ISEL / ADEETC

Master in Communication Network and Multimedia Engineering

Interactive Multimedia Applications

Tutorial 2

Interactive Multimedia Applications

Thematic Calculator

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Introduction

This work aims to introduce the application development environment for Android devices. The tutorial introduces the anatomy of an Android program. From the application "Hello World" a new application with a more elaborate user interface is built. The main idea is to make a simple calculator with an interface adjustable to any screen with content related to a theme. The suggested theme is soccer but the students are free to choose another theme.

Below is a link that you should consult during the development of this work.

Android Developers
http://developer.android.com/training/index.html

Note: this tutorial should be done in class and the code of the resulting Android projects must be delivered through the Moodle platform until the 24th of March.

Laboratory Work

Background Image

1. Create a new project in **Android Studio** repeating the steps already taken in the first tutorial.

2. Search the Web for an image of the "Estádio da Luz" with a resolution of at least 500x700 pixels. In an image editing program, change the image resolution to approximately 320x240 and convert the image to **png** format.

3. In **Android Studio**, copy the image to the **drawable** folder of the project.

4. Look in the project to open the file "*content_main.xml*". Select the "Design" tab in the lower left corner of the editor to switch to the Layout Editor. Select the <RelativeLayout> element and in the properties panel (lower right corner) put the name

of "**container**" in the attribute "id" of the element. In the "background" attribute, place the image you copied in the previous point.

5. Run the program on the Nexus 5 AVD created in the previous tutorial.

ImageButton

6. Look on the Web for an image with the S. L. Benfica emblem, another emblem of Sporting C. P. and another with the emblem of F. C. Porto. Images must have a resolution between 350x350 and 500x500 pixels.

7. In an image editor, change the image resolution to 60x60 pixels and convert the image format to PNG. Copy the images to the **drawable** folder of the project in Android Studio.

8. In the Layout Editor (file "content_main.xml") place three **ImageButtons** at the top (see Figure 1).

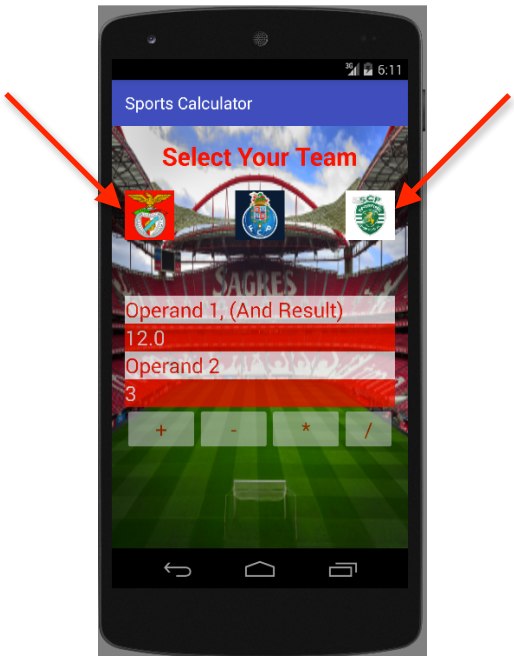


Figure 1. Main Layout of the application.

9. In each ImageButton place an image of a club in the "src" attribute and give a unique value to the "id" attribute of each. Do not forget to create a string in the file "strings.xml" with a short description for each emblem. Place its string in the "contentDescriptor" attribute of each ImageButton.

10. Run the program on the Nexus 5 AVD or on the mobile device.

Calculator - Graphical Interface

11. Construct the rest of the layout of Figure 1. The remaining elements are represented by the <TextView> tag. For elements that receive input from the user you must activate the "editable" property (they become EditView elements). Do not forget to assign a different "id" for each one. Later, we will manipulate the values of these elements in Java and for that reason we will need the "id". Use the "background" and "textColor" attributes to set the text and element colors. These colors should be defined in the "colors.xml" file.

12. For some elements it is necessary to put text. Make new strings in the file "strings.xml" with the content and use them in the respective attribute. Also define the "InputType" attribute as the decimal, of the element that receives the final result or the first operand.

13. Run the program and check if the user interface is close to the one in Figure 1. Small changes in the layout of the elements are accepted.

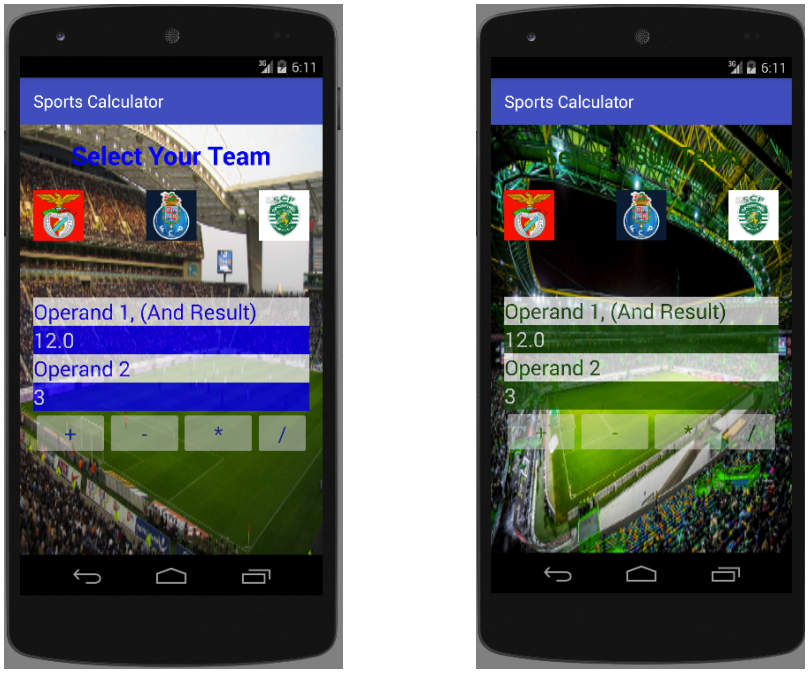
OnTouch Event - ImageButton

14. Search the Web for an image of the "Estádio do Dragão" stadium and the stadium of Alvalade XXI. Repeat points 2 and 3 for these images.

15. **ImageButton** elements with club badges serve to make minor changes to the layout according to the club. When the user clicks or touches the Porto emblem the interface should be as in Figure 2a and when the user clicks the Sporting emblem the interface is as in Figure 2b. To activate the **OnTouch** event in Benfica **ImageButton** use the code below. Should be placed inside the **OnCreate** (...) method of the "MainActivity" class.

```
ImageButton slbIcon = (ImageButton)findViewById(R.id.slbIcon);
slbIcon.setOnTouchListener(new View.OnTouchListener() {
            @Override
        public boolean onTouch(View arg0, MotionEvent arg1) {
            View container = (View)
findViewById(R.id.container);

container.setBackgroundResource(R.drawable.estadiodaluz);
            return false;
        }
});
```



a) b)

Figure 2. Layouts of the Application: at right the configuration of Porto and at left the configuration of Sporting.

16. Repeat the above for the ImageButton elements of Sporting and Porto.

17. Run the program and make sure that when you click on the emblem the background image changes.

18. To change colors when an **ImageButton** is clicked, first create the colors for each context (club) in the "colors.xml" file. Then, as we will have several things to do inside the **OnTouch** (...) method, created in point 15, create the private method "**setContext**

(...)" in the "MainActivity" class, to be called in the **OnTouch** method. Copy and complete the code of the "**setContext** (...)" method shown below.

```
private void setContext (int id) {
    TextView title;
    int fc = 0, bc  = 0;
    View container = (View) findViewById(R.id.container);

    if (id == R.id.fcpIcon) {
        container.setBackgroundResource(R.drawable.estadiododragao);
        fc = R.color.fcpf;
        bc = R.color.fcpb;
    }
    else if (id == R.id.slbIcon) {
      …


    title = (TextView)findViewById(R.id.title);
    title.setTextColor(ContextCompat.getColor(getBaseContext(),fc));

    title = (TextView)findViewById(R.id.operator1);
    title.setTextColor(ContextCompat.getColor(getBaseContext(),fc));
    title.setBackgroundColor(ContextCompat.getColor(getBaseContext(),bc));
      …
```

OnClick Event - Button

19. To enable the **OnClick** event for each **button** on the calculator, use the following lines of code:

```
Button b = (Button)this.findViewById(R.id.bsoma);
b.setOnClickListener(this);
```

20. When a **button** is clicked the following method must be executed:

```
public void onClick(View v)   {
    String sNum1 = number1EditText.getText().toString();
    String sNum2 = number2EditText.getText().toString();
    double num1 = getDouble(sNum1);
    double num2 = getDouble(sNum2);
    Button b = (Button)v;

    double value = 0;
    if (b.getId() == R.id.bsoma)
    {
      …
    }
    else if (b.getId() == R.id.bsub)
    {
       …
    }
    …
    number1EditText.setText(Double.toString(value));
}
```

21. Create a new Java class, "Calculator" within the same package with the methods needed for the calculator operations presented in the application.

22. Create an instance of the "Calculator" class in the "MainActivity" class and on the "**Onclick** (...)" method use the methods of the "Calculator" class to perform the calculator operations.

Alternative Images

23. The Nexus 5 AVD has a pixel density of 445dpi belonging to the generalized set of xxhdpi densities. The AVD has a resolution of 1920x1080. The background images (stadiums of Benfica, Sporting and Porto) should have at least this resolution. Generate the alternative images for the remaining generalized groups of densities so that in the other groups the image be represented by approximately 640x360 dp.

24. Copy the images generated in the previous point to the respective directories within the "res" directory. Run the program on the AVD Nexus 5, AVD Nexus 10 and on your device.

25. Create or search in the Web for an image with a minimum dimensions of 200x200 pixels to replace the application icon. Generate images so that in each density group the icon is represented by 48x48 dp.

26. Copy the images generated in the previous point to the respective directories within the "res" directory. Run the program on the AVD Nexus 5, AVD Nexus 10 and your device.

27. Repeat points 25 and 26 for the images of the clubs that are used on the buttons. The buttons should occupy 0.5 inches of display space in all generalized groups. When generating the images for the various generalized groups of density, put text in the image to tell which group (see figure 3). Thus, it will be possible to see which group is being used.

Figure 3. Image for button with text referring the density group.

Multiple Languages

28. Create a "values" directory within the "res" directory for the Spanish language. Within this directory create a file "strings.xml" with the strings in Spanish.

29. Run the program on the AVD Nexus 5 and your device. Change the language on the devices and verify that the application has changed.

Different Layouts

30. In the visual editor (file "content_main.xml") in the upper left corner are a dropdown menu that allows you to create alternate layouts. Create a layout variation in landscape mode. Organize the interface differently to take full advantage of the width space.

31. Run the program on the AVD Nexus 10 and your device. To test on the Nexus 5 AVD you need to change the presentation mode to "landscape".

32. Create another layout version for devices where the minimum size is 720dp. Run the program on the AVD Nexus 10.

33. Create another layout version for devices with a minimum height of 600dp. Create the Nexus 7 AVD based on the Nexus 7 smartphone (2012). Run the program on the Nexus 7 AVD.

34. Add two more mathematical operations to the calculator of your choice (e.g., the operation to calculate the exponential or the square root). Do not forget to change the alternate layout as well.