Complex User Input

CS 2046

Mobile Application Development

Fall 2010

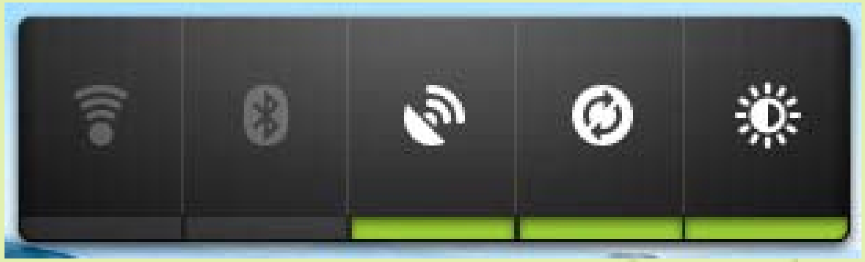
Announcements

- HW1 due Monday, 11/1, at 11:59pm
  - See newsgroup for more clarifications.

- If you're stuck:
- http://developer.android.com/resources/tutorials/notepad/index.html

Intro of the Day – App Widgets

- Miniature views that can be embedded in other applications
  - Usually, home screen



- Consist of:
  - AppWidgetProviderInfo
    - XML metadata
  - AppWidgetProvider
    - Program logic
  - View layout

Code from http://developer.android.com/guide/topics/appwidgets/index.html

AppWidgetProvider Info

- Defines properties of the App Widget
  - Minimum size, layout, update frequency

```
<appwidget-provider
  xmlns:android="http://schemas.android.com/apk/res/android"
  android:minWidth="294dip"
  android:minHeight="72dip"
  android:updatePeriodMillis="86400000"
  android:initialLayout="@layout/example_appwidget"
  android:configure=
    "com.example.android.ExampleAppWidgetConfigure">
</appwidget-provider>
```

AppWidgetProvider

- Misnomer; really a BroadcastReceiver
  - Details of receiver are abstracted away

- onUpdate: Called according to updatePeriodMillis.
  - This is where most program logic goes.
  - For non-updating widgets (buttons), called once on creation.
- onDeleted: When an instance is deleted.
- onEnabled: When the first instance is created.
- onDisabled: When the last instance is deleted.

App Widget Layout

- Like other layouts, goes in res/layout
  - UI guidelines: http://developer.android.com/guide/practices/ui_guidelines/widget_design.html
- Difference – layouts are based on RemoteViews, which only support:
  - FrameLayout, LinearLayout, RelativeLayout
  - AnalogClock, Button, Chronometer, ImageButton, ImageView, ProgressBar, TextView

Manifest

- Declare the App Widget in AndroidManifest.xml:

```
<receiver android:name="ExampleAppWidgetProvider">

  <intent-filter>
     <action android:name="android.appwidget.action.APPWIDGET_UPDATE" />
  </intent-filter>

  <meta-data android:name="android.appwidget.provider"
             android:resource="@xml/example_appwidget_info" />

</receiver>
```

More on App Widgets

- For more, see: http://developer.android.com/guide/topics/appwidgets/index.html
  - How to create configuration Activities
  - More example code and guidelines

- Some examples (with code):
  - App Widget API Demo
  - Wiktionary Sample

Recap

- Covered many basic UI elements
  - Widgets, layouts, menus, dialogs
  - Event handling
    - How do we respond to clicks, or other touch events?
- Next step – what other kinds of input are available to the user, and how do we process them?

Keyboard Input

- For standard widgets, keyboard input is automatic
  - i.e. EditText: Launches on-screen keyboard if needed

- What if we want to take input from keys?
  - Two cases:
    - Optional for phones with hardware keyboards
      - e.g. shortcuts
    - Required for program
      - e.g. a crossword puzzle program

Optional Keyboard Input

- Activity/view-wide: onKeyDown

```
private boolean onKeyDown(int keyCode, KeyEvent event) {
  switch (keyCode) {
    case KeyEvent.KEYCODE_X:
      // Handle X key
      return true;
  }
  return false;
}
```

- KeyEvent allows for more complex input
  - i.e. multiple keys, held keys

Required Keyboard Input

- Easiest way:
  - Extend EditText
  - Override onKeyDown to capture key events
  - Override onDraw to make it look however you want
- Lets EditText handle hiding/showing the software keyboard when necessary
  - This is a notoriously tricky task on Android

Customized IME

- Have ability to control the type of on-screen keyboard that appears.

- For EditText – use android:inputType flags
  - e.g. textEmailAddress will include @ key without having to press Alt.

- Many more customizations – see: http://developer.android.com/resources/articles/on-screen-inputs.html

Touch Screen for Custom Views

- Override onTouchEvent(MotionEvent e)
  - For gestures, we just passed this event elsewhere
- Call e.getX() and e.getY() to get coordinates
  - Top left is (0, 0)
  - Bottom right is (getHeight(), getWidth())
- Common task – drawing a custom grid
  - Need to map coordinates to location in grid
  - If grid width = w and height = h, just do e.getX()/w and e.getY()/h

Speech Recognition

- Another method of working around difficulty of keyboard input.

- Requires an app installed on the phone which responds to a Recognizer Intent.
  - Many phones come with Google Voice Search
  - Emulator, unfortunately, does not.

- Code from API demos: http://developer.android.com/resources/samples/ApiDemos/src/com/example/android/apis/app/VoiceRecognition.html

Accepting Speech Input

- Step 1: Check if recognition is possible

```
PackageManager pm = getPackageManager();
List<ResolveInfo> activities = pm.queryIntentActivities(
  new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH), 0);
if (activities.size() != 0) {
  // Speech recognition enabled
} else {
  // Speech recognition disabled
}
```

Accepting Speech Input

- Step 2: Request recognition

```
Intent intent =
  new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL,
  RecognizerIntent.LANGUAGE_MODEL_FREE_FORM);
intent.putExtra(RecognizerIntent.EXTRA_PROMPT, "Speak");
startActivityForResult(intent, UNIQUE_CODE);
```

Accepting Speech Input

- Step 3: Process results

```
if (requestCode == UNIQUE_CODE && resultCode == RESULT_OK)
{
  ArrayList<String> matches = data.getStringArrayListExtra(
    RecognizerIntent.EXTRA_RESULTS);
  // Process matches...
}
```

Accelerometer

- Detect orientation and motion of device.
- CAN be tested on Android emulator!
  - (not by shaking the window)
  - See SensorSimulator for a program which lets you simulate sensor data.
    - Unfortunately, requires use of a deprecated API, but the differences are small.

Basic Approach

- Access the SensorManager service through getSystemService(Context.SENSOR_SERVICE).
- Register a listener for the sensor you wish to use with SensorManager's registerListener() method
- Handle events on the onSensorChanged method of the listener.

Other Sensors

- Same approach works for other sensors – the values array changes based on the type.
- From Sensor class:
  - Sensor.TYPE_MAGNETIC_FIELD
  - Sensor.TYPE_LIGHT
  - Sensor.TYPE_PROXIMITY
  - Sensor.TYPE_TEMPERATURE
  - and more…

Device Orientation

- Can get orientation from sensors, but this is deprecated.
- Instead, use SensorManager.getOrientation()
- 3D coordinates = Linear Algebra
  - Out of the scope of the course, but see http://android-developers.blogspot.com/2010/09/one-screen-turn-deserves-another.html if you're interested.

Information Storage

CS 2046

Mobile Application Development

Fall 2010

Storing Information

- Many methods available for storing information
- Appropriate method depends on:
  - Type of information
  - Who needs to access it

Application Preferences

- Preferences is a bit of a misnomer
  - Can store preferences
  - Really, stores arbitrary, persistent key-value pairs
- Uses SharedPreferences class
- Thread-safe access model

Accessing Shared Preferences

- Obtain an instance with Context.getSharedPreferences(String name, int mode)
  - Name is unique per application
  - Mode is one of:
    - MODE_PRIVATE
    - MODE_WORLD_READABLE
    - MODE_WORLD_WRITABLE
- Alternative: If just one preferences file for Activity, can call Activity.getPreferences(int mode).

Reading Preferences

- Reading preferences is simple, given a SharedPreferences object (prefs).
  - prefs.get<TYPE>(String key, <TYPE> default)
    - If key doesn't exist, returns default
    - If key exists but is of wrong type, throws ClassCastException

Writing Preferences

- Writing is more complex – uses transactions.

```
SharedPreferences.Editor editor = prefs.edit();
editor.put*(key, value);
editor.remove(key);
editor.commit();
```

- All changes are committed atomically when commit() is called – enables thread safety.

Modifying Preferences

- What about actual preferences that we want the user to modify?
- Solution: XML and PreferenceActivity
- Pros:
  - Define preferences in a resource instead of in code
  - Consistent behavior with rest of platform

XML Preference File

- Place in res/xml/
- Root tag: <PreferenceScreen>
- Categories go in <PreferenceCategory>
- Preferences contain:
  - key – name of preference (unique ID)
  - title – plaintext name of preference
  - summary – more details
- Types of preferences:
  - CheckboxPreference, EditTextPreference, ListPreference
    - Each has additional attributes

Preference Activity

- Modifying preferences is easy:

```
public class PreferencesFromXml extends PreferenceActivity {
  @Override
  protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    addPreferencesFromResource(R.xml.preferences);
  }
}
```

Storing files

- Suppose preferences aren't enough, and we need to store some kind of file on the system.

- Three choices
  - Simplest – need a read-only file bundled with app.
  - Need a (small) file private to your application
  - Need a (possibly large) file which may be useful for other applications.

Raw Resources

- Case 1: Bundled file with application

- Place in res/raw/<filename>.ext
- Access with:

```
getResources().openRawResource(R.raw.<filename>)
```

- Returns an InputStream of the file.

Internal Storage

- By default, files stored internally are private to your application.
  - Other applications (and non-rooted phone users) cannot tamper with them.
  - Will be removed when app is uninstalled.

- Call Context.openFileOutput() for writing.
- Call Context.openFileInput() for reading.
  - Return FileOutputStream/FileInputStream.

Next time…

- How do we store potentially large files that we want to share with other applications (and the user)?
- How do we store tabular data?