Quality assurance testing to improve the quality of human resource management system

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Abstract. Developing a Human Resource Management System has minimum requirements that are needed to be fulfilled, which are software that can do and manage the schedule, roles, positions, attendance, leave, company's bulletin, and employee tracking. Human Resource Management System in its development concerns its quality, which one of the attempts in confirming the launched quality software is doing the quality assurance test. The quality assurance testing is needed to verify the application developed has been qualified to why launched the software. The quality assurance testing will provide several recommendations by giving information to detect system errors, providing information to prevent system errors from recurring, knowing the system's capability limits, and providing product quality information. This study conducted quality testing for a human resource management system for 62 test cases, including nine modules and two non-functional requirements.

1. Introduction
A software house and startup concerned with information and communication technology has produced and developed much software. Human Resource Management System is one of which is set in the startup field. The application itself has been developed to help the activities of Human Resource Management (HRM). HRM is the science or even strategic approach in organizing the relation between employees and their roles efficiently, effectively, and optimally until the goal is achieved [1]. The concept of HRM acknowledges each employee as a human being, not a machine, and not merely used as business resources. HRM shows its essential role in a company; it has two main goals by the company, which are management of people (productivity) and objectives of the organization (corporate profits) [2][3]. HRM is regarded as the critical component to promoting economic performance. The more qualified the company's human resource, the higher productivity for the company, related to corporate profits, the more suitable its human resource, the higher productivity will gain the more significant profits. Acknowledging these goals, Human Resource Software significantly needed for a company.

Developing a Human Resource Management System has two minimum requirements that needed to be fulfilled: software that can do and manage the schedule, role, position, attendance, leave, company’s bulletin, and employee tracking. Human Resource Management System in its development concerns to its quality, which one of the attempts in confirming the launched software quality is doing the Quality Assurance (QA) test. QA testing is needed to be done to verify that the application which has been developed has been qualified as the intention why the software launched. Furthermore, QA testing can also minimize bugs [4] in software found and used by end-user.

In Human Resource Management System, QA testing is carried out in several stages, which are 1) Analyzing the software testing requirements, 2) Designing test cases, 3) Conduct software testing, and the final step is 4) Submitting test results and recommendations. This study carried out test cases at 62 test cases covering nine modules and two non-functional requirements. Implementation of test cases
will be done by using Black-box Testing [5][6], Load Testing [7][8], and User Acceptance Testing (UAT) [9][10]. Thus, QA testing will provide several recommendations by providing information to detect system errors, providing information to prevent system errors from recurring, knowing the system's capability limits, and providing product quality information.

2. Methods
This research is carrying out four stages of QA testing for the Human Resource Management System, which are 1) Analyzing the software testing requirements, 2) Designing test cases, 3) Conducting software testing, and the final stage is 4) Submitting test results and recommendations. In Figure 1 can illustrate the QA process framework through the stages:

![Figure. 1 Research stage diagram](image_url)

3. Result and Discussion

3.1. Analyzing the software testing requirements
Your paper's text should be formatted as follows: This stage is the first step in QA testing by determining the methods of software testing, analyzing software specifications and software requirements. This stage is aimed to simplify the process of test case designing in software applications. The method used in software testing is black-box. Black-box testing aims to conduct software testing in specification aspects without testing the program's design and code to find out the suitability within the function and the specification requirement. The black-box method is easy to be conducted because it only requires the upper and lower limit of the expected data. Specification and software requirements will be divided in 2 sections which are functional requirements and non-functional requirements. In this study, black-box testing is conducted to find out categories errors: functionalities that do not work or are missing, errors
in the design interface, errors in software performance, and errors in initiation and termination. The steps taken at this stage are divided into 3, namely 1) Introduction of Human Resource Software, 2) Identification of functional requirements, and 3) Identification of non-functional requirements.

In introducing a human resource application, information is obtained that the application user is a staff in the human resource section, referred to as admin. This application has features to manage employee schedules, roles, positions, attendance, leave, company bulletins, and employee tracking and has functionality tailored to the needs of the admin. Several main modules, including Authentication Module, Users Module, Users Role Module, Group Module, Attendance Module, Leave Module, Schedule Module, Bulletin and News Module, Location Module, are developed in this research (see Table 1). The next step is identifying functional requirements that contain processes or services provided in the application system. Applicable requirements are divided into several modules and the researcher details the functions needed in the modules.

Table 1. Functional requirements

| Module                  | Function                                                                 |
|-------------------------|--------------------------------------------------------------------------|
| Authentication Module   | The system can log in using email and password and log out active user sessions. |
| Users Module            | The system can create a new user by inputting name, email, roles, staff type, phone number, entry date, photo, and description; activate and deactivate user that has been created; update user’s data; and display active user, non-active user, all users, user’s search and user’s |
| Users Role Module       | The system can create a new role by inputting the role name and head's position; display the role structure hierarchy; update the user’s role data, and display all the user’s roles. |
| Group Module            | The system can create a new group; add members in a group; delete member/s in a group; activate and deactivate groups; and display the active group, non-active group, and all groups. |
| Attendance Module       | The system can input the attendance of a specific user; display attendance data based on a particular period; display attendance data based on specific activities; and export excel based on a filter |
| Leave Module            | The system can add any types of employee leave by inputting type, leave budget, leave category, how to take the leave, and the role allowed taking leave; activate and deactivate leave types; display active leave type, non active leave type and all types of leave; update the leave type; display the list of applied employee leave by user; and accept and reject applied employee leave |
| Schedule Module         | The system is able to create a schedule for each user, group or even bulk schedule; duplicate schedule; create a schedule for group/ unit; delete user's plan; and add check-in location, check-out location, minimum labor hours, and visit schedule while creating a schedule for the user |
| Bulletin and News Module| The system can create news that few users can only read; create a bulletin that all company staff can read; and create a bulletin that can be shared, liked, and bookmarked. |
| Location                | The system can add the location by inputting the address, region, country, tolerance and name of the location; activate and deactivate the location; connect the location with maps; and display the active location, non-active location and all locations |

The third step in this stage is arranging non-functional requirements that contain the limitation of services offered by the application, which can affect the application's functional requirements, namely usability, and load. Usability requires that this system has a user experience and user interface that can ease users' ease of use. Meanwhile, Load requires that the system minimally be used by at least 1000 users simultaneously.
3.2. Designing Test Case

At this stage, the Test is carried out on UAT, which verifies the application's features and ensures it can function properly when used [11]. In the UAT process, software testing is directly conducted by user. UAT produces test documents that can be used as evidence that the application is accepted or not by the user. It can do whether the software's features work correctly on the user.

Functional requirements of the system and non-functional requirements usability will be tested using the black-box method. Non-functional requirements load will be tested using the load testing method with Apache Benchmark (AB) tools. Load testing is a testing performance technique to measure various load conditions to determine the state of the software when several users access the software simultaneously. Load testing is needed to simulate software access simultaneously. This way is better than inviting dozens of people to access a website. Load testing can be conducted using AB tools. To run AB, it requires several parameters, namely the number of requests at the same time, the number of connections made to the destination server, and the URL of the page to be processed. AB is a tool for performing load testing and benchmark testing for Hypertext Transfer Protocol (HTTP) servers. AB is run through the command line and produces output quickly. AB is automatically installed on the Apache webserver or can be installed separately.

The researcher arranged the test case design to ensure the functional and non-functional requirements of the human resource software according to the expected results. The test case design is prepared for all available modules by completing the document containing the id test, description, test step and Expected Outcome. In this study, a description and expected outcome of each module's test case design will be presented (see Table 2).

| Id   | Test Case      | Description                                                                 |
|------|----------------|-----------------------------------------------------------------------------|
| Auth | Authentication module | Test case design serves to check the user who will access the software. The authentication module consists of 2 functions, namely login, and logout. |
| User | User module    | Test case design works for managing user data. User module consists of 4 functions which are adding user, updating user, activating user and deactivating user |
| Role | Role module    | Test case design works for organizing roles data. Role module consists of 3 functions: adding role, updating role, and seeing its positions and hierarchy. |
| Group| Group module   | Test case design works for group data. The group module consists of 3 functions: creating a group, adding group members, and deleting group members. |
| Attendance | Attendance module | Test case design works for managing attendance data. The attendance module consists of 3 functions: inputting attendance, displaying attendance, and exporting attendance data. |
| Leave | Leave module, | Test case design works for managing employees' leave data. The leave module consists of 7 functions: creating the types of leave, deactivating the kind of leave, displaying the type of leave, updating type of leave, displaying the list of leave requests, accepting the leave request and rejecting leave request. |
| Schedule | Schedule module | Test case design works for managing schedule data. The schedule module consists of 4 functions: creating the schedule, duplicating the schedule, creating the schedule unit, and delete program. |
| News | News and bulletin module | Test case design works for managing bulletin and news data. Bulletin and news data consist of 4 functions: create |
Load testing design is needed as a guide to do load testing using AB tool. This load testing becomes a form of simulation when the software is run in the actual state, it takes the input variable as a parameter (see Table 3).

Table 3. Test case design of load testing

| Input Variable                                                                 | Expected Outcome               |
|-------------------------------------------------------------------------------|--------------------------------|
| The number of times the URL was accessed \((n) = 1000\)                       | Failed requests: 0             |
| Number of URLs accessed at the same time \((c) = 1000\)                      | Requests per second: > 2000/sec|

3.3. Result of Software Testing

The implementation of this Human Resource Management System has been done using black box testing based on test case design previously made. The Test is carried out on all modules and according to the design of the test case.

Table 4. Result of software testing

| Module                          | Pass | Fail |
|---------------------------------|------|------|
| Autenthification Module / Total : 6 tests | 6    | 0    |
| User Module / Total : 13 tests   | 10   | 3    |
| User Role Module / Total : 4 tests | 3    | 1    |
| Group Module / Total : 4 tests   | 3    | 1    |
| Attendance Module / Total : 5 tests | 4    | 1    |
| Leave Module / Total : 10 tests  | 7    | 3    |
| Schedule Module / T : 6 tests    | 6    | 0    |
| News and Bulletin Module / Total : 6 tests | 4    | 2    |
| Location Module / Total : 6 tests | 5    | 1    |

Based on Table 4, 60 test case UAT testing held, were found 48 eligible test cases and 12 ineligible test cases with software requirements. For the ineligible cases will be fixed by the software developer. The load testing has been done using Apache Benchmark (AB) tools. Apache Benchmark is a tool based on command line interface so it needs command code to run it and several parameters which are the number of requests at the same time \((c)\), the number of connections made to the destination server \((n)\), and the URL of the page to be processed.

The command code that is executed is: `ab -n 1000 -c 100 https://splend.id/`

Based on the load testing result, there are 6 requests failed out of 100 requests submitted by Apache Benchmark.

4. Conclusion

The software testing was done through requirements analysis process, test case design and test case implementation using the black box method and load testing. The total number of test cases is 62 test cases covering 9 modules and 2 non-functional requirements, 50 test cases meet the software requirements, and 12 test cases did not meet the software requirements. Bug fixing needs to be done before continuing to the production stage of the software.

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