

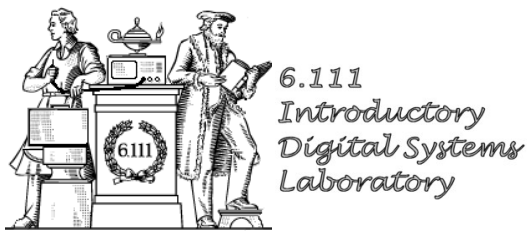
Interactive 3D Processing Framework

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Massachusetts
Institute of
Technology

3D Human-Computer Interaction



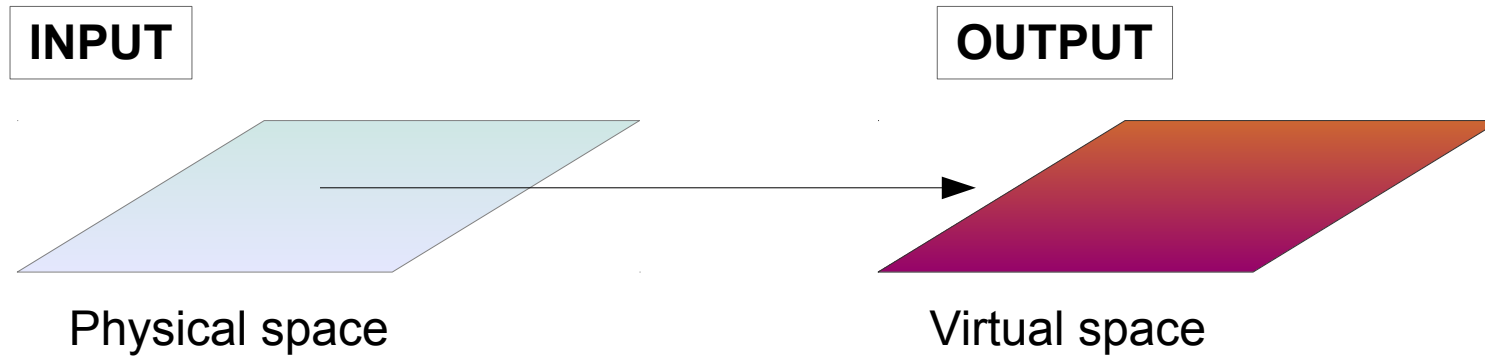
Auto-stereoscopy



Gestural interaction

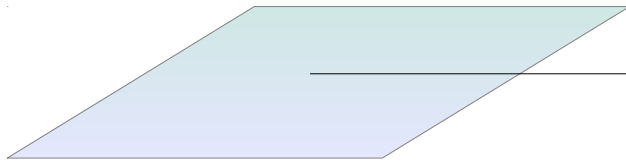
Modes of Interaction

Modes of Interaction



Modes of Interaction

INPUT



Physical space

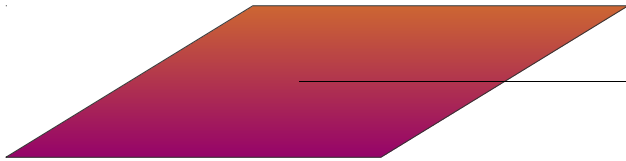
OUTPUT



Virtual space

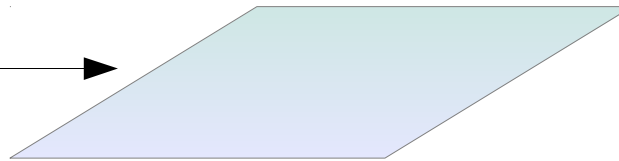


INPUT



Virtual space

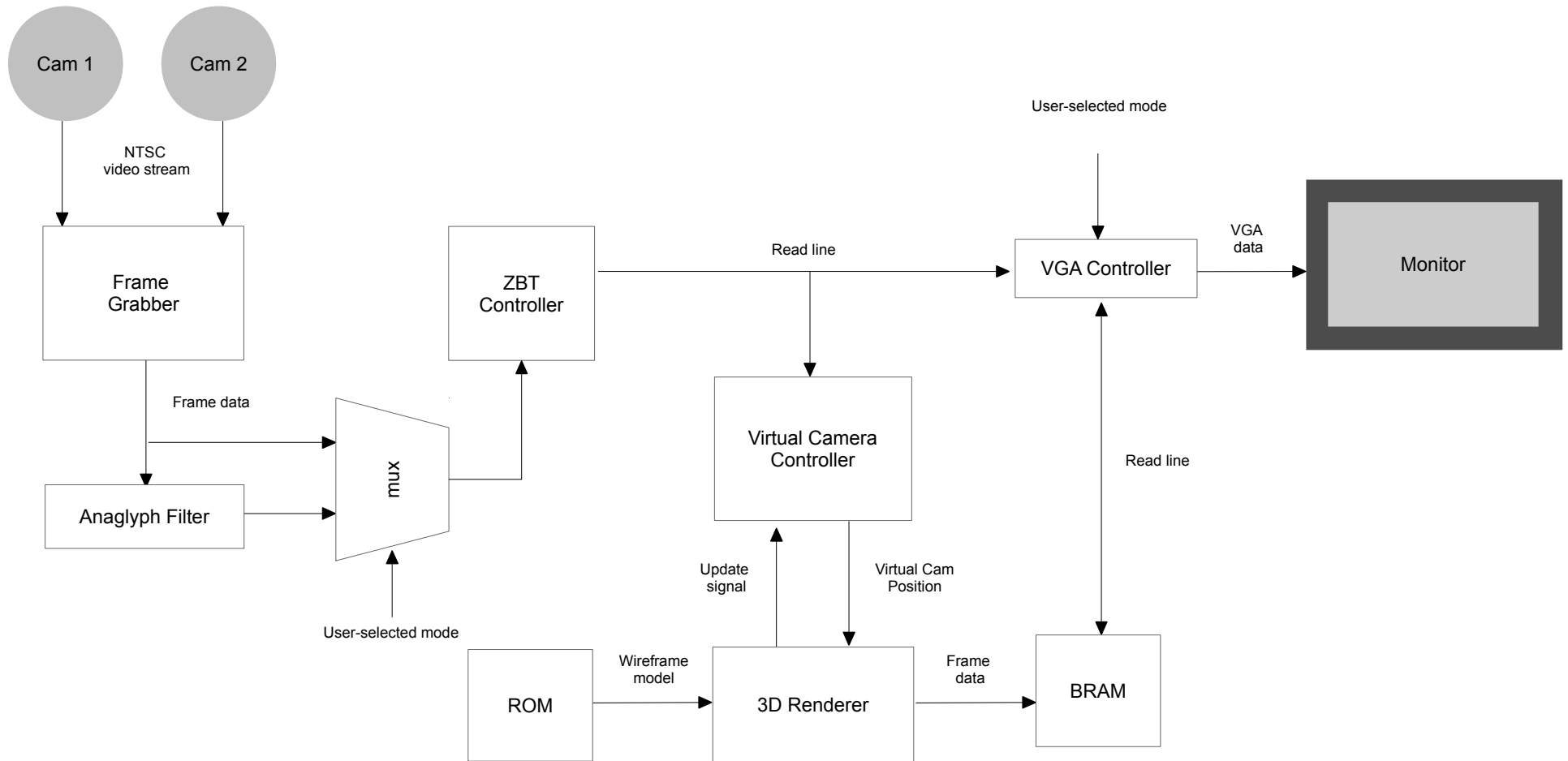
OUTPUT



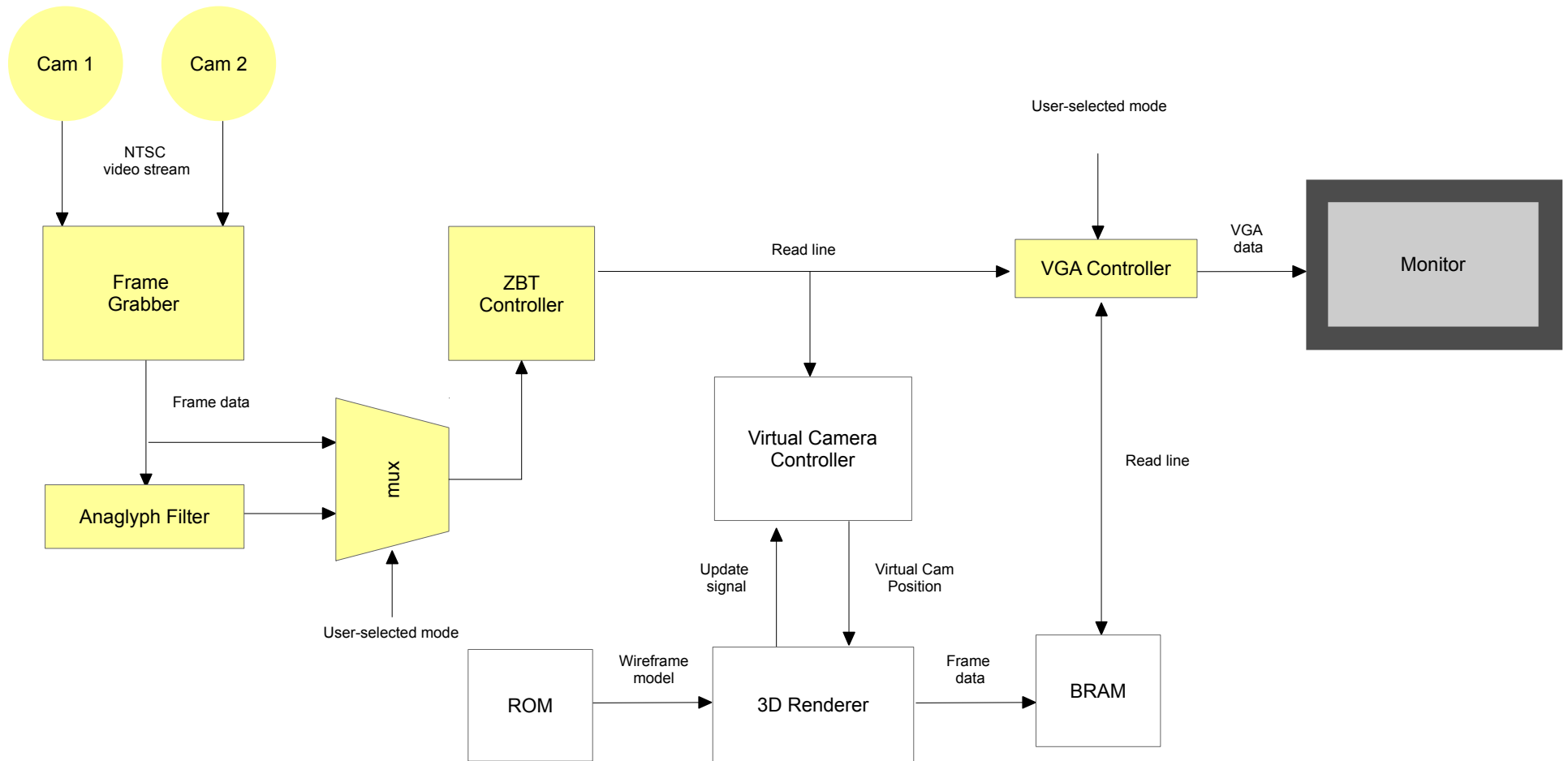
Physical space



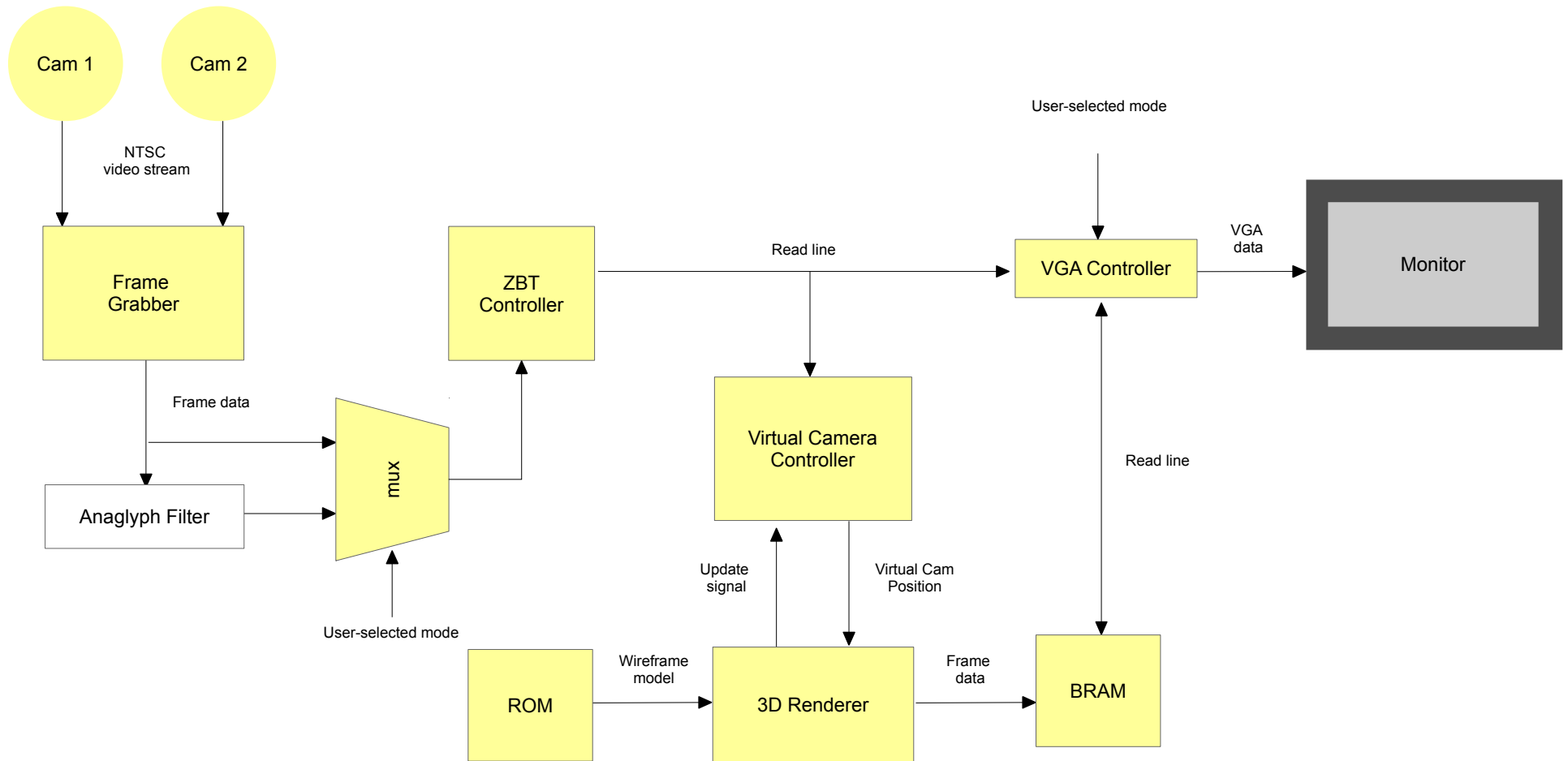
High-level Block Diagram



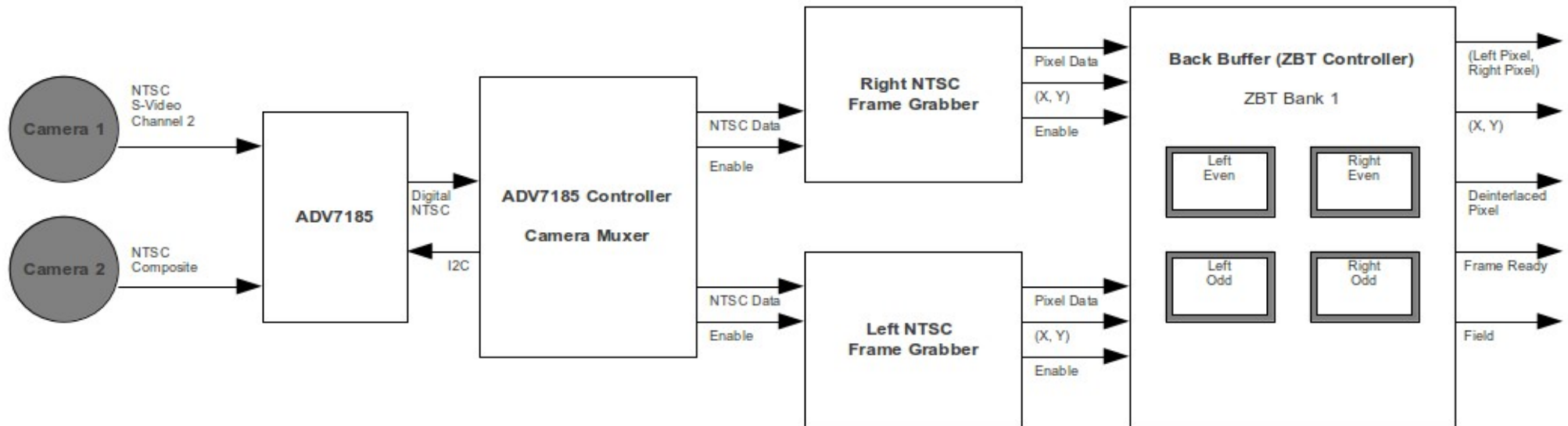
Stereoscopy Mode



Gesture-based Interaction Mode

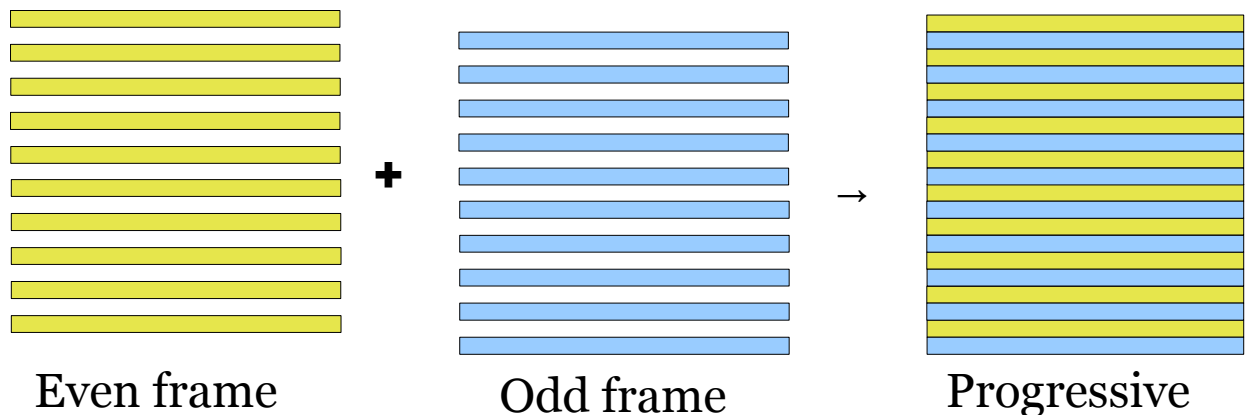
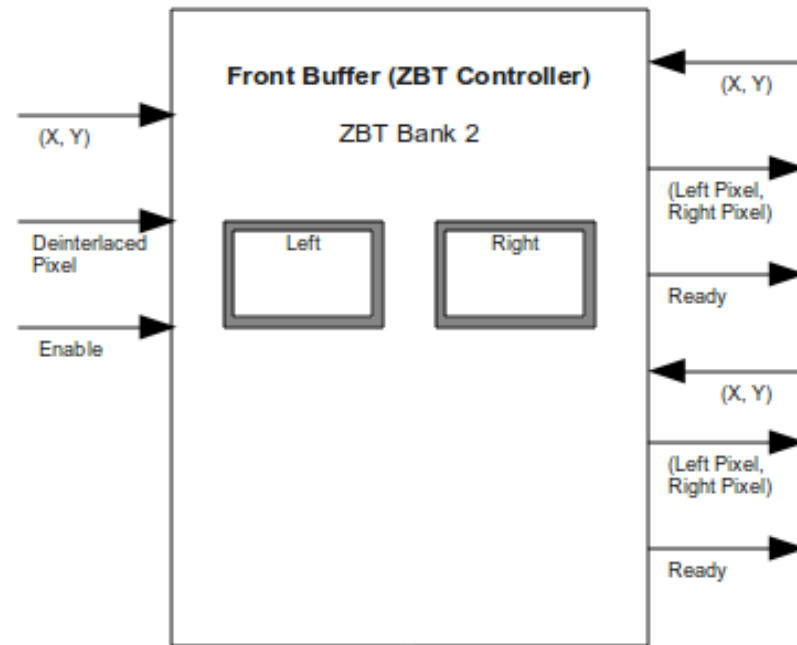


Video Capture Block Diagram

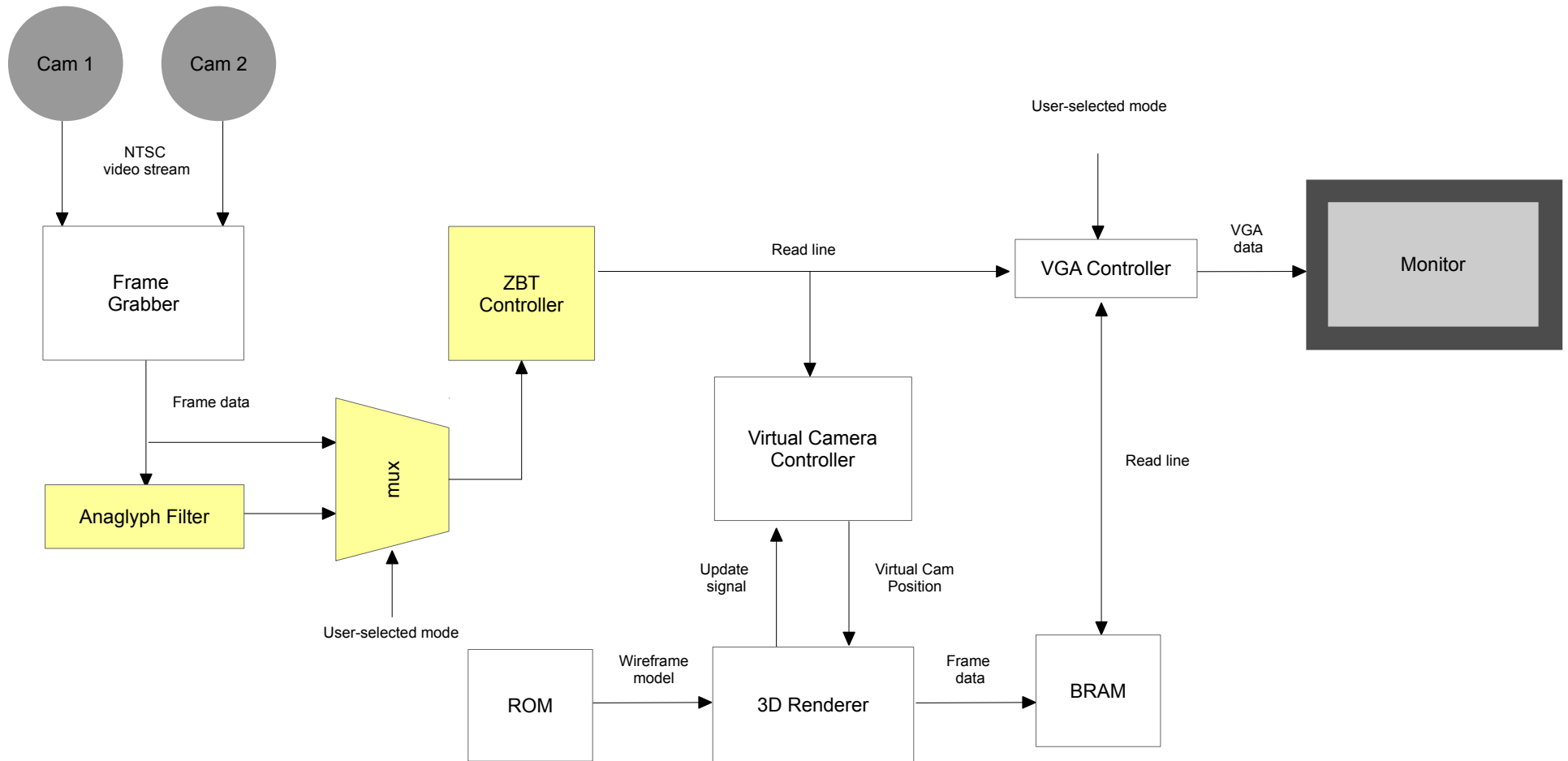


ZBT Frame Buffer Controller

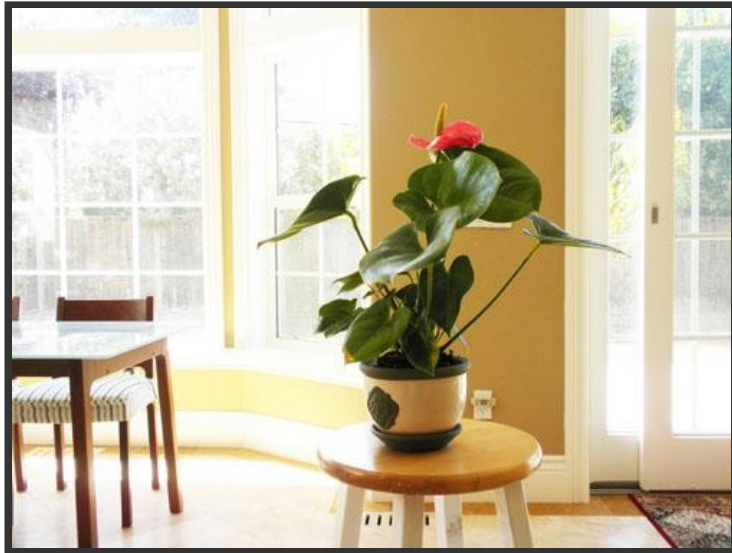
- Frame grabber writes to the back buffer
- VGA controller and Virtual camera controller read from frame buffer
- Buffer updated in between VGA frames



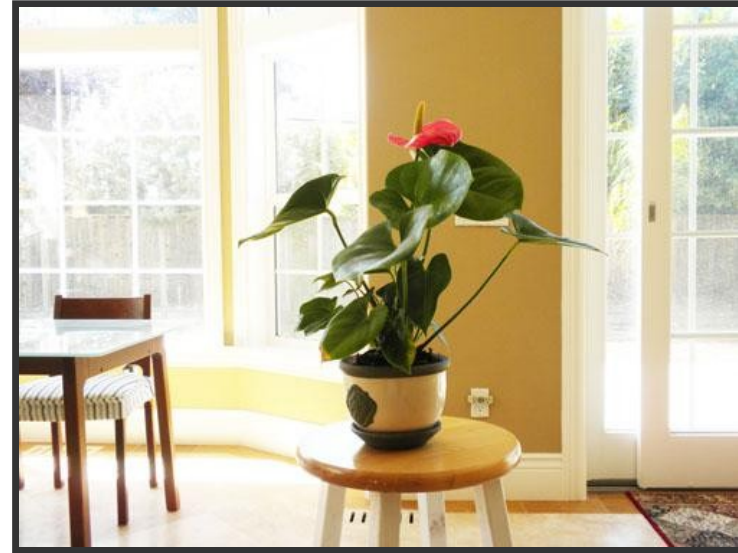
Stereoscopy Mode



Anaglyph Images

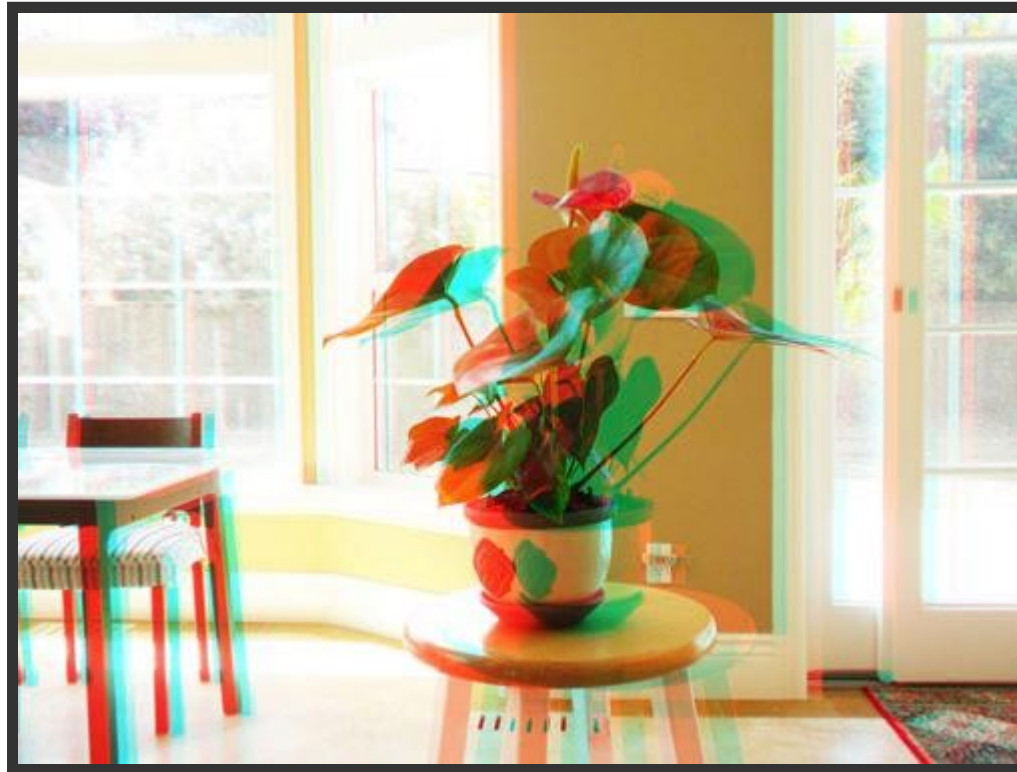


Left image



Right image

Anaglyph Images

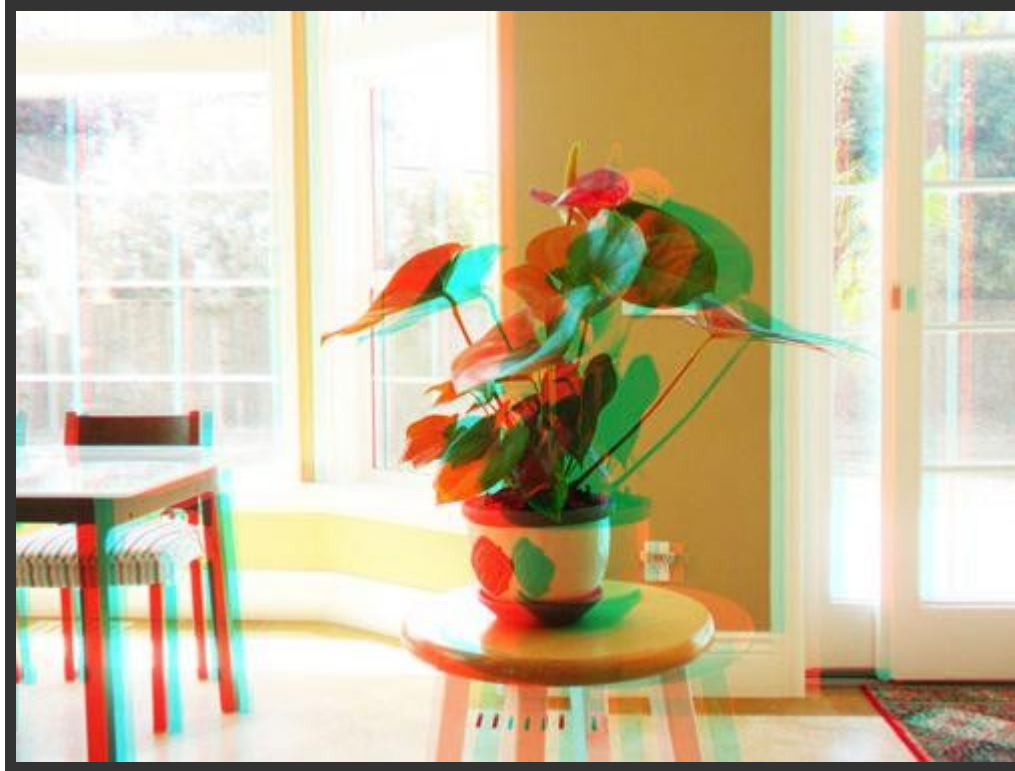


Anaglyph-filtered image

Anaglyph Images



3D glasses



Anaglyph-filtered image

Anaglyph Filter

Right pixel (RGB)

$$v_R = [r_R, g_R, b_R]$$

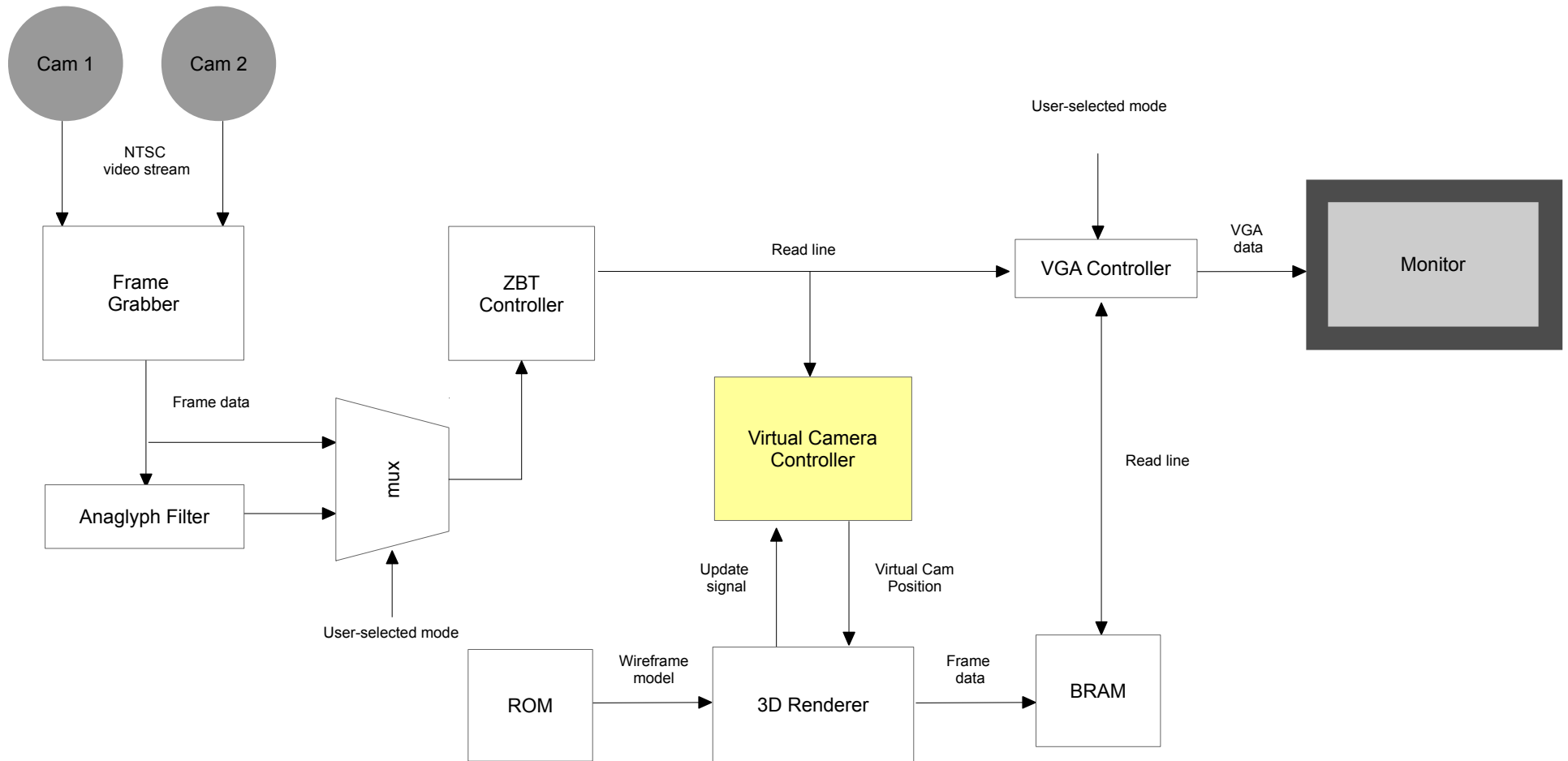
Left pixel (RGB)

$$v_L = [r_L, g_L, b_L]$$

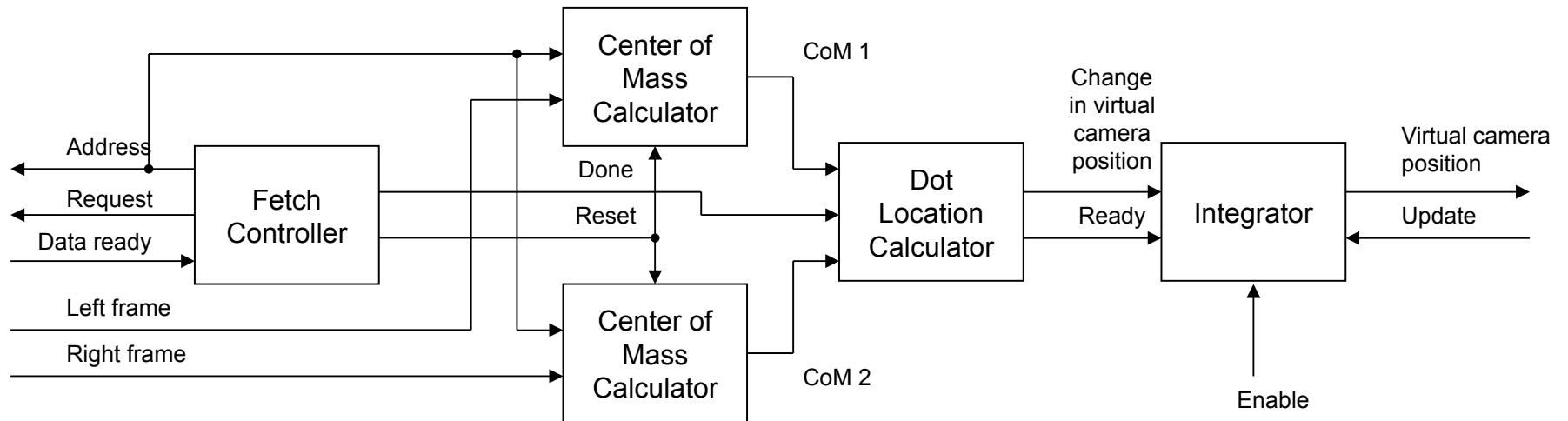
Anaglyph-filtered pixel (RGB)

$$v_{anaglyph} = [0.7 \cdot g_L + 0.3 \cdot b_L, \quad g_R, \quad b_R]$$

Gesture-based Interaction Mode

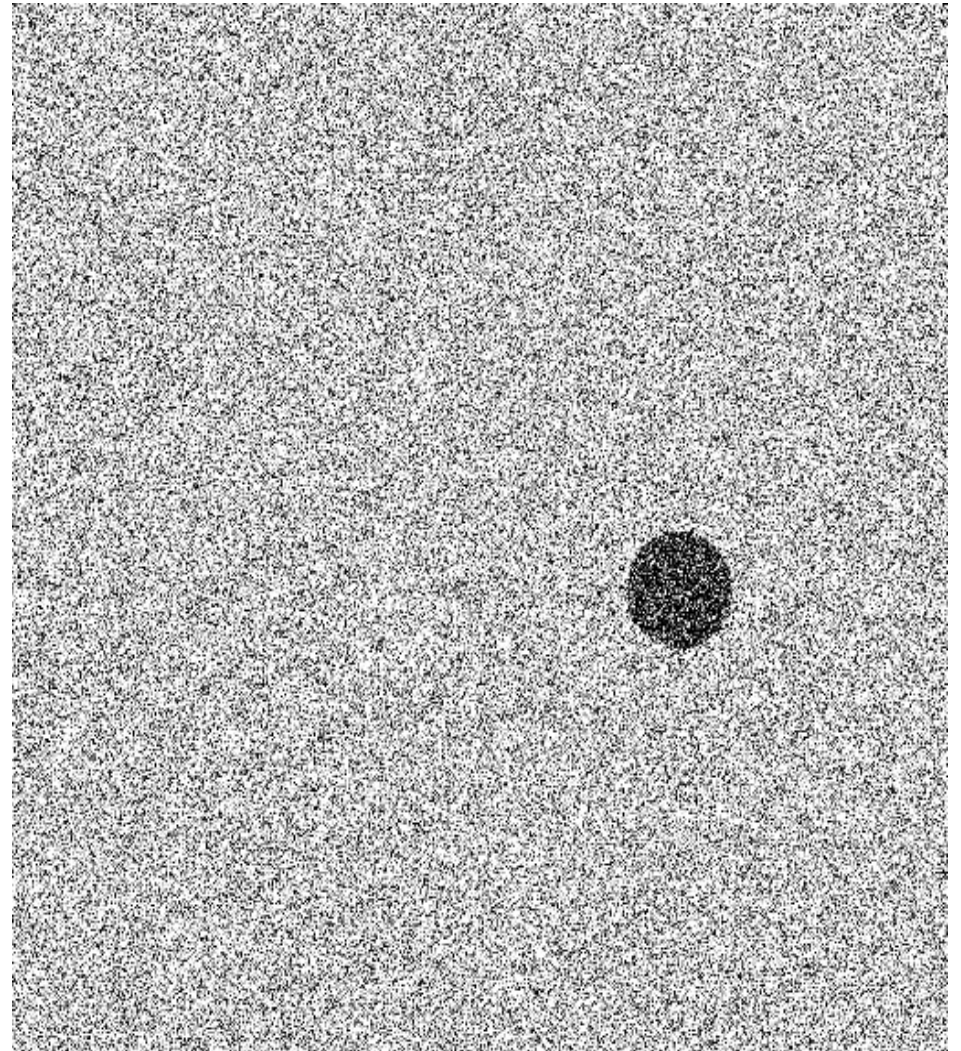


Virtual Camera Controller: Block Diagram



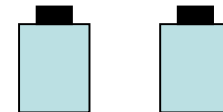
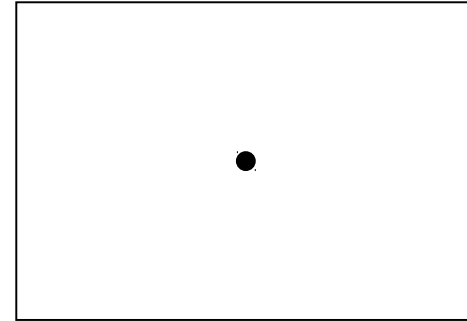
Center of Mass Calculator

- Takes camera frame data and finds a black dot
- Filters out possible noise using a low pass filter



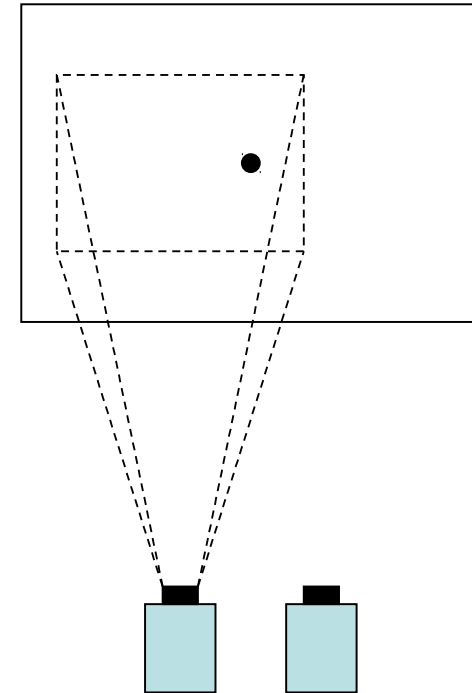
Dot Location Calculator

- Determines the location of the dot in 3D space
- Takes distance and angle between two cameras into account



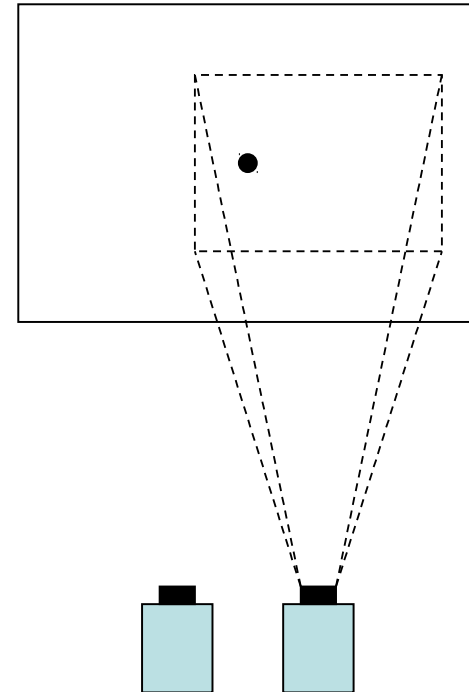
Dot Location Calculator

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- Takes distance and angle between two cameras into account



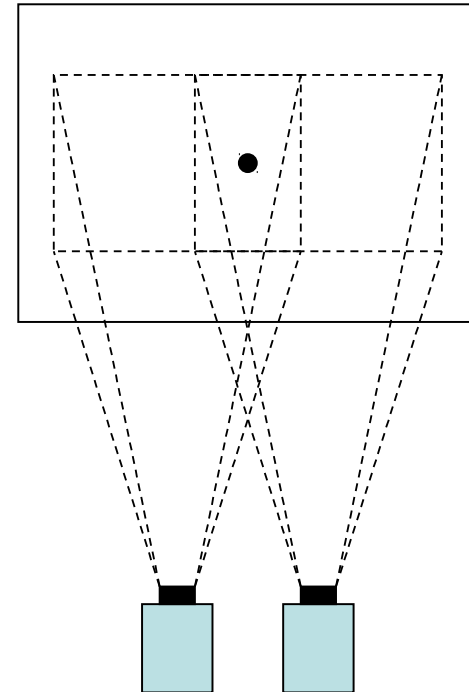
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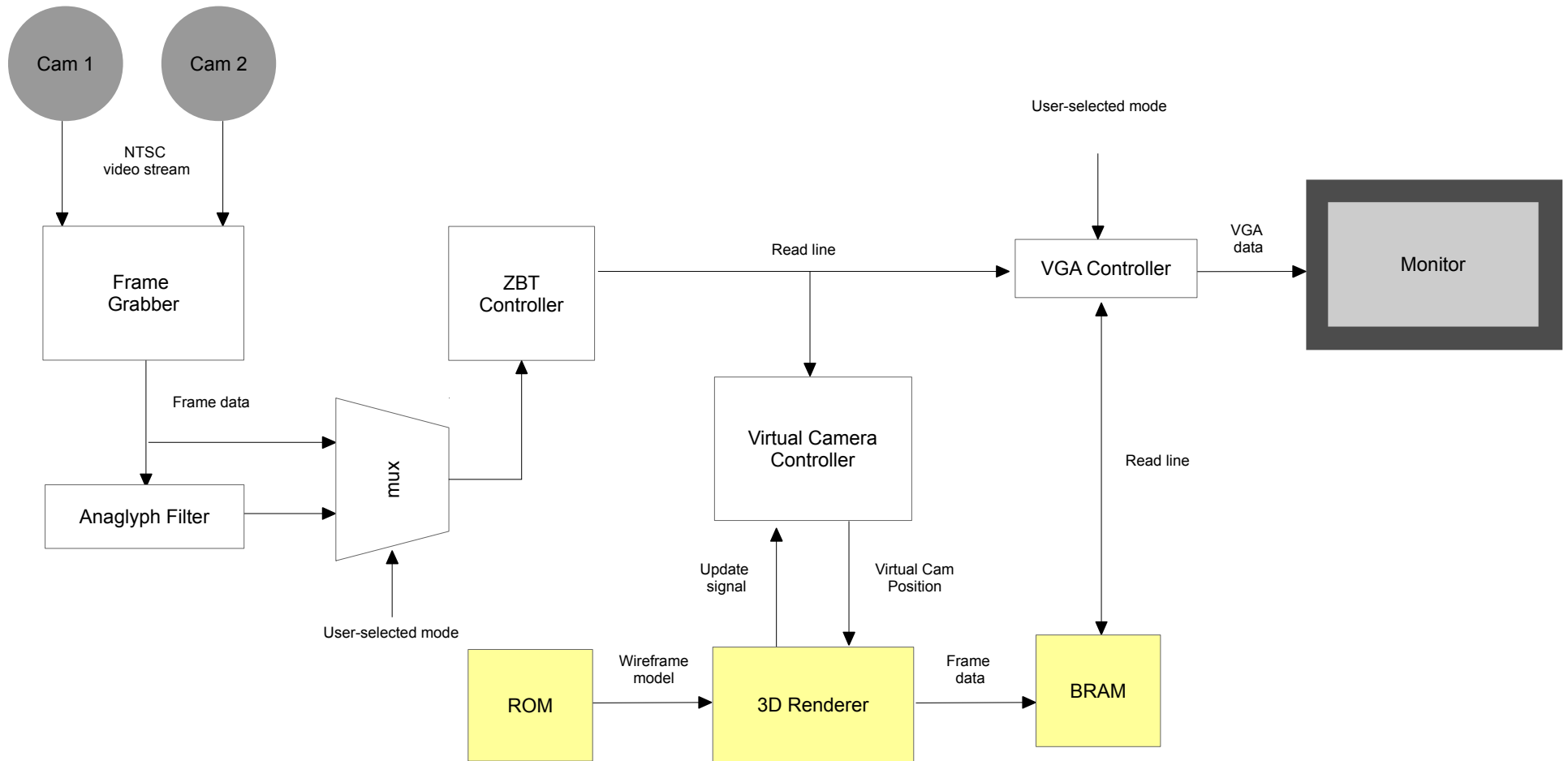


Dot Location Calculator

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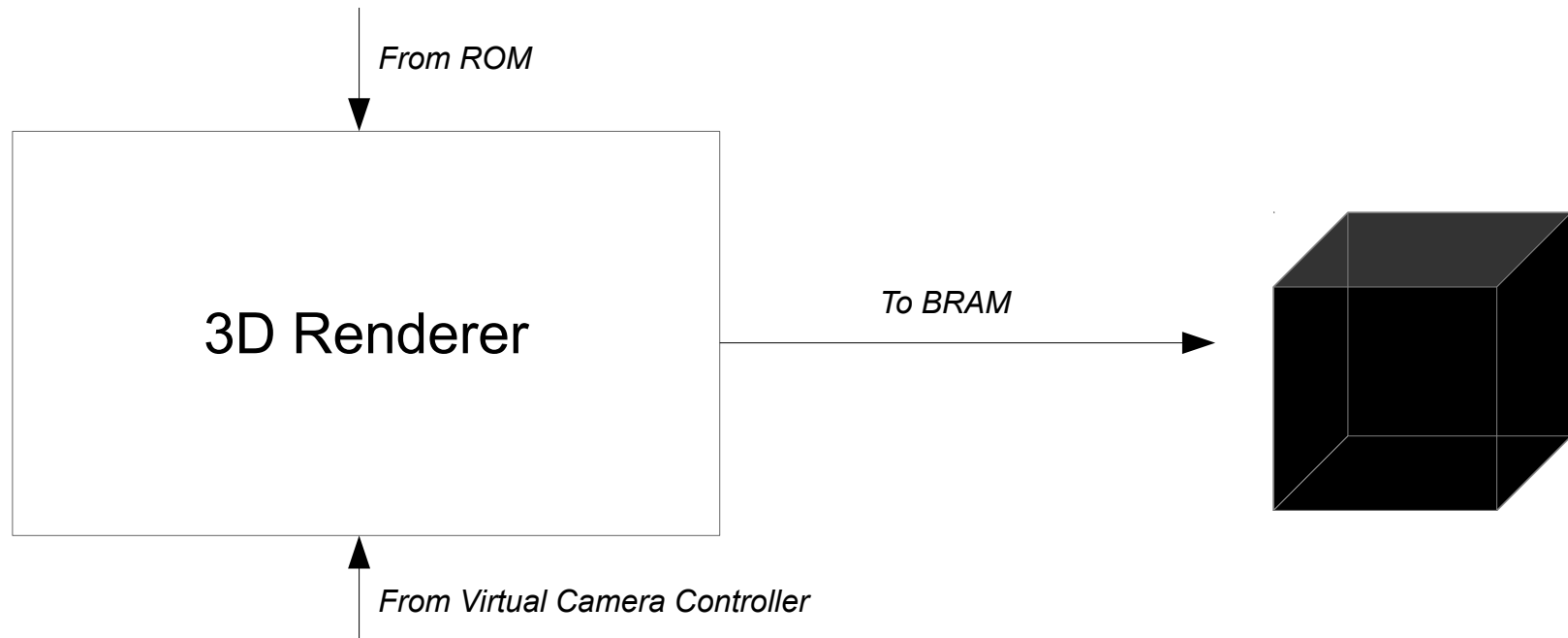
Gesture-based Interaction Mode



3D Renderer

[Vertex 1, ... , Vertex 8] = [(0,0,0), ... , (1, 1, 1)]

[Edge 1, ... , Edge 12] = [(1, 2), ... , (7, 8)]

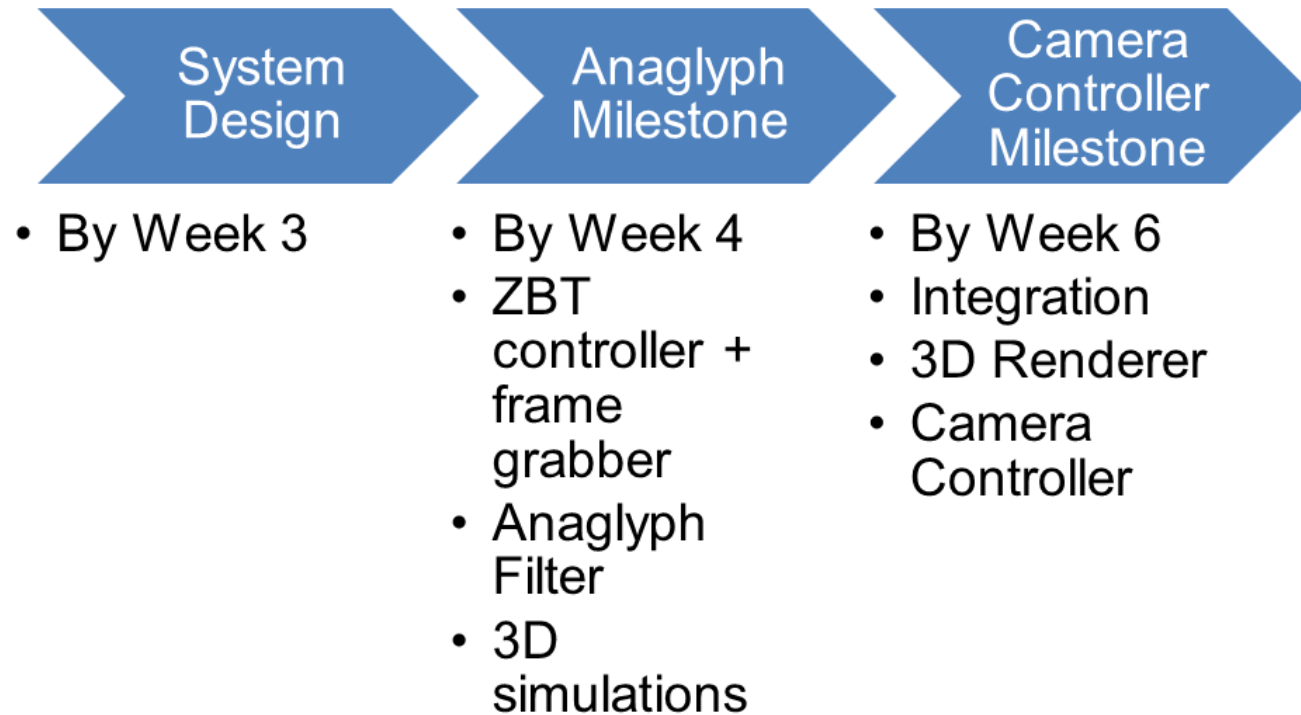


Virtual Camera Position = (r, Θ, Φ)

Organization

- **Two milestones**
 - Stereoscopy mode
 - Gestural interaction mode
- **Division of work**
 - Tim (Frame Grabber / ZBT Controller)
 - Andrew (Anaglyph Filter / 3D Renderer)
 - Adam (Virtual Cam Controller)

Organization



Q & A