One Touch Automation in Accessibility Value Chain

Dr. Charudatta Jadhav
Tata Consultancy Services Ltd
Intersil Building, SEEPZ, Andheri (East), Mumbai- 400096
Charudatta.jadhav@tcs.com

Sumeet Agrawal
Tata Consultancy Services Ltd
Intersil Building, SEEPZ, Andheri (East), Mumbai- 400096
Sumeet.a@tcs.com

Abstract

In spite of the presence of Web Content Accessibility Guidelines 2.0 (WCAG 2.0) published by W3C for more than a decade, the accessible websites are less in numbers. There are many reasons behind it however, the most prominent one is that the major portion of web accessibility evaluation requires manual efforts resulting in effort extensive and time-consuming task. This, in turn, increases the overall product development cost. Although a lot of work has been done to automate the evaluation, however, the current focus is only on accessibility test execution. In this paper, we present our pioneering accessibility evaluation platform 'One touch Automation' which introduces the automation across the accessibility value chain hence considerably reducing the manual effort. On the basis of our evaluation study, this platform has provided the cost-benefit close to 33 % and time and effort saving of 40% for accessibility implementation.

Author Keywords

Web Accessibility assessment; Web Accessibility automation; Web Accessibility validation.

ACM Classification Keywords

Human-centered computing: Accessibility-Accessibility design and evaluation methods, Accessibility systems and tools.

Introduction

Website Accessibility Conformance Evaluation Methodology (WCAG-EM) has two main steps [1]:

1. Selecting a representative sample
2. Auditing/testing the random sample of web pages/all web pages of the website.

The webpage needs to be evaluated against the testable success criteria of each guideline published by WCAG 2.0. These success criteria are tested using different types of tools (automated, browser plug-in, assistive technology: mainly screen readers). The above two tasks are treated as an effort-intensive and complex task and the three reason which we could identify are: automation quotient is less, high dependency on accessibility subject matter expert (SME) which is scarce skillset, multiple tools for testing the set of guidelines.

The first reason of automation quotient being less: the current automated accessibility testing tools can help us evaluate WCAG 2.0 to a certain extent i.e. 20-25% [2], [3],[4] and [5] leaving 70% of the testing to be performed manually. The accessibility testing of a single page on an average takes few hour efforts (ranging 3 to 7 hours). Performing two rounds of testing (first cycle testing and retesting after defects are closed) for the website having larger inventory will need the considerable amount of efforts and cost. To mitigate this challenge, IT industry widely uses the best practice/method of sample assessment. In sample assessment during the first cycle of the testing representative sample of web pages from the website are selected for testing which could give close to 100% coverage of applicable accessibility guidelines. This helps in identifying the unique type of issues, the accessibility performance of the website and in-turn reduces the efforts in first cycle. But selecting the sample set of pages requires manual review of all the pages of the website which can be tasking and effort consuming especially for large inventory websites.

Another reason is that WCAG 2.0 success criteria can be tested by multiple independent tool or combination of tools For example WCAG 2.0 1.1.1 Form fields missing explicit labels and/or titles can be tested using automated tool or semi-automated tool or screen reader. However, the testing efforts varies with each tool. As the result there is lot of repetitions and overlaps during testing. To avoid this the experts' needs to use their knowledge to decide which tool or combination of testing tools should be used to test the webpage of the website. To do this manually in a reasonable period of time, with a high degree of accuracy, requires a large battery of highly trained accessibility testing professionals which is scarce skillset.

Our research work started with the focus to increase the percentage of automation from 20 %, and reduce the manual intervention and dependency of Accessibility expert SME to an extent. This paper describes our pioneering accessibility evaluation platform called as 'One Touch Automation'.

One Touch Automation

One touch Automation is platform which automates accessibility evaluation across phases the lifecycle: Planning and validation phase. The platform consists of:

a) Sample Assessment engine,
b) Test Strategy Definition, Dynamic Test Case and Checklist Generation engine and
c) Enhanced automation validation engine.

As shown below in Figure 1, the accessibility tester inputs the URL and the required compliance level in the system. The platform crawls the entire website page by page and performs automated validation, generates the list of applicable remaining checkpoints and tool combinations to test each page. The platform also suggests sample set of pages from the website the accessibility tester should be testing which will give the 100% coverage to the accessibility guidelines and unique issues of the website under test.

Automated Sample Assessment: The engine, employs a statistical model to perform attribute based sampling, to select sample pages from the website under test. Once the user inputs the URL this engine scans the web pages present in the website using the crawler module. Sampling is performed on the basis of parameters, such as the types of elements present and the occurrence of each of those types (element density. Another such parameter is the structure of the page which dictates the type of interactions present on it. The algorithm selects pages that ensure 100% coverage of possible accessibility issues. This is extremely important, as it not only helps provide 100% coverage without having to physically go through each page, but it helps reduce first cycle testing efforts.

Enhanced Automated Validation: While automated accessibility testing has been around for a while, the level of automation was very low (20- 25%). Our unique invention for "Identification and Assessment of Widgets" for example, menubar, treeview, CAPTCHA, slider and date and time picker, and validations backed by intelligent algorithms have raised the bar to 50+% automation (169 checkpoints out of 325) with high accuracy. The accessibility testing of the widgets has been automated which cannot be identified based on the semantics available in the HTML DOM. For example the 'menubar' and 'nested list of links' are semantically similar as both contain the <li> HTML tag, however the accessibility requirement of the elements differ.

Automated Test Strategy & Dynamic Checklist generation: First, it generates the list of applicable checkpoints on a web page. Then it uses mathematical optimization and a rule-based engine to select the most effective tool combination for each of the applicable checkpoints on the web page, keeping in mind that the repetition of checkpoints and the time required is at a minimum while the coverage of scenarios for each checkpoint is maximum. The steps are summarized in Figure 1 below. Hence, it takes care of the generation of test cases and combination of tools to be used for each test case.

Based on our evaluation study OTA platform has provided us cost benefit of close to 33% and a time and effort saving of 40%.

Conclusion

The ultimate vision is to be achieve 85% automation across the accessibility evaluation life cycle. The future road map includes further increasing the automation further by: eliminating human judgement using artificial intelligence and simulation of screen reader testing (end user testing). Research has also been conceptualized to build a component that will insert compliant accessible code in real-time (proactive approach). Implementation of the current innovative process has resulted in 18% cost savings. We hope to present our analysis and experiment results during the presentation at EMPOWER 2018.

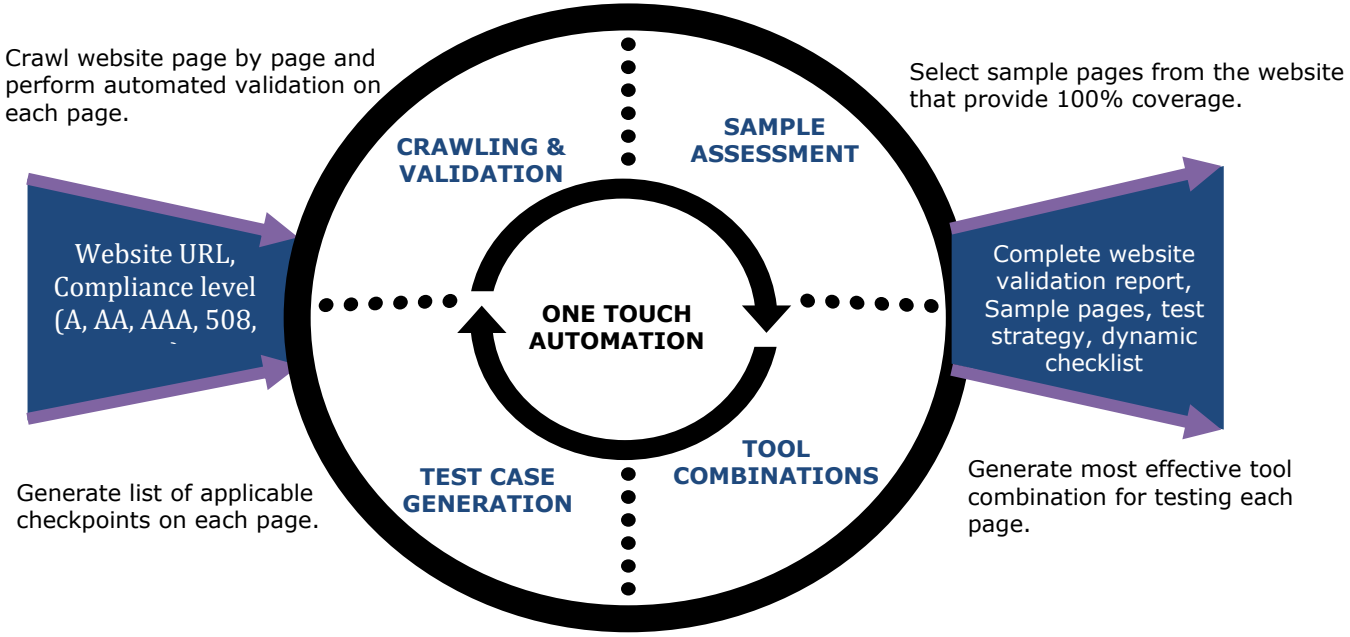

Figure 1: One touch solution platform

References

[1] Website Accessibility Conformance Evaluation Methodology - https://www.w3.org/WAI/test-evaluate/conformance/wcag-em/ - Accessed as on 9/3/2018

[2] http://www.karlgroves.com/2012/09/15/accessibility-testing-what-can-be-tested-and-how/, accessed May 3, 2017.

[3] A. Martínez, J. De Andrés, and J. García, "Determinants of the web accessibility of European banks", Information Processing & Management, Vol. 50 No. 1, pp. 69-86, 2014, DOI= https://www.sciencedirect.com/science/article/abs/pii/S0306457313000794

[4] S. Gordon, S. and S. Lujan-Mora, "Accessible blended learning for non-native speakers using MOOCs", Interactive Collaborative and Blended Learning (ICBL 2015), IEEE Computer Society, Washington, DC, pp. 19-24, 2015, DOI= https://ieeexplore.ieee.org/document/7387645/

[5] J. Lazar, B. Wentz, A. Almalhem, A. Catinella, C. Antonescu, Y. Aynbinder, …M. Seidel, "A longitudinal study of state government homepage accessibility in maryland and the role of web page templates for improving accessibility", Government Information Quarterly, Vol. 30 No.3, pp. 289-299, 2013, DOI= https://www.sciencedirect.com/science/article/pii/S0740624X13000403