COSC 4370 - Homework 3 Report
Name: Rosy Nguyen PSID: 2028823 October 2022

Phong.frag - Setting up the Phong lighting model

- The model is the combination of three lighting components: ambient, diffuse and specular light.
- Ambient lighting: lights up the cube in all directions st. each surface receive the same amount of light.
  - Set the color of the ambient
  - Set the ambient strength
  - Ambient component = ambient strength * light color
- Diffuse lighting (directional lighting): each surface of the cube receives a different amount of light.
  - The surface facing towards the light source (perpendicular) will be better illuminated.
  - While other surfaces would be darker depend on how the light hit them.
  - Normal vector: the vector that is perpendicular to the cube surface.
  - From the angle between the light ray direction vector and the normal vector, we can identify the impact of the light on each of the cube's surface, using the dot product.
    light direction vector = light position - fragment position
  - Note that the lower the angle between the two vectors, the more dot product is inclined toward 1 and thus if the light ray is perpendicular to the surface i.e. dot product equal 0.
    diffuse strength = dot product (light direction vector, normal vector)
    diffuse component = diffuse strength * light color
- Specular lighting: how the light reflect on the cube's surface.
  - Set the specular intensity (1.0)
  - Calculate the view direction vector, which is the difference vector between the view position (camera position) and the fragment position vector.
  - Get the reflect direction by implementing the built in reflect function. Note that need to reverse the light direction vector to ensure getting the vector from the light to the cube.
    reflect direction = reflect(- light direction, normal vector)
  - Get the dot product of the view direction vector the the reflection direction vector.
  - The more shiny the surface, the smaller the highlight becomes (set shininess value = 64)
    specular component = specular strength * specular dot product * light color
- Then finally, combine the three lighting components together and multiply with the cube's color to get the final result.

Phong.vs - Setting up the position

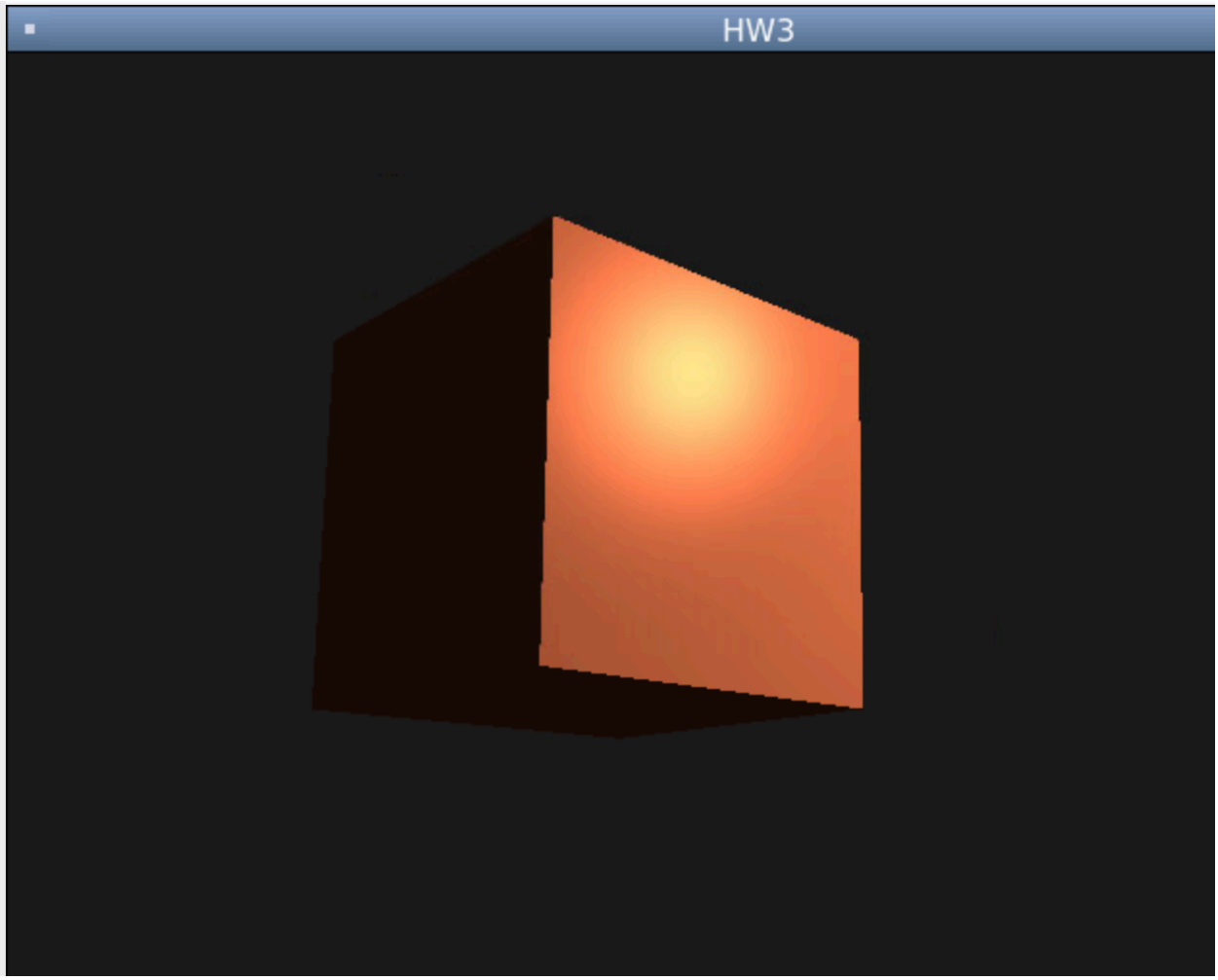
- Getting the actual fragment's position by multiplying the vertex position with the model matrix to transform it to world space coordinates.
- From the pipeline transformation, the order is determined as model trans. > camera (view) trans. > projection trans.
- Therefore, the position is calculated by multiply projection matrix, view matrix, model matrix and the initial position.

Camera.h - Setting up the GetViewMatrix()

- Using the lookat function to build the view.
- The three parameters:
  - Eye vector defines the position of the camera.
  - At vector defines the position where the camera (view) is (looking) pointing at.
  - Up vector defines the up direction of the camera.

main.cpp - Setting up the Projection Matrix()

- Using the perspective projection for the scene.
- The four parameters:
    - The view angle in the y direction (45 degrees)
    - The aspect ratio of width to height (800f / 600f)
    - The distance from the viewer (camera) to the near clipping plane (0.1f)
    - The distance from the viewer (camera) to the far clipping plane (100f)



Reference: learnOpenGl.com (basic lighting, coordinate system)
https://registry.khronos.org/OpenGL-Refpages/gl4/ (gl built in functions)