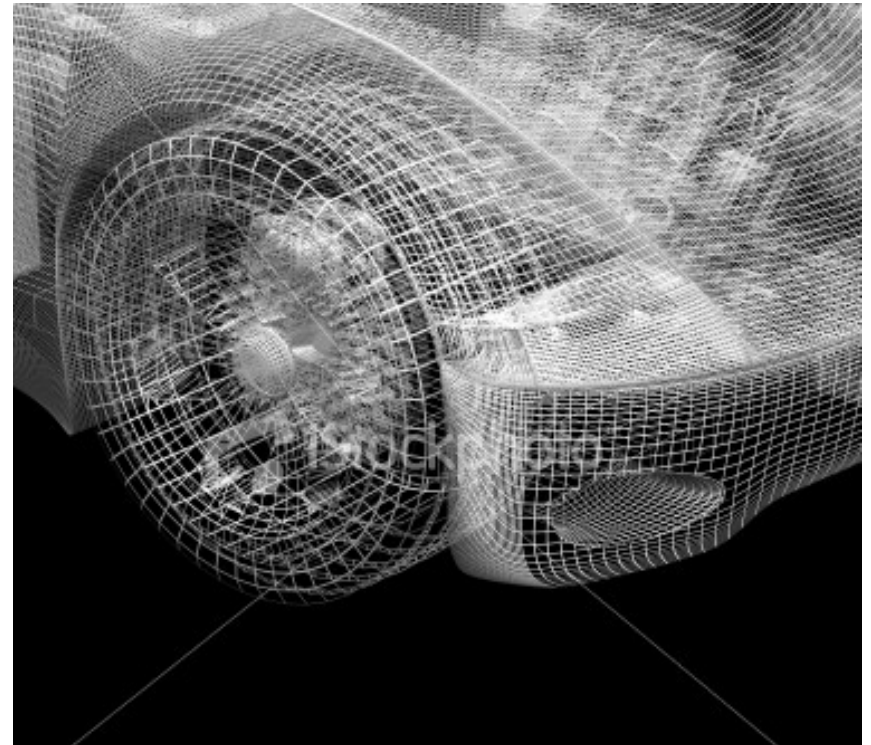# Wireframe Simulator

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Project Functionality

1. Read user-specified 3D coordinates from ROM

2. Transform (rotate, pan, zoom) coordinates if respective buttons are pressed

3. Generate wireframe model on-the-fly

Transformations

Perform grungy math on each of the vertices:

- Rotating left/right

  $(x', y', z') = (x \cos \theta + y \sin \theta, \quad x \sin \theta + y \cos \theta, \quad z)$

- Rotating up/down

  $(x', y', z') = (x \cos \varphi + z \sin \varphi, \quad y, \quad x \sin \varphi + z \cos \varphi)$

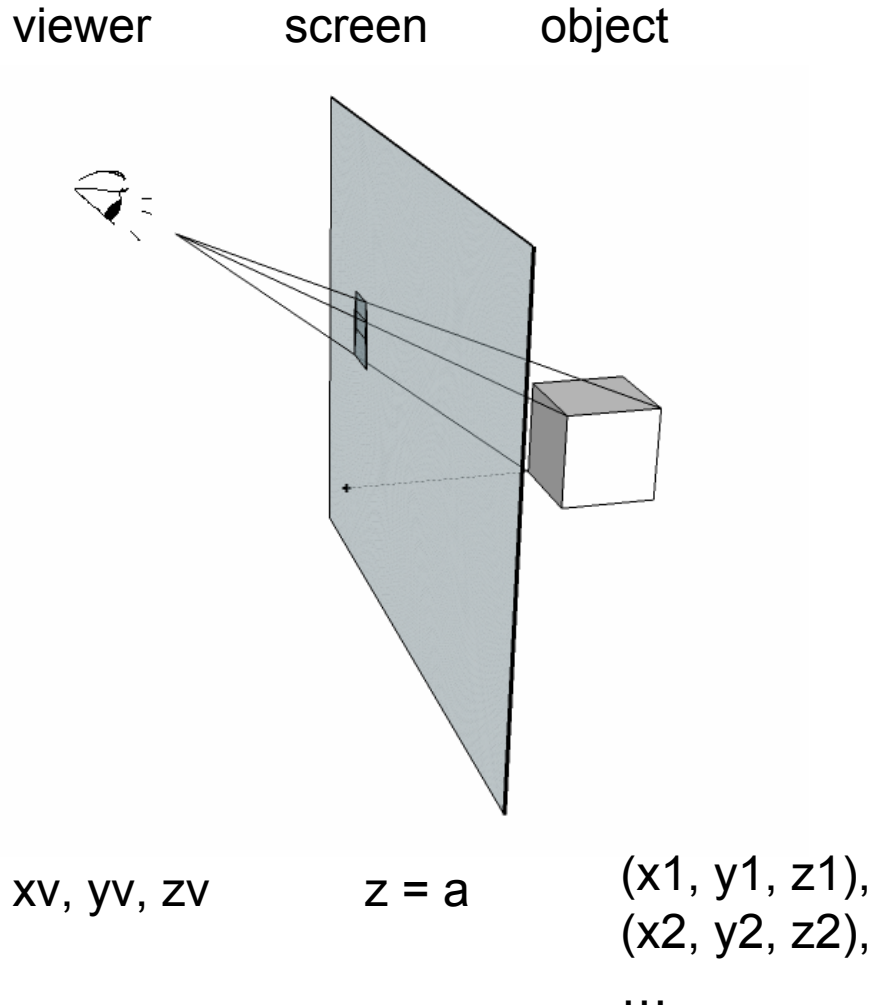- Panning left/right

  $(x', y', z') = (x + a, \quad y, \quad z)$

- Panning up/down

  $(x', y', z') = (x, \quad y, \quad z + a)$

- Zooming in/out

  $(x', y', z') = (x, \quad y + a, \quad z)$

Perspective Projection
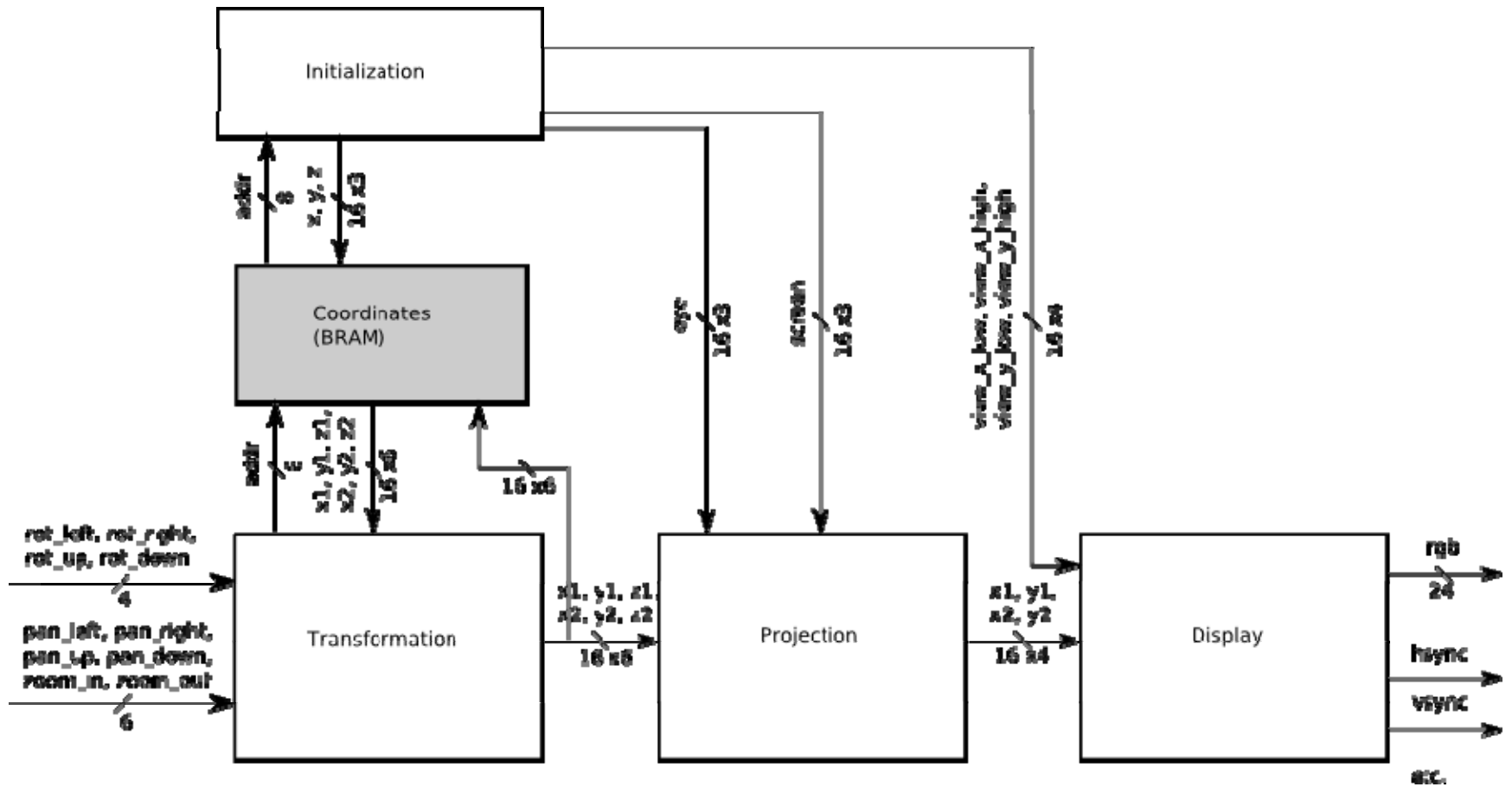
viewer   screen   object

xv, yv, zv   z = a   (x1, y1, z1),
(x2, y2, z2),
…

Projected coordinates
(xp1, yp1) onto screen
z = a:

$$(zv - a) / (zv - z1) =$$
$$(xv - xp1) / (xv - x1) =$$
$$(yv - yp1) / (yv - y1)$$

Solve for xp1, yp1!

Implementation

Display Module