CMSC436: Programming Handheld Systems

Fall 2017
Location & Maps
Today’s Topics

Location
Location support classes
Maps
Map support classes
Location Services

Mobile applications can benefit from being location-aware

Allows applications to determine their location and modify their behavior
Using Location Information

Find stores near the user’s current location
Direct a user from a current to a particular store
Define a geofence
Initiate action when user enters or exits the geofence
Location Architecture

Location
LocationProvider
LocationManager
LocationListener
Location

Represents a position on the Earth

A Location instance consists of:

- Latitude, longitude, timestamp and, optionally, accuracy, altitude, speed, and bearing
LocationProvider

Represents a location data source
Actual data may come from
- GPS satellites
- Cell phone towers
- WiFi access points
LocationProvider Types

Network – WiFi and cell tower

GPS - Satellite

Passive – Piggyback on the readings requested by other applications
NetworkProvider

Determines location based on cell tower and WiFi access points

Requires either

android.permission.ACCESS_COARSE_LOCATION
android.permission.ACCESS_FINE_LOCATION
GPSProvider

Determines location using satellites

Requires

android.permission.ACCESS_FINE_LOCATION
PassiveProvider

Returns locations generated by other providers

Requires

android.permission.ACCESS_FINE_LOCATION
LocationProvider

Different LocationProviders offer different tradeoffs between cost, accuracy, availability & timeliness
Location Provider Tradeoffs

GPS – expensive, accurate, slower, available outdoors

Network - cheaper, less accurate, faster, availability varies

Passive – cheapest, fastest, not always available
LocationManager

System service for accessing location data

getSystemService(Context.LOCATION_SERVICE)
LocationManager

Determine the last known user location
Register for location updates
Register to receive Intents when the device nears or moves away from a given geographic area
getLocationListener

Defines callback methods that are called when Location or LocationProvider status changes
LocationListener

void onLocationChanged (Location location)
void onProviderDisabled (String provider)
void onProviderEnabled (String provider)
void onStatusChanged (String provider, int status, Bundle extras)
Obtaining and Using Location Information

Start listening for updates from LocationProviders
Maintain a "current best estimate" of location
When estimate is “good enough”, stop listening for location updates
Use best location estimate
Determining Best Location

Several factors to consider

Measurement time
Accuracy
Power usage
LocationGetLocation

Application acquires and displays the last known locations from all providers

If necessary, acquires and displays new readings from all providers
Location
Get Location
LocationGetLocationServices

The same as LocationGetLocation, but uses newer FusedLocationProvider class

Uses Google Play Services
Battery Saving Tips

Always check last known measurement

Return updates as infrequently as possible. Limit measurement time

Use the least accurate measurement necessary

Turn off updates in onPause()
Maps

A visual representation of area

Android provides Mapping support through the Google Maps Android v2 API
Map Types

Normal: traditional road map
Satellite – Aerial photograph
Hybrid - Satellite + road map
Terrain - Topographic details
Customizing the Map

Change the camera position
Add Markers & ground overlays
Respond to gestures
Indicate the user’s current Location
Some Map Classes

GoogleMap
MapFragment
Camera
Marker
Setting up a Maps Application

Set up the Google Play services SDK
Obtain an API key
Specify settings in Application Manifest
Add map to project

See: https://developers.google.com/maps/documentation/android/start
Map Permissions

<uses-permission android:name="android.permission.INTERNET"/>
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE"/>
Map Permissions

<uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE"/>

<uses-permission android:name="com.google.android.providers.gsf.permission.READ_GSERVICES"/>
Map Permissions

<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION"/>

<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
MapEarthQuakeMap

This application acquires earthquake data from a server
Then it displays the data on a map, using clickable markers
public class MapsEarthquakeMapActivity extends Activity implements RetainedFragment.OnFragmentInteractionListener, OnMapReadyCallback {
    ...
    public void onCreate(Bundle savedInstanceState) {
        // Set up UI and get earthquake data
        ...
        // The GoogleMap instance underlying the GoogleMapFragment defined in main.xml
        MapFragment map = ((MapFragment) getFragmentManager().findFragmentById(R.id.map));
        map.getMapAsync(this);
    }
}
// Called when Map is ready
public void onMapReady(GoogleMap googleMap) {

    mMapReady = true;
    mMap = googleMap;
    mMap.moveCamera(
        CameraUpdateFactory.newLatLng(
            new LatLng(CAMERA_LAT, CAMERA_LNG)));

    if (mDataReady) {
        placeMarkers();
        mMapReady = false;
    }
}
public void onDownloadfinished() {
    mDataReady = true;
    if (mMapReady) {
        placeMarkers();
        mDataReady = false;
    }
}
private void placeMarkers() {
    // Add a marker for every earthquake
    for (EarthQuakeRec rec : mRetainedFragment.getData()) {
        // Add a new marker for this earthquake
        mMap.addMarker(new MarkerOptions()
            // Set the Marker's position
            .position(new LatLng(rec.getLat(), rec.getLng()))
            // Set the title of the Marker's information window
            .title(String.valueOf(rec.getMagnitude()))
            // Set the color for the Marker
            .icon(BitmapDescriptorFactory.defaultMarker(getMarkerColor(rec.getMagnitude()))));
    }
}
Next Time

The ContentProvider Class