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Implementation of Black-Box Testing on the Information System for the Smart Indonesian Card College Recommendation

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ABSTRACT

System testing is essential to determine whether a developed application performs as intended or still contains errors that require correction. One commonly adopted method for such testing is Black-Box Testing. This research implemented the Black-Box approach to evaluate an information system designed for the Smart Indonesia Card under the Let's Go to College Movement program. The system facilitates scholarship registration and selection processes targeted at students from economically disadvantaged backgrounds. Key components examined in this study include the registration form, login interface, announcement page, and administrative data control features. The testing outcomes revealed that all features produced results consistent with predefined expectations, suggesting a high level of reliability and functional adequacy. Nonetheless, a few minor shortcomings were identified, such as the lack of input validation alerts and the absence of confirmation notifications after certain actions. Although these issues did not interfere with the system's core operations, they may influence the overall user experience. Moreover, this study did not incorporate negative or stress testing, which are proposed as directions for future evaluation. In general, the system proved to be robust and effectively meets the functional needs of both student and administrator users.

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1. INTRODUCTION

The rapid technological development has significantly impacted various sectors, particularly in education. Education is a crucial factor for individuals to navigate and succeed in today's complex world [1]. The integration of technology has made it easier for both educators and students to access education [2][3]. Nevertheless, even with the growing integration of digital technologies in the education sector, disadvantaged groups frequently encounter major obstacles in both accessing and effectively using these tools. Such barriers often stem from inadequate infrastructure, limited digital literacy, and poor internet access, all of which contribute to unequal opportunities in obtaining quality educational resources. Students from marginalized urban communities commonly face difficulties due to a lack of technological skills and unsupportive digital environments at home, further deepening the gap in educational equity despite the existence of digital solutions. To promote inclusive progress in education, it is crucial to identify and overcome these challenges when implementing technology-driven learning platforms [4]. The Let's Go to College

Movement program is an initiative under the Family Home Program, designed to break the poverty chain by assisting Family Home Program beneficiaries in continuing higher education [5]. One of its key features is the use of a website to facilitate the KIP Kuliah recommendation process, allowing students to register, select, and receive announcements regarding the KIP Kuliah recommendation. This system aims to help Family Home Program children excel in education and ensure they gain access to higher education.

Previous research on Black-Box Testing highlights its effectiveness in identifying errors or bugs in various systems. For instance, applied Black-Box Testing to lecturer management systems [6], implemented it on sales selection systems [7], also applied this testing technique to inventory applications [8]. Although these implementations highlight the effectiveness of Black-Box Testing in verifying fundamental system operations, they are generally applied to platforms with well-defined data structures and predictable processing flows. In contrast, educational systems, particularly those intended for underserved populations, often present more intricate user interactions and inconsistent input quality, which may conflict with the assumptions of straightforward input-output mapping in Black-Box Testing.

Additionally, when compared to approaches like White-Box Testing or Model-Based Testing, Black-Box Testing provides no insight into the internal logic of the application, limiting its ability to detect nuanced logical faults. Nonetheless, its ease of use and focus on external functionality make it particularly well-suited for systems where access to source code is limited or unnecessary, such as educational platforms intended for a wide range of non-technical users.

Despite these advantages and limitations, few existing studies critically analyze the suitability of Black-Box Testing in the context of educational technologies serving marginalized groups. This research addresses that gap by applying Black-Box Testing to the Let's Go to College Movement platform and evaluating its effectiveness in identifying both functional performance and usability aspects relevant to education-oriented digital services. These studies emphasize the importance of Black-Box Testing in software development to validate the system's functionality and ensure that it meets user needs. However, there is limited research focused on applying this method specifically to educational systems like the Let's Go to College Movement website. Thus, this study aims to fill this gap by applying Black-Box Testing to a web-based system designed for the Family Home Program participants, ensuring its functionalities serve both students and administrators.

The main references for this study draw from various works applying Black-Box Testing in system evaluations, including on lecturer management information systems [6], on sales selection systems using Black-Box Testing [7], on web-based inventory systems [8], and on software development methods with a particular focus on Black-Box Testing to assess functionality [9]. Although these prior studies offer solid support for the application of Black-Box Testing, they seldom provide comparative analysis with other testing methodologies, such as White-Box or Grey-Box Testing. In educational software environments, where the quality of user interaction and input-output behavior are central, Black-Box Testing proves advantageous, as it assesses functionality strictly from the user's viewpoint and does not rely on access to the system's internal code, which is often inaccessible in cloud-hosted or third-party systems. Conversely, White-Box Testing allows detailed examination of a system's internal logic, but requires full access to the source code, making it more appropriate for developers rather than end-users. Grey-Box Testing blends both internal and external testing perspectives, yet may lack the simplicity and user-centered design emphasis that is essential for platforms serving a broad range of users, such as students, instructors, and administrative personnel with varied levels of technical expertise. These studies provide foundational insights into the significance of functional testing and help establish a methodological framework for this research.

The challenge addressed by this research is ensuring that the Let's Go to College Movement website functions smoothly and effectively for all users, including both students and administrators. Since the website handles critical functions like student registration, data collection, and selection of Smart Indonesian Card recommendation recipients, any issues in functionality, data flow, or user interface could compromise the system's objectives and user satisfaction [5]. To address these issues, this study implements Black-Box Testing, a method that evaluates the functionality of a system without considering its internal workings or source code. Black-Box Testing focuses on assessing whether the system's outputs match the expected results based on input, testing various scenarios like student registration, announcement views, and data management by the admins [10][11].

While existing studies on Black-Box Testing have been applied to a variety of systems (e.g., sales selection, lecturer management, inventory systems), no research has specifically addressed educational systems aimed at assisting economically disadvantaged students, such as the Let's Go to College Movement website. This study aims to fill this gap by applying Black-Box Testing to a system designed for a unique user base, such as students in the Family Home Program, and ensuring its features meet both administrative and student needs.

The novelty of this research lies in the application of Black-Box Testing to an educational support system designed for a socioeconomically vulnerable group. Furthermore, this study expands on the testing methodology by considering both student and admin roles, ensuring that the system is robust and user-friendly from multiple perspectives. This research contributes to the broader field of educational technology by providing insights into the testing and optimization of systems that support disadvantaged students. The findings of this study will help improve the Let's Go to College Movement website by identifying bugs, enhancing its functionality, and ensuring that it effectively supports its users. Additionally, the study will contribute to the ongoing development of testing methodologies, particularly in the context of web-based educational systems.

2. METHOD

This section outlines how Black-Box Testing was utilized to assess the Smart Indonesian Card Recommendation Information System developed under the Let's Go to College Movement initiative. The main goal of this testing stage is to determine whether the system performs as specified in its functional requirements, focusing on user-facing behavior without examining the underlying source code.

2.1. Testing Approach

The evaluation employed the Black-Box Testing approach, which assesses a system's functionality by inputting data and analyzing the resulting outputs, without taking into account the internal structure or source code [12][13]. This method emphasizes how users, both students and administrators, interact with various system components. The testing procedure was carried out in several sequential stages [14][15]:

a. Requirement Identification

The functional specifications for both student and administrator interfaces were identifies, encompassing features such as:

1. Student registration
2. Login process
3. Viewing selection result
4. Admin data manajemen (registration schdule, university and department data, participant data)

b. Test Scenario Design

Several test cases develepoed for every module, with each case comprising the following components:

1. Test cas ID
2. Scenario description
3. Input actions
4. Expected result
5. Actual result
6. Status (Success or Fail)

c. Test Execution

Every test case was carried out directly through the system's live interface. Test inputs were submitted via a web browser, and the resulting outputs were monitored in real time. The outcomes were recorded in tabular format, organized according to their respective functional modules.

2.2. Tested Functional Modules and Description

The following modules were tested:

Table 1 Tested Functional Module and Description

Module	Description
Registration Form	Tested registration flow, data entry, and proof generation.
Login Function	Verified access for both students and admin users.
Announcement View	Checked condition before and after announcement data.
Admin Dashboard	Verified all DCRU opertions, included managing universities, department, and participant data.

2.3. Evaluation Criteria

A test case was considered successful when the system's actual output aligned with the expected outcome. Any deviations encountered were documented and evaluated for potential improvements in subsequent development cycles. The fact that all tested features produced correct results signifies that the system is functionally prepared for deployment.

3. RESULT AND DISCUSSION

This section presents the outcomes of the Black-Box Testing performed on the Let's Go to College Movement system, focusing on the Resulting Website View and Test Results. The Resulting Website View subsection discusses the design and user interface of the Smart Indonesian Card Let's Go to College Movement Recommendation Information System, evaluating its user-friendliness, functionality, and alignment with user expectations. This part examines how the visual layout meets the needs of both students and administrators. The Test Results subsection outlines the results of the functional tests conducted on various system components. It includes a comparison of expected and actual outcomes, highlighting any errors or discrepancies identified during testing. The discussion will provide insights into the effectiveness of the system and suggest areas for improvement

3.1. Resulting Website View

In this section, the results of the design analysis and system design are displayed in the form of an interface display of the Smart Indonesian Card Let's Go to College Movement recommendation information system. The display is designed with a userfriendly design which is intended to make it easier for users to access this website or application [15]. There are two users in this system, namely students and Let's Go to College Movement admins. Both have access sections which are explained below.

a. User (Student)

1. Home Page View

   The home page display is the page that will appear first when users access the Let's Go to College Movement Website.

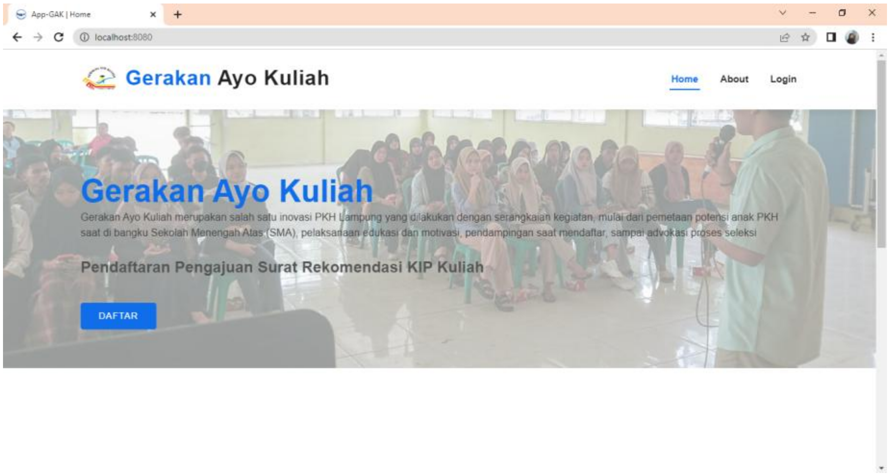

Figure 1. Home Page View

   This interface functions as the primary access point for students, offering an overview of the Let's Go to College Movement program along with buttons for login and registration. Its straightforward design enables first-time users to easily grasp the system's objectives.

2. Login Page View

   Users can enter their previously registered email and password to view announcements and fill in their personal data. Users who do not have an account must register first on the home page.

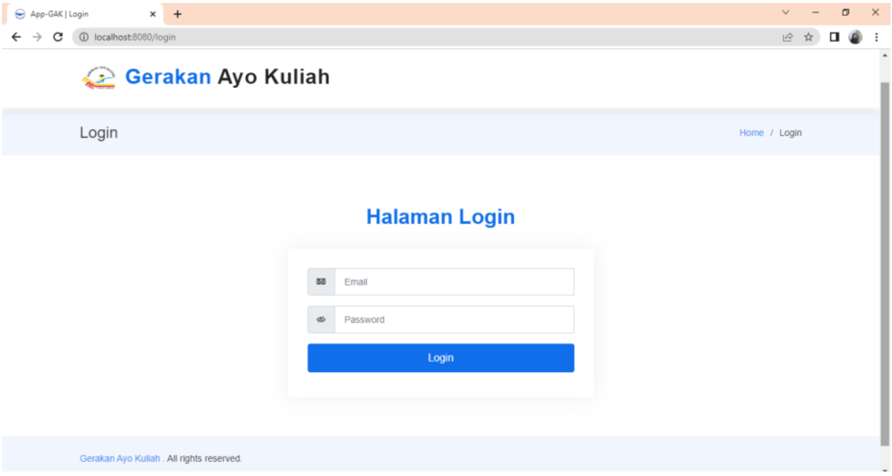

Figure 2. Login Page View

This interface enables registered students to access their accounts by entering their email and password. Before directing users to the dashboard, the system performs login validation to ensure credential accuracy.

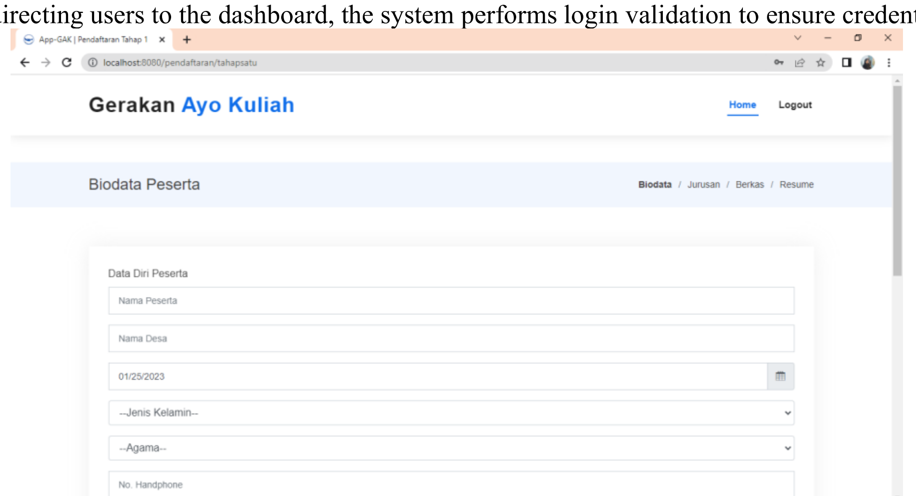

Figure 3. Participant Data Entry Page View

Prospective participants without existing accounts can use this page to create one, which will subsequently allow them to complete their personal data. The registration interface guides new students through a multi-step process to input personal and academic information. Once the registration is successfully completed, users gain access to the system's recommendation features.

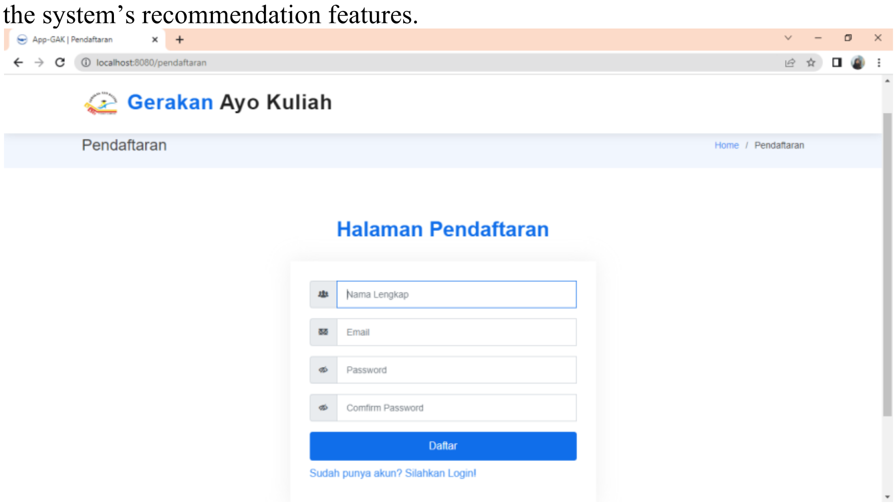

Figure 3. Registration Confirmation and Print Proof

Upon finishing the data input process, students are able to generate and print a registration receipt, which acts as official confirmation of their submission.

3. Selection Announcement Page View

Next is the display of the selection announcement page. On this page, students can log in first using their respective accounts to see the results of the announcement of course when the announcement time has been set.

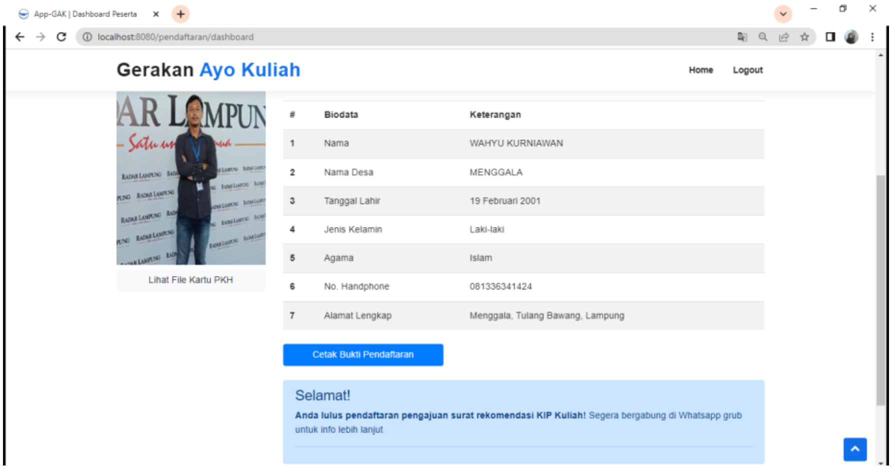

Figure 5. Selection Announcement Page View

This interface presents the selection results to students once the announcement date has passed. Based on the current status, it will either reveal the outcome or inform users that the announcement is still pending.

b. Admin

1. Manage Registration Information Data Page View

Admin can edit the opening and closing dates of registration as well as the announcement of those who passed the administrative selection.

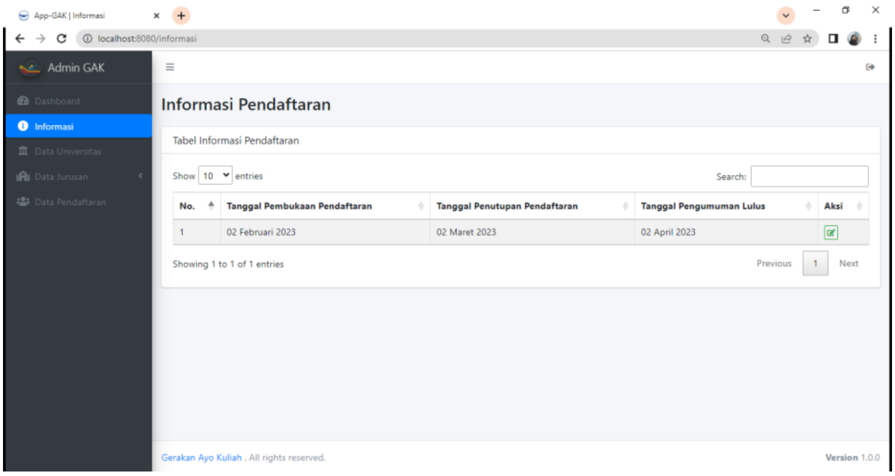

Figure 6. View of the Manage Registration Information Data Page

This page enables administrators to modify essential scheduling settings, including the start and end dates for registration as well as the timeline for announcements.

2. Manage University Data Page View

The manage university data page is used by Admin to manage university data for student choices during the registration process.

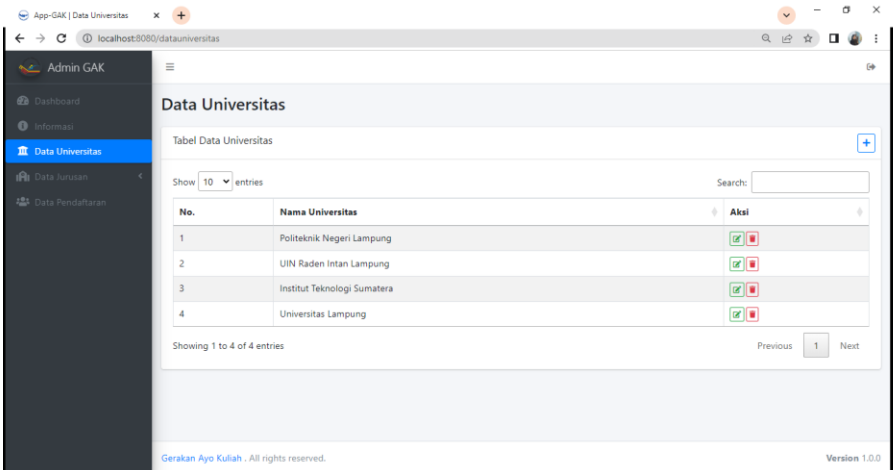

Figure 7. University Data Management Page View

Administrators utilize this module to manage university data available for student selection during registration. The module facilitates adding, editing, and removing university entries as needed.

3. Manage Department Data Page View

Admin can manage department data at each university. There are features to add, edit and delete department data.

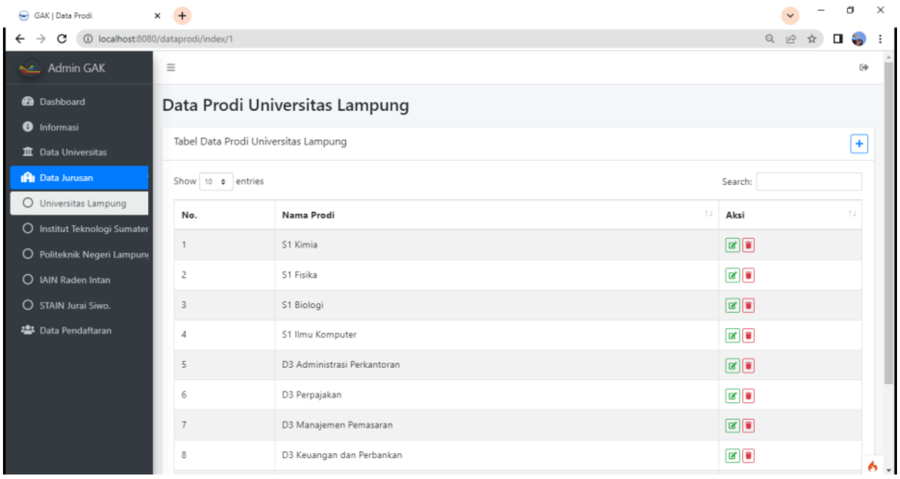

Figure 8. View of the Manage Department Data Page

This page is designed for managing the list of departments associated with each university. Administrators have the ability to add, modify, or delete department entries based on institutional changes.

4. View the Manage Participant Registration Data Page

On the manage participant registration data page, Admin can view data and confirm the passing of registration participants. In addition, Admin can also export registration participant data.

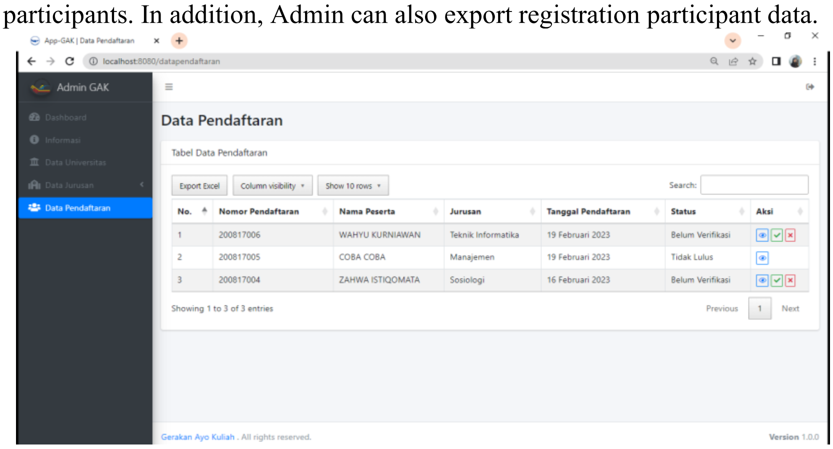

Figure 9. Manage Registration Data Page View

This interface allows administrators to access, review, and export participant information. Additionally, it supports the validation of registration results and the confirmation of each student's status.

3.2. Test Results

In this subsection, the results of the Black-Box Testing conducted on the Let's Go to College Movement system are presented in detail. It focuses on the functional tests applied to different components of the system, including registration, login, and data management. Each test case is outlined, comparing the expected results with the actual outcomes to identify any discrepancies, bugs, or errors. The insights gained from these results provide a clear understanding of the system's performance and highlight areas that require improvement for better user experience and functionality.

Table 1. Results of the Registration Form Test

No	Test Case ID	Test Scenario	Steps	Expected Result	Actual Result	Status
1	DFT_001	Students register	Students fill in the registration data, press the register button	Go to login page	Go to login page	Succeed
2	DFT_002	Students fill in the registration administration data	Students fill in their personal data in stages 1, 2, 3, finalize their registration and press the "Print Proof of Registration" button.	Students can print proof of registration	Students can print proof of registration	Succeed

In testing the registration form page, there are 2 test cases, namely students registering and filling in the registration administration data and both are in accordance with the expected input and output.

Table 2. Announcement Form Test Results

No	Test Case ID	Test Scenario	Steps	Expected Result	Actual Result	Status
1	PEN_001	Students see the announcement after the announcement time	Students fill in their username and password and press the login button.	Students can view the announcement of the selection results	Students can view the announcement of the selection results	Succeed
2	PEN_001	Students see the announcement before the announcement time	Students fill in their username and password	Students can view the information on "notification of the announcement date of the selection results	Students see the announcement before the announcement time	Succeed

On the announcement form page there are 2 test cases. The first condition is to see the announcement after the announcement time, and the test is successful. The second condition is to see the announcement before the time, and the test is successful.

Table 3. Login Form Test Results

No	Test Case ID	Test Scenario	Steps	Expected Result	Actual Result	Status
1	AUT_00 1	Admin logs in	Admin fills in username and password	Login to the system	Login to the system	Succeed

In the login condition, the input and output have appropriate test results, namely the admin can enter the system after filling in the username and password, so that the test status on the login form is successful.

Table 4. Results of Manage Testing Participant Data

No	Test Case ID	Test Scenario	Steps	Expected Result	Actual Result	Status
1	ADM_001	Admin logs into dashboard	Admin logs in	Admin can log in to dashboard	Admin can log in to dashboard	Succeed

No	Test Case ID	Test Scenario	Steps	Expected Result	Actual Result	Status
2	ADM_002	Admin edits information data	Admin presses the “update” button and saves it.	Admin can change the date on the information data page	Admin can change the date on the information data page	Succeed
3	ADM_003	Admin adds university data	Admin presses the “add” button, fills in the data and presses “save”.	University data successfully added	University data successfully added	Succeed
4	ADM_004	Admin edits university data	Admin presses the “update” button, changes and saves the data.	University data successfully updated	University data successfully updated	Succeed
5	ADM_005	Admin deletes university data	Admin presses the “delete” button on the selected data.	University data successfully deleted	University data successfully deleted	Succeed
6	ADM_003	Admin adds department data	The admin presses the “add” button on the department data page, fills it in, and saves it.	Major data successfully added	Major data successfully added	Succeed
7	ADM_004	Admin edits department data	Admin presses the “update” button on the selected data, edits and saves the data.	Department data successfully updated	Department data successfully updated	Succeed
8	ADM_005	Admin deletes department data	Admin presses the “pass” or “fail” button on the action table.	Participant registration data has been successfully verified	Participant registration data has been successfully verified	Succeed
9	ADM_006	Admin verifies participant data	Admin presses the “view” button on the action table	Participant registration data has been successfully verified	Participant registration data has been successfully verified	Succeed
10	ADM_007	Admin views participant data	Admin presses the “update” button and saves it.	Admin can change the date on the information data page	Admin can change the date on the information data page	Succeed

The next test is on the participant data management page. There are 10 conditions in the test. The first condition is that the admin enters the dashboard and the test results are successful. The second condition is that the admin edits the information data and the test results are successful. Conditions 3, 4, and 5 are that the admin inputs, edits, and deletes university data. Each has a final result that matches the expected test results. Conditions 6, 7, and 8 are that the admin inputs, edits, and deletes department data. Each condition is successful in its test, the expected result and the actual test result match. The next condition is that the admin verifies the participant data. In this condition, the final result matches the expected test results. The 10th condition is that the admin views the participant data. In this condition, the view button that is tested has a final result that matches the expected result.

Testing conducted on the Let’s Go to College Movement website uses valid data testing and vice versa. Based on the test results that have been described, it has been proven successful in all predetermined scenarios. The existence of this high accuracy indicates that the system is functioning well in carrying out the tasks given. The system has also been able to solve user needs problems with feature adjustments. Testing that has been conducted by the development team has not found any bugs or errors that occur to the system. The results of system testing can be used as a basis for recommending the discovery of other bugs, improving performance, and adding features or displays to improve the quality and performance of the system as a whole.

Although the functional testing in this study yielded positive outcomes for all test scenarios, it is important to recognize that the scope was confined to positive-path Black-Box Testing, focusing solely on valid inputs and standard user interactions. Scenarios involving invalid or atypical inputs, such as incomplete fields, improper data formats, or security-related anomalies, were not covered during this phase and are suggested for future assessments to evaluate the system’s resilience and error-handling capabilities.

Furthermore, performance evaluations like stress or load testing, which are crucial for understanding system behavior under heavy usage or resource constraints, were not conducted in this study. These non-functional assessments were outside the scope of this functional testing phase, which concentrated on validating primary features and user workflows. Future enhancements should consider incorporating such non-functional testing to ensure the system’s stability, scalability, and consistent performance under diverse operational conditions.

3.3. Discussion

The Black-Box Testing conducted on the Let's Go to College Movement system revealed that the system performed successfully across all test cases, meeting its functional requirements. However, there are areas that could be improved to enhance overall performance and user experience. While the registration and login processes were smooth, some minor discrepancies in the flow of data between forms were observed. These issues, although not critical, could affect user experience in real-world applications. To address this, future improvements should focus on refining error-handling mechanisms, providing clearer feedback for users when issues arise, and ensuring smoother navigation between different sections of the website.

Additionally, while the system passed functional tests, it has not yet been evaluated for performance under load. As the number of users increases, especially during peak times such as registration or announcement periods, the system could experience performance bottlenecks. Therefore, it is crucial to conduct stress and performance testing to evaluate the system's scalability and ensure its responsiveness even under heavy traffic. This will help prevent potential system slowdowns and ensure the system remains reliable as the user base expands.

Lastly, while the system has met the basic user needs, there is always room for enhancement. Future versions of the system should focus on further improving the user interface design, making it more accessible for users with limited technical skills. Integrating advanced features like real-time data updates or user personalization could significantly increase user engagement and the overall utility of the system. Regular updates and continuous monitoring should be part of the long-term plan to ensure that the system evolves in line with user needs and technological advancements.

4. CONCLUSION

This study applied Black-Box Testing to evaluate the functionality of the Smart Indonesian Card Recommendation Information System developed for the Let's Go to College Movement program. Testing was performed across key user and administrator modules, including registration, login, announcement views, and data management interfaces. The test results showed that all core features returned outputs that matched expected outcomes, indicating a high level of functional reliability. However, during testing, several minor discrepancies were identified, such as inconsistent label alignment on the registration form, a missing alert message when required fields were left empty, and the absence of visual confirmation after successful data submissions. Although these issues did not prevent the system from operating as intended, they may affect user experience and input clarity, particularly for first-time users. Future development should not only address these minor issues but also include extended testing such as negative testing (e.g., invalid inputs, blank submissions) and stress testing to evaluate system performance under high user loads. This would ensure a more robust and user-friendly platform for the beneficiaries of the Family Home Program.

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