Singapore Polytechnic
School of Electrical and Electronics Engineering
ET0104 Embedded Computer Systems DECC 3FT/4EO

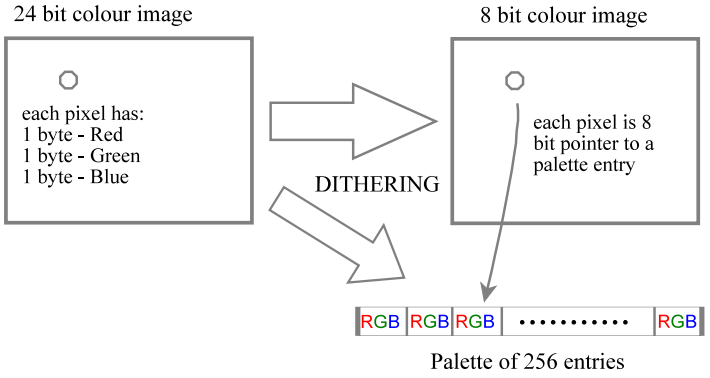
Tutorial 9 Graphical Display Technology

1. Describe how an image is stored in a computer.
- Image represented as a grid. Each grid element is called a pixel. Each pixel has a colour value which may be 1,4,8 or 24 bits.

2. i) 8 bit images take up less space than 24 bit. However, because they use less colours, images with a lot of colours like photos may not look good. However, cartoons and icons may be acceptable. GIF files are 8 bit.

Describe how 8-bit images are stored and displayed.
ii)) (Optional: A 24 bit 'truecolour' image is analysed for the best 256 colours to represent it). For each image, a palette is created - this is a 256 entry data structure. These entries are 3 bytes each and represent the colours used in the image. See page 9-4. The pixel at a point in an image has an 8 bit value which points to an entry in the palette.

To display it, the 8 bit pixel value points to a 3 byte palette entry which is used by the DAC (R,G,B) to provide the colour.



3. i) Describe how an interlaced display works.
An image is composed of lines. In the refresh period of the display, alternate lines take turns to be displayed. Due to the human persistence of vision, the human mind combines both images and one complete image is seen.

ii) What is the advantage and disadvantage of such displays.
Interlaced displays require a lower bandwidth (data rate) to display an image. N.B. the *amount* of data is still the same!

During certain conditions, the lower rate of data transfer may result in an inferior image - for example, flickering or even more noise. Such applications are for example, high speed games and animation, room lighting, etc,

4. Describe the types of display connections available and discuss their merits. Remember, video info is made up of:

Brightness / Colour / Timing signals - horizontal and vertical

Connection type	Advantages	Disadvantages
Composite video - all video info in one signal	Very wide compatibility	Picture quality low
S-video - brightness and colour info separate	Middle picture quality, good compatibility	Can be difficult to find.
RGB - all video info separate	Good picture quality, may be compatible	Varying horizontal scan rates cause compatibility problems
Direct - graphics connects to system bus	Small size, less interfacing hardware	Hardware interfacing required. Display device needs own memory.

5. i) A Super VGA display has a refresh rate of 85 Hz. When displaying a 24 bit image, calculate the rate of data transfer.
800*600*3 = 1,440,000 bytes.

This amount needs to be transferred to the DAC every 1/85 of a second, so the data rate is: 1,440,000 * 85 bytes/sec = 122,400,000 or 122.4 MB/s.

PC/104 sustains a maximum data rate of 8.33 MB/s - this resolution is not possible.

ii) What is the effect of display refresh rate.

For higher resolution displays (more horizontal lines) need higher refresh rate or else there will be a flickering effect, as human persistence of vision is not sufficient to compensate.