



(REVIEW ARTICLE)



A review of the software testing tools

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Abstract

The effectiveness of the testing process plays an important role in delivering quality software. The testing process may be impacted by many constraints like time, budget, resources, and scope. etc. Currently, due to the advancement and emergence of new technologies, efficiency and reliability have become very critical. The Software's automated testing tools help in delivering effective and quality software within constraints. The Automated software testing tools are effective in saving the testing cost and enhancing efficiency, test coverage, and accuracy scalability. Every software testing tool has a unique feature. Some testing tools require programming skills, whereas some do not. In this paper, a review of the various most popular software automated testing tools has been presented. The automated testing tools have proved effective in performing various tasks related to the testing. The use of automated testing tools is growing day by day. Nowadays, every type of testing can be performed by using testing tools. Some factors have been considered at the time of the selection of the testing tools. The automation of testing tasks using the automated testing tools proved very effective and beneficial.

Keywords: Software testing tools; Tools; Automated testing tools; Testing framework

1. Introduction

The effective testing process is crucial in producing and releasing high-quality software within the time and allocated budget. The testing process includes validating the functions across all possible scenarios and assuring that the delivered software will perform all the functionalities as per the customer's expectations. Software testing ensures that customers will not be affected by any bug. The process of effective testing of the software faces various difficulties in testing the software. These challenges [1] include time constraints, complex architectures, lack of testing expertise, test environment constraints, communication and collaboration, lack of test data, etc. As per the survey report 2019 [2], the software testing process consumes 15 to 25 % of the allocated budget. The cost of the software testing process depends on many factors. These factors include the complexity of software, testing approach, testing tools, team size, technologies being used, and time allocated to the completion of the project.

The cost of the testing process can be reduced by minimizing the test cases, prioritization of test cases, selecting the appropriate testing techniques and automated testing tools, etc. Automation of the test improves efficiency by executing the repetitive test cases, helps save time and effort for developers as well as testers, and quickly identifications if there are defects in the software. It also increases the accuracy of testing, and reduces the risk occurring due to human mistakes. There are various types of testing tools available in the market. Almost every type of task related to the testing of software can be automated by using the appropriate testing tools. There are many types of software testing tools that are used by the industry today. Some common types [3,4,5] of tools being used presently are given below

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- **Test Management tools:** These types of tools are used to manage test cases, execution of automated test cases, plan etc.
- **Unit Testing:** Unit testing tools are used to test the individual modules to ensure working as per expectations.
- **Integration Testing Tools:** The integration testing tools are used to detect the bugs when the various modules are connected.
- **Regression Testing Tools:** These types of tools are used to verify, whether the modified part of the software does not affect the working of the rest part of the software.
- **Performance Testing Tools:** These types of tools are used to evaluate the performance of the applications under various loads.
- **Bug Tracking Tools:** Bug tracking tools are used to detect the bugs in the testing phase.
- **Cross-Browser Testing Tools:** These types of testing tools are used to test the application on multiple types of web browsers, and devices.
- **Security Testing Tools:** Security testing tools find out any vulnerabilities that exist in the software that might be exploited by malicious users.
- **UI Testing tools:** These types of testing tools are used to ensure that the software offers a user-friendly experience.

The effectiveness of the testing process also depends on the software testing tools, that are used for the automated tests. Every testing tool has its advantages and disadvantages. The selection of a suitable tool is a very challenging task. The selection of inappropriate testing tools fails to deliver quality software within the allocated time and budget. The selection of tools should be done [6,7] based on the following factors

- Skills of the team to best utilize the tool
- Budget
- Required features
- Script maintenance and reusability
- Integration capabilities
- Technical support

Software testing tools play a very important role in delivering quality software within time and at minimum cost. In this paper, a review of the various software testing tools has been performed to find out the effective software testing tools that are performing well under different scenarios. The most common software tools that are being used by the industry in 2024 have been analyzed. It has been observed that a particular testing tool cannot fulfill all the required requirements. Every type of application is being tested using automated testing tools. The types of applications include mobile, desktop, and web-based applications. The use of automated testing tools helps in delivering quality and reliable software within the time and budget by automating the tasks related to the testing process.

2. Literature Review

In this section, a rewritten overview of the work related to the various automated testing tools has been presented. A brief overview of some most popular testing tools used presently by the industry has also been discussed.

Dilara Ateşoğullar and Alok Mishra [8] presented a comparative view of the automated software testing tools by categorizing the unique features of the considered testing tools. By reviewing the existing tools, they found that various tools had some unique features and some common features. They also observed that it is not feasible to remark on the quality features of a single tool that is used for automation tests.

Heidilyn V et al. presented [9] a comparative review of the features of the various existing open-source testing tools and commercial testing tools that help the user to consider effective automated testing tools to test the software based on the requirements. They found that selenium is the better choice to test the project having high consideration of the cost and Licensed tools such as QTP/UFT should be used where the availability of support, ease of learning, and report generation are required.

Arjun Satheesh and Monisha Singh presented [10] the analysis of the two open-source web testing tools namely Selenium and Sahi. The findings of their study indicate that selenium is an appropriate choice for testers having less experience and coding skills. They also found that the Sahi testing tools do not have some advanced features that exist in the selenium.

Jagdish Singh and Monika Sharma et al. [11] Sahi Pro and Selenium Webdriver web-based testing tools. They analysed the tools based on some factors. such as the time of execution, efficiency of recording and playback, compatibility with the browsers and platforms, cost, etc. They found that the Sahi Pro provides better efficiency than Selenium Webdriver in case of execution time, recording, and playback criteria, whereas Selenium is an appropriate option if platform compatibility and programming language support are considered.

F. Okezie et al. presented a [12] analysis of the software testing tools. they performed the analysis on the various software automated testing tools like Selenium, Test Complete, Ranorex, OpenScript, Janova, etc, and highlighted their basic features and attributes. They found that there is no single perfect tool for testing. The best tool can be selected based on the project size, testing cost, platform, and programming language used for the application.

Harpreet Kaur et al. [13] presented a comparative investigation of the various existing tools. such as Selenium, HP QTP and TestComplete. They compared the considered tools based on the six parameters. The considered parameters for the investigation are the recording efficiency, reports generation capacity, data-driven testing, result reports of tests, reusability, execution speed, script playback, learning easiness and cost. They found that the HP Quick Test Professional is an appropriate testing tool among all considered tools for the testing.

Mubarak Albarka Umar et al. [14] focused on the various tools and frameworks that have been used to perform the effective and successful testing of the software projects. They found that the right selection of the appropriate testing tool and frameworks played a vibrant role in the effective testing of the software. Elis. Pelivani and Betim. Cico [15] have analysed and compared the various features of the Katalon Studio and Selenium testing tools for web testing. Divya Kumar et al. [16] investigated the various factors related to the automation of the testing and the cost of the test automation. They formulated a mathematical model by considering the various factors related to the testing effort that helps to compute the test automation impact. They found that test automation is a beneficial approach in the long run where tests are run and rerun many times.

Dheanda Absharina et al. considered [17] the five test automation tools for the analysis. The considered tools include Selenium, QTP, TestComplete, Watir, and Ranorex. They found that every tool has its strong points and weak points. There is no single tool that is used to perform the test automation. They also discussed the merits and demerits of all five considered automated testing tools.

Sana Fatima et al. performed [18] an analysis of the frameworks of machine learning for software automation. The performance of the testing tools has been computed using the required manual labor. They found that by adopting artificial intelligence production and delivery of software will be much faster and more effective. The use of artificial intelligence helps in the quick development of tests and detects bugs earlier.

Natnael Gonfa et al. determined [19] the major test apprehensions and issues in the automated testing of mobile applications. The result of the analysis indicated that a keyword-driven framework is a broadly applied technique for testing. However, various hybrid test automation techniques have also been employed for mobile testing. They also found that the present frameworks needed to be updated by adopting reusable and area-specific keywords for effective testing of the mobile applications.

Abel Méndez-Porras et al. proposed [20] and evaluated the framework for automated testing. The proposed framework integrates various factors like the features of user interaction, historical bug information. The considered factors help in detecting new bugs. The evaluated result of the proposed framework showed the efficacy in bug detection related to the user interaction.

Lalji Prasad et al. performed [21] a survey of the widely automated testing tools for the testing of the software. They found that the selection of the appropriate tools depended on the development choices, evaluation objectives, execution facilities, etc. The finding of the review indicates that the insight of the managers and testers helps in the selection of the appropriate tool for the assignments.

Selenium is an open source [22] automated testing tool for web-based applications. The Selenium testing tools are used to automate functional testing, regression testing, and performance testing. The Selenium testing tools have been accessed by a wide range of developers as Selenium supports multiple programming languages. The Leapwork automated testing tool [23] is used to automate the testing process related to functional, User Interface, regression, and end to end testing. It can be also used for the continuous testing and automation of the application monitoring and process for agile transformations. It does not require any type of programming skills. Appium is a cross-platform [24]

automated testing tool for testing mobile-based applications. The standard WebDriver library is applied to test the native, hybrid, and mobile web applications.

Katalon Studio is a platform used [25][26] to test all applications like mobile, desktop, web, and API. With the help of the Katalon Studio tester, a tester can write the test efficiently and determine its results. The issue quickly. It also helps the teams speed up the process of development of the software and deliver a quality product. TestComplete is used to automate [27] the testing process of the various types of applications and technologies. The unit and functional testing can be performed by employing the test completely. It can be also used for regression and many other types of testing like data driven testing, distributed testing, etc.

Cypress is an open-source Java [28] script-based automated testing tool to test modern web applications. It can also be integrated with other types of tools and frameworks. This testing tool helps in improving the efficiency and reliability of the testing process as it provides features like automatic waiting, real-time reloads, time travel, interactive test runner, etc. Tricentis framework [29,30] is used to test all types of applications, data and processes related to the business. It can also be integrated with other types of tools. It can also reduce the test cycle time as it is leveraging artificial intelligence and cloud computing. The codeless approach of Tricentis focuses on the testing process. Cucumber is a software [31] tool used to design test cases related to the testing of the behavior of the functionalities of the software. The focus of the cucumber testing is on the experience of the end user. It also supports all types of programming languages like Java.Net, JavaScript, and other software tools.

Lambada test is a cross-browser [32] framework that tests the applications on desktop browsers and mobile configurations. With the Lambada test, live testing, screen, and responsive testing can be performed efficiently. It also provides the selenium cloud grid to run the testing script on the cloud. The postman automated testing tool [33] is used to perform the unit, functional, integration testing, end-to-end, regression, and mock testing. It also supports the reusability of the test cases. The Postman tools automatically share the collaborative projects with the other members of the testing teams. It includes the various snippets of Java Scripts and tests the APIs without writing the code.

After critically reviewing the above literature, it has been observed that no single automated testing tool fulfils all the requirements of the tester. Some factors need to be considered at the time of the selection of the appropriate testing tools. These factors include the requirement of the project to be tested, assigned budget, generation of the test case, capabilities of the data-driven, etc. Every automated testing tool has some merits as well as demerits. Most of the testing tools are not free and require some programming skills for the setup and configuration of the testing tools. The automated testing tools help to achieve the objective of delivering effective software within time and budget.

3. Conclusion

Automated tools for testing the software are used to deliver quality software within the allocated budget, and time and consume fewer testing efforts. Automated testing tools have been used for testing desktop, mobile, and web-based applications. Some testing tools require programming skills as some testing did not require such requirements. Some factors need to be considered at the time of the selection of the appropriate testing tool. Every tool has some unique features. The user can select the software testing tools that meet all the required features within cost. The analysis of software and outcomes reports and comparison of the results with the earlier test results has been performed by the testing tools. Selenium automated testing tool is widely used for testing web applications. So, it becomes the top choice when testing web applications. The widely automated testing tools for software testing are Selenium, Katalon, cypress, etc. Automated testing tools can automate various types of tests. These tests include the end-to-end, unit, integration, and performance. Tasks related to the use of the testing tools enhance the quality of the testing process and help in releasing quality software by saving testing efforts, time, and budget.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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