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What is Deep3D?

3D T&R Hardware Accelerator

□ A User's perspective

- Nintendo Controller input
- 5 DOF Camera
- 3D Glasses for depth

A High Level Perspective



Input

- Serialized Input via. Nintendo Controller
 - □Buttons A and B for forward/backward
 - □Arrow buttons for nod and shake angles
 - □Sample inputs every 100us
 - Accumulate the number of times each input is high per frame
 - □Reset accumulator when camera is updated

Math Unit Overview

Number Format

- 17-bit Sign-Magnitude Fixed Point
 - □ (8-bit whole, 8-bit decimal)
- Transform Representation
 - 4x4 Fixed Point Matrices
 - \Box (Stored as 3x4 since last row is always 0,0,0,1)

Functions

- Multiply and Accumulate
- Multiplicative Inverse
- Sin/Cos Calculation
- Matrix Multiplication
- Matrix/Vector Multiplication
- Transform Generation



Transformation Overview

Draw FSM

- Coordinates minor FSMs for Transformation/ Rasterization
- Two passes, one for each eye

Camera

- Calculates camera position & orientation from input
- Right eye/ left eye
- □ Transform Computation
 - Generates transform matrix from Camera
 - Important for abstracting other transformations
- □ Transform Application
 - Loads triangle from ROM into Vertex Buffer
 - Applies Camera Transformation
- □ Clipping
 - Clips Triangle against viewing planes
- Projection
 - Screen-space transformation
 - Rounds to nearest pixels for vertices

Transformation Diagram



Rasterization

Setup Phase

- Copies coordinates from vertex buffer
- □Uses math unit for 2D Clipping
- Signals control unit to begin transformation of next triangle

Rasterization Phase
Uses Bresenham's algorithm for interpolation
In parallel with next transformation
Sends x,y coordinates to Video unit

Video Overview

- 320x240, 3-bit color
- Page flipping
- Plotter FSM
 - Responsible for merging R, B values against white background

Video Diagram



Extra Features

- Animation
- □ Z-Buffering
- 24-bit Color
- □ Filled Triangles
- Point Light Sources
- Goroud Shading
- Texture Mapping