Lec5

Images and Graphics

Objectives:

To understand how computers process images and graphics
To understand how computers work with colors

The Nature of Digital Images

An *image* is a spatial representation of an object, a two-dimensional or three-dimensional scene or another image. Often the images reflect the *intensity* of lights.
Most photographs are called *continuous-tone* images because the method used to develop the photograph creates the illusion of perfect continuous tone throughout the image.
Images stored and processed by computers, displayed on computer screens, are called *digital images* although they often look like continuous-tone. This is because they are represented by a matrix of numeric values each represents a quantised intensity values

Basic Concepts

The smallest element on a digital image is known as a *pixel* — a picture element. A digital image consists of a (usually rectangular) matrix of pixels.

Depth

The *depth* of an image is the number of bits used to represent each pixel.
1-bit black-and-white image, also called *bitmap image*.
4-bit can represent 16 colors, used in low resolution screens(EGA/VGA)
8-bit can have 256 colors. The 256 color images are often known as *indexed* color images. The values are actually indexes to a table of many more different colors. For example, Color 3 is mapped to (200, 10, 10).
8-bit grey 256 grey-levels. The image contains only brightness/intensity data without color information.

16-bit can have 65536 colors, also known as hi-color in Windows systems. The 16 bits are divided into 5 bits for RED, 6 bits for GREEN and 5 bits for BLUE.

24-bit 2^{24} = 16 777 216 colors, true color. Each byte is used to represent the intensity of a primary color, RED, GREEN and BLUE. Each color can have 256 different levels.

32-bit 2^{32} = 4 294 967 296 (4G). Usually, 3 bytes are used to represent the three primary colors and the fourth byte is used as the *alpha channel*.

Resolution

Resolution measures how much detail an image can have. There are several resolutions relating to images.

Image resolution is the number of pixels in an image.
320 * 240 = 76800 pixels, 700 * 400 = 280000 pixels
Display (Monitor) resolution — refers to number of dots per inch (dpi) on a monitor.
Windows systems usually have 96dpi resolution. Some high resolution video adapters/monitors support 120dpi. For example, a 288 * 216 image displayed on a monitor with 96dpi will be 3^{11}*2 $1/4^{11}$.
Output resolution — refers to number of dots per inch (dpi) on a (hard copy) output device.
Many printers have 300dpi or 600 dpi resolution. High-quality image setters can print at a range between 1200dpi and 2400dpi, or higher. The above image printed on a 300dpi printer will be 0.96 * 0. 72 inch.

Devices for acquiring images:

1- **Digital Camera**
2- **Scanner**

TUT:

1. If image resolution (Depth) is equal to 6 bit what is the number of colors that can be represented in this picture?

2. Photo of 100 * 100 pixels, if use the grayscale 8bits to represent each pixel, calculate the size of the image? 100 * 100 * 8 bits

3. In any of the four angles of size 200 * 200 the coordinates (0,200) is located?

Located at the top right of the picture and because the value of x = 200 and y = 0.

4- A digital camera with a 8 mb storing space if the image resolution was 100*100 using RGB, what is the maximum number of images that can be stored in that camera.

Color Systems

- Color is a vital component of multimedia. Color management is both a subjective and a technical exercise, because:
- Color is a physical property of light, but Color perception is a human physiological activity.
- Choosing a right color or color combination involves many trials and aesthetic judgment.
- Color is the frequency/wave-length of a light wave within the narrow band of the electromagnetic spectrum (380 – 760nm) to which the human eye responds.

Wavelength	Intensity	Spectral Purity
Hue	Brightness	Saturation

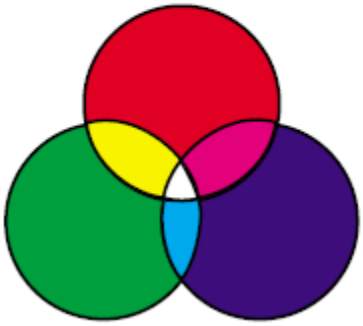
Our sensations of color are within us and color cannot exist unless there is an observer to perceive them.

Color does not exist even in the chain of events between the retinal receptors and the visual cortex, but only when the information is finally interpreted in the consciousness of the observer.

RGB Color Model

This is probably the most popular color model used in computer graphics.
It is an *additive* system in which varying amount of the three primary colors, red, green and blue, are added to black to produce new colors.
You can imagine three light sources of the primary colors shine on a black surface. By varying the intensity of the lights, you will produce different colors.

R — Red
G — Green
B — Blue



RED	GREEN	BLUE	Colour
255	0	0	Red
0	255	0	Green
0	0	255	Blue
255	255	0	Yellow
255	0	255	Magenta
0	255	255	Cyan
127	127	127	Light gray
255	255	255	White
0	0	0	Black