# 森林演唱会设计报告

## 一 功能详细描述

### 1.1 缩放功能

通过鼠标齿轮的操控，可实现画面的缩放。

### 1.2 平移功能

键盘方向键（上下左右键）操作，鼠标右键长按，两者均可实现平移操作。

### 1.3 视角转换

鼠标左键长按，视角转换。

### 1.4 音频播放

加载完成网页后音乐自动播放

### 1.5 动画功能

实现伴舞角色，挥动的荧光棒，不同方向转动的立方体显示屏

### 1.6 舞台灯光

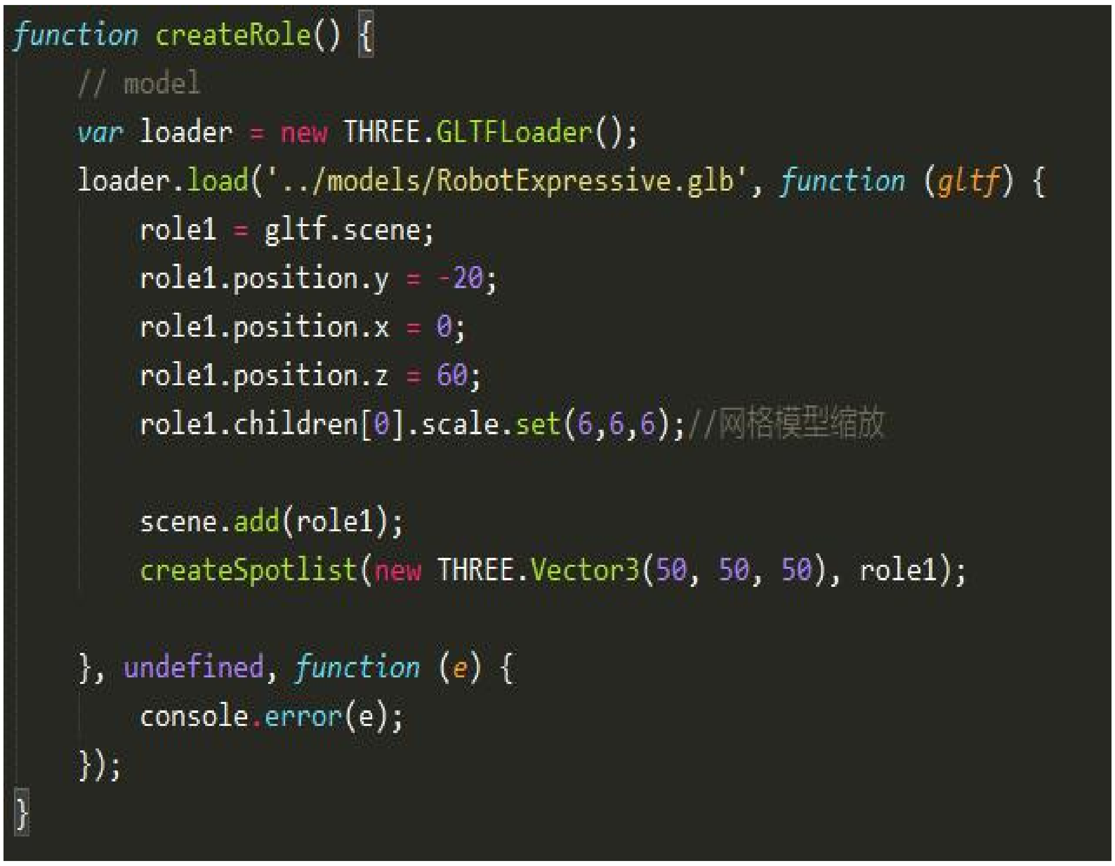
设置舞台灯光跟随任务进行移动，给人物添加舞台灯光的效果

# 二 核心代码清单

设计所采用的实现工具为 IntelliJ IDEA，开发环境为 web 及 webgl，主要工具库：基于 Three.js 库，主要包括 three.js、dat.gui.min.js、OrbitControls.js、util.js、GLTFLoader.js。

## 2.1 实现人物模型导入模块

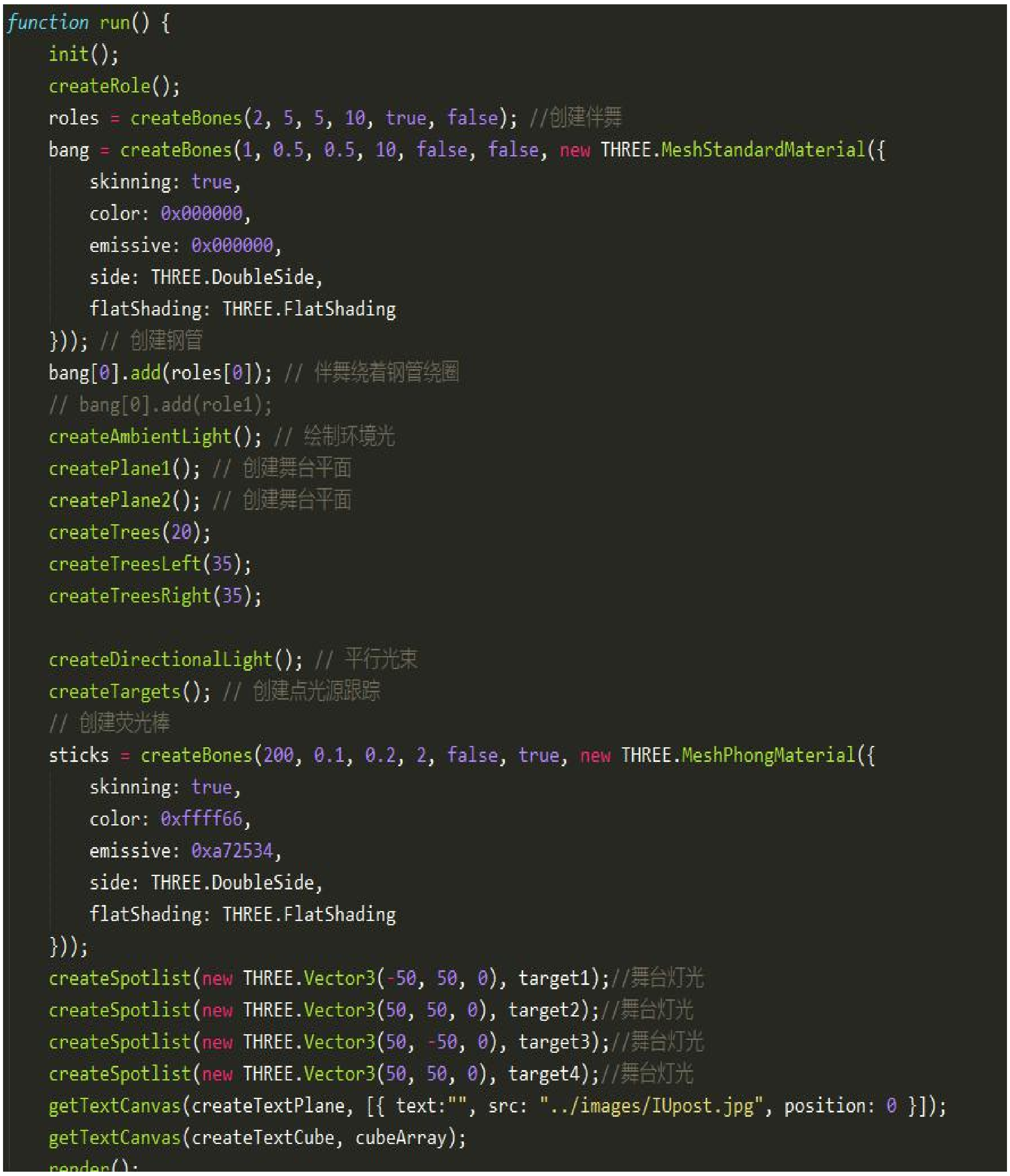
在 createRole()函数中，实现对 glb 模型的加载，设置导入模型的位置，为其添加点光源。



```
function createRole() {
    // model
    var loader = new THREE.GLTFLoader();
    loader.load('../models/RobotExpressive.glb', function (gltf) {
        role1 = gltf.scene;
        role1.position.y = -20;
        role1.position.x = 0;
        role1.position.z = 60;
        role1.children[0].scale.set(6,6,6);//网格模型缩放

        scene.add(role1);
        createSpotlist(new THREE.Vector3(50, 50, 50), role1);

    }, undefined, function (e) {
        console.error(e);
    });
}
```

## 2.2.主要内容的创建

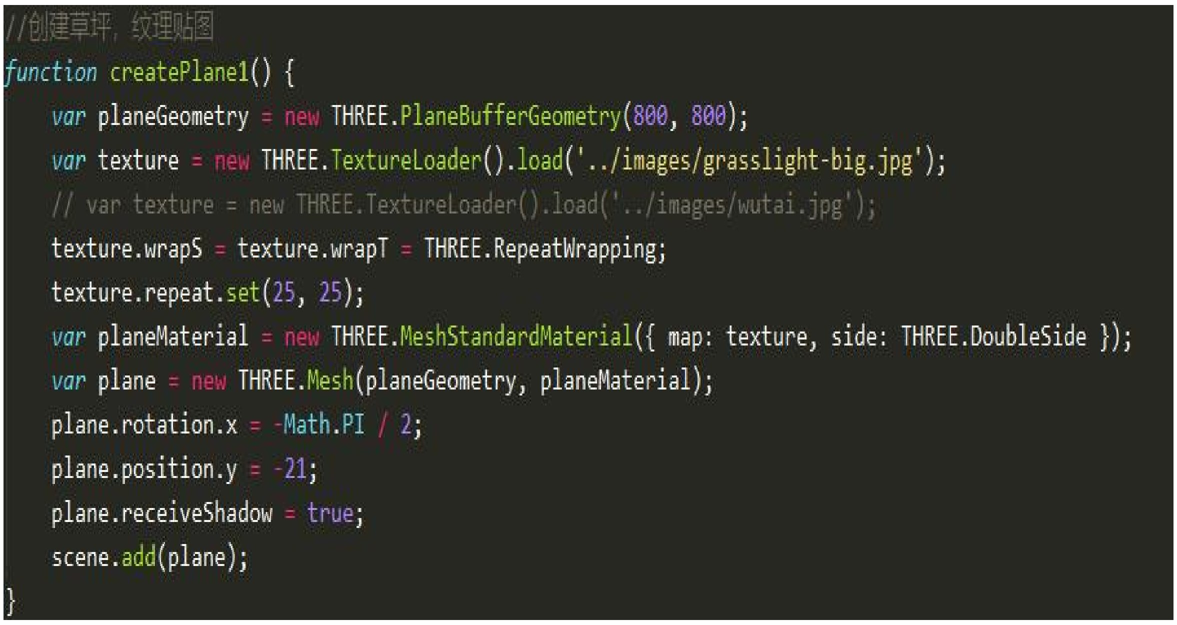
在 run()函数中，进行初始化，创建主角、伴舞、钢管、舞台、舞台灯光及荧光棒。



```
function run() {
    init();
    createRole();
    roles = createBones(2, 5, 5, 10, true, false); //创建伴舞
    bang = createBones(1, 0.5, 0.5, 10, false, false, new THREE.MeshStandardMaterial({
        skinning: true,
        color: 0x000000,
        emissive: 0x000000,
        side: THREE.DoubleSide,
        flatShading: THREE.FlatShading
    })); // 创建钢管
    bang[0].add(roles[0]); // 伴舞绕着钢管绕圈
    // bang[0].add(role1);
    createAmbientLight(); // 绘制环境光
    createPlane1(); // 创建舞台平面
    createPlane2(); // 创建舞台平面
    createTrees(20);
    createTreesLeft(35);
    createTreesRight(35);

    createDirectionalLight(); // 平行光束
    createTargets(); // 创建点光源跟踪
    // 创建荧光棒
    sticks = createBones(200, 0.1, 0.2, 2, false, true, new THREE.MeshPhongMaterial({
        skinning: true,
        color: 0xffff66,
        emissive: 0xa72534,
        side: THREE.DoubleSide,
        flatShading: THREE.FlatShading
    }));
    createSpotlist(new THREE.Vector3(-50, 50, 0), target1);//舞台灯光
    createSpotlist(new THREE.Vector3(50, 50, 0), target2);//舞台灯光
    createSpotlist(new THREE.Vector3(50, -50, 0), target3);//舞台灯光
    createSpotlist(new THREE.Vector3(50, 50, 0), target4);//舞台灯光
    getTextCanvas(createTextPlane, [{ text:"", src: "../images/IUpost.jpg", position: 0 }]);
    getTextCanvas(createTextCube, cubeArray);
    render();
```

## 2.3.创建森林地面

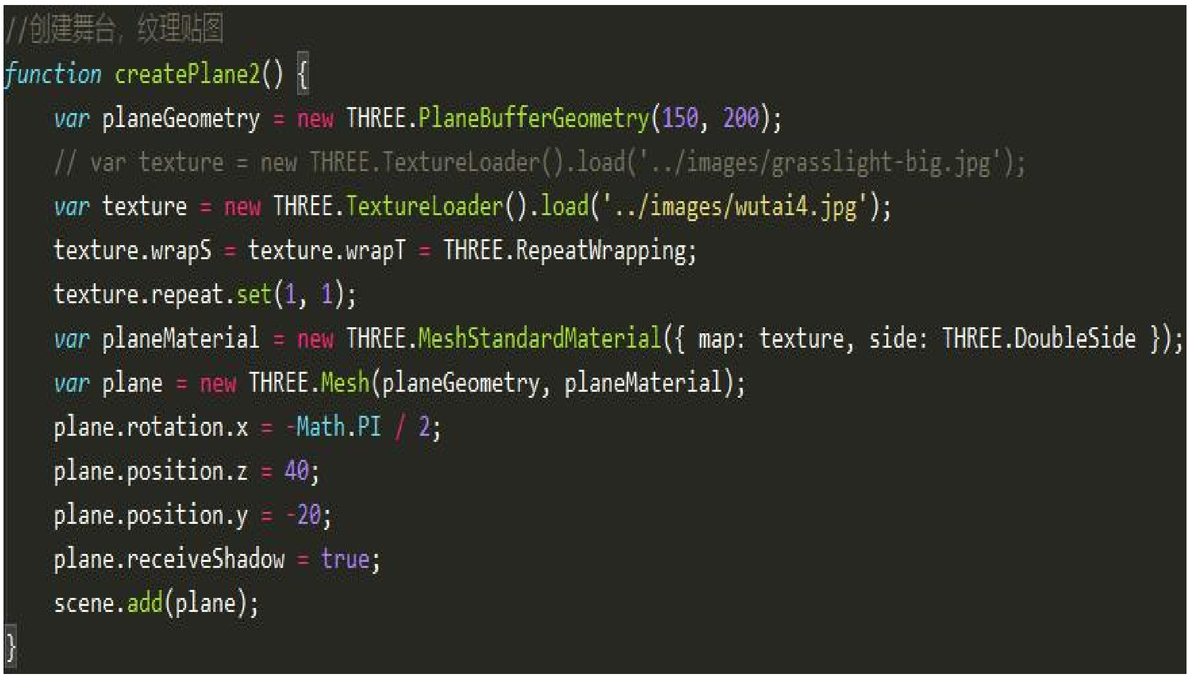
在 createPlane1（）这个函数中，实现对森林的纹理贴图的加载及其相关设置（大小，纹理重复，位置，阴影等）。



```
//创建草坪，纹理贴图
function createPlane1() {
    var planeGeometry = new THREE.PlaneBufferGeometry(800, 800);
    var texture = new THREE.TextureLoader().load('../images/grasslight-big.jpg');
    // var texture = new THREE.TextureLoader().load('../images/wutai.jpg');
    texture.wrapS = texture.wrapT = THREE.RepeatWrapping;
    texture.repeat.set(25, 25);
    var planeMaterial = new THREE.MeshStandardMaterial({ map: texture, side: THREE.DoubleSide });
    var plane = new THREE.Mesh(planeGeometry, planeMaterial);
    plane.rotation.x = -Math.PI / 2;
    plane.position.y = -21;
    plane.receiveShadow = true;
    scene.add(plane);
}
```

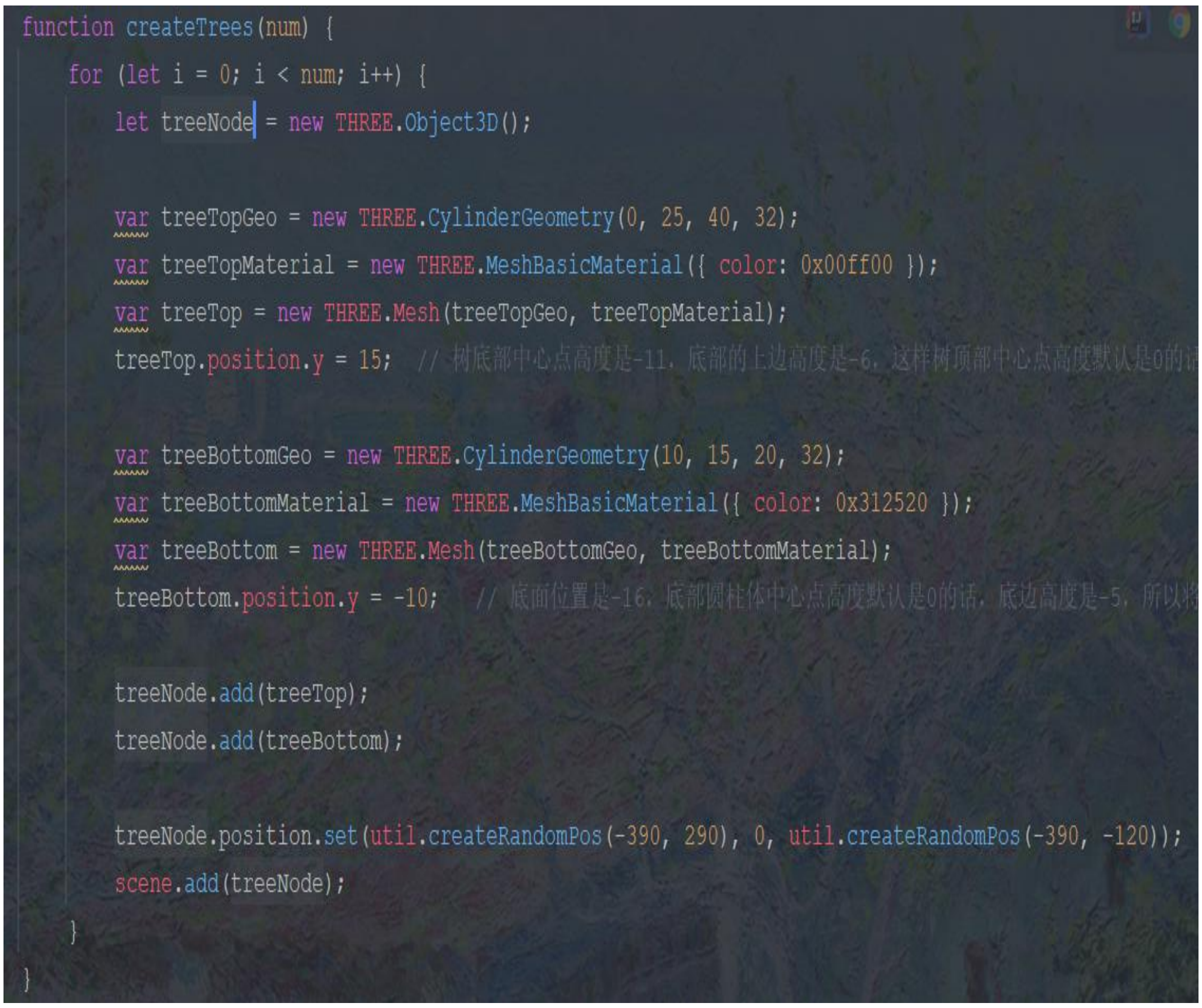
## 2.4.创建舞台纹理

在 createPlane2()这个函数中，加载作为舞台的纹理贴图，并对其进行相关设置（大小，纹理重复，位置，阴影等）。

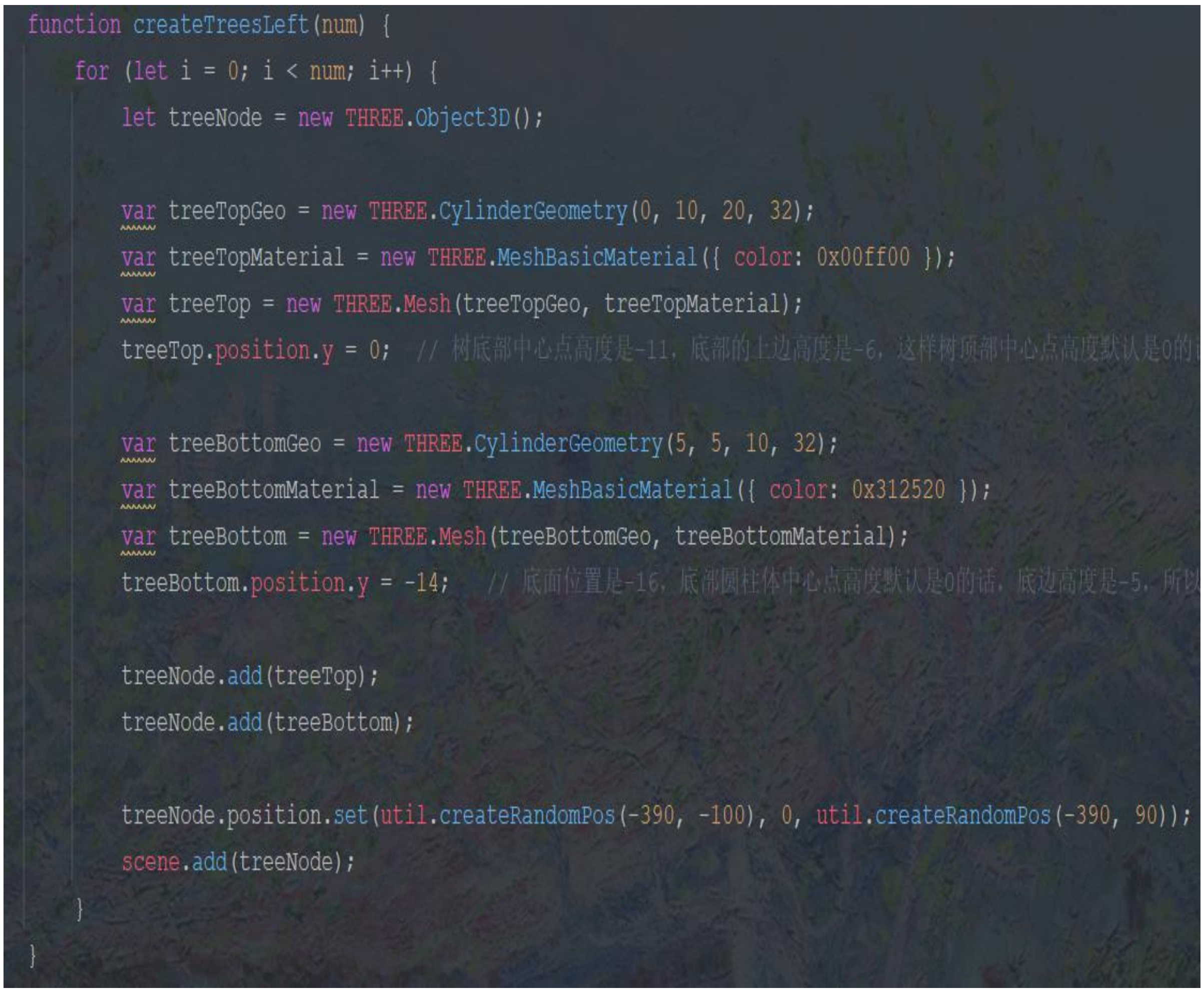

```
//创建舞台，纹理贴图
function createPlane2() {
    var planeGeometry = new THREE.PlaneBufferGeometry(150, 200);
    // var texture = new THREE.TextureLoader().load('../images/grasslight-big.jpg');
    var texture = new THREE.TextureLoader().load('../images/wutai4.jpg');
    texture.wrapS = texture.wrapT = THREE.RepeatWrapping;
    texture.repeat.set(1, 1);
    var planeMaterial = new THREE.MeshStandardMaterial({ map: texture, side: THREE.DoubleSide });
    var plane = new THREE.Mesh(planeGeometry, planeMaterial);
    plane.rotation.x = -Math.PI / 2;
    plane.position.z = 40;
    plane.position.y = -20;
    plane.receiveShadow = true;
    scene.add(plane);
}
```

## 2.5.创建森林

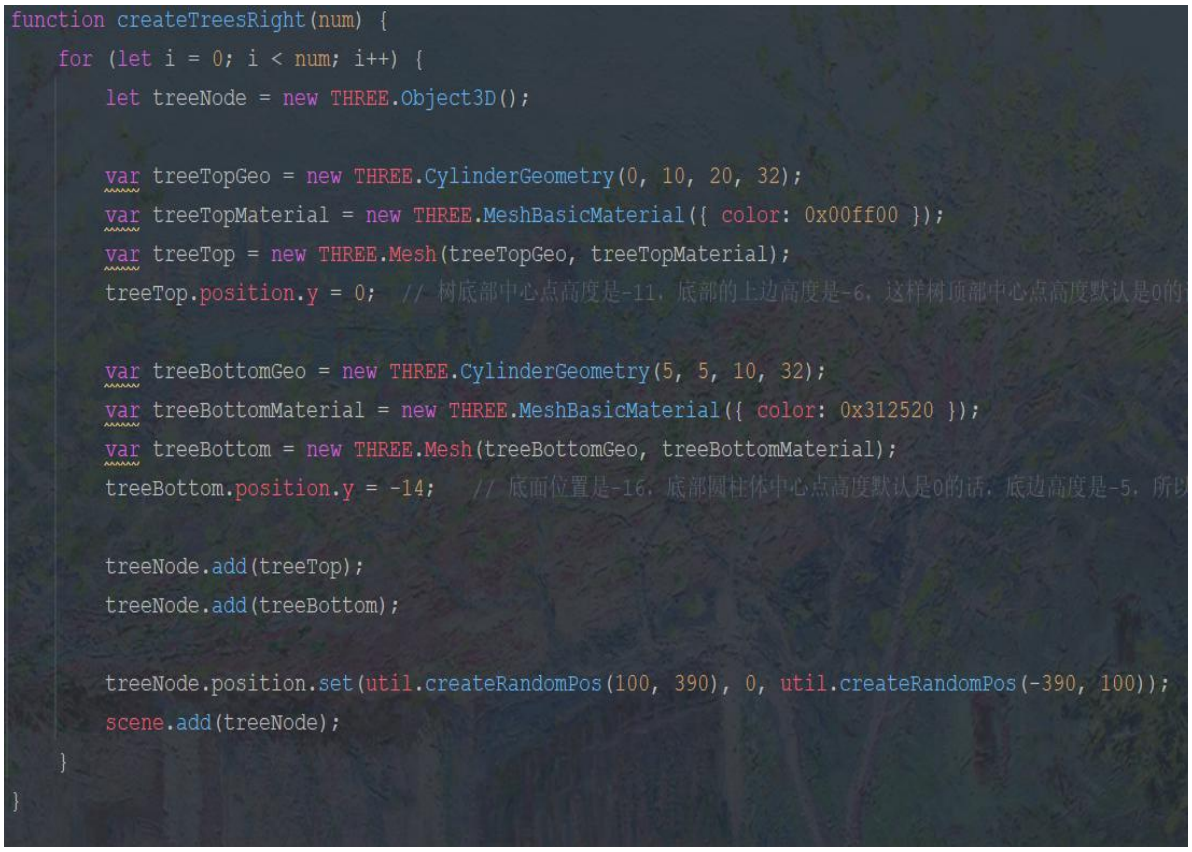
在 createTrees（num）这个函数中，创建 3d 树，在加载的 canva 的时候随机生成树的位置。



```
function createTrees(num) {
    for (let i = 0; i < num; i++) {
        let treeNode = new THREE.Object3D();

        var treeTopGeo = new THREE.CylinderGeometry(0, 25, 40, 32);
        var treeTopMaterial = new THREE.MeshBasicMaterial({ color: 0x00ff00 });
        var treeTop = new THREE.Mesh(treeTopGeo, treeTopMaterial);
        treeTop.position.y = 15;  // 树底部中心点高度是-11，底部的上边高度是-6，这样树顶部中心点高度默认是0的话

        var treeBottomGeo = new THREE.CylinderGeometry(10, 15, 20, 32);
        var treeBottomMaterial = new THREE.MeshBasicMaterial({ color: 0x312520 });
        var treeBottom = new THREE.Mesh(treeBottomGeo, treeBottomMaterial);
        treeBottom.position.y = -10;   // 底面位置是-16，底部圆柱体中心点高度默认是0的话，底边高度是-5，所以将

        treeNode.add(treeTop);
        treeNode.add(treeBottom);

        treeNode.position.set(util.createRandomPos(-390, 290), 0, util.createRandomPos(-390, -120));
        scene.add(treeNode);
    }
}
```

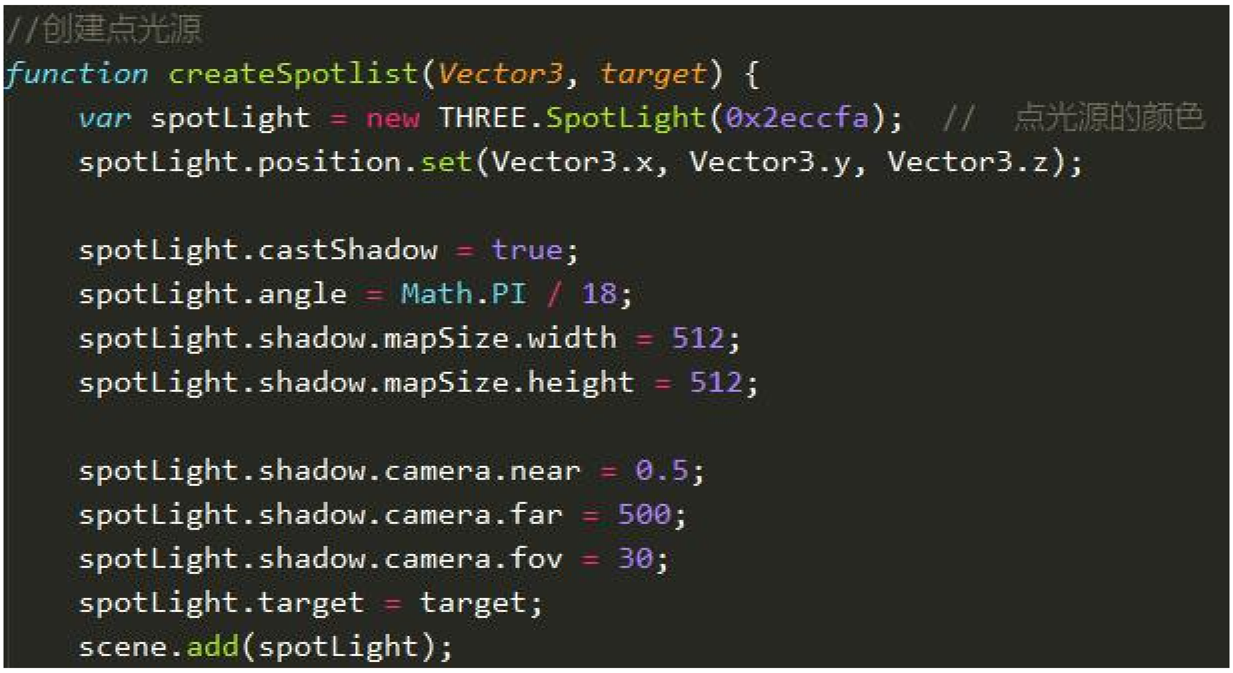


```javascript
function createTreesLeft(num) {
    for (let i = 0; i < num; i++) {
        let treeNode = new THREE.Object3D();

        var treeTopGeo = new THREE.CylinderGeometry(0, 10, 20, 32);
        var treeTopMaterial = new THREE.MeshBasicMaterial({ color: 0x00ff00 });
        var treeTop = new THREE.Mesh(treeTopGeo, treeTopMaterial);
        treeTop.position.y = 0;  // 树底部中心点高度是-11，底部的上边高度是-6，这样树顶部中心点高度默认是0的

        var treeBottomGeo = new THREE.CylinderGeometry(5, 5, 10, 32);
        var treeBottomMaterial = new THREE.MeshBasicMaterial({ color: 0x312520 });
        var treeBottom = new THREE.Mesh(treeBottomGeo, treeBottomMaterial);
        treeBottom.position.y = -14;   // 底面位置是-16，底部圆柱体中心点高度默认是0的话，底边高度是-5，所以

        treeNode.add(treeTop);
        treeNode.add(treeBottom);

        treeNode.position.set(util.createRandomPos(-390, -100), 0, util.createRandomPos(-390, 90));
        scene.add(treeNode);
    }
}
```



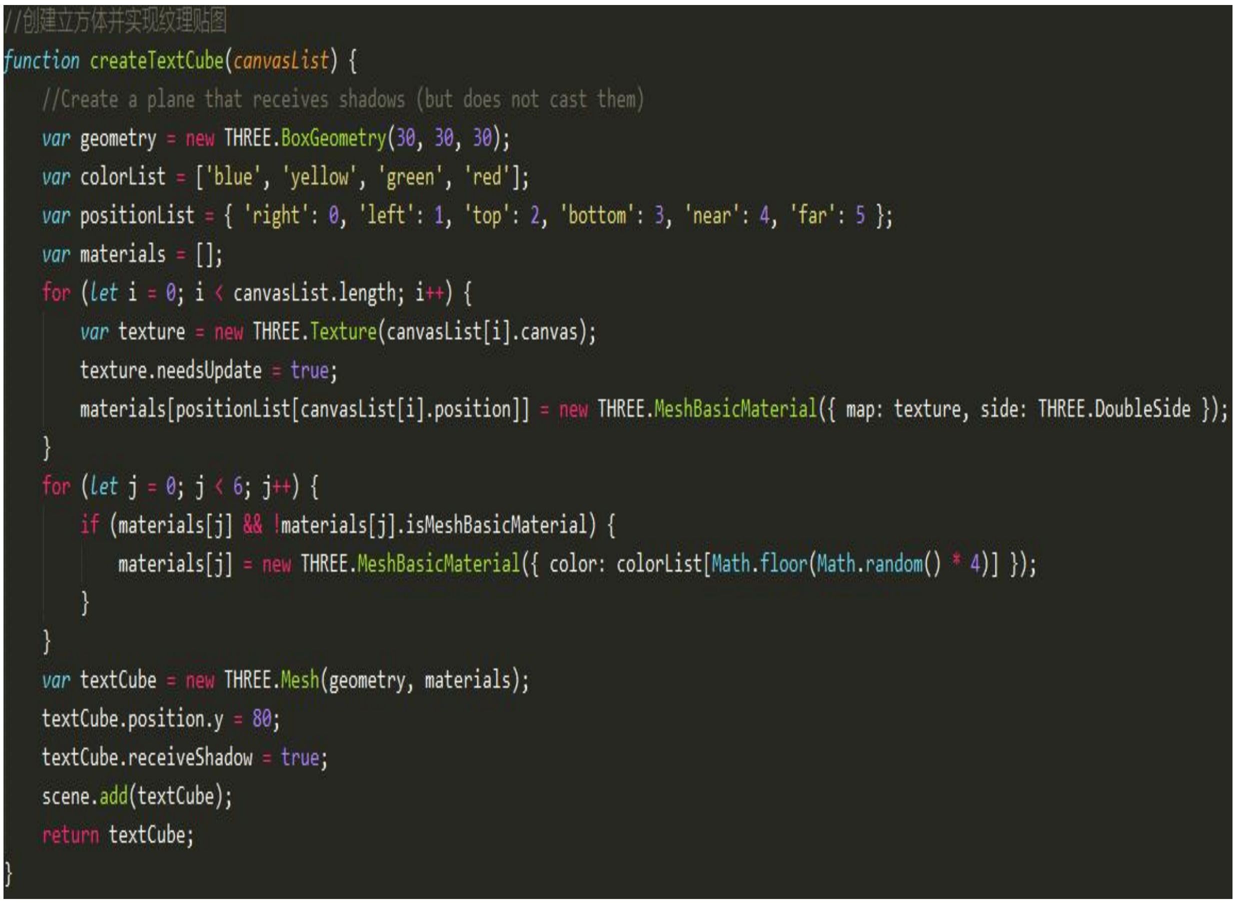
```javascript
function createTreesRight(num) {
    for (let i = 0; i < num; i++) {
        let treeNode = new THREE.Object3D();

        var treeTopGeo = new THREE.CylinderGeometry(0, 10, 20, 32);
        var treeTopMaterial = new THREE.MeshBasicMaterial({ color: 0x00ff00 });
        var treeTop = new THREE.Mesh(treeTopGeo, treeTopMaterial);
        treeTop.position.y = 0;  // 树底部中心点高度是-11，底部的上边高度是-6，这样树顶部中心点高度默认是0的

        var treeBottomGeo = new THREE.CylinderGeometry(5, 5, 10, 32);
        var treeBottomMaterial = new THREE.MeshBasicMaterial({ color: 0x312520 });
        var treeBottom = new THREE.Mesh(treeBottomGeo, treeBottomMaterial);
        treeBottom.position.y = -14;   // 底面位置是-16，底部圆柱体中心点高度默认是0的话，底边高度是-5，所以

        treeNode.add(treeTop);
        treeNode.add(treeBottom);

        treeNode.position.set(util.createRandomPos(100, 390), 0, util.createRandomPos(-390, 100));
        scene.add(treeNode);
    }
}
```

## 2.6.创建点光源



```javascript
//创建点光源
function createSpotlist(Vector3, target) {
    var spotLight = new THREE.SpotLight(0x2eccfa);  //  点光源的颜色
    spotLight.position.set(Vector3.x, Vector3.y, Vector3.z);

    spotLight.castShadow = true;
    spotLight.angle = Math.PI / 18;
    spotLight.shadow.mapSize.width = 512;
    spotLight.shadow.mapSize.height = 512;

    spotLight.shadow.camera.near = 0.5;
    spotLight.shadow.camera.far = 500;
    spotLight.shadow.camera.fov = 30;
    spotLight.target = target;
    scene.add(spotLight);
```

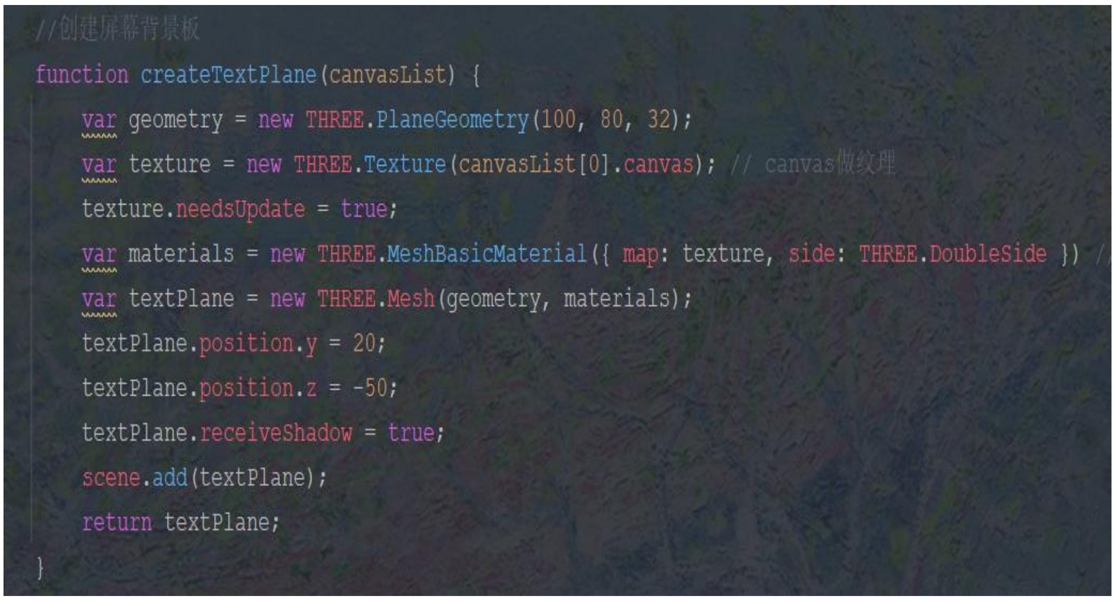
## 2.7. 创建转动的立方体屏幕



```javascript
//创建立方体并实现纹理贴图
function createTextCube(canvasList) {
    //Create a plane that receives shadows (but does not cast them)
    var geometry = new THREE.BoxGeometry(30, 30, 30);
    var colorList = ['blue', 'yellow', 'green', 'red'];
    var positionList = { 'right': 0, 'left': 1, 'top': 2, 'bottom': 3, 'near': 4, 'far': 5 };
    var materials = [];
    for (let i = 0; i < canvasList.length; i++) {
        var texture = new THREE.Texture(canvasList[i].canvas);
        texture.needsUpdate = true;
        materials[positionList[canvasList[i].position]] = new THREE.MeshBasicMaterial({ map: texture, side: THREE.DoubleSide });
    }
    for (let j = 0; j < 6; j++) {
        if (materials[j] && !materials[j].isMeshBasicMaterial) {
            materials[j] = new THREE.MeshBasicMaterial({ color: colorList[Math.floor(Math.random() * 4)] });
        }
    }
    var textCube = new THREE.Mesh(geometry, materials);
    textCube.position.y = 80;
    textCube.receiveShadow = true;
    scene.add(textCube);
    return textCube;
}
```

在 createTextCube（）函数中，实现舞台中央的立方体屏幕的创建，并为其设置相应的参数，同时加载纹理贴图。

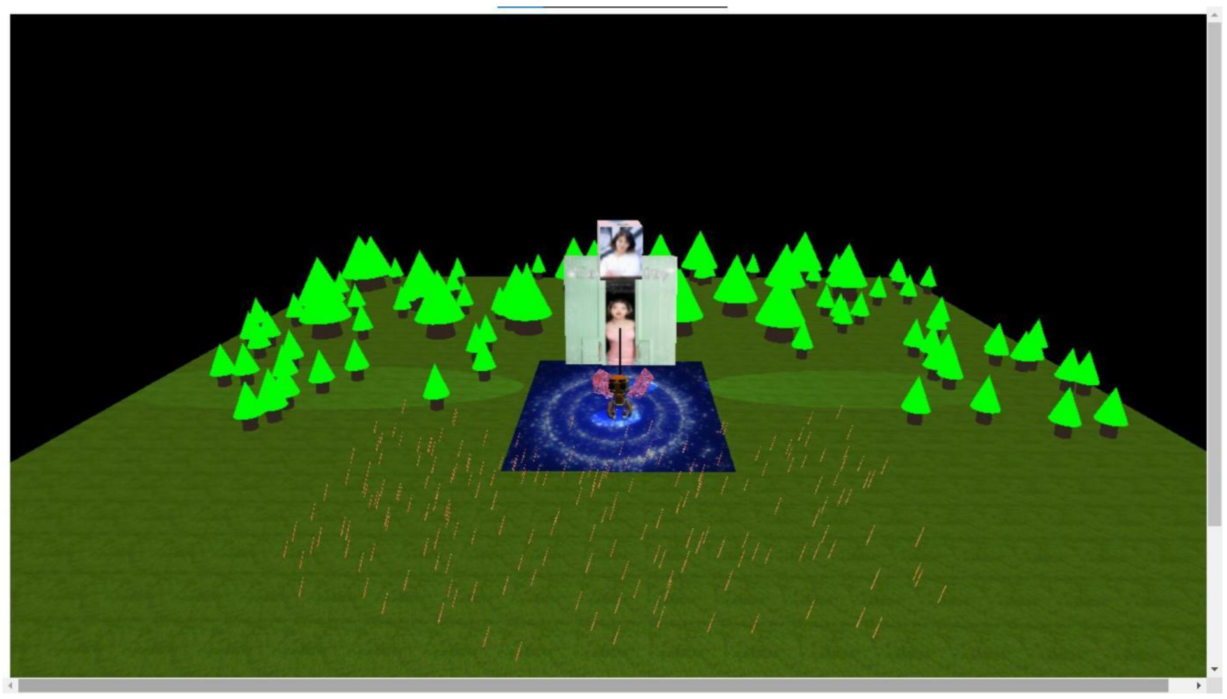
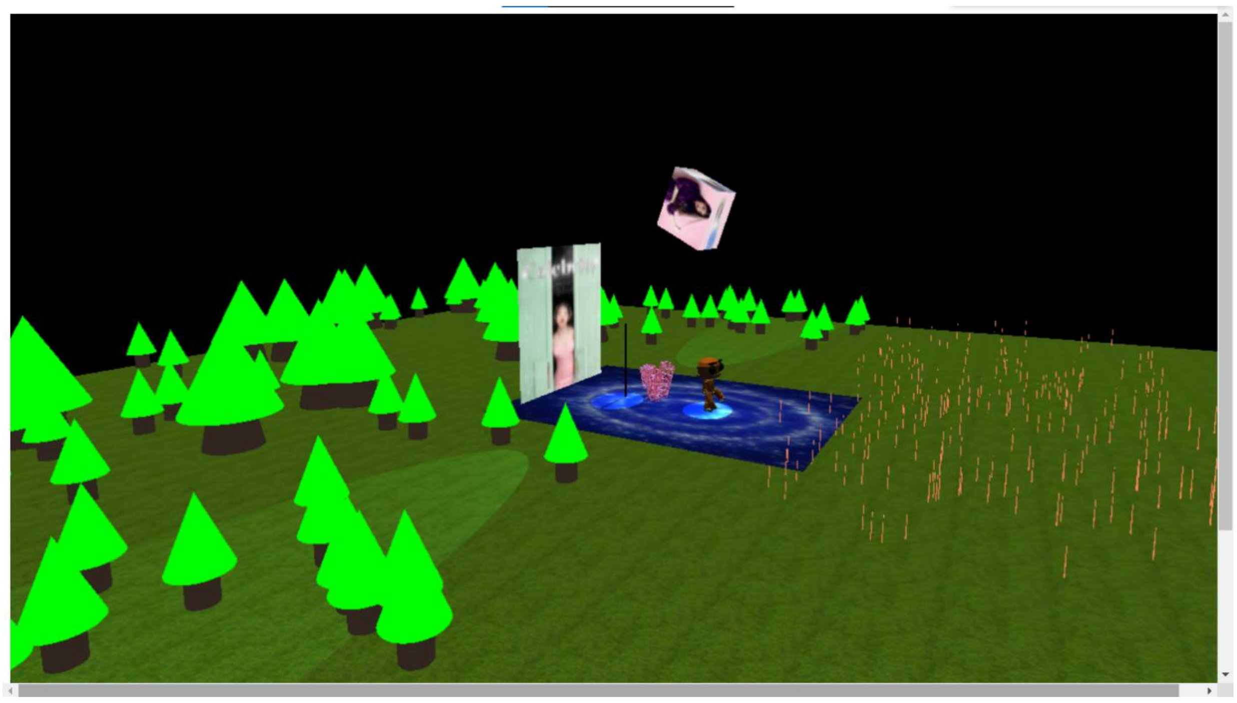
## 2.8 创建舞台大屏幕

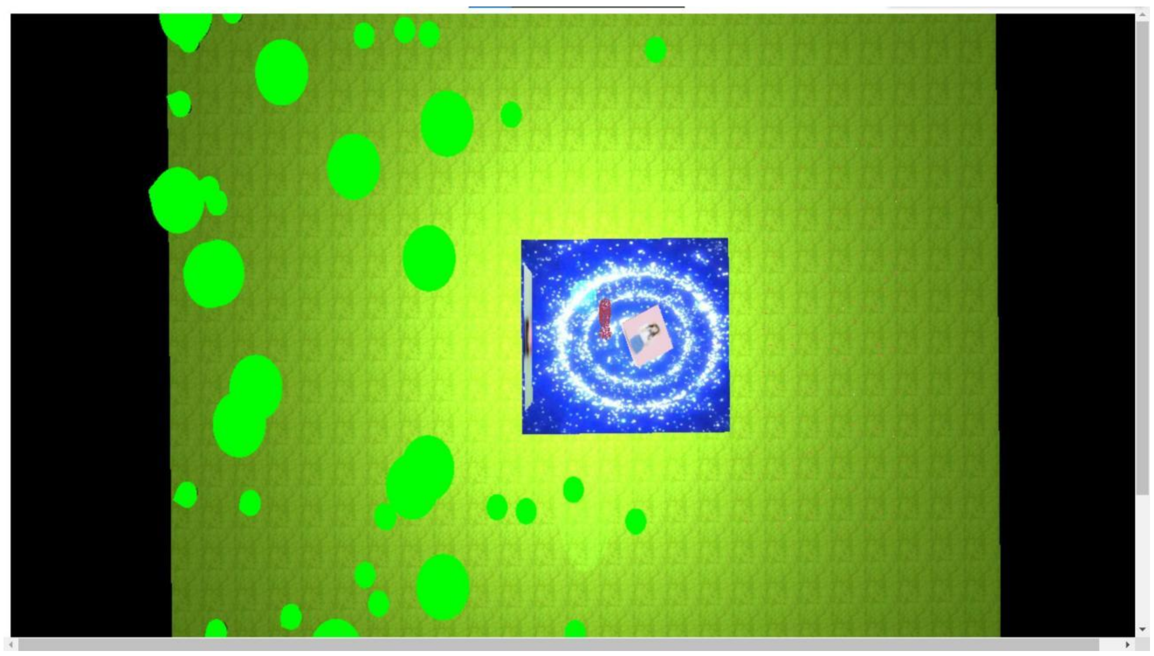


```
//创建屏幕背景板
function createTextPlane(canvasList) {
    var geometry = new THREE.PlaneGeometry(100, 80, 32);
    var texture = new THREE.Texture(canvasList[0].canvas); // canvas做纹理
    texture.needsUpdate = true;
    var materials = new THREE.MeshBasicMaterial({ map: texture, side: THREE.DoubleSide }) /
    var textPlane = new THREE.Mesh(geometry, materials);
    textPlane.position.y = 20;
    textPlane.position.z = -50;
    textPlane.receiveShadow = true;
    scene.add(textPlane);
    return textPlane;
}
```

# 三 功能展示

具体功能当面演示，部分效果图实现如下：



## 四 分工及自评

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| 容姿 | 201912213501009 | 代码编写，文档撰写，ppt编辑 | 90 |
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