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Designing a Website for Visually Challenged Persons

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Abstract: ***In recent times it has become necessary for any business to have an online platform to remain relevant and competitive. Because of this necessity, many businesses including small enterprises now operate an e-commerce web store to increase sales and attract new customers. Moreover, entrepreneurs don't need to stress over finding a spot to raise their stores and clients can have unhindered access to a wide scope of items whenever they need and at anyplace on the planet. The online stores or ecommerce websites are very useful to the people who have difficulty in accessing the outside world. While these websites are useful for other physically challenged people, most of the websites are not designed to be usable by visually impaired, partially blind or even color-blind people. The different types of blindness are surveyed in this paper and the paper proposes a framework that uses various techniques to aid the visually challenged, partially impaired person or color-blind people. An online food ordering website is developed using the framework and is tested by making the website available for use for visually blind, partially blind and color blind. The test results show that the framework had increased the usability of the website by them.***

Keywords: Website Accessibility, Visually Challenged, E-Commerce, Speech Synthesis and Recognition

I. INTRODUCTION

The Internet is frequently used for online shopping. Web-based shopping alludes to the shopping conduct of customers in an online store or a site utilized for web-based buying reasons [2]. Web-based shopping has encountered fast development during the ongoing years because of its one of a kind focal points for the two purchasers and retailer example, shopping at nonstop offices, diminishing reliance to store visits, sparing travel costs, expanding the market zone, diminishing overhead costs and offering a wide scope of items. Over 85% of the world's online populace has requested merchandise over the web during the ongoing year.

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The innovation trotted see includes the specialized determinations of an online store that impact a buyer's familiarity with utilizing that innovation. Then again, the purchaser situated view includes the client's comprehension or perspectives about web-based shopping. Right now, the innovation acknowledgment model is utilized to comprehend the factors that impact web-based shopping. Though many products are sold online, the purchase of food products has gained momentum in recent years. Food is a basic and important topic, which affects all aspects of our life and culture [1]. In thousands of years of development, people have cultivated many different cuisines and distinctive dietary cultures in its different regions. The online stores or e-commerce websites are very useful to the people who have difficulty in accessing the outside world. The websites which make food as commercial products are very much needed for a person who is physically challenged or for the one who is unable to move outside due to various reasons. While these websites are useful for other physically challenged people, most of the websites are not designed to be usable by visually impaired, partially blind or even color-blind people. There are many types of blindness. There are even people who became partially blind when they age. Other than medicinal services issues, issues identified with work, free-living, and education should all be viewed as when thinking about patients who are visually impaired. It is the responsibility of every developer who develops websites to create websites that are usable by these differently- able persons as well.

The paper is organized as below, Section II will give a brief outline on the different types of blindness, Section III briefs about the proposed framework, Section IV explains about the application which is developed for testing followed by the Section V where the results are discussed. Section VI concludes the paper and the future scope is also discussed in Section VII.

II. BLINDNESS

Blindness is defined as lack or loss of ability to see Legally, It is also defined as less than 20/200 vision in the better eye with glasses. A person with 20° or less vision is also legally blind. According to the Centers for disease control and Prevention, the five leading causes of impaired vision and blindness are cataract, glaucoma, diabetic retinopathy, and atrophy of the optic nerve. There is other blindness as well. Some are genetically acquired while some are developed due to aging or other medical disorders. This section briefs on the different types of blindness that are caused by humans.

A. Color Blindness

Color blindness is a genetic or acquired abnormality of color perception [3].

Complete color blindness, a rare disease, is called achromatopsia. Red-green color blindness affects about 8% of the male population. [7] Although color blindness is the term most commonly used, it is inaccurate: color deficiency and color vision deficiency are preferred.

Fig. 1. . Normal Color Vision and Confused Color Blindness

Cortical blindness

It is the visual impairment because of sores in the left and right occipital flaps of the cerebrum. The eyes are as yet ready to move, and the pupillary light reflexes remain, yet the visual deficiency is as though the optic nerves had been cut off [7]. The standard reason impedes the back cerebral veins. Temporary cortical visual impairment may follow head injury.

B. Glaucoma

Glaucoma is a long-lasting eye malady that can lead to vision misfortune if not controlled. Yet, for the vast majority, glaucoma doesn't need to lead to visual impairment. At the point when glaucoma harms your optic nerve, you start to lose patches of vision, normally side vision.

C. Cataracts

Cataracts are a degenerative condition in the focal point that is the lens of the eye [9]. Ordinarily, a solid focal point refracts light through the pupil and onto the retina, so the picture is transmitted to the brain. When Cataracts create, that implies the proteins in the focal point are breaking down. This will lead to a low vision.

D. Hyperopia

Hyperopia is a typical vision condition in which you can see distant objects clearly, but objects nearby may be hazy. The level of your farsightedness impacts your focusing ability. Individuals with hyperopia must squint to see close objects. Reading, Writing, PC work or drawing for significant periods may cause eye strain and headache.

Figure 2 explains depicts the global blindness. As indicated by gauges from the World Health Organization (WHO) Prevention of Blindness and Deafness program, about 285 million individuals are outwardly impeded worldwide. 39 million are visually impaired and 246 million have low vision.

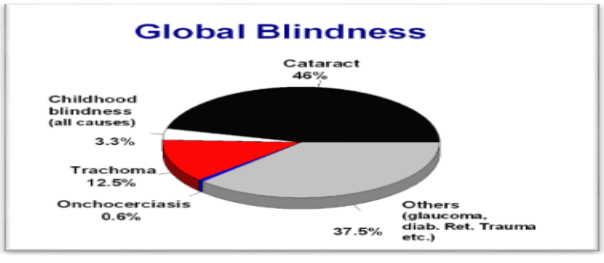

Fig. 2.. WHOs Report on Global Blindness

III. PROPOSED FRAMEWORK

The methodologies mentioned in the papers [2] and [4] are reviewed. The review introduced right now various opportunities for future work. While a portion of the introduced approach and its instrument support, there are additionally conceivable outcomes to consolidate the outcomes. The framework can be refreshed with the important upgrades in frontend and furthermore for different visual impairment sicknesses like partial blindness, mystic visual deficiency, note visual deficiency, object visual deficiency and other. The framework overheads the issue in the current ones by equipped for handling voluminous information in an easy to use way. Apart from this casing work, the typical site page will be a wellness site that should look crisp, incredible and efficient. A site for a band or style architect can be increasingly innovative with hues, surface and picture decisions.

Fig. 3.. Sample Webisite

The issues mapped with the above highlights are recorded beneath. A sample web page is given in figure 3. The website page is more on the Cutting edge, Stylish, High-tech, and Powerful and so on. But this won't help the outwardly impeded individuals to utilize those site pages. The website should have the following features when it is developed considering the outwardly impeded individuals.

- Speech Synthesis and Recognition of the content to aid the fully blind people.
- Announcements for them to keep them updated on the contents that are updated on the website. The website like the food ordering website should provide the announcements to help them in tracking the orders.
- Zoom Tool to help view the content in the magnified format for those have the problem of Hyperopia.
- Color Choice – The colors chosen while designing the website should be chosen in such a way that they do not confuse the color blind. The color blind will be prompted to select the color that is difficult for them to recognize. The prompt is given in the text format.

IV. IMPLEMENTATION

A. Development of Website

A web application for a small retail food store is developed with all the features that are proposed in the paper. In the application, the admin will be able to manage the food products,

customers, and orders while the customers will be able to order and pay for food products. Besides, the buyers will have the opportunity to view the list to get announcements about new arrivals and sales promotions. This web application is developed to aid access through PCs or mobile phones 24/7 and provides a platform for buyers and sellers. The suppliers can create an account in the application so that they can view the product posted by them. Furthermore, there will be a set of most viewed items and recently purchased items, which helps the user to choose better products and are free to traverse through any products to view the detailed description of the product**.**

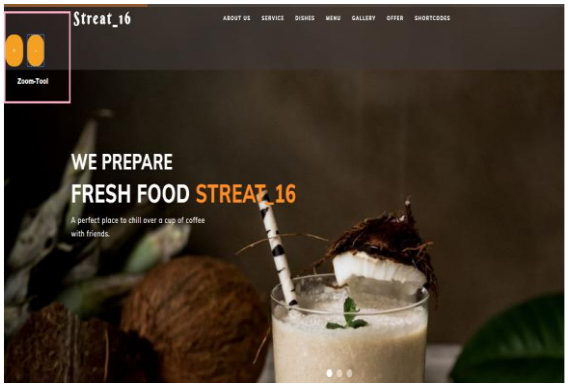

Fig. 4.Developed Food Ordering Site

The system of this site is to change over content to discourse (Speech). The algorithm is written converts the content from text to speech. Aside from different sites the extra highlights that are added to the page are changing over content to discourse and zoom in and zoom out an alternative. As visually impaired individuals don't have a dream on their both eye and they won't have the option to enter content, in view of specific conditions this paper is also intended for the outwardly hindered individuals. The site can be enlarged by the Zoom-tool. The content zoomed is figured underneath.

The sound of the website page will uproarious by choosing the content of the site page. The completely visually impaired can utilize the tab-key for changing over content to speech. There are two different ways of hearing the voice of the web content.

By selecting: The user can select the part of the webpage that needs to be converted into text and then select speak to hear the voice. This feature will help partially impaired individuals.

Using Tab-key: Whenever the tab key is pressed, the computer cursor moves to the next selection. The selection or highlighted option is sent to Speech Synthesis and Recognition module. The words are converted to the speech simultaneously while the selection is made using the Tab Key.

Fig. 5.Speech Synthesis Module

B. Website Validation

All generated site pages are tested both for validity and accessibility.

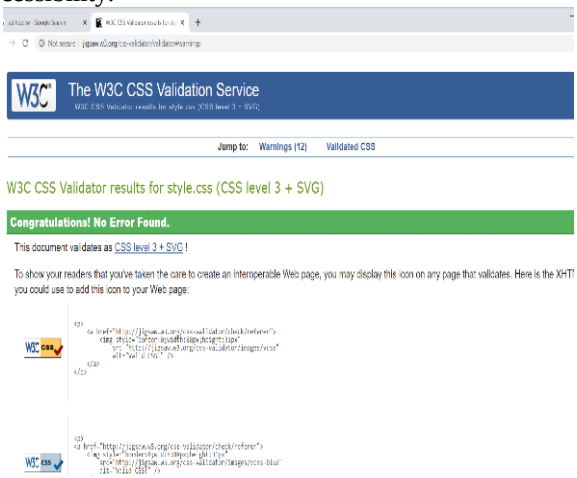

Fig. 6.Validation Result

W3C has been the main thrust behind WCAG through its Web Accessibility Initiative and has kept on contributing by giving free approval tests.

- W3C Mark-up Validation Service, a free help that checks web reports in arrangements, for example, HTML for conformance to W3C's proposals and different standard principles.
- W3C CSS Validation Service, free assistance that checks CSS in HTML archives for conformance to W3C's proposals

The website is checked for legitimacy by utilizing the W3C CSS Validation Service. The web page effectively passed the validation. The validation result is given in Figure 6.

V. SURVEY RESULTS

On taking a survey with more than 25 persons in various groups, this Framework helps the blind and partially blind persons to visualize the content on the page. The users were selected to represent various categories ranging from fully blind to partially blind.

The same web content is developed without incorporating the framework was given for accessing and then the website developed using the framework was given. Every individual felt that the website developed using the framework was a lot easier to access than the one which was developed without the framework. Some of the common feedbacks received from them are summarized below.

- The overall system helped them to navigate the webpage without any other help.
- There are of the view that for locating an object or by touching the things or by moving a cursor the sound effect must be louder and more effective, also sound effect must be played slowly by which the person can understand quickly and easily.
- Some blind persons who were affected by night blindness have partial blindness during the night were of the view that color like red and yellow are creating itching and sensitivity problems to them.

By locating the object due to darkness these people are also saying that black and white will suit them instead of other colors for which an alarming sound will help us to locate the object or place.

 For partial blind persons by touching a button or on clicking it the screen must zoom in or zoom out the content on the page.

On average, the system is rated to get a score of 4.1 out of 5.

VI. CONCLUSION

The framework is proven to help the outwardly weakened individuals to deal with any website site easier than the other sites that are developed as usual. Aside from different sites, the extra highlights that are added to the pages help the specially challenged people. The Survey results also show that they can access the website without the assistance of anyone.

FUTURE WORKS

The work presented in this paper provides different possibilities for future work. Whereas some of the presented approach and its tool support, there are also possibilities to combine the results. The system can be updated with necessary enhancement in the execution of the speech synthesis algorithm. The framework can also be improved to support persons with other illness related to blindness like psychic blindness, note blindness, object blindness and etc.

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