

Evaluation of Automation Testing Tools Using Quality Model ISO 9126

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Abstract— *Testing is an important stage in system development. Software testing is divided into two methods, namely white box testing and black box testing. Based on the execution, testing is divided into two, namely manual and automatic. Manual testing is still done manually without any tools, while automatic testing is done when testing using testing tools. Selenium is one of the most automated testing tools available on the internet. Selenium was evaluated using the ISO 9126 quality model with several characteristics and sub-characteristic adjustments. The result is that selenium gets an average value of 3.8 from a maximum value of 5.*

Keywords— *Selenium, ISO 9126, automated testing, software testing.*

I. INTRODUCTION

To ensure that the software that is used every day without problems, there needs to be testing to ensure that the software runs without any problems. The testing stage is one of the stages in the manufacture or development of a system. The main purpose of system testing is to measure the health and completeness of the software being tested.[1]

Software testing is divided into white box testing and black box testing. Both methods are used to draw the point of view taken by the testers to create a test case. Black box testing is also called data-based testing and functional testing. This test does not need to know about the internals of an application. Usually this testing is done by users, testers and programmers. This test is based on external expectations because the internals of the application are unknown.[2]

Based on the test execution, tests are divided into two categories, namely manual testing and automated testing. Manual testing is a testing technique in which the tester prepares test cases and is executed manually to identify defects in the software. While automated testing, testing involves the development of scripting languages such as python, JavaScript and Tool Command Language. So, the test case can be executed by the computer.[3]

There are various types of automation tools available on the internet. Each of these automation tools has advantages and disadvantages. To evaluate/select the right automated testing tools according to needs. The quality framework used to define the test equipment was adapted from ISO/IEC 9126-1. The main characteristics adopted from ISO 9126-1 are functionality, usability, efficiency and maintainability in the first layer of the quality framework and in the second layer each quality is further divided into sub-characteristics or attributes. These attributes will help assess the testing tool later.[4]

This research was conducted to analyze the automated testing tools that will be used by companies between Selenium and Katalon Studio.

II. LITERATURE REVIEW

A. Software

Software are computer program instructions that when executed provide desired functionality and performance, data structures that allow the program to adequately manipulate information and documents that describe the program's operation and use. To gain an understanding of software, it is important to know the characteristics of software that make it different from other things that humans build. When hardware is built, the process of analysis, design, construction and testing is ultimately translated into physical form. Software is more logical than physical system elements. Therefore, software has characteristics that are much different from hardware.[5]

B. Quality Model

Software quality is a planned and systematic pattern of all actions necessary to provide confidence that the software is working according to specified technical requirements. The purpose of software quality is to measure product quality and efforts to improve quality. It should also consider product maintenance, technical solutions, budget and scope.[6]

C. ISO 9126

Organization for Standardization (ISO) and the *International Electrotechnical Commission* (IEC) have published the ISO/IEC 9126 multipart standard that defines software product quality models, quality characteristics and related metrics. This model can be used to evaluate and set goals for software product quality. For internal and external quality modeling, ISO/IEC 9126 defines the same model. This generic quality model can then be used as a model for internal and external quality with different sets of metrics. The model itself is based on six characteristics, namely functionality, reliability, usability, efficiency, maintainability and portability.[7]

D. Software Testing

Software testing is the process of running a program or system with the aim of finding errors. Software is no different from any other physical process in that it receives input and produces output. Software can fail in many different ways. Detecting all the different failures for software is generally impossible.[8]

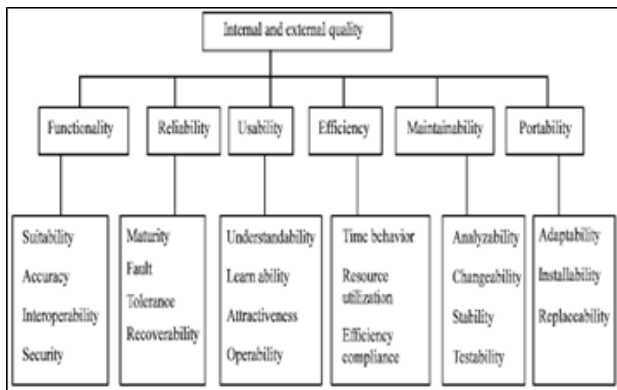


Fig. 1. characteristics and sub-characteristic ISO 9126

E. Software Testing Method

There are various types of testing techniques that have been discovered. Each testing technique has different purposes for testing different software such as designing, coding and planning software requirements specification. The testing technique is divided into three categories, black box testing, white box testing and gray box testing. Techniques that test the external system are categorized into black box testing and those that test the internal system are categorized into white box testing and those that test internal and external are usually called gray box testing.[8]

F. Automated Testing

Automated testing is the tester writing scripts and using software or other tools to test the software. The advantage of using automated testing is that automated testing of test case execution is faster than manual testing and automated testing can be programmed by testers to create satisfactory tests to find hidden information.[2]

G. Selenium

Selenium is an open source automated web test that runs on multiple platforms and browsers. It is not a single tool but a combination of many tools that can be used to meet the requirements of various tests. Selenium Webdriver executes commands in Selenese or from the application's client interface and sends them to the browser. Each browser has its own driver which is used to send the command to the browser to get the result. Previously Selenium required a dedicated server to manage the browser, but now Selenium directly uses the browser.[1]

III. RESEARCH METHODS

This research was conducted to analyze the automated testing tools according to the company's needs. There are several stages of the process for defining an automated testing tool. The research method chart can be seen from the following figure.

Data collection is done through observation on the internet by looking for references of similar research on the comparison of automated testing tools. The data is in the form of a web-based automated testing tool.

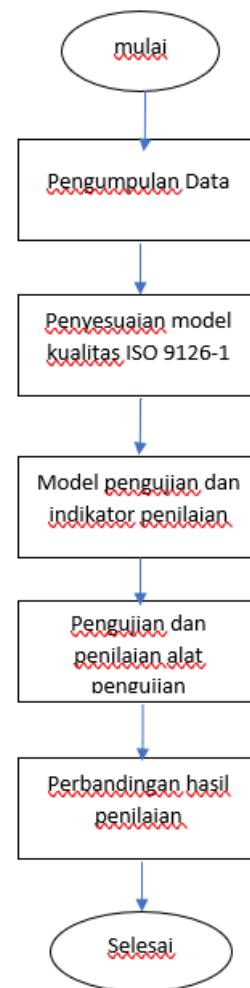


Fig. 1. Research method

This study uses the ISO 9126-1 model as a reference for software quality. The ISO 9126-1 model has many characteristics and sub-characteristics. However, not all characteristics and sub-characteristics become a reference. Therefore, it is necessary to adjust the ISO 9126-1 model. Adjustments are made to select the appropriate characteristics and sub-characteristics to assess software quality.

After that, making a test model of each of the characteristics and sub-characteristics that have been adjusted. The test model is made by citing similar research. The test model includes testing of assessment indicators that can be used to assess automated testing tools. testing of automated testing tools based on the test model of each characteristic and sub-characteristics. The test results are values based on the quality assessment indicators of automated testing tools.

The results of the automatic testing tool quality assessment can be calculated with the highest number of values. The calculation of the value involves each of the characteristics and sub-characteristics. The calculation gives the total quality value to the automated testing tool so that a comparison of the total quality value can be made to find the best automatic testing tool.

IV. RESULTS AND DISCUSSION

The parameters to be used in the software quality assessment are based on the previously described ISO 9126-1 model. However, adjustments are needed to the ISO 9126-1 model which refers to an automated testing tool.

The following is the ISO 9126-1 model as a reference in this study.

Functionality	Suitability
	Interoperability
Usability	Understandability
	Learnability
	Operability
Efficiency	Time Behavior
	Resource Utilization
Maintainability	Analysis

After determining the characteristics that will be used as parameters to determine the quality of the software. A model is needed to calculate the quality of the software. The test model consists of 4 parts of the characteristics that exist in the ISO 9126-1 model.

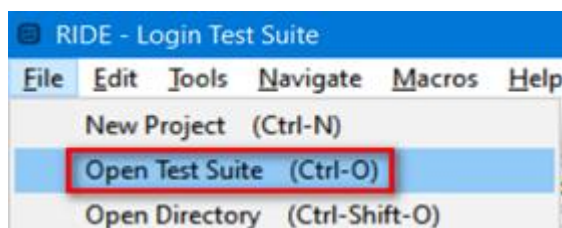
After determining the parameters of the characteristics and sub-characteristics. The following is a test using Selenium to get a value based on these characteristics.

A. Suitability Testing

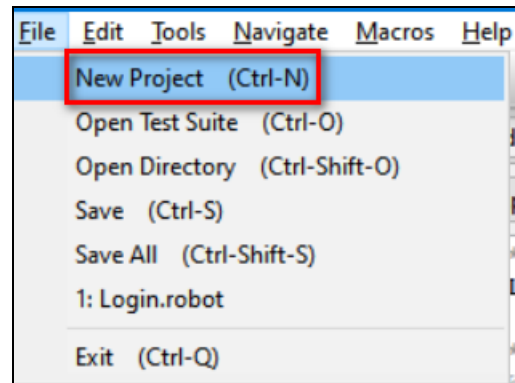
Testing the suitability of Selenium using black box testing. The purpose of this test is to find a way to create test cases in Selenium. The following are the results of the suitability test:

Test case number	Actual results	Conclusion
1	There is an Open button. When clicked, the page will move and the user selects a file to create.	Succeed
2	There is an Import button. When clicked, the page will move and the user selects a file to create.	Fail
3	There is a text editor for creating test cases.	Succeed
4	There is a record and replay to make a test case.	Fail

There are functions found related to scenarios, namely:



1. Function for opening test case
2. Function for create test case from text editor



Based on the suitability test table, it can be concluded that the suitability value of Selenium gets a value of 3 because it only meets 3 scenarios

B. Interoperability Testing

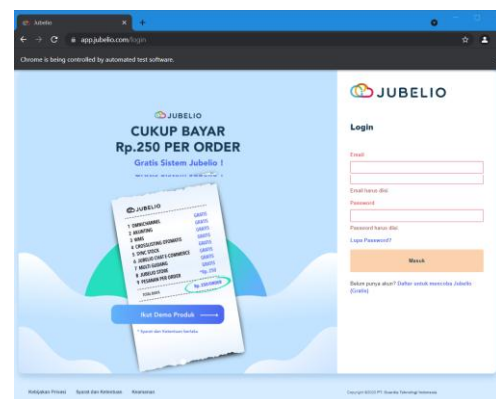
Interoperability testing is done using black box testing. The purpose of this test is how many external systems can interact with Selenium.

Scenarios have been run in various browsers and can be run in 4 different browsers through Selenium. Here are the test results:

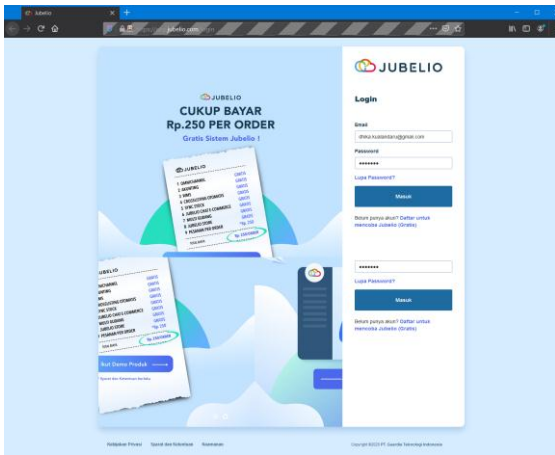
Test case number	Actual results	Expected results
1	There are 4 browsers that can be run, namely Chrome, Firefox, Edge and Opera	Succeed

There are functions found related to scenarios, namely:

1. Runs on chrome browser



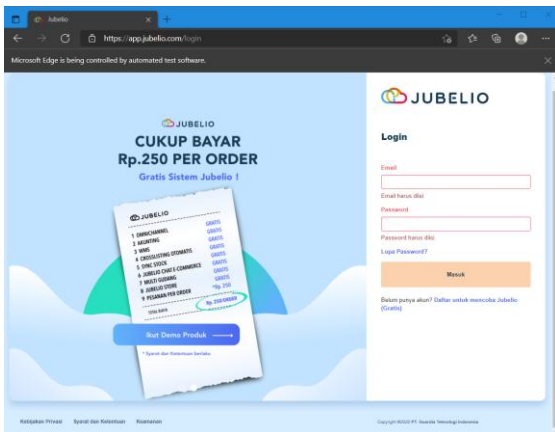
2. Running on firefox browser



3. Runs in opera browser



4. Runs on the edge browser



Based on the interoperability test table, it can be concluded that the interoperability value of Selenium gets a value of 4 because it can interact with 4 browsers

C. Usability Testing

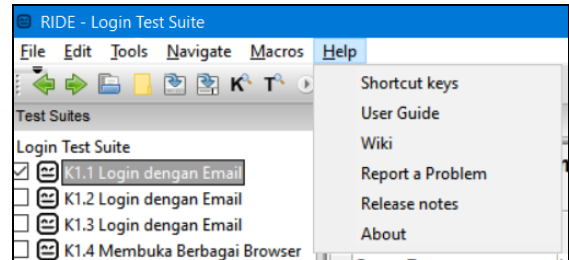
Testing usability characteristics using the black box testing method. The purpose of usability testing is to find features that help use the application.

After all the testing is done, for test cases 3 and 4 it fails because it does not display a warning message if an error occurs and cannot change the language. Here are the test results:

Test case number	description	Expected results
1	There is a "Help" menu button	Succeed
2	Tool column wearing icon	Succeed
3	An error warning column will appear	Fail
4	There is a button to change the language	Fail

There are functions found related to scenarios, namely:

1. There is a Help menu



2. Tools menu using icons



Based on the usability test parameter table, it can be concluded that the usability value of selenium is 3 because it only has a help button and the tool menu uses icons.

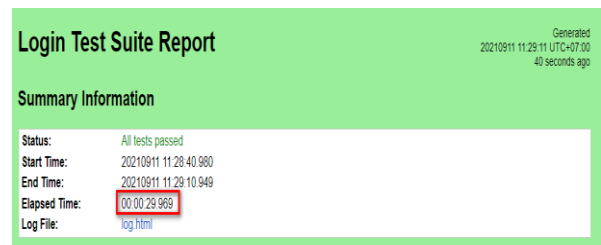
D. Testing Time Behavior

Software testing for efficiency characteristics using black box testing. The purpose of testing is to test the speed of execution in one test case.

After testing on Selenium and getting a test report, here are the test results.

Test case number	description	Conclusion
1	Get test report and get test case execution time.	Succeed

After the execution is done, the report will come out and get the processing time to complete. The following is a report of the tests that have been carried out:



The test case execution time with selenium was 29,969 seconds. Based on the processing time, the value of the processing time is 3 because the execution time is between 20-30 seconds.

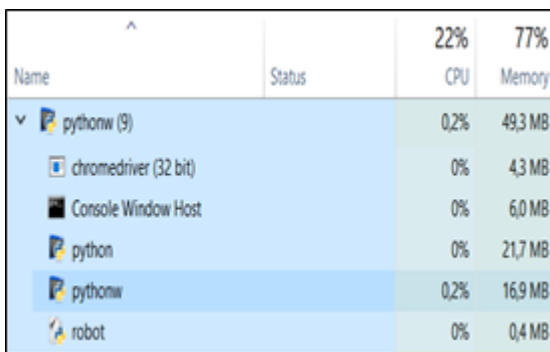
E. Resource Utilization Testing

Resource utilization testing uses black box testing. The purpose of this test is to find out the RAM usage when running Selenium.

After testing on Selenium and here are the test results:

Test case number	Actual results	Conclusion
1	Get RAM usage	Succeed

After running the test case, the results obtained from the use of RAM on Selenium when running the test case. It can be seen as follows:



Name	Status	CPU	Memory
pythonw (9)		0,2%	49,3 MB
chromedriver (32 bit)		0%	4,3 MB
Console Window Host		0%	6,0 MB
python		0%	21,7 MB
pythonw		0,2%	16,9 MB
robot		0%	0,4 MB

So RAM usage while Selenium is running is 49.3 MB. With that result, Selenium gets a score of 5 or very good because the RAM usage is below 100 MB

F. Analyzability Testing

Analyzability testing uses the black box testing method. The purpose of this test is to find errors in Selenium whether it gives error messages to analyze.

From these tests, errors can be analyzed because they display a clear error message. The following are the results of testing the scenario.

Test case number	Actual results	Expected results
1	Getting error messages clearly	Succeed

After testing is complete, a warning about an error is generated by Selenium. There are 5 test cases that were intentionally wrong by changing the script. But there is 1 that worked out of the 5 test cases. Here are the test results:

```

El.1 Login dengan Email
Element with locator '//body/div[@id="root"]/div[1]/div[1]/div[1]/div[2]/div[1]/form[1]/div[2]/div[1]/button[1]' not found.

El.2 Login dengan Email
SafariDriver was not found: are you running Safari 10 or later? You can download Safari at https://developer.apple.com/safari/download/.

El.3 Login dengan Email

El.4 Login dengan Email
Element with locator '//body/div[@id="root"]/div[1]/div[1]/div[1]/div[2]/div[1]/form[1]/div[2]/div[1]/button[1]' not found.

El.5 Login dengan Email
Element with locator '//body/div[@id="root"]/div[1]/div[1]/div[1]/div[2]/div[1]/form[1]/div[2]/div[1]/button[1]' not found.

Login Test Suite
5 tests, 1 passed, 4 failed
    
```

Selenium can display 4 error messages out of 5 test cases. Based on the analyzability parameter, it can be concluded that Selenium gets a value of 5 or good because it can display 4 error messages.

G. Total Selenium Quality Rating

Based on the assessment of the characteristics of the ISO 9126-1 model including functionality, usability, efficiency and maintainability. The total value of Selenium quality can be seen in the following table.

No	Subcharacteristics	Score
1	Suitability	3
2	Interoperability	4
2	Usability	3
3	Time Behavior	3
4	Resource utilization	5
4	Analysis	5
Total		23

V. CONCLUSION

Based on the results of the Selenium assessment, it can be concluded that Selenium has a good performance. This is evidenced by the overall score getting an average of 3.8 out of a maximum score of 5.

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