Lecture-6
MBU
05/02/18

classmate
Date 05/02/18
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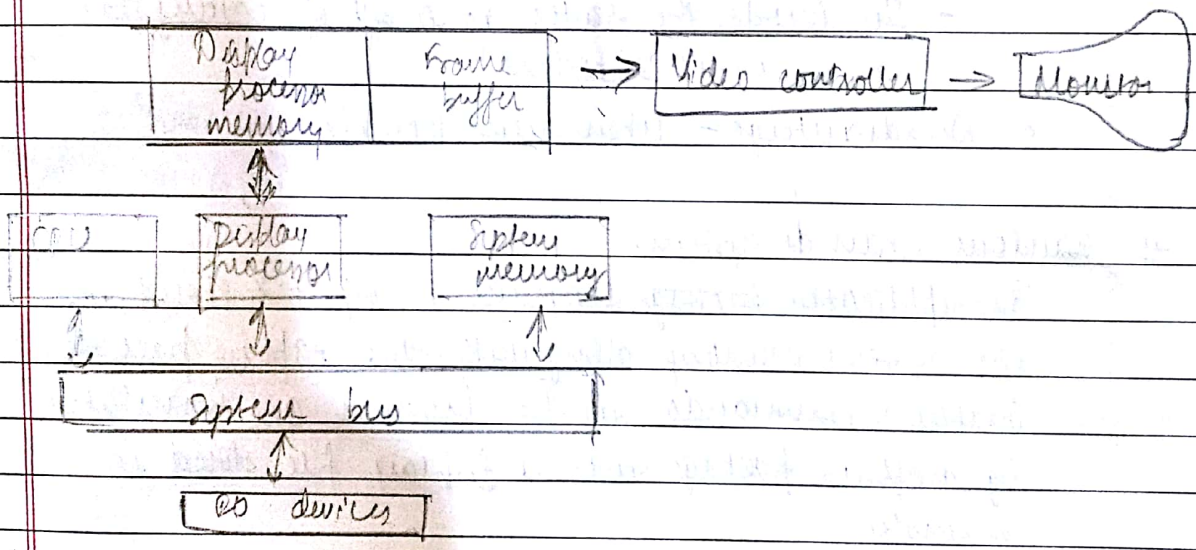
8 ~~bit~~ RGB colours for a three-bit per pixel frame buffer

Colour code	Bit value R	G	B	Colour
0	0	0	0	Black
1	0	0	1	Blue
2	0	1	0	Green
3	0	1	1	Cyan
4	1	0	0	Red
5	1	0	1	Magenta
6	1	1	0	Yellow
7	1	1	1	White

Display processor / Graphics controller / Display co-processor



- Purpose: free the CPU from graphics chores
- A seperate display processor memory
- Major tasks:

  Scan conversion:

  - digitizing a picture defⁿ given in an application program into a set of pixel-intensity values for store in the frame buffer.
  - Straight line segment, curved line polygon outline characters (rectangular grid / curved lines).

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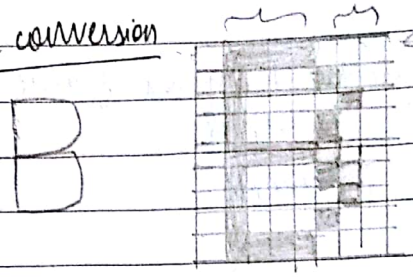
same type pixel intensities aren't saved twice (run length encoding)

Scan conversion



0, 0, W 1
0, 1 B 3
0, 4 W 3

Display processor - operation

- Generating various lines, displaying colour areas, performing transformations & manipulations
- Designed to interface with ~~the~~ input device as mouse.
- To reduce memory requirements
  - organizing the frame buffer as linked list and encoding the intensity information (run-length encoding)
  - To encode the raster as a set of rectangular areas (cell encoding)
- Disadvantage - when runs decrease.

Random scan system

An application program is input & stored in the system memory along with the graphics package. Graphics commands in the program are translated by graphics package into a display file stored in memory.

Display file is accessed by the display processor to refresh the screen.

Each command read on each refresh cycle.

Display processor : display processing unit / graphic controller.

- A scene is then drawn one line at a time positioning the beam to fill in the line b/w the end points.

Input devices

Hard copy devices

— Impact printer

Mechanical contact b/w print head & the paper.

Print head resembles hammer. Transfers ink to the paper

Impact
- Dot matrix
- Daisy wheel
- chain
- Line
- Drum

Non impact
- Inkjet
- Laser
- Thermal wax
- Thermal dye

— Non impact printer

No mechanical contact. Sprays ink on the paper.

Fully formed
- Daisy wheel
- Chain
- Line
- Drum

Bit image
- Dot matrix
- Inkjet
- Laser
- Thermal wax
- Thermal dye

Graphics software

- Graphics kernel system (GKS)
- PHIGS (Programmer's hierarchical interactive graphics standard)

- Standard[2] for device interface methods is given in Computer Graphics Interface (CGI) system.
- The computer graphics Metafile (CGM) system specifies standards for archiving and transporting pictures.

Afrimap

- For systems with multiple bits per pixel the frame is called a afrimap.
- Refresh rate > phosphor's persistence → moving object
- Refresh rate < phosphor's persistence → flickering

- Dot pitch: Measurement of the diagonal distance b/w two linked-colour (RGB) pixels on a display screen (0.25 mm to 0.40 mm ; 0.31 mm → clear image)
  — smaller dot pitch → higher resol[2]
- Bit depth / colour depth: no. of bits assigned to each pixel in the image

640×480

1.8

Q. The resolution of a screen is 640×480. How many pixels could be accessed per second in the system by a display controller that refreshes a screen 60 fps. What is the access time per pixel in the system.

Total pixels = 640×480

Total pixels/second = 640×480×60

= 18432000 pixels/second

Access time per pixel

$= \frac{1}{18432000}$ second/pixel

$= 5.42 \times 10^{-8}$ second/pixel

Q. How much time is spent scanning across each row of pixel during a screen refresh on a raster system? Resolution of the screen is 1280×1024. Refresh rate = 60 fps.

Total pixels/sec = 1280×1024×60

Total time for 1 scan line

$= \frac{1024}{1024 \times 1280 \times 60}$

$= \frac{1}{1280 \times 60}$ s

= 13 μs

60 frames → 1 sec

1 frame → $\frac{1}{60}$ sec

1024 scan line → $\frac{1}{60}$ sec

1 scan line → $\frac{1}{60 \times 1024}$ = 16 μs