

Tile Graphics

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Background - Pixels

- Graphics Displays made up of Pixels (Picture Elements)
- Color Determined by Relative Proportions of 3 Primary Colors - Red, Blue and Green.
- Bits per Pixel, or “Color Depth”, Ranges from 8 to 48.
- 24 Bits per Pixel Accepted Industry Standard Since about 1995, 8 Bits for each Primary Color.

Background - Resolution

- Resolution of an Image Depends on the Number of Pixels.
- NTSC (National Television Standards Committee) or Analog TV uses 525 Lines of 720 Pixels per Line = 378,000 Pixels.
- Computer Monitors Typically have 72 to 130 Pixels per Inch (PPI), or from 725 Thousand to over 2 Million Pixels for a 10 x 14 Inch Screen.
- HDTV Display Screens use up to 1,920 x 1,080 = 2,073,600 Pixels.

Background - Video

- Movie Reels Typically show 60 Frames per Second.
- Digital Video Divides the Screen into two sets of Alternate Horizontal Lines of Pixels, or Fields.
- All the Pixels in a Field are Updated at once, and the Fields Update in Alternate Cycles, so that each Field is Updated 30 times per Second.
- 2 Million Pixels x 24 Bits per Pixel per Cycle x 30 Cycles per Second = 1.44 Billion Bits per Second.



Video on Embedded Systems

- Data Compression Reduces the Data Rate Required.
- The FCC (Federal Communications Commission) Defines Broadband Internet Access as a Minimum of 768 kBits per Second, as of March 19th, 2008.
- This is still beyond the Capability of Current Embedded Systems, but Video Games do not Require Photographic Quality Video.
- Super Mario Brothers used a 6502 Processor and 10 kBits of Direct Display Memory in 1985.

Tile Graphics

- A Tile is a Group of Pixels Treated as a Single Unit.
- Display Screen is Divided into Blocks of Pixels, Typically 8 x 8 or 16 x 16. A “Map” in RAM Contains Pointers to Tiles in “Tile Memory”. Each Block is Assigned a Pointer to one Tile.
- Nintendo Entertainment Systems used 1 Byte Tile Numbers, for a Maximum of 256 Tiles.
- Author used 512 Tiles and a Screen Divided into 32 x 26 = 832 Blocks. To Change the Entire Screen Requires Changing 2 Bytes x 832 Blocks = 1,664 Bytes.

Tile Colors

- For Video Games, the Color Palette is also Simplified.
- The Author used Four Colors, White (00), Black (01), Green (10) and Red (11). This Allowed the use of One Byte to Store the Color Data for Four Pixels.
- Tiles 8 Pixels Square Required 16 Bytes of Memory Each. 512 Tiles Required a Total of 8,192 Bytes. With 1,664 Bytes for the Map, Graphics Required Less than 10 kBytes of Memory.
- 256 Tiles Would Require Less than 5 kBytes.

Hardware

- System used a Parallax Propeller demo Board.
- The Propeller Board uses 8 RISC CPUs (“Cogs”), each with 2 kBytes of RAM and Shared Access to 32 kBytes RAM and 32 kBytes ROM. Each Cog has a 12 Byte “Mailbox” for Communication with other Cogs, and can be Individually Programmed for a Specific Function within the System.
- Controller was a GameCube Controller from WalMart.
- First Game Implemented was “Battleship”.



References

- Tile Graphics, Chris Cantrell, Circuit Cellar Magazine.
- <http://lurkertech.com/lg/>
- <http://en.wikipedia.org/wiki/Pixel>
- http://en.wikipedia.org/wiki/Raster_graphics
- http://www.cnet.com/4520-7874_1-5137915-1.html
- http://en.wikipedia.org/wiki/Broadband_Internet_access

**Dam and Waterfall
at Great Falls
Cotton Mill Ruins,
Rockingham NC**

For Comparison, this Picture
is Stored in a File Listed at
1.66 MB.

