# **Computer Graphics Assignment #3**

Create cameras from 3 directions & Use Blinn-Phong shading

202021511 소프트웨어학과 조민재

## **Create cameras from 3 directions (front, side, and top)**

I implemented the lookat function to allow viewing from the front (default), left, right, and top perspectives by pressing each button.

  document.getElementById("viewFromFront").onclick = function (e) {

    cameraPos = [0, 0, 3.5];

    viewMatrix = lookAt(cameraPos, targetPos, upVector);

  };

  document.getElementById("viewFromRightSide").onclick = function (e) {

    cameraPos = [3.5, 0, 0];

    viewMatrix = lookAt(cameraPos, targetPos, upVector);

  };

  document.getElementById("viewFromLeftSide").onclick = function (e) {

    cameraPos = [-3.5, 0, 0];

    viewMatrix = lookAt(cameraPos, targetPos, upVector);

  };

  document.getElementById("viewFromUp").onclick = function (e) {

    cameraPos = [0, 5.5, 0.001];

    viewMatrix = lookAt(cameraPos, targetPos, upVector);

  };

For the front view, the camera was positioned at x:0, y:0, z:3.5, and the other views were similarly configured. However, the top view was set with a very small z value of 0.001, because setting it to 0 caused an error. This occurred because the cross product result was [0,0,0] and trying to normalize this resulted in a NaN error, so I used a small value instead.

ㅁ front

그래픽, 그래픽 디자인, 폰트, 로고이(가) 표시된 사진

자동 생성된 설명

ㅁ left side

그래픽, 그래픽 디자인, 디자인이(가) 표시된 사진

자동 생성된 설명

ㅁ right side

그래픽, 상징, 그래픽 디자인, 국기이(가) 표시된 사진

자동 생성된 설명

ㅁ top side

스크린샷이(가) 표시된 사진

자동 생성된 설명

## **Use Blinn-Phong shading to determine the colors of the model.**

To represent triangular plane primitives (each triangle having 3 vertices), I referenced the quad(a,b,c,d) function provided in the lecture materials and created the following functions.

  function triangle(a, b, c) {

    var t1 = subtract(vertices[b], vertices[a]);

    var t2 = subtract(vertices[c], vertices[a]);

    var normal = cross(t1, t2);

    var normal = vec3(normal);

    normal = normalize(normal);

    normalsArray.push(normal);

    normalsArray.push(normal);

    normalsArray.push(normal);

  }

  function computeNormalsForTriangleFan(startOfFANVertices, endOfFANVertices) {

    for (let i = 1; i < endOfFANVertices - 1; i++) {

      const vec1 = subtract(vertices[i], vertices[startOfFANVertices]);

      const vec2 = subtract(vertices[i + 1], vertices[startOfFANVertices]);

      let normal = cross(vec1, vec2);

      normal = normalize(normal);

      normalsArray.push(normal);

      normalsArray.push(normal);

      normalsArray.push(normal);

    }

  }

Using these two functions, I was able to create normal vectors for surfaces formed with gl.TRIANGLES and gl.TRIANGLE\_FAN.

    <script id="vertex-shader" type="x-shader/x-vertex">

        attribute vec4 vPosition;

        attribute vec3 vNormal;

        varying vec4 fColor;

        uniform vec4 ambientProduct, diffuseProduct, specularProduct;

        uniform mat4 modelMatrix;

        uniform mat4 viewMatrix;

        uniform mat4 translationMatrix;

        uniform mat4 initialScaleMatrix;

        uniform mat4 projectionMatrix;

        uniform vec4 lightPosition;

        uniform float shininess;

        mat4 modelViewMatrix = viewMatrix \* translationMatrix \* initialScaleMatrix \* modelMatrix;

        void main()

        {

            vec3 pos = -(modelViewMatrix \* vPosition).xyz;

            vec3 light = lightPosition.xyz;

            vec3 L = normalize( light - pos );

            vec3 E = normalize( -pos );

            vec3 H = normalize( L + E );

            vec4 NN = vec4(vNormal,0);

            vec3 N = normalize( (modelViewMatrix\*NN).xyz);

            vec4 ambient = ambientProduct;

            float d\_val = max( dot(L, N), 0.0 );

            vec4 diffuse = d\_val \*diffuseProduct;

            float s\_val = pow( max(dot(N, H), 0.0), shininess );

            vec4 specular = s\_val \* specularProduct;

            if( dot(L, N) < 0.0 ) {

                specular = vec4(0.0, 0.0, 0.0, 1.0);

            }

            gl\_Position = projectionMatrix \* modelViewMatrix \* vPosition;

            fColor = ambient + diffuse + specular;

            fColor.a = 1.0;

        }

    </script>

In the vertex shader, spatial transformations and lighting calculations were performed for each vertex,

    <script id="fragment-shader" type="x-shader/x-fragment">

        precision mediump float;

        varying vec4 fColor;

        void main()

        {

            gl\_FragColor = fColor;

        }

    </script>

and the results were passed to the fragment shader to determine the colors at the pixel level.

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Thus, the light was reflected to produce colors, but something seems off. The initials reflect light and sparkle, but other primitive surfaces facing the same direction do not sparkle. I think this might be due to not creating the 3D initials perfectly and possibly the positioning of the lights, or there could be an issue with how I created the function for generating normal vectors.