МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
“КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ”

Факультет прикладної математики
Кафедра програмного забезпечення комп’ютерних систем

Лабораторна робота № 6
з дисципліни “ МАОКГ”

Виконала
студентка ІІІ курсу
групи КП-83
Снітко Маріанна Дмитрівна
(*прізвище, ім’я, по батькові*)
Варіант № 19

Зарахована
“____” “____________” 2021 р.
викладачем
Шкурат О. С.
(*прізвище, ім’я, по батькові*)

Київ 2021

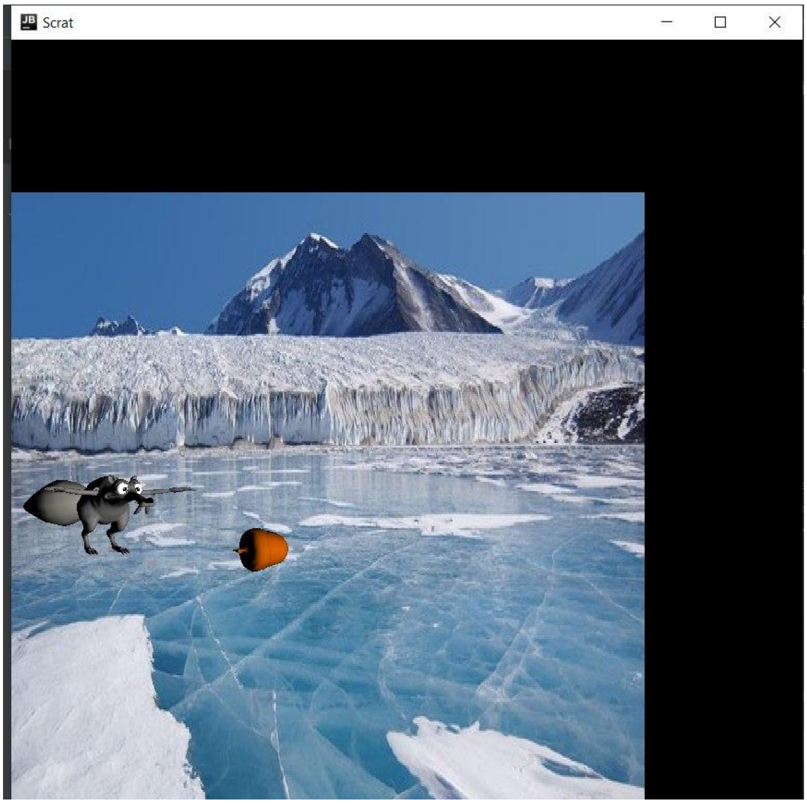
Лістинг коду програми

Scrat.java

```
package application;
import javax.vecmath.*;

import com.sun.j3d.utils.image.TextureLoader;
import com.sun.j3d.utils.universe.*;
import javax.media.j3d.*;
import com.sun.j3d.utils.behaviors.vp.*;
import javax.swing.JFrame;
import javax.xml.crypto.dsig.Transform;

import com.sun.j3d.loaders.*;
import com.sun.j3d.loaders.objectfile.*;

import java.awt.*;
import java.util.Hashtable;
import java.util.Enumeration;

public class Scrat extends JFrame{
    public Canvas3D myCanvas3D;

    public Scrat(){
        this.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);

        myCanvas3D = new Canvas3D(SimpleUniverse.getPreferredConfiguration());
        SimpleUniverse simpUniv = new SimpleUniverse(myCanvas3D);

        simpUniv.getViewingPlatform().setNominalViewingTransform();

        createSceneGraph(simpUniv);
        addLight(simpUniv);

        OrbitBehavior ob = new OrbitBehavior(myCanvas3D);
        ob.setSchedulingBounds(new BoundingSphere(new
Point3d(0.0,0.0,0.0),Double.MAX_VALUE));
        simpUniv.getViewingPlatform().setViewPlatformBehavior(ob);

        setTitle("Scrat");
        setSize(700,700);
        getContentPane().add("Center", myCanvas3D);
        setVisible(true);
    }

    Material getMaterialForBody() {
        Material material = new Material();
        material.setAmbientColor ( new Color3f(new Color(0x7F636363, true)) );
        material.setDiffuseColor  ( new Color3f(new Color(0x7F636363, true)) );
        material.setSpecularColor( new Color3f(new Color(0x7F636363, true)) );
        material.setShininess( 0.3f );
        material.setLightingEnable(true);
        return material;
    }

    Material getMaterialForEyes() {
        Material material = new Material();
        material.setAmbientColor ( new Color3f(new Color(0x0FFFFFF, true)) );
        material.setDiffuseColor  ( new Color3f(new Color(0x0FFFFFF, true)) );
        material.setSpecularColor( new Color3f(new Color(0x0FFFFFF, true)) );
        material.setShininess( 0.3f );
        material.setLightingEnable(true);
        return material;
    }

    Material getMaterialForBlack() {
        Material material = new Material();
        material.setAmbientColor ( new Color3f(new Color(0xFF000000, true)) );
        material.setDiffuseColor ( new Color3f(new Color(0xFF000000, true)) );
        material.setSpecularColor( new Color3f(new Color(0xFF000000, true)) );
        material.setShininess( 0.3f );
        material.setLightingEnable(true);
        return material;
    }

    Material getMaterialForTail() {
        Material material = new Material();
        material.setAmbientColor ( new Color3f(new Color(0xCC78776F, true)) );
        material.setDiffuseColor ( new Color3f(new Color(0xCC78776F, true)) );
        material.setSpecularColor( new Color3f(new Color(0xCC78776F, true)) );
        material.setShininess( 0.3f );
        material.setLightingEnable(true);
        return material;
    }

    Material getMaterialForNut() {
        Material material = new Material();
        material.setAmbientColor ( new Color3f(new Color(0xCA9F4600, true)) );
        material.setDiffuseColor ( new Color3f(new Color(0xCA9F4600, true)) );
        material.setSpecularColor( new Color3f(new Color(0xCA9F4600, true)) );
        material.setShininess( 0.3f );
        material.setLightingEnable(true);
        return material;
    }

    Texture getTexture(String path) {
        TextureLoader textureLoader = new
TextureLoader(path,"LUMINANCE",myCanvas3D);
        Texture texture = textureLoader.getTexture();
        return texture;
    }

    private Appearance getForBody(){
        Appearance appearance = new Appearance();
        appearance.setTexture(getTexture("source_folder//body.jpg"));
        TextureAttributes texAttr = new TextureAttributes();
        texAttr.setTextureMode(TextureAttributes.COMBINE);
        appearance.setTextureAttributes(texAttr);
        appearance.setMaterial(getMaterialForBody());
        return appearance;
    }

    private Appearance getForEyes(){
        Appearance appearance = new Appearance();
        appearance.setTexture(getTexture("source_folder//eyes.jpg"));
        TextureAttributes texAttr = new TextureAttributes();
        texAttr.setTextureMode(TextureAttributes.COMBINE);
        appearance.setTextureAttributes(texAttr);
        appearance.setMaterial(getMaterialForEyes());
        return appearance;
    }
    private Appearance getForBlack(){
        Appearance appearance = new Appearance();
        appearance.setTexture(getTexture("source_folder//black.jpg"));
        TextureAttributes texAttr = new TextureAttributes();
        texAttr.setTextureMode(TextureAttributes.COMBINE);
        appearance.setTextureAttributes(texAttr);
        appearance.setMaterial(getMaterialForBlack());
```

```java
        return appearance;
    }

    private Appearance getForTail(){
        Appearance appearance = new Appearance();
        appearance.setTexture(getTexture("source_folder//tail.jpg"));
        TextureAttributes texAttr = new TextureAttributes();
        texAttr.setTextureMode(TextureAttributes.COMBINE);
        appearance.setTextureAttributes(texAttr);
        appearance.setMaterial(getMaterialForTail());
        return appearance;
    }

    private Appearance getForNut(){
        Appearance appearance = new Appearance();
        appearance.setTexture(getTexture("source_folder//nut.jpg"));
        TextureAttributes texAttr = new TextureAttributes();
        texAttr.setTextureMode(TextureAttributes.COMBINE);
        appearance.setTextureAttributes(texAttr);
        appearance.setMaterial(getMaterialForNut());
        return appearance;
    }


    public void createSceneGraph(SimpleUniverse su){
        ObjectFile f = new ObjectFile(ObjectFile.RESIZE);
        BoundingSphere bs = new BoundingSphere(new
Point3d(0.0,0.0,0.0),Double.MAX_VALUE);
        String name;
        BranchGroup trainerBranchGroup = new BranchGroup();
        TextureLoader t = new TextureLoader("source_folder//bg.jpg", myCanvas3D);
        Background trainerBackground =  new Background(t.getImage());
        trainerBackground.setImageScaleMode(Background.SCALE_FIT_ALL);

        Scene trainerScene = null;
        try{
            trainerScene = f.load("source_folder//Scrat.obj");
        }
        catch (Exception e){
            System.out.println("File loading failed:" + e);
        }
        Hashtable roachNamedObjects = trainerScene.getNamedObjects();
        Enumeration enumer = roachNamedObjects.keys();
        while (enumer.hasMoreElements()){
            name = (String) enumer.nextElement();
            System.out.println("Name: " + name);
        }

        // start animation
        Transform3D startTransformation = new Transform3D();
        startTransformation.setScale(2.0/6);
        Transform3D combinedStartTransformation = new Transform3D();
        combinedStartTransformation.mul(startTransformation);

        TransformGroup scratStartTransformGroup = new
TransformGroup(combinedStartTransformation);

        // moves
        int movesCount = 100; // moves count
        int movesDuration = 700; // moves for 0,3 seconds
        int startTime = 0; // launch animation after timeStart seconds

        // head
        Shape3D nose = (Shape3D) roachNamedObjects.get("nose");
        nose.setAppearance(getForBlack());
        TransformGroup headTG = new TransformGroup();
        Shape3D noseCircles = (Shape3D) roachNamedObjects.get("objsphere12");
        noseCircles.setAppearance(getForBlack());

        Shape3D mouth = (Shape3D) roachNamedObjects.get("objobject07");
        mouth.setAppearance(getForBody());

        Shape3D eyeLeft = (Shape3D) roachNamedObjects.get("left_eye");
        eyeLeft.setAppearance(getForEyes());

        Shape3D eyeRight = (Shape3D) roachNamedObjects.get("right_eye");
        eyeRight.setAppearance(getForEyes());

        Shape3D eyesPoints = (Shape3D) roachNamedObjects.get("objsphere09");
        eyesPoints.setAppearance(getForBlack());

        Shape3D tongue = (Shape3D) roachNamedObjects.get("objobject06");
        tongue.setAppearance(getForBody());

        Shape3D mouth2 = (Shape3D) roachNamedObjects.get("objobject05");
        mouth2.setAppearance(getForBody());

        Shape3D body = (Shape3D) roachNamedObjects.get("body");
        body.setAppearance(getForBody());


        headTG.addChild(nose.cloneTree());
        headTG.addChild(tongue.cloneTree());
        headTG.addChild(mouth.cloneTree());
        headTG.addChild(eyesPoints.cloneTree());
        headTG.addChild(eyeLeft.cloneTree());
        headTG.addChild(eyeRight.cloneTree());
        headTG.addChild(noseCircles.cloneTree());
        headTG.addChild(mouth2.cloneTree());
        headTG.addChild(body.cloneTree());

        Alpha bodyAlpha = new Alpha(movesCount, Alpha.INCREASING_ENABLE,
startTime, 0, movesDuration,0,0,0,0,0);
        Transform3D bodyRotAxis = new Transform3D();
        bodyRotAxis.rotX(Math.PI/2);
        RotationInterpolator bodyrot = new RotationInterpolator(bodyAlpha,
headTG, bodyRotAxis, (float) -Math.PI/6, (float) Math.PI/6); // Math.PI*2
        bodyrot.setSchedulingBounds(bs);
        headTG.setCapability(TransformGroup.ALLOW_TRANSFORM_WRITE);
        headTG.addChild(bodyrot);
        TransformGroup sceneGroup = new TransformGroup();
        sceneGroup.addChild(headTG);


        TransformGroup TailTG = new TransformGroup();
        Shape3D tail = (Shape3D) roachNamedObjects.get("tale");
        tail.setAppearance(getForTail());
        TailTG.addChild(tail.cloneTree());

        Alpha tailAlpha = new Alpha(movesCount, Alpha.INCREASING_ENABLE,
startTime, 0, 1000,0,0,0,0,0);
        Transform3D tailRotAxis = new Transform3D();
        tailRotAxis.rotZ(Math.PI/2);
        RotationInterpolator tailrot = new RotationInterpolator(tailAlpha,
TailTG, tailRotAxis, (float) -Math.PI, (float) Math.PI); // Math.PI*2
        tailrot.setSchedulingBounds(bs);
        TailTG.setCapability(TransformGroup.ALLOW_TRANSFORM_WRITE);
        TailTG.addChild(tailrot);
        sceneGroup.addChild(TailTG);

        TransformGroup LeftHandTG = new TransformGroup();
        Shape3D leftHand = (Shape3D) roachNamedObjects.get("left_hand");
        leftHand.setAppearance(getForBody());
        LeftHandTG.addChild(leftHand.cloneTree());

        Alpha leftHandAlpha = new Alpha(movesCount, Alpha.INCREASING_ENABLE,
startTime, 0, 500,0,0,0,0,0);
        Transform3D leftHandRotAxis = new Transform3D();
        leftHandRotAxis.rotX(Math.PI/4);
        RotationInterpolator leftHandrot = new
RotationInterpolator(leftHandAlpha, LeftHandTG, leftHandRotAxis, (float)
-Math.PI/2f, (float) Math.PI/4.5f); // Math.PI*2
        leftHandrot.setSchedulingBounds(bs);
        LeftHandTG.setCapability(TransformGroup.ALLOW_TRANSFORM_WRITE);
        LeftHandTG.addChild(leftHandrot);
        sceneGroup.addChild(LeftHandTG);


        TransformGroup RightHandTG = new TransformGroup();
        Shape3D rightHand = (Shape3D) roachNamedObjects.get("right_hand");
        rightHand.setAppearance(getForBody());
        RightHandTG.addChild(rightHand.cloneTree());

        Alpha RightHandAlpha = new Alpha(movesCount, Alpha.INCREASING_ENABLE,
startTime, 0, 500,0,0,0,0,0);
        Transform3D RightHandRotAxis = new Transform3D();
        RightHandRotAxis.rotX(-Math.PI/4);
        RotationInterpolator RightHandrot = new
RotationInterpolator(RightHandAlpha, RightHandTG, RightHandRotAxis, (float)
Math.PI/2f, (float) -Math.PI/4.5f); // Math.PI*2
        RightHandrot.setSchedulingBounds(bs);
        RightHandTG.setCapability(TransformGroup.ALLOW_TRANSFORM_WRITE);
        RightHandTG.addChild(RightHandrot);
        sceneGroup.addChild(RightHandTG);


        TransformGroup NutTG = new TransformGroup();
        Shape3D Nut = (Shape3D) roachNamedObjects.get("nut");
        Nut.setAppearance(getForNut());
        NutTG.addChild(Nut.cloneTree());

        Transform3D x = new Transform3D();
        x.rotX(-Math.PI/2);
        NutTG.setTransform(x);
        TransformGroup NutRotGroup = translate(NutTG,new
Vector3f(-1.0f,-0.3f,0.0f));


        TransformGroup whiteTransXformGroup = translate(
                            scratStartTransformGroup,
                            new Vector3f(0.0f,0.0f,-0.7f));

        TransformGroup whiteRotXformGroup = rotate(whiteTransXformGroup, new
Alpha(10,5000));
        scratStartTransformGroup.addChild(sceneGroup);
        scratStartTransformGroup.addChild(NutRotGroup);
        trainerBranchGroup.addChild(whiteRotXformGroup);


        BoundingSphere bounds = new BoundingSphere(new
Point3d(120.0,250.0,100.0),Double.MAX_VALUE);
        trainerBackground.setApplicationBounds(bounds);
        trainerBranchGroup.addChild(trainerBackground);

        trainerBranchGroup.compile();
        su.addBranchGraph(trainerBranchGroup);
    }

    public void addLight(SimpleUniverse su){
        BranchGroup bgLight = new BranchGroup();
        BoundingSphere bounds = new BoundingSphere(new Point3d(0.0,0.0,0.0),
100.0);
        Color3f lightColour1 = new Color3f(1.0f,1.0f,1.0f);
        Vector3f lightDir1 = new Vector3f(-1.0f,0.0f,-0.5f);
        DirectionalLight light1 = new DirectionalLight(lightColour1, lightDir1);
        light1.setInfluencingBounds(bounds);
        bgLight.addChild(light1);
        su.addBranchGraph(bgLight);
    }

    private TransformGroup translate(Node node, Vector3f vector){

        Transform3D transform3D = new Transform3D();
        transform3D.setTranslation(vector);
        TransformGroup transformGroup =
                                     new TransformGroup();
        transformGroup.setTransform(transform3D);

        transformGroup.addChild(node);
        return transformGroup;
    }

    private TransformGroup rotate(Node node, Alpha alpha){
        TransformGroup xformGroup = new TransformGroup();
        xformGroup.setCapability(
                TransformGroup.ALLOW_TRANSFORM_WRITE);

        RotationInterpolator interpolator =
                new RotationInterpolator(alpha,xformGroup);

        interpolator.setSchedulingBounds(new BoundingSphere(
                new Point3d(0.0,0.0,0.0),1.0));

        xformGroup.addChild(interpolator);
        xformGroup.addChild(node);

        return xformGroup;
    }


    public static void main(String[] args) {
        Scrat start = new Scrat();
    }

}
```

Результати роботи програми



Висновки

Виконавши дану лабораторну роботу, я здобула навички імпорту моделей, побудованих у тривимірних редакторах, (об’єктів форматів .obj, .lwo, .3ds) до бібліотеки java3D. Також навчилася анімувати імпортовані об’єкти.

Система була написана на мові програмування **Java.**