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
    - (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
Extra Features

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