Introduction

Definition

- Computer generated pictures, software & hardware.
- Computer graphics are pictures & movies created using computers- usually referring to image data created by a computer specifically with help from specialized graphical hardware & software.

- **Computer Generated Imagery (CGI)**
- The creation of manipulation of analysis and interaction with pictorial representations of objects & data using computers.

Graphics Storage Devices

- Some common storage devices are,
  - Floppy Disk
  - Hard Disk
  - Punch Card
  - Video Tape
  - Zip Drive
  - DVDs & CDs

Each storage devices has unique advantages & disadvantages therefor the graphic user should carefully examine the final application before selecting a storage devices.

Graphics Storage Format

- Regardless of the storage medium selected for graphics system, designer will always use some combination of the following 4 basic storage formats.

1. Image only storage
   - The system can be design to store only the images created.
2. Display memory storage
   - The system can be design to store bit by exactly what is the display memory.
3. Compressed memory storage
   - The system can be design to store the contents of the display memory in compressed form.
4. Information storage
   - The system can be design to store only the information that was used to create the image.

Image Only Storage

- Images are stored in a storage device as a photograph. Storage of images in this passion is relatively expensive.
- Once the image is stored however it is relatively difficult & expensive to restore it in the computer for further manipulation.

Display Only Storage

- The bit pattern that represents the image is copied directly from memory to the storage medium.
- System that store images by this method are very easy to develop because most computer operating system contain utility programs, that saves blocks of the computer memory.

Compressed Memory Storage

- Generally images contain continuous region of same gray level pixels. The pixel information can be compressed by some algorithm.
- Advantages are storage time & space can be reduced.

Information Storage

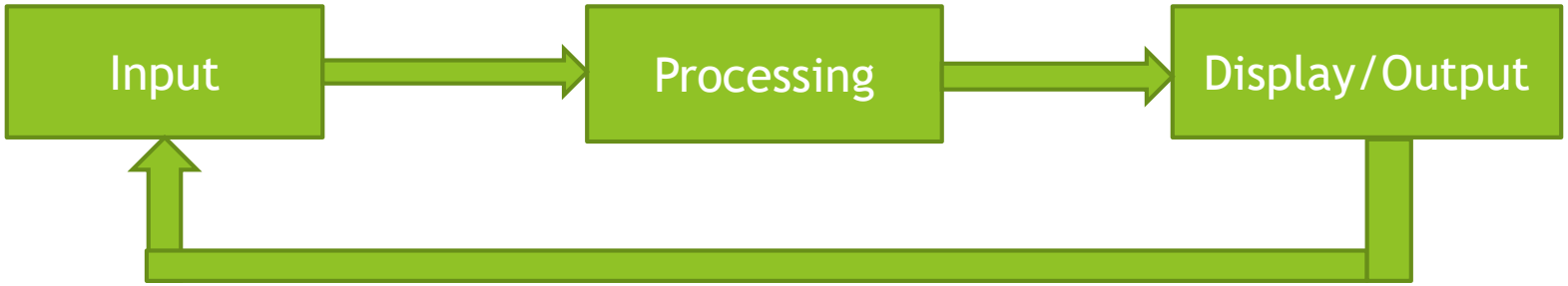
- A storage system that retains the information used to construct the image retain a series of command that describe the image.

Introduction to Computer Graphics

- Computer graphics are graphics created using computers and more generally the representation and manipulation of image data by a computer with help from specialized software & hardware.

Interactive Computer Graphics

- Typically we have the following cycle:



- Mouse
- Tablet & stylus
- Force feedback device
- Scanner
- Live video streams

- Screen
- Paper-based Printer
- Video Recorder
- Projector
- VR/AR headset

Some Applications of computer Graphics

- Some of the application areas which make heavy use of Computer Graphics are:
  - Computer Aided Design- CAD
  - Scientific Visualization
  - Films
  - Games
  - Virtual/Augmented Reality
  - Advertisements

  Note: there are lots more & there is a huge overlap between these different areas.

Graphic Devices

- Input Devices: Keyboard, Track Ball, Joystick, Mouse, Light Pen, Digitizing Camera, Scanner.
- Output Devices: Cathode Ray Tube(CRT),Plasma Display, Liquid Crystal Display(LCD), Light Emitting Diode Display, Plotters & Printers.

Pixels

- A computer image is usually represented as a discrete grid of picture elements called pixels. The number of pixels determine the resolution of the image. Typical resolutions range vary from 320*200 to 2000*1500.
- For a black and white image, a number describes the intensity of each pixel. It can be expressed between 0.0(Black) &1.0 (White). However, for internal binary representation reasons, it is usually stored as an integer between 0 (black) and 255 (white). For a color image, each pixel is described by a triple of numbers representing the intensity of red, green & blue. For example, pure red is (255,0,0) & purple is (255,0,255)
- There are 2 kinds of computer graphics- raster and vector

Raster Graphics

- A raster image is a collection of dots called pixels. Each pixel is a tiny colored square. When an image is scanned, the image is converted to a collection of pixels called raster image. Scanned graphics & web graphics(JPEG &GIF files) are the most common forms of raster images.
- The resolution of a raster images or scanned image is expressed in terms of the dots per inch or dpi. A printer or scanner's resolution also measured in dots per inch.

Vector Graphics

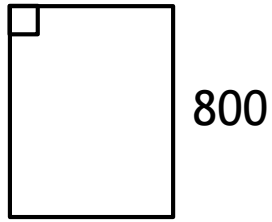
- Vector graphics are based on images made up of vectors (also called paths or strokes) which lead through locations called control points. Each of this points has a definite position on the x & y axis of the work plan. When creating a vector image in a vector illustration program, node or drawing points are inserted and lines & curves connect nodes together.
- This is the same principle as “connect the dots”. Each node line and curve is defined in the drawing by the graphics software by a mathematical description. Every aspect of a vector object is defined by math include node position, node location, line length & on down the line.
- Text objects are created by connecting nodes, lines & curves. Every letter in a font starts out as a vector object. Vector images are Object-Oriented while raster images are pixel oriented. A vector object will have a “wireframe” underneath the colors in the object. In a vector object, colors are like cloths over the top of a skeleton.

Image Representaion

- We can classify the images according to its representation as follows.
  - Binary Images
  - Grey Level images
  - Color images

Binary Images

- Binary images are the basic image format in the computer graphics it has only pure black & pure white colors. In binary image 1 bit is enough to store the color information of one pixel.
- Eg:



800*600 =Number of Pixels
800*600*1 =Bits enough to store this image.
=480000 bits
=6000 byte
=58.59kB

Grey Level Images

- Grey level images are black and white images.
- Eg: 8 bit grey level image.

600

1024

Number of bits = 1024*600*8 bits
= 1024*600 Byte
= 600kB

Color Images

- Primary colors Red, Blue, Green are stored separately for each pixel color information in color images.
- Eg: 24 bit color image.

800

1024

Number of bits = 1024*800*24 bits
= 1024*2400 Byte
= 2400kB