

Investigation of Manual and Automation Testing using Assorted Approaches

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Abstract- Testing means “revealing a person’s capabilities by putting them under strain; challenging”. Software testing exist a vast domain, but it may be classify into two way: manual testing and automated testing. In manual testing, test cases are executed (run) manually without any help from tools/scripts, but with automated testing, test cases are executed (run) with the help of tools, scripts, and software. Software testing is expensive, labor intensive and consume more time in a software development life cycle. There was forever a need in software testing to decrease the testing time. The type of testing (manual or automated) depends on various factors, adding project need, budget, timeline, expertise, and suitability. Three fundamental factors of any project are of course time, cost, and quality – the objective of any successful project is to diminish the cost and time required to complete it successfully while maintaining quality output. When it comes to testing, one type may accomplish this goal better than the other. This paper presents the concept of automation and manual testing and problem with manual testing and benefit of automatic testing. The main objective of this paper is to conduct a comparative study of Manual and Automation testing Method based on Accuracy, Bug detection, Efforts, cost and Time.

Keyword- Software Testing, Manual Testing, Automation Testing

I. INTRODUCTION

The motive of software testing technique is to recognize all the errors exists in a software product. It is a procedure to exercise and evolution a system or its component by manual automatic means to authenticate that it satisfies particular requirements or to recognize differences between expected and actual results. Testing activity can be conducted in to two ways: Manual testing & automation testing. Any kind of software testing can be complete by manually and by automation tool. Manual testing is in which the testing activity is executed by testing persons.

Manual Testing is a procedure where in a tester usually follows a documented test plan which leads them with in a set of important test-cases. In a software testing a test-case is group of terms written for particular applications & tester run all these Conditions to make sure the correct functionality of the software applications. Automated software testing’s the finest way to increase the effectiveness, efficiency and coverage of software testing. Automation testing requires considerable amount of investment for buying the software & compatible hardware resources. Automation testing does what manual testing does not. Automation testing improves the accuracy & it saves the time of the tester & organization’s money. Automation testing is best suited in the environment where

the necessities are frequently changing & huge amount of regression testing is required to be performed. [1], [2], [3], [4].

The overall work of Research Paper is divided into five parts, First we describe Related Work, second part conduct Methodology, third part present the comparison of software testing techniques, Fourth part presents the Result, and finally fifth part conclude the Research Paper.

II. RELATED WORK

SOFTWARE TESTING

Software testing is procedure that ensures the value of the product to its stakeholders with information about the superiority of the product. It is the method of evaluating a system by manual automatic means to recognize differences between expected and real results. [5][6].

Fig. 1. Shows Mode of Testing Based on test execution, is divided into two categories.

1. Manual Testing
2. Automation testing



Fig. 1 Types of software Testing

1. Manual Testing

Manual testing is a testing method in which a person initiate every test, interacts with it, and compile, analyzes and reports the outcome. When there is a functioning that the test-cases is run without tester than Software testing is called automated. [7]

Manual testing is a testing procedure in which the test engineer organize test-case manually and execute them to recognize bugs in the software. It is old way of software testing. Manual testing is a painstaking movement that requires the tester to have a certain set of qualities; to be observant, creative, innovative, open-minded, and skillful. Repetitive manual testing may be not easy to execute on big software applications. Manual testing have many problems like: it is very time consuming procedure, not reusable, has no scripting capability, huge effort required, and some bugs remain uncovered. [8].

We may categorize manual testing in following kinds of testing which is indicates in Fig. 2. These are,

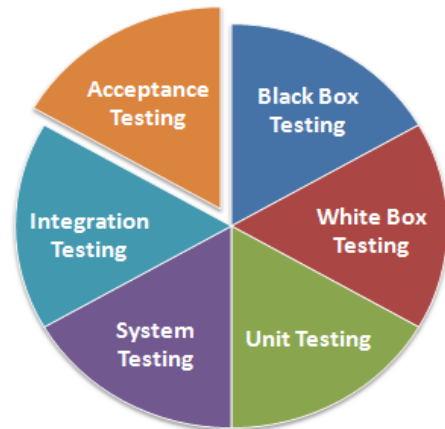


Fig. 2 Types of Manual Testing

- **Black Box Testing** – Black-Box testing method is used to test the functionalities and needs of the software/system. It doesn't test the internal fraction of the system. Black-Box Testing is testing without awareness of the interior working of the application under test (AUT). Also known as functional testing or input output- driven testing.

- **White Box Testing** – This is a testing method which is based on information of the interior logic of an application's code and also identified as Glass box Testing. It means its works on interior working of code in the system.
- **Integration Testing** – In integration testing, the individual parts of the system/application are joint and tested as a group. Integration testing follow unit testing and precedes system testing. [9]
- **System Testing** – It is a method to test whole system. System Testing (ST) is a black-box testing procedure performed to assess the whole system the system's fulfillment against specified necessities.
- **Unit Testing** – A unit may be defined as “the smallest possible testable software component”. A unit is the least testable element of an application. Unit tests focus on functionality and reliability, and they typically consist of a cycle of stand-alone tests.
- **Acceptance Testing** – Acceptance testing, a testing procedure performed to find out whether or not the software system has meet the requirement specifications. The main motive of this test is to estimate the system's compliance with the business requirements and verify if it is has met the required criteria for delivery to end users.

A. Benefits of manual testing

1. If Test Cases have to be run a small number of times it's more likely to perform manual testing.
2. It permit the tester to execute additional ad-hoc (random testing).
3. It requires minimum cost

B. Drawbacks of manual testing

1. Manual tests may be extremely time consuming.
2. Manual testing requires more testers to perform testing.

C. Limitations of Manual Testing

1. Performing manual testing is a boring activity for a testers. It needs to check each link on the site and every facts of the product under test.
2. It requires so much time for testing. We have to do same operations again & again. Regression testing is being used for checking bugs after making modification on one fraction of the software have negative effects on the other fraction of software.
3. Manual testing is time consuming, error prone and need lot of infrastructure and manpower[10].

2. Automation Testing

In compare to manual testing, automated testing automates not only test-case execution, but also test-case generation and test result verification. A completely automated testing system is work without any user interference.[11].

Automated tests perform a series of events without user intervention. It is also defined as a testing a system with different data sets continuously without intervention of human. Simply automated testing is automating the manual testing method currently in use. Automation is the utilize of strategies, toolset. Automation testing uses automation testing tools. The job of automation testing tool is to test the intended task and to cut down the human effort. Automation testing is faster than manual testing and it is more reliable since it performs every test case with precision. [12][13]

A. Benefits of automation testing

- **Fast:** Automation is less time consuming than manual testing.
- **Repeatable:** Repetition of data or content can be easily achieved by automation tools in no time.
- **Reusable:** It can be operated on different version of the software.
- **Load & Performance Testing:** No viable manual alternative exists [14]
- **Programmable:** Testers should be check hidden information at advance level.
- **Comprehensive:** Testers can make test suites of tests that cover up each quality in software application.
- **Reliability:** Automation of test-cases reduces this risk. The organization can put a procedure in place, which can make sure that the test scripts written are correct
- **Cost Effective:** In Automation method expenditure of money is less than manual testing. [15][16]
- **Test Coverage:** Wider test coverage of application features [5].
- **Performance:** Automated testing reduces the testing cycle time and hence the time-to-market for a product. [17].

B. Drawbacks of Test Automation

- **It's Not Easy!**
Writing test automation scripts is not an easy task. You really require testers who are knowledgeable in doing this otherwise it will go horribly wrong and you will end up spending even more money and time than if done manually.
- **Automation Script Errors**
If an error is exist in the test automation script and which is undetected would give wrong output respectively. In fact you can't even realize the error until the software launches and then falls over
- **Scope Changes**
Every project will have to implement change request management. However despite best endeavors there will still be some which get through.

- **Complexity**

With the increase in the number of requirements that are to be tested, this leads to more and more complexity which makes the maintenance of test data extremely difficult.

C. Limitations of Automation Testing

- **Automation cannot replace manual testing:** Not all testing tasks may be easily automated, especially those that require widespread knowledge in a domain.
- **Difficulty in maintenance of test automation:** Change in technology and evolution of software products leads to difficulty in preserve automated tests.
- **Process of test automation needs time to mature:** Creating the infrastructure and tests for automation requires time, hence maturity of automation (and related benefits) requires time
- **False expectations:** Firms/Companies have impractical expectations when it comes to AST with the aim of saving as much cost as possible.
- **Inappropriate test automation strategy:** An appropriate policy is hard to decide, hence leading to inappropriate strategies that do not allow to utilize the benefits of AST
- **Lack of skilled people:** To automate tests many skills are needed (e.g. knowledge of test tools, general software development skills, domain and system knowledge[18])

D. Motivation for the Automation of Testing

Testing software is often times repetitive in nature. A list of steps is executed, the output is examined, the system is restored to its pre-test state, and the list is executed again. Perhaps there is a room full of testers, all running tests on the same system. Maybe the testers have programming skills, or maybe not. In any case, running test cases by hand is error prone, slow, and expensive. Fatigue and ennui have the effect of reducing the level of attention to detail paid to test execution and critical test steps may be missed or haphazardly done. Automated tests, on the other hand, run the same way every time and reduce errors that result from these factors. Automated testing makes possible the kind of short release cycles demanded by development processes such as Extreme Programming (XP). Bugs introduced by changes in the code are detected at an earlier stage of the development process, thus saving money and effort. [19] The scope of the planned automation tasks also depends on the existing and available test ware elements and tools. [20]

- **Increases in productivity:** Ideally, an automated test suite should run without any user intervention at all...
- **Increases in reliability:** The best tests are those that are easily repeatable, and having to do everything by hand can undermines that. Automated tests are more reliable

than tests run manually because they run exactly the same way each time they are run.

- **Increases in coverage:** Automated tests are fast. A computer isn't going to go back and forth between a written script and execution of the tests. The test software already has those instructions built in. [21].

III METHODOLOGY

My research methodology for this Research Paper is empirical and fundamental. Empirical methodology is used for observing the fact and ideas of manual and automation testing techniques, and fundamental methodology is used for describing the fundamental facts of both testing techniques.

IV.COMPARISON OF SOFTWARE TESTING TECHNIQUES

The software testing is a very wide topic. It includes varies methods, types and levels or stages of testing. To find an appropriate result we analyze following difference table.

- Difference between Static and Dynamic Testing
- Difference between box approach method
- Manual and Automation Testing

A. Difference between Static and Dynamic Testing

TABLE I. Comparison between Static and Dynamic testing

	Static Testing	Dynamic Testing
1	In static testing we don't execute the code	Dynamic Testing facilities that we code at all time.
2	It means exploratory and reviewing the software.	It means testing, running, and using the software.
3	It definitely comes before dynamic testing.	It definitely follows after static testing.
4	This testing is not take more time because its intention to inspect the software or code.	This testing takes more time at all time because its intention to execute the software or code.
5	This testing starts always early in the life cycle so it's defiantly decrease the cost of project/Product.	This testing not starts early in the life cycle so its defiantly expand the cost of project/Product
6	It is always consider as least cost effective task.	It is always consider as additional cost effective task.

7	Static testing may detect bugs that dynamic testing may not detect and it is low level task.	Dynamic testing may detect bugs that static testing may not detect and it is a high level task.
8	It is not considered as time consuming task.	It is considered as a time consuming task at all time because it requires several test-cases for execute.
9	Static testing have one another name that is Dry Run Testing.	Dynamic Testing is not known by any other name.

B. Difference between box approach method

TABLE II. Comparison between Black Box and White Box testing

#	Black Box Testing	White Box Testing
1	Black-box testing is the testing method which is used to test the software without the knowledge of interior structure of program/code.	White box testing is the testing procedure which is work in internal structure of the software and this internal structure needs knowledgeable tester
2	This type of testing is carried out by testers.	Generally, this type of testing is carried out by software developers.
3	In Black-Box testing there is no requirement of implementation knowledge.	In White-Box testing there is requirement of implementation knowledge
4	It's not need to know the Programming Knowledge in Black Box Testing.	Its need to know the Programming Knowledge in White Box Testing.
5	Testing is appropriate on upper levels of testing like System Testing, Acceptance testing.	Testing is appropriate on minor level of testing like Unit Testing, Integration testing.
6	Black box testing means functional test or external testing.	White box testing means structural test or interior testing.
7	In Black Box testing is	In White Box testing is mainly

	mainly focus on the functionality of the system under test.	focus on the testing of program code of the system under test like code structure, branches, conditions, loops etc.
8	The main goal of this testing to check on what functionality is performing by the system under test.	The main goal of White Box testing to check on how System is performing.
9	Black-box testing includes Functional testing, Behavior testing, Close-box testing, so there is no any requirement of programming knowledge.	White-box testing includes Structural testing, Logic testing, Path testing, Loop testing, Code coverage testing, Open box testing, so there is compulsory to know about programming knowledge.

C. Complete Difference between Manual and Automation Testing

Automated testing is, well, automated. This differs from manual testing where a human being is responsible for single-handedly testing the functionality of the software in the way a user would. The benefit of manual testing is that it allows a human mind to draw insights from a test that might otherwise be missed by an automated testing program. [22]

TABLE III. Comparison between Manual and Automation testing

#	Manual Testing	Automation Testing
1	Manual Testing is a procedure which is done manually.	Automation Testing is a procedure which is done by the automated tools.
2	In software testing we have to first start Manual Testing, without starting the manual testing we can't start Automation Testing.	Automation Testing is a continuous part of Manual Testing.
3	In Manual Testing testers are allowed to do Random Testing to find the Bugs.	In Automation Testing we always test through Running Scripts.
4	Manual Testing requires more time to test test-cases	Automation testing requires less time to test test-cases.
5	It is done without interaction of any Tool.	It is done using tools at all times.
6	Manual Testing would be run sequentially.	Automation Testing is done on different machines at same time.

7	It is not expensive.	It is expensive.
8	Manual testing needs more testers because in manual testing all of the testing works are carry out manually.	Automation testing needs some testers because it needs to execute all testing work.
9	It gives low accuracy result.	It gives high accuracy result.
10	It is considered as low quality.	It is considered as high quality.
11	In this Testing we cannot do batch testing.	In this Testing we can do multiple types of batch testing.
12	No require of programming knowledge in Manual Testing.	It is necessary to know the programming knowledge in Automation Testing

V.RESULTS

The Result table shows that Automation testing is better than Manual testing because if we think about that the accuracy, bug detection percentage, time required, cost required, effort estimation and people requirement then the graph shows that In every different thing Automation testing is better than Manual testing.

APR: According to People Requirement
 ASICCT: According to spending in installation, configuration, customization and training

Table IV. Comparisons Based on Survey Report

Keys	Manual (in %)	Automation (in %)
Accuracy	68	83.2
Bugs detection percent average.	36	15
Time Required	34	7.8
Cost requirement APR	20	8
Cost requirement ASICCT	20	50
Effort	87	56
People required	32	14

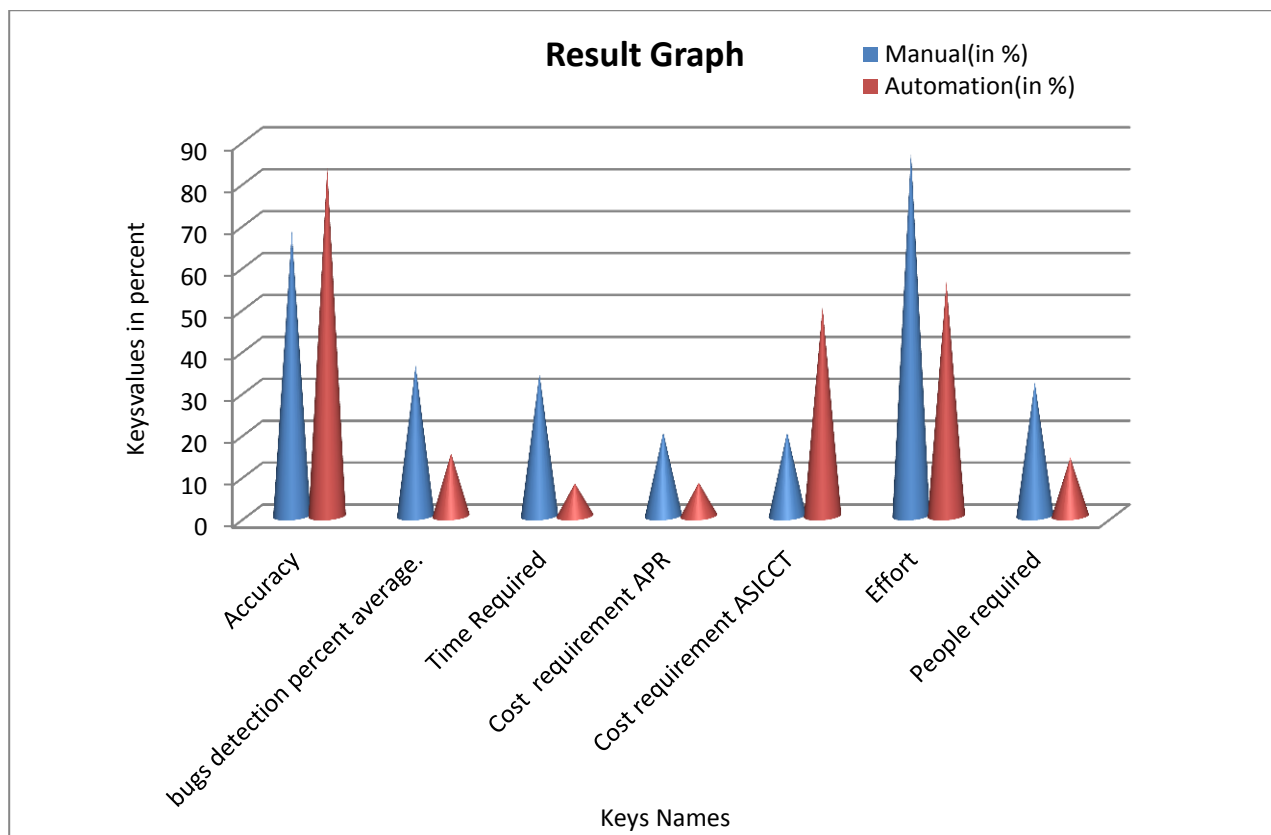


Fig. 3 Result Graph Based on survey

Discussion of Graph:

The entire graph shows the key values, here key means the properties of Manual and Automation testing. The vertical axis shows the keys values of Manual and Automation testing in percent, and the horizontal axis shows the keys name of both testing techniques. The bars show the different testing approaches, here blue bars indicate manual testing and red bars indicate Automation testing .

From this graph it is show that the accuracy of Automation testing is better than manual testing. It means is gives the result with high accuracy. This Graph also show that automation testing approach detect the bugs quickly. Also this graph shows that the Automation testing required less time to test the test case. Cost requirement is also less for the automation testing according to People Requirement but cast requirement is high according to spending in installation, configuration, customization and training for development of software. Effort estimation is also minimum for the automation testing than the manual testing. No of People which works for the automation testing is minimum, it means some people is required for automation testing to test the test case.

Note:In the above graph and comparion table show the survey data that conduct during research work.This resealt based on Dollop InfoTech, Labha Technologies, Hammer InfoTech, Mainfest InfoTech and India InfoTech etc.

VI. CONCLUSION AND FUTURE SCOPE

The simulation result and observations in can be summarized as follow:

- Automation testing gives the result with high accuracy than the manual testing.
- Automation testing approach detect the bugs quickly than the manual testing.
- Automation testing required less time to test the test case than the manual testing.
- Cost requirement to test test case according to is testers is less but according to the cost of which is spending in installation, configuration, customization and training of those tools is high than Manual Approach.
- Effort estimation is also minimum for the automation testing than the manual testing.
- No of People which works for the automation testing is minimum, it means some people is required for automation testing to test the test case.

From this observation it is shown that Automation testing is a good idea to test the test cases in software development process in this new generation world where people want "better results in short time" so automation work is good for them than Manual work.

This proposed Approach does not show the low cost for spending in installation, configuration, customization and training of those tools in automation testing and also some depletion in automation approaches. So in Future work could involve both these left aspects. And one of the testing fact is also involve that 75% company are using Manual testing so in future we want that maximum all company are used Automation approaches for their work of test to test cases. So in this thesis we show the good properties of Automation approach to show the company that automation is good for their work and use it.

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