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COLOR COMPENSATION FOR COLOR VISION DEFICIENCY USING IMAGE PROCESSING

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ABSTRACT:

The inability or decreased ability in perception of some specific colors generated by colour vision deficiency called color blindness. CVD is classified into several types, of which red-green color vision defects called deuteranomaly, another blue-yellow color vision defect is rare called protanomaly.

In this paper we use the CVD compensation image processing by using inverse simulation matrix applying shift of LMS cones spectral response. It is most essential to determine CVD affected one-on-one, at an early age by gives proper guidance in selection of the suitable career path.

KEYWORDS: Color blindness, color vision deficiency (CVD), Daltonism, Deuteranomaly, LCD, Protanomaly.

I.INTRODUCTION:

Most colors- blind people have a deficiency with either red or green.That is generated by inability in perception of some specific colors this is known as color vission deficiency.We perceive colour via photosensitive cells in the eye, the rods and cones.Color and brightness when light reflected off an object's surface is detected by visual cells. A visual cell is composed of cone cells and rod cells; there are approximately over 6 million cone cells and over 90 million rod cells in human retina. Three kinds of major genes of color vision present in humans- short wavelength sensitive [SWS] genes, medium wave length sensitive [MWS] and long wave length sensitive [LWS] that is calle LMS cone.It is having specific spectral wavelengh. CVD is a common among human population as seen in Table 1 [2], [3].

Table 1 : % of CVD people among humman population.

Ethinic Groups	Incidence of RED – GREEN CVD (%)	
	MALE	FEMALE
Africans	2.6	0.54
Asians	4.2	0.58
Caucasians	7.9	0.42

CVD peoples having lot of suffers due to some specific job in their career. So effort to help people with CVD, we Represent an image processing method with coior compensation for CVD peoples, so that they can realise the colors likewise as the normal people do. Tritanomaly is very rare among human population,so we can consider image processing for only deuteranomaly and protanomaly.

II. LITERATURE REVIEW:

The cones commonly carry pigments adjusted to receive wavelengths in three parts of the visible spectrum (Table 2). This gives us trichromatic vision.Containing Red, Green and Blue, although r (rho), g (gamma) and b (beta) . That wavelength receives light spread 100 nm and rod receives light around 500nm for only lightness .

Table 2 Comparing of Cone and Visible Spectrum Colours

	Alias	Symbol	Wavelengh	clour	proportion
Rho	Red	r	590 nm	yellow-orange	60%
Gamma	Green	g	550 nm	yellowish green	30%
Beta	Blue	b	440 nm	bluish violet	10%

Dichromat person missing one of the pigment . This is usually red or green, and sometimes blue. Normal vision of human is (normal trichromacy) requires three kinds of photoreceptors: L,M,S cones. For each one cone is in use to receive lights of various wavelength .According to the intensity of the perceived light, information in each cone cell combines to perceive chromatic and achromatic colors.

The images are produced by con-verting the RGB of the original image with simulation matrix.Our image physical process model needed some normal-izing method. That can be completed ability to realise red and green colour by absorption wavelength shifted. In either protanomaly or deuteranomaly, both red and green are affected.This happen because the wavelengths of L and M cones, which recognize red and green respectively.

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As an example, a color image with various vision defects is shown in figure (1).

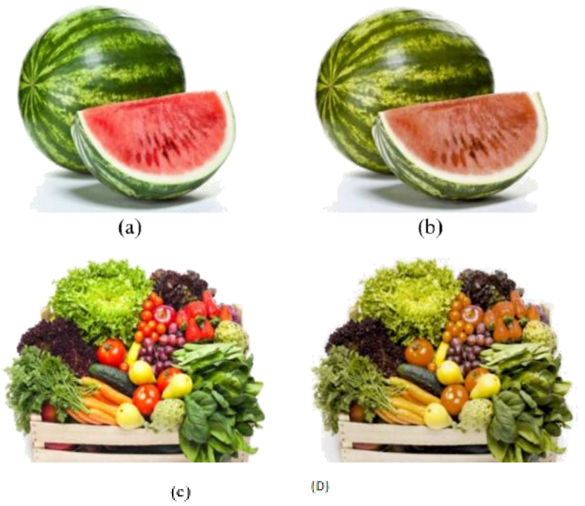

Fig. 1 (a) Original image of water melon. (b) Protanomaly image (c) Original image of vegetable. (d) Deuteranomaly image.

In the previous researches, it was found that people with CVD can understand almost all colors in the visible light spectrum because they have all three cone cells. Due to the shift of the absorption wavelength, people with CVD receive the colors in the overlapping area differently than the normal trichromat. So in this study we have to apply inverse simulation matrix to LMS cones.That can be shift LMS cones spectral wavelengh .That result gives final image to the CVD peoples.

Fig 2. Ordanary color vision and color blind vision

Fig2. shows the Normal color vision and color blind vision obtained in CVD peoples.

III.METHODOLOGY

III.I) SYSTEM BLOCK DIAGRAM:

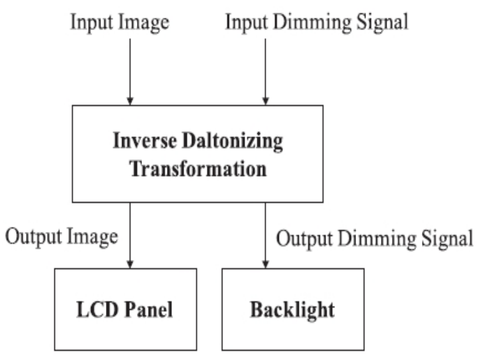

Fig 3. Control process and back light system

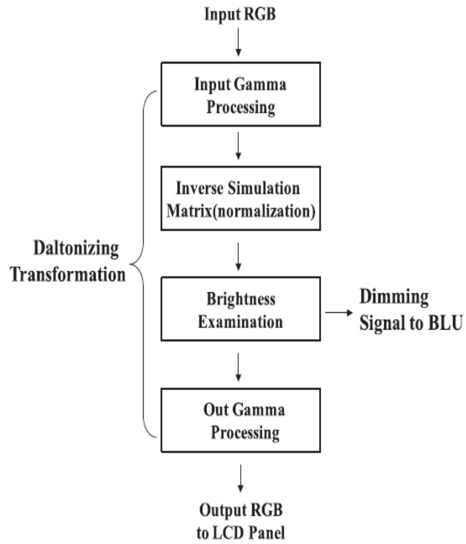

Fig 4. Algorithm for image adjusting for CVD people

III.II) STEPS:

A. DYSCHROMATOPSIA:

In ordinary people realize object's color and brightnesis is detected by visual cells when light is reflected of an object's surface . This visual cell is made up of cone cells and rod cells; there are approximately over 6 million cone cells and over 90 million rod cells in human retina. Rod cells differentiate light and shade, and cone cells understand a more specific shape and color. Cone cells sense light that is over 0.1 lux. Normal color vision specifically with the L, M or S cones, the condition can be further classified as protanomaly, deuteranomaly, Human normal vision (called normal trichromacy) requires three kinds of photoreceptors: L,M,S cones. For each one cone is in use to receive lights of various wavelength, and the spectral response of each kindly of cone is defined by the specific type of photo-pigment it contains.

B. DYSCHROMATOPSIA MODEL

In this research we apply inverse simulation matrix to shift the spectral wavelength of LMS cones.That provided finalized image producing appropriate vision of color for the CVD peoples. From LMS spectral sensitivity function which displays intensity of a wavelength range that causes certain cone cell's response.Cones' output signals are united into the spectral response function of the adversary channels V, y-b, and r-g.

$$\begin{bmatrix} V\lambda \\ y-b \\ r-g \end{bmatrix} \begin{bmatrix} 0.600 & 0.400 & 0.000 \\ 0.240 & 0.105 & -0.700 \\ 1.200 & -1.600 & 0.400 \end{bmatrix} \begin{bmatrix} L \\ M \\ S \end{bmatrix} \quad (1)$$

Anomalous trichromacy can be described by a shift in the spectral sensitivity purpose of the cones and the spectral sensitivity functions of the anomalous cones are represented as

$$\begin{aligned} L_a(\lambda) &= L(\lambda + \Delta\lambda_L) \\ M_a(\lambda) &= M(\lambda + \Delta\lambda_M) \\ S_a(\lambda) &= S(\lambda + \Delta\lambda_S) \end{aligned} \quad (2)$$

CVD compensation algorithm is developed by inverse simulation matrix applied to LMS cone.

C. BLU CONTROL ALGORITHM:

We apply inverse simulation matrix on original image that amplify the weak signal of RGB and provided appropriate brightness by using back light control system.Earlier than normalizing the RGB data of the inversed image, we saved the peak intensity in the form of brightness. Peak brightness later the normalization was obtained, and the maximum brightness earlier the normalization was divided by the one after as shown in (3). This value is represented BL gain and that value; backlight compensated the brightness of the normalized image.

$$BL\ Gain = \frac{Maximum\ Data(Before\ normalization)}{Maximum\ Data(After\ normalization)} \quad (3)$$

The output of BL value is equal to product of original BL value and BL gain as shown in (4)formula.

$$Output\ BL\ Value = Original\ BL\ Value * BL\ Gain \quad (4)$$

For an example Fig (5) shows images of Watermelon.Original image applied inverse simulation matrix obtained deuteranomaly image.

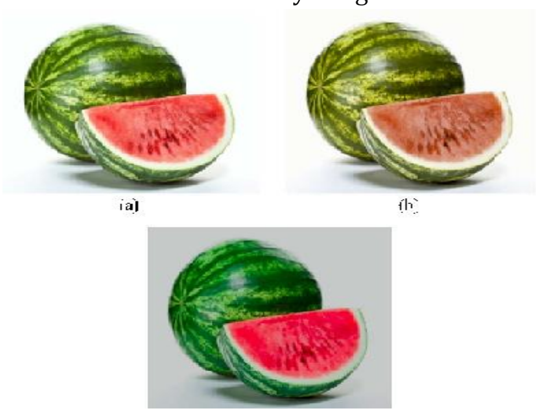

Fig. 5. (a) Original Image of watermelon. (b) Simulated image applied protanomaly (c) Simulated image applied inverse simula-tion matrix of deuteranomaly.

IV CONCLUSION:

In this result represented a color vision deficiency compensation al-gorithm for speople with both deuteranomaly and protanomaly, and shown how the adjusted image amplifies colors ac-cordingly for different types of color vision deficiency by using a inverse simulation matrix with color componsation . This methodology al;so applied with tritanomaly people by the same operation used for protanomaly and deuteranomaly.This model help led to a problem where the RGB value went over the RGB data level that an LCD display can produce.It overcome the problems generated in color blind people.s

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