COM3037 – Computer Graphics Homework 1

Name, Surname: Elvin Huseynli **Date: 28.11.2021**

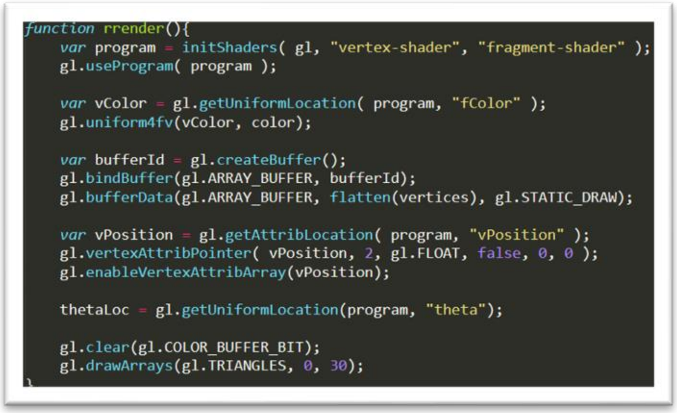
Student Number: 20290122 **Sign:** HuE

Table of Functions

Functionality	**Its purpose**
Rotate	Rotate Letters counter-clockwise
Change Direction	Change rotating direction opposite
Change Color	Change the color of current letters
Change speed	It speeds up or down rotation speed
Move X	Translate letters together in X axis
Move Y	Translate letters together in Y axis
Move XF	Translate first letter in X axis
Move YF	Translate first letter in Y axis
Move XS	Translate second letter in X axis
Move YS	Translate second letter in Y axis
Scale	Scale letters together
Scale F	Scale the first letter
Scale S	Scale the second letter

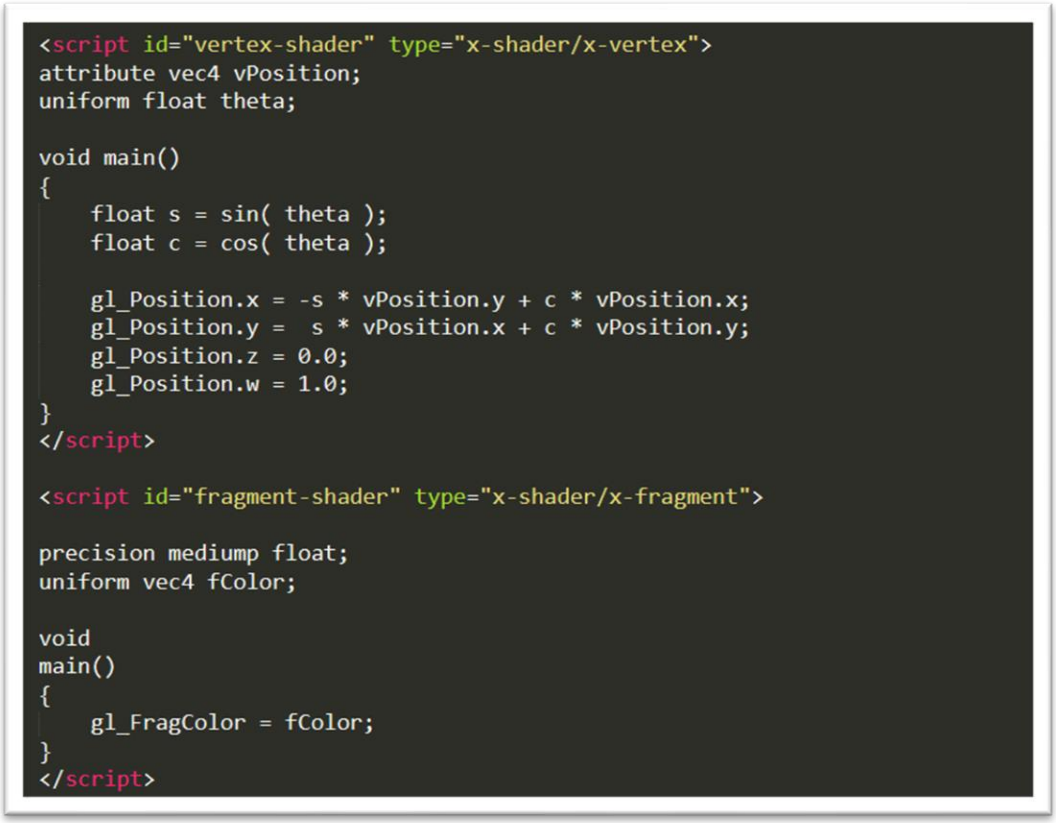
1. Drawing Letters

Letters are drawn by using TRIANGLES. By defining all the vertices, a vertices array is used to be utilized for other functions in (Figure.1). There is also a color array that is used to get a random color for the initialized letters (Figure.2). There is a **rrender()** function that initializes the buffer data.



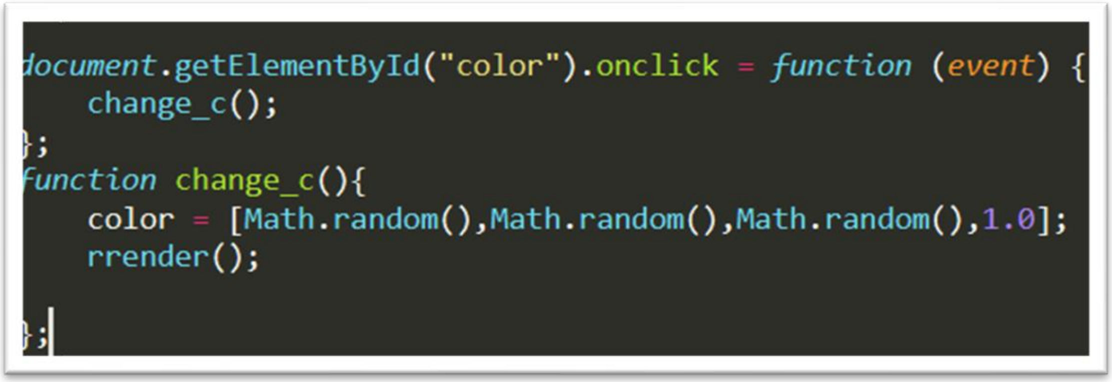
```
function rrender(){
    var program = initShaders( gl, "vertex-shader", "fragment-shader" );
    gl.useProgram( program );

    var vColor = gl.getUniformLocation( program, "fColor" );
    gl.uniform4fv(vColor, color);

    var bufferId = gl.createBuffer();
    gl.bindBuffer(gl.ARRAY_BUFFER, bufferId);
    gl.bufferData(gl.ARRAY_BUFFER, flatten(vertices), gl.STATIC_DRAW);

    var vPosition = gl.getAttribLocation( program, "vPosition" );
    gl.vertexAttribPointer( vPosition, 2, gl.FLOAT, false, 0, 0 );
    gl.enableVertexAttribArray(vPosition);

    thetaLoc = gl.getUniformLocation(program, "theta");

    gl.clear(gl.COLOR_BUFFER_BIT);
    gl.drawArrays(gl.TRIANGLES, 0, 30);
}
```

Also there are **fragment-shader** and **vertex-shader** functions in html file written in webgl.



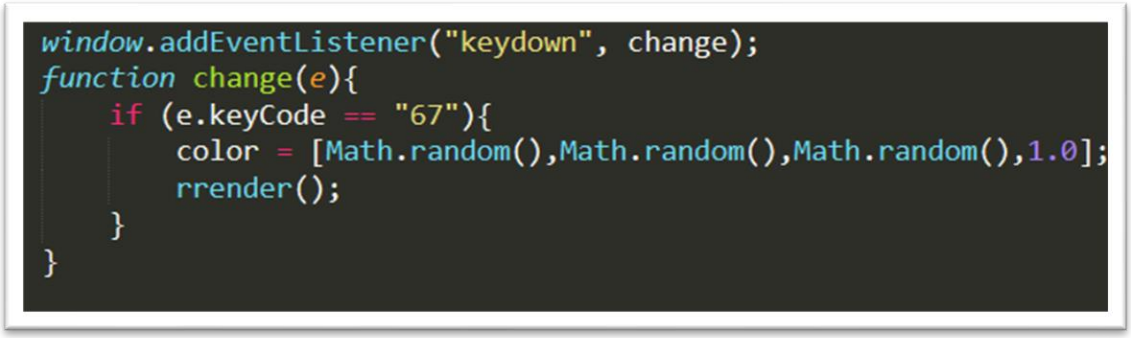
```
<script id="vertex-shader" type="x-shader/x-vertex">
attribute vec4 vPosition;
uniform float theta;

void main()
{
    float s = sin( theta );
    float c = cos( theta );

    gl_Position.x = -s * vPosition.y + c * vPosition.x;
    gl_Position.y =  s * vPosition.x + c * vPosition.y;
    gl_Position.z = 0.0;
    gl_Position.w = 1.0;
}
</script>

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

precision mediump float;
uniform vec4 fColor;

void
main()
{
    gl_FragColor = fColor;
}
</script>
```

2. Changing Color
   By using “Change Color” button and “c” key on keyboard, color of letters can be changed randomly. For changing color with button, below script and function are used:



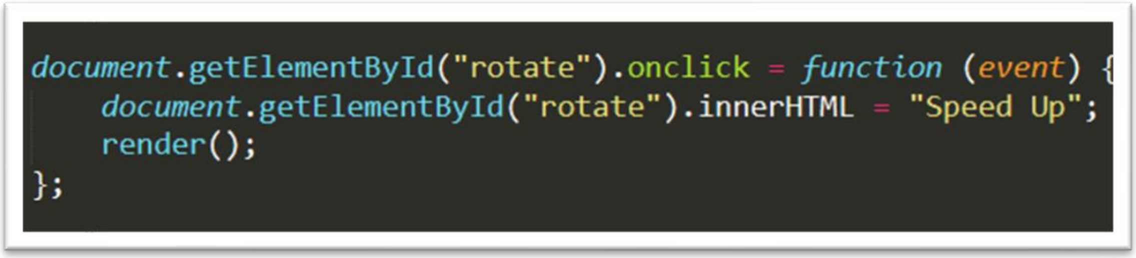
```
document.getElementById("color").onclick = function (event) {
    change_c();
};
function change_c(){
    color = [Math.random(),Math.random(),Math.random(),1.0];
    rrender();

};
```

For changing color with key, below script and function are used:

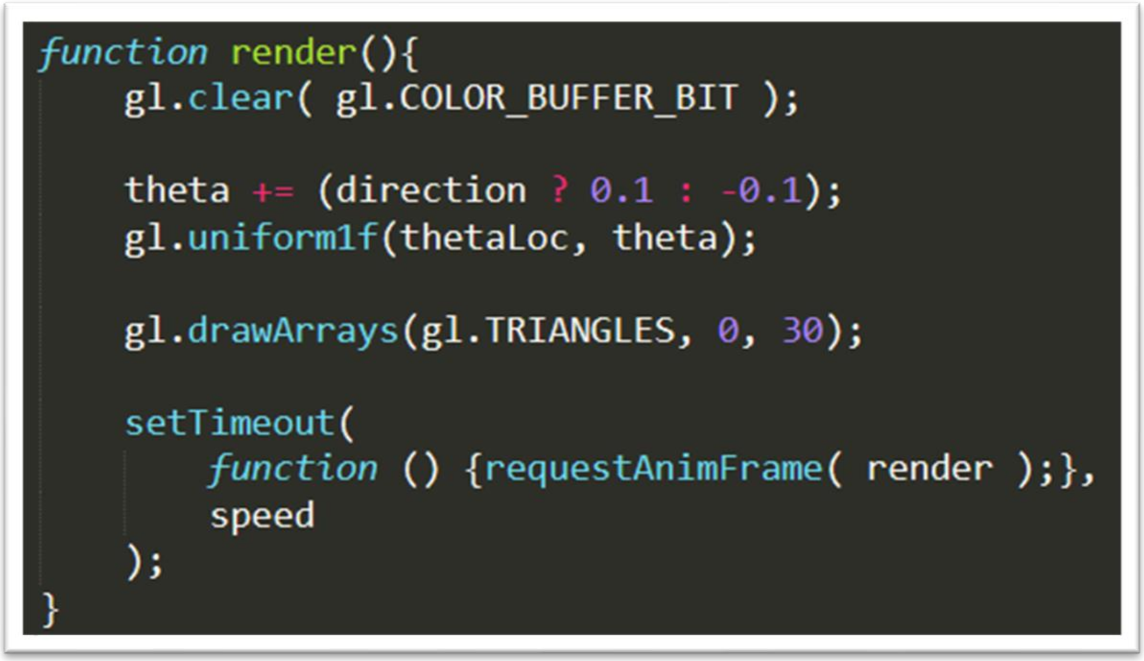


```
window.addEventListener("keydown", change);
function change(e){
    if (e.keyCode == "67"){
        color = [Math.random(),Math.random(),Math.random(),1.0];
        rrender();
    }
}
```

3. Rotating
   By using “Rotate” button, letters are rotated together. Also when this button is pressed, the content changes to “Speed up” and it speeds up the current speed. Below script and function are used:

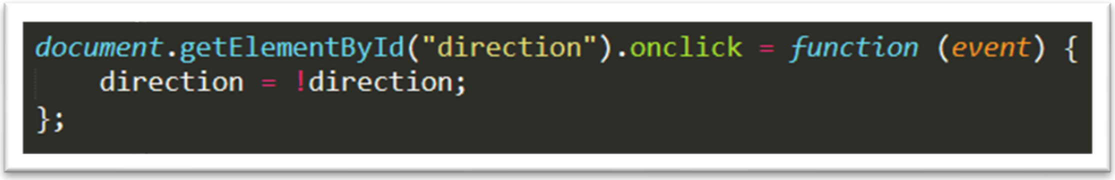


```
document.getElementById("rotate").onclick = function (event) {
    document.getElementById("rotate").innerHTML = "Speed Up";
    render();
};
```



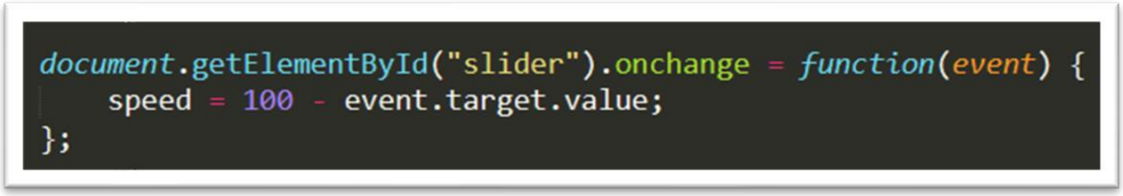
```
function render(){
    gl.clear( gl.COLOR_BUFFER_BIT );

    theta += (direction ? 0.1 : -0.1);
    gl.uniform1f(thetaLoc, theta);

    gl.drawArrays(gl.TRIANGLES, 0, 30);

    setTimeout(
        function () {requestAnimFrame( render );},
        speed
    );
}
```

4. Change Direction
   For changing direction, “Change Direction” button is used. Below script is used:



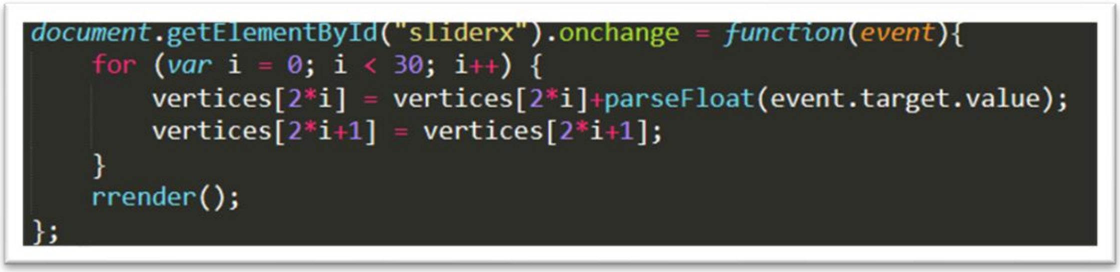
```
document.getElementById("direction").onclick = function (event) {
    direction = !direction;
};
```

5. Change Speed
   To change or initialize the speed of rotation, “Change Speed” slider is used. When it is slided to rightmost side, its speed increases, and when it is slided to the leftmost side, its speed decreases compared to the current speed. Below script is used:



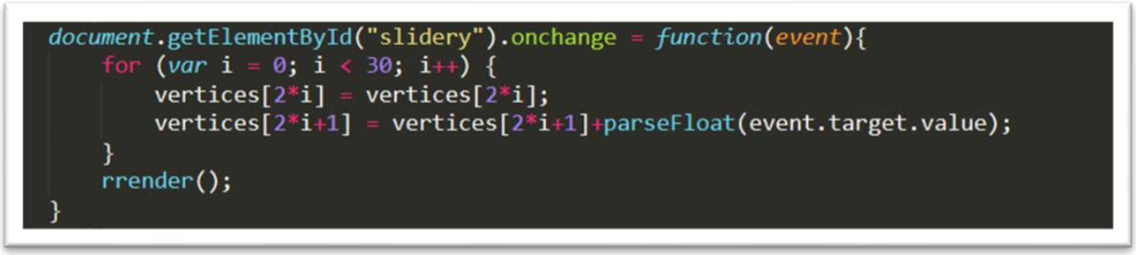
```
document.getElementById("slider").onchange = function(event) {
    speed = 100 - event.target.value;
};
```

6. Move X
   To translate letters together on X axis by sliding it to right and left, below script is used:



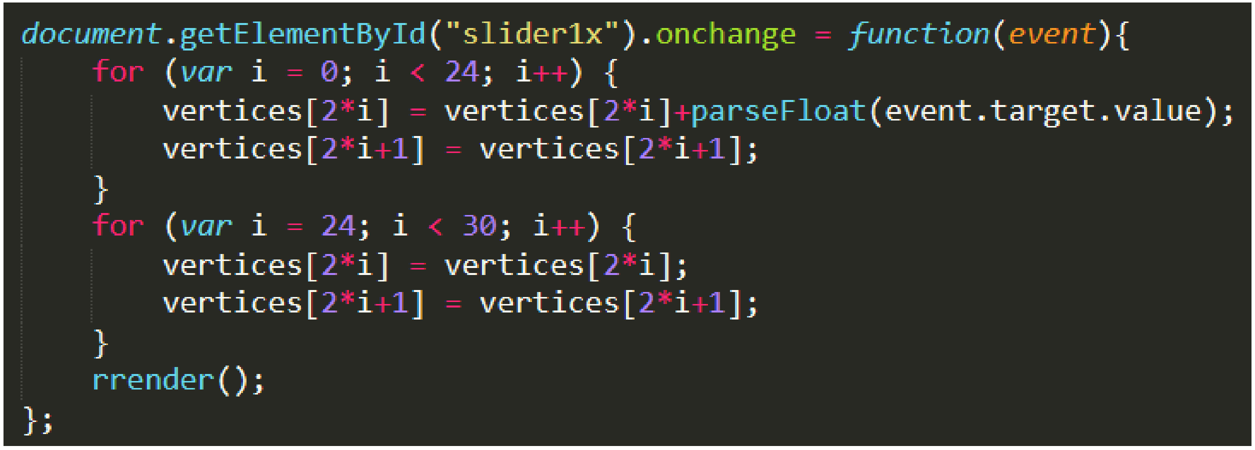
```
document.getElementById("sliderx").onchange = function(event){
    for (var i = 0; i < 30; i++) {
        vertices[2*i] = vertices[2*i]+parseFloat(event.target.value);
        vertices[2*i+1] = vertices[2*i+1];
    }
    rrender();
};
```

7. Move Y
   To translate letters together on Y axis by sliding it to right and left, below script is used:



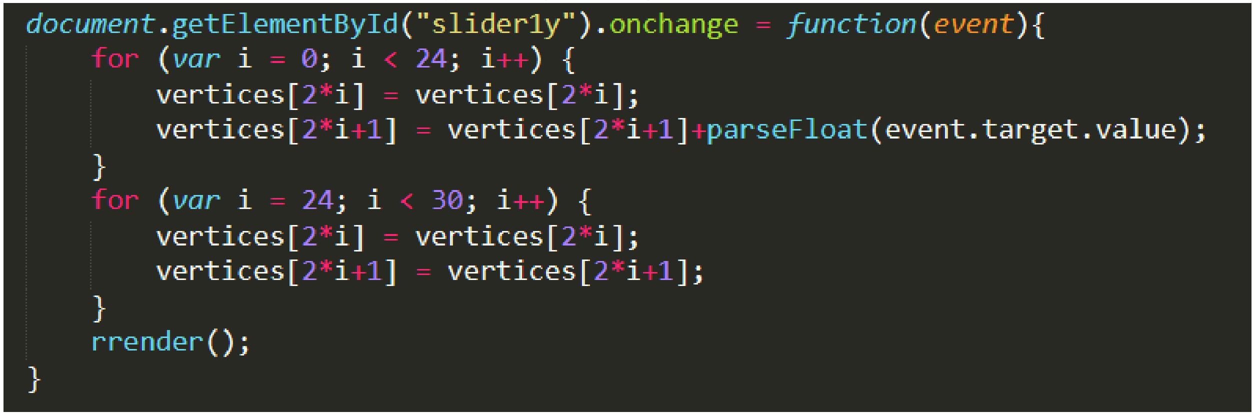
```
document.getElementById("slidery").onchange = function(event){
    for (var i = 0; i < 30; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1]+parseFloat(event.target.value);
    }
    rrender();
}
```

8. Move XF
   To translate first letter on X axis by sliding it to right and left, below script is used:



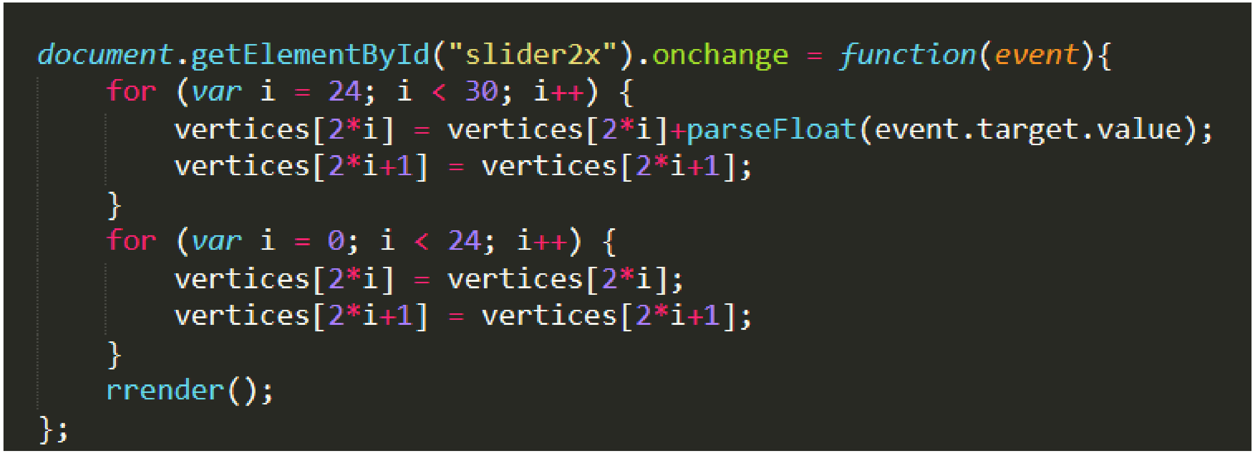
```
document.getElementById("slider1x").onchange = function(event){
    for (var i = 0; i < 24; i++) {
        vertices[2*i] = vertices[2*i]+parseFloat(event.target.value);
        vertices[2*i+1] = vertices[2*i+1];
    }
    for (var i = 24; i < 30; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1];
    }
    rrender();
};
```

9. Move YF
   To translate first letter on Y axis by sliding it to right and left, below script is used:



```
document.getElementById("slider1y").onchange = function(event){
    for (var i = 0; i < 24; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1]+parseFloat(event.target.value);
    }
    for (var i = 24; i < 30; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1];
    }
    rrender();
}
```

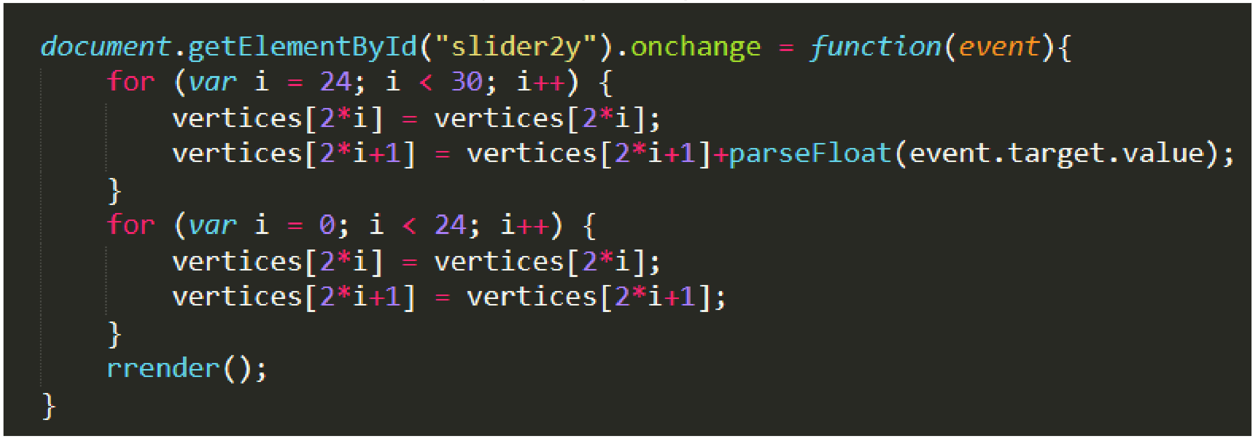
10. Move XS
    To translate second letter on X axis by sliding it to right and left, below script is used:



```
document.getElementById("slider2x").onchange = function(event){
    for (var i = 24; i < 30; i++) {
        vertices[2*i] = vertices[2*i]+parseFloat(event.target.value);
        vertices[2*i+1] = vertices[2*i+1];
    }
    for (var i = 0; i < 24; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1];
    }
    rrender();
};
```

11. Move YS

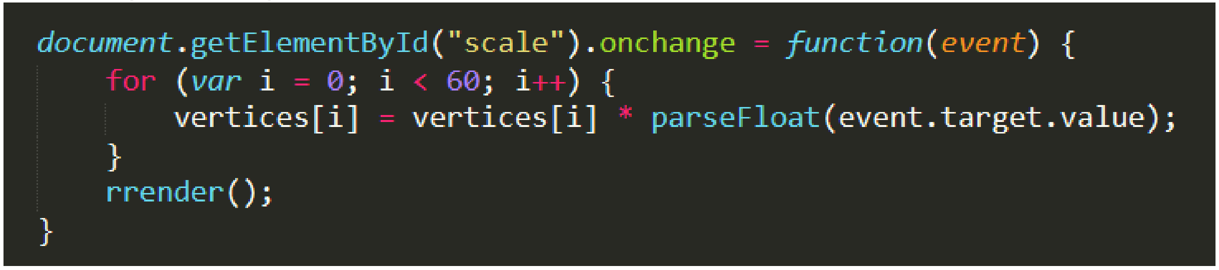
To translate second letter on Y axis by sliding it to right and left, below script is used:



```
document.getElementById("slider2y").onchange = function(event){
    for (var i = 24; i < 30; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1]+parseFloat(event.target.value);
    }
    for (var i = 0; i < 24; i++) {
        vertices[2*i] = vertices[2*i];
        vertices[2*i+1] = vertices[2*i+1];
    }
    rrender();
}
```

12. Scale

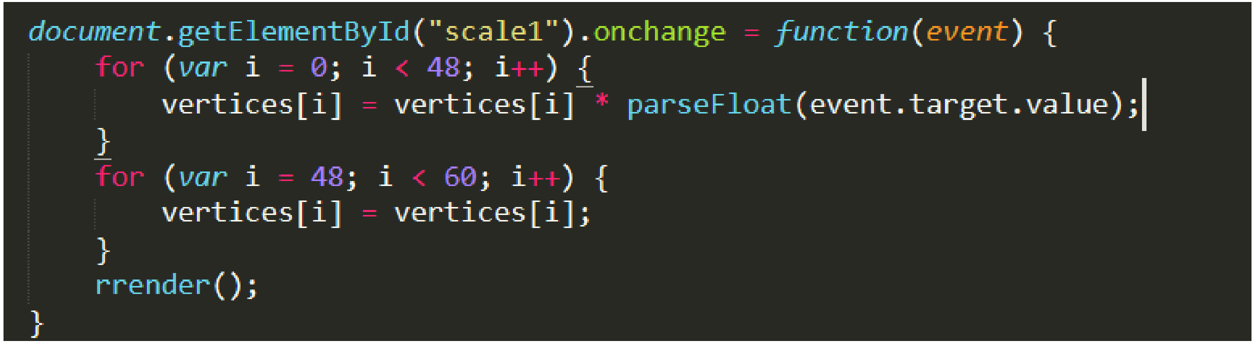
This function is used to scale the letters together to a value with the help of “Scale” button. When it is slided to the rightmost and leftmost side, the letters get n times larger (according to the target value of slided position). Below script is used:



```
document.getElementById("scale").onchange = function(event) {
    for (var i = 0; i < 60; i++) {
        vertices[i] = vertices[i] * parseFloat(event.target.value);
    }
    rrender();
}
```

13. Scale F

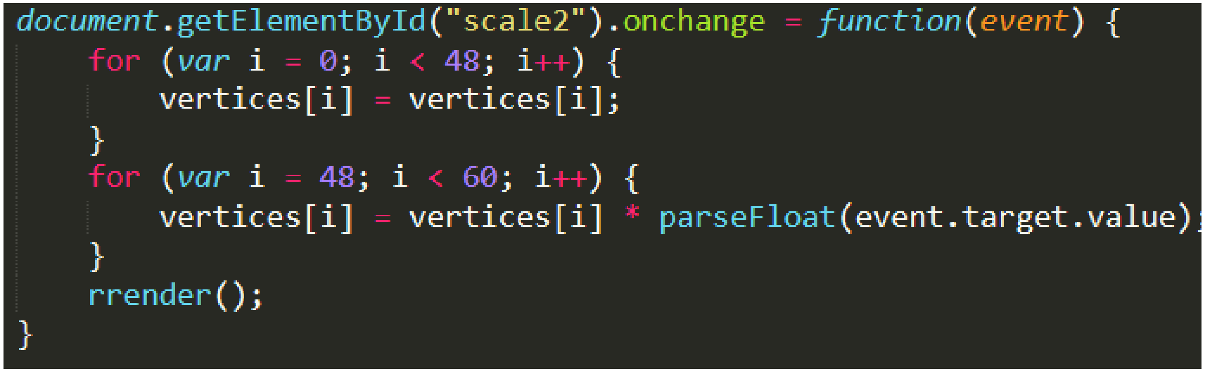
This function is used to scale the first letter to a value with the help of “Scale” button. When it is slided to the rightmost and leftmost side, the letters get n times larger (according to the target value of slided position). Below script is used:



```
document.getElementById("scale1").onchange = function(event) {
    for (var i = 0; i < 48; i++) {
        vertices[i] = vertices[i] * parseFloat(event.target.value);
    }
    for (var i = 48; i < 60; i++) {
        vertices[i] = vertices[i];
    }
    rrender();
}
```

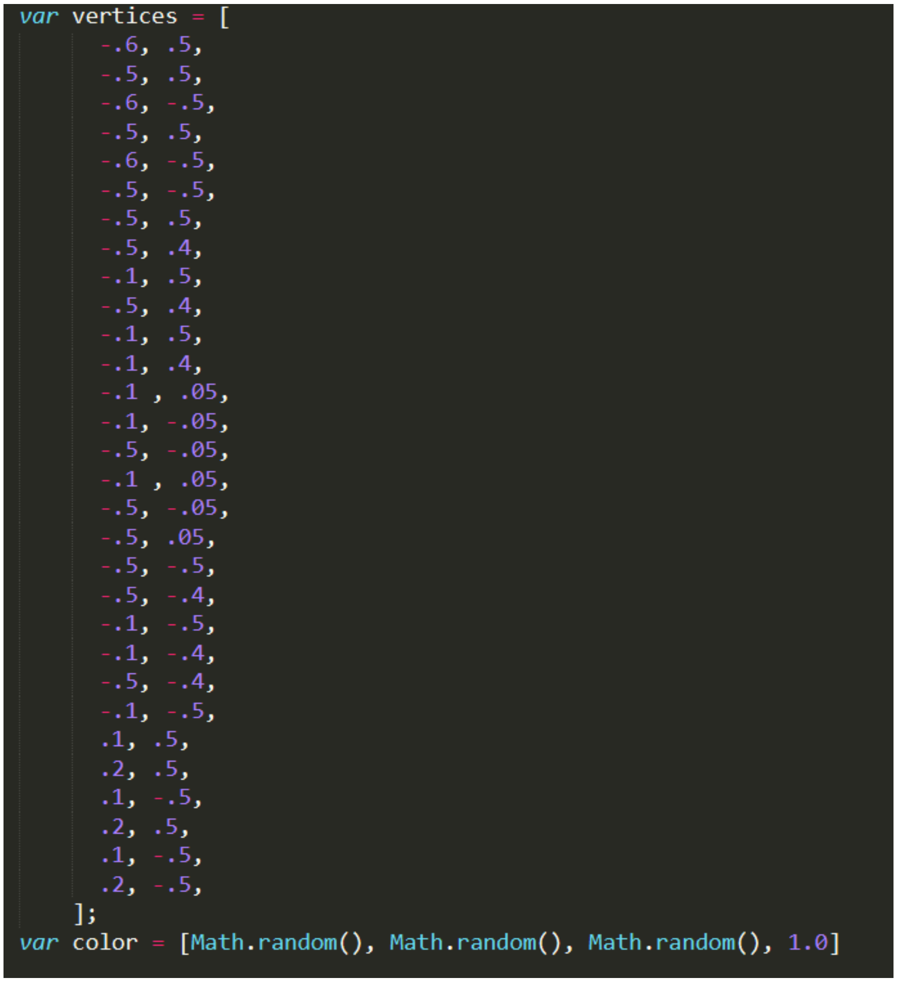
14. Scale S

This function is used to scale the second letter to a value with the help of “Scale” button. When it is slided to the rightmost and leftmost side, the letters get n times larger (according to the target value of slided position). Below script is used:



```
document.getElementById("scale2").onchange = function(event) {
    for (var i = 0; i < 48; i++) {
        vertices[i] = vertices[i];
    }
    for (var i = 48; i < 60; i++) {
        vertices[i] = vertices[i] * parseFloat(event.target.value);
    }
    rrender();
}
```

Following code part defines the vertices and colors:



```
var vertices = [
        -.6, .5,
        -.5, .5,
        -.6, -.5,
        -.5, .5,
        -.6, -.5,
        -.5, -.5,
        -.5, .5,
        -.5, .4,
        -.1, .5,
        -.5, .4,
        -.1, .5,
        -.1, .4,
        -.1 , .05,
        -.1, -.05,
        -.5, -.05,
        -.1 , .05,
        -.5, -.05,
        -.5, .05,
        -.5, -.5,
        -.5, -.4,
        -.1, -.5,
        -.1, -.4,
        -.5, -.4,
        -.1, -.5,
        .1, .5,
        .2, .5,
        .1, -.5,
        .2, .5,
        .1, -.5,
        .2, -.5,
    ];
var color = [Math.random(), Math.random(), Math.random(), 1.0]
```

Figure 1 & 2.