Computer Graphics
Lecture-2
(Image Representation)

What is Pixel?

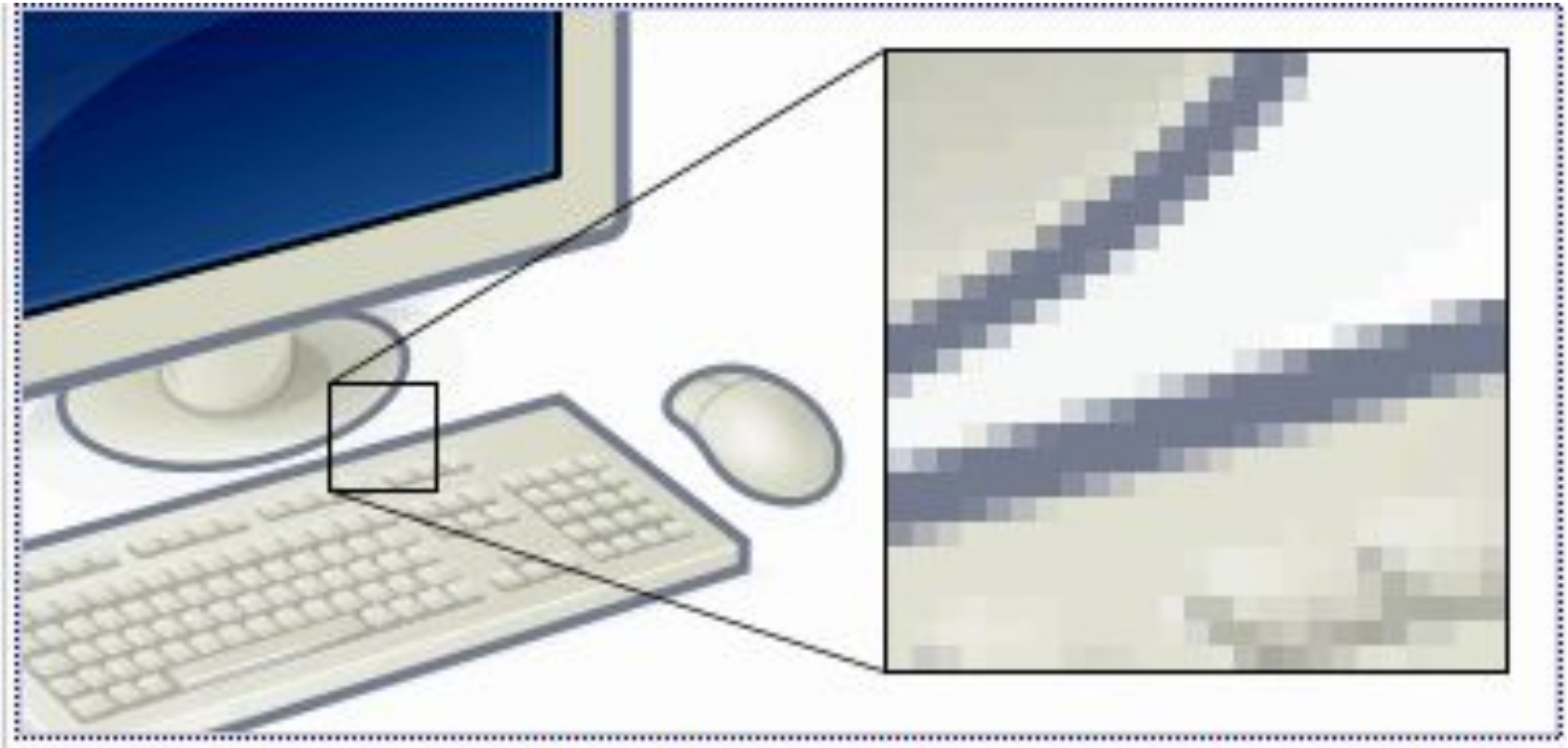
•In digital image processing, a pixel or picture element is a physical point in an image.

•It is the smallest addressable element in a display device; so it is the smallest controllable element of a picture represented on the screen.

•The address of a pixel corresponds to its physical coordinates.

•Each pixel is a sample of an original image; more samples typically provide more accurate representations of the original. So picture quality is directly proportional to the picture resolution.

What is Pixel?



This example shows an image with a portion greatly enlarged, in which the individual pixels are rendered as small squares and can easily be seen.

What is Resolution?

- In digital image processing, number of pixels per unit length (eg. inch) in vertical as well as horizontal direction is called resolution
- A 3*2 inch image having resolution of 300 pixels per inch would have total of 540000 pixels ($3*2*300^2$)

What is Aspect ratio ?

•Aspect ratio is a fancy term for "proportion," or the ratio of width to height.

•In computer graphics, the ratio of an image's width to its height, measured in unit length or number of pixels, is referred to as it's aspect ratio.

• For example, if a graphic has an aspect ratio of 2:1, it means that the width is twice as large as the height.

•1024x768 image have an aspect ratio of 4:3.

• When resizing graphics, it is important to maintain the aspect ratio to avoid stretching the graphic out of proportion.

Math Problems

1. Compute the resolution of a 2 × 2 inch image that has 512 × 512 pixels.

SOLUTION

512/2 or 256 pixels per inch.

2. If an image has a height of 2 inches and an aspect ratio of 1.5, what is its width?

SOLUTION

width = 1.5 × height = 1.5 × 2 = 3 inches.

Math Problems

3. If we want to resize a 1024 × 768 image to one that is 640 pixels wide with the same aspect ratio, what would be the height of the resized image?

SOLUTION

height = 640 × 768/1024 = 480.

4. Compute the size of a 640 × 480 image at 240 pixels per inch.

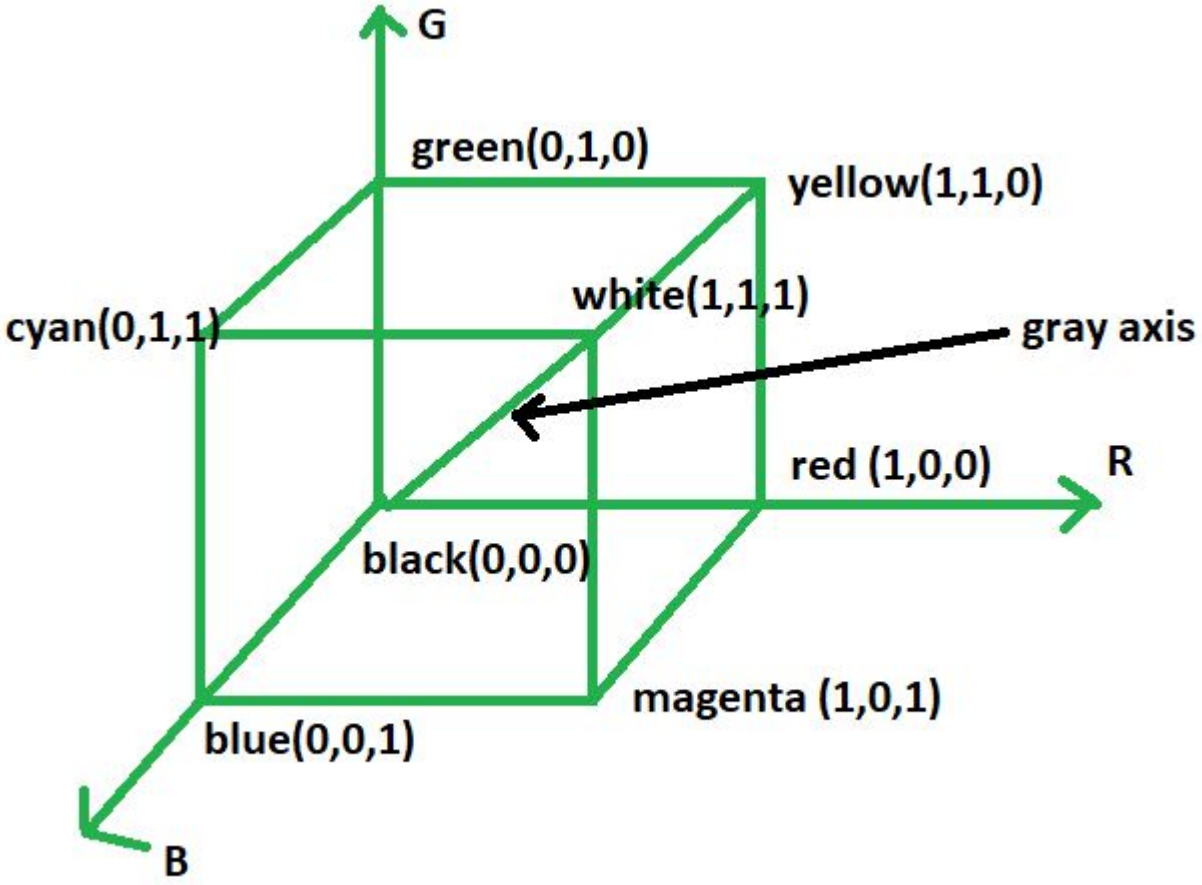
SOLUTION

640/240 by 480/240 or $2\frac{2}{3}$ by 2 inches.

RGB Color Model

- The RGB color model is an additive color model.
- In the RGB color model red, green and blue lights are added together in various ways to reproduce a broad array of colors.
- The name of the model comes from the initials of the three additive primary colors, red, green and blue.

RGB Color Model



RGB Color Model

- Each primary color can take on an intensity value ranging from 0 (off-lowest) to 1 (on-highest)
- Variety of colors can be achieved by mixing those 3 colors.
- The Diagonal line connecting black and white corresponds to all the grey colors known as grey axis
- It is an additive process in which we start with black color and add on appropriate primary colors to get desired color,.

Direct Coding

- One of the way of Image representation (representation of pixel color)
- Certain amount of storage is allocated for each pixel to code it's color.
- We may allocate 3 bit (each bit for primary color) for each pixel
- Each primary color can be varied between two intensity level 0(off) and 1(on)
- Hence each pixel can take one of the eight colors corresponding to the corners of RGB color cube.

Direct Coding

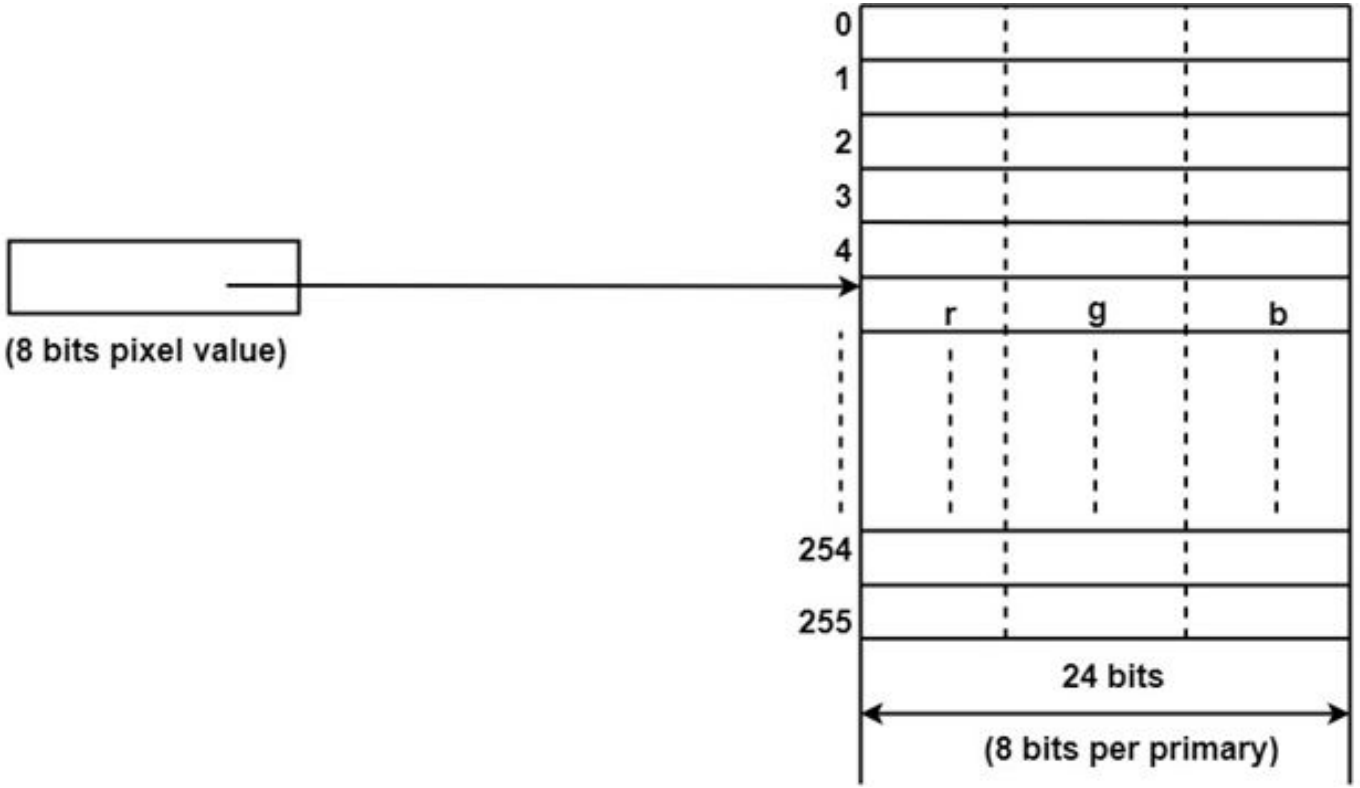
bit 1: r	bit 2: g	bit 3: b	color name
0	0	0	black
0	0	1	blue
0	1	0	green
0	1	1	cyan
1	0	0	red
1	0	1	magenta
1	1	0	yellow
1	1	1	white

Fig. 2-3 Direct coding of colors using 3 bits.

Look-up Table

- It is used to have a lower storage requirement.
- A pixel value do not represent a color code directly.
- Instead they are addresses into a table of color values.
- The color of the pixel is determined by the entry of the table that the pixel corresponds to.

Look-up Table



Book Reference

- Chapter 2, Computer Graphics (Second Edition), Schaum's outlines.

If you have any query, please contact me at
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