Improved Method of Software Automation Testing Based on the Robotic Process Automation Technology

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***Abstract*— Nowadays the automation of repetitive and time-consuming tasks for employees is becoming more and more popular. Automation of software testing has lots of benefits but it also has limited functions and strictly rely on the system under the test (SUT). One of the technologies that may be used to leverage its disadvantages is Robotic Process Automation (RPA). RPA is an approach to business workflow automation, in which the program emulates user actions within graphical user interface to achieve the desired result. In this paper the basic approaches for automation of software testing using RPA are investigated. This paper describes the proposed method for software test automation which allows to execute tests in a faster and more reliable way.**

Keywords—Robotic process automation, software testing, test automation.

I. INTRODUCTION

Robotic Process Automation is a new approach to the business processes automation. It allows users to avoid doing the repetitive tasks that need manual data entry and processing. The main feature of Robotic Process Automation is that with the RPA framework one application (software robot) interacts with another application not through the API (Application Programming Interface) or the integration bus, but through the existing user interface. Due to this one program communicates with another program in the same way as the typical user does. Simulating user actions provides some benefits for example there is no need to change existing IT systems to deploy the RPA infrastructure [6]. Due to the fact that Robotic Process Automation does not change the IT solution itself, its implementation is very fast. And if, for any reason, it is necessary to set another workflow, it is enough to disable the software robot and return the processing of the task to the employee while the automation steps are being changed. RPA is being introduced gradually, process by process, and the result comes with the first process automation. It significantly reduces costs and increases the operational performance with a little changes in technology, particularly when open source solutions that do not require license costs are used.

Also the robots are ready to perform assigned tasks 24 hours a day. Once they are properly configured, the software robots perform their tasks without any errors. If the executable process requires modification, it is enough for the robot to change the rules of operation (modify the script). The RPA is usually applied to the following types of tasks (Fig. 1):

- regularly and frequently repeated tasks. Any automation is effective only for the repetitive processes;
- tasks that have a great influence on the business. In this case the process may not be repeated as often, however, it would be very important for the company;
- tasks which require processing of the substantial amount of data. With increasing loads, people tend to make more and more mistakes, while the robot will continue to work stably;
- tasks that are explicitly described by the strict business rules. Robotic processes, by definition, imply the exclusion of a person from the decision-making process. Therefore, any judgment, agreement, use of external data should be also excluded. The robot is able to make decisions regarding the course of processing, but the rules must be strictly defined and fixed;
- tasks which requires work with at least one electronic system (external, internal).

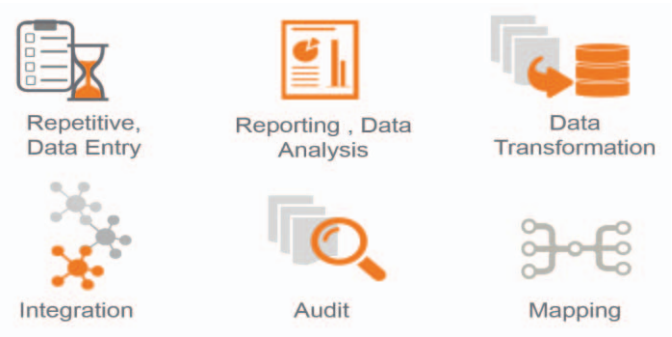

Fig. 1. Business processes that can be automated with RPA [6]

Of course, the robot is obliged to interact with the corporate system in order to perform its work. However, the greatest effect is observed when the robot is used in the processes where it interacts with two or more systems, for example, transferring data from one system to another.

RPA technology is widely used in various industrial areas due to its advantages. For example, in logistics it helps to process the information from the websites of transport companies, form a pool of orders and the status of the order execution. Another area where RPA can be successfully implemented is human resource management. The robot searches on the specialized sites for a resume with required skills and, when the suitable candidate is found, it sends them appointment for meeting with a recruiter, and the recruiter receives a candidate's resume. In addition, the robot can add and manage information about the employees in the accounting systems of the company, and correctly and accurately change its status, when it should be done according to the company's policies. Also, RPA can be applicable in the finance and accounting sphere. The robots can execute a wide range of different tasks, for example loading primary information into the financial and accounting systems, initial processing of orders and integration with legacy and low-level systems that do not have software interfaces [5].

II. Robotic Process Automation in Software Testing

Robot Process Automation provides a new more accessible and useful tool for testers and users who are responsible for the acceptance testing, especially in the context of developing and implementing large scale systems [7]. There are numerous automation testing tools that are used specifically for web, desktop or mobile application testing or API testing. However, the RPA tools are versatile, so they can be used for UI or API testing as well as for the test data preparation, setting up preconditions (for example, resetting application state), regression testing and checking post-condition. Due to this it allows to make user acceptance testing and end user testing more effective than before.

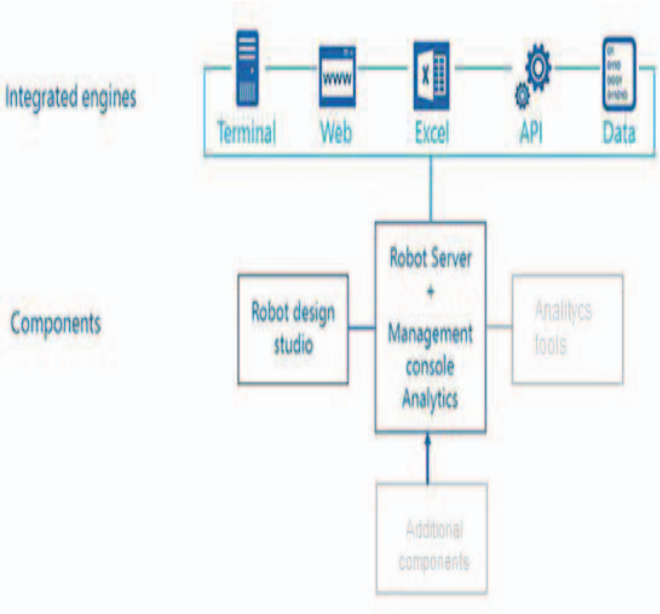

Fig. 2. Basic components of the RPA solution

The typical RPA solution for automation testing includes the following components (Fig. 2) [8]:

- Process design environment. It is usually called "design studio" and used to describe the process steps, rules and procedures for accessing integrated systems, transition conditions from stage to stage, cycles, etc. Some systems allow automatic recording of user actions, others require the usage of programming languages like Java or Python to create the steps. In any case, the result is the executable code, which, in fact, is the software robot.
- Process execution environment. It is the environment where user (a schedule, event or another robot) starts the work of the robot. The execution of the robot can take place directly at the workplace (typically on the virtual machine) or on a dedicated server (or a cluster of servers).
- Management environment. Since the industrial application of RPA in a large company may involve the simultaneous execution of many robotic processes, there is a need to coordinate and control all components. This component is responsible for the creation of schedules, delimitation of user rights to launch processes, coordination of processes, etc.
- Process analysis environment. The analytical system provides reporting and visualization of the current status of all robots.
- Additional components. Manufacturers can provide these or other additional components besides the main set of RPA tools. So, the integration of robots from a particular manufacturer with external text recognition tools can be provided or there may be an option to the use the open source solutions for generating huge inputs or picture recognition.

The main challenges of software test automation are the resource consumption, long execution time, changes in system under the test or in test environment and covering some types of requirements, such as UI testing and performance.

In this research we compared two main approaches to the test automation. As far as we need to execute both functional tests and check the correctness of user interface, we used Selenium Web Driver to develop automation test script. Selenium is an open-source tool with a large community which supports many programming languages, for example C#, Java, Python, JavaScript etc. It allows to run tests in different browsers and the blocks of code can be easily reused for another test. The test execution can be done in the background and it consumes less resources than record playback tools.

We implemented a framework written in C# language using Selenium Web Driver and NUnit framework (Fig. 3). Sign up test includes the followingt steps: users launches web browser and enter the web site link. Then they click on the "Sign In" button. After redirection to the Sign In/ Sign Up page users enter the emails and creates the accounts. Then users have to fill in all the required fields with the valid data and click on the "Sign Up" button.

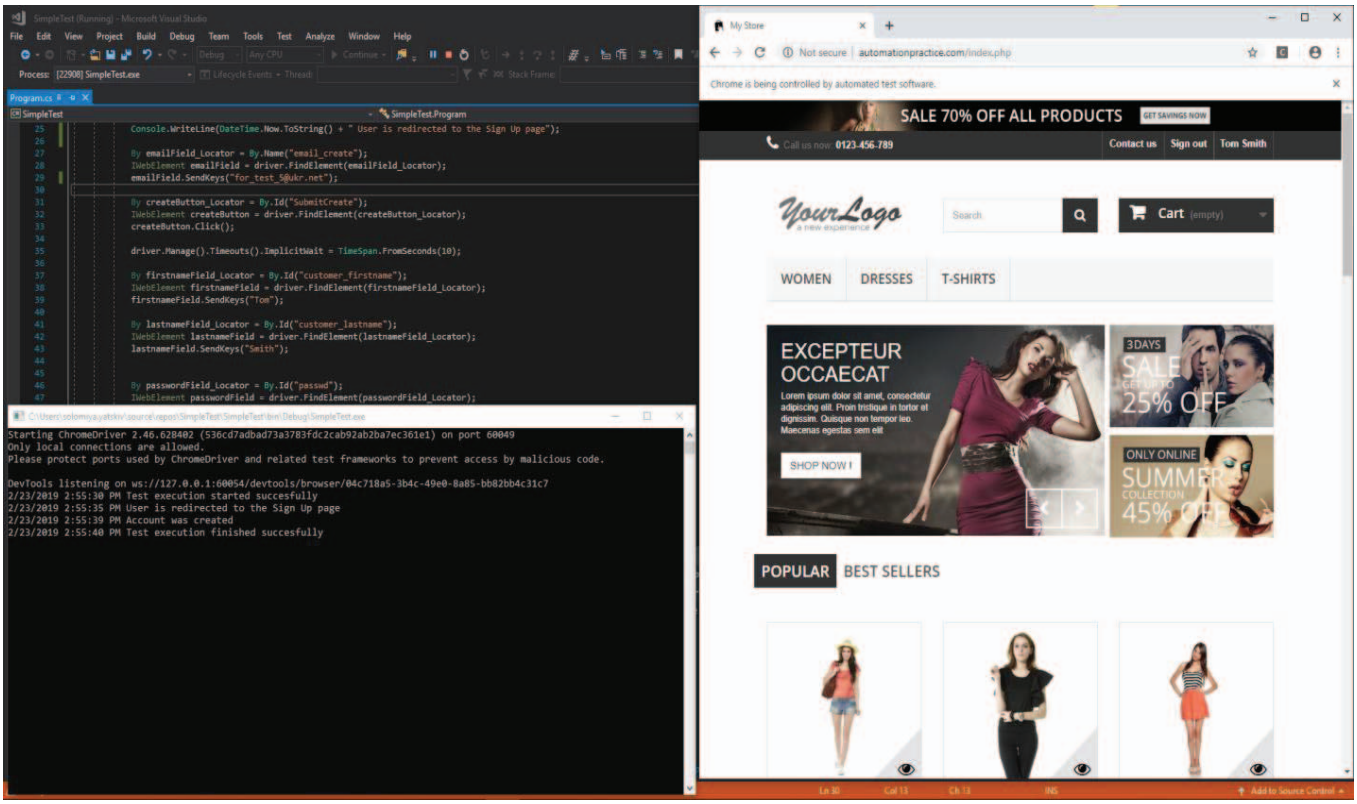

Fig. 3. Test automation via Selenium Web Driver

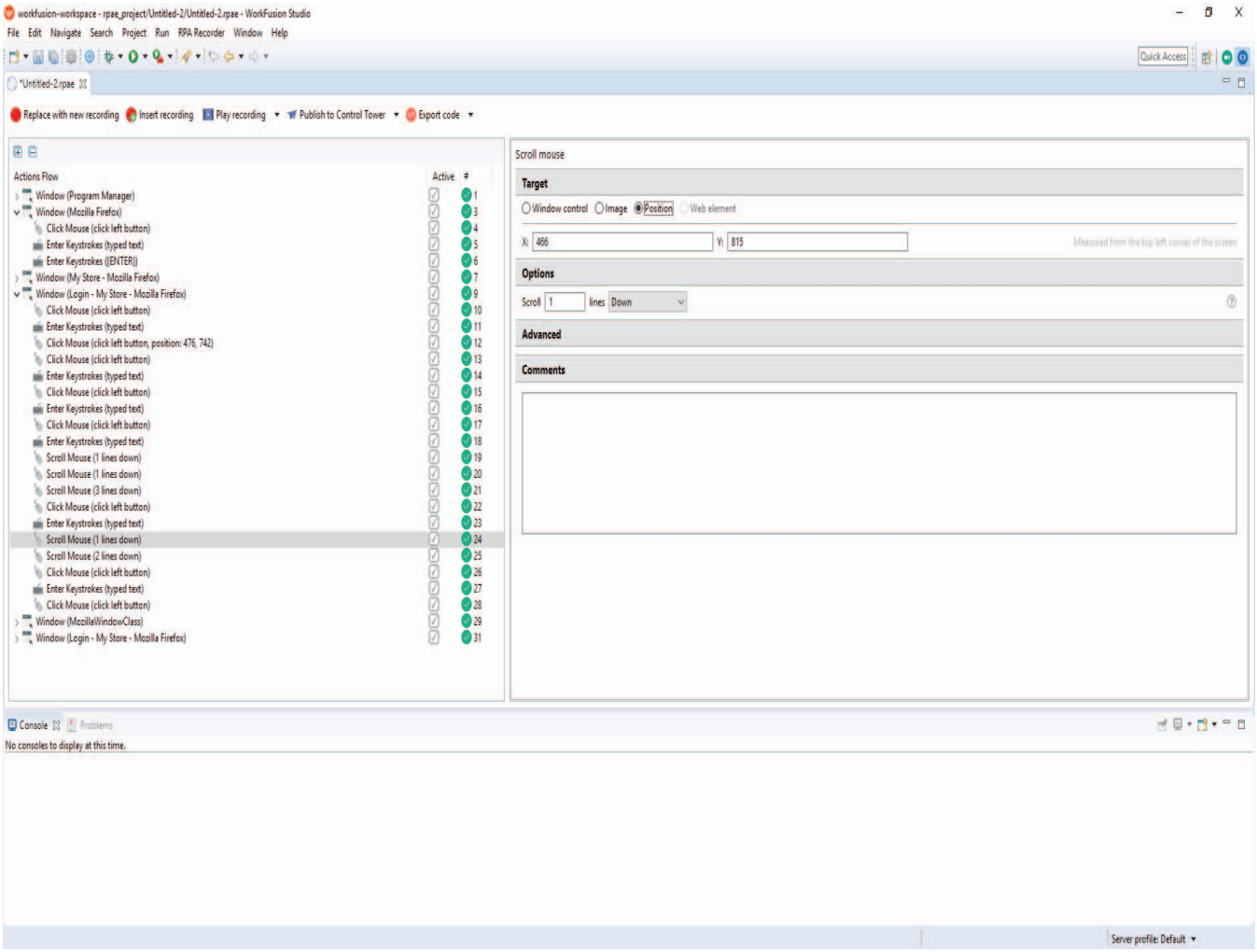

Fig. 4. Test automation via Selenium Web Driver

As a result, the account for new user is created and the user is logged in. The positive sign up flow is executed in around 20 seconds. However, test data generation and validation of user interface elements on the screenshots take extra time (up to 1 minute). Another approach uses WorkFusion RPA Express software to record user actions and then reproduce them when it is needed (Fig. 4).

It provides the WorkFusion design studio to create and run the robots, Control tower and build-in Optical Character Recognition (OCR) [8]. If the simple script automation does not cover all the business requirements, WorkFusion offers the SPA platform (Smart Process Automation), which includes an enhanced version of RPA, elements of artificial intelligence, complex machine learning algorithms and the ability to connect crowd platforms and Business Intelligence analytics (BI). Recording user action introduces the redundant steps to the test case that is why the whole flow must be reviewed and checked according to the business requirements. After eliminating the needless steps we adjusted test cases and added validation.

The execution of recording cannot run in the background so user is not able to perform any actions on the workstation while the automation script is being playing. However, due to the OCR and other tools RPA allows to interact not only with web browser, but with any other software on the client machine. Also the RPA software consumes more resources because of precise simulation of user actions.

The proposed method suggests combining RPA solution with test scripts written in any programming language to have better performance, spend less resources and make the tests more reliable and error-free.

Let's consider a case when to check a business rule 100 users must be added to the database and then log into the system. This can be done using the Selenium Web Driver, but the generation of such a huge amount of test data takes a lot of time and connection to the database can cause additional issues and delays. RPA allows us to generate data faster and user interface verification is easier due to the build-in tools.

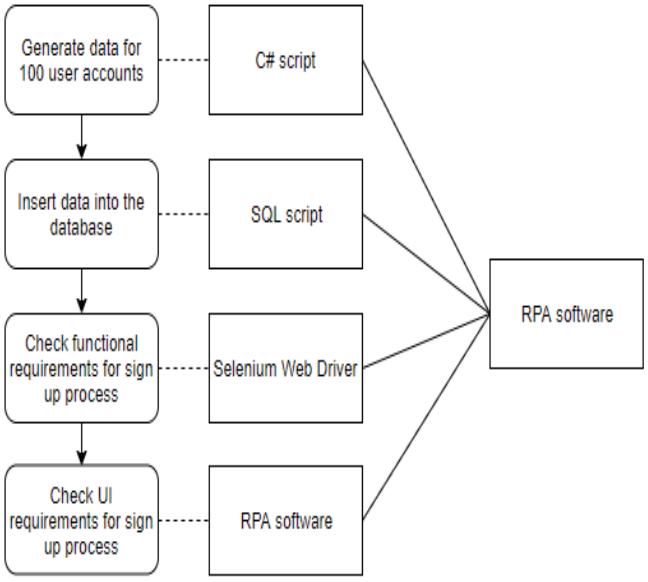

Fig. 5. Work breakdown structure for sign up process

However, when it's used for many users, it will have noticeably longer execution time, which leads to possible errors and interruptions. That is why we decided to break this task into the subtasks (Fig. 5) and create different modules to execute them. Data generation and insertion are done using scripts which consume less resources.

Selenium Web Driver is applied to check functional and non-functional requirements, such as business rules and performance.

WorkFusion schedules and controls the scrips execution and checks elements of graphical user interface which eliminates manual tasks of the tester.

III. Conclusion

In this article two main approaches to the software test automation are compared and the new method based on RPA usage is suggested.

Even though the Selenium Web Driver showed less or the same execution time for most operations it does not provide data generation options and the possibility of switching to another program during test execution. So it usually requires additional scripts and tools to cover the whole workflow. Also the knowledge of any supported programming language is required.

At the same time, in the WorkFusion Design Studio tests can be created without writing the programming code. Also it provides extended functionality that allows to automatically check preconditions and post-conditions for the test and use other software to generate test data.

The most effective RPA automation is when user interacts with different applications and needs to have specific actions done before test execution. And it is easier to handle errors while test execution, because each step has a detailed description and attached screenshot. However, it needs more hardware resources and test execution takes more time.

Therefore the proposed method is the most effective because it combines different technologies and allows to leverage their disadvantages and eliminate manual work with RPA software.

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