Today's Topics

- Views
- Layout
- UI Event
  - Event Listener
- Menu
- Dialog

Lecture 3
Creating User Interfaces

Kettering University
View, ViewGroup, and Activity

- The user interface is built using View and ViewGroup objects.
- View Hierarchy
  - View object
  - The basic unit of user interface expression.
  - ViewGroup object
  - The base for subclasses called “layouts.”
- Activity
  - To display a user interface, assign a View (a layout) to an Activity.
  - `setContentView()`
    - Activity must call this method.

Creating Activity UI w/ Views

- The `setContentView` method accepts either a layout resource ID or a single View instance.
- Example
  1) Using a layout resource
    - @Override
      - public void onCreate(Bundle savedInstanceState) {
          super.onCreate(savedInstanceState);
          setContentView(R.layout.main);
          TextView myTextView = (TextView)findViewById(R.id.myTextView);
      }
  2) Creating a UI layout in code
    - @Override
      - public void onCreate(Bundle savedInstanceState) {
          super.onCreate(savedInstanceState);
          TextView myTextView = new TextView(this);
          myTextView.setText("Hello, Kettering");
          setContentView(myTextView);
      }

Layout

- The name of an XML element is respective to the Java class.
  - `<TextView>` element creates a TextView in your UI.
  - `<LinearLayout>` element creates a LinearLayout view group.
- Layout manager is the extension of the ViewGroup class
  - Used to position child controls for your UI.
- Layout classes
  - RelativeLayout
  - LinearLayout
  - FrameLayout
  - TableLayout
  - Gallery
    - Displays a single row of items in a horizontally scrolling list.
- RelativeLayout
  - It lets child views specify their position relative to the parent view.
- FrameLayout
  - The simplest type of layout object.
  - It is a blank space on your screen that you can later fill with a single object.
- LinearLayout
  - It aligns all children in a single direction – vertically or horizontally.
  - All children are stacked one after the other.
- TableLayout
  - It positions its children into rows and columns.
  - TableRow is the child view of a TableLayout
Element Size

wrap_content and fill_parent

- **wrap_content**
  - Sets the size of a View to the minimum required to contain the contents it displays.
- **match_parent**
  - Expands the View to fill the available space within the parent View.
  - The width and height can be set by `wrap_content` and `match_parent` rather than an exact height or width in pixels.

LinearLayout Example

- **Size of elements**
  - `match_parent` vs. `wrap_content`
  - Text boxes have their widths: `match_parent`
  - Other elements have their width: `wrap_content`.
- **Gravity (alignment):**
  - The gravities of all elements are left.
- **Weight:**
  - The left version: 0 for all UI components.
  - The right version:
    - Comments text box has 1.
    - If the Name text box has also 1, then two text boxes would have the same height.

TableLayout Example

- **Size of elements**
  - `match_parent` vs. `wrap_content`
  - Text boxes have their widths: `match_parent`
  - Other elements have their width: `wrap_content`.
- **Gravity (alignment):**
  - The gravities of all elements are left.
Layout Parameters

Box Model for View Dimension

- **ViewGroups** provide **Margin**.
  - ViewGroup.LayoutParams.leftMargin
  - ViewGroup.LayoutParams.topMargin
  - ViewGroup.LayoutParams.rightMargin
  - ViewGroup.LayoutParams.bottomMargin

- **Views** support **Padding**.
  - GetPaddingLeft();
  - GetPaddingTop();
  - GetPaddingRight();
  - GetPaddingBottom();

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UI Events

- Now you have some Views on the screen.
- How to connect user’s interactions with Views?
- You need to do one of these
  - Event Listener
    - Define an event listener and register it to the View.
    - The View class contains a collection of nested listener interfaces.
    - Examples
      - View.OnClickListener
      - View.OnTouchListener
    - Override an existing callback method for the View.
    - When you’ve implemented your own UI class.

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Event Listener

- For example,
  - A View is touched.
  - onTouchEvent() method is called on that object.
  - In order to intercept this event, we must extend the class and override the method.
  - This approach is OK for a single view.
  - What if there are many different types of views on one Activity?
  - Extending each class and override the method for each View are not practical.

- Event Listener!
  - An interface in the View class that contains a single callback method.
  - Set your own event handler to the Listener. Then Android framework will call it when a corresponding event occurs.
**Event Listener**

**Callback methods and EventListener interface**

- **Callback method and Event listener interfaces**
  - `onClickListener` `View.OnClickListener`
  - `onLongClickListener` `View.OnLongClickListener`
  - `onFocusChangeListener` `View.OnFocusChangeListener`
  - `onTouchListener` `View.OnTouchListener`
  - `onCreateContextMenu` `View.onCreateContextMenu`

**Examples**

```java
private OnClickListener myButtonListener = new OnClickListener() {
    public void onClick(View v) {
        // do something when the button is clicked
    }
};

protected void onCreate(Bundle savedInstanceState) {
    ...
    Button button = (Button)findViewById(R.id.myButton);
    // Register the onClick listener with the implementation above
    button.setOnClickListener(myButtonListener);
    ...
}
```

**Menu**

**Three types of application menus**

- **Options Menu**
  - The primary menu for an Activity
  - When the user presses the device MENU key.
  - Two groups of Option Menu
    - **Icon Menu**
      - The menu items visible at the bottom of the screen.
      - Maximum of six menu items.
      - Icon menu items do not support checkboxes and radio buttons.
    - **Expanded Menu**
      - The vertical list of menu items exposed by the "More" menu item in the Icon Menu.
  - **Context Menu**
    - A floating list of menu items.
  - **Submenu**
    - A floating list of menu items that the user opens by pressing a menu item in the Options Menu or Context Menu.

**Definition of Options Menu**

- **Define a menu and its items in an XML.**
- **Create an XML file inside `res/menu/` directory.**

**XML items**

- `android:id`
  - Unique id to the item.
- `android:title`
  - Visible to the user.

```xml
<menu xmlns:android="http://schemas.android.com/apk/res/android">
    <item android:id="@+id/item01" android:title="@string/item01"></item>
    <item android:id="@+id/item02" android:title="@string/item02"></item>
    <item android:id="@+id/item03" android:title="@string/item03"></item>
</menu>
```
Options Menu

Inflating a Menu Resource

- Use MenuInflater.inflate() to inflate a menu resource in onCreateOptionsMenu() callback method.

```java
@Override
public boolean onCreateOptionsMenu(Menu menu) {
    MenuInflater inflater = getMenuInflater();
    inflater.inflate(R.menu.main, menu);
    return true;
}
```

When the user selects a menu item from Options Menu, onOptionsItemSelected() method will be called with MenuItem by the system.

```java
public boolean onOptionsItemSelected(MenuItem item) {
    switch (item.getItemId()) {
        case R.id.item01:
            doSomething01();
            return true;
        case R.id.item02:
            doSomething02();
            return true;
        case R.id.item03:
            doSomething03();
            return true;
        default:
            return super.onOptionsItemSelected(item);
    }
}
```

Context Menu

- A context menu is displayed when the user long-presses an item.
- Conceptually similar to Right-click menu on a PC.
- Use onCreateContextMenu().

```java
public void onCreateContextMenu(ContextMenu menu, View v,ContextMenuInfo menuInfo) {
    super.onCreateContextMenu(menu, v, menuInfo);
    MenuInflater inflater = getMenuInflater();
    inflater.inflate(R.menu.context, menu);
}
```

Creating Submenus

- No nested submenus
- A submenu cannot have another submenu.
- Adding a <menu> element as the child of an <item>.

```xml
<menu xmlns:android="http://schemas.android.com/apk/res/android">
    <item android:id="@+id/item01" android:title="@string/item01">
        <!-- "item01" submenu -->
    </item>
    <item android:id="@+id/item01_new" android:title="@string/item01_new" />
    <item android:id="@+id/item01_open" android:title="@string/item01_open" />
</menu>
```
Dialog

- A small window that appears in front of the current Activity.

- Four Dialog object types.
  - AlertDialog
    - A dialog that has buttons or selectable items.
  - ProgressDialog
    - A dialog that displays wheel or progress bar.
  - DatePickerDialog
    - A dialog that allows the user to select a date.
  - TimePickerDialog
    - A dialog that allows the user to select a time.

AlertDialog

- Use onCreateDialog(int) callback method to create dialogs.
- Use showDialog(int) to show a dialog.
- Call onPrepareDialog(int, Dialog) if you want to change any properties of the dialog.
- Example:

```java
// 1. define an integer ID for your dialog
static final int DIALOG_ID = 0;
// 2. Then, define the onCreateDialog(int) callback
protected Dialog onCreateDialog(int id) {
    Dialog dialog;
    switch(id) {
    case DIALOG_ID :
        // Build a dialog!!
        break;
    default:
        dialog = null;
    }
    return dialog;
}
// 3. Now, you can show the dialog
showDialog(DIALOG_ID);
```

Creating an AlertDialog

- Use AlertDialog.Builder to make an AlertDialog.
- A title
- A text message
- Button(s)
- A list of selectable items.

```java
AlertDialog.Builder builder = new AlertDialog.Builder(this);
builder.setTitle("Confirmation")
    .setMessage("Are you sure you want to exit?")
    .setCancelable(false)
    .setPositiveButton("Yes",
        new DialogInterface.OnClickListener()
        {
            public void onClick(DialogInterface dialog, int id) {
                HelloKettering.this.finish();
            }
        })
    .setNegativeButton("No",
        new DialogInterface.OnClickListener()
        {
            public void onClick(DialogInterface dialog, int id) {
                dialog.cancel();
            }
        });
AlertDialog alert = builder.create();
alert.show();
```
Supporting Multiple Screens

Variety of Android Devices

- Android runs on a variety of devices that offer different screen size and densities.
- Developers should make the effort to optimize your app for different screen size and densities.

Screen

- Screen size
  - Actual physical size measured as the screen’s diagonal.
  - All actual screen sizes into four generalized sizes: small, normal, large, and extra large.

- Screen density
  - The quantity of pixels with a physical area of the screen. (usually referred to as dots per inch (dpi)).
  - All actual screen densities into four generalized densities: low, medium, high, and extra high.

- Density independent pixel (dp)
  - A virtual pixel unit that you should use when defining UI layout, to express layout dimensions or position in a density-independent way.

Density-independent pixel (dp)

- dp is equivalent to one physical pixel on a 160 dpi screen (medium density screen), the baseline density.
- At runtime, the system transparently handles any scaling of the dp units, as necessary, based on the actual density of the screen in use.
- The conversion of dp units to screen pixels is simple:
  - \( px = \frac{dp \times \text{dpi}}{160} \).
  - For example, on a 240 dpi screen, 1 dp equals 1.5 physical pixels.
  - You should always use dp units when defining your application’s UI, to ensure proper display of your UI on screens with different densities.
Range of Screens

- **xlarge** screens are at least 960dp x 720dp
- **large** screens are at least 640dp x 480dp
- **normal** screens are at least 470dp x 320dp
- **small** screens are at least 426dp x 320dp

Best Practices

- Use `wrap_content`, `fill_parent`, or `dp` units when specifying dimensions in an XML layout file.
- Do not use hard coded pixel values in your application code.
- Do not use `AbsoluteLayout` (it’s deprecated).
- Supply alternative bitmap drawables for different screen densities.

Further Readings

ProgressDialog

- Two types of ProgressDialog.
  - **HORIZONTAL / SPINNER**
    ```java
    progress.setProgressStyle(ProgressDialog.STYLE_HORIZONTAL);
    progress.show();
    
    final int total = 100;
    new Thread() {
        @Override
        public void run() {
            int i = 0;
            while (i < total) {
                try {
                    sleep(100);
                } catch (InterruptedException e) {
                    e.printStackTrace();
                }
                i++;
                progress.setProgress(i);
            }
        }
    }.start();
    ```
To use DatePickerDialog using DialogFragment, you need to define a fragment class that extends DialogFragment and return a DatePickerDialog from the fragment’s onCreateDialog() method.

Create a new class.

```java
public class TimePickerFragment extends DialogFragment implements TimePickerDialog.OnTimeSetListener {
    @Override
    public Dialog onCreateDialog(Bundle savedInstanceState) {
        final Calendar c = Calendar.getInstance();
        int hour = c.get(Calendar.HOUR_OF_DAY);
        int minute = c.get(Calendar.MINUTE);

        // Create a new instance of TimePickerDialog and return it
        return new TimePickerDialog(getActivity(), this, hour, minute, DateFormat.is24HourFormat(getActivity()));
    }

    public void onTimeSet(TimePicker view, int hourOfDay, int minute) {
        // Do something with the time chosen by the user
    }
}
```

Create an instance of TimePickerFragment and call .show() method of the instance.

```java
public void showTimePickerDialog(View v) {
    DialogFragment newFragment = new TimePickerFragment();
    newFragment.show(getFragmentManager(), "timePicker");
}
```

Pretty much same as DatePickerDialog.

Questions?