IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 6 ISSUE : 1 Print / Issue Publication Date: 08-Aug-2021

ISSN : 2455-2143

DOI : 10.33564/IJEAST.2021.v06i01.065

Indexed In

Google SCHOLAR OPEN ACCESS doi Crossref

WWW.IJEAST.COM

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International Journal of Engineering Applied Sciences and Technology, 2021
Vol. 6, Issue 1, ISSN No. 2455-2143, Pages 415-419
Published Online May 2021 in IJEAST (http://www.ijeast.com)

TEST COVERAGE ENHANCEMENT USING HYBRID MODULAR APPROACH FOR WEB BASED APPLICATION

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***Abstract*—Automation testing may be a process that compares the particular results to the specified outcome within the software application. Automation testing is one of the foremost effective ways to check web-based applications since it allows you to hide more scenarios in less time. Selenium is one every of the foremost popular and effective automation frameworks that have been widely used for automating the testing of applications. The modular testing framework is one of the techniques used for automated testing, in which test scripts are built by breaking down the entire application into smaller pieces. Multiple data sets cannot be used thanks to hardcoded data within the test scripts. In this paper, a hybrid approach of keyword-data driven strategy is presented, in which the test data and script are separated to allow for various datasets and greater coverage. Furthermore, for improved test coverage, this split procedure is used across many modules.**

***Index Terms*—Selenium, Automation, Modular, Data-Driven, Keyword Driven**

I. INTRODUCTION

Automation testing is a software testing approach that uses a set of tools and Automation Testing Frameworks to evaluate the quality of a software application. Because of its open-source availability, flexibility, cross-browser and cross-platform compatibility, re-usability, and integration, Selenium is one of the most commonly used automation frameworks in the world. It is very simple to deploy [1].

Selenium framework has a bunch of tools which are required by the organizations.

- Selenium RC - This is the first flavor of Selenium. Selenium WebDriver was created as a result of the complicated architecture and lack of object-oriented APIs of Selenium RC.
- Selenium IDE - A selenium-specific integrated development environment.
- Selenium Grid - used to run many tests in parallel across various browsers and platforms
- Selenium WebDriver - This tool is used to test web-based software applications.

Selenium 2 is a combination of Selenium RC and Selenium WebDriver. [2].

A substantial percentage of users send several requests at the same time in most current online applications. A device must be tested extensively to ensure that it can manage the number of concurrent requests that it was designed to handle. Load testing is used to see how well an application works under different load conditions. Failure to do a load test might have disastrous results. A typical organization's web application contains a large number of modules. It's difficult to deliver error-free apps. Performing testing on such an application is a time-consuming processing of such kind of application is nothing less than a tedious job.

The modular testing technique promises that large programs may be readily tested by breaking them down into smaller modules, testing each one independently, and computing the results, however, the test data is hardcoded here. We must change the code for each new set of test data. A data-driven approach to web application testing is one in which the test data is separated from the test script logic in order to load various datasets for greater coverage.

The incorporation of a keyword-data-driven (hybrid) method into a modular approach leads to increased test coverage and improved product quality.

II. LITERATURE SURVEY

The asset utilisation of Selenium-based load testing in various designs was read for load test execution [3]. The most noteworthy discovery is that headless browsers consume far less resources than other browser variants. Similarly, a load driver's limit can be extended by at least 20% by distributing instances across client situations.

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In an SDLC, software testing has been demonstrated to be the most important need [4]. The main goal of testing techniques is to compare the findings acquired with those that the end-user is familiar with. This focuses on using the Selenium web driver to test an application and shows how to utilise it in conjunction with other devices like TestNG, Maven, and others, making it easier to improve the nature of testing.

The advantages and disadvantages of using Git are dis-

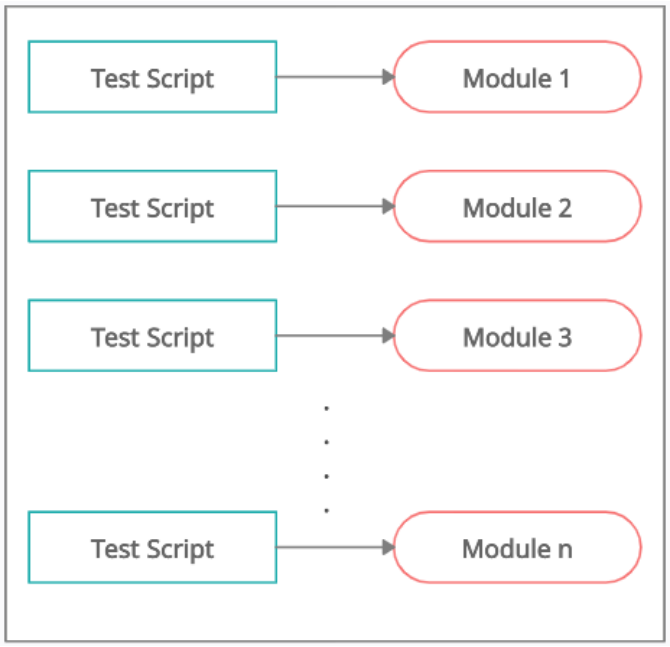

Fig. 1. Module Based Testing Framework

is important for continuous data development if the merging technique is not carefully controlled.

Software testing is the practice of evaluating programs with the goal of identifying faults and ensuring that the software is defect-free [6].As a result, over time, a number of testing procedures have been used. Various tools for automating testing have also been created. Selenium is one of the automation tools, and it's mostly used for validating product quality.

Let's take a quick look at the various testing techniques we'll be addressing in this paper.

A. Module Based Testing Framework

The Module-based Testing Approach is based on abstraction, which is one of the most well-known OOPs principles. The framework deconstructs the whole "Application Under Test" into logical and distinct parts. For each module, we build a separate and independent test script. As a result, combining many test scripts produces a larger test script that represents several modules. The main downside of this framework is that test data is hard-coded, which means that the test script must be rebuilt for each new data, which is a time-consuming task for larger applications [7]. Figure 1 shows how a module-based testing framework works at high level.

B. Data Driven Testing Framework

The Data-Driven Framework separates test script logic from test data, allowing for greater flexibility in selecting various sets of test data for increased coverage. The test data is processed using a test data reading mechanism (such as an XML reader or a JSON parser) before being used to test script logic. The result of the execution is compared to the expected outcomes, allowing the feature or module to be evaluated

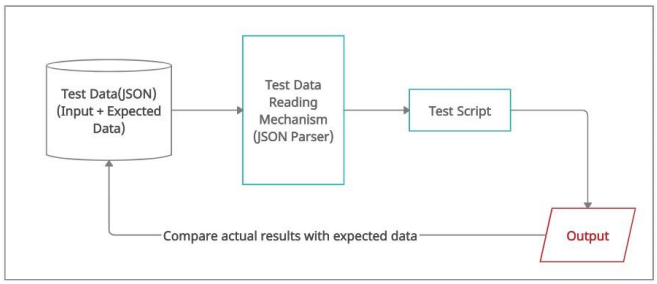

Fig. 2. Data Driven Framework

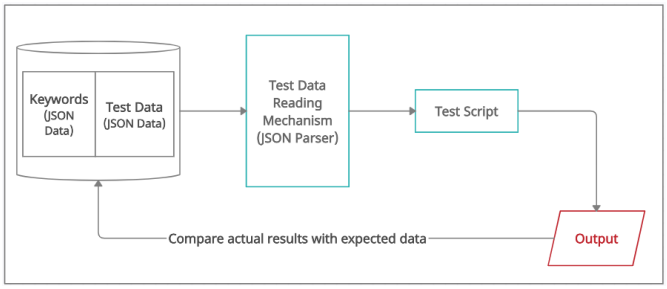

Fig. 3. Hybrid Testing Framework

in a variety of ways in order to enhance the application's quality [8].The high-level working model of the data driven test framework is shown in Figure 2. Each test scenario necessitates a large number of data files. Depending on how many screens are viewed, we may have a lot of data inputs and require a lot of verification. As a result, the test case's data files must be maintained in separate directories [9].

C. Keyword Driven Testing Framework

The keyword-driven test script integrates test data with test logic. Data is similar to data-driven technology in that it is a very fundamental term. Keywords in a test script relate to test data. During the script run, we just need to replace the real test data with the key word in this framework. The main disadvantage of the keyword-driven technique is keyword management; it is difficult to build test cases only by glancing at the keyword and without the test data, and it also need extensive knowledge of scripting abilities to write the test script.

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D. Hybrid Framework (Keyword-Data Driven Framework)

The term ”hybrid framework” refers to the process of integrating several test frameworks to overcome their flaws. The Keyword-Data Driven Framework is a well-known hybrid framework in which both the keyword and its related test data are accessible to push into the test script, as the name implies. Figure 3 represents the high level flow of the Hybrid Framework

III. Proposed Work

The incorporation of a Hybrid testing framework (Keyword- Data Driven Framework) into the module-based testing frame- work is recommended in this study to increase overall testing

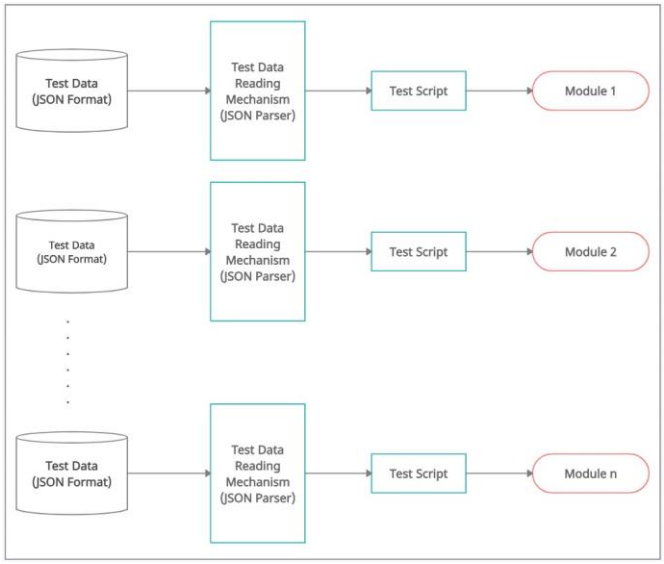

Fig. 4. Proposed Hybrid Modular Framework

efficiency. The same is done here by replacing the hardcoded test data with a JSON parser that loads JSON files specific to that module. Figure 4 represents the high level working flow of the proposed approach.

The below steps are followed for the implementation of the proposed model:

1) POM Creation
2) Java Dependency import
3) Necessary ATF(Automation Test Framework) method inheritance
4) Azure Logging
5)Testcases Execution
6)Reviewing the reports

Figure 5 shows the flow diagram of the how the current approach is implemented.

A. POM Creation

The Project Object Model (POM) is a most crucial file in any Java project because it contains all of the metadata about the dependencies required to run the Java code. In Maven, a POM is the fundamental unit of work. Configurations that may be supplied in the POM include project dependencies, plugins or objectives that may be executed, build profiles, and so on. Other information can be provided, such as the project’s version, description, developers, mailing lists, and so on. [10].

Similarly, across each test suite, a pom.xml file is required to store the test environment’s setup data.

B. Java Dependency import

We utilise Apache Maven to import the dependencies. A fundamental component of Maven is its dependency management. Managing dependencies for a single project is straightforward. Managing dependencies for multi-module projects and apps with hundreds of modules is possible. Maven makes

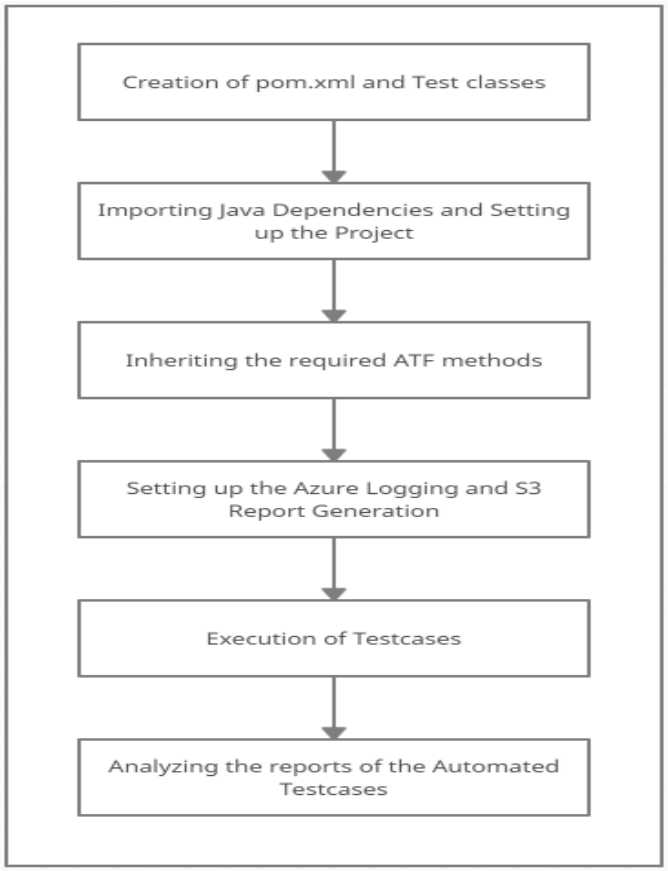

Fig. 5. Implementation Methodology

it easier to develop, create, and maintain repeatable builds with well-defined classpaths and library versions [11].

C. Necessary ATF(Automation Test Framework) method inheritance

In ATF, there are several methods that must be used in order

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to execute any test suite. A few methods should run before the execution of the testcase to assist build the appropriate environment, and a few methods should run after the execution of the testcase to determine what should happen based on the conclusion.

D. Azure Logging and S3 Report Generation

The outcomes of the testcases are logged using Microsoft Azure. The findings are stored and reports are generated using Amazon S3.

E. Testcases Execution

1) Selecting a data file format and data parser creation: Because JSON is a lightweight, less compact file that contains data in a hierarchical fashion, it is preferred over Excel. Excel is the best programme for importing small spreadsheet files with a lot of structure. When loading files with 10,000 rows and 100 or more columns, it performs badly, with some of these columns being provided by unstructured information such as reviews or descriptions. Excel, it turns out, does not follow CSV formatting requirements, so even if we encoded all of the characters correctly, they are not read by Excel [12]. JSON is the real data exchange standard for web servers, browsers, and mobile apps. Its basic structure and flexibility make it simple to read and grasp, as well as manipulate in your preferred programming language.

The test data input method used to parse JSON data is called JSON Parser. We use a JSON parser to parse the test data so that it can be retrieved by the test script [13].

2) TestScript Creation: TestNG is a framework for automated testing. TestNG is based on JUnit, which makes use of annotations (@). TestNG is designed to fix JUnit's flaws and make end-to-end testing straightforward. By producing an appropriate report, TestNG assists in determining how many test cases are passed, failed, or skipped. Failed test cases can be performed independently [14].

Instead of using hard coded data, we utilise TestNG dataprovider to acquire data from the JSON data parser and use it as test data in a module-based testing framework. The scenarios that are designed are used to generate test scripts. Multiple test data is provided into the modular testing framework in this way.

3) Testcase Execution: In reality, testcases are nothing more than a collection of data and scripts. On the basis of the preceding procedures, testcases are performed, and the results are calculated.

F. Reviewing the reports

An analysis of the Computed Reports is performed to determine whether or not an application is of high quality.

IV. RESULTS

On the basis of the proposed approach, approx. 40 modules have been tested, and significant improvements have been made in terms of the time taken to execute each module, as well as the coverage % of each module.. Table I shows the comparison of testing methods for few of the different modules.

The pass rate for manual testing will be slightly greater than that of automated testing, as manual testing uses far fewer data points than automation testing. Twenty percent. Only a few testcases failed in Modular, and manual testing was higher (about. 40 % As a result, the hybrid modular method has a much greater failure rate than the modular approach, which ranges from 70 to 80 percent.

V. CONCLUSION AND FUTURE WORK

This article proposes a methodology that helps achieve greater test automation coverage than the modular approach. The suggested hybrid modular architecture, it is thought, covers nearly every aspect of the application in order to validate its quality in an effective manner.

Exploring machine learning techniques and how they may be used in automated testing in order to enhance test coverage and minimise human involvement is recommended as a future desire.

TABLE I
RESULTS OBTAINED FOR A FEW OF THE MODULES

Modules	No. of TCs	Manual QE	Modular Approach	Proposed Approach
Project	30	7 days	8 hours	4 hours
Budget	30	5 days	5 hours	2 hours
Bid	30	6 days	7 hours	4 hours
Master Contracts	18	6 days	8 hours	3 hours
Contracts	10	3 days	4 hours	1 hour
Work Orders	35	5 days	3 hours	2 hours
Library	80	10 days	12 hours	7 hours

VI. ACKNOWLEDGEMENT

Dr. Manimala S, assistant professor at JSS Science and Technology University, Mysuru, and Dr. Shivamurthy P M, my advisor and professor, always have my profound gratitude for their constant guidance and tenacity throughout my career. This paper's approach was developed with the help of Mr. Sumit Batabyal from Aurigo Technologies in Bangalore.

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