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Building Accessible Websites With Component Based Software Development (CBSD)

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Abstract

The web should be designed properly so that all users regardless of their ability, age, equipment and disability can use it. Some websites, however, do not function well for disabled people. Some websites areso poorly built that disabled people can find it difficult or impossible to use them. In order to make the web handy to every user the World Wide Web Consortium(W3C) Web Accessibility Initiative(WAI) provides rules and guidelines. Accessibility evaluation tools are used to check whether websites follow accessibility rules and guidelines or not. Most of the tools fail to give adequate results. These tools do not cover all web accessibility requirements. It is essential for organizations to pay attention on web accessibility from initial stage of web development. However, adding WCAG guidelines in website design is not an easy task. It takes lot of effort and time. This problem can be solved using component based software engineering. Component Based Software Development (CBSD) has increased popularity as it often contributes to software of higher quality with significantly reduced the cost and time to develop the software. The objective of this paper is to develop accessible websites by selecting appropriate components that cover WCAG guidelines and assemble them.

Keywords: Accessibility, W3C Standard, Component Based Software Development (CBSD), Web C ontent Accessibility Guidelines (WCAG).

1. Introduction

In modern era, to develop software from scratch, with million lines of code has become very difficult. It results in low productivity, large development time and high cost. It is the responsibility of web developers to follow guidelines and standards of web accessibility so that each personcan avail the opportunity of web.World Wide Web Consortium (W3C) publishes guidelines to guide web developers about web accessibility rules but few web designers follow guidelines.

The main reason is lack of awareness of the web accessibility among developers. Some organizations take web accessibility into account. In the market different kinds of web accessibility improvement tools are available which can ensure the user-friendliness of websites. These tools cannot check all WCAG requirements. The organizations are still unable to tackle web accessibility problems. The organizations should pay attention on web accessibility from initial stage of web development.

The COTS components are developed using different platforms and languages by different devel opers. The components of the code are written in such a way that many systems have similar feat ures.CBSE's main objective is to improve reusability by using an existing component with shorte r development times and higher quality products[4].

In CBSE, the main task is to select the components intelligently, if mistakenly incorrect component is selected then it will degrade the software quality as quality depends on the component selected from the repository. It may result in system failure of the cost of implementing the program can increase. In this paper, it is deemed to improve the approach of choice which guarantees the optimum component.

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Component Based Software Engineering (CBSE) approach to address challenges of developing accessiblewebsites.The approach to CBSE is based on the idea of designing the code by selecting and assembling suitable accessible commercial-off-the-shelf (COTS) components.

2. Web Accessibility

According to inventor of the World Wide Web, Tim Berners-Lee, "The power of the Web is in its universality". The web should be reached to all people including disabled people. Web accessibility provides means to make web accessibility. It refers to the methods and efforts which are used to develop accessible websites. There are also many advantages of accessible websites. Surveys [2] prove that user-friendly websites give enhanced search outcomes, decreasethe cost to maintain the software and improve usability of websites. Hence web accessibility has social and financial benefits. In many developed countries web accessibility is legal requirement. The universities websites and government websites which do not comply with web accessibility rules can be challenged in courts in these countries. In United States of America [33] , Section 508 which is the amendment of rehabilitation law recommends to all electronic and information technology to provide equal access to all people. In order to provide universal access web accessibility rules must be followed by web developers. If web content is not designed properly it can make difficult or impossible for persons with disabilities to use web.

3. Web Accessibility problems

The people who are totally blind can use computer, phones and other electronic devices. The assistive technology is used by blind which enables them to access computers and other electronic devices. The Screen reader [6] is a software which uses text to speech engine in order to provide on screen information to blind. The blind cannot use mouse, by using keyboard shortcuts can get the on screen information..
The most common [34] screen reader used by the blind is JAWS (Job Access with Speech).
Majority of the smart phones provides text to speech applications for blind. The blind can also use touch screen for e.g. VoiceOver application allow blind to use touch screen. Voiceover takes input as gesture and provides speech as output. Slide Rule [5] is another option in Android phones to make touch screen more accessible. However if web content is not designed according to WCAG accessibility rules and standards then it can create problems to screen reader users.Ambiguous links, complex [21] form, missing improper heading, too many links, complex data forms, inaccessible search, lack of skip, and table data without summary are the common web accessibility mistakes.

4. Web Accessibility Guidelines

The first edition of internet accessibilityWCAG1.0 (Web Content Accessible Guidelines) was released by W3C[1]in 1999 and second version WCAG2.0 (Web Content

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Accessible Guidelines) in 2008. There are mainly four main W3 guidelines [32] for accessible web design. Further check points are provided for each guideline. There are priorities for checkpoints ,priority 1 checkpoint means the checkpoints which must be include to make website accessible. Priorities 2 which remove all the web accessibility problems .priority 3 improves the accessibility of web sites. Three rates are A, AA, AAA, level.

1. A identifies all the checkpoints of priority 1
2. AA both priority 1 and priority 2 check points
3. AAA all the three priority checkpoints

Mainly the W3C guidelines are divided into four parts:

1. PERCEIVABLE: Make Content Presentable to user so that they can perceive the content easily.
2. OPERABLE: Ensure that any client can use the Interface Elements in the Material.
3. UNDERSTANDABLE: allow as many users as possible to understand material and contr ols
4. ROBUST: Using Web technologies to optimize web capabilities

5. Literature Survey

Michele Kirchner [35] in this paper author gives a complete review of web accessibility evaluation tools. The paper also describes the main functionality of web accessibility tools.

De Sousa e Silva [17] evaluates the accessibility of Integrated Development Environments (IDE).The author also measures the capacity of Integrated Development Environment to generate accessible software.

The two papers [6], [19] show that if the web accessibility is included in requirement face it will improve the worth of the software automatically.

HelaniWanniarachchi et al.[16] proposes a frame work to automate the development process of accessible web sites. The author describes a web accessibility generator tool which can scan code and give immediate warning of violated web accessibility rules. The web developers can correct those warnings and improve the web accessibility of the web sites. The tool is platform independent.

Mayol, J.J [20] presents development of a web accessibility improvement tool .The tool can check html code and give warning if violation in the rules. The tool covers the critical points of W3C guidelines as compared to existing web accessibility tools. G.A. Di Lucca et al.[23] the paper represents a tool to indentify and fix the web accessibility problems. The author uses a model to correct and fix the web accessibility problems which is based on WCAG 2.0.

Thi-Huong-Giang et al.[10] the paper presents a framework which checks the client as well as server side code . The framework directly reports and suggests solution for web accessibility violations.

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Vitharana, Padmal (2003) uses componentbased applications to discuss risks and challenges face d by stakeholders.CBSD component designers, software assemblers and customers are mainly in volved in three groups of stakeholders.Many risks and challenges are faced by each stakeholder.I f one stakeholder faces the risk challenge.Therefore, the risk and challenges involved with the project must be addressed beforehand [3].

Kaur, Loveleen and Hardeep Singh (2013) discussed the techniques of selection of components for software- A review paper. It is intended to reviewseveral different techniques of formal software selection. There are two primarily manual and programmed methods. The pros and cons of these two strategies were discussed. Each technique has been found to have its own pros and cons; no technique is best for every scenario[4].

Pande, Jeetendra, Christopher J. Garcia and Durgesh Pant(2013) discussed an approach to eleme nt assessment using different quality attribute measurements.

Pliability metrics are introduced in this paper. Pliability is a dynamic metric which measures the quality of the software in terms of the quality of its components across different quality attributes.This approach encourages a clear and versatile way of assessing and comparing the ove rall quality.Each attribute's weighting depends on the code sort.One major problem being studied is how to establish a systematic tactic for choosing the relative weights to be allocated to various superiority indicators based on feedback from stakeholders[8].

Ayala, Conradi et al(2011) The proposed element selection methods were seldom used in industr y.Instead, other resources are used in industries that have not given considerable attention.Such s trategies incorporate either gettingthe software from third parties or choosing the components from online repository. The outcome is valuable from both research and industry as they giveefficienttechniques for improvement[10].

6. Proposed Methodology

In the paper the problem which is to be discussed is stated as:

To select the optimal component is a difficult and time consuming process in CBSE. Existing components could be reused instead of building it from scratch, which leads a system to fast deliverytime.However, it becomes more difficult to find the appropriate components that meet a set of accessible necessities.We require to choose appropriate plug-ins that covers every criteria together in such way that increases the weighted performance parameter rates accomplish when balancing against costs. To accomplish all quality attributes such as transparency, interoperability,

reusability.CBSE's goal is to achieve various quality goals such as reusability, interoperability, tr ansparency of execution and the most important feature accessible guidelines of the WCAG[2].

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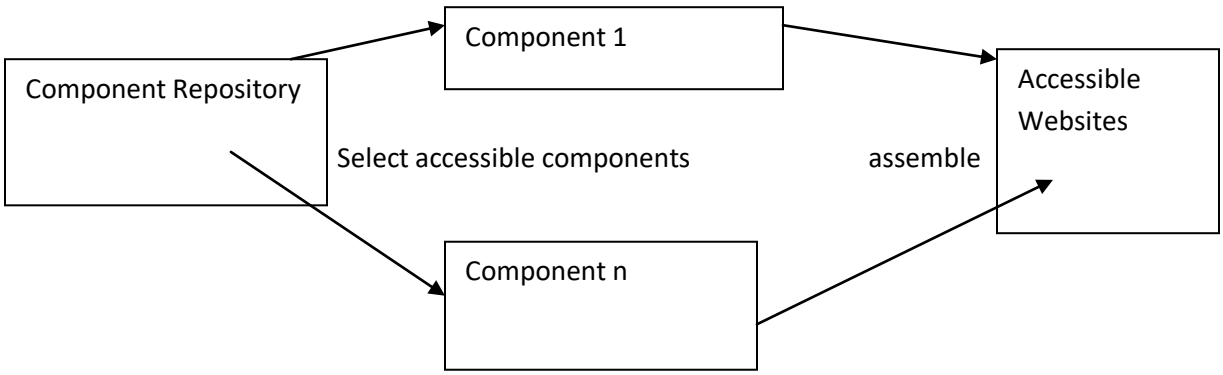

Figure1 Selection of accessible components

In order to make the accessible software components WCAG guidelines must be added in software components. The methodology has been suggested in this paper.

Step1

First the software components will be checked using accessibility evolution tools.

Step2

Then accessibility evolution tool will generate WCAG errors.

Step3

In final step these errors can be removed in new accessible components.

7. Result Analysis

In this paper example of one website has been taken. In order to check website, WCAG1.0 , level A guidelines has been taken.

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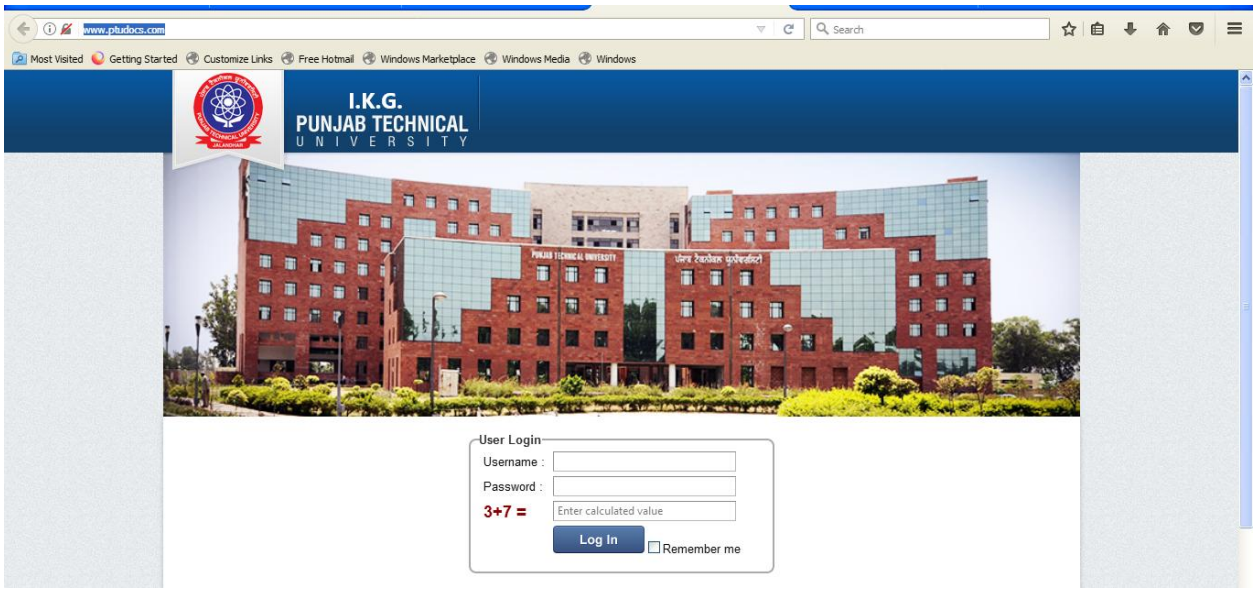

Figure 2 Webpage

First the website's single page has been tested using AChecker tool.

Check webpage using AChecker tool

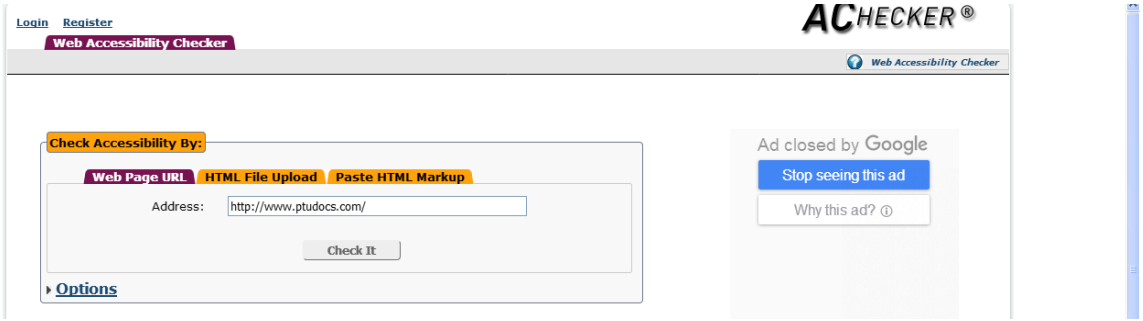

Figure 3 Check Web Page using AChecker

1. Select WCAG1.0 A level guidelines

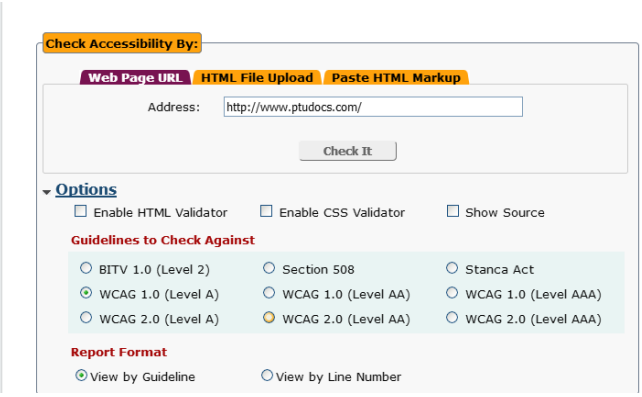

Figure 4. Select WCAG1.0 level 1

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2. WCAG1.0 Errors

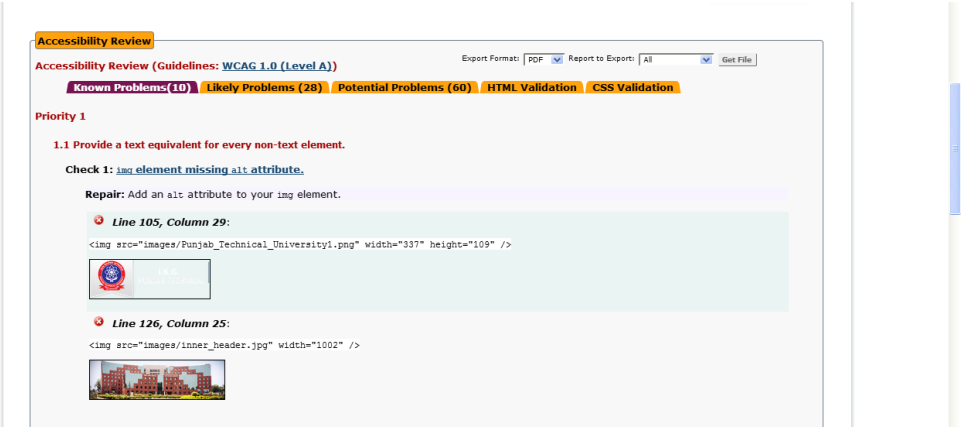

Figure 5. WCAG1.0 Errors

In second step the WCAG1.0 errors of webpage has been removed using AChecker validation option. AChecker Validation option removes WCAG errors.

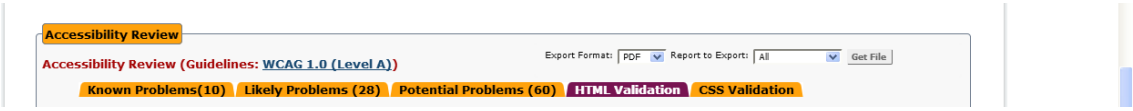

Figure 6.AChecker Validation option

In final step , the new accessible page with WCAG has been created. In this page way accessible components can be created and accessible websites can be developed using component based engineering

8. Conclusion

To build accessible websites, it is important for the web developers to follow proper WCAGguidelines. Before releasing the website it must be checked against W3C web accessibility rules. Manually it is very difficult to check web sites. Web accessibility evaluations tools test single page or entire websites for web accessibility .However these tools have some limitations. These tools are incapable to cover all web accessibility rules. These tools do not autocorrect web accessibility violations.

The qualitative research conducted aims to help software developers / IT practitioners choose hig h-qualityaccessiblecomponents based on quality attributes identified by WCAG guidelines.
Not only does the developer task become simpler, but the customer is also pleased as the chosen item meets the customer's needs and therefore the product performance is retained.After the curre nt research, more research opportunities emerge.Future Scope should also take into account cost and time attributes for optimum component selection. Cost will be measured based on the quality and size of the design.

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