IMPORTANCE OF MANUAL AND AUTOMATION TESTING

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ABSTRACT

Automation testing has become increasingly needed due to the nature of the current software development project which comprises of complex application with shorter development time. Most of the companies in the industry have used Selenium extensively as functional automation tool to verify their web application's functionalities are working as expected. However, for any new project Manual testing is equally important instead of automating. Thus, this research project is about the importance of manual and exploratory testing in industry when our project is under develop stage.

KEYWORDS

Automation Testing, Regression Test Suite, Selenium, Java Automation Framework, Test Ng, Manual Testing, Exploratory Testing

1. INTRODUCTION

Flipmind Company started in 2005 with a dream helping clients get the most out of ideas by Michael Jones Owner and Director of the Company. Flipmind creates software to help businesses succeed in E-commerce, graphic design, mobile design and development, CRM etc. Company had done a lot of projects in New Zealand such as 2-degree international call to overseas, Learn Maori etc. Company has worked with Torpedo7 since 2006 providing BA, systems architecture, web & ecommerce development & load testing services.

Flipmind is rapidly growing company in New Zealand as it offers high class service such as website developing, testing and its maintenance, updating data regularly etc. to its stakeholders. Currently working on Project named as Pickupmax website. The idea is originated from Michael Jones when he once faces problem to find shuttle and hotel at Hong Kong Airport while travelling back to New Zealand after holidays with his family. Pickupmax helps travellers in finding hotel and shuttle near to airport with free of charge they are being picked up and dropped off to the Airport (International and Domestic).

Main challenge for Pickupmax is to manage huge database and have updated data regularly. If any hotel or parking company changed their fares, while on website fares are not update then it can create dissatisfaction among customers and can raise trust issues.

I discussed with Project Manager about this issue and it was in their future work list for Pickupmax website project. Since project is in its starting phase only and not yet stabilized so manual and exploratory testing are main part of my internship in my starting Sprints. Once website get stabilized later will create automation regression suite for the project.

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The scope and objective of this project is to do manual and exploratory testing and once have stabilized pages for website we have to create automation regression suite that will help Flipmind Company to save time. Since scheduling pick up is repetitive task and executing it manually again and again is time consuming and waste of time in the project. Hence regression suite helps company in verifying that any code change in software is not impacting the existing functionality of the website. Also, automation helps in ensuring quality and increase efficiency of software. Security testing is out of scope for this project.

This project report is organized as follow: Section 2 focuses on the literature review on the manual and automation testing. Section 3 is focused on the tools and techniques and research methodology for the project. Section 4 contains project execution for this project. Section 5 provides the results of this project. Discussion to the results are provided in section 6 recommendations for future researches are provided. Finally, in section 7 conclusion to the research project is provided and followed by recommendations in section 8.

2. LITERATURE REVIEW

Google Scholar tool have been used to conduct research on manual and automated testing studies in testing environment. Many studies have been conducted in past in favour of manual and automation testing and we will investigate these studies one by one.

Testing is mandatory for ensuring software quality [1]. Software under testing is necessary to generate high quality test cases, but to execute more than 80% of its source code is not an easy task. When we combined manual with automated test cases resultant test cases overcame in more than 10%, on average, statement coverage and mutation score when compared to rates of manual test set, keeping a reasonable cost. Therefore, we advocate that we should concentrate the use of manually generated test sets on testing essential and critical parts of the software

While doing manual testing tester takes over role of end user executing the software under test to verify its behaviour and find the observable defects [2]. However, automation testing is done using certain tools and test codes scripts e.g. selenium framework, Junit framework etc. and these codes, scripts and tools are developed and tested by humans. So, for having benefits from automated testing it should be planned and implemented properly else could lead to extra cost and effort and could even be less effective than manual testing in detecting fault [2]. Hence for my project manual testing is performed first and once we have stabilized pages in project an automated regression suite is made so that if there is any change in code from developer side we can just run an automated script for that page to check whether project page is working fine or not.

A study has been conducted by [3] that shows results that automated generated tests achieve similar code coverage as manually created tests. So as per above study conducted, we cannot say that only automation is better to save cost of project. It depends on how company is planning to implement the testing and to what extent automated

3. RESEARCH METHODOLOGY

Project run by Flimind Company works on agile methodology for the development and testing throughout SDLC. Project is divided into sprints and one sprint can last for 2 to 3 weeks. Daily stand-up meeting and discussion were held to give brief description of project

progress and what issues we are facing. Agile scrum is fitted into this research project as following:

- Roles: Research owner, research team and supervisor (scrum master)
- Artefacts: Research backlog and sprint backlog
- Ceremonies: weekly scrum meeting, sprint review, sprint retrospective

As scrum master is defined to be the person who the scrum team report to, and the one who resolves any hindrance in achieving the project goal, supervisor is appointed to be scrum master. Meanwhile, product owner is defined to be research owner – the one who knows the requirements and specifications of this research. As this research project is evaluated as individual work, research owner and research team will be the same individual.

On the other hand, as daily stand up meeting is not possible in research-based project, sometimes due to different research findings as opposed to software development where they make significant changes in 24 hour period, as well as due to supervisor unavailability handling 10 or more researches at one time, weekly scrum meeting is seen to be more feasible than daily stand up.

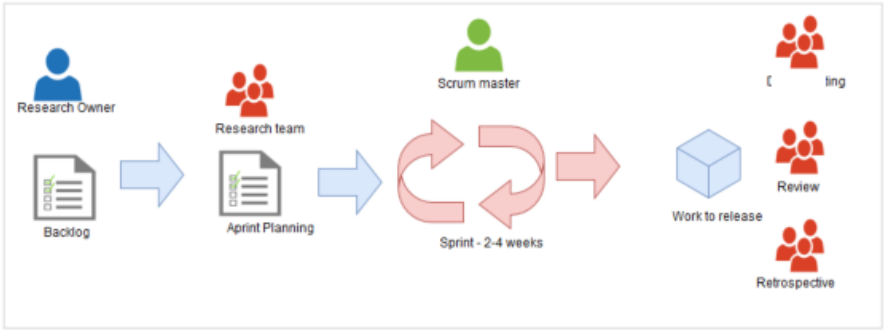

Figure 1. Research Project's Scrum Processes [15]

3.1. Selected Tool

The reason for selecting JIRA for our project is because JIRA is most popular project management tool and contains standard issue tracking repository. Also had a special board that has a virtual representation of agile and is widely used by developers [4]. Can easily trace bugs and issues. Generate project progress report. Can make our own workflows for the project. With the help of JIRA project manager can automatically assign issues and keep track record by having updates regularly either by phone or email by using an add-on automation for JIRA.

Confluence helps in gathering all requirements of my project at one place and if there is any change in requirements they can be updated easily, and other team members can also see it. Confluence also helps in keeping work organized and project team can create meeting notes, plans, policies etc. about the project.
Selenium

Selenium tool is most popular and open source tool for testing the web applications which is best for the Company as they don't have to pay for it. Large community support is also

available for its free use. Selenium web driver reduce time for development, minimize the risks and increase return on investment [5].

Features of Selenium

- Highly extendable through a wide range of libraries.
- Large and active development and user community.
- Flexible and supports parallel test execution which helps in reducing time and increase efficiency.

As per Google Trends, Figure below for the project shows that Selenium is the most common tool used by companies in New Zealand for automation.

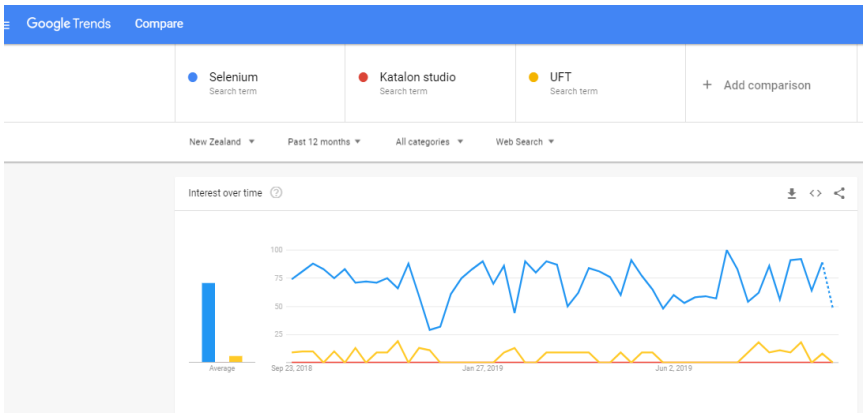

Figure 1 : Google Trends Showing Selenium popularity among Companies in New Zealand

4. PROJECT EXECUTION

4.1. Test Plan

Test Plan is like a blueprint that has detailed information about test strategy, testing objectives, resources and tools required for testing, test estimation, schedule and deliverables. For my project testing team and project manager decides to have manual and exploratory testing first on the “pickupmax” website and once website pages are stabilised and they don’t need any changes then we can write automation scripts for those designed web pages.

Importance of Test Plan

- Helps in guiding whether we are on right track or not in our project.
- Helps in determining efforts required by the team.
- Helps in understanding the details of testing.

Why Automation?

- Automation helps in improving testing efficiency.
- Some test cases are hard to execute manually e.g. APIs
- Automation is very useful for repetitive tasks.

Risks in Automation

- Browser updates: Auto-updates for browsers and software installed can create risks in automation. It may possible that old eclipse IDE is not compatible with the updated browser.
- X-path error: sometimes it's hard to detect X-path, it may work well in one browser, but it can also be possible that same X-path is not working for another browser.

4.1.1. Functional Test Cases

Table-1 shows the functional test cases for the project. Since project is new and is in developing stage, hence I showed one fail case that is bug and soon to be resolved by the developer as ticket is already raised by me to fix it.

Table 1. Functional Executed Test Steps and Results

Test Case ID	Test Case Scenario	Test Case Description	Expected Result	Actual Result	Status
PICK-	Signup	1. Open browser and enter URL "https://www.pickupmax.com/". 2. Click on Signup Button. 3. Enter valid credentials for signup and click on "create an account" button.	As a user, I want to sign up to "Pickupmax" website	User can signup	Pass
PICK-02	User Profile	1. Open browser and enter URL "https://www.pickupmax.com/". 2. Click on "Login" and enter valid credentials for login to website. 3. Click on "Account" button on top right of website page. 4. Click on Profile. 5. Profile page is displayed. Enter First name, last name and mobile number. 6. Click on "SAVE CHANGES".	As a user, I should be able to make my profile.	User is able to make profile.	Pass
PICK-03	Login	1. Open browser and enter URL "https://www.pickupmax.com/". 2. Click on Login Button. 3. Enter valid Email id and password. 4. Click on "Login" Button.	As a user, I should be able to login with valid email id and password.	User can login and Homepage is displayed.	Pass
PICK-04	Search Auckland International Airport	1. Click on Airports and drop down list will pop up showing "All New Zealand airports". 2. Click on "All New Zealand Airports". 3. New page is displayed showing all airports in New Zealand. 4. Click on "Auckland International Airport".	As a user, I should be able to see list of New Zealand Airports, showing Auckland International Airport	User can see list of all New Zealand Airports, and Auckland International Airport is displayed.	Pass

PICK-05	Search Novotel Hotel	1. Click on Airports and drop down list will pop up showing "All New Zealand airports". 2. Click on "All New Zealand Airports". 3. New page is displayed showing all airports in New Zealand. 4. Click on "Auckland International Airport". 5. New page is displayed showing list of hotels. 6. Click on "Novotel Auckland Airport"	As a user, I should be able to see Novotel Auckland Hotel page.	User can see Novotel Auckland Hotel page.	Pass
PICK-06	Search Commodore Airport Hotel, Christchurch	1. Click on Airports and drop down list will pop up showing "All New Zealand airports". 2. Click on "All New Zealand Airports". 3. New page is displayed showing all airports in New Zealand. 4. Click on "Christchurch International Airport". 5. New page is displayed showing list of hotels in Christchurch 6. Click on "Commodore Airport Hotel".	As a user, I should be able to see Commodore Airport Hotel page	User can see "Commodore Hotel" Page with details	Pass
PICK-07	Scheduling Pick up from Auckland Airport to Heartland Hotel	1. Click on Airports and drop down list will pop up showing "All New Zealand airports". 2. Click on "All New Zealand Airports". 3. New page is displayed showing all airports in New Zealand. 4. Click on "Auckland International Airport". 5. New page is displayed showing list of hotels. 6. Click on "Heartland Hotel Airport". 7. Slide bar "Are you ready for pickup" status must be "NO". 8. Enter Pick update "25th Sep 2019", Time "11:00am", Adults "2", Children-"1", pick up address is "Auckland International Airport" and drop-off address is "Heartland Hotel" 9. Click on "Schedule pickup" and tick mark on accept terms and conditions. 10. If you already Signing it will automatically take your details and shows ETA "estimated time of shuttle arrival", else enter email id, mobile number for scheduling pick up.	As s user, I should be able to schedule pick up from Auckland International Airport to Heartland Hotel on "25th September 2019" at "11:00am" with 2 adults and 1 child.	User can schedule pickup.	Pass

PICK-08	Arrange Pickup Now from Auckland Domestic Airport to Novotel Hotel	1. Click on Airports and drop down list will pop up showing "All New Zealand airports". 2. Click on "All New Zealand Airports". 3. New page is displayed showing all airports in New Zealand. 4. Click on "Auckland International Airport". 5. New page is displayed showing list of hotels. 6. Click on "Novotel Hotel Auckland". 7. On "Are you ready now" sidebar status is "yes" 8. Change Pickup address to Auckland Domestic Airport. 9. Click on "Pick ME UP NOW". 10. Click on check box for accepting terms and conditions. 11. Your Shuttle ETA is displayed.	As a user, I should be able to Arrange pick up.	User can arrange pick up.	Pass
PICK-09	User Profile-Bug	1. Open browser and enter URL "https://www.pickupmax.com/". 2. Click on "Login" and enter valid credentials for login to website. 3. Click on "Account" button on top right of website page. 4. Click on Profile. 5. Profile page is displayed. 6. Click on "SAVE CHANGES".	User is not able to click on save changes as Profile page needs credentials to fill before clicking on save changes.	User can click on "SAVE CHANGES" without entering any first name, last name and mobile number. Hence, its bug.	Fail
PICK-10	Logout	1. Click on "Account" on top right of website page 2. Click on "Logout" Button.	As a user, I should be able to logout from "pickupmax" website and Login button is displayed on website page.	User can logout, and Login Button is displayed on website page.	Pass

4.1.2. Gantt chart for Project

Table-2 below shows Gantt chart for the project. The project is having five sprints and each sprint is described below and can last for one to two weeks.

Table 2 : Gantt chart for project

Sprint	Actions/Deliverables	Day	Start Date	End Date	Durations(Hrs)
Sprint 0	Discussion about the pickupmax website and analysing documents of the project	1	19/08/2019	20/08/2019	6
	Exploratory testing on Pickupmax website	2	20/08/2019	20/08/2019	8
	Review documents and tool that are to be used in website	3	21/08/2019	23/08/2019	8
	1. Set up Testing Environment, links provided by Project Manager. 2. Manual testing is to be performed for the assigned issues in JIRA. 3. Passed issues are moved to "Ready for production" stage in JIRA. 4. Tickets must be raised for bugs and assigned to developer. 5. Make report for Project Manager for issues that need improvement.	4, 5	22/08/2019	23/08/2019	8
	Meeting with the Project Manager about issues that need improvement.	5	23/08/2019	23/08/2019	1
Sprint 1	1. Email and console-3 sprint for pickupmax website will start 2. Exploratory Testing is done on Pickupmax website.	6	26/08/2019	29/08/2019	8
	Assigned issues in JIRA have to be tested and raise tickets for issues having bugs.	7,8	27/08/2019	30/08/2019	8
	Exploratory testing on Pickupmax website and report must be made for Project Manager for issues that need improvement	8	29/08/2019	30/08/2019	8
Sprint 2	Manual testing is to be performed for assigned issues/tasks.	9	28/08/2019	30/08/2019	8

	Analysing tools that can be implemented in project by comparative analysis.	10	30/08/2019	30/08/2019	8
Sprint 3	Setting Framework and configuring testing environment	11	2/09/2019	2/09/2019	5
	Creating automation scripts for regression testing	12	4/09/2019	4/09/2019	8
	Executing scripts, sharing results with project manager	13	5/09/2019	5/09/2019	8
	Working on report and presentation.	13,14	6/09/2019	6/09/2019	8
	Creating test case plan for project	14	9/09/2019	11/09/2019	8
Sprint 4	Working on report and presentation.	15,16	9/09/2019	9/09/2019	8
	Creating automation scripts for regression testing	16	10/09/2019	13/09/2019	9
	Working on report.	17,18	11/09/2019	12/09/2019	8
	Exploratory testing to be performed on website. Make report for issues that need improvement and submit to project manager.	18	12/09/2019	12/09/2019	6
	Assigned issues have to be tested and raise tickets for issues having bugs.	19,20	13/09/2019	13/09/2019	8
Sprint 5	Working on report.	21	16/09/2019	18/09/2019	8
	Creating automation scripts for regression testing	22	17/09/2019	17/09/2019	7
	Assigned issues have to be tested and raise tickets for issues having bugs.	23	18/09/2019	18/09/2019	8
	Exploratory testing to be performed on website. Make report for issues that need improvement and submit to project manager.	24	19/09/2019	19/09/2019	6
	Working on report and presentation	25	20/09/2019	20/09/2019	8

4.1.3. Schedule for Sprints in Project

Table 3 below is showing the schedule for the project. The schedule for project is divided into five sprints and each sprint action or deliverables are described below.

Table 3 : Schedule for project

Sprint	Actions/Deliverables
Sprint 0 (14th Aug -16th Aug 2019)	• Understanding the guidelines of the Pickupmax website • Gathering all information related to website. • Creating plan, review and had meeting with the Project Manager for the feedback. • Read the documents related to website
Sprint 1 (19th Aug – 23rd Aug 2019)	• Installation of the Skype for communication. • Preparing setup of testing environment • Meeting with the Project Manager (Michael Jones) for the project report. • Executing the issues assigned in JIRA
Sprint 2 (26th Aug -30th Aug 2019)	• Preparing reports for issues in JIRA • Passed issues were transferred "Ready for Testing" stage in JIRA. • Tickets to be raised if any issues were found and assign it to developer • Preparing report for Project Manager about issues that need improvement
Sprint 3 (02nd Sept – 06th Sept 2019)	• Writing automation scripts for stabilised webpages of website • Meeting with testing team and project manager for project progress • Manual and exploratory testing for issues assigned. • Preparing report for issues that need improvement.
Sprint 4 (09th Sept – 13th Sept 2019)	• Setting up automation environment by installing Eclipse IDE, selenium, browsers and creating framework for automation • Preparing report for passes test cases using TestNg. • Meeting with Project Manager and testing team for suggesting improvements in website. • Working in project report and presentation
Sprint 5 (16th Sept – 20th Sept 2019)	• Exploratory testing for "Email and console-4 sprint". • Assigned issues to me need to be tested manually. • Running automation scripts and generate report • Working on presentation and project report.

4.2. Code Snippet

4.2.1. Project Structure in Eclipse IDE

Figure 2 below is showing the structure for automating scripts for the project. Here three packages have been created under "Pickupmax" java project and these three packages have different classes for calling the UI elements. TestNg is used as an add-on in Eclipse for generating reports. Also, POM (Page object model) is used for creating object repository for web elements.

Advantages of POM:

- Helps in making code clean and easy to understand.
- Object repository is independent of test cases hence same repository can be used for different purpose with different tools.
- Code is less and optimised. Methods have more realistic names.

4.2.2. Packages for Pickupmax project

- Pickupmax Browser Library: Under this package class browser factory is been created that is having all list of browsers that are supported by the project. Browsers can be easily updated and added in this class and hence we don't have to change the whole code.
- Pickup Pages: Under this package stabilised pages of project website have been created such as Signup, Login, Logout and searching airports. Here only stabilised pages of website are been tested as project is new and is under developing stage, so we are automating only that don't need lot of changes in their code and are repetitive.
- Pickup Testcases: Under this package methods are being called that needs to be tested.

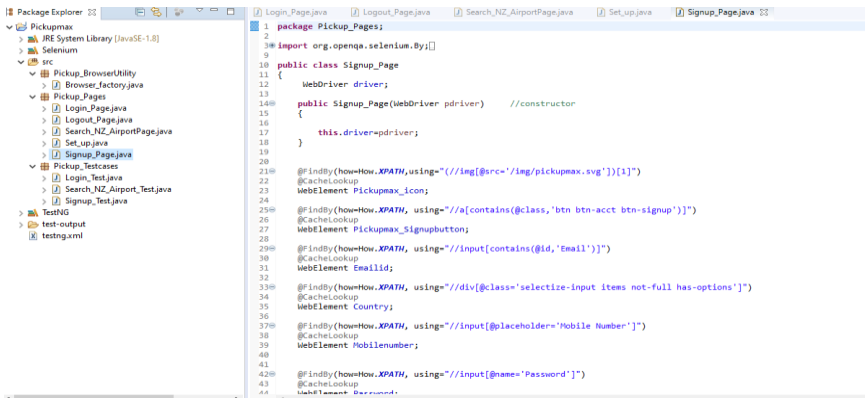

Figure 2: Code for Login Page of project

4.2.3. Login Test Class

Figure 3 of project shows the code for calling Login method for testing login functionality of the website. As we can see this code is independent of other codes and is a complete function which is a great advantage of Page Object Model (POM). By giving assertions we are verifying that our test case is successfully passed or failed. This helps in generating a good report and project manager and team whosoever (e.g. stakeholders, business analyst) is reading report can easily know whether test case is failed or passed.

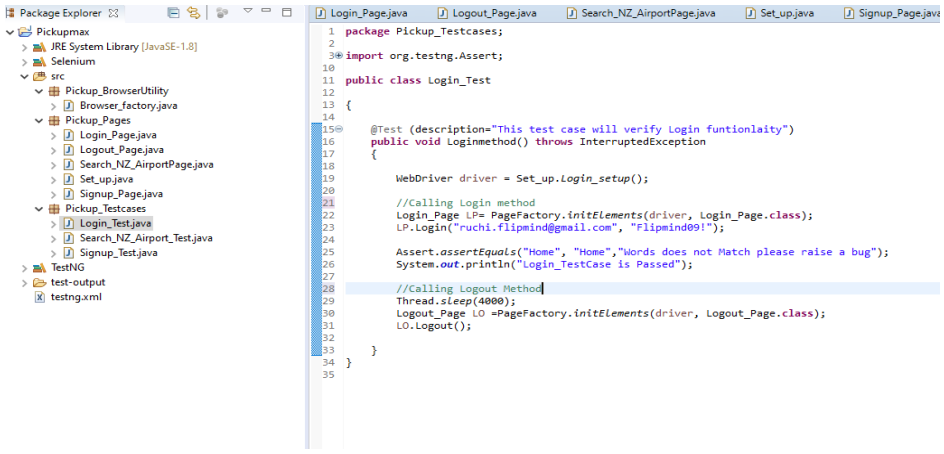

Figure 3: Code for Login Page of project

4.2.4. Project is showing three different colours

Figure 4 of project is showing three different colours. By choosing these colours I want to clarify that by looking at the structure in Eclipse one can easily know whether this is a class, method or constructor. If we look carefully yellow colour box has a green dot with C on the top, which means that “Logout Page (WebDriver) is a constructor in class “Logout Page”. For red box symbol “C” is there in front which means it’s a Class name and if its green dot it means it is method in that class which is clearly seen below.

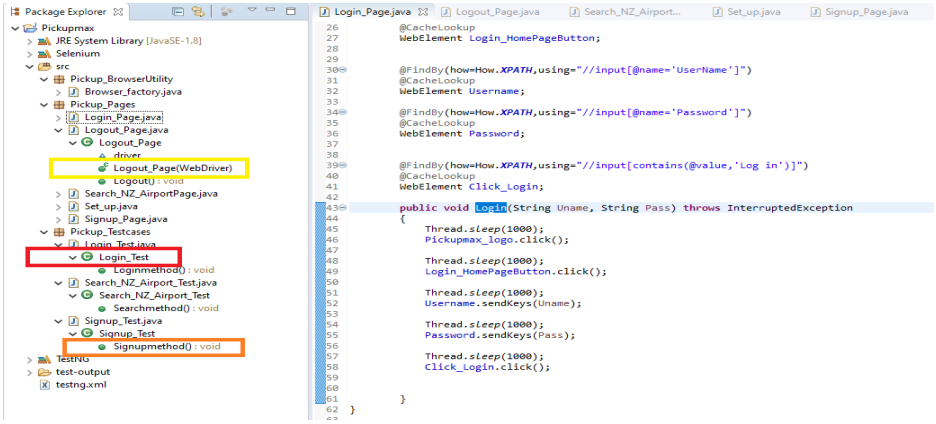

Figure 4: Eclipse Structure showing class, methods and constructor in project

4.2.5. Issues Assigned in JIRA

Below figure 5 shows issues assigned to me that are ready for testing and manual testing is to be performed for these assigned issues. As it is clearly mentioned above that project application is new and still under development and changing frequently hence creating automation scripts is a waste of time. Also, manual testing is good option to check usability, look and feel of any application.

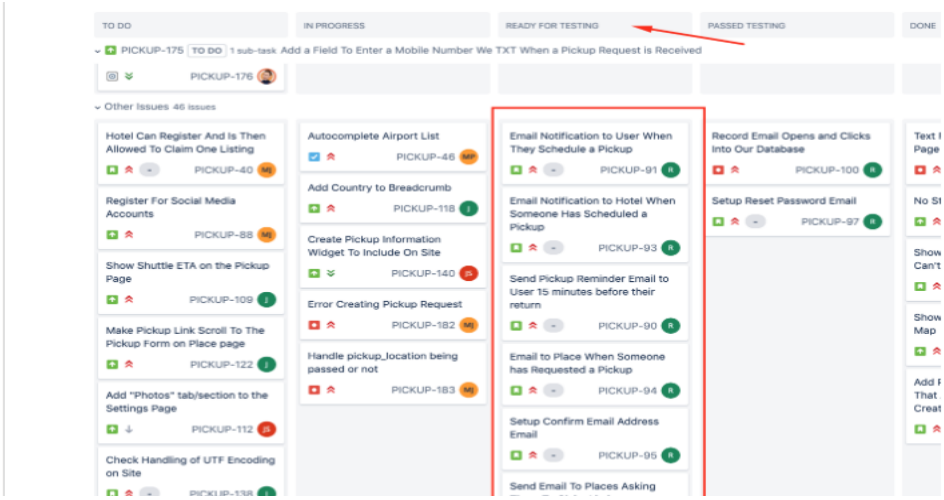

Figure 5 : Issues assigned to me for Testing in JIRA for the project

5. RESULTS

5.1. Results of reports generated in JIRA tool

Figure 6 below is showing the sprint report in JIRA for the project. As in figure it is clearly shown bug, story and issues that need improvement are done.

Figure 6 : Sprint Report in JIRA for project

Figure 7 below is showing the cumulative flow diagram for the project. As it clearly shows that orange coloured part is to do, and dark red colour states that issues are completed or done in project. Cumulative diagram shows the quantity of work. It depicts various stages of work item in the project.

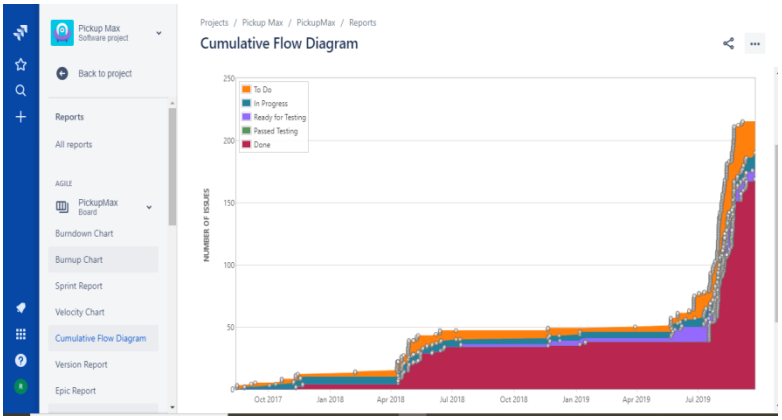

Figure 7: Cumulative Flow Diagram of project in JIRA

Figure 8 is showing created vs resolved issues till 21st of Sept 2019 for the project in JIRA.

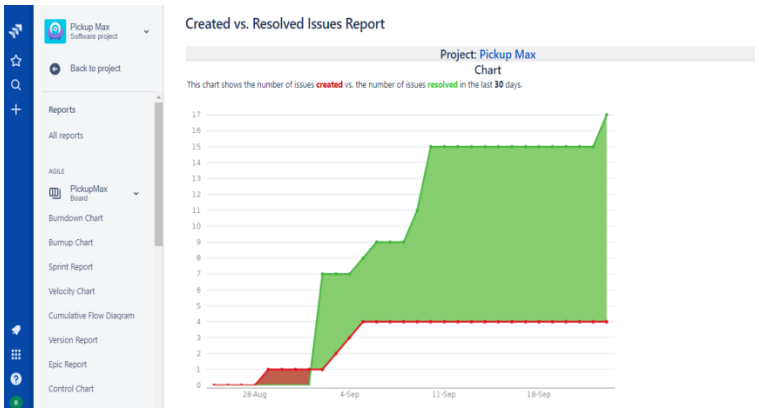

Figure 8: Created VS Resolved Issues for project in JIRA

5.2. Test NG reports result

TestNG is an add-on in Eclipse that is used for generating reports for the project. TestNg uses annotations that are very easy to understand, and we can execute multiple test case on multiple browsers. There is an .html file under test output and if we double click on that file, we can easily see reports for our test cases.

Figure 9 and 10 below showing results obtained after running test suite for the project. It clearly states that Signup Test case for the project is passed but method fails and reason for that is project is still under developing phase. So, as a user I can sign up by filling all details, but it leads to server error instead of taking me to Home page of the website. Such problems can be faced if we do automation for a new project that is changing frequently.

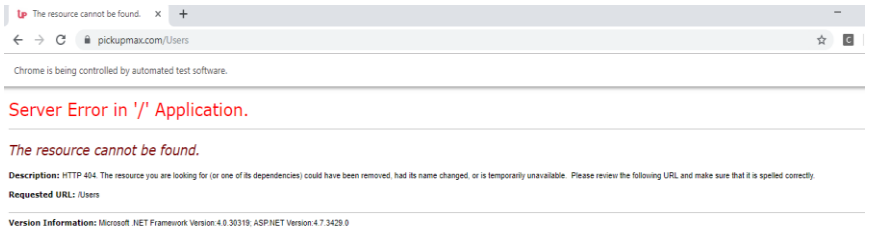

Figure 9: Signup Page server error for project website

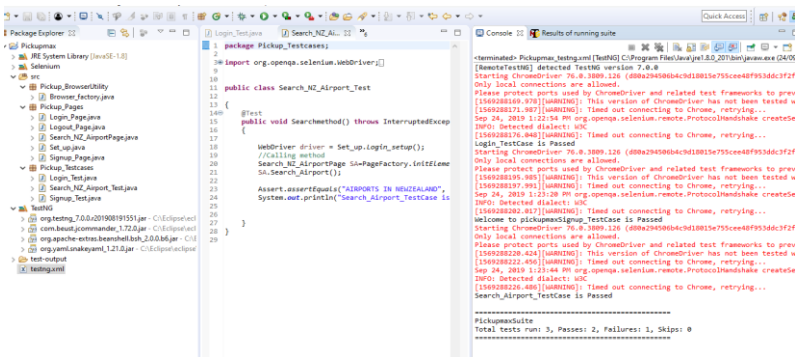

Figure 1: Console showing Signup Test case is passed for project

Figure 11 shown below is a TestNg suite for pickupmax website showing Signup method as fail and giving details of failure while Login and search method are shown as passed.

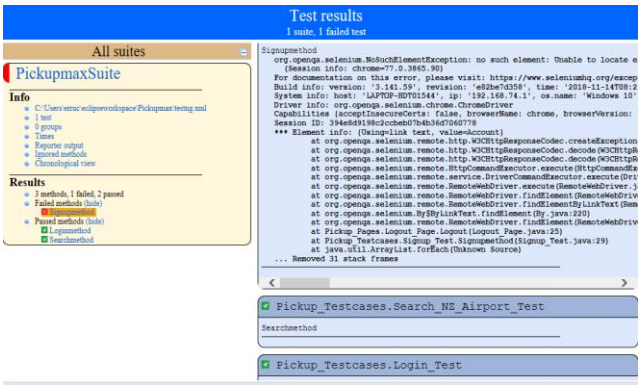

Figure 11: TestNg .html report result for project

6. DISCUSSION

The purpose for this report is to make users understand the importance of manual and exploratory testing as it is not a good idea to automate the project when project is in its starting phase. In initial stage, developers are developing website and lot of changes are done every day to make project user friendly, developers try best to give good feel and look, and these can be tested doing manual and exploratory testing on the project. Automating scripts can only tell that website functionality is working or not as expected. But to test usability, look and feel manual testing is a good idea. Since project is new, hence functions are developed and changed frequently so creating automated scripts is waste of time. But once we get stabilized pages for the web applications then we can automate the repetitive task in the project as it saves time and we can easily check the functionality of web application if there is any change in code.

Tools for project management and issues or bug tracking are very useful for governing the development process of any web application or software. These tools simplify the communication process among developers and ensures scalability of the project and JIRA is one of the best issue/bug tracking as well as project management tool used in this project [6]. Also, Scrum methodology is adopted by the Flipmind Company for their projects and after going through different research papers mentioned above it can be clearly stated that scrum methodology is better from others as defects are identified at very early stage of project which helps in reducing cost and time of project.

Issues faced during this report is that it's hard to automate project application at this stage due to frequent changes in the website design. Since project is novice and company is currently working on it and due to continuous changes and updating testing is difficult at this stage. Hence manual and exploratory is best option at this stage. Automation scripts are done only for stabilized pages of website as other pages are still in developing phase and cannot be automated.

7. CONCLUSION

Pickupmax website proposal covers brief intro about Flipmind Company and what they do in New Zealand. Flipmind Company is using agile methodology for their Pickupmax project. JIRA and confluence tools are being used for project management, bug and issues tracking.

Exploratory and manual testing is being performed by the Testers to check functionality of website that website pages are working as expected. An attempt has been made to give justification for selecting open source tools and how are they useful. Once we get stabilized pages for website an automated regression suite is made to effectively utilize time of the project and confirms if any change in code is affecting the functionality of the website or not. TestNg is used as add-on in Eclipse for generating reports of automation scripts of project. Also, POM is for easy understanding of code and it helps in reusing code for automating the scripts. This report helps manual and automated testers to carry out the similar tasks. Also, it helps future researchers how to start testing from the very beginning of project and selecting open source tools for any web application and how to create automated regression suite.

8. RECOMMENDATIONS

Flipmind Company works with different clients in New Zealand. It's hard for company to manage and handle such a huge database and regularly updates sites as per stakeholders' demand. To overcome such situations Company is thinking of adopting new tool for managing database provided by Microsoft. Although it will cost them as training need to be provided for the team to use the tool. But to have high security for their data Company is trying to implement tool in their system. Since the tool is expensive and training will also cost time and money, hence Company can have first try free tools available in market and from online internet videos training cost can be saved and data security can also be maintained.

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