LabW05 – Location Access

Objectives:

1. Understand how to use Google Maps API
2. Understand how to use Google Location Services API

Tasks:

1. Use Google Maps API
2. Access to the current location

Location Services allows apps and websites (including Maps, Camera, Weather, and other apps) to use information from cellular, Wi-Fi, Global Positioning System (GPS) networks, and Bluetooth to determine your approximate location.

Using location-based information in your app is a great way to keep the user connected to the surrounding world. Whether you use this information for practical purposes such as navigation or for entertainment, location-based information can offer users a more contextual experience and enhance the overall user experience.

In this tutorial, we will explore how to capture this location information by using Google Maps API and Google Location Services API in your mobile device.

Task 1: Use Google Maps API

This guide is a quick start to adding a map to an Android app. Android Studio is the recommended development environment for building an app with the Maps SDK for Android.

With the Maps SDK for Android, you can add maps based on Google Maps data to your application. The API automatically handles access to Google Maps servers, data downloading, map display, and response to map gestures. You can also use API calls to add markers, polygons, and overlays to a basic map, and to change the user's view of a particular map area. These objects provide additional information for map locations, and allow user interaction with the map. The API allows you to add these graphics to a map:

- Icons anchored to specific positions on the map (Markers).
- Sets of line segments (Polylines).
- Enclosed segments (Polygons).
- Bitmap graphics anchored to specific positions on the map (Ground Overlays).
- Sets of images which are displayed on top of the base map tiles (Tile Overlays).

This task is based on the following tutorial links:
https://developers.google.com/maps/documentation/android-sdk/start
https://developers.google.com/maps/documentation/android-sdk/map-with-marker

1. Start Android Studio and pick a “No Activity” project under “Phone and Tablet” category for creating a new project. Enter the following information as prompted:

    - **Name:** “GoogleMaps”
    - **Package name:** “comp5216.sydney.edu.au.googlemaps”
    - Choose your preferred Save location
    - **Language:** Java
    - **Minimum API level:** API 24 Android 7.0 (Nougat)
    - **Build Configuration level:** Groovy DSL
    - Click Finish

2. Once your project is created, right-click on **App -> Java -> comp5216.sydney.edu.au.googlemaps** and select **New -> Activity -> Gallery -> Google Maps View Activity** and complete the details of the activity screen.

3. Your app needs a Google Map API key to access the Google Maps servers, so in the next steps, you should obtain a Google Maps API key that you can add to your app. Android Studio Androidmanifest.xml file contains a link to the website with directions on how to get the Google Map API key. Do not add your API key to the file. Doing so stores your API key less securely.

4. Proceed to the Google Cloud Platform Console to create a Google Maps API key. In the Google Cloud Console, on the “**Select a project**” page, click Create “**NEW PROJECT**” to begin creating a new Google Cloud project. Choose a Project name and click Create.

5. Provide the billing information to start the free trial and enable the Maps APIs or SDK for Android to use the Google Maps Platform. Select “**APIs and Services -> Enabled APIs and Services**” on the “Getting Started” section. Select the “Library” option to proceed to the API library. Click “**Maps SDK for Android**” tile to enable the SDK to be used with your project and click **enable** button.

6. Select the payment method if billing account is already created or set up the payment method to generate API key.

7. In the Google Maps Platform, proceed to the **Keys and Credentials** tab.

8. On the Credentials page, click “+ Create Credentials” > API key. The API key created dialog displays your newly created API key.

9. Click Close. The new API key is listed on the Credentials page under API Keys. (Remember to restrict the API key before using it in production)

10. In Android Studio, open your **project build.gradle** file and add the following code to the id under the plugins section. These lines might have been already added to the gradle files automatically.

```
plugins {
    id 'com.android.application' version '8.1.0' apply false
    id 'com.android.library' version '8.1.0' apply false
    id 'com.google.android.libraries.mapsplatform.secrets-gradle-plugin' version
'2.0.1' apply false
}
```

11. Next, open your **module build.gradle** file and add the following code to the plugins element.

```
id 'com.google.android.libraries.mapsplatform.secrets-gradle-plugin'
```

12. Save the file and sync your project with Gradle. In your AndroidManifest.xml file, go to com.google.android.geo.API_KEY and update the android:value attribute with **MAPS_API_KEY** as follows.

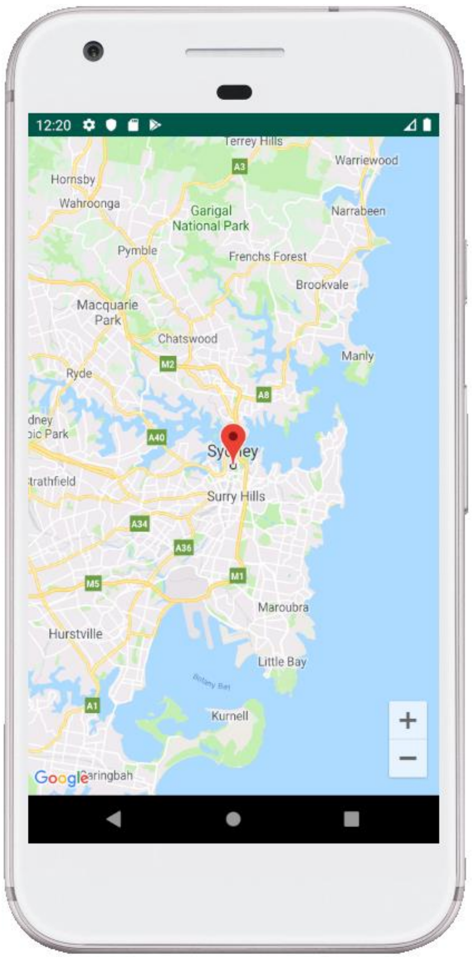
```
<meta-data
    android:name="com.google.android.geo.API_KEY"
    android:value="MAPS_API_KEY" />
```

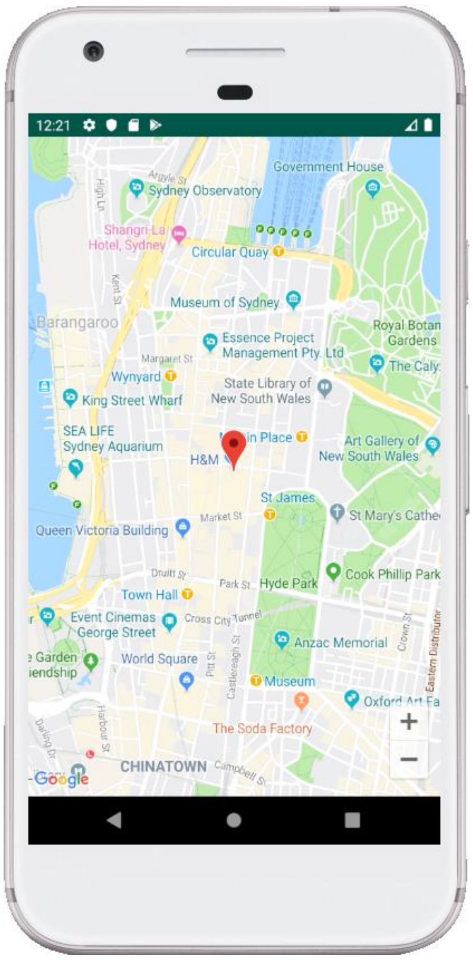
13. Review the code generated by Android Studio. Have a look at the app’s layout XML file activity_maps.xml, and the Java file that defines the maps activity MapsActivity.java.

14. Enable zoom controls on your map and animate the camera to zoom into the map as soon as the map is ready to be used. Refer to the code snippet below.
    The final code should look the same as per MapsActivity.java file given in the Appendix.

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

    binding = ActivityMapsBinding.inflate(getLayoutInflater());
    setContentView(binding.getRoot());

    // Do a null check to confirm that we have not already instantiated the map.
    if (mMap == null) {
   // Obtain the SupportMapFragment and get notified when the map is ready to be used.
        SupportMapFragment mapFragment = (SupportMapFragment)
getSupportFragmentManager()
                .findFragmentById(R.id.map);
        mapFragment.getMapAsync(this);
    }
}


@Override
public void onMapReady(GoogleMap googleMap) {
    mMap = googleMap;

    if (mMap != null) {
        // Map is ready
        Toast.makeText(this, "Map is ready to be used!", Toast.LENGTH_SHORT).show();

        // Add a marker in Sydney and move the camera
        LatLng sydney = new LatLng(-33.8692, 151.2089);
        mMap.addMarker(new MarkerOptions().position(sydney).title("Marker in Sydney"));
        mMap.moveCamera(CameraUpdateFactory.newLatLng(sydney));

        // Enable zoom controls
        mMap.getUiSettings().setZoomControlsEnabled(true);
        // Animate the camera to zoom into the map
        mMap.animateCamera(CameraUpdateFactory.newLatLngZoom(sydney, 11));
    } else {
        Toast.makeText(this, "Error - Map was null!", Toast.LENGTH_SHORT).show();
    }
}
```

15. Build and run your app.
    A Google map, a marker anchored to a specific Sydney location and zoom controls should be displayed as per the following screenshots. Use the zoom controls on the map to zoom in or out of your map.





Task 2: Access to current location

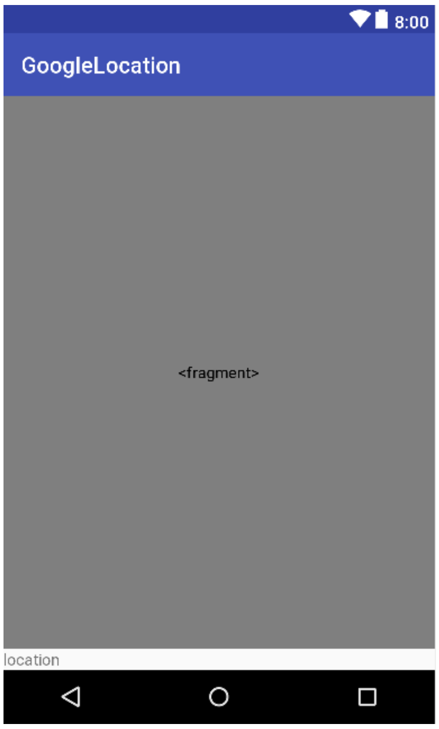
This task shows you how to find the current location of an Android device. It builds an Android app using the Maps SDK for Android and the fused location provider in the Google Play services location APIs. The content is partially adopted from the following tutorial https://developers.google.com/maps/documentation/android-sdk/current-place-tutorial

1. Start Android Studio and pick a "**No Activity**" project under the "Phone and Tablet" category for creating a new project. Enter the following information as prompted:

   a. **Name:** "GoogleLocation"
   b. **Package name:** "comp5216.sydney.edu.au.googlelocation"
   c. Choose your preferred Save location
   d. **Language:** Java
   e. Minimum API level: API 24 Android 7.0 (Nougat)
   f. **Build Configuration level:** Groovy DSL
   g. Click Finish

2. Once your project is created, right-click on **App -> Java -> comp5216.sydney.edu.au.googlelocation** and select **New -> Activity -> Gallery -> Google Maps View Activity** and complete the details of the activity screen.

3. Copy the ***activity_maps.xml*** (from the appendix) into your project's res/layout folder. It only contains a location TextView at the bottom to show the latitude and longitude, and a Google Map Fragment above it to cover the rest of the screen.



4. Obtain a Google Maps API key and add the API key to your app. Refer to steps 4 to 12 from Task 1 on how to obtain a key and use it for your app.

5. In your MapsActivity.java file, declare variables to reference the location

```
private GoogleMap mMap;
private ActivityMapsBinding binding;
private CameraPosition mCameraPosition;
private TextView locationTextView;
private static final String TAG = MapsActivity.class.getSimpleName();

// The entry point to the Fused Location Provider.
private FusedLocationProviderClient mFusedLocationProviderClient;

// The geographical location where the device is currently located. That is, the last-
known location retrieved by the Fused Location Provider.
private Location mLastKnownLocation = new Location("");

// A default location (Sydney, Australia) and default zoom to use when location
permission is not granted.
private final LatLng mDefaultLocation = new LatLng(-33.8523341, 151.2106085);
private static final int DEFAULT_ZOOM = 15;
private static final int PERMISSIONS_REQUEST_ACCESS_FINE_LOCATION = 1;
private boolean mLocationPermissionGranted = false;

// Keys for storing activity state.
private static final String KEY_CAMERA_POSITION = "camera_position";
private static final String KEY_LOCATION = "location";
```

(***locationTextView***), the current location (***mLastKnownLocation***), default location (***mDefaultLocation***), default zoom and other supporting variables.

6. Add Google Play Services libraries in build.gradle file inside your app module directory

```
implementation 'com.google.android.gms:play-services-maps:18.1.0'
implementation 'com.google.android.gms:play-services-location:21.0.1'
```

7. In ***onCreate***() method, use the layout activity_maps, and initialise the Fused Location Provider Client. Also initialise the Google Map.

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

    // Retrieve the content view that renders the map.
    binding = ActivityMapsBinding.inflate(getLayoutInflater());
    setContentView(binding.getRoot());

    // Retrieve location and camera position from saved instance state.
    if (savedInstanceState != null) {
        mLastKnownLocation = savedInstanceState.getParcelable(KEY_LOCATION);
        mCameraPosition = savedInstanceState.getParcelable(KEY_CAMERA_POSITION);
    }

    // Obtain the SupportMapFragment and get notified when the map is ready to be used.
    SupportMapFragment mapFragment = (SupportMapFragment) getSupportFragmentManager()
            .findFragmentById(R.id.map);
    mapFragment.getMapAsync(this);

    // Obtain the location TextView
    locationTextView = (TextView) this.findViewById(R.id.location);

    // Construct a FusedLocationProviderClient.
    mFusedLocationProviderClient =
        LocationServices.getFusedLocationProviderClient(this);
}
```

8. Make sure your activity extends FragmetActivity instead of Activity, and implements OnMapReadyCallback. We will add the required methods in the next step.

```
public class MapsActivity extends FragmentActivity implements OnMapReadyCallback {
    ...
}
```

9. Add the required callback methods.

```
@Override
public void onMapReady(GoogleMap googleMap) {
    mMap = googleMap;

    // Prompt the user for permission.
    getLocationPermission();

    // Turn on the My Location layer and the related control on the map.
    updateLocationUI();

    // Get the current location of the device and set the position of the map.
    getDeviceLocation();
}
```

10. Make sure getLocationPermission, updateLocationUI, and getDeviceLocation methods are implemented and you understand what each function does. Refer to MapsActivity.java in the lab files.

```
private void getDeviceLocation() {
    try {
        if (mLocationPermissionGranted) {
            Task<Location> locationResult =
mFusedLocationProviderClient.getLastLocation();
            locationResult.addOnCompleteListener(this, new
OnCompleteListener<Location>() {
                @Override
                public void onComplete(@NonNull Task<Location> task) {
                    if (task.isSuccessful()) {
                        // Obtain the current location of the device
                        mLastKnownLocation = task.getResult();
                        String currentOrDefault = "Current";

                        if (mLastKnownLocation != null) {
                            mMap.animateCamera(CameraUpdateFactory.newLatLngZoom(
                                    new LatLng(mLastKnownLocation.getLatitude(),
                                            mLastKnownLocation.getLongitude()),
DEFAULT_ZOOM));
                        } else {
                            Log.d(TAG, "Current location is null. Using defaults.");
                            currentOrDefault = "Default";

mMap.animateCamera(CameraUpdateFactory.newLatLngZoom(mDefaultLocation, DEFAULT_ZOOM));
                            mMap.getUiSettings().setMyLocationButtonEnabled(false);

                            // Set current location to the default location
                            mLastKnownLocation = new Location("");
                            mLastKnownLocation.setLatitude(mDefaultLocation.latitude);

mLastKnownLocation.setLongitude(mDefaultLocation.longitude);
                        }

                        // Show location details on the location TextView
                        String msg = currentOrDefault + " Location: " +
                                Double.toString(mLastKnownLocation.getLatitude()) + ",
" +
                                Double.toString(mLastKnownLocation.getLongitude());
                        locationTextView.setText(msg);

                        // Add a marker for my current location on the map
                        MarkerOptions marker = new MarkerOptions().position(
                                new LatLng(mLastKnownLocation.getLatitude(),
mLastKnownLocation.getLongitude()))
                                .title("I am here");
                        mMap.addMarker(marker);
                    } else {
                        Log.d(TAG, "Current location is null. Using defaults.");
                        Log.e(TAG, "Exception: %s", task.getException());
                        mMap.moveCamera(CameraUpdateFactory
                                .newLatLngZoom(mDefaultLocation, DEFAULT_ZOOM));
                        mMap.getUiSettings().setMyLocationButtonEnabled(false);
                    }
                }
            });
        }
    } catch (SecurityException e)  {
        Log.e("Exception: %s", e.getMessage());
    }
}
```

11. Setup the permission for accessing location. You may refer to ***AndroidManifest.xml*** file in the lab material to update your own version.

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

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

12. Build and run the app, preferably on a mobile phone.
    The app should display your current location. The final code will be the similar to that of ***MapsActivity.java*** (in Appendix).

To learn more about the Location Services API, see Google Location Services for Android:

- Build location-aware apps - https://developer.android.com/training/location/
- Get the last known location - https://developer.android.com/training/location/retrieve-current

To learn more about the step-by-step process of getting an embedded Google Map working within an Android emulator, refer to this tutorial:
https://github.com/codepath/android_guides/wiki/Google-Maps-Fragment-Guide

APPENDIX

Activity_maps.xml

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    tools:context=".MapsActivity">

    <fragment xmlns:android="http://schemas.android.com/apk/res/android"
        xmlns:map="http://schemas.android.com/apk/res-auto"
        xmlns:tools="http://schemas.android.com/tools"
        android:id="@+id/map"
        android:name="com.google.android.gms.maps.SupportMapFragment"
        android:layout_above="@+id/location"
        android:layout_width="match_parent"
        android:layout_height="match_parent" />

    <TextView
        android:id="@+id/location"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignParentBottom="true"
        android:text="location" />
</RelativeLayout>
```