Федеральное агентство связи
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высшего образования

«Сибирский государственный университет

телекоммуникаций и информатики»

Лабораторная работа по теме: «Примитивы OpenGL ES 1»

Выполнили:

студентки 4 курса

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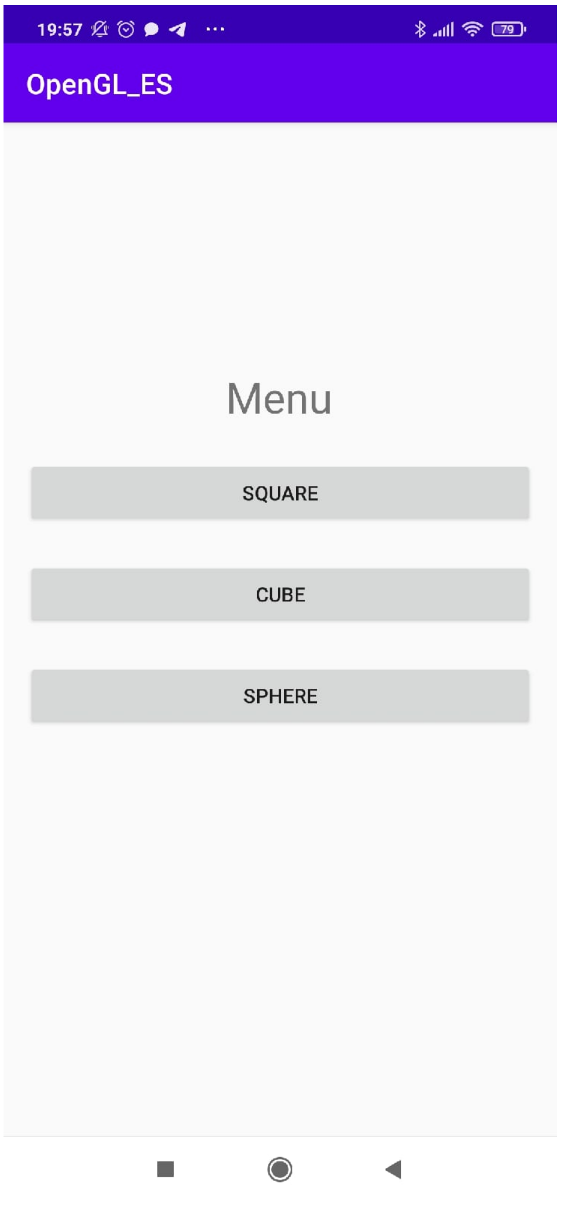
Оглавление

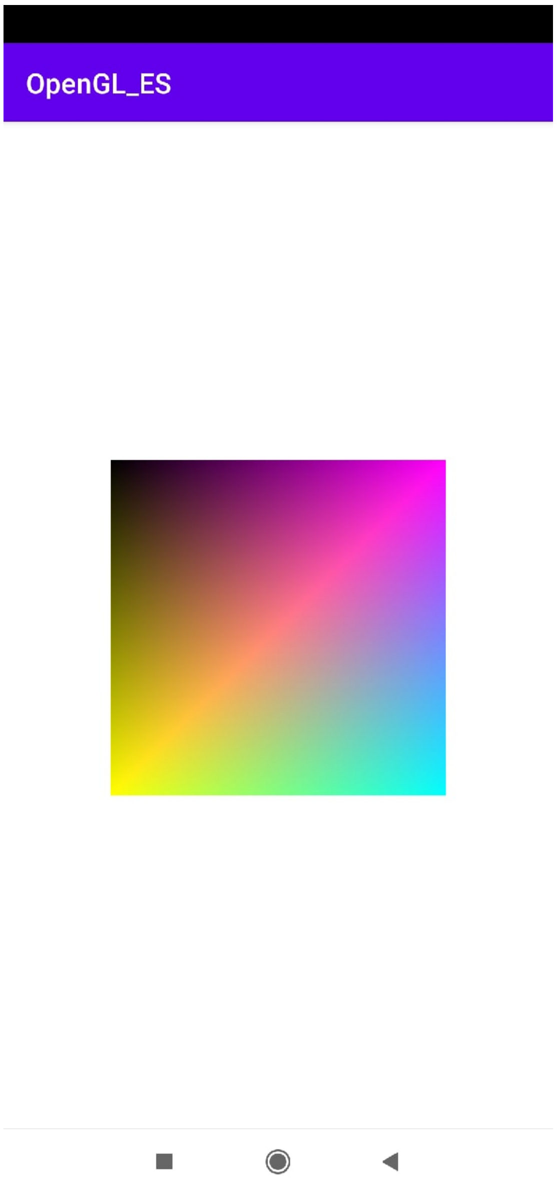
Задание

Необходимо создать классы прорисовки квадрата, куба, сферы.

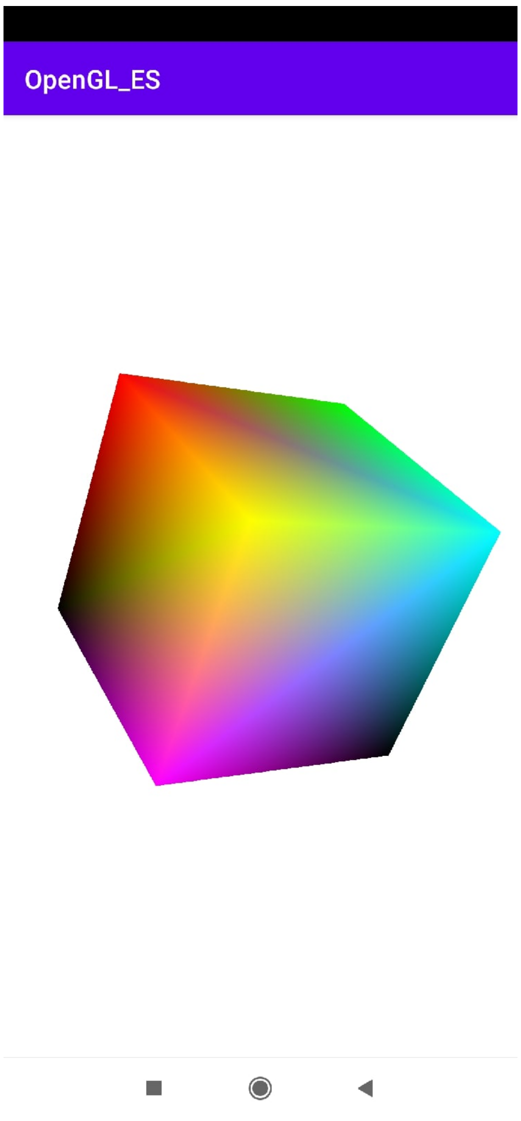
Скриншоты

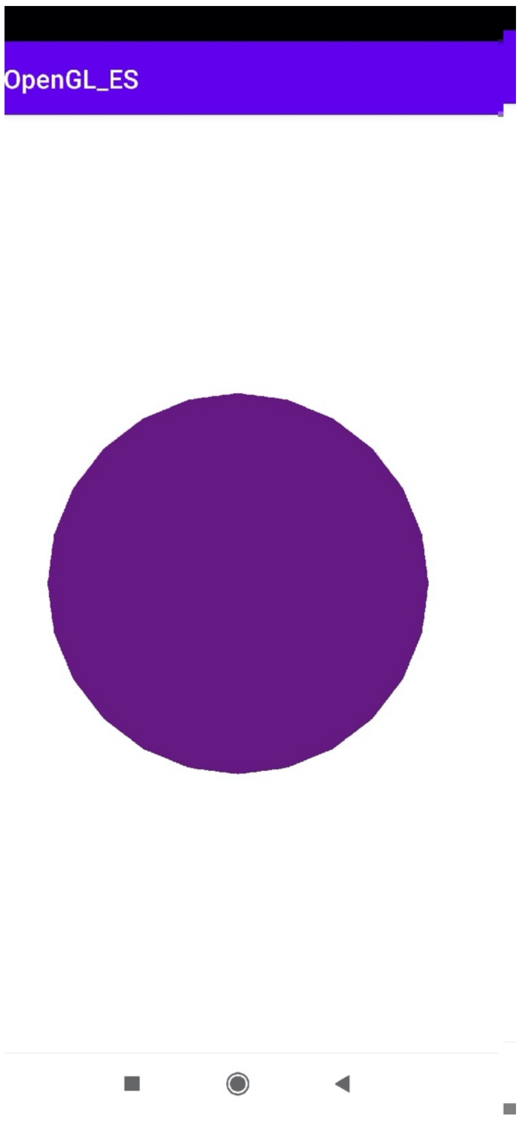


Стартовая активность



Прорисовка квадрата





Прорисовка куба	Прорисовка сферы

Листинг кода

Приложение написано на языке Java.

MainActivity.java

```
package ru.sibsutis.opengl_es.activity;

import androidx.appcompat.app.AppCompatActivity;

import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;

import ru.sibsutis.opengl_es.R;

public class MainActivity extends AppCompatActivity {

   Button squareButton;
   Button cubeButton;
   Button sphereButton;

   @Override
   protected void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.activity_main);

      squareButton = (Button) findViewById(R.id.squareButton);
      cubeButton = (Button) findViewById(R.id.cubeButton);
      sphereButton = (Button) findViewById(R.id.sphereButton);

      squareButton.setOnClickListener(new View.OnClickListener() {
         @Override
         public void onClick(View v) {
            Intent intent = new Intent(MainActivity.this, SquareActivity.class);
            startActivity(intent);
         }
      });

      cubeButton.setOnClickListener(new View.OnClickListener() {
         @Override
         public void onClick(View v) {
            Intent intent = new Intent(MainActivity.this, CubeActivity.class);
            startActivity(intent);
         }
      });

      sphereButton.setOnClickListener(new View.OnClickListener() {
         @Override
         public void onClick(View v) {
            Intent intent = new Intent(MainActivity.this, SphereActivity.class);
            startActivity(intent);
         }
      });
   }
}
```

SquareActivity.java

```
package ru.sibsutis.opengl_es.activity;

import androidx.appcompat.app.AppCompatActivity;

import android.opengl.GLSurfaceView;
import android.os.Bundle;
import android.view.WindowManager;

import ru.sibsutis.opengl_es.entity.Square;

public class SquareActivity extends AppCompatActivity {

   @Override
   protected void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);


getWindow().setFlags(WindowManager.LayoutParams.FLAG_FULLSCREEN,
WindowManager.LayoutParams.FLAG_FULLSCREEN);
      GLSurfaceView view = new GLSurfaceView(this);
      view.setRenderer(new Square());
      setContentView(view);
   }
}
```

Square.java

```
package ru.sibsutis.opengl_es.entity;

import android.opengl.GLSurfaceView;

import java.nio.ByteBuffer;
import java.nio.ByteOrder;
import java.nio.FloatBuffer;

import javax.microedition.khronos.egl.EGLConfig;
import javax.microedition.khronos.opengles.GL10;
import javax.microedition.khronos.opengles.GL11;

/**
 * A vertex shaded square.
 */
public class Square implements GLSurfaceView.Renderer {

   private FloatBuffer mFVertexBuffer;
   private ByteBuffer mColorBuffer;
   private ByteBuffer mIndexBuffer;

   private boolean mTranslucentBackground;
   private float mTransY;

   public Square() {
      float[] vertices = {
            -1.0f, -1.0f,
            1.0f, -1.0f,
            -1.0f, 1.0f,
            1.0f, 1.0f
      };

      byte maxColor = (byte) 255;

      byte[] colors = {
            maxColor, maxColor, 0, maxColor,
            0, maxColor, maxColor, maxColor,
            0, 0, 0, maxColor,
            maxColor, 0, maxColor, maxColor
      };

      byte[] indices = {
            0, 3, 1,
            0, 2, 3
      };

      ByteBuffer vbb = ByteBuffer.allocateDirect(vertices.length * 4);
      vbb.order(ByteOrder.nativeOrder());
      mFVertexBuffer = vbb.asFloatBuffer();
      mFVertexBuffer.put(vertices);
      mFVertexBuffer.position(0);

      mColorBuffer = ByteBuffer.allocateDirect(colors.length);
      mColorBuffer.put(colors);
      mColorBuffer.position(0);

      mIndexBuffer = ByteBuffer.allocateDirect(indices.length);
      mIndexBuffer.put(indices);
      mIndexBuffer.position(0);
```

```
    }

    public void draw(GL10 gl) {
        gl.glFrontFace(GL11.GL_CW);
        gl.glVertexPointer(2, GL11.GL_FLOAT, 0, mFVertexBuffer);
        gl.glColorPointer(4, GL11.GL_UNSIGNED_BYTE, 0, mColorBuffer);
        gl.glDrawElements(GL11.GL_TRIANGLES, 6,
GL11.GL_UNSIGNED_BYTE, mIndexBuffer);
        gl.glFrontFace(GL11.GL_CCW);
    }

    @Override
    public void onSurfaceCreated(GL10 gl, EGLConfig config) {
        gl.glDisable(GL10.GL_DITHER);
        gl.glHint(GL10.GL_PERSPECTIVE_CORRECTION_HINT,
GL10.GL_FASTEST);
        if (mTranslucentBackground) {
            gl.glClearColor(0, 0, 0, 0);
        } else {
            gl.glClearColor(1, 1, 1, 1);
            gl.glEnable(GL10.GL_CULL_FACE);
            gl.glShadeModel(GL10.GL_SMOOTH);
            gl.glEnable(GL10.GL_DEPTH_TEST);
        }
    }

    @Override
    public void onSurfaceChanged(GL10 gl, int width, int height) {
        gl.glViewport(0, 0, width, height);
        float ratio = (float) width / height;
        gl.glMatrixMode(GL10.GL_PROJECTION);
        gl.glLoadIdentity();
        gl.glFrustumf(-ratio, ratio, -1, 1, 1, 10);
    }

    @Override
    public void onDrawFrame(GL10 gl) {
        gl.glClear(GL10.GL_COLOR_BUFFER_BIT |
GL10.GL_DEPTH_BUFFER_BIT);
        gl.glMatrixMode(GL10.GL_MODELVIEW);
        gl.glLoadIdentity();
        gl.glTranslatef(0.0f, (float) Math.sin(mTransY), -3.0f);

        gl.glEnableClientState(GL10.GL_VERTEX_ARRAY);
        gl.glEnableClientState(GL10.GL_COLOR_ARRAY);

        draw(gl);
        mTransY += .075f;
    }
}
```

CubeActivity.java

```
package ru.sibsutis.opengl_es.activity;

import androidx.appcompat.app.AppCompatActivity;

import android.opengl.GLSurfaceView;
import android.os.Bundle;
import android.view.WindowManager;

import ru.sibsutis.opengl_es.R;
import ru.sibsutis.opengl_es.entity.Cube;
import ru.sibsutis.opengl_es.entity.Square;

public class CubeActivity extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);


getWindow().setFlags(WindowManager.LayoutParams.FLAG_FULLSCREEN,
WindowManager.LayoutParams.FLAG_FULLSCREEN);
        GLSurfaceView view = new GLSurfaceView(this);
        view.setRenderer(new Cube());
        setContentView(view);
    }
}
```

Cube.java

```
package ru.sibsutis.opengl_es.entity;

import android.opengl.GLSurfaceView;

import java.nio.ByteBuffer;
import java.nio.ByteOrder;
import java.nio.FloatBuffer;

import javax.microedition.khronos.egl.EGLConfig;
import javax.microedition.khronos.opengles.GL10;
import javax.microedition.khronos.opengles.GL11;

public class Cube implements GLSurfaceView.Renderer {

   private FloatBuffer mFVertexBuffer;
   private ByteBuffer mColorBuffer;
   private ByteBuffer mTfan1;
   private ByteBuffer mTfan2;

   private boolean mTranslucentBackground;
   private Cube mCube;
   private float mTransY;
   private float mAngle;

   public Cube() {

      float[] vertices = {
            -1.0f, 1.0f, 1.0f,
            1.0f, 1.0f, 1.0f,
            1.0f, -1.0f, 1.0f,
            -1.0f, -1.0f, 1.0f,

            -1.0f, 1.0f, -1.0f,
            1.0f, 1.0f, -1.0f,
            1.0f, -1.0f, -1.0f,
            -1.0f, -1.0f, -1.0f
      };

      byte maxColor = (byte) 255;

      byte[] colors = {
            maxColor, maxColor, 0, maxColor,
            0, maxColor, maxColor, maxColor,
            0, 0, 0, maxColor,
            maxColor, 0, maxColor, maxColor,

            maxColor, 0, 0, maxColor,
            0, maxColor, 0, maxColor,
            0, 0, maxColor, maxColor,
            0, 0, 0, maxColor
```

```
    };

    byte[] tfan1 = {
            1, 0, 3,
            1, 3, 2,
            1, 2, 6,
            1, 6, 5,
            1, 5, 4,
            1, 4, 0
    };

    byte[] tfan2 = {
            7, 4, 5,
            7, 5, 6,
            7, 6, 2,
            7, 2, 3,
            7, 3, 0,
            7, 0, 4
    };

    ByteBuffer vbb = ByteBuffer.allocateDirect(vertices.length * 4);
    vbb.order(ByteOrder.nativeOrder());
    mFVertexBuffer = vbb.asFloatBuffer();
    mFVertexBuffer.put(vertices);
    mFVertexBuffer.position(0);

    mColorBuffer = ByteBuffer.allocateDirect(colors.length);
    mColorBuffer.put(colors);
    mColorBuffer.position(0);

    mTfan1 = ByteBuffer.allocateDirect(tfan1.length);
    mTfan1.put(tfan1);
    mTfan1.position(0);

    mTfan2 = ByteBuffer.allocateDirect(tfan2.length);
    mTfan2.put(tfan2);
    mTfan2.position(0);

}

public void draw(GL10 gl) {
    gl.glVertexPointer(3, GL11.GL_FLOAT, 0, mFVertexBuffer);
    gl.glColorPointer(4, GL11.GL_UNSIGNED_BYTE, 0, mColorBuffer);
```

```
      gl.glDrawElements(gl.GL_TRIANGLE_FAN, 6 * 3,
gl.GL_UNSIGNED_BYTE, mTfan1);
      gl.glDrawElements(gl.GL_TRIANGLE_FAN, 6 * 3,
gl.GL_UNSIGNED_BYTE, mTfan2);
   }

   @Override
   public void onSurfaceCreated(GL10 gl, EGLConfig config) {
      gl.glDisable(GL11.GL_DITHER);

      gl.glHint(GL11.GL_PERSPECTIVE_CORRECTION_HINT,
GL11.GL_FASTEST);

      if (mTranslucentBackground) {
         gl.glClearColor(1, 0, 0, 0);
      } else {
         gl.glClearColor(1, 1, 1, 1);
      }

      gl.glEnable(GL11.GL_CULL_FACE);
      gl.glShadeModel(GL11.GL_SMOOTH);
      gl.glEnable(GL11.GL_DEPTH_TEST);
   }

   @Override
   public void onSurfaceChanged(GL10 gl, int width, int height) {
      gl.glViewport(0, 0, width, height);

      float aspectRatio;
      float zNear = .1f;
      float zFar = 1000;
      float fieldOfView = 30.0f / 57.3f;
      float size;

      gl.glEnable(GL10.GL_NORMALIZE);

      aspectRatio = (float) width / (float) height;

      gl.glMatrixMode(GL10.GL_PROJECTION);

      size = zNear * (float) (Math.tan((double) (fieldOfView / 2.0f)));

      gl.glFrustumf(-size, size, -size / aspectRatio,
            size / aspectRatio, zNear, zFar);
```

```
        gl.glMatrixMode(GL10.GL_MODELVIEW);
    }

    @Override
    public void onDrawFrame(GL10 gl) {
        gl.glClearColor(1.0f, 1.0f, 1.0f, 1.0f);
        gl.glClear(GL11.GL_COLOR_BUFFER_BIT |
GL11.GL_DEPTH_BUFFER_BIT);

        gl.glMatrixMode(GL11.GL_MODELVIEW);
        gl.glLoadIdentity();
        gl.glTranslatef(0.0f, (float) Math.sin(mTransY), -7.0f);

        gl.glRotatef(mAngle, 0.0f, 1.0f, 0.0f);
        gl.glRotatef(mAngle, 1.0f, 0.0f, 0.0f);

        gl.glEnableClientState(GL11.GL_VERTEX_ARRAY);
        gl.glEnableClientState(GL11.GL_COLOR_ARRAY);

        draw(gl);

        mTransY += .075f;
        mAngle += .4;
    }
}
```

s

SphereActivity.java

```
package ru.sibsutis.opengl_es.activity;

import androidx.appcompat.app.AppCompatActivity;

import android.opengl.GLSurfaceView;
import android.os.Bundle;
import android.view.WindowManager;

import ru.sibsutis.opengl_es.entity.Sphere;

public class SphereActivity extends AppCompatActivity {

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);

getWindow().setFlags(WindowManager.LayoutParams.FLAG_FULLSCREEN,
WindowManager.LayoutParams.FLAG_FULLSCREEN);
        GLSurfaceView view = new GLSurfaceView(this);
        view.setRenderer(new Sphere(0.5f));
        setContentView(view);
    }
}
```

Sphere.java

```
package ru.sibsutis.opengl_es.entity;

import android.opengl.GLSurfaceView;
import android.opengl.GLU;

import java.nio.ByteBuffer;
import java.nio.ByteOrder;
import java.nio.FloatBuffer;

import javax.microedition.khronos.egl.EGLConfig;
import javax.microedition.khronos.opengles.GL10;

public class Sphere implements GLSurfaceView.Renderer {

    public FloatBuffer mVertexBuffer;
    private ByteBuffer mColorBuffer;
    private boolean mTranslucentBackground;

    public int n = 0, sz = 0;

    public Sphere(float R) {

        float i = 0;
        int dtheta = 15, dphi = 15;

        int theta, phi;
        float DTOR = (float) (Math.PI / 180.0f);

        ByteBuffer byteBuf = ByteBuffer.allocateDirect(5000 * 3 * 4);
        byteBuf.order(ByteOrder.nativeOrder());
        mVertexBuffer = byteBuf.asFloatBuffer();
        byteBuf = ByteBuffer.allocateDirect(5000 * 2 * 4);
        byteBuf.order(ByteOrder.nativeOrder());
        for (theta = -90; theta <= 90 - dtheta; theta += dtheta) {
            for (phi = 0; phi <= 360 - dphi; phi += dphi) {
                sz++;
                mVertexBuffer.put((float) (Math.cos(theta * DTOR) * Math.cos(phi *
DTOR)) * R);
                mVertexBuffer.put((float) (Math.cos(theta * DTOR) * Math.sin(phi *
DTOR)) * R);
                mVertexBuffer.put((float) (Math.sin(theta * DTOR)) * R);

                mVertexBuffer.put((float) (Math.cos((theta + dtheta) * DTOR) *
Math.cos(phi * DTOR)) * R);
                mVertexBuffer.put((float) (Math.cos((theta + dtheta) * DTOR) *
Math.sin(phi * DTOR)) * R);
                mVertexBuffer.put((float) (Math.sin((theta + dtheta) * DTOR)) * R);

                mVertexBuffer.put((float) (Math.cos((theta + dtheta) * DTOR) *
Math.cos((phi + dphi) * DTOR)) * R);
                mVertexBuffer.put((float) (Math.cos((theta + dtheta) * DTOR) *
Math.sin((phi + dphi) * DTOR)) * R);
                mVertexBuffer.put((float) (Math.sin((theta + dtheta) * DTOR)) * R);
                n += 3;

                mVertexBuffer.put((float) (Math.cos(theta * DTOR) * Math.cos((phi +
dphi) * DTOR)) * R);
                mVertexBuffer.put((float) (Math.cos(theta * DTOR) * Math.sin((phi +
dphi) * DTOR)) * R);
                mVertexBuffer.put((float) (Math.sin(theta * DTOR)) * R);
                n++;
            }
        }

        mVertexBuffer.position(0);

    }

    public void draw(GL10 gl) {

        gl.glFrontFace(GL10.GL_CCW); // Front face in counter-clockwise
orientation
        gl.glEnable(GL10.GL_CULL_FACE); // Enable cull face
        gl.glCullFace(GL10.GL_BACK); // Cull the back face (don't display)
        gl.glEnable(GL10.GL_BLEND);
        gl.glBlendFunc(GL10.GL_SRC_ALPHA,
GL10.GL_ONE_MINUS_SRC_ALPHA);
```

```
        gl.glEnableClientState(GL10.GL_VERTEX_ARRAY);
        gl.glVertexPointer(3, GL10.GL_FLOAT, 0, mVertexBuffer);


        int i = 0;
        for (i = 0; i < n; i += 4) {
            gl.glColor4f(0.4f, 0.1f, 0.5f, 1.0f);
            gl.glDrawArrays(GL10.GL_TRIANGLE_FAN, i, 4);
        }

        gl.glColor4f(0.4f, 0.1f, 0.5f, 1.0f);
    }

    @Override
    public void onSurfaceCreated(GL10 gl, EGLConfig config) {
        gl.glDisable(GL10.GL_DITHER);
        gl.glHint(GL10.GL_PERSPECTIVE_CORRECTION_HINT,
GL10.GL_FASTEST);
        if (mTranslucentBackground) {
            gl.glClearColor(0.0f, 0.0f, 0.0f, 0.0f);
        } else {
            gl.glClearColor(1, 1, 1, 1);
            gl.glEnable(GL10.GL_CULL_FACE);
            gl.glShadeModel(GL10.GL_SMOOTH);
            gl.glEnable(GL10.GL_DEPTH_TEST);
        }

        gl.glEnableClientState(GL10.GL_VERTEX_ARRAY);
    }

    @Override
    public void onSurfaceChanged(GL10 gl, int width, int height) {
        gl.glViewport(0, 0, width, height);
        gl.glMatrixMode(GL10.GL_PROJECTION);
        gl.glLoadIdentity();
        float ratio = (float) width / height;
        GLU.gluPerspective(gl, 45.0f, ratio, 1f, 100f);
    }

    @Override
    public void onDrawFrame(GL10 gl) {
        gl.glClearColor(1.0f, 1.0f, 1.0f, 1.0f);
        gl.glClear(GL10.GL_COLOR_BUFFER_BIT |
GL10.GL_DEPTH_BUFFER_BIT);
```

```
        gl.glMatrixMode(GL10.GL_MODELVIEW);
        gl.glLoadIdentity();

        gl.glTranslatef(0f, 0f, -3.0f);
        draw(gl);
    }
}
```