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Digital Enhancement of Color for Hard of Vision- A Review

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Abstract: ***Hard of understanding color is the disorder of color vision and the people suffering from it find difficulties in distinguishing colors. Studies reported that color vision deficiency, fundamentally genetic in nature, may occur due to some injury and mess up in brain and eye. Hard of color vision is erratic in day-to-day life, besides in some specific areas that requires carefulness eyesight. Color vision deficiency is of many types like Blue-Yellow, Red-Green etc. and Red-Green is commonly observed. Visual Auxiliary System (VAS) in which suitable transformation was experimented for making it sensible to understand the color for hard of color vision people. Self-organizing color transformation helped for hard of color vision people to differentiate the colors in better way. Eyeglass lens with transparent three color strip, is not only used for knowing traffic signal such as red, green, yellow, but also use in differentiating wires or else parts of different colors while carrying out factory assembly work. In one of the studies a system was developed in which hard of color vision people could distinguish the colors of the traffic lights. In this paper, different methods and systems for improving the color vision for hard of color vision people reported in literature are reviewed with a brief introduction of a system being implemented.***

Keywords*: *People with hard of vision, HSV (Hue, Saturation, Value), RGB (Red, Green, Blue), Image processing, Color space

I. INTRODUCTION

Color enacts an important character in everyday life as a monumental visible characteristics which gives luminosity to the world. Majority of people have color understanding however 1% female and 8% male cannot perceive the color from the birth [1]. In consonance with types of color blindness, there are two main types that are green defective and red defective. In order to compensate color for hard of color vision people, researchers established a color blind aid system.

Color blindness is a color eyesight dispute where person is impaired to recognize colors like red, green and blue. In order to see something there are two photoreceptors are present on retina of human eye, which carry information of light to the brain. The two photoreceptors are named as rods and cones. Cones are liable for color vision while rods are not sensitive to colors.

There are three types of cones:-

1) *L cones:* These cone cells are sensitive to long wavelength (Red color)
2) *M cones:* These cone cells are sensitive to medium wavelength (Green color)
3) *S cones:* These cone cells are sensitive to short wavelength (Blue color)

Each of these cones is described by curve with peaks at different points in the color spectrum. When these three L, M, S cones are mixed up it can pretend color vision. When any one type of cone is not present or failure to reflect the color then cone changes from its normal consumption of perceiving the color. This conversion in the color impression results in a different way of observing the color. It is considered as color blindness.

Due to the deformity of these three cones such as L cone, M cone, S cone there are 3 types of color blindness:

a) *Monochromacy:* These type of hard of color vision is very rare because in this type person has single cone cell or no cone cells. Hence it is called as total color blindness.
b) *Dichromacy:* This type of hard of color vision is occur when one of the three cone cells disappeared.
c) *Anomalous Trichromacy:* In this type of hard of color vision, all three types of cones present but with shifted peaks of sensitivity.

There are many categories and ranges of hard of color vision. Red-Green color blindness is the most common type. Red-Green color blindness is absolutely possessed of 4 types of color blindness, such as protanopia, protanomaly, deuteranopia and deuteranomaly. It can't be concluded that these group of people can't visualize the red/green color. They just have complication in discriminate between these 2 colors because not all reds and greens are detectable [2].

The electromagnetic spectrum is made up of a variety of types of electromagnetic waves, each waves has different wavelengths or frequencies. For example, x-rays, gamma rays, infrared radiation and ultraviolet radiation are examples of electromagnetic waves.

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The human eye can see a small portion of the spectrum of wavelengths. This visible portion of the electromagnetic spectrum is called the visible spectrum. This shows the full spectrum of electromagnetic radiation and highlights the small part of the spectrum that can be called the visible spectrum.

The wavelength interval of red color is ~625-740nm and its frequency interval is ~480-405THz. Similarly the wavelength interval of green color is ~500-565nm and corresponding to its frequency interval is ~600-530THz. In same way the wavelength interval ~440-485 nm is of blue color and its frequency interval is ~680-620THz. Accordingly the wavelength interval of yellow color is ~565-590nm and corresponding to its frequency is ~530-510THz.

White light is defined as the complete mixture of all of the wavelengths of the visible spectrum. This means that when beams of light of all of the colors of the rainbow and focus all of the colors onto a single spot, the combination of all of the colors will result in a beam of white light.

There are two causes of hard of color vision. It can occur in an accident after birth causing eye, brain or nerve damage. Most commonly hard of color vision is passed down genetically from mutations on the X-chromosome. Since males have only a single X-chromosome, they are much more affected to hard of color vision. In case of affect on a single X-chromosome, the male will be suffer from hard of color vision. Upon affecting women's X-chromosomes, she may not present any hard of color vision problem as the other chromosome could make up for the defect. Therefore, both X-chromosomes must be affected in order for a female to be hard of color vision. As a result, less than 1% and about 8 % hard of color vision was observed in case of females and males respectively [3].

There is no cure for hard of color vision. However, people with hard of red-green color vision may be able to use a special set of lenses to help them observe colors more precisely. These lenses can only be used outdoors under bright lighting conditions. Visual aids have also been developed to help people cope with hard of color vision. There are iPhone and iPad apps, for example, that help people with hard of color vision discriminate among colors. Some of these apps allow users to snap a photo and tap it anywhere on the image to see the color of that area. More sophisticated apps allow users to find out both color and shades of color. These kinds of apps can be helpful in selecting ripe fruits such as bananas, or finding complementary colors when picking out clothing.

Different methodologies used for hard of color vision such as color blind glasses which helped color blind people to see specific color, color compensation vision system which differentiate the traffic light colors. A visual auxiliary system is used for hard of color vision people to perceive an image clearer. The system has ability to identify and formulate the user's perceptual model and then meet their vision requirements by compensating the input visual data. Self-organizing color transformation help out color blind people to recognize colors better. This technique handle the repetition of color message and switch the colors of the image into recognizable by hard of color vision people. Glass for traffic signal color recognition and glasses for desktop color differentiation, being use in differentiating wires. Text and voice based color recognition system and color blind aid system with digital image processing is used for hard of color vision people are explained as follows.

II. CORRECTION FOR HARD COLOR VISION

At present time, there is color blind glasses which are the main instrument recommended for hard of color vision people [4].The operation of these glasses is a very sober way of filtering the colors to assist them to characterize certain specific colors such as red and green color. Even if these glasses look as if like can be easily helping them to see the colors, it can cause other color blurring [6].

A. Different Methodologies

Some researchers had carried out a color compensation vision system in which color vision assist system helps hard of color vision people in distinguishing the color of the traffic lights. The system consist of a unit: 1) Camera 2) Image Processing 3) Wearable Display i.e. single eye glass which can monitor real time. The image is captured in Red (R), Green (G), Blue (B) color space and then converted into Hue (H), Lightness (L), and Saturation (S) color space. For example, the red color of traffic lights is captured by the camera and the system converts the color to become magenta color. Therefore, when red-green blind people look at the lights, they can see the blue color and they know that the red color light is on.

In color vision assist system, to enhance color difference depending on the defective color type, the RGB color space can be converted to HLS color space. For the defective area in HLS color space, the defective color space is transform to visible color space. The proposed system is validated with the help of camera and display compensation system [1].

Visual Auxiliary System also supports for those people who have hard of color vision deficiencies to improve their color vision.It will endure a compensation processes such as linear or nonlinear image scaling, edge and contrast enhancement, color coordinate transformation and histogram modification. The compensation processes are done depends on the types of color deficiencies the

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users are. Hence, the output of the image will depends on the types of deficiencies that user affected with. A visual auxiliary system is used for hard of color vision people to perceive an image clearer. This system is a movable, convenient and integrated visual function aid system that can comply multiple visual compensation subsystems for sight defects. A visual auxiliary system has real time image processing algorithm, the system has ability to identify and formulate the user's perceptual model and then meet their vision requirements by compensating the input visual data thus to fit their vision models. The system algorithm help them to improve their quality and have a better communication with world especially in the IT era [4].

Some of the researchers has illustrate that Self organizing color transformation help out color blind people to recognize colors better. This technique handle the repetition of color message and switch the colors of the image into recognizable by hard of color vision people. The self-organizing map (SOM) algorithm is used to build a nonlinear color map, maintaining the bystander relations between colors. The self-organizing map has the property of effectively creating spatially organized internal representations of various features of input signals and their abstractions. The self-organizing map algorithm (an algorithm which order responses spatially) is reviewed, focusing on best matching cell selection and adaptation of the weight vectors. This method show the result that it can effectively reinforce the color discrimination for color deficient people [7]. The output color of conversion is fixed through end users themselves according to their preference. The output color is fixed in SOM mesh. After the self-organizing method, the load of the SOM network are rooted. They are known as 'codebook vectors' or 'reference vectors. Any codebook vector correlates to one color in the original color space. Any other way, a new color space is constructed with the similar size and resolution as the codebook color space. It has black and white color in the conflicting corners and a peaceful interpolation in between. Then the codebook color space is rotated to make its corner colors most closely related to the corresponding corner colors of the new color space [4].

B. Variable Of Conversion Technique From RGB Color Space To HSV Color Space

The red, green, blue colors are reconstructed in the direction of through to Hue, saturation, value colors for color spectrum transmission and independent adjustment of hues and saturation as explained as below:

$H' = H+\Delta H;$ $S' = S+\Delta S;$ $V' = V$

where H', S' and V' indicate the corrected hue, saturation and brightness values to substitute the elementary erroneous color's attributes HSV respectively along with ΔH and ΔS are the hue and saturation displacement value [8] [9].

C. Systems For Improving The Vision

Figure 1 shows glass for traffic signal color recognition. Eyeglass lens with transparent three color strip, high on the lens, method is use for knowing traffic signal such as red, green, yellow on road for secure driving the vehicles. This method is frequently convenient for color deficient people. The 3-color filter strip is cemented onto the lens of the better eye, as shown. The driver looks at the traffic light through each of the three filters, red, then amber, then green. The traffic light will be red, amber or green. Its image will be bright through the filter of the same color, and much darker as seen through either of the other two filters. Since this is not the case, then the driver is looking at a light that is a color other than red, amber or green.

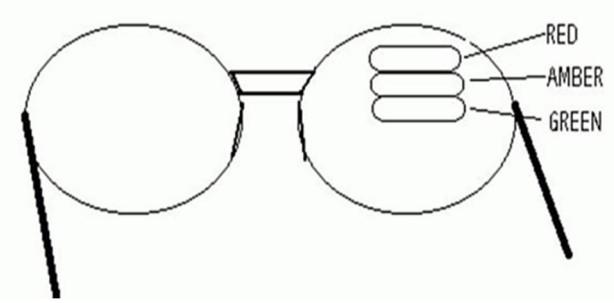


Fig.1 Glasses for traffic signal color recognition

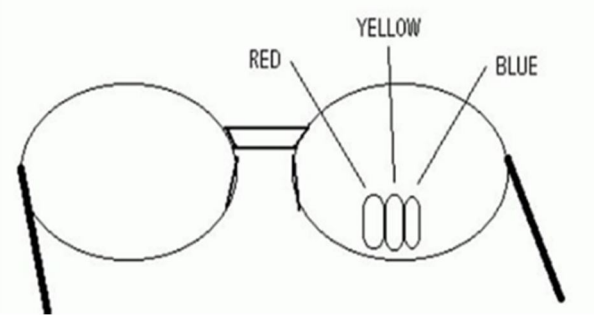


Fig.2 Glasses for desktop color differentiation

Figure 2 shows glasses for desktop color differentiation. Eyeglass lens with transparent 3-color strip, low on the lens, being use in differentiating wires or else parts of different colors while carrying out factory assembly work at desktop or work station or lower level. One of the researchers investigate image processing methods to aid the color blind. Using digital image processing color

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blind aid system is proposed. Color blindness is occurs due to decreasing the sensitivity to certain color wavelengths, depending on the defect. Mostly red and green color blindness is occur because in which reds or greens are weakened producing in vibrant shades being simply detected and dull shades not. The Ishihara color test is a method used to diagnose the color vision deficiency. A filter was constructed based on the Ishihara color test which can correct the color blind deficiencies. This designed filter is only useful for the test plates but it didn't convert well for the real image after all there was too much color compensation. The filter was modified, removing the dullest/lightest shades and shifting all the red shades to the darker vibrant shades. This resulted in an image where color blind subjects were able to identify the colors in the image correctly, while still having the image appear naturally to those with normal vision. Future research is essential to generalize the results in a larger study and to investigate the implementation of such processing in a portable aid for the color blind. [10] The researchers developed a color blind aid system in two platforms, that are based on window embedded standard (WES) 2009 and system based on windows phone 7 system. Using both systems the output is generated as color recognition with augmented reality concept. This system is intended to support hard of color vision patient in distinguishes objects around them. The system is developed with a feature is point to sound feature. This characteristic make possible the user cooperate directly with the colored objects. Text with voice command feature will interpret the virtual augmented objects, that is name of color in term of text, based on color of real objects pick up by camera. The system showed the text according to color type with voice command. With the help of voice command the user can find a certain color. The system has another feature that is color differentiator feature. This feature is used for user to distinguish certain colors according to their type of hard of color vision. In this, they have implemented same technique of finger detection to track finger's position which is color based finger detection technique. It is implemented for providing user with finger interaction method in order to recognize object's color by pointing to the colored object.[11]

III. APPROACH TOWARDS THE ENHANCEMENT

Based on the survey, it was decided to developed system with image processing in which the image is captured by camera. After that with the help of python programming we can make an software in which ,the red, green and blue colors on live images is transform into another color so that hard of color vision people can improve their visibility and see that color into another color so that individual can recognize that color easily.

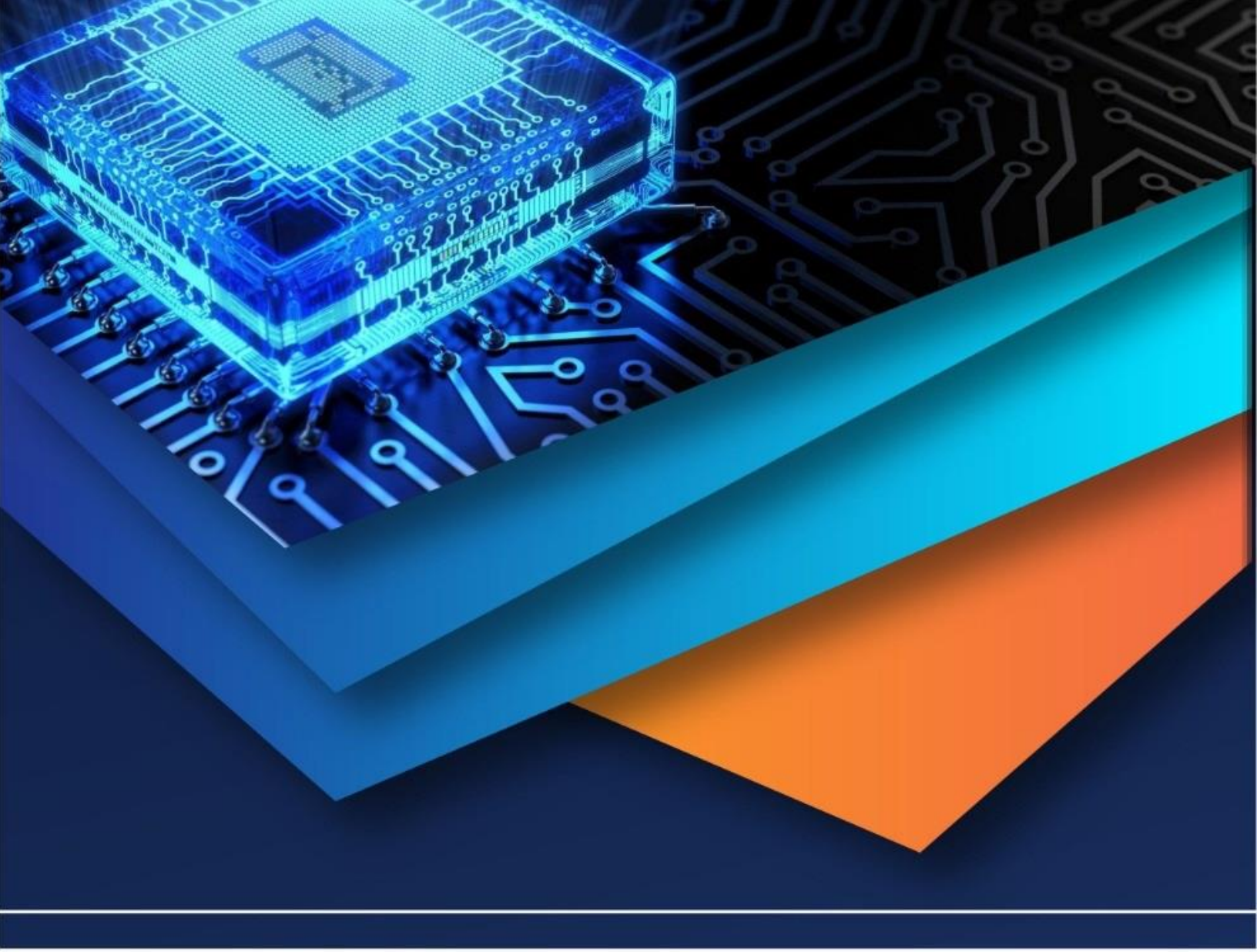
IV. CONCLUSION

In this paper, different types of hard of color vision methods and systems are studied. Some of the researchers implemented some color blind aid systems with the help of that hard of color vision people improved their visibility on colors and can perceive the color whichever individual would not see by their own eye. Studies reported color compensation vision system, visual auxiliary system, eye glass lenses, color transformation techniques for hard of color vision people and they could validated their methods and systems. The system is being implemented to enhance quality of recovered image and to make clearer the difference between colors such as the red, green and blue colors on live images transformed to another color so that hard of color vision people can improve their visibility with learning.

REFERENCES

[1] T. Ohkubo and K. Kobayash "A color compensation vision system for color blind people'',SICE annual conference ,pp.1286-1289, Japan, 2008.
[2] R. Kulshrestha , R. Bairwa "Review of Color Blindness Removal Methods using Image Processing" International Journal of Recent Research and Review, Vol.VI,pp.18-21, India, June 2013.
[3] A.Jamwal, S.Bhardwaj "Color Compensation for Vision Defects" Vol 5,pp.363-365,India, issue 9, sep2016 .
[4] S. Ching, and M. Sabudin " A Study of Color Transformation on Website Images for the Color Blind" World Academy of Science, Engineering and Technology International Journal of Computer and Information Engineering Vol:4, No:2, pp.298-301,2010.
[5] R. Harwahyu, A. Manaf, B. Ananto, B. Wicaksana and R. Sari "Implementation of Color-Blind Aid System"Journal of Computer Science 9 (6): pp.794-810, Indonesia, 2013.
[6] G. Muttaqin, I. Suwandi "Simulation System of Color Blind Glasses by Image Processing" International conference on electrical engineering and Informatics, Bandung, Indonesia, 2011.
[7] Ma, Y., Gu, X., Wang and Y., "Color Discrimination Enhancement for Dichromats Using Self-organizing Color Transformation", Information Science, Vol. 179, pp. 830-843, 2009.
[8] Lai, C. L. and Chang, S. W., "An image Processing Based Visual Compensation System for Vision Defects", International Symposium on IEEE Xplore, pp. 472-476, 2008.
[9] Yang, S. and Ro, Y. M., "Visual Contents Adaptation for Color Vision Deficiency", ICIP Proceedings, Vol. 1, pp.1-453, 2003.
[10] S. Poret, R. Dony, S. Gregori ''Image Processing for Colour Blindness Correction'' School of Engineering University of Guelph, Guelph, pp. 539-544, Canada, 2009.
[11] A. Manaf and R. Sari, "Color Recognition System with Augmented Reality Concept and Finger Interaction''Ninth International Conference on ICT and Knowledge Engineering,pp.118-123,Indonesia,2011

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