A 3-D Rendering System

6.111 Final Project

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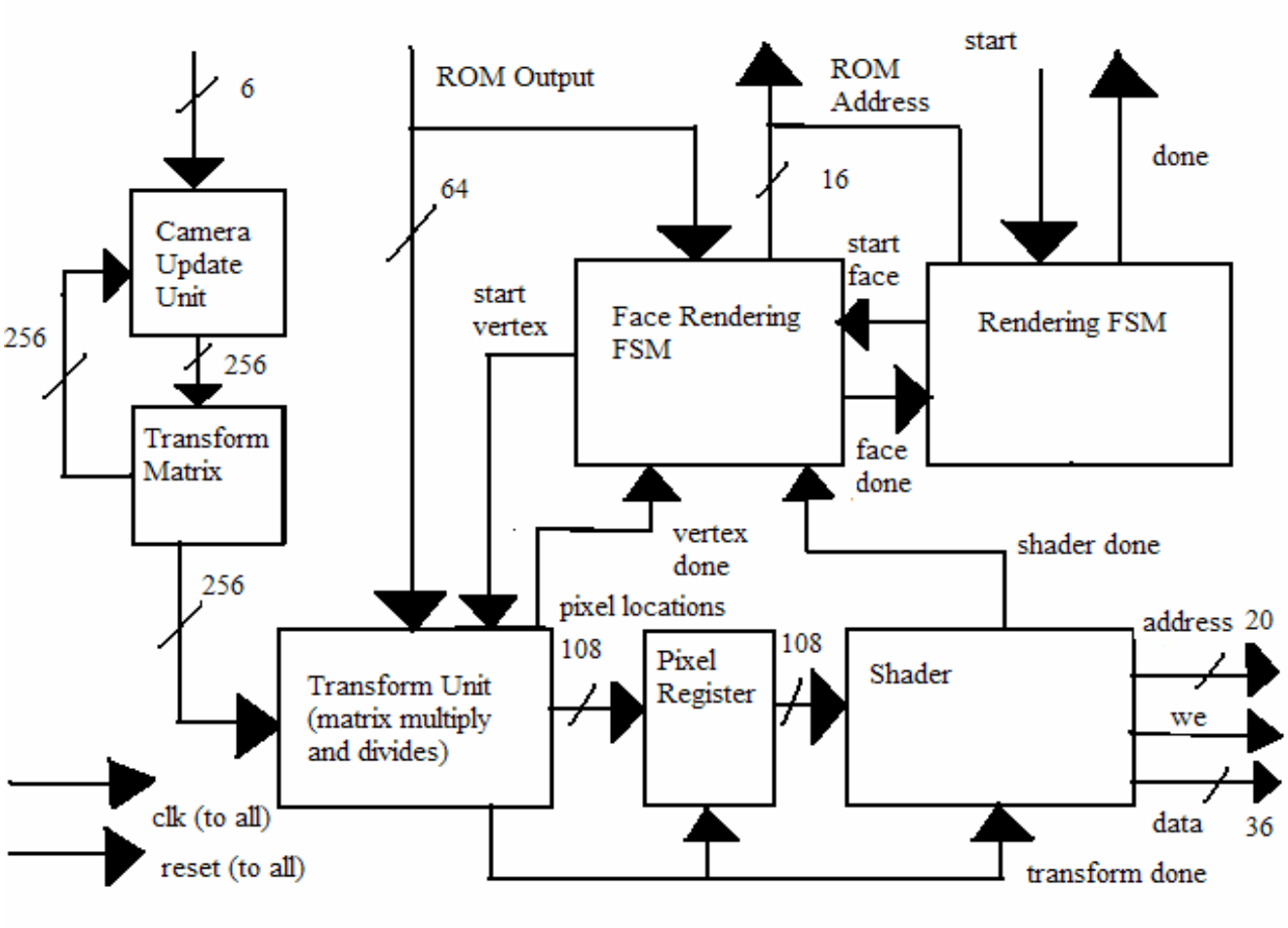
Project Overview

- Implement a 3D Model Rendering System
- Two Components:
  - Rendering and Shading of Models
  - Output Video to VGA Monitor
- Initial Implementation: Simple monochrome polygons
- Add features sequentially: camera control, shading, lighting, etc.

Block Diagram of Rendering Engine



Rendering Engine

- Transforms the 3-D model into the sequence of pixels that comprise an image.
- Rendering consists of a series of matrix transformations to the 3-D Model.
- Sequential design that first renders the vertices of a model and then shades it.

Rendering (cont.)

- Highly Pipelined Design
- Can implement more modules in parallel with the shader unit.
- Camera Control is implemented by a matrix transformation based upon input.

3D Model Format

- Model format is Alias Wavefront:

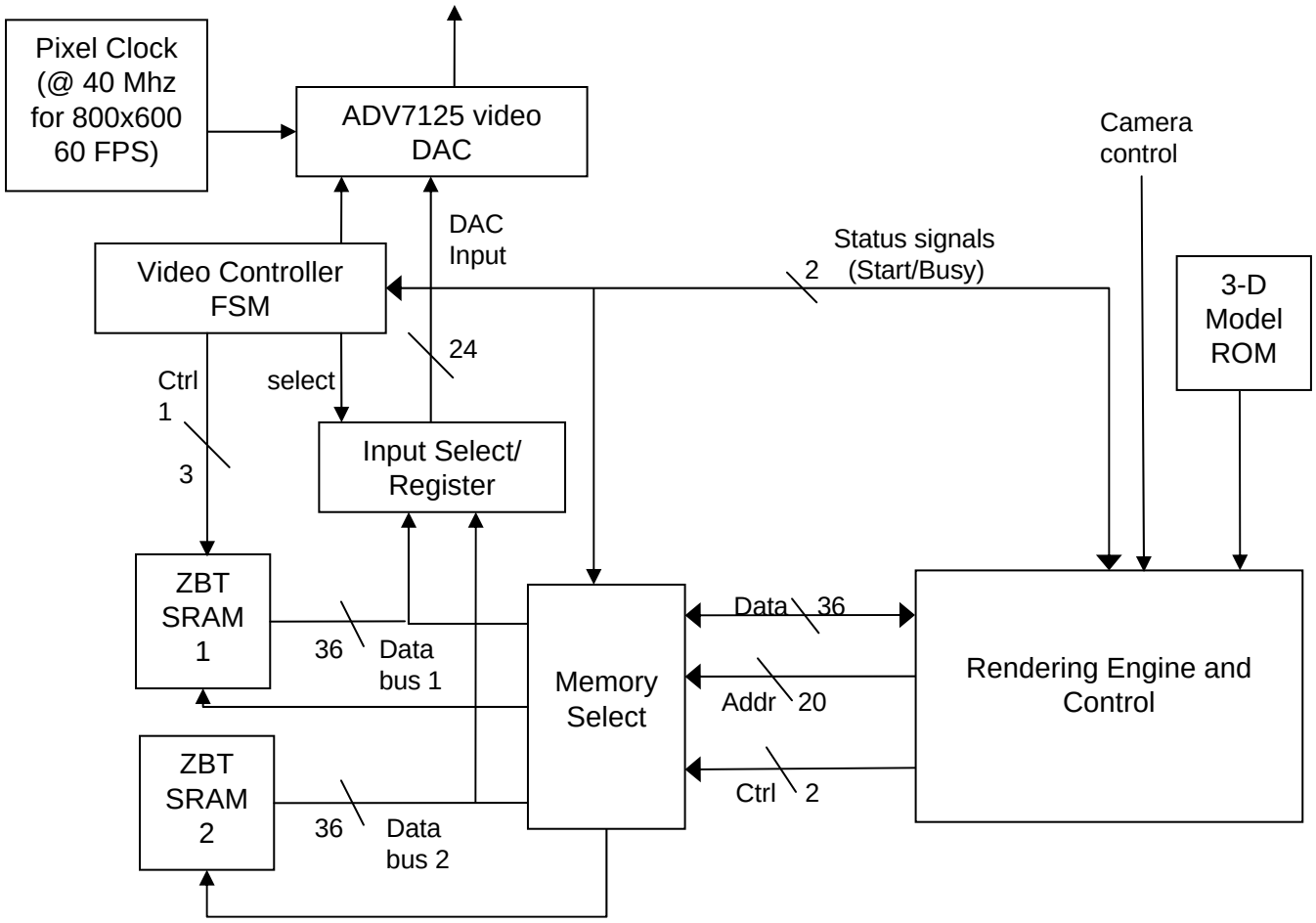
```
g tetrahedron
v 1.00 1.00 1.00
v 2.00 1.00 1.00
v 1.00 2.00 1.00
v 1.00 1.00 2.00
f 1 3 2
f 1 4 3
f 1 2 4
f 2 3 4
```

Simple 3-D Tetrahedron Model in OBJ Format

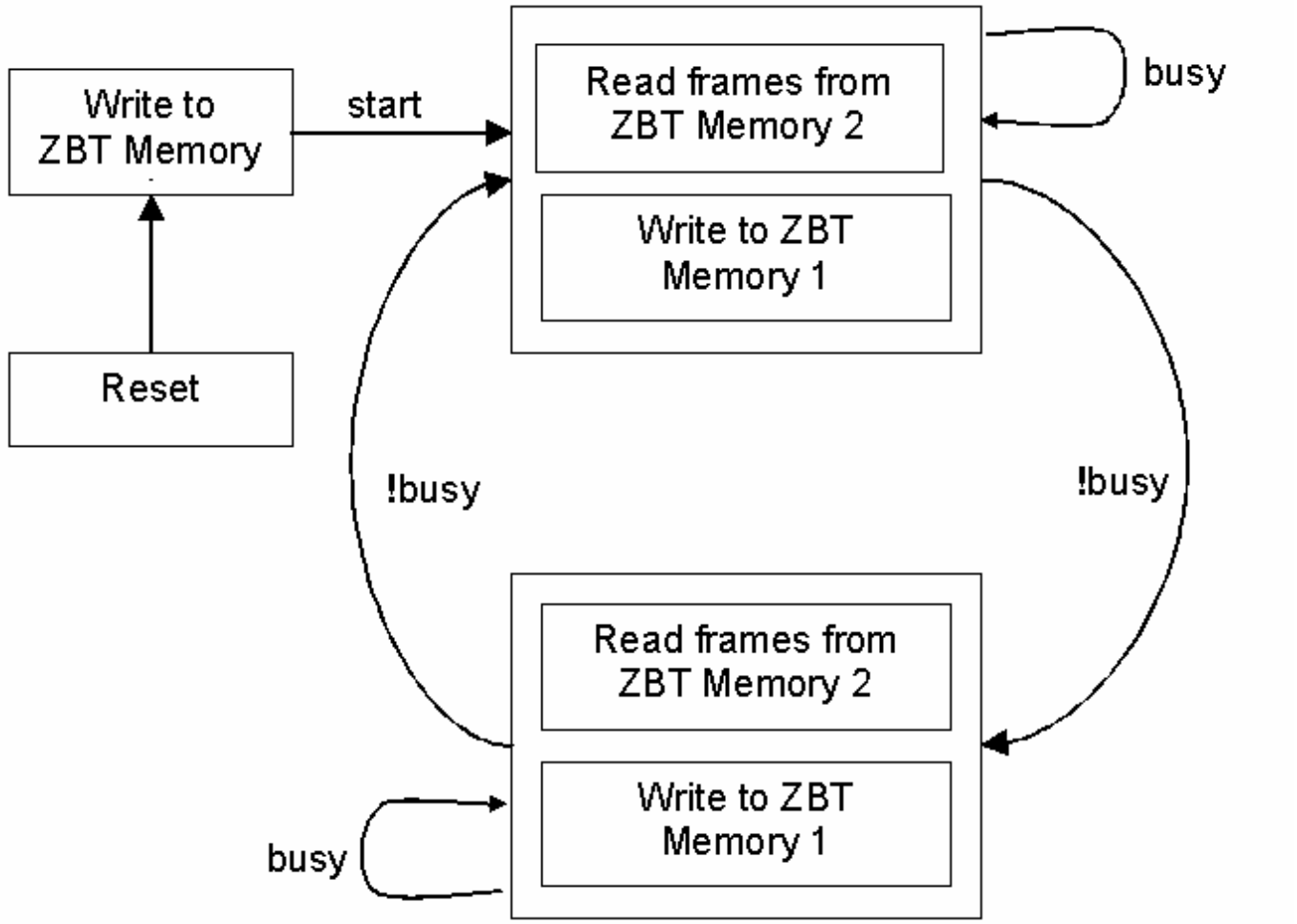
Video Component

- Responsible for transmitting frames from Rendering Engine to D/A Video Converter
- Utilizes a double-buffering scheme with ZBT memories to allow for parallel rendering and video.
- Important synchronization issues

Block Diagram of Video Component



Double Buffering of Frames



Project Timeline

Phase I

- Is there video output (without rendered model) 4/22
- Is the initial transform functional 4/24
- Is there video output showing rendered model 4/27
- Simple Shader (Vertices -> White Dots) 4/27
- Polygon Shader (including color) 5/1

Phase II

- Camera Control 5/1
- Lighting 5/4
- Debugging/Additional Features 5/9