Tracer study information system for higher education

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Abstract. A good education system has a looping system in which the responsibility of higher education for students does not end at graduation but also related to the sustainability of graduates careers so that they are better prepared to work in the community. The purpose of this study is to develop a one-door Tracer Study Information System managed by universities to improve the quality of graduates through improving the education process. The results of the tracer study as feedback are expected to be an input for the education system, curriculum, student activity direction, and Universitas Negeri Jakarta (UNJ) policies which include the development of student hard skills, soft skills, and life skills. A reliable tracer study system is due to the availability of adequate resources, namely information systems, survey teams, publications, also the reward and punishment given to respondents. The prototype was developed using the waterfall method which went through several stages specifically analysis, design, implementation, testing and maintenance. The prototype was tested using black box testing. Based on the functional test, it is known that all functions of the system prototype are running according to plan.

1. Introduction
Tracer study is a study of high-performing organizing institutions [1]. The results of the tracer study are a powerful tool for documenting work, shifting workplaces and levels of satisfaction in terms of University service satisfaction levels, learning environment and facilities. Tracer study can also be used to see the abilities and competencies of undergraduate programs provided that programs are still effective, appropriate and relevant in the rapid and complex development developed by emerging developments [2]. Tracer studies that reveal results obtained by educational programs can be tracked using unique sampling techniques that can provide useful information related to the quality of educational programs offered to alumni. This study used a descriptive survey including demographic profile, employment characteristics, and job satisfaction of graduates. It is an evaluation of the curricular offerings on how useful, relevant, applicable, and adequate competencies (knowledge, skills, and attitude) of the graduates have achieved by the vision, mission, goals, and objectives (VMGO) of their respective study program [3].

The benefits of Tracer Study for study programs can be used as a condition for completing accreditation by the National Accreditation Board of Higher Education (BAN-PT) [4]. The main problem of the tracer study is its coverage. It is not easy to reach alumni and ask them to fill out the survey. Only successful alumni are willing to respond to the survey [5]. Other alumni may not be willing...
to fill out the survey, which is the same as the survey fulfilling some private information (e.g. salary). Moreover, an effective tracer system can also contribute to poor coverage. Here, the selection of media to reach alumni can affect this issue.

As a reference for carrying out this research, several studies on tracer study will be explained in outline. The First, the research conducted by H. Toba et al. [6] propose a strategy of gathering information by gathering information spread on the Internet through search engines. This research focuses more on alumni search without information systems, only using search engines on the internet. Second, the research conducted by A. Wibisono, et al. [7], as one of the prominent university in Indonesia, Institut Teknologi Sepuluh November (ITS) recognizes the need of integrated tracer study to maintain its curriculums competitive to address stakeholders’ needs. The term integrated here is used to distinguish this program with previous tracer study efforts conducted independently by each department within ITS. Then the third study from Renny, et al. [8] states that the results of the Tracer Study can be used by universities to determine the success of the educational process that has been carried out on their students. Therefore, universities need a technology service to support the optimization of the use of tracer study. One of those is the use of a website to facilitate the conduct tracer study. Most services tracer study provides information to the college, like year graduated, got a job waiting period, the first salary to work, first job, the relevance of the curriculum to the work, and compliance with the major areas of work taken in college. Therefore in this study we made Universitas Negeri Jakarta as a case study of this research in order to improve services for the campus community.

2. Material and methods

2.1. Material

Universitas Negeri Jakarta (UNJ) currently runs a partial Tracer Study. The Tracer Study is carried out by each Study Program. Tracer Study is usually done only when applying for accreditation. Data Tracer Studies cannot be elaborated into institutional policies because they are only collected at the level of the study program. The Tracer Study conducted by the Study Program did not go hand in hand so that the policies taken by the institution also only resolved case by case for several Study Programs that had conducted Tracer Studies.

2.2. Methods

This Tracer Study Information System was developed using the Waterfall Software Development Lifecycle Model. Lifecycle Software Lifecycle Model Waterfall is the process of developing / making a software that is sequential from one process to the next [9]. In this model, there are several stages / phases to be carried out, namely: analysis, design, implementation, testing, and maintenance.

The First, in the analysis phase, the needs of the Tracer Study Information System are identified. The system requirements consist of functional, and non-functional needs. Functional requirements, containing functions that must exist, and will be made in the Tracer Study Information System. One example of a function that must be made is that Alumni can fill out the Form Tracer Study. Non-functional requirements can be identified as supporting needs to create a Tracer Study Information System.

The second stage, namely design, is the development stage of the first stage. At this stage what is done is making Use Case Diagrams and Activity Diagrams. Use Case Diagram is a diagram that describes what functions / features are in the system. Activity Diagram is a diagram that will describe the processes that occur in the system. Based on Use Case Diagrams that have been created then the Activity Diagram will describe technically the processes that will occur.

The third stage, namely the implementation stage, namely implementing the design results from the fourth stage, into the programming language. In the Tracer Study Information System, the Programming Language used is PHP with MySQL Database.

The fourth stage, namely the testing phase, is the testing phase of the system that has been made. The test method uses functional tests which are part of the standard application feasibility according to ISO
which includes functional aspects of suitability, performance efficiency, usability, reliability, maintainability, and portability [10]. This test method focuses on the side of the functionality of the system. Are functions that have been made can run well, and as expected.

The last stage, maintenance is the monitoring and repair stage if there is a bug in the system. If there are still bugs, it will continue to be improved, developed, and enhanced features in the system to be more useful, and relevant to the needs of users (Alumni). The purpose of this stage is that the system can continue to run well, along with the development of the world of technology, and information.

3. Results and discussion
In designing and constructing this tracer study system there are stages of the research carried out covering:

3.1. Analysis
Based on observations made on the process of tracer studies conducted by each study program, data on Alumni needs by the Bureau of Academic Student and Public Relations (BAKHUM), especially the Alumni Subdivision of UNJ, the Vice Rector for Student and Alumni Affairs UNJ, and the Ministry of Research and Technology can be obtained the information is BAKHUM UNJ has alumni data through the graduation registration form which is then sent to the BAKHUM Alumni Subdivision Head. The study program has a partial tracer study data because it only does data collection when it will apply for study program accreditation. the Vice Rector for Student and Alumni Affairs UNJ field every year must report the results of the study tracer to the Ministry of Research, Technology and Higher Education where the study tracer data is in each study program. In accordance with the provisions of the Ministry of Research, Technology and Higher Education, Tracer studies must be carried out by Universities for graduates in the current year up to three years before. So based on the analysis of the system that is running, the system requirements are formulated as shown in Table 1.

| No | System Requirements                                               |
|----|-------------------------------------------------------------------|
| 1  | The system can verify and validate the user ID and password       |
| 2  | The system can manage data administrators                         |
| 3  | The system can manage graduates / alumni data                     |
| 4  | The system can manage graduate personal data                      |
| 5  | The system can manage stakeholders' data                          |
| 6  | The system can manage tracer study instruments                    |
| 7  | The system can provide a tracer study report                      |

3.2. Use case diagram
Based on the analysis of the study of information system requirements, the Use Case diagram can be described as shown in Figure 1. According to the need analysis of the information system of the tracer study to be developed, it can be identified that the system will have 5 types of users, that are:

3.2.1. Admin of university. The University Admin has special rights and authority to manage the entire data of the University's tracer study information system. The University Admin is responsible for managing data and full responsibility for data and information from tracer studies. University admin have all access and application services so that the information presented is more accurate, effective, and efficient in assisting leaders in making decisions. University admins can manage study tracer instruments at both the university level and Study Program.

3.2.2. Admin of study program. The study program admin has access rights to manage data and information based solely on the origin of the study program, meaning that the study program admin cannot see the tracer study data from other study programs because of restrictions on access. The study
program admin has the duty to validate and check alumni data whether it is in accordance with the data in the study program. Tracer study data can later be used by study programs to be used in the study program accreditation process. Study Program Admin can manage study tracer instruments with limited target in the Study Program.

![Diagram](image)

**Figure 1.** Use case of tracer study system.

3.2.3. **Graduates/Alumni.** Alumni are data sources from tracer studies where alumni are required to register to be able to enter the information system application for tracer studies to then fill out the tracer study questionnaire. Alumni get the ease of registration by using an email to register after they can log in and fill in the tracer study. Alumni can manage their personal identities.

3.2.4. **Stakeholders.** Stakeholders are third parties involved with the University. The form of stakeholders can consist of individuals, entities, institutions, business units, or companies. Stakeholders in the tracker study receive as part of the user obtaining / alumni. Stakeholders also provide input (feedback) from the registration application.

3.2.5. **Guest.** Guest is an ordinary user who can only view general information from the tracer study information system such as a news page and see a list of alumni who have registered in this system.

3.3. **Implementation**

The development of an information system for tracer studies using the PHP programming language and MySQL database. Examples of system development results are shown in Figure 2 (2a-2f).
3.4. Testing

After the implementation process is complete, the testing process will then be carried out to find out whether the application has been built in accordance with the identification of the needs obtained during the process of engineering needs or not. The testing process used is functional testing with Blackbox testing. In this stage of Functionality Testing, testing will only focus on the functionality of the Tracer Study Information System. Each function will be tested (with predetermined test points), whether each of the existing functions can run well as expected. For example, the test points of the Tracer Study Information System are testing the Blackbox for the Login Page. The following are the results of testing the Blackbox Method on the login page as shown in Table 2. Based on the results of functional testing, it can be seen that all functions developed can run well on localhost without any obstacles.
Table 2. Black box testing on the login page.

| Test ID | Testing Scenario | Results are Expected | Result | Note |
|---------|------------------|----------------------|--------|------|
| A.1     | Log in with the correct username and password | Successfully logged in (entered the user page) | V      | Valid |
| A.2     | Log in with the correct username but the password is incorrect | Login failed with the description "The username or password you entered is incorrect" | V      | Valid |
| A.3     | Log in with the incorrect username but the password is correct | Login failed with the description "The username or password you entered is incorrect" | V      | Valid |
| A.4     | Log in with the incorrect username and password | Login failed with the description "The username or password you entered is incorrect" | V      | Valid |

3.5. Maintenance
In this study, the maintenance phase has not been carried out because the testing phase is still done locally.

4. Conclusion
The results of system testing using black-box testing techniques, namely testing carried out by observing the results of execution and checking the functionality of the software show that the system has been running properly on a localhost basis and can be continued at the implementation stage on the internet network. For further, this system will be tested in terms of speed and responsiveness of the interface and security issue of the website system.

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