Test Automation Frameworks for Handling Requirement Changes in Web Applications

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ABSTRACT

In present using web applications have become a normal aspect of day to day life, ranging from a simple site to corporate web applications. The growth of web applications has shown a tremendous improvement with time. In this context of popularity, the importance of testing web applications has become a crucial process. Test Automation Frameworks are used to do the testing more efficiently and accurately.

As per the researchers when it comes to web application testing perhaps the hardest part is to handle the dynamic nature of the application. The dynamic nature can be triggered by causes like the uncertainty of the program behavior, rapidly evolving web technology etc. The dynamic nature of a web application can bring challenges in each and every step in the developing life cycle of the application. When there are rapid changes of the requirements, testing web applications can also be quite difficult and complicated.

Mainly this is a comparative analysis to identify how the Test Automation Frameworks handles the dynamically changing behaviors of a web application during testing.

From the findings of this research, it was concluded that most of the issues that arise when using a Test Automation Framework depends on the type of the framework used. When considered about the frequent dynamic changes it was concluded that apart from the users who are using modular framework, the majority of other framework users are satisfied with the way the framework handles the frequent dynamic changes.

1.0 INTRODUCTION

1.1 Background of the Study

Web applications have become a normal aspect of day to day life. Most of the companies use web applications to solve company needs due to their advantages in collecting information easily, speed conjoint of information and communication facilities etc. All these aspects are continuously evolving for the betterment of the company needs [1]. With the extreme demand, web applications has become an important requirement for businesses, education and other sectors including our personal lives. When there is such a demand, these web applications need to be functioning adequately to serve customer requirements and testing of web applications has become a crucial process due to their popularity and the importance of web applications

There are two approaches for testing, i.e. manual and automation testing. This research is focused on automation testing. In order to organize the test suites and to improve the efficiency of testing, to overcome the above mentioned issues, the testers use Test Automation Frameworks. "A Test Automation Framework is a set of assumptions, concepts and tools that provide support for automated software testing [2]." As per Mascarenhas there are five types of Test Automation Frameworks as Modular framework, Data driven framework, Key word driven framework, Hybrid framework and Model based framework used in the field by testers to make this process more reliable and thus to increase the quality of the product [3].

1.2 Research Problem

As mentioned when it comes to web application testing perhaps the hardest part is to handle the dynamic nature of this application. The dynamic nature can be triggered by causes like the uncertainty of the program behavior, rapidly evolving web technology, changing requirements of the customer and so forth. The dynamic nature of a web application can bring challenges in each and every step in the developing life cycle of the application. When there are rapid changes of the requirements, testing web applications can also be quite difficult, since the test cases are needed to be written and executed from the beginning. This makes the testing process more complex and more complicated.

With the current demand for the web applications, there could be rapid amendments and changes of the requirements throughout the life time of the development. This in turn creates the whole testing procedure more and more complex. So it is really important to capture the behavioral changes and continue the testing process. This research is mainly focused on analyzing the different frameworks comparatively along with different dynamical changes during the testing. Given below are the research questions which will be answered through the research to achieve the ultimate target of the study.

RQ1. What are the current Test Automation Frameworks used in the software industry?

RQ2. How do testers handle the rapidly changing requirements of a web application during testing?

1.3 Significance of the Study

With more and more complex web applications, the requirements of the client can get changed frequently. When a specified behavior changes, the test script automatically needs to be changed. For this you have to change the test design, re-execute it and then release the script. This time consuming activity needs to be triggered whenever a requirement (behavioral) change occurs. Therefore when we have applications which could have hundreds of requirements and need rapid changes; creating, maintaining and updating test scripts is becoming a serious issue for testers.

This study emphasize on analyzing about the current Test Automation Frameworks used in the industry along with different dynamic changes that can occur during the testing procedure. It significantly helps to gain a comparative understanding about the different Test Automation Frameworks.

2.0 LITERATURE REVIEW

2.1 Test Automation Frameworks

"A Test Automation Framework is a set of assumptions, concepts and tools that provide support for automated software testing [2]." Test Automation Frameworks have been use to organize the test suites and to improve the efficiency of testing. It's an execution environment for automated tests. It is basically building a layer over the existing automation tool. Test Automation Frameworks have been use to organize the test suites and to improve the efficiency of testing. It's an execution environment for automated tests. It is basically building a layer over the existing automation tool [4].

As per Mascarenhas there are five types of Test Automation Frameworks used in the field by testers to make the testing process more reliable and to increase the quality of the product [3].

- Modular framework

There are two types of modular frameworks based on test scripts and test libraries. They are test script modular framework and test library modular framework. This can be considered as the most basic framework among the five. The idea behind this framework has been building an abstraction layer in front of a component to hide from the rest of the application. This is achieved by using either test scripts or test libraries [5].

- Data Driven framework

  This framework is basically based on the data provided. Test input and output values are mainly based on the data files like ODBC sources, CSV files Excel files and etc. If needed these output test data can be used as input data for the next test. These test scripts can be used repeatedly with varying inputs so in turn it reduces the time consuming testing processes.

- Key Word Driven framework

  As stated by Jain and Sharma "Keyword driven test automation framework is a mainly adopted framework by lot of software industries [6]" This framework uses data tables as well as the key words to create the test cases. Here the key words are given to a driver file where it's turned into actions.

- Hybrid framework

  The whole concept of hybrid framework is to combine all the above mentioned techniques to pull out their strengths while mitigating the weaknesses. This can be considered as a more customized framework developed according to the requirements of a project [5].

- Model based framework

  The basic concept behind a model based framework is to create abstract models to come up with certain properties [7]. Using model at the design stage itself the testers can create test cases in order to carry out automation testing which is really helpful to grasp the test cases at very early stage of developing the web application.

As stated by Wu and Offutt one of the key aspect and may be hardest part of analyzing a web application is handling the dynamic nature of the application. These aspects can be caused by uncertainty of the program behavior, changes in the application requirements, rapidly evolving web technologies and other factors [8].

3.0 RESEARCH METHODOLOGY

This research mainly focuses on QA engineers working at software development companies in Sri Lanka. Also it was very important to identify QA engineers who are familiar with Test Automation Frameworks to carry out the research. So determining the target population was carried out in three steps.

Step 1: Identification of major software development companies registered under SLASSCOM and having separate QA teams with more than 10 QA engineers and identified 17 companies who fulfill the criteria.

Step 2: Among these companies there were 12 companies currently practicing testing automation and they were selected to identify the QA engineers.

Step 3: Target population was then calculated from the QA engineers who were at operational level excluding the trainee QA engineers.

According to that the population size for the research was 780 QA engineers. Since this is a scientific research we have decide on a sample size of 120 targeting 10 QA engineers from each company. Simple random sampling method was used to select the QA engineers who need to be involved in the research which comes under probability sampling.

Primary data collection was carried out with a structured questionnaire. A comprehensive literature review was done parallel to the primary data collection.

4.0 RESULTS AND DISCUSSION

The main objective of this research was to identify the different Test Automation Frameworks used in the Sri Lankan IT industry and to discover how

testers handle the dynamic behaviors of web applications during testing. Finally, based on the findings, the researcher has done a comparative analysis of Test Automation Frameworks to analyze their behavior to the dynamical changes during the testing. Given below are the results based on the research questions.

RQ1. What are the current Test Automation Frameworks used in the software industry?

As per the analysis done given below are the percentages of using each type of frameworks.

- Modular Framework – 14 %
- Data Driven Framework – 34%
- Key Word Driven Framework – 13%
- Hybrid Framework – 38%

As per above Hybrid framework is the type of framework mostly used by the respondents which is approximately 40%. Approximately around 35% of QA engineers are using Data Driven framework as well. The usage of Modular framework and Key word driven framework are very low compared to the other two frameworks.

RQ2. How do testers handle the rapidly changing requirements of a web application during testing?

This research question was focused on analyzing the frequent dynamic changes based on how they occurred, when they occurred and impact it had on testing overall. There were 6 different types of dynamic changes identified as mentioned below and the relevant information was gathered through the questionnaire distributed among the target sample.

1. The stage which customers frequently request for a requirement change.

2. The number of changes that need to be addressed before the releasing of web applications

3. Number of complaints receive from the client

4. Impact of the complexity of a web application to the testing procedure

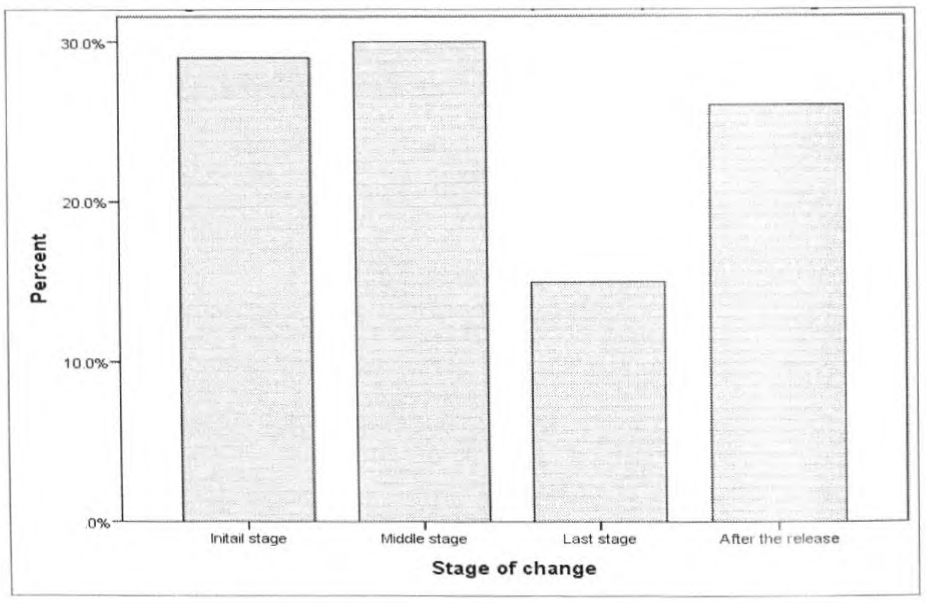
5. Impact of the Cost of Setting up the Environment on Testing Procedure

6. Difficulty of testing the generating and re-running the same condition based on user inputs and server status.

These responses were mainly analyzed using graphical representations with percentages.

Eg: The stage which customers frequently request for a requirement change.

Figure 1: Percentage of States when the Customer Requests a Requirement Change



According to figure 1approximately 60% of the customers had requested a requirement change during the initial and middle stages of development. A considerable percentage, 27% of customers had also requested for changes after the release is made.

Similarly all six identified requirements were analyzed and given below are the major findings derived from the analysis.

- Most of the requirement changes had being requested during the initial and middle stages of the development
- More than 80% of changes need to be addressed before releasing the web application and also the no of changes do not depend on the framework type
- According to the statistical analysis, the number of complaints depends on the type of framework used. In this situation Modular framework and Key word driven framework

seems to facilitate the complaints better than the other two frameworks.

- According to the analysis there is an impact of the complexity on the testing procedure.
- All the frameworks apart from Key word driven framework seems to have an impact on the testing procedure according to the cost for setting up the environment.
- Significantly the majority of respondents using Hybrid framework has mentioned that it is easy to do generating and re-running the same test cases according to user inputs and server status while the other frameworks doesn't facilitate this properly. According to the statistical analysis it was concluded that generating and re-running the same test cases according to user inputs and server status depends on the type of framework.
- Apart from the users who are using Modular framework the majority of other framework users are satisfied with the way the framework handles the frequent dynamic changes.

5.0 CONCLUSION AND FUTURE WORK

When considered about the frequent dynamic changes it was concluded that apart from the users who are using Modular framework the majority of other framework users are satisfied with the way the framework handles the frequent dynamic changes. Also through statistical analysis it was proved that the number of complaints received after the release of application and the generating and re-running the same test cases according to user inputs and server status depends on the type of framework while the number of changes need to address before releasing the web application does not depends on the type of framework. Although more than 80% of changes need to be addressed before releasing the web application, most probably there could be several other factors which contribute for this.

As per the conducted analysis majority of the users are using either a Hybrid or a Data Driven framework. Hybrid framework is a customized kind of a framework which is done according to the specific requirements. Data Driven framework is a scripting reliable framework. So majority of the time even though they handled the dynamic changes it had its own overheads. So as a future work since the researcher had analyzed about how each framework reacts towards the dynamical changes this knowledge can be used to introduce a novel framework which can handle the dynamical changes much efficiently and accurately.

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