Development of an Islamic Higher Education Institution Tracer Study Information System and It's Performance Analysis using ISO/IEC 25010

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Abstract*—Alumni is one of the benchmark points in accreditation to assess the quality of higher education and as a comparison of a learning curriculum, Tracer Study is a method used to collect information about alumni using questionnaires. After the authors of the system analysis of the Universitas Islam Negeri (UIN) Syarif Hidayatullah Jakarta, for now, do not have a Tracer Study Information System, thus the authors want to develop a Tracer Study information system that is integrated with the AIS database and analyzes its performance using ISO / IEC 25010 and uses Rapid Application system development methods Development (RAD). The results of testing using the characteristics of ISO / IEC 25010 are functional suitability Tracer Study Information System with a value of 1, performance efficiency with page responses of less than 5 seconds, compatibility with can be run on several browsers with different versions, Reliability with a value of 100% , usability with a value of 67.5%, maintainability with a value of less than 0.56%, and portability, namely responsive websites in various browser sizes. With the success of this writing, it can facilitate the university in monitoring alumni and getting a comparison of learning curriculum.

Keywords— Information Systems, Software Testing, Tracer Study, ISO/IEC 25010, System Usability Scale

I. INTRODUCTION

Jakarta State Islamic University is one of the universities in Indonesia that has been accredited A until February 27, 2023, by the national accreditation agency BAN-PT (National Accreditation Board of Higher Education) and each department has its own accreditation [1]. One of the points approved by accreditation is based on university alumni data based on guidelines that complement the BAN-PT instrument [2]. The effort to obtain data on college alumni is also called Tracer Study.

Tracer Study is an alumni tracking study that serves to obtain data sources for college graduates. Tracer Study is not only useful for universities in developing their educational processes, but also provides information about the relationship between the process of education services and the world of work. For universities, information about competencies relevant to the world of work can help efforts to improve curriculum and learning systems [3].

The author conducted an interview with Mr. Supardi as the Information System Development Coordinator of the Pustipanda (Information Technology Division) of UIN Syarif Hidayatullah which can be concluded, namely, the first web-based alumni Information System already exists, but only limited to search features and showing alumni profiles, the second Tracer Study system but copyright and source code do not belong to the UIN Syarif Hidayatullah and have not been integrated with the Academic Information System (AIS) database, the three faculties do not yet have a Tracer Study system. Thus the authors draw the conclusion that the UIN Syarif Hidayatullah still do not have an integrated Tracer Study system and is still looking for data by manually distributing questionnaires to alumni, therefore the authors will unite the Tracer Study under one system, UIN Syarif Hidayatullah Tracer Study Information System website-based.

To analyze the quality of the website Tracer Study Information System there are various quality models that have been developed. The following is a comparison of the characteristics of each model in Table I [4]:

TABLE I COMPARISON OF THE CHARACTERISTIC QUALITY MODEL OF THE SOFTWARE

Characteristic	Mc Call	Boe hm	FU RPS	Dro mey	ISO-9126	ISO-25010
Functional Suitability			X	X	X	X
Efficiency	X	X		X	X	X
Performance			X		X	X
Compatibility						X
Usability	X		X	X	X	X
Reliability	X	X	X	X	X	X
Security						X
Maintainability	X			X	X	X
Portability	X	X	X		X	X

Based on Table I, it can be seen that ISO 25010 has all the characteristics compared to other models.

ISO 25010 is one of the ISO standards that emerged in 2007. ISO 25010 is a standard based on ISO 9126 and one of its main objectives is to guide the development of software products with specifications and evaluation of quality requirements. ISO 25010 has 8 aspects in determining the

quality of the application, namely Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability [4]. Therefore the author uses ISO 25010 as a method for analyzing the quality of the Tracer Study Information System website.

In the development of the website, there have been many available various kinds of PHP and CSS frameworks, while examples of PHP frameworks are Laravel, CodeIgniter, Symfony, CakePHP, and Zend while examples of CSS frameworks are Boostrap, Foundation, Bulma, Ulkit and Semantic UI.

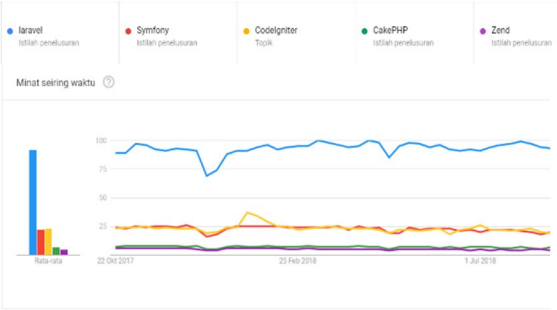


Fig. 1. Framework PHP [5]

Based on Figure 1 is an interest graph along with time from google trends, it is known that Laravel framework is the most popular framework in 2017-2018.

Therefore, the authors made a study by analyzing the application development of UIN Syarif Hidayatullah Tracer Study Information System using ISO / IEC 25010 and Laravel as the PHP framework used.

II. Related Works

In the Ernes et al. research entitled the College Career Center and Tracer Study System [6], This research makes a tracer study information system but has not yet integrated users with the university database.

Then in Zumrotul research entitled Development and Quality Analysis of Guidance Information Systems for Thesis Final Project Online for Students at the End of Electronics Engineering Education at Ft Uny [7], This research makes online guidance information systems then analyzed using ISO 25010 except compatibility but users are not yet integrated with the university database.

Then in the research of Zulfikar et al, entitled Information System of Tracer Study Alumni of Semarang State University with Digital Maps Application [8], This research makes a tracer study information system but has not yet integrated users with the university database.

It can be concluded that from the three studies above made information systems that have not been integrated with the central database or have not been centralized. with the centralization of data, it will be easier to monitor and exchange data.

III. Methodology

In this research, the author uses the method of developing a Rapid Application Development (RAD) system consisting of Requirement Planning, Workshop Design, and Implementation [9].

A. Requirement Planning

In the planning phase conditions there are two stages, namely:

1) Collecting data and information, namely the stages of collecting interview data to facilitate system identification.
2) Identify the system to solve problems that exist in the Tracer Study Information System.

B. Design Workshop

At this stage, the author designed the proposed system so that it could run better. The steps taken include:

1) System Design
   a) Designing processes on the system using UML that is by making Use Case Diagrams, Activity Diagrams, Sequence Diagrams, and Class Diagrams. The author uses software (Umlet, Visio) and web tools (WebSequenceDiagram, Draw.io) in the design.
   b) System database design on systems using ERD the author uses the web too draw.io in the design.
   c) c) Designing the user interface on the system using the wireframePro web tool.
2) Writing the Programming Code

   At this stage, a program is made on the designs that have been defined. The author in writing programming code uses visual code.

C. Implementation

After the system design and writing the programming code are complete, the next steps are the application installation and system testing. The system testing phase is done to ensure the system can be used. The author uses the ISO / IEC 25010 standard to conduct system quality testing and analysis.

1) Functional Suitability

Analysis for testing functional suitability uses a checklist method that contains functions that have been designed before and will then be validated by an expert programmer in developing Information Systems.

This characteristic measurement is done by the formula from the Feature Completion matrix in equation (1) below [10].

$$X = \frac{I}{P} \quad (1)$$

P = Number of functions designed.
I = Number of functions successfully implemented in the system.

In the Feature Completeness matrix, the value close to 1 indicates that most of the proposed features have been successfully implemented.

2) Performance Efficiency

Analysis for testing performance efficiency uses the GTmetrix web tool, using GTmetrix will display the total response to load a website. According to Suffian, Fahrurazi and Ibrahim [11], System response time must be less than or equal to 5 seconds.

3) Compatibility

This analysis for compatibility testing uses Powermapper to see whether a website is compatible or not with a different browser version

4) Usability

The analysis for usability testing was by distributing questionnaires using the System Usability Scale (SUS) method which contained 10 question points to 14 respondents consisting of 12 alumni and 2 admin from UIN Jakarta student affairs. As for determining the number of respondents is using the quota sampling technique.

As for the SUS score calculation method that is by way of each question with an odd number, the respondent's answer scale is reduced 1. Every question with an even number is 5 minus the respondent's answer scale. The results of the scale are 0 to 4 (four being the most positive responses). Sum the respondent's answer scale and multiplied by 2.5. Next, determine the average answer of all respondents [12]

5) Reliability

This analysis for reliability testing using LoadImpact will know the reliability of a website with the specified time period and number of users. Then it will be calculated by the Nielson formula in equation (2) to find out the standard of a reliable website.

$$R1 = 1 - \frac{ne}{n} \quad (2)$$

Information :
R1 = *Reliability Value*
ne = Number of failed requests
n = Number of requests

According to Asthana & Olivery [13] in writing Ahkamiyati [7] in Telcordia standards, the test results are said to fulfill the reliability aspect if the percentage is worth at least 95%.

6) Maintainability

This analysis to test maintainability uses phpcpd to see the duplicate code that is on the PHP controller. Code duplication is one of the factors that greatly complicate maintenance and changes in software systems [14].

7) Portability

Analysis for testing this portability uses the web tool, Browserstack. An evaluation of portability is based on the browser, screen size, and screen resolution. Portability of a set of attributes that depend on the ability of software to be transferred from one environment to another [10].

IV. Result and Discussion

Figure 2 is a use case diagram of the Information System Tracer Study in general where there are three actors, namely admin, alumni, and the end of the website.

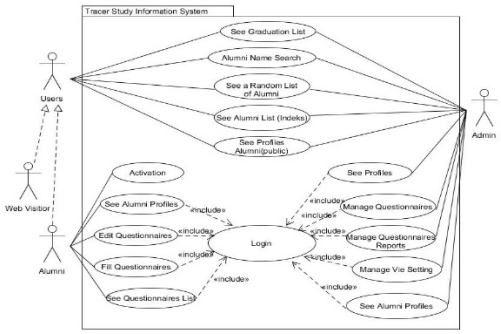


Fig. 2. General Use Case Diagram

A. Functional Suitability

In the characteristics of functional suitability, testing for expert programmers, namely Mr. Supardi, uses a questionnaire that contains functions in the Tracer Study Information System. The test results are attached to the functional suitability test results with a total of 28 functions and 28 functions that are successful and 0 functions that fail. Thus the calculation is carried out using the Equation 1. So the calculation of functional suitability is:

$$X = \frac{28}{28} = 1$$

Based on the calculation of functional suitability, the Tracer Study Information System is declared good, because the value of X approaches 1, which means that all proposed functions are successfully implemented. Therefore, it can be concluded that the Tracer Study Information System works well for testing functional suitability.

B. Performance Efficiency

On the characteristics of performance efficiency, testing is done using the GTmetrix web tool, which in the web tool has 2 scores, namely pageSpeed and Yslow. The results of performance efficiency testing on the Tracer Study Information System will be placed in the following Table 2 :

TABLE II Results of Performance Efficiency Testing using GTmetrix

The website page that was tested	PageSpeed Score	Yslow Score	Response Time
Start page of the Tracer Study Information System website	89%	88%	2.8s
The results page of the graduation list	86%	73%	3.8s
Page see alumni profile for website visitors	88%	86%	3.3s
Alumni search results page	88%	83%	4.2s
Alumni list results page based on index to -	76%	73%	4.3s
Login page	88%	88%	3.0s
Activation page	88%	88%	3.0s
Average	86.14%	82.71%	3.48s

Based on Table II, the results of performance efficiency testing show the average response time of the system is 3.48 seconds with a score of B (86.14%) using pageSpeed and score B (82.71%) using Yslow through the GTmetrix website. Based on the calculation of performance efficiency, the Tracer Study Information System is declared good,

because the system response is less than 5 seconds. Therefore, it can be concluded that the Tracer Study Information System works well for testing performance efficiency.

C. Compatibility

In this compatibility characteristic, testing is done using the Powermapper web tool, which in this website will run the alumni Information System website in various browser versions such as Figure 3.

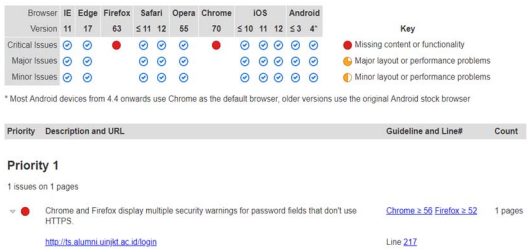


Fig. 3. Compatibility Test Results using Powermapper

Based on Figure 3 the compatibility test results show that the Tracer Study Information System website is compatible with IE browser (Internet Explorer) version 11, Edge version 17, Safari Version 12 down, Opera version 55, IOS version 12 down, Android version 4 down, Firefox version 63 and Chrome version 70. But in Firefox and Chrome get an alert when you want to access the login and activation page because it doesn't use https this is due to security issues. Therefore, it can be concluded that the Tracer Study Information System works well for compatibility testing.

D. Usability

In this usability, characteristic testing is done by giving a questionnaire that uses the System Usability Scale (SUS) method which consists of 10 question points and 5 answer options from strongly disagree to strongly agree to 14 respondents consisting of 12 alumni and 2 admin from student affairs UIN Syarif Hidayatullah. The calculation for the SUS method is Every question with an odd number, the respondent's answer scale is reduced 1. Every question with an even number is 5 minus the respondent's answer scale. Then the calculation results will be shown in Table III.

TABLE III RESULTS OF SUS SCORE CALCULATIONS

Respondents	Results	Score
1	33 X 2.5	82.5
2	29 X 2.5	72.5
3	34 X 2.5	85
4	29 X 2.5	72.5
5	16 X 2.5	40
6	18 X 2.5	45
7	29 X 2.5	72.5
8	28 X 2.5	70
9	30 X 2.5	75
10	25 X 2.5	62.5
11	25 X 2.5	87.5
12	32 X 2.5	80
13	20 X 2.5	50
14	20 X 2.5	50
Average		945 / 14 = 67.5

Usability test results based on Table III can be seen that the average SUS score is 67.5.

Based on Figure 4 which is the basis of SUS assessment, the value of 67.5 is still acceptable, therefore it can be concluded that this testing usability works well.

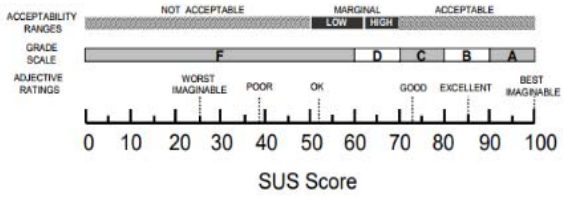


Fig. 4. SUS Score

E. Reliability

In this reliability characteristic using the LoadImpact web tool in this website will run a test on the alumni Information System website with the condition of 100 users who access the website for 15 minutes and use the stress test method that produces a graph like a Figure 5.

Fig. 5. Graph of Reliability Test Results using Loadimpact

In Figure 5, no request failed with a total of 100 VUS (Virtual Users) with a maximum response time of 4.89 seconds and the highest request rate 81 requests/second.

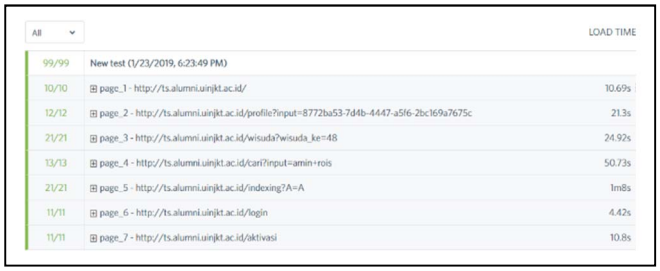


Fig. 6. Input The Reliability Test Results Using Loadimpact

Based on Figure 6 it can be seen that LoadImpact requests a total of 99 requests with successful 99 results and 0 failings. Then the results are calculated using the nelson formula of Equation 2, so the calculation of reliability is as follows:

$$R1 = 1 - \frac{0}{99} = 1$$

Based on the calculation of reliability, the Tracer Study Information System is declared reliable with a Telcordia standard of at least 95%. Because the results of the calculation of reliability 1 are if it is made into percent, the result is 100%. Therefore, it can be concluded that the Tracer Study Information System works well for reliability testing.

F. *Maintainability*

In this maintainability characteristic, it uses `phpcdp` to check for duplicate code on the Controller. The results of testing maintainability will be shown in Figure 7.

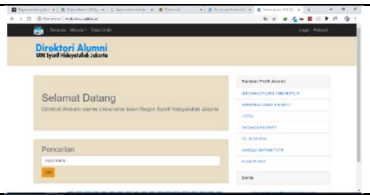
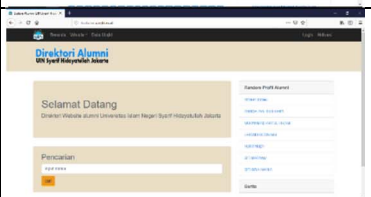
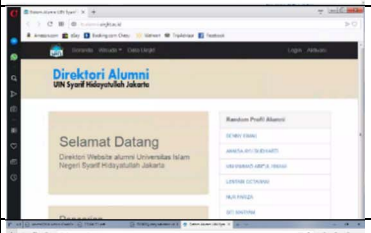
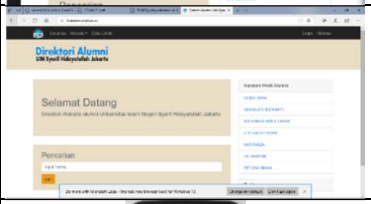
```
c:\Users\Juniko\Project\alumni\vendor\bin>phpcpd   Controllers/
phpcpd 4.1.0 by Sebastian Bergmann.

No clones found.

Time: 166 ms, Memory: 6.00MB

c:\Users\Juniko\Project\alumni\vendor\bin>
```

Fig. 7. Results from Testing PHPCPD on the Website System Controller

Based on Figure 7, it can be seen that there is no duplication of the code that occurs in the Tracer Study Information System controller. Therefore the Tracer Study Information System works well for testing maintainability.

G. *Portability*

TABLE 4: PORTABILITY TESTING RESULTS IN DESKTOP BROWSER

Browser	**User Interface**	***Error***
Google Chrome		No error
Mozilla Firefox		No error
Opera		No error
Microsoft Edge		No error
Chrome android		No error

This portability characteristic uses browserling to try the Tracer Study Information System website in various different browsers (Desktop) and use browserstack test for chrome (Mobile) browsers. The following are the results of portability testing in Table IV.

Based on Table IV, the results of portability testing show that the system can be run in several browsers (Chrome, Mozilla Firefox, Opera, Edge, and Chrome Android) without any errors in appearance or functionality. Therefore, it can be concluded that the Tracer Study Information System works well for portable testing.

H. Metrics ISO / IEC 25010 Testing Results

In Table V, the results of the ISO / IEC 25010 test metrics are based on the characteristics of the model along with calculation methods and tools used to measure software quality.

TABLE V METRICS ISO / IEC 25010 TEST RESULTS

Characteristics	**Calculation**	**Tool used**	**Result**
Functional Suitability	$X = \frac{I}{P}$	None	1
Performance Efficiency	None	GTmetrix	Response time<5 s
Compatibility	None	Powermapper	No error
Usability	System Usability Scale	None	67,5%
Reliability	$R1 = 1 - \frac{ne}{n}$	LoadImpact	100%
Maintainability	$Skor_d = \min(-30\ x\ log10(codedup) + 60,1)$	PHPCPD	0%
Portability	None	Browserling	No error

V. CONCLUSION

Based on the discussion conducted, it can be concluded that:

1. Furthermore, the Tracer Study Information System that was successfully developed was analyzed using 7 characteristics of ISO / IEC 25010, namely functional suitability with the results of all functions running well, performance efficiency with the average page response results of less than 5 seconds, compatibility with results in some browsers (Internet Explorer version 11, Edge version 17, Safari Version 12 publicity, opera version 55, IOS version 12 down, android version 4 down, firefox version 63 and chrome version 70), usability with results, reliability is 100% means that no request failed, maintainability with the result that there is no duplicate code found on the PHP controller, and portability with responsive website results.
2. With the successful development of the Tracer Study Information System, it will make it easy for UIN Syarif Hidayatullah to monitor and collect information about alumni of the UIN Syarif Hidayatullah.

Suggestions should be made, as follows:

1. Development of a mobile version (android and IOS)
2. Can add job features so that alumni get an interest in accessing the Tracer Study Information System.
3. 3. Adding 1 characteristic, namely security in analysis using ISO / IEC 25010.

VI. REFERENCES

[1] banpt.or.id, "Pencarian Institusi," *BAN-PT*, 2018. [Online]. Available: https://banpt.or.id/direktori/institusi/pencarian_institusi.php. [Accessed: 17-Oct-2018].

[2] BAN-PT, "Peraturan Badan Akreditasi Nasional Perguruan Tinggi Nomor 4 Tahun 2017 Tentang Kebijakan Penyusunan Instrumen

Akreditasi," 2017.
[3] M. Dr. Jejen Musfah, *Pendidikan Islam: memajukan umat dan memperkuat kesadaran Bela Negara*, 1st ed. Jakarta: KENCANA, 2016.
[4] J. P. Miguel, D. Mauricio, and G. Rodríguez, "A Review of Software Quality Models for the Evaluation of Software Products," *Int. J. Softw. Eng. Appl.*, vol. 5, no. 6, pp. 31–53, Nov. 2014.
[5] trends.google.com, "laravel, Symfony, CodeIgniter, CakePHP, Zend," 2018. [Online]. Available: https://trends.google.com/trends/explore?q=laravel,Symfony,%2Fm%2F02qgdkj,CakePHP,Zend. [Accessed: 17-Oct-2018].
[6] E. C. Nugroho and I. Nugroho, "Sistem Pusat Karir Dan Tracer Study Perguruan Tinggi," vol. 7, no. 1, pp. 1–5, 2018.
[7] Z. Ahkamiyati, "Pengembangan Dan Analisis Kualitas Sistem Informasi Bimbingan Tugas Akhir Skripsi Online Untuk Mahasiswa Tingkat Akhir Pendidikan Teknik Elektronika Ft Uny," Universitas Negeri Yogyakarta, 2016.
[8] Z. A. Nugroho and R. Arifudin, "Sistem Informasi Tracer Study Alumni Universitas Negeri Semarang Dengan Aplikasi Digital Maps," *Sci. J. Informatics*, vol. 1, no. 2, pp. 153–160, 2014.
[9] K. Kendall, *System Analysis and Design*. Upper Saddle River, New Jersey: Pearson Prentice Hall, 2011.
[10] A. Acharya and D. Sinha, "Assessing the Quality of M-Learning Systems using ISO / IEC 25010," no. 3, 2013.
[11] M. D. M. Suffian, F. R. Fahrurazi, and S. Ibrahim, "The Design and Execution of Performance Testing Strategy for Cloud-based System," *Int. J. Softw. Eng. Technol.*, vol. 1, no. 2, pp. 19–25, 2014.
[12] U. Ependi and F. Panjaitan, "System Usability Scale Antarmuka Palembang Guide Sebagai Media Pendukung Asian Games XVIII," vol. 3, no. 2, 2018.
[13] A. Asthana and J. Olivieri, "Quantifying software reliability and readiness. Communications Quality and Reliability," *IEEE Int. Work. Tech. Comm.*, pp. 1–6, 2009.
[14] Paul Jansen, "The TIOBE Quality Indicator a pragmatic way of measuring code quality," 4.3., vol. 3, 2018, pp. 1–16.