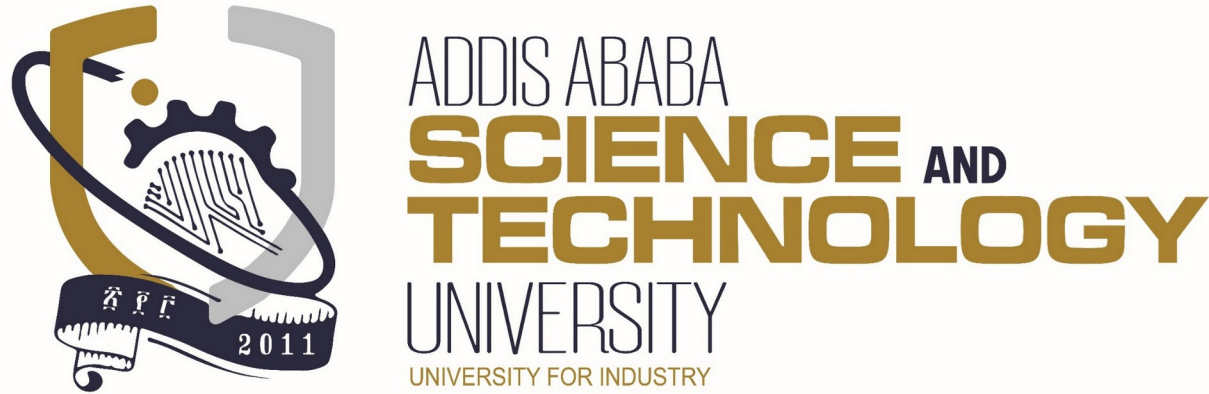




Department of Software Engineering

Computer Graphics

Overview of Graphics Systems: Graphics primitives

- Graphics primitives are the component elements of geometry that construct a certain display.
- Points, lines, paths, curves... can be considered as graphics primitives
- Pixel (picture cell) is the smallest graphics primitive representing a point
- There are different algorithms to generate the remaining primitives.
 - DDA and BRESENHAM'S algorithms are mechanisms of generating vectors (line)
- There are also other algorithms to generate circles and curves.

Display systems

- Some of the common types of display systems available in the market are:
 - Raster Scan Displays
 - Random Scan Displays
 - Direct View Storage Tube
 - Flat Panel Displays
 - 3D Viewing Devices
 - Stereoscopic and Virtual Reality System
- Displays are often referred to as Video Monitor or Video Display Unit (VDU)
- The most common monitor that comes with PC is the **Raster Scan type**
- Every display system has three basic parts:
 - Display adapter that creates and holds video information,
 - Monitor which displays that information, and
 - Cable that carries image data between display adapter and monitor

Pixel

- Pixel (also known as picture element) is the smallest size object or color spot that can be displayed and addressed on a monitor
- Image displayed on the monitor is made up of thousands of pixels
- Each pixel has particular color and brightness value
- The finer the pixels the more number of pixels displayable on a monitor- screen

Resolution

- The maximum number of points that can be displayed without overlap on a screen is referred to as **resolution**
- **Image resolution** refers to the pixel spacing, i.e., the distance from one pixel to the next pixel
- A typical PC monitor displays screen images with a resolution somewhere between 25 pixels per inch and 80 pixels per inch (ppi)
- A full screen image with resolution 800×600 means that there are 800 columns of pixels, each column comprising 600 pixels, i.e., a total of $800 \times 600 = 480000$ pixels in the image area

Aspect Ratio

- The aspect ratio of an image is the ratio of the number of X pixels to the number of Y pixels
- The standard aspect ratio for PCs is 4:3 and some resolutions even use a ratio of 5:4
- Image displayed using 5:4 aspect ratio will cause the image to appear somewhat distorted
- The table below (Table 1.1) shows common resolutions, respective number of pixels and standard aspect ratios

What's Our Scope?

- Table 1.1 Common resolutions, respective number of pixels and standard aspect ratios

Resolution	Number of Pixels	Aspect Ratio
320 × 200	64,000	8:5
640 × 480	307,200	4:3
800 × 600	480,000	4:3
1024 × 768	786,432	4:3
1280 × 1024	1,310,720	5:4
1600 × 1200	1,920,000	4:3

Graphics Display Devices

Graphics Display Devices

- Any computer-generated image must be displayed in some form. The most common graphics display device is the video monitor, and the most common technology for video monitors is the Cathode Ray Tube (CRT). Now we will examine the technology behind CRT displays, and how they can be used to display images.

A. CRT Displays

- CRT display devices are very common in everyday life as well as in computer graphics:
- most television sets use CRT technology.

Graphics Display Devices

DVST (Direct View Storage Tube)

- Stores picture information as a charge distribution
- Uses two electron guns. Primary gun and flood gun.
- Primary gun is responsible to store the picture pattern. While the flood gun is responsible to maintain the picture display.
- There is no refreshing system in DVST because of the flood gun.
- Complex picture can be displayed at high resolution.

Graphics Display Devices

- **Colour displaying systems**

- A. Beam penetration method**

- Simple modification of CRT
- Uses two phosphor coats: green phosphor and red phosphor.
- Colours are displayed depending on the beam strength.

- B. Shadow mask method**

- To achieve a color display, CRT devices have three electron beams,
- On the screen the phosphor dots are in groups of three, which give off red, green and blue light respectively.

Random Scan Devices

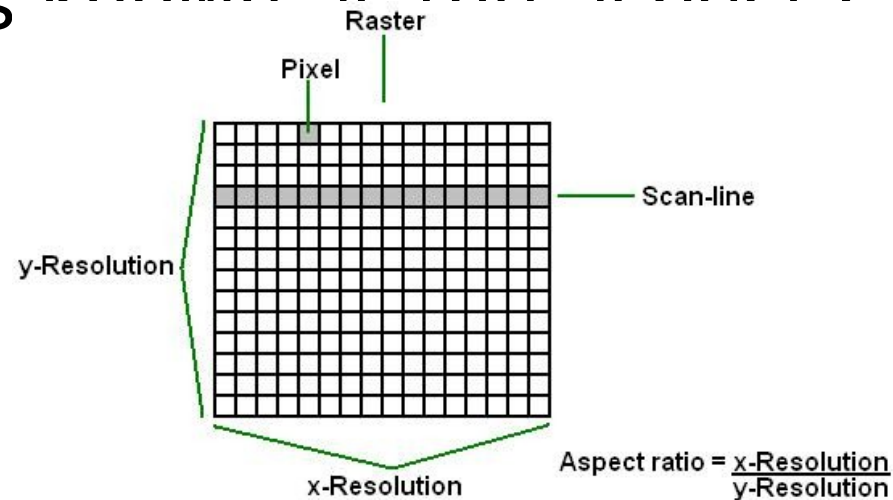
- In a random scan device the CRT beam is only directed to areas of the screen where parts of the picture are to be drawn.
- For this reason, random scan devices are also known as *vector graphics displays*.
- Random scan displays are not so common for CRT devices, although some early video games did use random scan technology.
- These days random scan is only really used by some hard-copy plotters.

Raster Scan Devices

- In a raster scan device the primitives to be drawn are first converted into a grid of dots.
- The brightness of these dots is stored in a data structure known as a *frame buffer*.
- The CRT electron beam then sweeps across the screen line-by-line, visiting every location on the screen, but it is only switched on when the frame buffer indicates that a dot is to be displayed at that location.
- Raster scan CRT devices are the most common type of graphics display device in use today, although recently LCD (Liquid Crystal Display) devices have been growing in popularity.

Raster Scan Terminology

- The number of pixels in a scan-line is known as the *x-resolution* of the raster, and the number of scan-lines is known as the *y-resolution*. Finally, the ratio of the *y-resolution* to the *x-resolution* (or sometimes the other way around) is known as the *aspect ratio* of the display.



Frame Buffers

- Frame buffers are used by raster scan display devices to store the pixel values of the image that will be displayed on the raster.
- It is a 2-D array of data values, with each data value corresponding to a pixel in the image.
- The number of bits used to store the value for each pixel is known as the *bit-planes* or *depth* of the frame buffer.
- o For example, a 640x480x8 frame buffer has a resolution of 640x480 and a *depth* of 8 bits; a 1280x1024x24 frame buffer has a resolution of 1280x1024 and a *depth* of 24 bits.

Architecture

- The Architecture of a Raster Graphics System with a Display ~

