

A Review for Automating a Website using Selenium and Java

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Abstract:- One of the most important and fundamental stages of the software development life cycle also known as SDLC. Nowadays, there exists a large number of applications that run directly through the browser, also known as browser based applications. Selenium is an open source tool, it is freely available on the internet, and can be downloaded and installed by anyone. It is supported by various operating systems such as windows, macOS, etc. and it supports various languages such as Java, Python, Ruby, etc. The importance of controlling and improving the quality of web applications will increase its economic relevance. Automation testing lowers test costs and boosts productivity to produce a final product that is high-quality and stable. Web applications are becoming so complex that manual testing of them is challenging. The time and expense will go up. No accurate outcomes are possible. Test automation can be used to prevent this. Making test automation for Web applications using a software testing tool (Selenium) is the paper's main goal. Selenium Webdriver is used to develop a framework, and automate web applications to verify it works as expected.

Keywords: Selenium, Framework, Test Automation, Automation Testing Tools Selenium Webdriver.

INTRODUCTION

1.1 Testing of software

Testing is a very important process that must be done while developing a software as it helps ensure the quality of the project or product being developed. Testing can be carried out manually or via an automation tool. [1][4] Testing the application via an automation tool poses a number of advantages: Automating the test cases and creating automated test scripts saves time, effort and cost, and helps ensure that the software required by the client is delivered within the stipulated time frame..

1.2 Ways of Testing

Without the use of any software automation tools or test scripts, manual testing involves manually testing the product or application. It is a method of manually evaluating the software or programme to see if it complies with the necessary specifications that is the expected and actual behavior matches and find out defects if any. There are various challenges offered by manual testing

[1] Manual testing causes Human Errors [2] Higher chances of risk. [3] Effort: Doing Regression and Retesting manually requires a lot of effort and time which further affects the project delivery process. [4] Reporting: Reporting of bugs too needs to be done manually which makes the process very tedious and confusing.. There are various things that we should have in mind while choosing the tool for testing the software. It should gel with the design, should be easy to integrate & implement in the application, execution and maintenance of the automation scripts.

Hence automating the test cases is necessary for CI/CD that is continuous integration/continuous delivery and ensuring that testing is carried out efficiently. Automation Testing overcomes all the disadvantages offered by manual testing, in addition it provides a lot of features. The fundamental goal of automation testing is to reduce the amount of testing required while maintaining the software's quality using the fewest possible scripts. Through Automation testing we can execute tests, report the outcomes. Automation testing is not a replacement to manual testing but its an add on to it and makes the process more efficient, less time consuming, and more reliable.

1.3 Comparison between Automation and Manual Testing

Table 1.1: Difference between automation and manual testing [11]

Manual Testing	Automation Testing
The simplest low-level type, during each a QA runs all tests manually, without using any helpful software.	A QA uses a special program/tool for running tests, already existing or written specially for the project.
A time-consuming process.	Time-saving, particularly, because a QA can re-run the same tests numerous times
Can be repetitive and boring.	Helps to avoid repetitive tasks as a QA "delegates" them to a computer.
Is suitable for almost any software product.	Is suitable only for stable systems and used mainly for regression. Some types of testing (research, ad-hoc, etc.) cannot be automated.
Helps to define whether automation testing is possible and necessary.	100% automation is not possible.

ANALYSIS

Software Quality

1.4 Advantages of Automation Testing

In the digital environment, testing's significance is now well acknowledged. But the current generation of development environments is frequently constrained by time and money. Testing and quality assurance are eventually frequently put on the back burner and you fail to offer value to the end user. It will be expensive to maintain any bugs that make it into the production environment undetected.

Automated testing is suitable for large projects that require repeatedly testing the features, whereas manual testing allows a human mind to assess the product and produce test findings.

With the help of automation tools, automation scripts are written and those scripts are executed. Test automation is used to automate repetitive operations and other challenging manual testing jobs.

Testing the software, or application through automation tools has proven to be really efficient in all IT companies. Automation testing saves time, increases reliability and gives more profit to the IT companies while ensuring client requirements are met. Various advantages offered by automation testing. [12] .These are:

- Automated testing overcomes the disadvantages offered by manual testing.
- Automated testing decreases the dependency on the availability on QA people.
- Test automation scripts once written can be run any time of the day and any number of times.
- QA automation engineers maintain separate repository for the automation scripts being written by them.

Here the amount of dependence on human effort is reduced and hence the chances of human errors are reduced as well.

Once the automation scripts have been written they can be executed any number of times and we can generate attractive reports for test execution results by using the reporting feature known as Extent Reports.[3] While carrying Automation Testing, an "Automation Framework" needs to be developed. The main job of the tester is to assure the quality of the software by finding and reporting bugs to the developer so it can be fixed and the actual behavior of the application matches the expected behavior more. Software Quality is very important for client satisfaction.[6]Ensuring a high level of customer satisfaction should be made a top priority.

Doing Manual Testing is a very tedious process, which requires a lot of effort, time and energy .

By utilizing automation tools like Selenium, JMeter, Load Runner, etc., automation testing solves all the difficulties presented by manual testing. Because it saves us time and effort and streamlines the process, automation testing is more practical and effective than manual testing.

The suitability of a software programme for a certain function defines its quality. In other words, a high-quality product precisely satisfies customer needs. Software products' appropriateness for use is often determined by their compliance with the standards established in the SRS document. For many items, such as cars, table fans, grinding machines, etc., "fitness of purpose" is a suitable definition of quality; nevertheless, it is not totally satisfactory for software products. [8] While software testing is primarily used to enforce and evaluate functional quality. It is impossible to judge quality by looking at a finished product. [10] As a result, testing is crucial to establishing and evaluating the quality of a software or application. By comparing the improvement to how end users and the business organization see software quality, it is possible to identify areas for improvement. When new requirements are identified, the input is then sent back into the SDLC process, where a new or expanded set of Quality Control functions may be added.

Some Ways of assuring quality includes- test frequently and early. Put quality controls in place right away, and emphasize the value of quality control throughout the whole software development process. Standard software development is used to structure the development process, and methodologies, techniques, and tools are used to support it. According to the needs of the software being built, testing is also done in several stages. Testing can be carried out manually or via automation tools, though automation is not a replacement to manual testing.

2.1 Steps while developing Framework

Automation is not carried out for all the test cases. Only those scenarios are chosen that covers end to end functionality As per the client there may be certain functionalities to be automated. Prerequisites to automating test cases include all the manual test cases must be executed and passed and test planning should be done. There are various steps to developing framework.

These are [14]

- Feasibility analysis and research
- Choose Test cases for automation
- Design and implementation of Framework
- Execution
- Maintenance

Automation Testing Life Cycle Diagram

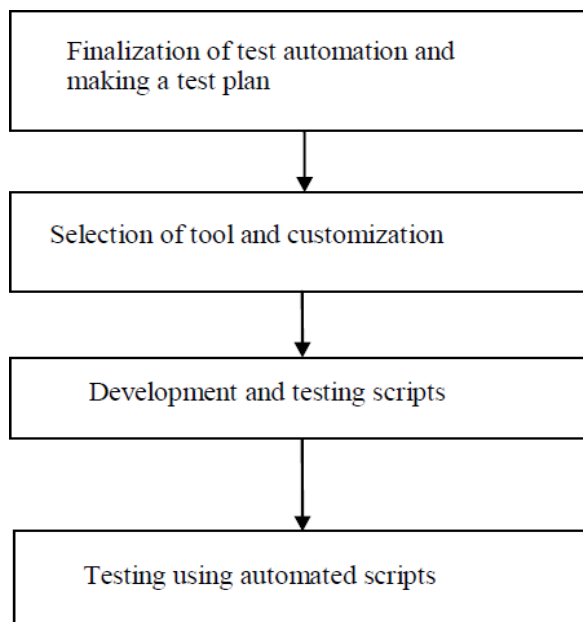


Figure 2.1: Automation lifecycle [9]

2.2 Finalizing Test Automation and constructing a Test Plan:

A test strategy, objectives, schedule, estimation, deliverables, and resources required to test a software product are all detailed in a test plan. The Test Plan assists us in determining the effort required to verify the application's quality. The duration in which the creation of automation test suites needs to be done is also taken into consideration.

INTRODUCTION TO SELENIUM

Selenium is an open source tool, it is freely available on the internet, and can be downloaded and installed by anyone. It is supported by various operating systems such as windows, macOS, etc. and it supports various languages such as Java, Python, Ruby, etc. The automated test cases can be run on different browsers such as chrome, firefox, edge, internet explorer, etc. We can carry out parallel and cross browser testing.[5] Various plugin such as TestNG, Maven, Jenkins, Git, Github etc. can be integrated to provide additional features. We have various components in Selenium, these include:

- **Selenium IDE:** The acronym for Selenium's integrated development environment is Selenium IDE. It is a record and playback tool developed for firefox web browser. The advantages it offers is that it is only compatible with firefox browser and we cannot automate complex features using it.
- **Selenium RC:** Selenium RC stands for Selenium Remote Control. The automation scripts can interact with the web browsers using the Remote Control. Here there is dependency on RC to execute the scripts and the process is a bit slow since an intermediary component is involved.
- **Selenium Web Driver:** Selenium Web Driver is the heir to Selenium RC that lets direct interaction of the browser with automation scripts.
- **Selenium Grid:** Selenium Grid provides hub and node architecture and lets you run the automation scripts remotely.

Is 100% Automation possible?

No, 100% automation is not possible since in real world projects there are always going to be scenarios or situations in which you need to test manually and they can't be automated. If there are 100 Test cases and you automate 90 of them, then there are going to be 10 Test cases which you need to test manually.

Eg. You cannot automate captcha using selenium, so you need to test it manually. Also, we cannot automate graphs since they are dynamic, are constructed based on data, hence it cannot be tested through automation, we need to test them manually.

TEST AUTOMATION FRAMEWORK

POM is a design pattern which is commonly used in Selenium for Automating the Test Cases. In this model all the web elements, and their action methods are maintained in different java classes while steps on these elements are performed in a separate java classes.

For every page of website we create a page object class, wherein we identify the elements and we have action methods operating on them. We usually keep all the page object classes in a separate package. An object-oriented class called the Page object serves as an interface for the page of your application that is currently being tested. Web elements and methods for interacting with them are both contained in the Page class.

Selenium Testing Process consists of following phases:



Figure 3.1: Selenium Testing Process

Test case class makes use of page object's class(es) and performs validations. We create the object of these Page Classes while automating the test cases and interact with web elements by calling their methods..

A separate class created to keep all the reusable methods. The base class is the primary class responsible for configuring the browser, loading configuration files, and other reusable functions like taking screenshots or shutting down the browser when a script has been run, for example. We usually keep the base class in a separate package. Every test case class extends base class so that every test case class is able to access the methods in the base class and reusability of code is ensured.

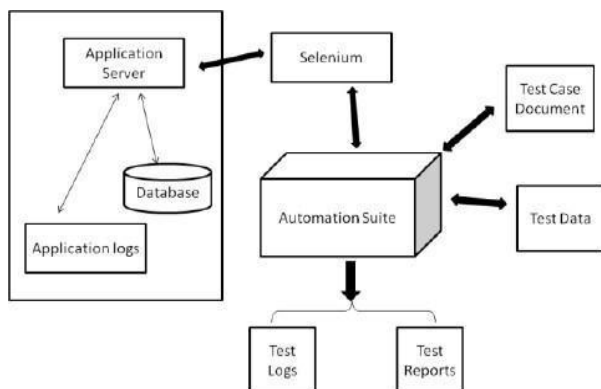


Figure 4.1: Framework structure

Framework is used for organizing project related files in proper structure. Framework provides reusability since we maintain a separate base class to reuse methods in test case classes, and it provides maintainability since it helps us maintain a folder structure to organize the project in a specified manner.

Types of frameworks in the market-

- Pre-defined framework- These are frameworks already available in the market, ready made frameworks. eg. JUnit, TestNG, Cucumber etc.
- User-defined framework- We can create frameworks of our own as per our own convenience according to our project, functionalities, team skill set, etc. eg. Data Driven Framework, Keyword Driven Framework, HybridFramework(TestNG, Maven, DataDriven, Git, Github, Jenkins, etc.), etc..

CONCLUSION

The idea of software testing and numerous testing techniques were put forth in this work. Using automation tools to test a web application undoubtedly cuts down on the time needed to generate test cases and improves testing productivity. There were many web automation tools available, including JMeter and Selenium. Our study focuses on how to maintain a framework for the same that promotes reusability, modularity, and makes it simple and effective to add or delete files from it in order to automate test cases and keep all project files organized.

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