St. Francis Institute of Technology

Department of Computer Engineering

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Subject: Human Machine Interaction   **Class / Branch / Division: BE/CMPN/A**

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Experiment No: 4

Aim: - To understand the fundamental properties and features of Color. Apply color theory in creating attractive web content.

II-OBJECTIVE

1. To understand the fundamental properties of color, color wheel and color context.
2. To apply color theory in creating attractive web content.
3. To understand essential features required for color text legibility on web pages.
4. To apply W3C guidelines for color text readability on web pages

II-THEORY

Color Properties

Hue

Hue defines pure colors in terms of red, green or blue. Hue also defines mixtures of two pure colors like red-yellow or yellow-green.
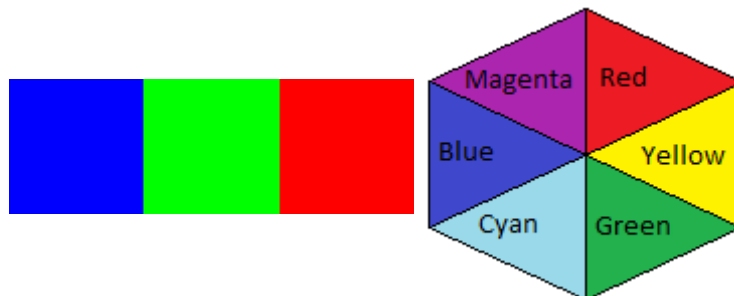

Figure 4.1 : Color Properties Hue

Tint

A tint is a mixing result of an original color to which has been added white. If you tinted a color, you've been adding white to the original color.

Figure 4.2 : Color Properties Tint

Shade

A shade is a mixing result of an original color to which has been added black. A shade is darker than the original color.

Figure 4.3 : Color Properties Shade

Tone

Tone is result of mixing a pure color with any neutral/grayscale color including the two extremes white and black. By this definition all tints and shades are also considered to be tones.

Figure 4.4 : Color Properties Tone

Lightness or Value = Tone in percentage

Lightness is usually one property of three when used to determine a certain color and measured as percentage value. Lightness defines a range from dark (0%) to fully illuminated (100%).Any original hue has the average lightness level of 50%. Lightness is the range from fully shaded to

fully tint. Value or tone is a measure of how light or dark a color is, without any consideration for its hue.
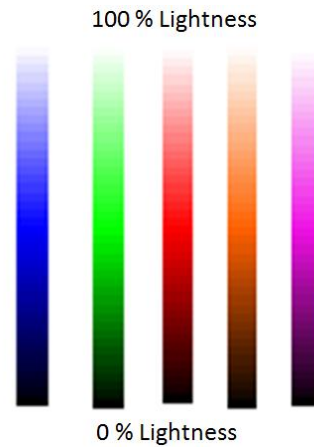

Figure 4.5 : Color Properties Lightness

Saturation or Chroma

Saturation is usually one property of three when used to determine a certain color and measured as percentage value. Saturation defines a range from pure color (100%) to gray (0%) at a constant lightness level. A pure color is fully saturated. Saturation is the purity of a color. The Chroma or saturation of a color is a measure of how intense it is. High saturation colors look rich and full. Low saturation colors look dull and grayish.
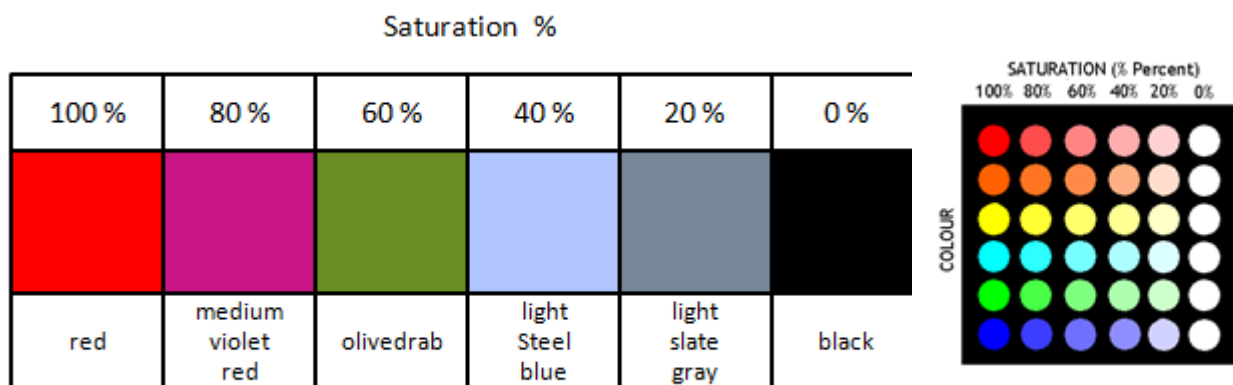

Figure 4.6 : Color Properties Saturation or Chroma

Intensity / Luminosity

It can be used in conjunction with any color property. **Luma (%)** is the intensity of the achromatic signal contributing to our color perception.

Brightness / Luminance

Brightness is an attribute of our perception which is mainly influenced by a color's lightness. For one color of specific hue the perception of brightness is also more intense, if we increase saturation.
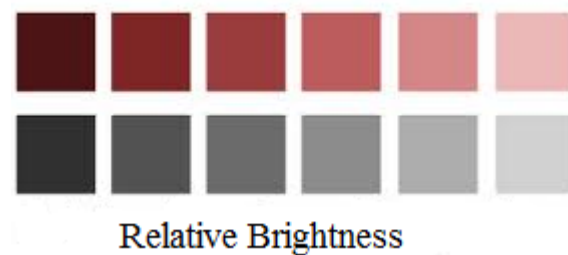

Relative Brightness

Figure 4.7 : Color Properties Brightness / Luminance

Gray Scale

A grayscale is a series of neutral colors, ranging from black to white, or the other way around. Each step's color value is usually shifted by constant amounts.

Figure 4.8 : Color Properties Gray Scale

The color wheel

A color wheel or color circle is an abstract illustrative organization of color hues around a circle that shows relationships between primary colors, secondary colors, complementary colors.
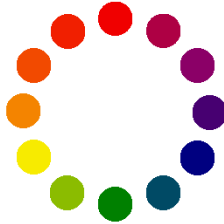
Figure 4.9 : Color Wheel

Primary Colors

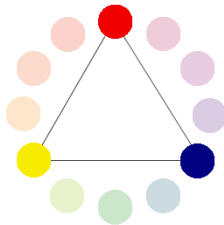Colors at their basic essence; those colors that cannot be created by mixing others. e.g. Red, yellow and blue.

Figure 4.10 : Primary Colors

Secondary Colors

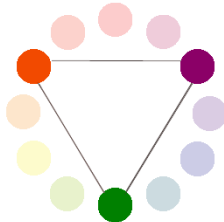Those colors achieved by a mixture of two primaries. e.g. Green, orange and purple

Figure 4.11 : Secondary Colors

Tertiary Colors

Those colors achieved by a mixture of primary and secondary hues. e.g. Yellow-orange, red-orange, red-purple, blue-purple, blue-green & yellow-green
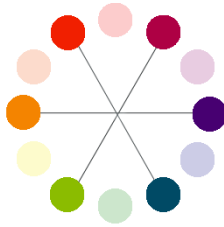

Figure 4.12 : Tertiary Colors

Complementary Colors
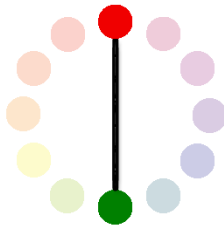
Those colors located opposite each other on a color wheel.

Figure 4.13 : Complementary Colors

Analogous Colors

Those colors located close together on a color wheel.

Figure 4.14 : Analogous Colors

(Above content can be referenced at http://www.worqx.com/color/color_wheel.htm)

Color Context

How color behaves in relation to other colors and shapes is a complex area of color theory. Compare the contrast effects of different color backgrounds for the same green square in figure below.
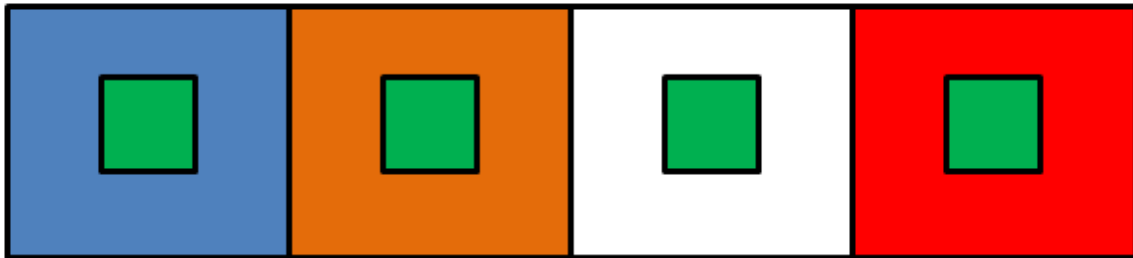

Figure 4.15 : Color Context

Web Content Accessibility Guidelines (WCAG) 2.0

Web Content Accessibility Guidelines (WCAG) 2.0 covers a wide range of recommendations for making Web content more accessible. These guidelines will also often make your web content more usable to users in general.

Principles of Accessibility

Anyone who wants to use the Web must have content that is:

- **Perceivable-**Information and user interface components must be presentable in ways they can be perceived.
- **Operable -** User interface components and navigation must be operable.
- **Understandable -** Information and the operation of user interface must be understandable.
- **Robust -** Content must be robust that it can be interpreted reliably by a wide variety of user agents and assistive technologies.

Guidelines for making content perceivable

- Provide text alternatives for non-text content – like braille, speech etc.
- Provide alternatives for time-based media.
- Create content that can be presented in different ways.
- Make it easier to see and hear content separating foreground from background.

Color Text Legitibility

W3C Guidelines for color readability

The brightness difference between foreground text-color and background-color should follow the formulae suggested in W3C Guidelines for good text-color visibility.

Color visibility algorithm (suggested by W3C standard)

Two colors provide good color visibility if the brightness difference and the color difference between the two colors are greater than a set range.

Color brightness = ((Red value X 299) + (Green value X 587) + (Blue value X 114)) / 1000

For good color visibility brightness difference should be **> 125**

Color difference =

(maximum (Red value 1, Red value 2) - minimum (Red value 1, Red value 2)) +

(maximum (Green value 1, Green value 2) - minimum (Green value 1, Green value 2)) +

(maximum (Blue value 1, Blue value 2) - minimum (Blue value 1, Blue value 2))

For good color visibility color difference should be > **500**

Note:

These formulae are only suggestions and are not reliable to full extent. In actual practice you are expected to test the color combinations again and again for readability.

III-PROCEDURE

The simulation based experiment allows you to apply various colors to text as well as its background and create different color contrasts.

To activate this simulation program go to simulator tab and click on the relevant button.

Steps for experiment

The screen consists of two sections

      a) website window - black outline

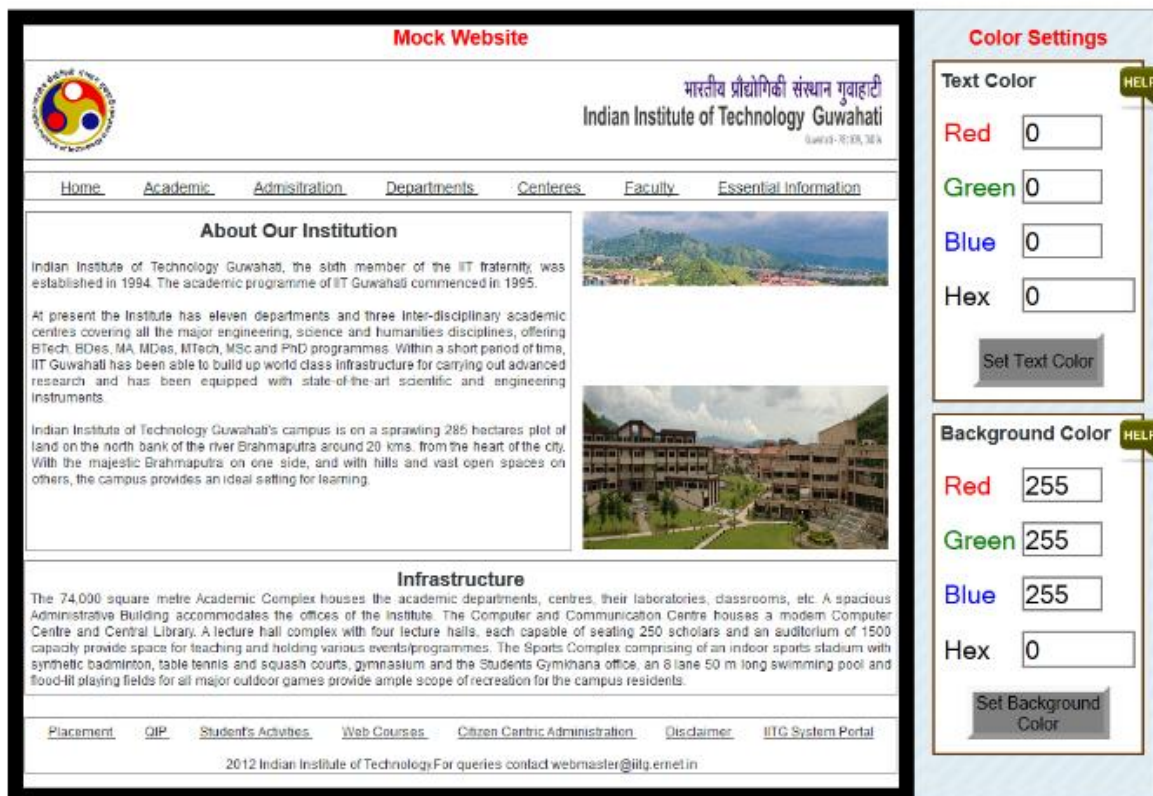   b) color- setting window -- blue outline

Figure 4.16 : mock web-site of IITG, Guwahati

IV-TOOL/TOOLS

Website Window

1. You will see a mock web-site of IITG, Guwahati in this window with broad black outline.

2. Various sections of this homepage have been identified with thin black borders.

3. You can select any of these sections by clicking within its boundary.

4. When you select a section the color of its border will change to red.

5. You can now use color setting window to set colors of this selected section.

6. <u>Unless you select a section from the homepage the color setting will not be applied.</u>

Color-setting window (Text color setting)

1. You can give the RGB color values required through the input boxes provided. The converted hex color code will automatically be displayed.

2. To apply this color to text press the **set color** button.

3. Visa-versa if you know the hex color code of a color, you can directly enter it in the input box provided. The corresponding RGB color values will be computed and dislayed after you press **set color** button.

4. Using color selection slider - In case of hex color code setting, a color selection slider can be used which will give you an immediate visual feedback of the color selected. Press **OK** button to select the color identified using the slider.

5. Remember that the **set color** button will apply the text color settings only to the selected section of the website.

Color-setting window (Bakground color setting)

1. Same as above you can give the RGB color values required in the input boxes provided.

2. To apply this color setting to background press same **set color** button. The converted hex code of the color will automatically be computed and displayed.

3. Visa-versa if you know the hex color code of a color, you can directly enter it in the input box provided. The corresponding RGB color values will be computed and dislayed after you press **set color** button.

4. Using color selection slider - A similar color selection slider is available for selecting background color with hex values. Use this slider if required and press **OK** button in the end.

5. Remember that the **set color** button will apply the background color settings only to the selected section of the website.

You can experiment by selecting different sections of the home-page in the mock website window and apply various text and background colors.

Apply the color **brightness difference** and **color difference** formulae to see if they really work in practice improving legibility of the color text.

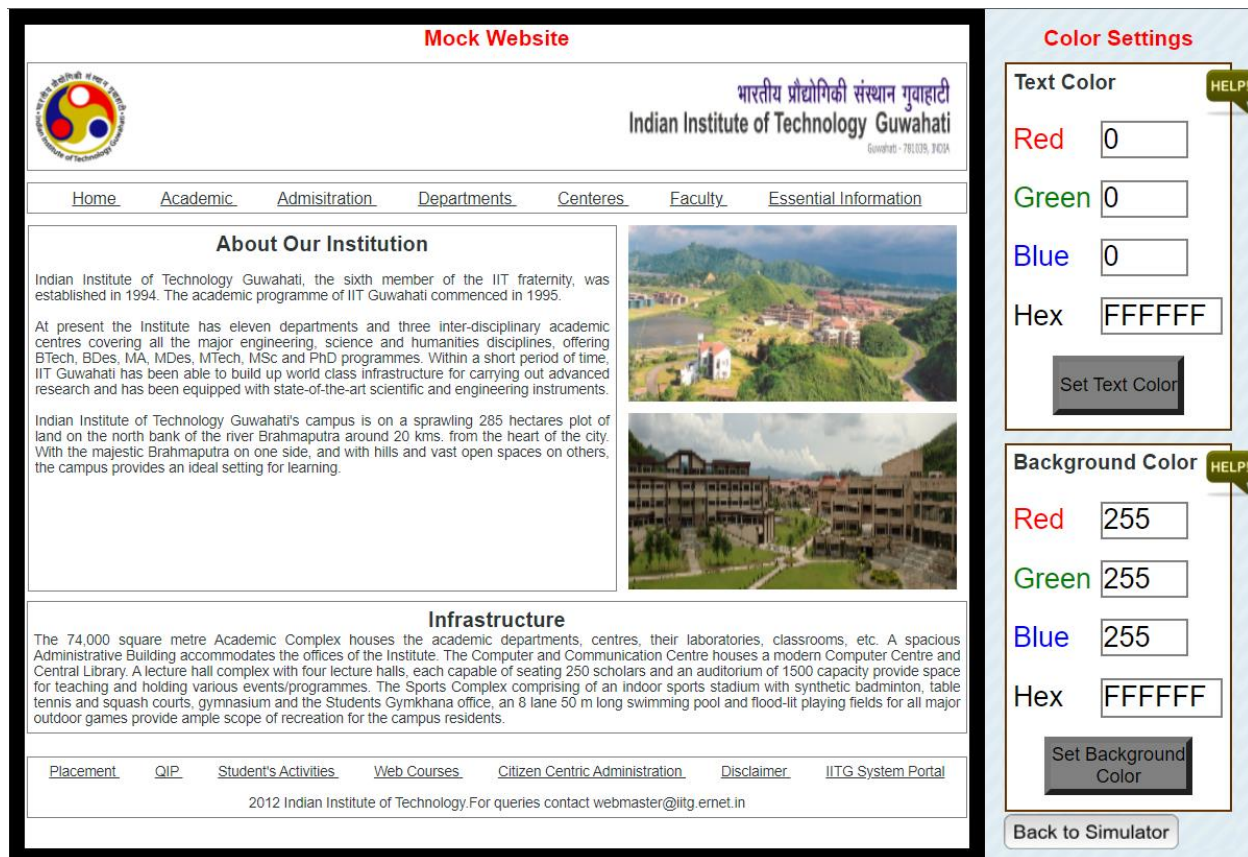## V-IMPLEMENTATION

Simulator

To activate the simulation

Figure 4.17 :Original website before applying color theory

You can select any of these sections by clicking within its boundary. When you select a section the color of its border will change to red. When you select a section the color of its border will change to red.

Figure 4.18 : Section selected and its background changed

Color-setting window (Text color setting)

You can give the RGB color values required through the input boxes provided. The converted hex color code will automatically be displayed.

Figure 4.19 : Text color setting for About our Institution section by giving RGB value

Color-setting window (Bakground color setting)

Figure 4.20 : Background color setting for About our Institution section by giving RGB value.

VI-CONCLUSION

Understand color properties, features and W3C guidelines and applied color theory in creating attractive web content

VII-POST LAB QUESTION-ANSWER

Q1.What does CMYK and RGB stand fo

Ans

RGB refers to the primary colors of light, Red, Green and Blue, that are used in monitors, television screens, digital cameras and scanners. **CMYK** refers to the primary colors of pigment: Cyan, Magenta, Yellow, and Black. ... The combination of **RGB** light creates white, while the combination of **CMYK** inks creates black.

Q2 What are primary, secondary and tertiary colors?

Ans

Three **Primary Colors** (Ps): Red, Yellow, Blue. Three **Secondary Colors** (S'): Orange, Green, Violet. Six **Tertiary Colors** (Ts): Red-Orange, Yellow-Orange, Yellow-Green, Blue-Green, Blue-Violet, Red-Violet, which are formed by mixing a **primary** with a **secondary**

VIII- REFERNCE

https://hci-iitg.vlabs.ac.in/Color.html

http://www.workwithcolor.com/color-properties-definitions-0101.htm

http://www.colormatters.com/color-and-design/basic-color-theory

http://www.techbomb.com/websafe/

http://samples.msdn.microsoft.com/workshop/samples/author/dhtml/colors/ColorTable.htm

http://donnayoung.org/art/color-theory.htm