

## CS405 Project 3

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### Task 1:

I modified the draw method in the SceneNode class so that each node's transformation matrix was multiplied by its parent's matrix. This ensures hierarchical transformations. For example, if the Sun rotates, all child nodes will rotate around it. The updated method takes the parent's model view projection and model matrices, multiplies them by the node's local transformation (from TRS), and then passes these updated matrices down to the node's children.

### Task 2:

In the fragment shader, I added calculations for ambient, diffuse and specular lighting inside the meshDrawer code. First, I compute the diffuse term using the dot product of the light direction and the surface normal. Then, for the specular term, I reflected the light vector around the normal and take the dot product with the view direction to create a shiny highlight. Finally, to ensure the specular highlight follows the correct rotation, which is clockwise and matching the planet's orbit, I flipped the X coordinate of the light direction. This tweak reverses the highlight's traversal and makes sure it stays correctly with the Sun rather than rotating independently.

### Task 3:

I inserted a new node for Mars in the HTML file. Mars is created with the same sphere geometry as other planets, but it is applied a different texture. Then I set its translation to -6 on the X-axis relative to the Sun, scale it to 0.35, and place it as a child of the Sun node in the scene graph. In the renderLoop, Mars rotates around its Z-axis at 1.5 times the Sun's rotation speed, creating a new planet that orbits independently but remains attached to the Sun's transformation.