

Feasibility Analysis of Bengkel Koding Website Using Black Box Testing and Boundary Value Analysis

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Abstract: In an era of rapid technological development, application development has become common, especially in coding. However, most websites do not give appropriate assignments and instructors to help improve coding skills. Because of this, the Bengkel Koding of Dian Nuswantoro University Semarang is a solution to improving the quality of coding learning. This research aims to identify the shortcomings in the website and ensure that the website functions as expected by the users. By testing the application like this, researchers can know which problems can affect the user experience. This research uses one of the frequently used tests, namely Black Box testing. The objective is to verify that the system's functions, inputs, and outputs align with the specified requirements. In addition to the Black Box method, this research uses a technique called Boundary Value Analysis. This technique is to identify errors or bugs that can affect the user experience by focusing on the input value boundary. The test results will use a quality ratio that will determine whether or not the system is suitable for use by users. Through 30 test cases, most website functions have been tested properly, with the feasibility level reaching 83.333%. Nonetheless, five errors or bugs were still found, emphasizing the need for further improvement. The results of this study provide valuable insights into improving the quality and convenience of users in accessing the Bengkel Koding website.

Keywords: Bengkel Koding; Black Box Testing; Boundary Value Analysis; Quality Ratio; Website

INTRODUCTION

In the development of technology that is growing every year (Muhammad et al., 2021), many applications are made for various purposes, ranging from e-commerce information providers to education. Many people are interested in this field of education, especially coding. However, most of these coding learning websites do not give adequate tasks or qualified instructors to help improve coding skills for people who need it. To overcome this problem, the Bengkel Koding team of Dian Nuswantoro University Semarang created the Bengkel Koding website to help students learn to code. Web application development was chosen because it is easily accessible to many users online and easy to manage. The display on the web is also made as simple and effective as possible so that users are clear (Lim et al., 2021). However, web developers are also faced with the challenge of ensuring user comfort when accessing the website. Because of this matter, the research aims to improve the user experience on the Bengkel Koding website. This will ensure that the website functions correctly and provides a seamless user interface, making the learning experience more effective and enjoyable for users. By conducting these tests, researchers can also identify vulnerabilities and potential security threats in this system. Furthermore, with the increasing occurrence of website breaches, it is crucial for web developers to ensure the system's security. Therefore, this research also aims to identify and address potential vulnerabilities and security threats on the Bengkel Koding website. This is intended to protect sensitive user data, prevent unauthorized access, and maintain the system's overall integrity. Consequently, users can feel safe and comfortable accessing the website, enhancing the overall user experience.

This research will focus on implementing black box testing with the boundary value analysis technique on the Bengkel Koding website. Black box testing is essential to identify flaws in the website and ensure that it functions as users expect (Ningrum et al., 2019). With this test, researchers can determine which problems can affect the user experience, such as functional, content, visual, UI, and performance errors (Gilang Ryan Fernandes & Ika

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Mei Lina, 2021). By applying the boundary value analysis technique in these black-box tests, errors associated with boundary values can be found. By identifying these boundaries, tests can be conducted to ensure that the system correctly behaves when input values approach or exceed them (Hakimah Kusuma Dewi et al., 2022). This technique is crucial because it can identify hidden bugs and reduce the risk of errors from the input received by the system. Although previous research has conducted black box testing methods with boundary value analysis techniques, especially in web application testing, some things have not been studied in depth. The main difference between this and previous research is providing clear steps in Black Box Testing, including finding system errors in detail and calculating application feasibility. The main objective of this research is to improve the quality and convenience of users in accessing the Bengkel Koding website so that the user's learning experience becomes more effective and enjoyable.

LITERATURE REVIEW

Learning has evolved rapidly from computer-based platforms to web-based platforms and mobile devices. This has been shown in a study by Saputra and Kania (Saputra & Kania, 2022), which noted learning development regarding platforms. Learning using web engineering techniques can also potentially develop learning systems in the future (Hamzah & Seman, 2022). This development allows users to access learning materials more easily and flexibly without the need to install additional applications.

Applying Black Box Testing methods such as Boundary Value Analysis is essential in web development and learning systems. Research has shown the importance of using techniques such as Boundary Value Analysis in testing web-based applications to ensure their functionality and reliability (Prayudha et al., 2020). By using Black Box Testing and Boundary Value Analysis techniques, developers can identify potential problems at the boundaries of valid input ranges, significantly improving web application quality and robustness (Puspitasari et al., 2023). Other research also shows that Boundary Value Analysis (BVA) is proven to be the most effective compared to other techniques, such as Equivalence Partitioning (EP) and random testing (Reid, 1997).

For example, research conducted by Yulistina (Yulistina et al., 2020) discussed the implementation of Boundary Value Analysis for sales application testing. This study emphasizes the significance of employing this method to guarantee the quality and dependability of web applications. Still, in the same context, Santi's (Santi et al., 2022) research explored the application of Black Box testing techniques, specifically Equivalence Partitioning and Boundary Value Analysis, in the context of academic information systems at Mataram University. This research aims to evaluate the effectiveness of these testing methods in ensuring that the functional needs of the system are met. However, the research from Yulistina (Yulistina et al., 2020) needs to include a calculation method to assess the feasibility of the application. In addition, the steps to find system errors should be presented in Santi's research (Santi et al., 2022). Because of this problem, a study is needed to clarify the steps to find errors and calculate application feasibility. In addition, making test cases along with the steps can be concrete evidence that the bug does exist and is not just an assumption.

In contrast to previous research, which focused primarily on the application of testing techniques, this study will emphasize the importance of documenting the steps taken to identify and rectify system errors. By providing structured test cases for error detection and resolution, this research aims to enhance the overall effectiveness and efficiency of software testing practices. Furthermore, this study will use a calculation method that quantitatively assesses the feasibility of applications based on predefined criteria such as performance metrics, scalability, and cost-effectiveness. By incorporating this calculation method into the testing process, this research can be advantageous for developers and testers to make informed decisions regarding the deployment and maintenance of software applications.

METHOD

System or application testing is done because it ensures that the system is sound and meets the expectations of the users who use it. Software quality needs to be maintained for the following purposes (As & Shalahudin, 2014), namely, to survive in the software business world, compete with other software, necessary for global marketing, cost-effective so as not to waste much software due to marketing failure or production failure, retain customers and increase profits. Errors or bugs in software often occur during specific processes when users are already using the software. Software testing is vital before the software is released to users or during the development stage and reduces the number of bugs. Software developers should minimize bugs by conducting tests because software behavior that does not conform to specifications is considered a bug.

One of the testing methods used is the black-box testing method. Black box testing focuses on testing functional specifications without knowledge of the design or program code (Mahendra & Asmarajaya, 2022). The goal is to ensure that the system's functions, inputs, and outputs match the required specifications. This test includes all functions executed to check the conformity of the desired specifications in black box testing. These cases include valid and invalid scenarios to ensure the completeness of the test. Black Box Testing attempts to find errors in the

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following categories (Pressman, 2020), which consist of incorrect or missing functions, interface errors, data structure or external database access, behavioral or performance errors, initialization, and termination errors.

Black-box testing uses several techniques, including the boundary value analysis technique. This testing technique entails identifying input values and choosing values from these boundaries, both beyond and within the limits, to use as test data (Sholeh et al., 2021). A typical approach to implementing Boundary Value Analysis involves incorporating additional variables alongside the maximum value for one variable and setting them to specific values, including Minimum, Minimum + 1, Average, Maximum-1, and Maximum (Sasmito & Nishom, 2020). The research will use the quality ratio calculation to determine the feasibility of this system. Quality ratio is one of the formulas of software metrics that depends on the success or failure of a test used in system testing. The formula can be calculated as formula (1).

$$Quality\ Ratio = \left(\frac{Successful\ Tests\ Case}{Total\ Number\ of\ Test\ Cases} \right) \times 100\% \quad (1)$$

The research requires a structured and clear flow (Nurudin et al., 2019). This research uses the flowchart as shown in Figure 1. Through this flow process, researchers can ensure that each stage is coherently and systematically. The first thing done in this research is to analyze the problem to be solved, whether the system or application behaves as expected when given an input value. Then, the second stage will collect information about the system or application to be tested. This stage includes specifications, documentation, and an understanding of the system's functionality. Researchers used the Bengkel Koding website to test the system in this study. The method is determined in stage 3. In this case, this research will use the black-box testing method of Boundary Value Analysis for the system or application. They continued to stage 4, namely, making test cases. Making this test case is to detect errors from a system or application quickly. The results of this research will be given to the last stage, which determines whether this application is suitable for use.

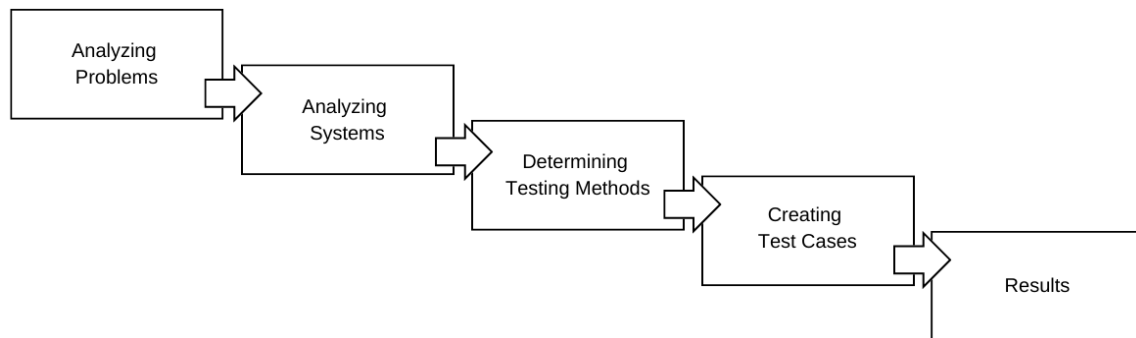


Figure 1 Research Stages

RESULT

The results of this test will include a table of test cases and the status of the results, along with feasibility calculations for the Bengkel Koding web.

Test Cases and Status

This test case table totals three tables, which consist of the results of testing the Login Page in Table 1, Dashboard Student in Table 2, and Assignment Details in Table 3. This test case table will show the results of each test through status. The total number of test cases in each table is 30.

Table 1
Testing on Login Page

| Precondition: Login page has been successfully opened | | | | | | |
|---|------------------------------|-------|-----------------------------|--|--|--------|
| ID | Test Case | Steps | Action | Expected Output | Actual Output | Status |
| TC-LP-01 | Login with valid credentials | 1 | Enter a valid email address | Email has been successfully entered into the email field | Email has been successfully entered into the email field | Pass |

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| | | | | | | |
|----------|--------------------------------------|---|--|--|--|------|
| | | 2 | Enter a valid password | Password has been successfully entered into the password field and encrypted | Password has been successfully entered into the password field and encrypted | Pass |
| | | 3 | Click on Remember Me | 'Remember Me' option has been successfully checked and will store the login data | 'Remember Me' option has been successfully checked and will store the login data | Pass |
| | | 4 | Click Login button | Login is successful, and user will be directed to the dashboard page | Login is successful, and user will be directed to the dashboard page | Pass |
| TC-LP-02 | Login with an empty email | 1 | Leave email field empty | | | |
| | | 2 | Fill all other fields with valid data | | | |
| | | 3 | Click on Remember Me | | | |
| | | 4 | Click Login button | An error message appears telling the user that email can't be left empty | An error message appears telling the user that email can't be left empty | Pass |
| TC-LP-03 | Login with an empty password | 1 | Leave password field empty | | | |
| | | 2 | Fill all other fields with valid data | | | |
| | | 3 | Click on Remember Me | | | |
| | | 4 | Click Login button | An error message appears telling the user that password can't be left empty | An error message appears telling the user that password can't be left empty | Pass |
| TC-LP-04 | Login with an incorrect email format | 1 | Fill email field with wrong format (111202113374 or 'OR '1'='1' #) | | | |
| | | 2 | Fill all other fields with valid data | | | |
| | | 3 | Click on Remember Me | | | |
| | | 4 | Click Login button | An error message appears telling the user that email must have a correct format (111202113374@mhs.dinus.ac.id) | An error message appears telling the user that email must have a correct format (111202113374@mhs.dinus.ac.id) | Pass |
| TC-LP-05 | Login with an incorrect password | 1 | Fill password field with wrong credentials | | | |

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| | | | | | | |
|----------|---|---|---|--|--|------|
| | | 2 | Fill all other fields with valid data | | | |
| | | 3 | Click on Remember Me | | | |
| | | 4 | Click Login button | An error message appears telling the user that password is wrong | An error message appears telling the user that password is wrong | Pass |
| TC-LP-06 | Login without clicking Remember Me | 1 | Fill all other fields with valid data | | | |
| | | 2 | Leave button Remember Me | | | |
| | | 3 | Click Login button | System will not automatically log in because the user data is not stored | System still retains user data and automatically logs in to the website | Fail |
| TC-LP-07 | The 'Forgot your password?' button is functional | 1 | Click on Forgot your password | User is directed to the forgot password page | User is directed to the forgot password page | Pass |
| | | 2 | Enter a valid email address | Email has been successfully entered into the email field | Email has been successfully entered into the email field | Pass |
| | | 3 | Click the Email Password Reset Link button | User will receive a password reset link via email | User will receive a password reset link via email | Pass |
| TC-LP-08 | Fill the forgot your password form with an empty email | 1 | Leave email field empty | | | |
| | | 2 | Click the Email Password Reset Link button | An error message appears telling the user that email can't be left empty | An error message appears telling the user that email can't be left empty | Pass |
| TC-LP-09 | Fill the forgot your password form with an incorrect email format | 1 | Fill email field with wrong format (111202113374 or 'OR '1'='1' #) | | | |
| | | 2 | Click the Email Password Reset Link button | An error message appears telling the user that email must have a correct format (111202113374@mhs.dinus.ac.id) | An error message appears telling the user that email must have a correct format (111202113374@mhs.dinus.ac.id) | Pass |
| TC-LP-10 | Fill the forgot your password form with an email that is not registered | 1 | Fill the email field with an email that is not yet registered (abc@mhs.dinus.ac.id) | | | |
| | | 2 | Click the Email Password Reset Link button | An error message appears telling the | An error message appears telling the | Pass |

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| | | | | | | |
|--|--|--|--|-----------------------------------|-----------------------------------|--|
| | | | | user that email is not registered | user that email is not registered | |
|--|--|--|--|-----------------------------------|-----------------------------------|--|

Table 2
Testing on Dashboard Student

| Precondition: User has successfully logged in and the student dashboard has been successfully opened | | | | | | |
|--|--|-------|---|--|--|--------|
| ID | Test Case | Steps | Action | Expected Output | Actual Output | Status |
| TC-DS-01 | Enrolling in one of the courses at Bengkel Koding | 1 | Click 'Pilih Kursus' button | System will display various courses | System will display various courses | Pass |
| TC-DS-02 | Viewing the available course content | 1 | Click 'Pilih Kursus' button | System will display various courses | System will display various courses | Pass |
| | | 2 | Click on one of the courses in the Bengkel Koding section with the 'Belajar Sekarang' button | System will show a brief description of the course | System will show a brief description of the course | Pass |
| | | 3 | Click 'Gabung' on the desired class schedule | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini?' | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini?' | Pass |
| | | 4 | Click 'OK' in the confirmation dialog | Course button will change to 'Belajar Sekarang' | Course button will change to 'Belajar Sekarang' | Pass |
| TC-DS-03 | Enrolling in one of the courses at Bimbingan Karir | 1 | Click 'Pilih Kursus' button | System will display various courses | System will display various courses | Pass |
| | | 2 | Click on one of the courses in the Bimbingan Karir section with the 'Belajar Sekarang' button | System will show a brief description of the course | System will show a brief description of the course | Pass |
| | | 3 | Click 'Gabung' on the desired class schedule | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini? Masukkan token aktivasi anda untuk masuk kelas' | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini? Masukkan token aktivasi anda untuk masuk kelas' | Pass |
| | | 4 | Type the activation token and click 'OK' in the confirmation dialog | Course button will change to 'Belajar Sekarang' | Course button will change to 'Belajar Sekarang' | Pass |
| TC-DS-04 | Registering for one of the courses in BK | 1 | Click 'Pilih Kursus' button | System will display various courses | System will display various courses | Pass |

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| | | | | | | |
|----------|---|---|---|---|---|------|
| | with an invalid token | | | | | |
| | | 2 | Click on one of the courses in the Bimbingan Karir section with the 'Belajar Sekarang' button | System will show a brief description of the course | System will show a brief description of the course | Pass |
| | | 3 | Click 'Gabung' on the desired class schedule | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini? Masukkan token aktivasi anda untuk masuk kelas' | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini? Masukkan token aktivasi anda untuk masuk kelas' | Pass |
| | | 4 | Type the invalid activation token and click 'OK' in the confirmation dialog | An error message will appear and informing the user that the token is invalid | System does not display an error message | Fail |
| TC-DS-05 | Registering for another course when the user already has a course | 1 | Click on the Bengkel Koding symbol in the top left corner | User is directed to the dashboard page. | User is directed to the dashboard page. | Pass |
| | | 2 | Scroll down until find the course section | System displays various courses in the Bengkel Koding and Bimbingan Karir sections | System displays various courses in the Bengkel Koding and Bimbingan Karir sections | Pass |
| | | 3 | Click on one of the courses in the course section with the 'Belajar Sekarang' button | System will show a brief description of the course | System will show a brief description of the course | Pass |
| | | 4 | Click 'Gabung' on the desired class schedule | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini?' when registering for a course at Bengkel Koding. Meanwhile, at BK, it will tell user to enter the token first | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini?' when registering for a course at Bengkel Koding. Meanwhile, at BK, it will tell user to enter the token first | Pass |
| | | 5 | Click 'OK' in the confirmation dialog | Course button will change to Belajar Sekarang' | Course button will change to Belajar Sekarang' | Pass |
| TC-DS-06 | Registering for a course when the | 1 | Click on the Bengkel Koding | User is directed to the dashboard page. | User is directed to the dashboard page. | Pass |

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| | | | | | | |
|----------|---|---|--|---|---|------|
| | class quota is full | | symbol in the top left corner | | | |
| | | 2 | Scroll down until find the course section | System displays various courses in the Bengkel Koding and Bimbingan Karir sections | System displays various courses in the Bengkel Koding and Bimbingan Karir sections | Pass |
| | | 3 | Click on one of the courses in the course section with the 'Belajar Sekarang' button | System will show a brief description of the course and displaying the class list with the description 'Kuota Habis' | System will show a brief description of the course and displaying the class list with the description 'Kuota Habis' | Pass |
| TC-DS-07 | Registering for a course when the course has already been taken | 1 | Click on the Bengkel Koding symbol in the top left corner | User is directed to the dashboard page. | User is directed to the dashboard page. | Pass |
| | | 2 | Scroll down until find the course section | System displays various courses in the Bengkel Koding and Bimbingan Karir sections | System displays various courses in the Bengkel Koding and Bimbingan Karir sections | Pass |
| | | 3 | Click on one of the courses in the course section with the 'Belajar Sekarang' button | System will display the message 'Anda sudah terdaftar dalam kelas!' in the class list | System will display the message 'Anda sudah terdaftar dalam kelas!' in the class list | Pass |
| TC-DS-08 | Canceling the course registration | 1 | Click on one of the courses in the course section with the 'Belajar Sekarang' button | System will show a brief description of the course | System will show a brief description of the course | Pass |
| | | 2 | Click 'Gabung' on the desired class schedule | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini?' when registering for a course at Bengkel Koding. Meanwhile, at BK, it will tell user to enter the token first | System will display a message 'Apakah Anda yakin ingin mendaftar ke kelas ini?' when registering for a course at Bengkel Koding. Meanwhile, at BK, it will tell user to enter the token first | Pass |
| | | 3 | Click 'Cancel' in the confirmation dialog | User will receive the message 'Pendaftaran dibatalkan'! | User will receive the message 'Pendaftaran dibatalkan'! | Pass |

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Table 3
Testing on Assignment Details

| Precondition: User has successfully opened the assignment details | | | | | | |
|---|---|-------|---|--|--|--------|
| ID | Test Case | Steps | Action | Expected Output | Actual Output | Status |
| TC-AD-01 | Submitting the assignment before the start time | 1 | Click on the desired assignment title | System will display 'Maaf, tugas belum dibuka' in the assignment column, and the upload file cannot be filled in yet | System will display 'Maaf, tugas belum dibuka' in the assignment column, and the upload file cannot be filled in yet | Pass |
| TC-AD-02 | Submitting the assignment on time | 1 | Click on the desired assignment title | System will display the description and the upload file | System will display the description and the upload file | Pass |
| | | 2 | Submit the assignment in the upload file by drag and drop or clicking on the column | Assignment file has been successfully uploaded | Assignment file has been successfully uploaded | Pass |
| | | 3 | Click the 'Upload File' button | System will display 'Semoga mendapatkan hasil terbaik' and the file will be successfully submitted | System sometimes displays 'resource limit is reached' when many users are accessing to submit files | Fail |
| TC-AD-03 | Submitting the assignment after the deadline | 1 | Click on the desired assignment title | The system will display 'Maaf, tugas sudah ditutup' and the file upload will be closed | The system will display 'Maaf, tugas sudah ditutup' and the file upload will be closed | Pass |
| TC-AD-04 | Submitting without uploading the assignment file | 1 | Click on the desired assignment title | System will display the description and the upload file | System will display the description and the upload file | Pass |
| | | 2 | Click the 'Upload File' button | System will display 'The task file field is required' | System will display 'The task file field is required' | Pass |
| TC-AD-05 | Edit the uploaded assignment file with valid format | 1 | Upload a valid assignment file format (rar, zip, pdf, doc, docx) in the upload file | Assignment file has been successfully uploaded | Assignment file has been successfully uploaded | Pass |
| | | 2 | Click the 'Update File' button | System will display a review of the updated file below the upload file | System will display a review of the updated file below the upload file | Pass |
| TC-AD-06 | Edit the uploaded assignment file | 1 | Upload an invalid assignment file format (.txt, .jpg, | Assignment file has been | Assignment file has been | Pass |

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| | | | | | | |
|----------|--|---|---|--|--|------|
| | with invalid format | | .php.jpg) in the upload file | successfully uploaded | successfully uploaded | |
| | | 2 | Click the 'Update File' button | An error message will appear and informing the user that 'the task file must be a file of type: rar, zip, pdf, doc, docx | An error message will appear and informing the user that 'the task file must be a file of type: rar, zip, pdf, doc, docx | Pass |
| TC-AD-07 | Submit an assignment file with valid format | 1 | Upload a valid assignment file format (rar, zip, pdf, doc, docx) in the upload file | Assignment file has been successfully uploaded | Assignment file has been successfully uploaded | Pass |
| | | 2 | Click the 'Submit File' button | System will display a review of the updated file below the upload file | System will display a review of the updated file below the upload file | Pass |
| TC-AD-08 | Submit an assignment file with invalid format | 1 | Upload an invalid assignment file format (.txt, .jpg, .php.jpg) in the upload file | Assignment file has been successfully uploaded | Assignment file has been successfully uploaded | Pass |
| | | 2 | Click the 'Submit File' button | An error message will appear and informing the user that 'the task file must be a file of type: rar, zip, pdf, doc, docx | An error message will appear and informing the user that 'the task file must be a file of type: rar, zip, pdf, doc, docx | Pass |
| TC-AD-9 | Submitting the assignment with a valid file size | 1 | Upload the assignment file with a valid size (1 – 10 MB) in the upload file section | Assignment file has been successfully uploaded | Assignment file has been successfully uploaded | Pass |
| TC-AD-10 | Submitting the assignment with an invalid file size | 1 | Upload the assignment file with an invalid size (>10 MB) in the upload file section | System will display an error message if the file exceeds the specified limit | System does not display an error message | Fail |
| TC-AD-11 | Reviewing the assignment after it has been submitted | 1 | Make sure to submit the assignment file in the upload file section | System will display a file review below the upload file | System will display a file review below the upload file | Pass |
| TC-AD-12 | Reviewing the assignment after it has been submitted and passed the deadline | 1 | Make sure to submit the assignment file in the upload file section | System will display a file review below the upload file | System does not display anything | Fail |

System Feasibility Calculations

The following is the status of all test cases run on the system.

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Table 4
Status Test Cases

| Test Case Status | Number of Test Cases |
|----------------------------|----------------------|
| Total Number of Test Cases | 30 |
| Passed Test Cases | 25 |
| Failed Test Cases | 5 |

Using the table addressed in Table 4, the table will be calculated using the quality ratio formula. By using the passed test case data and total test cases, it can be calculated as follows.

$$Quality\ Ratio = \left(\frac{25}{30}\right) \times 100\% = 83.333\%$$

With the results reaching 83.333%, it can be ascertained that most of the functions in the Bengkel Koding web have run well. These testing results are significant because they also highlight areas where error-handling mechanisms are practical, such as providing informative error messages when users encounter issues like incorrect login credentials, invalid inputs, or system errors. Proper error handling contributes to a positive user experience by guiding developers in resolving problems or taking appropriate actions. However, some errors or bugs must be fixed as soon as possible so as not to disturb users. If these issues are not addressed promptly, they could lead to server downtime, disrupting the user experience and potentially causing frustration among users. Ensuring quick resolution of errors and bugs is crucial for maintaining the website's reliability and preventing any significant disruptions in user access and interaction.

DISCUSSIONS

Tests on the Bengkel Koding web show that 25 out of 30 test cases have successfully passed the test. However, 8 test cases failed and showed that there were some errors or bugs that needed to be fixed by the development team. The results of the calculation of system feasibility with the quality ratio reached 83.333%, which means that most aspects of the Bengkel Koding web have been appropriately tested and meet the desired standards. A comparison of the results with other research conducted by Megawati, Miwa, and Palevi (Megawati et al., 2023) shows that the percentage of test success on the Bengkel Koding web (83.333%) is higher than the "Hybrid Engine" application tested using the same technique (78.245615%).

These two studies highlight the importance of black box testing with the boundary value analysis technique in identifying errors or bugs that can affect the quality and comfort of users in using an application (Debiyanti et al., 2020). The limitation of this research is that it needs to pay attention to aspects related to user experience, such as conducting in-depth testing of defects found by the users themselves. This indicates that although the Black Box method with the boundary analysis technique has been implemented successfully in the Bengkel Koding application, this research has not fully taken into account the user perspective, which may significantly influence the overall quality and usability of the application.

Black box testing with boundary value analysis technique is a widely used method in software testing due to its effectiveness in identifying errors and bugs that may impact the quality and usability of an application (Putra et al., 2019). This technique involves testing the application's functionality without understanding its internal code structure. By focusing on the input and output boundaries of the system, boundary value analysis helps uncover potential issues that may arise at the edges of acceptable ranges. If black box testing with boundary value analysis is not employed during the testing phase of an application, security vulnerabilities such as SQL injection and attacks on file uploads like Local File Inclusion (LFI) could pose significant threats. SQL injection occurs when malicious SQL queries are inserted into input fields, potentially leading to unauthorized access to the database or manipulation of data. On the other hand, LFI exploits vulnerabilities in file upload functionalities to execute arbitrary code, potentially exposing sensitive information or compromising the integrity of the application (Shahid et al., 2022). In the context of the Bengkel Koding web application, LFI can be used to upload a malicious PHP file that, when executed, can reveal the source code of the web server running PHP. This can be particularly dangerous as it allows attackers to gain unauthorized access to sensitive information and potentially manipulate the application's functionality.

By utilizing black box testing with boundary value analysis, developers can systematically test various input scenarios, including boundary values, to ensure that the application handles them correctly and securely. This method helps identify weaknesses in input validation mechanisms that attackers could exploit to carry out security breaches. Additionally, by uncovering and addressing these vulnerabilities during the testing phase, developers

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can enhance the application's overall security posture and mitigate the risks associated with potential attacks (Harefa et al., 2021).

CONCLUSION

This research contributes to improving the quality and convenience of users in using the web Bengkel Koding of Dian Nuswantoro University Semarang. Through the implementation of Black Box testing with the Boundary Value Analysis technique, most of the web functions have been tested successfully with 25 test cases out of a total of 30 test cases and achieved a feasibility level of 83.333% based on the quality ratio calculation. However, five errors or bugs out of 30 test cases indicate the need for further improvement to ensure optimal user experience. Thus, this research provides valuable insights for developing and maintaining better web applications in the future.

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