minimum of 0.7 amperes and Control of electrical load can be done within a distance of 0 meters - 15 meters from the wireless router**

Keywords: ***Web-design; Electrical control; Raspberry pi***

I. INTRODUCTION

In the current era of globalization, technology greatly helps human activities to be easier and more efficient. Electronic equipment technology is one of the technologies that will certainly help humans in doing various things, especially in controlling various electrical devices.

The use of current website technology can be applied as control and monitoring, which is used to control electrical devices, so that the user can only control the PC or smartphone that has been connected with Wi-Fi or the Internet. In this case the control uses the Raspberry Pi which has several advantages such as low power and is relatively easy when connected with a web server compared to a microcontroller. By utilizing Raspberry Pi Mini PC as a web server, it can replace PC functions in general [1], [2], [3]. Some studies have utilized the Raspberry Pi Mini PC, [4], [5].

II. METHOD

A. Proposed System

The control system proposed in this study is shown in Figure 1. This control system uses logic 0 and logic 1 output from the Raspberry Pi GPIO pin it controls via a web server. Control of electronic devices is done by users of PCs or smartphones that have been connected to Wi-Fi. Users are connected to a web server, which can then be selected on the web page "ON" or "OFF". After pressing the button on the web server, the web server will send data to the Raspberry Pi that has been connected to Wi-Fi.

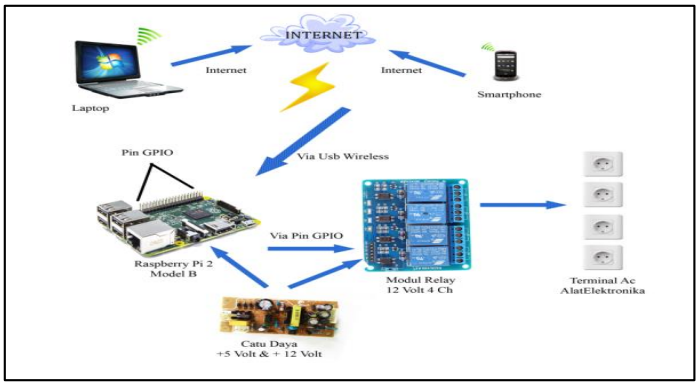


Fig. 1. Control system schema

B. Flowchart system

Figure 2 shows that the first client to do is configure an IP address, PC or similar device according to the local network. After the configured IP address client connects the client device to the local network via wireless.

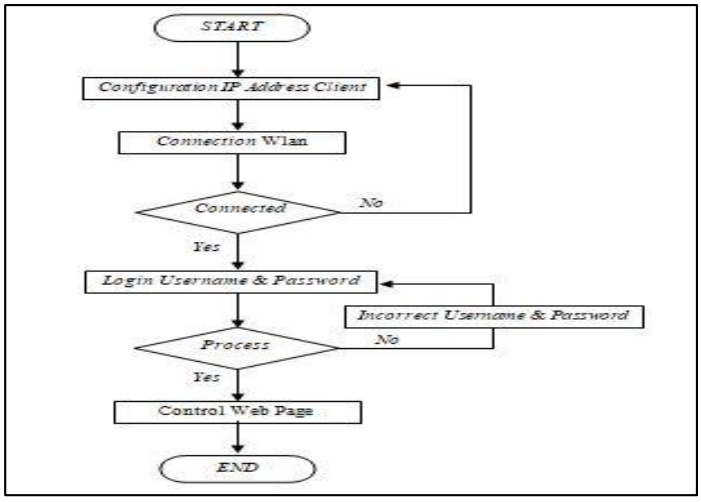


Fig. 2. Control system access flowchart

If it cannot connect to the local network, there may be an error in configuring the IP address, repeat the configuration steps. after connecting to the local network, open a web browser, then open the electric control system web page. On the web page to enter the electrical control system first fill in the username and password, if the login is successful then enter the main menu of

the control system web page. The electrical control system is only limited to relay status via the button, the relay function is on and off only.

C. Control system program flowchart

Figure 3 shows that in the initial stage of the control system program, initialization of the GPIO pin is used. After that, reading each relay status depends on the GPIO pin used. To find out the relay status through a web page that is represented by the status button of each relay.

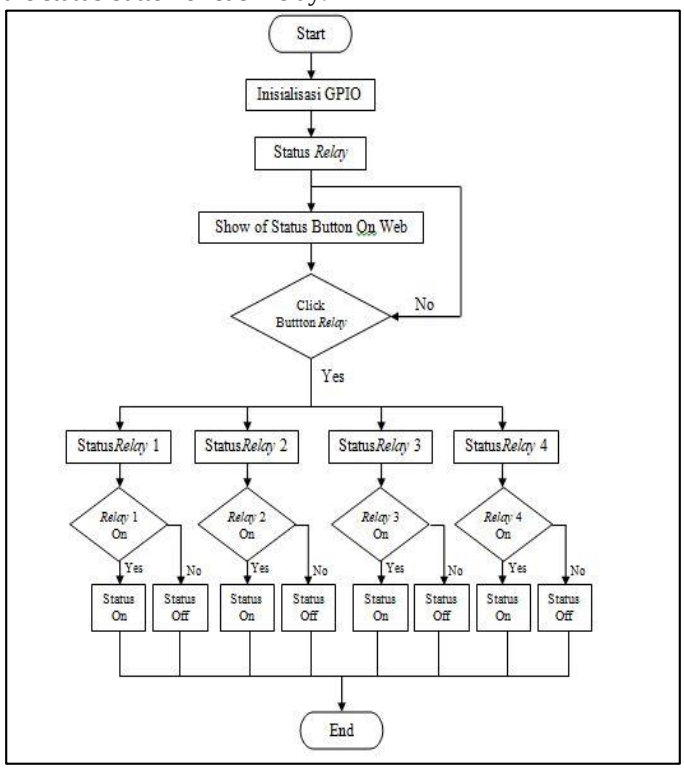


Fig. 3. Control system program flowchart

The client can input actions via the button on the web page. there are 4 buttons representing 4 relays. input action on if you want to turn on and input the action off if you want to turn off the relay. And if you don't want to do an action, or just check the status, the client can immediately exit by closing the web page.

III. RESULT AND DISCUSSION

The implementation phase of this system is the preparation of the Raspberry Pi 2 model B. It includes steps to assemble system equipment including power supply, relay, raspberry pi, and electrical load terminals into 1 part. Next step is to install OS Raspbian Jessie Lite on the MicroSD card, step network IP address settings, install Python steps, code control system programs, step install Apache as a web server, Chromium web browser for displaying systems through the website.

A. Stringing System Equipment

The power supply used is the DVD regulator circuit because it is simpler and safer for the resources of the system to be built. The power supply circuit used has a 5 volt output to connect to the Raspberry Pi module and 12 volts for relay circuits are shown in Figure 4.

Fig. 4. Power suplay circuit with output 12 volt and 5 volt

In the design of the electrical load control system limits the number of loads to be controlled by 4 electronic equipment. It means using 4 pieces of relay. But in this system design, 8 channel relays are used to anticipate if there is a problematic relay circuit shown in Figure 5.

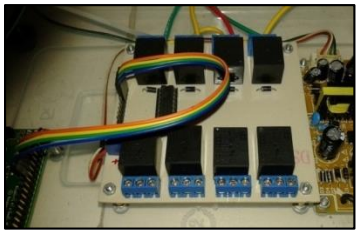


Fig. 5. Relay circuit 8 Ch 12 volt

The Raspberry Pi used is the Raspberry Pi 2 Model B 1Gb. GPIO pins used on raspberry pi include GPIO 7, 11, 27 and 22 shown in Figure 6.

Fig. 6. Module rapsberry Pi 2 model B

The system design output uses 4 AC terminals so that all electrical equipment to be controlled is shown in Figure 7.

Fig. 7. AC terminal

B. Testing

In this test we performed with 2 stages, namely, First using the Test from a Web Browser on the Laptop Client and Second using the Testing from a Web Browser on an Android Mobile Client.

In the first test, the test is carried out using the Laptop Client. Tests carried out are how far the client laptop can control the system. These test results are shown in Table I.

TABLE I
Result of client laptop testing

No.	Distance (Meter)	Control Capability	Description
1	1	Good	Good Connection
2	5	Good	Good Connection
3	10	Good	Good Connection
4	20	Good	Good Connection
5	30	Good	Good Connection
6	40	Not Good	Slow Connection
7	50	Not Good	Lost Connection

Based on Table 1, testing the distance control by using the laptop above, that electronic devices can work at a considerable distance, which is in the range of 30 meters and is located in 1 adjacent building area. However, not only does the distance that determines the performance of the tool run well or not. Given that Wi-Fi has the nature of LOS (Line Of Sigh), or in other words that the nature of the waves used Wi-Fi is microtic waves that have a straight propagating nature, so the signals emitted by Wi-FI will be received maximally if there are no obstacles which inhibits it.

In the second test, Testing on the Android Mobile Client. Testing of a Web Browser on an Android Mobile Client. Testing is done is how far the Android Mobile client can control the system. The test results are shown in Table II.

TABLE II
Result of client laptop testing

No.	Distance (Meter)	Control Capability	Description
1	1	Good	Good Connection
2	5	Good	Good Connection
3	10	Good	Good Connection
4	20	Good	Good Connection
5	30	Not Good	Slow Connection
6	40	Not Good	Slow Connection
7	50	Not Good	Lost Connection

Based on Table II, the test results, it can be seen that there is a difference between testing using a laptop with testing using Android mobile. Testing using a laptop has a greater control distance compared to using an Android phone. This happens because laptops have Wi-Fi adapters with better specifications compared to Wi-Fi adapters that are on Android phones. Then, Wi-Fi adapters that are on Android phones also have less power when compared to Wi-Fi adapters available on Laptops.

IV. CONCLUSION

The Electric Control System that has been made is able to control 4 AC voltage electronic devices at the same time by 4 relays with each relay capable of bearing a maximum load of 2200 watts using a power supply on the Raspberry Pi which has a minimum of 0.7 amperes and Control will have performance more leverage if controlled via a PC / Laptop compared to using an Android mobile.

V. ACKNOWLEDGMENT

We would like to thank the Universitas Muslim Indonesia who have helped carry out this research in terms of funding.

VI. REFERENCES

[1] K. Londhe, "Design and Implementation of Embedded web Server Using Raspberry Pi for Monitoring Battery/ Solar System," *International Journal of Innovative Research in Computer and Communication Engineering International Journal of Innovative Research in Computer and Communication Engineering*, vol. Vol. 5, no. Issue 1, pp. 1111-1116., 2017.

[2] C. W. Zhao, J. Jegatheesan and S. C. Loon, "Exploring IOT Application Using Raspberry Pi," *International Journal of Computer Networks and Applications*, vol. 2, no. 1, pp. 27-34, 2015.

[3] S. Wisnusenna, M. S. Yonatana, A. Wibisurya, F. and T. Yuwon, "Model of Web Based Application to Control Brigde Traveler Using Raspbery Pi," *ElSEVIER*, vol. Procedia Computer Science 135, no. 135, pp. 518-525, 2018.

[4] N. Shroff, . P. Kauthale, A. Dhanapune and N. S. Patil, "IOT Based Home Automation system using Raspberry Pi-3," *International Research Journal of Engineering and Technology (IRJET)*, vol. 04, no. 05, pp. 2824-2826, 2017.

[5] M. Anwaruddin and M. A. Ali, "A Review On Raspberry Pi Based Industrial Process Monitoring And Control Using Modbus Protoco," *INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH (IJITR)* , vol. 5, no. 1, pp. 5483-5486., 2017.

ANALYSIS AND DESIGN OF DISTRIBUTED SYSTEM FOR MONITORING COMPUTER INFRASTRUCTURE MANAGEMENT BASED ON CLIENT/SERVER BY USING WINDOWS MANAGEMENT INSTRUMENTATION TECHNOLOGY

Musawarman[1], Muhammad Nugraha[2]
[1 2]*Politeknik Enjinering Indorama, Indonesia*
(*[1]r.musawarman@gmail.com,)*

***Abstract*-- This research aims to analyze and develop a system for monitoring computer infrastructure management in real time (real-time monitoring). The developed system was a distributed system that would help IT Administrators work at the Center for Computing and Information Technology Faculty of Engineering Universitas Indonesia (CCIT FTUI) to monitor the computer infrastructure in real-time. The Real-time referred to a system that was able to do direct monitoring to computer infrastructure, and quickly able to transmit the data status of the device. Limitations of the current monitoring process were that the IT Administrator checks directly into the computer lab room if there were problems related to a computer or cable that was not connected from the computer system based on a report from teachers or students. The developed monitoring system was a client/server based system that used network infrastructure so that the computer infrastructure could be optimally monitored. The modules used in this research are computer input and output modules, and installed applications or system services. This research is expected to be able to overcome the problems associated with computer infrastructure's performance, conduct supervision and centralized control in helping the problems that often occur during the learning process or examination.**

Keywords: **Monitoring; Computer Infrastructure Management; Distributed System; Computer Network; Real-time.**

I. INTRODUCTION

Computer infrastructure monitoring systems cannot be separated from the process of monitoring some hardware that is often lost or not automatically detected by a centralized system that has a significant impact, such as delayed learning process or exam for some students. Some hardware those may be missing or undetectable is a mouse, keyboard, graphics adapter, storage adapter, network adapter, services, and applications installed on the computer. This research is going to build a system that is able to conduct a comprehensive monitoring process on computer systems, especially computer infrastructure located in Computer Lab of Center for Computing and Information Technology Faculty of Engineering, Universitas Indonesia. The system development method used in this research is a prototyping [1] which consists of several stages, including identifying the requirements of system users, developing prototypes, determining whether prototypes can be used, and prototype implementations. The system development with a prototyping model is used because the problem is not properly structured and the data requirements are uncertain.

A. Prototyping Model

The prototyping model is a model used to identify detailed input, processing, or output requirements. In different cases, the developer might be not sure of the efficiency of the algorithm, adaptability to the system, or the interaction form between human and computer to be performed, so that the prototyping model (Pressman, 2001) can be applied.

There are two kinds of prototypes. Type I prototype is a model that will develop into an operational system. The Type II prototype is a discardable model that serves as a blueprint for the operational system. The approach to the Type I prototype is only possible if prototyping equipment enables prototypes to load all the essential elements of the new system while the Type II prototype approach is conducted if the prototype is only intended for the display as operating systems and is not intended to contain all the essential elements (McLeod, 2001).

B. Database Management System

DBMS (Database Management System) is a software that allows users to define, load, maintain, and manage access to databases (Connolly and Beg, 2010). DBMS is a software that interacts with users of application programs and databases.

C. Distributed System

The distributed system is a computer system that is geographically distributed, the system has databases, functions, and processes distributed. The common architecture for distributed systems is a local area network (LAN) client/server system [2]. The advantage of a distributed system is that when designed properly, it is able to integrate different applications running on different computer system into one system [3].

D. Real-time Application

Real-time application is an application that manages a hardware and software system that is limited by time span and has clear deadlines relative to the time of an event or operation such as manufacturing process control, or high-speed data

acquisition devices. The unique characteristic of real-time application is that it not only provides the correct response but also responds within a certain time frame. The real-time system is the set of all hardware system elements, operating systems, and applications required to meet the system requirements [4].

E. Windows Instrumentation Management

Windows Management Instrumentation (WMI) is an infrastructure for data management and operation on Windows operating systems. Writing programming using WMI support can automatically run administrative tasks on computers that are connected to the network. WMI implements the functionality described in WMI class function and class characteristic called WMI Provider and WMI Class [5].

F. Programming Language C#

C# is an object-oriented programming language that is modern, created and developed by Microsoft along with the .NET platform. There is various software developed with C# and .NET platform: office applications, web apps, websites, desktop apps, mobile apps, games and more. C# is a high-level language like Java and C ++ and, to some extent, other languages like Delphi, VB.NET and C. All C# programs are exploring. The C# language consists of a set of definitions in the class that include the functions and functions of a computer-run program [6].

G. Local Area Network (LAN)

Local Area Network (LAN) is a network bounded by a relatively small area, generally restricted by an environmental area such as an office building, or a school, and usually not far from about 1 square kilometer. Some LAN configuration models, one computer then become a File Server. The server is used to store network activities devices, or as software that can be used by computers which are connected to the network. The computers that are connected to the network are commonly called workstations. Usually, a workstation capability is lower than a File Server and has other applications in the storage devices. Most of LAN use the media cable to connect one computer to another.

H. Network Topology

Network topology is a way to connect one computer with another computer to form a network. There is one central computer or hub, all computers in the network are directly connected to the central.

I. Client/Server Computing

Client/server computing is a system model that divides processing between clients and servers residing within the network, providing a specific function to a computer machine, so it's able to process an instruction or command [1].

J. Black Box Testing

Black-box testing is an approach to testing where test results are obtained from the program or component specifications. In this case, the black box testing is more focused on the functional requirements of the software and not from its implementation (Sommerville, 2001).

II. METHOD

The research method used in this research was the prototyping model development system. There are several stages in system development using this methodology [1], including Identification of Users' Requirements, Prototype Development, Prototype Validation, and Operating the Prototype

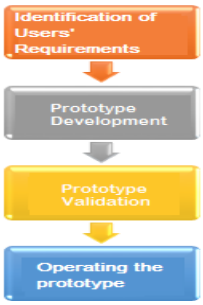


Figure 3.1. System Development Stages

A. Identification of Requirements

At this stage, developer and users met and objectively defined the whole of the software and identified all the requirements and outline of system coverage. Information requirements analysis was done by discussing with the users, which were the System Administrators in the Information Technology division so that at this stage would be obtained the expected results. At this stage, several steps can be done to identify and analyze Requirements are as follows [1]:

a. Problem Identification

The problem faced was how to develop a system for monitoring hardware and services system that were in the computer system in the Lab. Data collection was done by observing the operation of some installed devices in the computer system. It was conducted based on type, object, source, and preparation of data collection. Object and source of data consist of elements, characteristics, population, and sample. Preparation of data collection was done technically and nontechnically. The data could be obtained directly or indirectly. The data and information collection was conducted through the collecting process of information resources by the user of information.

b. Users Restriction Analysis

The process undertaken at this stage was to define user limits. Information obtained from discussion with IT Administrator, that system user consists of only one user, the IT Administrator. It was caused by the fact that the monitoring function may only be performed by a single user, the IT Administrator.

c. System Requirements Analysis

This stage was the process of determining some functions would be built, including the determining monitoring function of computer hardware.

d. User Requirements Analysis

The activity undertaken at this stage was determining the requirements of the system user. The requirements of users were obtained by determining the function of the system where the users could access information related to the computer infrastructure.

e. Information Requirements Analysis

This stage was the process of information requirements analysis needed by the system user. The information requirements referred to information needed to show the detailed data, notification system and the search system.

f. System Analysis

At this stage, an observation was done to collect system requirements. The system requirements specification that had been analyzed was a system that was able to know the detailed availability of computer devices, take over the computers even though they were in different places, and notify the computer Administrator if there were problems related to the computer infrastructure, especially the computer network.

B. Prototype Development

The prototype was developed through several stages as follow [7]:

a. Database Design

This stage was the stage of designing a specific database related to installing computer devices in the computer system. The design was done by using SQL Server 2014 database software.

b. System Interface Design

The system interface was designed by using Visual Studio 2015 to get a detailed design that described the overall system functionality.

c. Alternative System Configuration

This stage was the stage of determining the specification of the hardware and software requirements which were required to run a computer monitoring system. At this stage, some software was required to support the implementation of the design result. Software specification used in the prototype development of the system including SQL Serves 2014 as the database processor, C# as the programming language, and Visual Studio 2015 as the programming language editor.

C. Prototype Validation

The developed prototype was then explained its function to the users. The prototype testing would be done directly by the users by checking the functions of the system. If the developed prototype satisfied the users then proceeded to step 4, Operating the prototype. If the prototype failed to satisfy the users then the prototype would be revised by repeating step 1,2, and 3 (Figure 3.2) with additional input or suggestions for improving the prototype.

D. Operating the Prototype

The final stage of System Development by using Prototyping Model was operating stage. At this stage, the prototype would be explained how to use operational functions of each part in the system.

III. RESULT AND DISCUSSION

A. Requirements Identification Results

1. Problem Identification Result

In improving the process of monitoring the computer infrastructure in the classroom, IT Administrator has not yet had the relevant system to perform real-time monitoring using computer network that has been built, it is necessary to build a system that is able to perform the process of computerized and network connected monitoring.

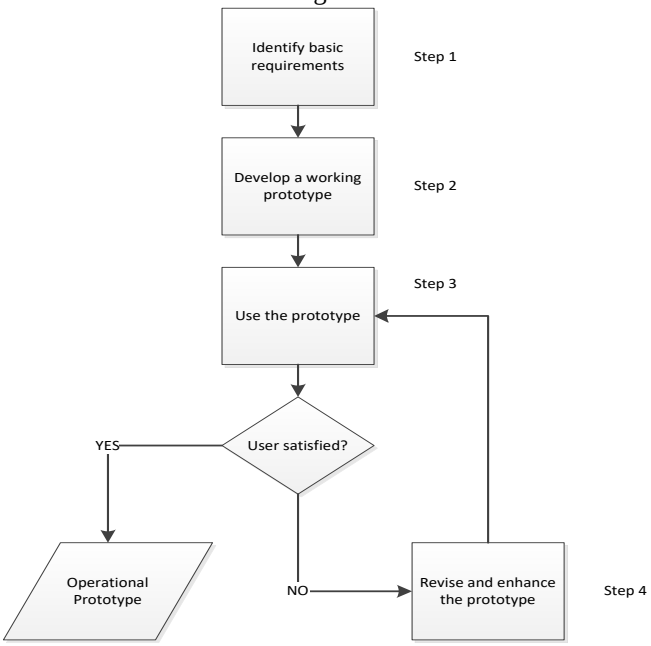


Figure 3.2. Prototyping Model

The process of monitoring the infrastructure currently being carried out was by direct inspection if there are reports from users, for example by calling the IT Administrator directly if there is a problem related to hardware or network so that from time aspect would charge the IT Administrator to conduct an infrastructure inspection.

Based on the above information, several problems that arise, including:

- There was no computerized monitoring process so the computer inspection process became ineffective.
- There was no computerized notification process in case of hardware and software related problems using the network.
- Unavailability of audit report process to some problems that arise related to process monitoring of computer infrastructure.

2. User Restrictions

The users of this system consisted of only one person, the Administrator, who had the authority to access all parts of the system, such as the process of monitoring computerized infrastructure.

3. System Requirements Analysis Results

The developed system would be named CCIT Surveillance System (CCSS) which would have several features, including:

- The function of computerized monitoring to the computer infrastructure.
- Tools to provide immediate notification if there were infrastructure related issues.

4. User Requirements Analysis Results

The needs of users which successfully identified were:

- Required a system that was accessible on both server and client sides in real-time.
- Required a system that was able to notify the Administrator directly if a problem had occurred related to the computer infrastructure.
- Required a system that was able to manage the monitoring results in the form of reports.

5. Information Requirements Analysis Results

Referring to the results of discussions with the IT Administrator, it found the needs for information required by the researcher, including:

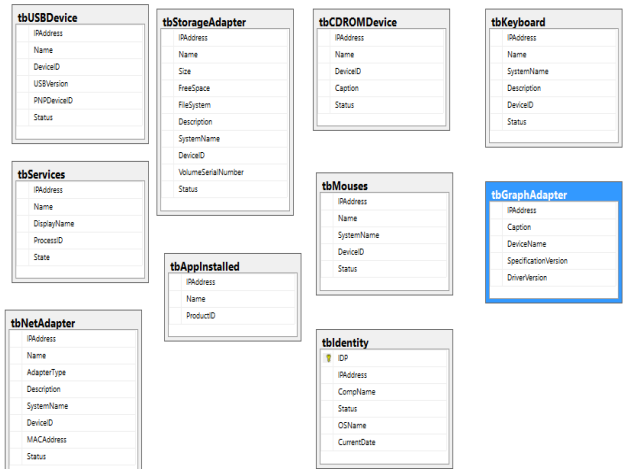
- Displayed the details of data. The data displayed were the status of the mouse, keyboard, storage device data, computer addresses, services and applications installed on the computer.
- Notification information if there was a problem with the system.
- The system had a search function to display specific information, such as a computer address and a specific computer infrastructure.
- 

Figure 4.1. Database Design

6. System Analysis Results

The developed system should have several facilities, including:

- Monitoring System

  In this section, the system was able to perform real-time monitoring of some components of the computer infrastructure. In this section, client-based applications would be installed on the computer and provide detailed information about the computer's infrastructure status. The data would be stored into the database provided and the server would display the data if needed.
- Remote Computer Monitoring System
- The system could perform remote computer monitoring using network devices.
- Notification System
- The system could notify directly to the Administrator if a problem with the computer infrastructure was detected.
- Reporting System
- The system could print computer infrastructure data in the form of reports for audit purposes.

B. Prototype Development Results

1. Detail of System Design

A system that was able to display some computer information, such as computer network, mouse, storage media, services, and computer graphics adapters. Administrators could view the status of each device listed in the system automatically. Any computer that installed the automation system could display detailed information on its computer information. The system was designed using a data flow diagram to view the data transmission of each process.

2. System Interface Design Results

The design of the developed system interface consisted of database design, menu interface, and submenu.

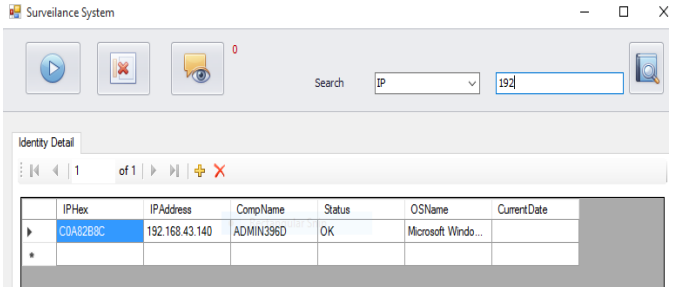


Figure 4.2. System Menu Design

Menu design was done to provide a clear picture of the information that would be displayed. Basically, the menu design consisted of several parts, including navigation menu, search and display data as shown in Figure 4.2.

The sub-menu interface design was used to display detailed information about the status of the scanned computer. The design of the interface can be seen in Figure 4.3.

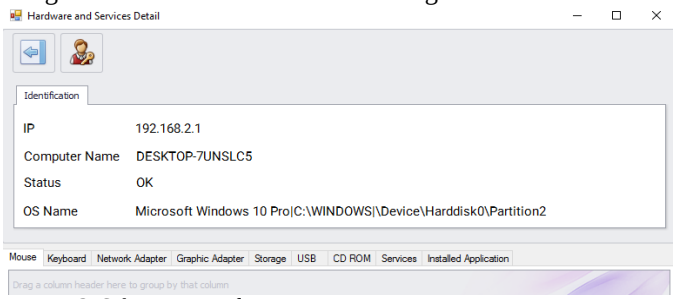


Figure 4.3. Sub-menu Interface Design

3. Alternative System Configuration

Hardware requirements for servers and clients were different in terms of performance. In order to the system developed could work optimally, the minimum hardware requirements that recommended for the server and client were as follows:

Server

- Processor Core i3 2.1 GHz. High-speed processors are needed for the system to work properly and the process can take place quickly.
- 4 GB memory is used to support the performance of the system to run properly, required large memory capacity.
- Minimum storage capacity 1 GB for system installation.
- Monitor resolution 1152 x 864. The display system will be better if using a high-resolution monitor.

Client

- Dual Core Processor 1.8 GHz.
- 2 GB of memory.
- Minimum 500 MB storage capacity for system installation.
- Monitor resolution 1152 x 864. System display will be better if using a high-resolution monitor.

C. Prototype Validation Results

At this stage, the test was held by using black box testing method, where each function was tested to get the expected results. The cases that have been tested can be seen in Table 4.1.

Table 4.1. Black Box Testing

Test Case	Input Value	Scenario	Expected Results	Test Result
Display of the Main Page	Correct	Users press the navigation *monitoring* button.	Displays the information about the identity of the computer	Success
		Users press the *Stop* button.	Stopping the process *monitoring* of infrastructure computer.	Success
		Users press the *information notification* button.	Get the Information	Success
		Users press the *Export* to *File* button.	Obtain the device information report.	Success
		The System displays computer information on *Datagrid*	Get computer device information on the *Datagrid*	Success
		Users press the data grid to display computer details when the data grid is pressed.	*Datagrid* displays detailed computer information	Success
Detailed Page View	Correct	Displays the information of IP data, status and computer name.	Data showing on the panel to display IP, status, and computer name.	Success
		Function button to the remote client computer.	The client computer can be remote	Success
		Function button to return to the main menu.	Users can return to the main menu.	Success
		Function to display mouse data.	Mouse data can be visible in the Datagrid	Success
		Function for displaying keyboard data.	The keyboard data can be visible on the Datagrid.	Success
		Function for displaying network device data.	Network device data can be visible on the Datagrid	Success
		Function to display monitor device data.	Monitor device data can be visible on the datagrid	Success
		Function to display storage media data.	Storage media data can be visible on the Datagrid	Success
		Function to display *universal serial bus* data.	USB data can be visible on the Datagrid	Success
		Function to display *CD-ROM* data.	The CD-ROM data can be visible on the Datagrid	Success
		Function to display computer service data.	The computer services data can be visible on the Datagrid	Success
		Function to display application data installed on the computer.	Application data can be visible on the Datagrid	Success
Remote Desktop Display Function	Correct	The function of the connection button to gain access to the client computer.	Users successfully to remote client computer	Success
		The function of the Disconnect button to stop connecting to the client computer.	Disconnect from client computer	Success

D. Prototype Implementation Result

Prototype implementation result is divided into two:

1. Operating System Functions On The Client

❖ Store Mouse Device Data

The data stored while running this function is the computer address, device name, user's computer name, device ID, and mouse device status (Figure 4.4).

IPAddress	Name	SystemName	DeviceID	Status
192.168.43.149	USB Input Device	ADMIN396D	USB\VID_203A&PID_F...	OK
192.168.43.149	USB Input Device	ADMIN396D	USB\VID_203A&PID_F...	OK
192.168.43.149	Parallels Mouse Synchronization Device	ADMIN396D	ACPI\PNP0F03\4&184...	OK

Figure 4.4. Mouse Device Data

❖ Store Keyboard Device Data

The next function is a function to store keyboard data installed on a computer system. Data is stored every second after the function is executed by the system (Figure 4.5).

IPAddress	Name	SystemName	Description	DeviceID	Status
192.168.43.149	Enhanced (101- or 102-key)	ADMIN396D	Standard PS/2 Keyboard	ACPI\PNP0303\4&1846B261&0	OK

Figure 4.5. Keyboard Data

❖ Store Network Device

The function that is run is used to store the data of computer network devices, such as hardware adapters. The data adapter is stored in the database once every second. The test results of the function can be seen in Figure 4.6.

IPAddress	Name	AdapterType	Description	SystemName	DeviceID	MACAddress	Status
192.168.43.149	Microsoft Kernel Debug Network Adapter	N/A	Microsoft Kernel Debug Network Adapter	ADMIN396D	0	N/A	N/A
192.168.43.149	Intel(R) 82574L Gigabit Network Connection	Ethernet 802.3	Intel(R) 82574L Gigabit Network Connection	ADMIN396D	1	00:1C:42:2B:30:89	Connected
192.168.43.149	Microsoft ISATAP Adapter	Tunnel	Microsoft ISATAP Adapter	ADMIN396D	2	N/A	N/A
192.168.43.149	Microsoft Teredo Tunneling Adapter	Tunnel	Microsoft Teredo Tunneling Adapter	ADMIN396D	3	N/A	N/A

Figure 4.6. Network Data

❖ Store Universal Serial Bus (USB) Data

USB data is required by the Administrator to check some of the connected devices to the computer system. The stored USB data includes computer address, device name, device ID, USB version and device status. The result of the function that runs on the client computer produces the data as shown in Figure 4.7.

IPAddress	Name	DeviceID	USBVersion	PNPDeviceID	Status
192.168.43.149	USB Root Hub	USB\ROOT_HUB20\4&1387C2E6&0	N/A	USB\ROOT_HUB20\4&1387C2E6&0	OK
192.168.43.149	USB Root Hub (xHCI)	USB\ROOT_HUB30\4&39A6351E&0&0	N/A	USB\ROOT_HUB30\4&39A6351E&0&0	OK
192.168.43.149	USB Root Hub	USB\ROOT_HUB\4&2FB9F663&0	N/A	USB\ROOT_HUB\4&2FB9F663&0	OK
192.168.43.149	USB Composite Device	USB\VID_203A&PID_FFF9\0XFA20000005AC8509	N/A	USB\VID_203A&PID_FFF9\0XFA20000005AC8509	OK
192.168.43.149	USB Printing Support	USB\VID_203A&PID_FFFA\TAG21D87ACA0	N/A	USB\VID_203A&PID_FFFA\TAG21D87ACA0	OK
192.168.43.149	USB Printing Support	USB\VID_203A&PID_FFFA\TAG2982A5F8C	N/A	USB\VID_203A&PID_FFFA\TAG2982A5F8C	OK
192.168.43.149	USB Composite Device	USB\VID_203A&PID_FFFC\PW3.0	N/A	USB\VID_203A&PID_FFFC\PW3.0	OK

Figure 4.7. USB Data

❖ Store Services Data

Network administrators need to check the services of the software running on the computer system. Monitoring covers computer address data, service names, on-going software names, process IDs, and system service statuses. The executed function manages to get data every second to enter data related to the computer system service (Figure 4.8).

IPAddress	Name	DisplayName	ProcessID	State
192.168.43.149	lfsvc	Geolocation Service	904	Running
192.168.43.149	LicenseManager	Windows License Manager Service	396	Running
192.168.43.149	lltdsvc	Link-Layer Topology Discovery Mapper	0	Stopped
192.168.43.149	LSM	LSM	656	Running
192.168.43.149	MpsSvc	Windows Firewall	1428	Running
192.168.43.149	MSDTC	Distributed Transaction Coordinator	3216	Running
192.168.43.149	MSOLAP$DBSERVER	SQL Server Analysis Services (DBSERVER)	1820	Running
192.168.43.149	MSSQL$DBSERVER	SQL Server (DBSERVER)	7608	Running
192.168.43.149	MSSQLFDLauncher$DBSERVER	SQL Full-text Filter Daemon Launcher (DBSERVER)	7464	Running
192.168.43.149	NcbService	Network Connection Broker	952	Running
192.168.43.149	NlaSvc	Network Location Awareness	912	Running
192.168.43.149	Parallels Coherence Service	Parallels Coherence Service	1804	Running
192.168.43.149	Parallels Tools Service	Parallels Tools Service	1928	Running
192.168.43.149	PrlVssProvider	PrlVssProvider	2068	Running
192.168.43.149	ReportServer$DBSERVER	SQL Server Reporting Services (DBSERVER)	2680	Running
192.168.43.149	RpcEptMapper	RPC Endpoint Mapper	708	Running
192.168.43.149	SamSs	Security Accounts Manager	572	Running
192.168.43.149	Spooler	Print Spooler	1340	Running
192.168.43.149	sppsvc	Software Protection	6460	Running
192.168.43.149	SQLBrowser	SQL Server Browser	2180	Running
192.168.43.149	SQLWriter	SQL Server VSS Writer	2172	Running
192.168.43.149	SSDPSRV	SSDP Discovery	1004	Running
192.168.43.149	StateRepository	State Repository Service	2392	Running
192.168.43.149	stisvc	Windows Image Acquisition (WIA)	2232	Running
192.168.43.149	VSStandardCollectorService140	Visual Studio Standard Collector Service	812	Running

Figure 4.8. Services Data

2. Operating System Functions On The Server

The function of the operating system on the server computer is used for the monitoring process of every computer

device installed in the computer system, the computer device consists of the mouse device, keyboard, universal serial bus, system services, graphics, computer network, CDROM, and installed applications. There are several functions associated with the operating system on the server computer, including:

❖ Computer Identity Monitoring Function

The function that is run is used for monitoring the process of general information on computer identity. The identity of the computer successfully displayed is the computer's address data, computer name, status, and name of the operating system used (Figure 4.9).

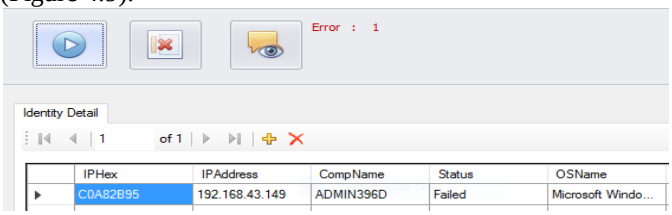


Figure 4.9. Computer Monitoring Result

The monitoring result in Figure 5.8 explains that there is one computer network device that is not connected to the server, this can be caused by the cable device that is not connected to the computer. The system error indicator is indicated by displaying an error message, i.e Error: 1 which means there is 1 computer not connected to the computer system.

❖ Mouse Device Monitoring Function

The computer monitoring functionality is used to facilitate IT Administrators to get detailed information related to the mouse device. The information displayed consists of computer address, device name, user's computer name, device ID, and mouse device status (Figure 4.10).

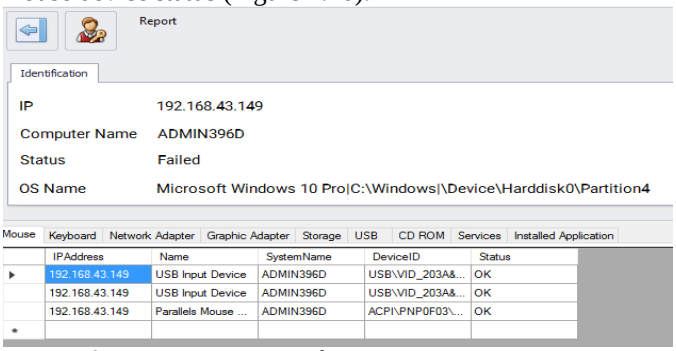


Figure 4.10. Mouse Monitoring Result

❖ Keyboard Monitoring

Keyboard device information needs to be displayed for general device information details. The information displayed consists of the computer address, device name, computer name, device status, and device ID as seen in Figure 4.11.

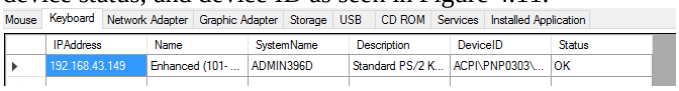


Figure 4.11. Keyboard Monitoring Result

❖ Network Monitoring

The monitoring function of the network device is used to display information consisting of a computer network device, the name of the network device, the device type, the device description, the computer system name, the device ID, the physical address of the computer, and the status of the network device (Figure 4.12).

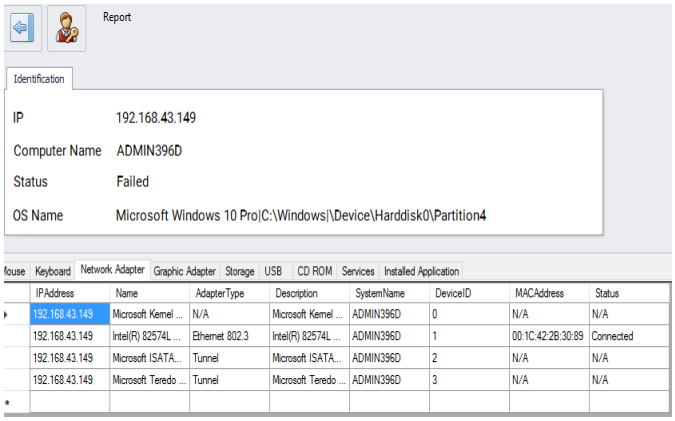


Figure 4.12. Network Monitoring Result

❖ USB Monitoring

The USB device monitoring function is used to display the computer's address data, device name, device ID, USB version and device status (Figure 4.13).

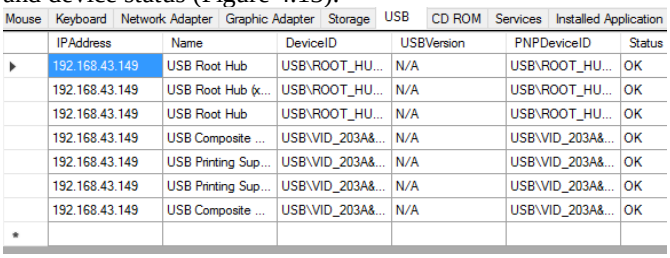


Figure 4.13. USB Monitoring Result

❖ Services Monitoring

Computer services is a service that runs in the background system when the operating system is run for the first time and provide specific functions. The information displayed consists of computer address, service name, current software name, process ID, and system service status (Figure 4.14).

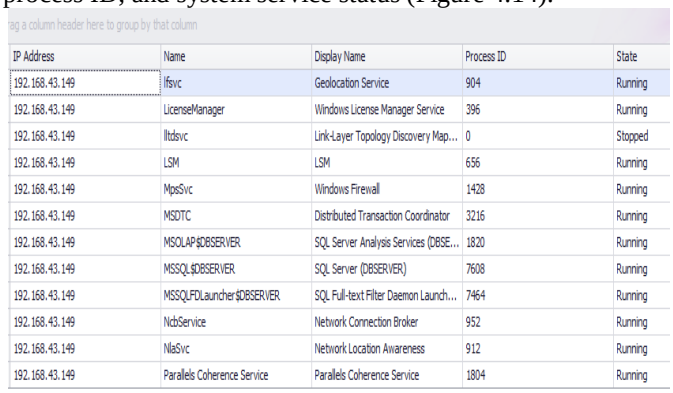


Figure 4.14. Services Monitoring System

E. Performance Measurement Results

The performance measurement of computer infrastructure monitoring process was done on one server computer and a client computer. The parameters used for this performance measurement were the use of a computer processor and memory. On the client side, with the process name RealTimeMonitoring.vshost.exe, processor performance measurement obtained data that the monitoring system used 0.61% processor of the total 100% (Figure 4.15).

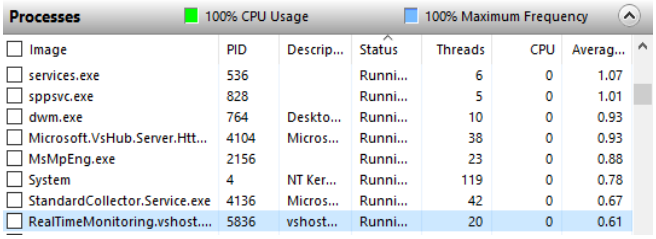


Figure 4.15. Processor Performance Measurement from Client Side

The client-side monitoring system used 38.284 KB (0.0365 GB) of memory from a total of 4 GB of memory used (Figure 4.16). From the performance measurement results concluded that the monitoring system on the client side did not burden the performance of the processor and did not require excessive computer memory usage.

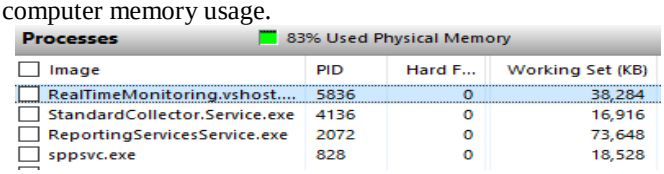


Figure 4.16 Memory Performance Measurement from Client Side

On the server side, with the process name ServerManager.vshost.exe, performance measurement of the processor found that the monitoring system used 1.01% processor consumption of the total 100% (Figure 4.17).

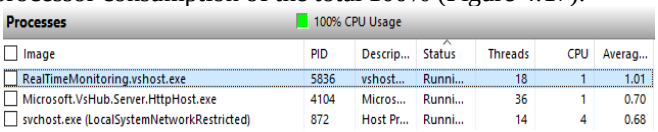


Figure 4.17. Processor Performance Measurement from Server Side

The measurement of the computer's memory performance on the monitoring system from the server side showed that the system used 58.620 KB (0.056 GB) from a total of 4 GB used (Figure 4.18). The system usage did not burden the computer's performance significantly in terms of memory and processor.

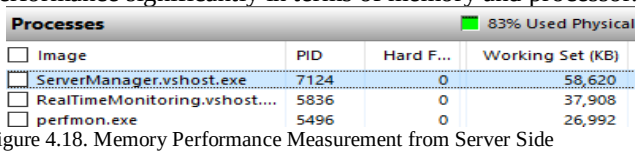


Figure 4.18. Memory Performance Measurement from Server Side

IV. CONCLUSION

ICT has been widely used in rural areas. ICTs are used by individual and household communities, although they are mostly used only for social media and entertainment. In addition to individuals, in some regions, ICTs are also used to support journalism through village portals and community radio. ICT has also been used by farmers and fishermen. in addition, local governments have also used ICTs to promote their regions.

Most of ICT for development models in Indonesia, especially in rural area are the telecenter. The kind of telecenters has held in Indonesia such as PLIK, MPLIK, Information Village and DBT. Most of literatures states that this telecenter program was less successful.

Some ICT problems for development, especially in rural areas are revealed in the literature, such as problem of ICT programs for development (limited infrastructure, management and communication), territories problems (location, culture), e-literacy problems, and public awareness issues.

The challenge of ICT for development especially in rural areas is a literacy problems. ICT literacy itself, public awareness, cultural issues and the problem of unsuccessful various ICT programs for development, one of the reasons is illiteracy. In addition, Indonesia's territorial issues are quite difficult challenges, so an ICT model for development is really planned and mature. In addition, the important thing is that this work must be carried out together.

V. ACKNOWLEDGMENT

I gratefully acknowledge to Head of Politeknik Enjinering Indorama for all facilities I use to complete this paper. Big thanks also to researchers partnert for supporting me to complete this paper.

VI. REFERENCES

[1] K. C. Laudon dan J. P. Laudon, Management Information Systems, 13th ed., Edinburgh: Pearson Education Limited, 2014.

[2] K. E. Kendall dan J. E. Kendall, System Analysis and Design, 9th ed., Edinburgh: Pearson Education Limited, 2014.

[3] A. S. Tanembaum dan M. V. Steen, Distributed System, 2nd Edition., USA: Pearson Prentice Hall, 2006.

[4] Microsoft, “Real-Time Application Development,” Microsoft Corporation, 18 May 2004. [Online]. Available: https://msdn.microsoft.com/en-us/library/ms918013.aspx. [Diakses 19 June 2016].

[5] Microsoft, “Windows Management Instrumentation,” Microsoft Coorporation, 31 May 2018. [Online]. Available: https://msdn.microsoft.com/en-us/library/aa394582%28v=vs.85%29.aspx. [Diakses 19 June 2016].

[6] S. e. a. Nakov, Fundamentals of Computer Programming with C#, Bulgaria: Sofia, 2013.

[7] R. McLeod, , Sistem Informasi Manajemen - Volume 1 Version Indonesian Seventh Edition, Jakarta: PT Prenhalllindo, 2001.

[8] C. P. dan Y. E., Object-Oriented Analysis, New Jersey: Prentice Hall International, Inc., 1991.

[9] P. Nielsen, SQL Server 2005, Bible: Wiley Publishing, Inc, 2005.

[10] J. O’Brien, Management Information System, New York: McGraw-Hill, 1999.

[11] B. Patil, A. Jain, Pathak dan V. Kumar, “WMI Based Real Time Agentless Enterprise Monitoring,” *International Journal of Scientific & Engineering Research*, vol. 6, no. 2, 2015.

[12] H. Peng dan Y. Wang, “WMIC Realize Enterprise Remote Information Management,” *IEEE*, vol. 1, pp. 323-326, 2010.

[13] H. Peng dan Y. Wang, “WMIC-Based Technology Server Network Management Software Design,” *IEEE*, vol. 1, pp. 253-256, 2010.

[14] R. S. Pressman, Software Engineering: A PRACTITIONER'S APPROACH. Fifth Edition, McGraw-Hill, 2001.

[15] A. Steven, Information Systems: A Management Perspective. Second Edition, Menlo Park:: The Benjamin/Cumming Publishing Company, Inc, 1996.

[16] I. Sommerville, Software Engineering – 6th Edition, Essex: Addison-Wesley, 2001.

[17] C. TM dan B. CE, Database Systems: A Practical Approach to Design, implementation, and Management – Third Edition, USA: Addison Wesley, 2002.

[18] Y. Wang dan Y. Yu, "WMIC in the Remote Monitoring System," *IEEE*, pp. 1-4, 2010.

ASSESSMENT OF ESSAY QUIZ SYSTEM IN THE LMS VIDYANUSA PLATFORM USING THE NAZIEF AND ADRIANI STEMMING ALGORITHMS "COMPARISON OF TEACHER, EXPERT RUBRIC, AND SYSTEM ASSESSMENTS"

Ratih Kusuma Dewi[1], Mervin Tangguar Hutabarat[2]
[1 2]*Bandung Institute of Technology*
(*[1]ratihkusumadewi09@gmail.com, [2]mhutabar@gmail.com)*

***Abstract*— This study focuses on the assessment system of the essay quiz answers on the LMS VidyaNusa platform using Nazief and Adriani algorithms. The stemming algorithm is a word cutting process that makes use of basic words using certain rules. This method uses LSA (Latent Semantic Analysis) which determines the similarity values of two documents, to find interaction between sentences using SVD (Singular Value Decomposition) algebraic calculation of each statement then to get the similarity value from each statement using cosine similarity algorithm. This system is followed to assist the teacher in evaluating answers to student essay quizzes because this system is equipped with value weighting so that it reduces subjective assessors and increases accuracy in assessment. The results of this study from 15 students by answering 10 questions and 1 teacher obtained results, that the assessment given by the teacher without the vulnerable rubric was 8-10, the value given by the vulnerable system was 0-10, and the assessment of the system with the vulnerable rubric was equal 0 -10. So when viewed from the function of the rubric on the objectivity of the assessment, the value given by the teacher without rubrics is less objective. Correlation or relationship between expert assessment system using rubric with the results of r = 0.82166624 So that both variables have a close relationship and the form of the relationship is linearly positive.**

***Keywords:* LMS; Essay Quiz; Nazief dan Adriani Algorithms; LSA; VidyaNusa; Rubric**

I. INTRODUCTION

E-Learning is a system or concept of education that utilizes information technology in the teaching and learning process. E-Learning is a learning system that is used as a means for teaching and learning that is carried out without having to face to face directly between the teacher and students (Ardiansyah, 2013) [1]. In the concept of e-learning, all teaching and learning processes can be done online, starting from giving material, evaluating learning to the results of evaluation. Evaluation is a process of collecting data to determine how far, in what way, and how educational objectives have been achieved. If not, what is not and why (Ralp Tyler (in Arikunto, 2011: 3)) [2]. Learning evaluation is very important for students to know the understanding of a material. Evaluation of manual evaluation in the form of a test requires a very long time so that a solution is needed to minimize the assessment time of the exam results. Sometimes manual assessment there are several obstacles, namely an inconsistent assessment between students with one another even though the answer is almost the same, then because the writing of each student is different sometimes there is something that is difficult to read it also makes it difficult for the teacher to make an assessment, this can reduce the quality from the teacher's assessment of students' answers sometimes the study is no longer objective. Objectivity is an honest attitude, not influenced by personal or group opinions and considerations in taking decisions or actions. Then at the time of paper quiz collection sometimes the paper was scattered which resulted in invaluable student exam papers and it was very detrimental to students. To overcome these problems, an essay examination system is needed online. This system will correct students' answers quickly and precisely and automatically as well as assessments to be more effective and efficient because usually used paper that accumulates will become a pile of garbage.

A. Essay Question

Essay questions are questions used to measure (the goal) achievement of learning outcomes in complex aspects. And it is recommended that the test designer measure the ability of test participants in the form of analysis, organizing and expressing ideas about something [3]. Also called essay examination is a tool to evaluate learning outcomes, in the form of written questions that demand answers: describe, explain, compare, give reasons, using words and languages themselves or express ideas through written language [4]

B. Automatic Essay Assessment

Manual essay assessments have several problems, such as lack of objectivity in assessment, lack of accuracy, tend to take time [5], to reduce the problem, several automatic essay assessment systems are proposed, including: essay grader (PEG) project developed in 1960- [6] But PEG is criticized because it ignores the semantic aspects of the essay and focuses more on the structure of the word length, the number of semicolons or commas, the number of spaces [6] [7]. Then Intelligent Essay Assessor (IEA) developed by Landauer, Laham, and Foltz. This IEA system uses a semantic text analysis method called Latent Semantic Analysis (LSA). IEA

was developed in 2001 while LSA itself was developed in 1996 [6]. Furthermore Electronic Essay Rater (E-rater) developed by Educational Testing Service (ETS) in 1999. E-rate uses natural Language Processing (NLP). Currently E-rater is used to assess GMAT essay exams (Postgraduate Admissions Manager Tests) [6] [7] [8] [9].

C. Stemming

Stemming is the word cutting process to determine the basic word. The process of stemming this by eliminating all types of affix (affix).

D. Morphology Word Indonesian

Words in Indonesian can be divided into four types, namely basic words, repetition words, derivative words, compound words. Indonesian can be developed into new words or different meanings by adding affixes according to the language grammar. There are several types of affixes or affixes in Indonesian including: prefix, suffix, suffix (confix), insert (infix).

E. Rubric

The rubric is a guide used to assess consistently by the teacher and can be accounted for the quality of student work. Rubrics can also be said to be feedback on the quality of student work.

F. Assessment Formative and Summative

Formative assessment is an assessment process, which is used to obtain information and learning evidence from students to plan the next instructional activities. While summative assessment is an assessment used at the end of the student learning process.

II. METHOD

Nazief and Adriani algorithms have a high degree of accuracy in the stemming process compared to other algorithms. The method used in this study is Latent Semantic Analysis (LSA This LSA concept will look for similarity values between two segments of text without regard to word arrangement. The main function of this LSA is to calculate the similarity of documents by comparing vector representations of each document. In the formation of a vector-based term representation, LSA will form a matrix that represents the relationship between terms and documents called semantic space, that is, words and documents that are closely associated will be placed close to each other represented by vectors [6]. between the sentence and the word algebraic method used is a singular value decomposition.

III. RESULT AND DISCUSSION

There are many development projects using the Nazief and Adriani algorithms. Dheru Alam Perkasa, Eki Saputra, S.Kom, M.Kom, Mona Fronita, S.Kom used Nazief and Adriani algorithms to develop the Essay Online Examination System with Assessment using the Latent Semantic Analysis (LSA) Method. The results of their research between the expected values and the observed values generated by the difference system are only 0.04 [10]. Atqia Aulia, Dewi Khairani, and Nashrul Hakiem. Their research produced a perfect recall score of 1 and an accuracy of 0.961 [11]. Reina Setiawan, Aditya Kurniawan, Widodo Budiharto, Iman Herwidiana Kartowisastro, Harjanto Prabowo. They conducted a study using 1,704 text documents in the forum by comparing their approach better than the confix-stripping approach stemming from Nazief and Adriani [12]. Rahardyan Bisma Setya Putra, Ema Utami. They modified the Nazief and Adriani algorithm with Flexible Affix Classification to be able to stem 40 of the 60 non-formal words [13]

In making this application, several supporting devices are needed including hardware, software and users.

a. Hardware Requirements

This hardware requirement is used at the time of making the system, the following hardware specifications are used:

1. Processor intel i5-7200U CPU @ 2.50GHz 2.71 GHz
2. RAM 12.0GB
3. 1T hard drive
4. Operating system Windows 10

b. Software requirements

This software requirement is used at the time of making the system, the following software specifications are used:

1. WebStorm
2. Robo3T
3. Postman
4. Filezilla
5. Command Prompt
6. MEAN (Mongo, Express, Angular, NodeJS)
7. ArgoUML
8. Microsoft Visio 2010

c. User/ Brainware

To support the system that has been created, this system requires users who are familiar and understand using a computer.

LMS VidyaNusa is made with several menus for teachers and students.

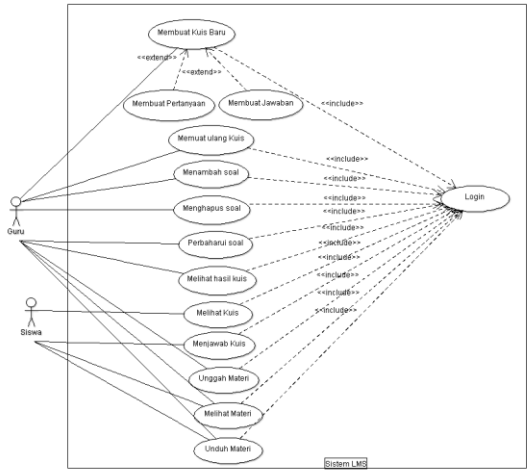


Figure 1 LMS System

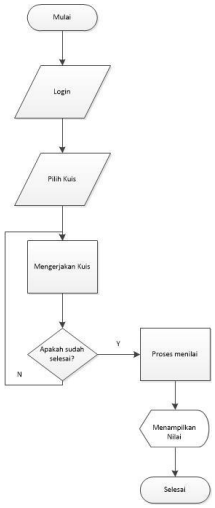


Figure 2 Student Flowchart Quiz

Actor description

1. Guru

Login is the initial step that is done by the teacher or students to enter the LMS module. In the LMS module, there are two main menus in the teacher section, namely making a quiz and uploading material. On the quiz menu the teacher can create a new quiz or reload the existing quiz. There are two quiz choices, namely multiple choices and essays. When you have entered the quiz form the teacher is required to fill out the quiz information first such as the name of the quiz, the name of the lesson, the duration of work, time to work and choose the type of quiz to proceed to the question menu. After entering the menu the teacher must fill in all available forms, namely the question form, answer form and value form. After that when students have taken the quiz, there will be a report containing the weight of the values received from each student. In the upload material menu the teacher must also fill in all available forms including subjects, discussion material, descriptions of the material to be uploaded and the material documents. After uploading the material the teacher can also see the material that has been uploaded on the dashboard menu then the teacher can also download the material.

2. Siswa

The LMS module on the student side has two main menus, namely taking a quiz and downloading material. Before students take the quiz, students are required to log in first, then students choose the quiz menu to take part in the quiz. Students will find out the amount of grades obtained after completing the available quiz. Then besides participating in the quiz, students can also view and download material that has been uploaded by the teacher.

In the flowchart, the student's process flow answers the quiz starting from the login, then the student chooses the quiz that will be followed. After choosing the quiz, students will work on the quiz that has been selected if they have finished working on the student pressing the submit or send answer then the system will process the student's answer and produce the final grade of the student.

Quiz essay application is a web-based application. Users of this application are teachers and students. The teacher will enter the question, answer key, along with the weight of each question into the system. Students see and answer questions, the answers are typed in the form provided. The system will process the student's answers and match the answer keys that have been provided, then will calculate the value of the similarity between the student's answers and the teacher's answers. This process will go through two stages, namely preprocessing and correction of answers using the LSA algorithm. After going through the final score is obtained.

I. Assessment Design Using Nazief and Adriani Stemming

a. Designing questions and Answers

Question: Apa yang dimaksud dengan kuman
Answer Key: Organisme mikroskopis yang bisa menyebabkan penyakit dan infeksi bila mereka masuk ke dalam tubuh
Answer:

- Siswa 1: Organisme yang bisa menyebabkan penyakit dan infeksi pada manusia dan hewan
- Siswa 2: Organisme yang membuat manusia sakit jika masuk kedalam tumbuh
- Siswa 3: Organisme yang dapat menimbulkan rasa sakit dan infrksi nagi masnua jika masuk kedalam tubuh
- Siswa 4: Organisme yang dapat menimbulkan penyakit bagi manusia jika masuk kedalam tubuh.

b. Processing

After the key answers and answers are implemented, the next process is the processing process. In the process there are several stages, namely:
1. Stage of the removal of punctuation marks (stoplist)

2. The phase of solving the sentence becomes a fragment of words (tokenization)
3. Removal of prepositions, links that are not related to the essence of the sentence (stopword)
4. The word cutting stage becomes the basic word (stemming)

c. Answer Correction

1. Correction of answers or the application of the Latent Semantic Analysis method is to determine each query, including the answer key query (Q), query the student answer (D), and query the combined student answer and answer key (QS).
2. Weighting the word or TR (term frequency) from the answer key query (Q), querying the student answer (D), and querying the combined key of the student's answer and answer (QS).
3. Form a matrix with Amxn size
4. Calculate the value of the matrix U, S, VT using the Singular Value Decomposition (SVD) calculation. Manual calculations can use the matrix calculator found in the toolmat website http://www.bluebit.gr/matrix-calculator/calculate.aspx
5. Reduction of k = 2
6. Calculate the key vector answers and answers

The key vector answers with the following formula:

Matrix Q = tf x matrix Uk x matrix Sk

Q = | 1010011010010 | x matrix Uk x matrix Sk

Then the results

Q = 6,296 4,256

The answer vector is obtained from the corresponding column in the Vt matrix of the SVD results with the following results:

D1 = 0.317 0.916

D2 = 0544 -0.030

D3 = 0.526 -0.376

D4 = 0.572 0.133

7. Calculate CoSim values from each matrix Q and D, with calculations using the following formula:

$$\text{CoSim}\ (D_n Q) = \frac{\sum \text{Q} D_n}{|\text{Q}||D_n|}$$

The CoSim calculation uses the Cosine Similarity Calculator with a Web address http://scistatcalc.blogspot.com/2015/11/cosine-similarity-calculator.html#.

The results of the calculation are as follows:

CoSim (D_1 Q) = 08002
CoSim (D_2 Q) = 0.8284
CoSim (D_3 Q) = 0.3483
CoSim (D_4 Q) = 0.9338

8. Multiply the cosim value by the value weight

In this case the weight of the problem is 100. The results are as follows:

Value D1 = 80.02 (Student final score 1)

Value of D2 = 82.84 (Student's final grade 2)

Value D3 = 34.83 (Student final score 3)

Value of D4 = 93.38 (Student's final grade 4)

II. Testing Value Validation

The test is done by giving a quiz in the form of essay questions to students then the teacher assesses manually and compares the value given by the teacher to the assessment carried out by the system. The following is an assessment conducted by the teacher and system:

Question : Apa yang dimaksud dengan merangkum
Answer Key : Kegiatan menyusun gagasan pokok dari suatu bacaan/ buku menjadi bentuk yang ringkas atau pendek

Table 1 Testing Value Validation

No	Student Id	Answer	Grade		
			Teacher	System	Rubric
1	599q	menyimpulkan kata yang pentingnya saja	10	7.41	6
2	59d2	persingkat uraian dengan perbandingan secara proporsional	8	1.3	5
3	59fw	meringkas suatu paragraf dengan cara mengambil poin-poin pentingnya saja	10	7.32	7
4	5a0z	suatu kegiatan yang mengambil pokok-pokok suatu tulisan atau pembicaraan atau menjadi suatu uraian yang lebih singkat dengan perbandingan secara proporsional antara bagian yang dirangkum dengan rangkuman	10	3.73	4
5	5a0x	mencatat pokok-pokok teks dan menyusunnya menjadi singkat dan jelas	10	8.23	8
6	5a0c	memendekan suatu paragraf yang panjang menjadi lebih pendek	8	2.52	4
7	5a0v	mempersingkat uraian dengan	10	2.52	4

No	Student Id	Answer	Grade		
			Teacher	System	Rubric
		perbandingan secara proporsional			
8	5a0b	merangkum atau kegiatan meringkas yang isinya penting-penting saja	10	2.54	6
9	5a0n	merangkum adalah mempersingkat uraian dengan perbandingan secara proporsional	10	1.3	4
10	5a1s	merangkum adalah suatu tek yang hanya di ambil intinya saja, jadi mengambil yang pentingnya saja	10	6.91	6
11	5a0w	merangkum adalah mengambil inti-inti dari sebuah teks yang membuatnya menjadi lebih ringkas.	10	9	6
12	5a0u	merangkum adalah pengambilan pokok-pokok tulisan atau pembicaraan yang penting saja menjadi uraian yang lebih singkat	10	8.33	9
13	5a0	merangkum adalah menyimpulkan kata yang pentingnya saja	10	7.18	7
14	5a0m	merangkum adalah menyimpulkan kata yang pentingnya saja	10	7.18	7
15	5a0s	merangkum adalah kegiatan menyusun gagasan pokok dari suatu bacaan / buku menjadi bentuk yang ringkas atau pendek	10	9.47	9

Vulnerable values that are given by the teacher manual system and assessment are far enough, while assessments that use rubrics and systems are not far enough. For more details, here is a comparison chart of assessments given by the teacher, system, and using rubrics.

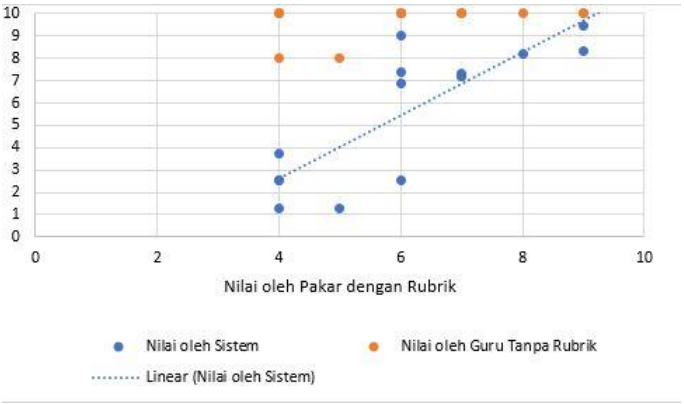


Figure 3 Analisys Beween System Assessment, Experts With Rubrics, and Teacthers without Rubrics

From the diagram above shows that the value given by the teacher without the vulnerable rubric is 8-10, the value given by the vulnerable system is 0-10, and the evaluation of the system with the vulnerable rubric is equal to 0-10. So when viewed from the function of the rubric on the objectivity of the assessment, the value given by the teacher without rubrics is less objective. In the essay quiz assessment, a rubric is needed to help guide the objective assessment, information on the value weight, determine student learning strategies. So with the assessment system, the essay quiz can help the teacher's assignment for assessment.

III. Discussion

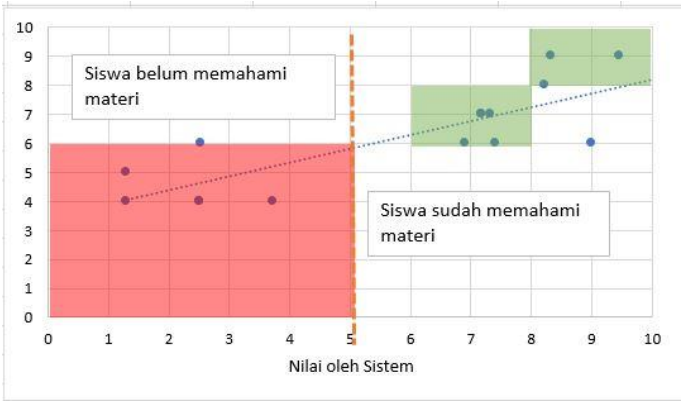


Figure 4 Corelation of System Assessment and using Rubrics

From the picture, shows that there is a correlation or relationship between the appraisal system and expert judgment using a rubric with the results of r = 0.82166624 So that both variables have a close relationship and the form of the relationship is linearly positive. When checking the variance value of the two data, it is found that the value for variance using the rubric is s2 = 2.98095238 and the variance using the system is s2 = 8.75746381. From the results of the variance can be seen the distribution of its value. If the value of variance uses the rubric s2 = 2.98095238, it means that it is close to the average value of the student as a whole. Because it is getting closer to 0, the data is getting more homogeneous and vice versa. The value of the variance of the system value indicates

that the results of system data vary, between students one with other students. Assessment using this system can be used as a formative assessment..

IV. Conclusion

This system needs further research, because there is still a considerable difference between the assessment of the system and the teacher's assessment, for example students get a score of 10 using a manual assessment by the teacher and get a score of 1.39 using the assessment by the system, although this assessment has been assisted by the rubric assessment.

This appraisal system can help teachers, but it still needs system development that is adding a method that can recognize the similarity of words with different representations but has the same meaning.

V. Acknowledgment

This is my thesis project, , I would like to thank Mr. Kokon Komarudin for his assistance in making assessment rubric and assessing the student's quiz using the rubric and Mrs. Wati who helped in getting a comparison in the assessment of this system.References

VI. REFERENCES

[1] M. Riyadi, "Pengertian, Karakteristik dan Manfaat E-Learning," 17 June 2014. [Online]. Available: https://www.kajianpustaka.com/2014/06/pengertian-karaktiristik-dan-manfaat-elearning.html. [Diakses 03 July 2018].

[2] Nurwahyuningsih, "ANALISIS KUALITAS SOAL TRY OUT ... Bab 2 - 04201244078," 1 Februari 2013. [Online]. Available: http://eprints.uny.ac.id/9672/3/bab%202%20-%20%2004201244078.pdf - http://eprints.uny.ac.id/9672/. [Diakses 03 July 2018].

[3] S. Anwar, Penilian Berbasis Kompetensi, Padang: UNP Press, 2009.

[4] N. Sudjana, Penilaian Hasil Proses Belajar Mengajar, Bandung: PT. Remaja Rosdakarya, 1991.

[5] A. A. P. Ratna, B. Budiardjo dan D. Hartanto, "SIMPLE: SISTIM PENILAI ESEI OTOMATIS UNTUK MENILAI UJIAN," *MAKARA, TEKNOLOGI*, vol. 11, pp. 5- 11, 2007.

[6] Turkish Online Journal of Distance Education-TOJDE, "Automated Essay Scoring," *Semire DIKLI. Florida State University Tallahassee, FL, USA*, vol. 7, no. January 2006 ISSN 1302-6488, p. Number: 1 Article: 5, 2006.

[7] A. A. P. Ratna, A. Henry dan A. B. Anantasatya, "GLSA Based Online Essay Grading System," dalam *IEEE - TALE*, Bali, 2013.

[8] S. D. S. L. T. F. G. a. H. R. Deerwester, "Indexing by Latent Semantic Analysis," *Journal of the American Society for Information Science & Landauer*, 1990.

[9] J. e. a. Burstein, "Enriching automated essay scoring using discourse marking. Proceedings of the Workshop on Discourse Relations and Discourse Marking," dalam *Annual Meeting of the Association of Computational Linguistics*, Montreal, Canada, 1998.

[10] D. A. Perkasa, Sistem Ujian Online Essay Dengan Penilaian Menggunakan Latent Semantic Analysis (LSA) Pada Jurusan Sistem Informasi Universitas Islam Negeri Sultan Syarik Kasim Riau, Riau: Fakultas Sains dan Teknologi. UIN Suska, 2014.

[11] A. A. , D. K. dan N. H. , "Development of a Retrieval System for Al Hadith in Bahasa (Case Study: Hadith Bukhari)," dalam *5th International Conference on Cyber and IT Service Management (CITSM)*, Denpasar, pp. 1-5, 2017.

[12] K. A. B. W. K. I. H. P. H. S. Reina, "Flexible Affix Classification for Stemming Indonesian Language," dalam *Internasional Conference IEEE*, 2016.

[13] P. R. B. S. U. Ema, "Non-formal Affixed Word Stemming in Indonesian Language," dalam *International Conference on Information and Communications Technology (ICOIACT)*, Yogyakarta, 2018.

[14] R. B. Aji, "Automatic Essay Grading System Menggunakan Metode Latent Semantic Analysis," dalam *Seminar Nasional Aplikasi Teknologi Informasi 2011 (SNATI 2011)*, Yogyakarta 17-19 Juni 2011, 2011.

BENCHMARKING MYSQL AND NOSQL DATABASE ON EGOVBENCH APPLICATION

Nur Aini Rakhmawati, Muhammad Zuhri, Radityo Prasetianto Wibowo, Anwar Romadhon, Herdy Ardiansyah, Olive Khoirul

Departement of Information Systems, Institut Teknologi Sepuluh Nopember
Jalan Raya ITS, Keputih, Sukolilo, Kota Surabaya, Indonesianur.aini@is.its.ac.id, izzur.zuhri@gmail.com, radityo.p.w@is.its.ac.id, anwar_28romadhon@yahoo.co.id, herdy5758@gmail.com, olive.klma@gmail.com

***Abstract*-- Egovbench application monitors websites or social media of Indonesia local governments daily. The process of crawling done by Egovbench produces extensive data, which reduced performance in the data processing. Therefore, there is a need for a database solution that has the best performance such as high processing speed and small database size. This study examined the comparison between relational databases and non-relational databases based on selected metrics to obtain the most suitable database solution for Egovbench. The results show that the MySQL database has the advantage of complex query processing and the use of the database with the smallest storage space. MongoDB database has the advantage of low data transfer volumes. Couchbase database has the advantage of short and straightforward query processing with a high number. The evaluation results show that MySQL is more suitable for Egovbench needs, which is the best response time and query per second. MySQL outperformed the other two databases on backup and storage file sizes testing.**

***Keywords*: benchmark, database, crawling, E-government**

I. INTRODUCTION

In recent decades, there has been a revolution in computing and communication, with the indications that technological advances and the use of information technology[1]. The internet is the place for the development and use of information resources that include a sea of global information [2]. For billions of people around the world, the internet has become an essential component of their daily social and business life [3]. Based on a survey conducted by the Indonesian Internet Service Providers Association (APJII), in 2016 there were 132.7 million Indonesians who had used the internet. With a total population of 256.2 million people, more than 52% of Indonesia's population is connected to the internet [4]. With the breadth of the field of information technology, the world moves from the industrial age to the information age. The manifestation of this transformation and the emergence of transitions of terms and concepts have become part of everyday life. The economic field emerged ideas such as E-commerce, E-business, and electronic money, while in the area of public sector appeared the concept of E-government [5]. E-Government is defined as a way for governments to use the most innovative information and communication technology, especially web-based internet applications, that provides citizens and businesses with easier access to information and government services, to improve service quality and to provide more significant opportunities for participating in democratic institutions and processes [6].

E-government services can be provided through several media, such as websites and social media. Based on the various E-government media, there are differences in quality so that the assessment of different data models is needed to provide a level of consistency, availability, and efficiency in measuring this E-government service using the Egovbench application. Egovbench (E-government benchmarking) is an application that is used to assess, compare and rank websites and social media owned by local governments[7]. Egovbench assessed whether the website and social media were indeed used as E-Government media that served the community or not. Egovbench is used to determine the quality, performance, and quality of official government social media sites and media.

Egovbench crawler obtains information from existing websites or social media. This crawling generates very large data. As a result, it might decrease performance in the data processing. The development of database technology in the last few years has become popular with the presence of non-relational or NoSQL database technology. The NoSQL database appears as a new data management system for managing and processing large volumes of data in an efficient manner [8]. Many companies integrate both databases; users interact with Relational Database (RDB) to handle small scale data, NoSQL databases function as a back-end system for data analysis. NoSQL databases process large volumes of data and produce results in real time such as the analysis of millions of tweets [9]. Unlike the database in general, NoSQL follows different data models and provides a level of consistency, availability, and efficiency.

This research is intended to find out the database performance as the Egovbench storage. We compare MySQL databases, MongoDB, and Couchbase by using four metrics: the response time metrics, query throughput, storage size, and volume of data transfers. Data used for benchmarking is data from social media crawling and government websites. By comparing existing databases, it can be seen how to store

Egovbench data using those three databases. In addition, it can determine the relevance of performance metrics in data processing and can compare performance in Egovbench data processing. By measuring the performance of the database used and conducting website and social ranking of E-government media, it can find out which performance of E-government services are good and which E-government services still need to be improved to provide the best service to the public through the internet.

A. Egovbench

Based on the 2014 United Nations E-Government Survey, the definition of E-Government or Electronic Government is the use of information technology and its application by the government to provide information and public services to the public [11]. The Egovbench system currently stored data in the form of documents from content that has been crawled by Egovbench. Data storage is divided into two parts, namely social media data and government website data. Egovebench is an application that is useful for assessing, comparing and ranking e-government websites and government social media. The assessment criteria are:

1. The website must follow the President Instruction Number 3 the Year 2003
2. Website availability
3. Website Update Frequency
4. Social Media availability (Facebook, Twitter, Youtube)
5. Social Media Updates Frequency

B. NoSQL Database

NoSQL or Not only SQL or Non-SQL Databases are terms used for formless database types. The NoSQL database follows different data models and provides a level of consistency, availability, and efficiency [9]. Although there are many NoSQL databases on the market, various industry trends show that the top three used today are MongoDB, Apache Cassandra, and HBase [13]. The characteristics below distinguish NoSQL from RDB or Relational Database [14]. NoSQL generally has the following features:

6. Schema-free
7. Easy replication support
8. Simple API
9. Consistent / BASE

MongoDB is a schema-free document-based database written in C ++ and developed open-source. The primary purpose of MongoDB is to close the gap between fast and highly scalable key-/ value-stores and feature-rich traditional RDBMS. MongoDB has better scalability, meaning MongoDB can connect and utilize multiple devices while managing data [12]. MongoDB databases can provide faster results because MongoDB supports nested documents. By querying the document ID, all documents can be given. In contrary to the relational database, to obtain all the contents of the database a query is needed that involves several tables because they are interrelated.

Couchbase or Membase is a schema-less and document-oriented NoSQL database system and supports zero document storage in JSON format. Couchbase is intended to run in memory and use as many database nodes as possible to store datasets in RAM before they are written to disk[17].

C. Database benchmarking

The database system contributes enormously to the proper and efficient organizational functions and business information [15]. Therefore, choosing the right database with the right features is often a critical decision. Benchmarking is called the process of evaluating a system for the performance of the system. Benchmark is a process to measure performance using specific indicators that produce a value that will be used as a comparison with other objects[16]. The benchmark performance of MongoDB is slightly under Couchbase. The latency of MongoDB increases when additional database servers are performed[13].

Yunhua Gu et al. [12] describes how the type of NoSQL database, namely MongoDB acts as a data storage media in the web crawling process. The purpose of the study was to determine the performance and characteristics of the NoSQL database, especially the MongoDB database. The results obtained from the study show that the MongoDB database does not have the same schemes found in the relational database. In the MongoDB database, there is also no need to specify the number of columns and rows to store data and the absence of a foreign key. Therefore, MongoDB has a more flexible structure. For queries performed can provide faster results because it supports layered or nested documents. By querying the document ID, all the contents of the document can be returned, whereas in the relational database to obtain all the contents of the database a query that involves several tables is needed. On a very large amount of data (above 50 GB), the difference in MongoDB access speed can be up to 10 times faster than the relational database. Also, MongoDB has better scalability, it means that MongoDB can connect and utilize multiple devices while storing and managing data. Yunhua Gu's research has a relationship with this research because it discusses the performance and characteristics of MongoDB in the web crawling process.

Datastax Corporation [13] did a benchmarking the Amazon Web Services EC2 platform by testing using the Cassandra, Couchbase, HBase, and MongoDB databases. The results obtained were that almost all MongoDB performance benchmarks were slightly under Couchbase and latency in MongoDB increased sharply when adding servers to the database.

Joao Ricardo Lourenco, et al. [18] conducted a quality comparison of some of the popular NoSQL databases, Aerospike, Cassandra, Couchbase, CouchDB, HBase, MongoDB, using quality attributes that are measurement parameters, namely Availability, Consistency, Durability, Maintainability, Read & Write Performance, Recovery Time, Reliability, Robustness, Scalability, and Stabilization Time. With the aim to determine the performance of the NoSQL database when measured using several predetermined parameters. The results obtained are that Couchbase is superior in availability, scalability, stabilization time and write-performance when compared with MongoDB which excels in consistency, recovery time, and reliability. The study of Joao

Ricardo Lourenco has a relationship with this research because it discusses the measurement of performance of Couchbase and MongoDB. Comparison between NoSQL Databases can be seen in Table 1.

Paper	AUTHORS	Database
Benchmarking Top NoSQL Databases	End Point Corporation (2013)	☐ Cassandra, ☐ Couchbase, ☐ HBase, ☐ MongoDB
Choosing the right NoSQL database for the job: a quality attribute evaluation	Joao Ricardo Lourenc¸o, Bruno Cabral, Paulo Carreiro, Marco ˜ Vieira, and Jorge Bernardino (2015)	☐ Aerospike ☐ Cassandra ☐ Couchbase ☐ CouchDB ☐ HBase ☐ MongoDB ☐ Voldemort
Application of NoSQL Database in Web Crawling	GU Yunhua, SHEN Shu, ZHENG Guansheng (2011)	☐ MongoDB

II. METHOD

A. Benchmark Metrics

The performance metrics used in this benchmarking are explained as follows:

a) Storage size (bytes): to find out how much storage space is needed for each database (DBMS) for the same data type.
b) Query per second (Query/second): to determine the level of query throughput that can be served by the database in units of time. We run a set of queries repeatedly and measure the average difference when running a single query.
c) Response time (second): to find out the average time needed to run a single query.
d) Volume data transfer (bytes): to determine the bandwidth capacity that can be transferred to the related database.

B. Benchmark Database Configuration

There are several tables that are used on the Egovbench service, i.e. result_sosmed, content, local government (pemda), and list of website URLs (Daftar link). The database schema can be seen in Figure 1.

The three databases tested have several different characteristics of how to store data because there are differences in structure and features. One of the differences can be seen in Table 2.

TABLE 2. DIFFERENCES IN TERMINOLOGY BETWEEN DATABASES

Terminologi	MySQL	MongoDB	Couchbase
Database	Database	Database	Bucket
Table	Table	Collection	Bucket
Column	Column	Field	Field
Row	Row	Document	Document

In general, the data used consists of 4 parts, namely:

1. The social media result table has 26 data fields such as date, regional ID, FB day count, FB content count, etc. This data is used to store the results of local government social media assessments conducted on the Egovbench application
2. Pemda table has seven data fields such as URL, type, FB id, etc. This table is used to keep a list of local government names, local government web addresses, local government types, and social media Facebook Facebook,
3. The content table has 4 data fields, namely: regional government id, criteria, documents, and URL. This table is used to store crawling data from local government web content based on predetermined criteria

The Daftar link table has two data fields, namely: local government id and URL link. This section is used to store a list of URLs that have been successfully crawled from the local government web

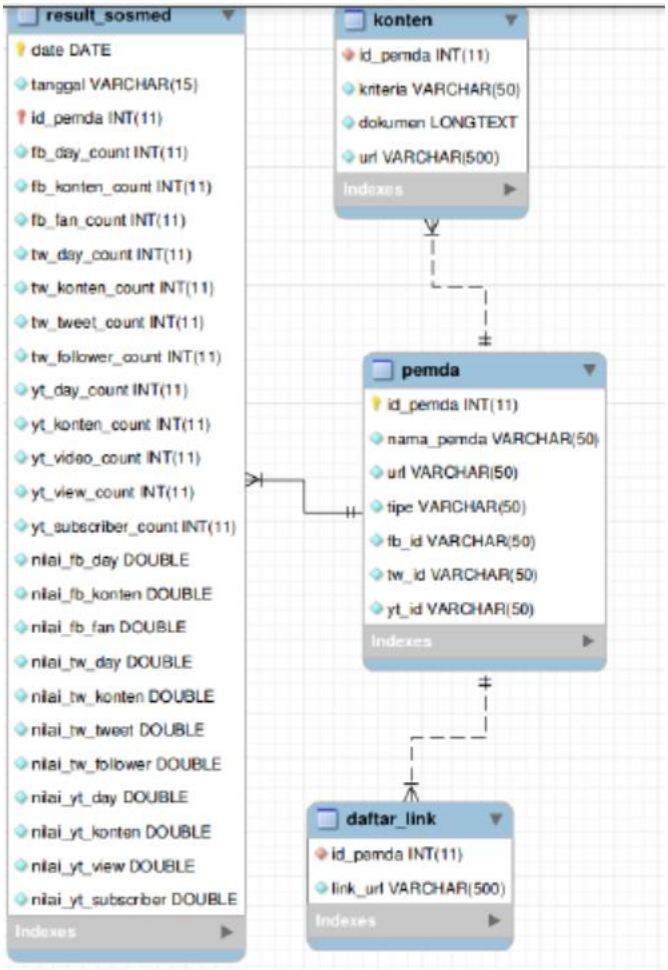


Fig. 1. Database Schema

C. Set of Evaluation Queries

The queries used in the benchmark are divided into two operations:

1. Query Select data from the Egovbench database that has been filled
2. Query Insert / Restore data from the database backup

Five queries were selected from the Egovbench application.

The selected queries are queries that often appear in the application. Moreover, we choose simple queries and complex queries. The comparison of the five queries can be seen in Table 3.

TABLE 3. COMPARISON OF THE FIVE QUERIES

Query	Tabel	Jumlah Kolom	Keywords	Operator
1	pemda	2	-	= (equal to)
2	result sosmed	2	ROUND, AS, ORDER BY, LIMIT	* (multiplication) + (addition) = (equal to)
3	result sosmed	2	ORDER BY	>(greater than) = (equal to) AND
4	konten	4	-	= (equal to) AND
5	daftar link	2	ORDER BY	= (equal to)

MySQL queries:

1. SELECT id_pemda, url FROM ‘pemda‘ WHERE id_pemda=275
2. SELECT id_pemda, ROUND(((((nilai_fb_day *52.7794746487477)+(nilai_fb_konten *23.7018937080024)+(nilai_fb_fan*23.5186316432498))*0.35284139100933) +(((nilai_tw_day *36.5019011406844)+(nilai_tw_konten *16.3920574566962)+(nilai_tw_tweet *30.8407266582172)+(nilai_tw_follower *16.2653147444022))*0.33587786259542) +(((nilai_yt_day*42.8571428571429)+(nilai_yt_konten *19.2460317460317)+(nilai_yt_view *18.7996031746032)+(nilai_yt_subscriber *19.0972222222222))*0.31128074639525)) ,2) AS totalscore FROM ‘result_sosmed‘ WHERE date =’2017-06-14’ ORDER BY totalscore DESC LIMIT 10
3. SELECT id_pemda, tw_tweet_count FROM ‘result_sosmed‘ WHERE tw_tweet_count>0 AND date=’2017-06-14’ ORDER BY tw_tweet_count DESC
4. SELECT id_pemda, kriteria, dokumen, url FROM ‘konten‘ WHERE id_pemda=170 AND kriteria=’sejarah’
5. SELECT id_pemda, link_url FROM ‘daftar_link‘ WHERE id_pemda=162 ORDER BY link_url ASC

MongoDB Queries:

1. db.pemda.find({ "id_pemda": 275 }, { "id_pemda": 1, " url": 1 })
2. db.result_sosmed.aggregate([{ $match: {"date": "2017-06-14"} }, { $project: { "id_pemda": 1, " totalscore": { $add: [{ $multiply: [{ $add: [{ $multiply: ["$nilai_fb_day", 52.7794746487477] }, { $multiply: ["$nilai_fb_konten", 23.7018937080024] }, { $multiply: ["$nilai_fb_fan ", 23.5186316432498] }] }, 0.35284139100933] }, { $multiply: [{ $add: [{ $multiply: ["$nilai_tw_day ", 36.5019011406844] }, { $multiply: [" $nilai_tw_konten", 16.3920574566962] }, { $multiply: ["$nilai_tw_tweet", 30.8407266582172] }, { $multiply: ["$nilai_tw_follower", 16.2653147444022] }] }, 0.33587786259542] }, { $multiply: [{ $add: [{ $multiply: ["$nilai_yt_day ", 42.8571428571429] }, { $multiply: [" $nilai_yt_konten", 19.2460317460317] }, { $multiply: ["$nilai_yt_view", 18.7996031746032] }, { $multiply: ["$nilai_yt_subscriber", 19.0972222222222] }] }, 0.31128074639525] },] } }, { $sort: { "totalscore": -1 } }, { $limit: 10 }, { $project: { "id_pemda": 1, "totalscore": { $subtract: ["$totalscore", { $divide: [{ $mod: [{ $multiply: ["$totalscore", 100] }, 1] }, 100] }] } } }])
3. db.result_sosmed.find({ "$and": [{ "tw_tweet_count": { "$gt": 0 } }, { "date": "2017-06-14" }] } , { " _id": 0, "id_pemda": 1, "tw_tweet_count": 1 }). sort({ "tw_tweet_count": -1 })
4. db.konten.find({ "$and": [{ "id_pemda": 170 }, { " kriteria": "sejarah" }] } , { "_id": 0, "id_pemda ": 1, "kriteria": 1, "dokumen": 1, "url": 1 })
5. db.daftar_link.find({ "id_pemda": 162 } , { "_id": 0, "id_pemda": 1, "link_url": 1 }).sort({ "link_url": 1 })

Couchbase Query

1. SELECT id_pemda, url FROM ‘pemda‘ WHEREid_pemda=275
2. SELECT id_pemda, ROUND(((((nilai_fb_day *52.7794746487477)+(nilai_fb_konten *23.7018937080024)+(nilai_fb_fan*23.5186316432498))*0.35284139100933) +(((nilai_tw_day *36.5019011406844)+(nilai_tw_konten *16.3920574566962)+(nilai_tw_tweet *30.8407266582172)+(nilai_tw_follower *16.2653147444022))*0.33587786259542) +(((nilai_yt_day*42.8571428571429)+(nilai_yt_konten *19.2460317460317)+(nilai_yt_view *18.7996031746032)+(nilai_yt_subscriber *19.0972222222222))*0.31128074639525)) ,2) AS totalscore FROM ‘result_sosmed‘ WHERE date=\"Jun 14, 2017\" ORDER BY totalscore DESC LIMIT 10
3. SELECT id_pemda, tw_tweet_count FROM ‘result_sosmed‘ WHERE tw_tweet_count>0 AND date=’Jun 14, 2017’ ORDER BY tw_tweet_count DESC
4. SELECT id_pemda, kriteria, dokumen, url FROM ‘konten‘ WHERE id_pemda=170 AND kriteria=’sejarah’
5. SELECT id_pemda, link_url FROM ‘daftar_link‘ WHERE id_pemda=162 ORDER BY link_url

D. Evaluation Scenario

The evaluation steps are as follows:

1. Backing up the database into a file
2. Measuring the size of the backup restore database file from a file calculation of storage used in the database
3. Capturing data packets to calculate the volume of data used by query transactions
4. Running the five queries that have been determined each - 100 times

For each query calculated the time needed to run the query 100 times, the average time needed to run 1 query, and the average query per second.

III. RESULTS AND DISCUSSION

The results of testing the MySQL database, MongoDB, Couchbase are divided into four metrics, including response time, throughput, backup and storage, volume.

The smaller the value of response time, the better the performance because a low response time means that the database can respond to queries given faster. Table 4 shows a comparison of the average response time queries (milliseconds). Couchbase outperforms the other two databases in query 1 and 5 but slower in query 2 and 3 compared to other databases. Couchbase is superior because the nature of the Couchbase database is more memory-centric and more memory

additions greatly help Couchbase's performance, queries 1 and 5 have more simple characteristics than queries 2, 3 and 4. MySQL and MongoDB have almost consistent results in every query. MySQL outperforms MongoDB in each query.

TABLE 4. COMPARISON OF THE AVERAGE RESPONSE TIME QUERY (MILLISECONDS)

Query	MySQL	MongoDB	Couchbase
1	23.99	57.10	22.73
2	27.27	73.93	896.57
3	24.86	74.06	910.41
4	26.17	73.00	32.00
5	24.67	58.10	20.12

The higher the value of query throughput, the better performance because a massive throughput means the database can handle many queries in one second. Table 5 shows a comparison of the average query value per second. Again, Couchbase outperforms the other two databases in query 1 and 5.

TABLE 5. COMPARISON OF AVERAGE QUERY VALUES PER SECOND.

Query	MySQL	MongoDB	Couchbase
1	41.68	17.51	43.99
2	36.67	13.53	1.16
3	40.23	13.50	1.10
4	38.21	13.70	31.25
5	40.53	17.21	49.69

The smaller the value of file size, the better the performance because the small value means that the database can store more data in the same size of storage. Table 6 shows a comparison of the size of the backup and storage files (MB). MySQL outperformed the other two databases in terms of backup files and total database storage. MySQL storage can be smaller because MySQL only converts all data into tabular text and in the query form and stores it in one .sql file whose size is smaller. MongoDB and Couchbase databases store in JSON or BSON (Binary JSON). Moreover, they store for each collection or bucket in different files and folders including metadata information in a separate file. Therefore, the total size of the used file is higher than MySQL.

TABLE 6. COMPARISON OF BACKUP AND STORAGE FILE SIZE (MB).

	MySQL	MongoDB	Couchbase
Backup result file	44.77	186.57	96.84
Database storage size	89.75	310.24	167.48

Table 7 shows a comparison of the volume of TCP data (MB). MongoDB has a slightly better value than MySQL because the output queries of MongoDB are in JSON forms that are shorter than tables generated by MySQL. The Couchbase database uses the most significant volume of data compared to the other two databases because the output generated by Couchbase is JSON which is longer than MongoDB. Besides, the output of the Couchbase contains more metadata.

TABLE 7. TCP DATA VOLUME COMPARISON (MB)

	MySQL	MongoDB	Couchbase
Volume data	4.39	4.27	6.12

IV. CONCLUSION

Based on the results of tests conducted on MySQL databases, MongoDB and Couchbase which are divided into four metrics, including response time, throughput, backup and storage, volume, can be summarized in Table 8. The more star (*) the more preferred database.

TABLE 8. BENCHMARK RESULTS OF FOUR MYSQL, MONGODB, AND COUCHBASE DATABASE PERFORMANCE METRICS ON THE EGOVBENCH WEB

Database	Response Time	Throughput	Storage Size	Volume Data
MySQL	***	***	***	**
MongoDB	*	*	*	***
Couchbase	**	**	**	*

MySQL database has advantages in query processing. MySQL provides fast response time, the highest query per second, and the smallest storage. MongoDB has advantages in the size of the volume of data queries because it can use fewer network resources in processing queries. Couchbase integrates MySQL and MongoDB databases in terms of measuring response time and throughput metrics in queries 1 and 5. Based on the results of tests that have been carried out, the recommended database for Egovbench is MySQL because it has the best response time and query per second among other databases which is more suitable for Egovbench's service needs.

This research has been attempted and carried out by scientific procedures, but still has flaws, namely:

- This study consists of four metrics, namely response time, throughput, backup and storage, volume. Therefore, it is necessary to consider other metrics and more varied configurations such as indexes on non-relational databases.
- This research is only done on queries 1 to query 5

V. ACKNOWLEDGMENT

We would like to thank the Departement of Information Systems, Institut Teknologi Sepuluh Nopember who have helped carry out this research in terms of funding

VI. REFERENCES

[1] B. Shaqiri, "Impact of Information Technology and Internet in Businesses," *Academic Journal of Business, Administration, Law and Social Sciences*, vol. 1, p. 1, 2015.

[2] Bughin et. al, "The impact of Internet technologies: Search," McKinsey Company, 2011.

[3] APJII, "Asosiasi Penyelenggara Jasa Internet Indonesia. Penetrasi & Perilaku Pengguna Internet Indonesia. Asosiasi Penyelenggara Jasa Internet Indonesia (APJII)," APJII, 2016.

[4] A. Almarabeh.T. , "A General Framework for E-Government: Definition Maturity Challenges, Opportunities, and Success," *European Journal of Scientific Research ISSN 1450-216X*, vol. 39 No. 1, no. 29-42, p. 1, 2010.

[5] J. Fang, J. Wu and W. Tian, "On the Relationship between Internet and Traditional Communication Industry," pp. 1-6, 2017.

[6] Z. Fang, E-Government in Digital Era: Concept, Practice, and Development, 2002.

[7] L. A. ITS, "Egov Bench [Online]," [Online]. Available: http://egovbench.addi.is.its.ac.id.

[8] Y. T. Z. J. L. C. H. C. S. C. H. C. H. C. W. …. C. Y. C. Liao, "Data adapter for querying and transformation between SQL and NoSQL database," Future Generation Computer Systems, 2016, p. 111–121.

[9] M. T. Y. M. T. J. &. C. R. González-Aparicio, "Testing of transactional services in NoSQL key-value databases.," 80, 384–399, Future Generation Computer Systems, 2018.

[10] R. G. G. P. A. O. C. Győrödi, "A comparative study: MongoDB vs. MySQL"," in *13th International Conference on Engineering of Modern Electric Systems (EMES), page. 1-6, ISBN 978-1-4799-7650-8*, Oradea, Romania, 2015.

[11] O. d. N. Unidas., "E-Government Survey: e-Government for the Future We Want.," https://doi.org/10.1016/S1369-7021(02)00629-6, United Nations, 2014.

[12] S. S. a. G. Z. Yunhua Gu, "Application of NoSQL database in web crawling," *International Journal of Digital Content Technology and its Applications,* vol. 5, no. 6, p. 261–266, 2011.

[13] Z. Majkic, "Intensional RDB Manifesto: a Unifying NewSQL Model for Flexible Big Data," 2014. [Online]. Available: http://arxiv.org/abs/1403.0017.

[14] S. &. N. G. Gupta, "Efficient Query Analysis and Performance Evaluation of the NoSQL Data Store for Big Data. In Proceedings of the First International Conference on Computational Intelligence and Informatics," in *In Proceedings of the First International Conference on Computational Intelligence and Informatics (pp. 549-558)*, Singapore, 2017.

[15] R. M. Fifer, "Cost benchmarking functions in the value chain," Planning Review 17(3):18–19, 1989.

[16] P. E. I. F. S. G. P. H. A. H. A. …. a. C.-M. P. E. I. F. S. G. P. H. A. H. A. …. a. M. W. (. W. (. Cudr´e-Mauroux1, "NoSQL database for RDF: An Empirical Evaluation, 310–311.," Retrieved from http://ribs.csres.utexas.edu/nosqlrdf/nosqlrdf_iswc2013.pdf , 2013.

[17] J. R. C. B. C. P. V. M. &. B. J. Lourenço, "Choosing the right NoSQL database for the job: a quality attribute evaluation. Journal of Big Data, 2(1)," 2(1), 1–26. https://doi.org/10.1186/s40537-015-0025-, 2015.

SCHEDULING USING GENETIC ALGORITHM AND ROULETTE WHEEL SELECTION METHOD CONSIDERING LECTURER TIME

Herman1, Lukman Syafie2, Irawati3, Lilis Nur hayati4, Harlinda5
Computer Science Dept. Universitas Muslim Indonesia, Indonesia
1herman@umi.ac.id, 2lukman.syafie@umi.ac.id, 3irawati@umi.ac.id, 4lilis.nurhayati@umi.ac.id, 5harlinda@umi.ac.id

***Abstract*—Scheduling lectures is not something easy, considering many factors that must be considered. The factors that must be considered are the courses that will be held, the space available, the lecturers, the suitability of the credits with the duration of courses, the availability of lecturers' time, and so on. One algorithm in the field of computer science that can be used in lecture scheduling automation is Genetic Algorithms. Genetic Algorithms can provide the best solution from several solutions in handling scheduling problems and the selksi method used is roulette wheel. This study produces a scheduling system that can work automatically or independently which can produce optimal lecture schedules by applying Genetic Algorithms. Based on the results of testing, the resulting system can schedule lectures correctly and consider the time of lecturers. In this study, the roulette wheel selection method was more effective in producing the best individuals than the rank selection method.**

Keywords: **Scheduling; Genetic algorithms; Roulette wheel**

I. INTRODUCTION

The scheduling process involves lecture, lecturers, time and day slots, and lecture rooms. In addition to these factors, in the scheduling of lectures it is also necessary to pay attention to the suitability between course credits with the length of lecture time and the availability of lecturers' time in teaching. Space management or in this case is scheduling education institutions more difficult compared to other institutions. Therefore the management of space and facilities in an organization is important and must be handled efficiently [1].

In a previous study conducted by [2], the factors that have been written into consideration in the process of making a class schedule. The application generated from the study scheduling lectures automatically and producing class schedules according to the factors under consideration. However, the resulting schedule has not been efficient from the lecturer side because it cannot make time requests. This certainly makes the lecturer a difficulty, especially lecturers who have positions, given the lecturers' busy life in addition to teaching time. The conclusions from the study also showed that the selection method used was ineffective which resulted in repeated scheduling processes. On this basis, the authors conducted research scheduling lecture by considering the lecturer time and making improvements to the selection method.

In this study, the authors used Genetic Algorithms. This is based on [3] which states that Genetic Algorithms have good resistance, not only can solve scheduling problems but also can provide satisfactory results. According to [3], Genetic Algorithms have speed in carrying out calculations.

Regarding efficiency issues in scheduling, several researchers have conducted research using Genetic Algorithms. Kurniawan et al. [4] used Genetic Algorithms in scheduling the use of parallel machines to minimize costs, one of which was electricity costs. The resulting schedule was improved by a mechanism of work delays that shifted work to other periods to avoid high electricity costs. The same is done by [5], which uses Genetic Algorithms to perform parallel machine scheduling with the aim of optimizing energy consumption in iron and steel mills. The same was done by [6], where in his research applied Genetic Algorithms to solve the problem of scheduling bus vehicles in urban areas.

In this study a selection method using roulette wheel was used. This is based on research conducted by [4] which is able to produce individuals or solutions to parallel machine scheduling with electricity cost efficiency. The roulette wheel method can retain individuals or the best solution when selecting from several solutions.

II. METHOD

The system built in this study consisted of 2 parts of the scheduling process, namely scheduling the theoretical subjects and scheduling the lab lecture. The first step is to schedule a theoretical lecture and then proceed with scheduling the lab lecture. The description of the system, shown in Figure 1.

Separation of the scheduling process of the theoretical and lab lecture is done to get the student's schedule in the lab course which is not collision with the theoretical class schedule. Before conducting the scheduling process, first the data collection process or inputting the data needed in the lecture scheduling process, where this has been discussed in previous research.

The last part of the system design is Output. After the scheduling process is done, the best schedule generated from the Genetic Algorithm is stored in the database. The best schedules stored on the database can be displayed on the monitor screen.

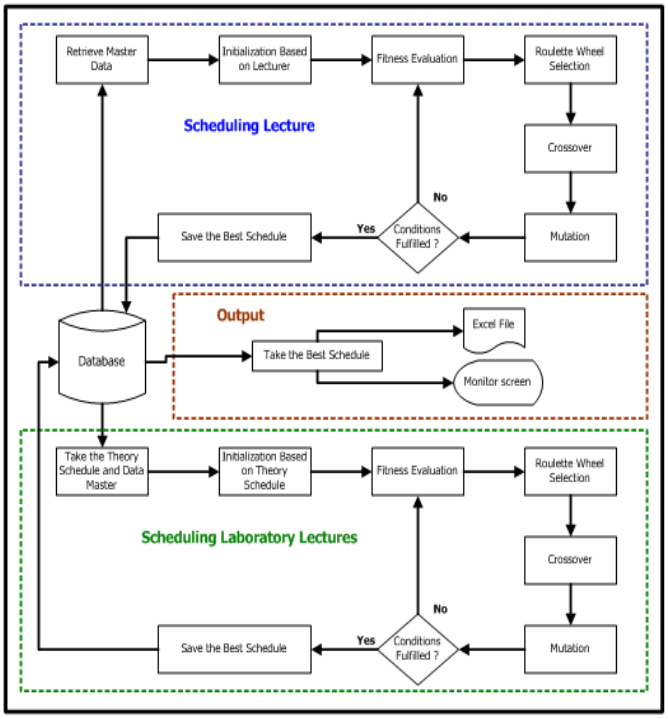


Fig. 1. Flow of lecture scheduling system

The process of scheduling lectures on the system built consists of several processes, namely: data retrieval process, initialization process, fitness value evaluation process, selection process based on fitness value, crossover process, mutation process, and the last is storing scheduling results in the database . To get the fitness value used equation (1).

$$fitness(i) = \frac{1}{1+no\_collisions} \qquad (1)$$

After the fitness value is obtained for each individual, then the next is the selection process using the Roulette Wheel Selection method. For example, suppose that in one population there are 5 individuals with each having a fitness value of f (1) = 0.4, f (2) = 0.1, f (3) = 0.16, f (4) = 0.6, and f (5) = 0.5, so the total fitness value is 1.76.

Individual probabilities obtained p [1] = 0.23, p [2] = 0.057, p [3] = 0.091, p [4] = 0.34, and p [5] = 0.28. Next is to generate random numbers [0,1] to get individuals as parents in the next generation. Large probability values have a great opportunity to be chosen as the parent of the next generation. An overview of the opportunities of each individual is shown in Figure 2.

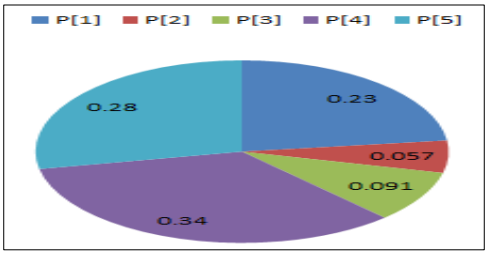


Fig. 2. Opportunities for each individual

For example random numbers generated are 0.81, 0.32, 0.01, 0.42 and 0.65. based on random values generated, the selected individuals are individuals 5, 3, 1, 4, and individuals 4. Illustrations of determining individuals based on random values are shown in Figure 3.

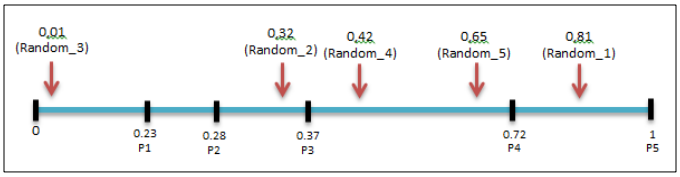
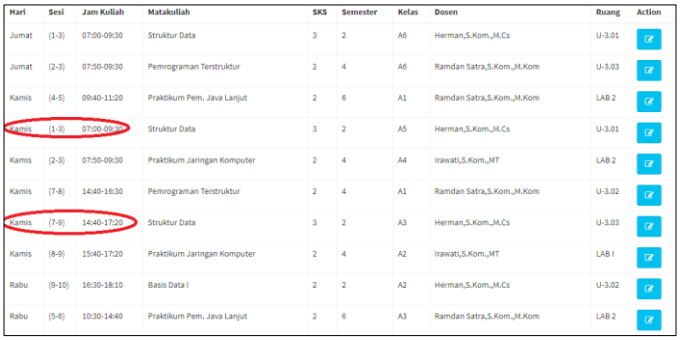


Fig. 3. Illustration of individual selection

III. Result and Discussion

Testing of Genetic Algorithms in the lecture scheduling system is done with 2 approaches. The approach in question is testing of the results of scheduling by paying attention to the lecturer, and the second is testing from the side of the selection method used.

To streamline the lecture process, departments will usually ask lecturers, especially lecturers who have busy activities such as lecturers who have positions or are placed in certain units / institutions to determine the days and hours that are not used for teaching. In the system created, the menu / interface for the availability of lecturers' time and choosing the name of the lecturer and unwanted days and hours are provided. For example, a lecturer named Herman could not teach on Thursday and Tuesday from 10 to 12:00. Figure 4 shows the scheduling results that did not provide teaching schedules to Herman's lecturers on Thursday and Tuesday at 10 to 12.

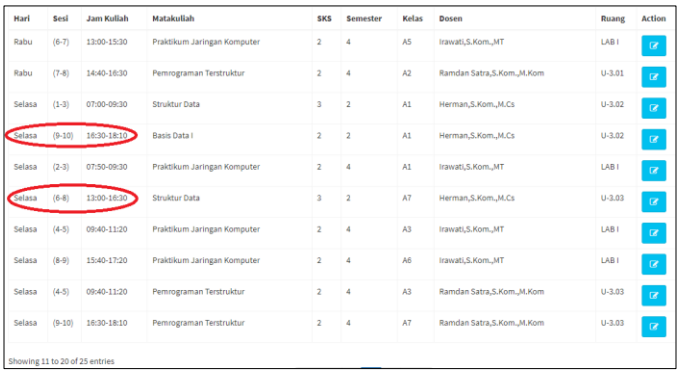


Hari	Sesi	Jam Kuliah	Matakuliah	SKS	Semester	Kelas	Dosen	Ruang	Action
Jumat	(1-3)	07:00-09:30	Struktur Data	3	2	A6	Herman,S.Kom.,M.Cs	U-3.01	
Jumat	(2-3)	07:50-09:30	Pemrograman Terstruktur	2	4	A6	Ramdan Satra,S.Kom.,M.Kom	U-3.03	
Kamis	(4-5)	09:40-11:20	Praktikum Pem. Java Lanjut	2	6	A1	Ramdan Satra,S.Kom.,M.Kom	LAB 2	
Kamis	(1-3)	07:00-09:30	Struktur Data	3	2	A5	Herman,S.Kom.,M.Cs	U-3.01	
Kamis	(2-3)	07:50-09:30	Praktikum Jaringan Komputer	2	4	A4	Irawati,S.Kom.,MT	LAB 2	
Kamis	(7-8)	14:40-16:30	Pemrograman Terstruktur	2	4	A1	Ramdan Satra,S.Kom.,M.Kom	U-3.02	
Kamis	(7-9)	14:40-17:20	Struktur Data	3	2	A3	Herman,S.Kom.,M.Cs	U-3.03	
Kamis	(8-9)	15:40-17:20	Praktikum Jaringan Komputer	2	4	A2	Irawati,S.Kom.,MT	LAB I	
Rabu	(9-10)	16:30-18:10	Basis Data I	2	2	A2	Herman,S.Kom.,M.Cs	U-3.02	
Rabu	(5-6)	10:30-14:40	Praktikum Pem. Java Lanjut	2	6	A3	Ramdan Satra,S.Kom.,M.Kom	LAB 2	

Fig. 4. Schedule results for Thursday

Figure 5 displays the results of Tuesday's scheduling. The schedule also displays the schedule of Herman's lecturers not seen Tuesday at 10 to 12

When looking at Figures 4 and 5, it can be seen that the scheduling process immediately schedules the theoretical courses and practical subjects. This gives a good impact on student class schedules because usually in the Departement, the scheduling of theory and practicum lecture is carried out separately which results in a schedule of theoretical and practical collisions and this can harm students..



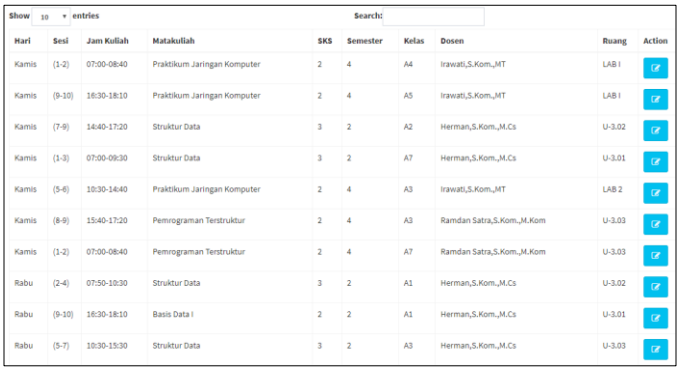
Hari	Sesi	Jam Kuliah	Matakuliah	SKS	Semester	Kelas	Dosen	Ruang	Action
Rabu	(6-7)	13:00-15:30	Praktikum Jaringan Komputer	2	4	A5	Irawati,S.Kom.,MT	LAB I	
Rabu	(7-8)	14:40-16:30	Pemrograman Terstruktur	2	4	A2	Ramdan Satra,S.Kom.,M.Kom	U-3.01	
Selasa	(1-3)	07:00-09:30	Struktur Data	3	2	A1	Herman,S.Kom.,M.Cs	U-3.02	
Selasa	(9-10)	16:30-18:10	Basis Data I	2	2	A1	Herman,S.Kom.,M.Cs	U-3.02	
Selasa	(2-3)	07:50-09:30	Praktikum Jaringan Komputer	2	4	A1	Irawati,S.Kom.,MT	LAB I	
Selasa	(6-8)	13:00-16:30	Struktur Data	3	2	A7	Herman,S.Kom.,M.Cs	U-3.03	
Selasa	(4-5)	09:40-11:20	Praktikum Jaringan Komputer	2	4	A3	Irawati,S.Kom.,MT	LAB I	
Selasa	(8-9)	15:40-17:20	Praktikum Jaringan Komputer	2	4	A6	Irawati,S.Kom.,MT	LAB I	
Selasa	(4-5)	09:40-11:20	Pemrograman Terstruktur	2	4	A3	Ramdan Satra,S.Kom.,M.Kom	U-3.03	
Selasa	(9-10)	16:30-18:10	Pemrograman Terstruktur	2	4	A7	Ramdan Satra,S.Kom.,M.Kom	U-3.03	

Showing 11 to 20 of 25 entries

Fig. 5 Schedule results for Tuesday

Often also happens is a collision between class schedules with thesis exam schedule. This will make the lecturers choose between teaching and testing and most lecturers prefer to test. The incident was more or less detrimental to lecturers and students. In the research object it was determined that the schedule of student thesis examinations on Friday and Saturday. Therefore the lecturer is not scheduled to teach on that day. To answer this, a system is provided to disable the day on the system. For example in this case, first on the system select the menu / day interface and select the day to deactivate.

Figure 6 displays the scheduling results that do not include Friday and Saturday. Scheduling results only schedule lectures until Thursday.



Show 10 entries Search:

Hari	Sesi	Jam Kuliah	Matakuliah	SKS	Semester	Kelas	Dosen	Ruang	Action
Kamis	(1-2)	07:00-08:40	Praktikum Jaringan Komputer	2	4	A4	Irawati,S.Kom.,MT	LAB I	
Kamis	(9-10)	16:30-18:10	Praktikum Jaringan Komputer	2	4	A5	Irawati,S.Kom.,MT	LAB I	
Kamis	(7-9)	14:40-17:20	Struktur Data	3	2	A2	Herman,S.Kom.,M.Cs	U-3.02	
Kamis	(1-3)	07:00-09:30	Struktur Data	3	2	A7	Herman,S.Kom.,M.Cs	U-3.01	
Kamis	(5-6)	10:30-14:40	Praktikum Jaringan Komputer	2	4	A3	Irawati,S.Kom.,MT	LAB 2	
Kamis	(8-9)	15:40-17:20	Pemrograman Terstruktur	2	4	A3	Ramdan Satra,S.Kom.,M.Kom	U-3.03	
Kamis	(1-2)	07:00-08:40	Pemrograman Terstruktur	2	4	A7	Ramdan Satra,S.Kom.,M.Kom	U-3.03	
Rabu	(2-4)	07:50-10:30	Struktur Data	3	2	A1	Herman,S.Kom.,M.Cs	U-3.02	
Rabu	(9-10)	16:30-18:10	Basis Data I	2	2	A1	Herman,S.Kom.,M.Cs	U-3.01	
Rabu	(5-7)	10:30-15:30	Struktur Data	3	2	A3	Herman,S.Kom.,M.Cs	U-3.03	

Fig. 6. Scheduling results without Friday and Saturday

In the previous study, the selection process used the rank selection method, while this study used the roulette wheel method. This test aims to measure the effectiveness of the roulette wheel method compared to the method previously used.

For example there are 10 individuals and each has got a fitness score. Table I shows the fitness values of each individual.

TABLE I
The fitness value of each individual

Individual	Fitness Value
1	0.2
2	0.5
3	0.5
4	0.2
5	0.5
6	0.166
7	0.25
8	0.333
9	0.2
10	0.5
Sum *f(i)*	3.349

By using the selection selection method, the individuals in Table I are sorted or ranked based on the highest fitness value. Next is to generate random values and determine the individuals selected for the next generation. Based on the process of calculation and generation of random values, the individuals selected are individuals 8th, 2th, 10th, 10th, 10th, 7th, 8th, 1st, 8th, and 2nd.

Next, testing is done using the roulette wheel selection method with the same data. Based on Table I, the total fitness value is 3.349. The next step is to find the probability value of each individual. Table II shows the probability values of each individual.

TABLE II
Fitness value and probability of each individual

Individual	Fitness Value	Probability Value
1	0.2	0.059
2	0.5	0.149
3	0.5	0.149
4	0.2	0.059
5	0.5	0.149
6	0.166	0.049
7	0.25	0.075
8	0.333	0.099
9	0.2	0.059
10	0.5	0.149
Sum *f(i)*	3.349	

Then generate a random value [0-1]. Based on the experiment, 10 random values appeared, namely: 0.23, 0.65, 0.82, 0.45, 0.91, 0.32, 0.54, 0.71, 0.22, and 0.43. In Figure 7 an illustration of parent selection is based on probability values and random values generated. Based on Figure 7, the selected individuals are individuals 3rd, 7th, 9th, 5th, 10th, 3rd, 5th, 8th, 3rd, and 5th.

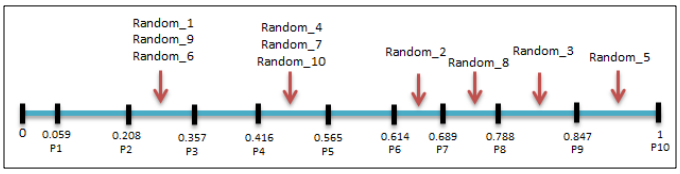


Fig. 7. Selection illustrations based on random values and probabilities

Based on the results of testing of the roulette wheel selection method, it can be seen that this method can maintain the best individuals compared to the selection method used previously. This can be seen from more selected individuals who have the highest fitness value.

IV. Conclusion

The lecture scheduling system using Genetic Algorithms can solve problems when teaching lecturers. Based on the test results, the method of selecting Roulette Wheels is more effectively used in this study compared to the ranking method.

V. Acknowledgment

We would like to thank the Universitas Muslim Indonesia who have helped carry out this research in terms of funding

VI. References

[1] A. J. O. S. Soyemi J., "Electronic Lecture Time-table Scheduler Using Genetic Algorithm.,," *IEEE 3rd Intl Conf on Big Data Intelligence and Computing and Cyber Science and Technology Congress.*, pp. 710-715.

[2] L. S. D. L. Herman., "Lecture Scheduling Automation Using Genetic Algorithm," in *East Indonesia Conference on Computer and Information Technology (EIConCIT), pp: 23-27*, Balikpapan, Indonesia, 2017.

[3] F. Y. L. P. Y. J. Peng C., "Analysis of Double-Resource Flexible Job Shop Scheduling Problem Based on Genetic Algorithm," in *15th International Conference on Networking, Sensing and Control (ICNSC), pp:1-6*, Zhuhai, China., 2018..

[4] G. A. W. W. F. S. Kurniawan B., "A Genetic Algorithm for Unrelated Parallel Machine Scheduling Minimizing Makespan Cost and Electricity Cost Under Time-of-Use (TOU) Tariffs with Job Delay Mechanism,," in *IEEE International Cenference on Industrial Engineering and Engineering Management (IEEM), pp:583-587*, Singapore, 2017.

[5] L. H. a. Q. F., "An Improved Genetic Algorithm for a Parallel Machine Shceduling Problem with Energy Consideration," in *13th IEEE Conference on Automation Science and Engineering (CASE), pp: 1487-1492.*, Xi'an, China., 2017.

[6] Zuo X, " Vehicle Scheduling of an Urban Bus Line via an Improved Multiobjective Genetic Algorithm.," *IEEE Transaction on Intelligent Transportation System*, vol. 16, no. 2, pp. pp:1030-1041, 2015.