LAB 14 – Making Runtime Permission Requests in Android

At the end of this lab, students should be able to:

- Demonstrate the steps involved in requesting runtime permissions when running on the latest generations of Android.

Understanding Normal and Dangerous Permissions

Android enforces security by requiring the user to grant permission for an app to perform certain tasks. Prior to the introduction of Android 6, permission was always sought at the point that the app was installed on the device. Figure 12.1, for example, shows a typical screen seeking a variety of permissions during the installation of an app via Google Play.

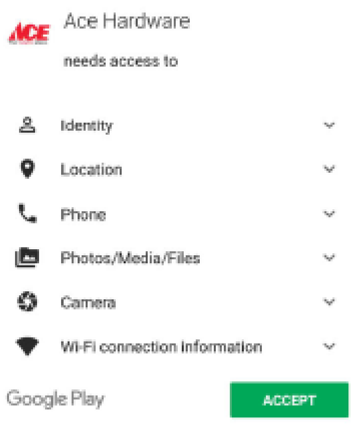


Figure 12.1

For many types of permissions this scenario still applies for apps on Android 6.0 or later. These permissions are referred to as normal permissions and are still required to be accepted by the user at the point of installation.
A second type of permission, referred to as dangerous permissions must also be declared within the manifest file in the same way as a normal permission, but must also be requested from the user when the application is first launched. When such a request is made, it appears in the form of a dialog box as illustrated in figure 12.2 a below:

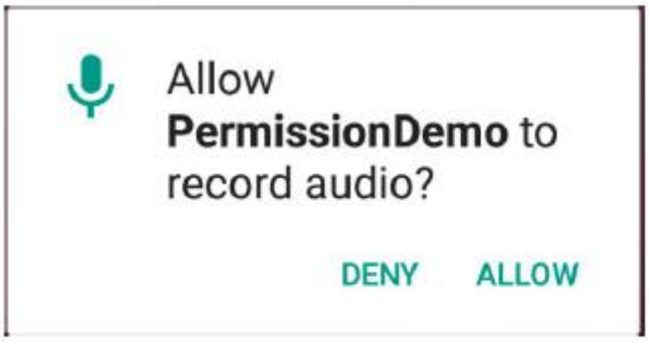


Figure 12.2

The full list of permissions that fall into the dangerous category is contained in Table below:

Permission Group	Permission
Calendar	READ_CALENDAR WRITE_CALENDAR
Camera	CAMERA
Contacts	READ_CONTACTS WRITE_CONTACTS GET_ACCOUNTS
Location	ACCESS_FINE_LOCATION ACCESS_COARSE_LOCATION
Microphone	RECORD_AUDIO
Phone	READ_PHONE_STATE CALL_PHONE READ_CALL_LOG WRITE_CALL_LOG ADD_VOICEMAIL USE_SIP PROCESS_OUTGOING_CALLS
Sensors	BODY_SENSORS
SMS	SEND_SMS RECEIVE_SMS READ_SMS RECEIVE_WAP_PUSH RECEIVE_MMS
Storage	READ_EXTERNAL_STORAGE WRITE_EXTERNAL_STORAGE

Creating the Permissions- An Example

a) Creating the Example Application

i. Go to File -> New Project
ii. Choose **Empty Activity** template, then click Next
iii. Enter *PermissionDemo* into the Name field and specify com.ebookfrenzy.permissiondemo as the package name.
Change the Minimum API level setting to API26: Android 8.0(Oreo) and the Language menu to Java.
Click Finish.

b) Checking for a Permission

The Android Support Library contains a number of methods that can be used to seek and manage dangerous permissions within the code of an Android app.
Before an app attempts to make use of a feature that requires approval of a dangerous permission, and regardless of whether or not permission was previously granted, the code must check that the permission has been granted.
This can be achieved via a call to the *checkSelfPermission()* method of the ContextCompat class, passing through as arguments a reference to the current activity and the permission being requested.
The method will check whether the permission has been previously granted and return an integer value matching *PackageManager.PERMISSION_GRANTED* or *PackageManager.PERMISSION_DENIED.*

i. Within the MainActivity.java file of the example project, modify the code to check whether permission has been granted for the app to record audio:

```
package com.ebookfrenzy.permissiondemoactivity;
import androidx.appcompat.app.AppCompatActivity;
import androidx.core.content.ContextCompat;
import android.os.Bundle;
import android.Manifest;
import android.content.pm.PackageManager;
import android.util.Log;
public class MainActivity extends AppCompatActivity {
private static final String TAG = "PermissionDemo";
@Override
protected void onCreate(Bundle savedInstanceState) {
super.onCreate(savedInstanceState);
setContentView(R.layout.activity_permission_demo);
setupPermissions();
}
private void setupPermissions() {
int permission = ContextCompat.checkSelfPermission(this,
Manifest.permission.RECORD_AUDIO);
if (permission != PackageManager.PERMISSION_GRANTED) {
Log.i(TAG, "Permission to record denied");
}
}
}
```

Run the app on a device or emulator running a version of Android that predates Android 6.0 and check the Logcat output within Android Studio. After the app has launched, the Logcat output should include the “Permission to record denied” message.

ii. Edit the *AndroidManifest.xml* file (located in the Project tool window under *app -> manifests*) and add a line to request recording permission as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest
xmlns:android="http://schemas.android.com/apk/res/android"
package="com.ebookfrenzy.permissiondemoactivity" >
<uses-permission
android:name="android.permission.RECORD_AUDIO" />
.
.
```

Compile and run the app once again and note that this time the permission denial message does not appear. Clearly, everything that needs to be done to request this permission on older versions of Android has been done.
Run the app on a device or emulator running Android 6.0 or later, however, and note that even though permission has been added to the manifest file, the check still reports that permission has been denied. This is because Android version 6 and later require that the app also request dangerous permissions at runtime.

c) Requesting Permission at Runtime

A permission request is made via a call to the *requestPermissions()* method of the ActivityCompat class. When this method is called, the permission request is handled asynchronously and a method named *onRequestPermissionsResult()* is called when the task is completed.
The *requestPermissions()* method takes as arguments a reference to the current activity, together with the identi.er of the permission being requested and a request code. The request code can be any integer value and will be used to identify which request has triggered the call to the *onRequestPermissionsResult()* method.

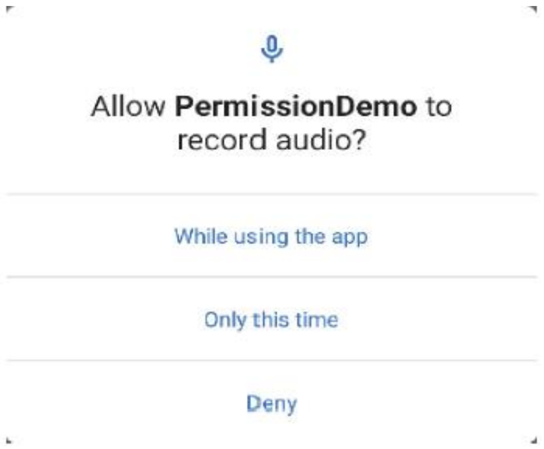
i. Modify the *MainActivity.java* file to declare a request code and request recording permission in the event that the permission check failed:

```
..
import androidx.core.app.ActivityCompat;
..
public class MainActivity extends AppCompatActivity {
private static final String TAG = "PermissionDemo";
private static final int RECORD_REQUEST_CODE = 101;
.
.
@Override
private void setupPermissions() {
int permission = ContextCompat.checkSelfPermission(this,
Manifest.permission.RECORD_AUDIO);
if (permission != PackageManager.PERMISSION_GRANTED) {
Log.i(TAG, "Permission to record denied");
makeRequest();
}
}
protected void makeRequest() {
ActivityCompat.requestPermissions(this,
new String[]{Manifest.permission.RECORD_AUDIO},
RECORD_REQUEST_CODE);
}
}
```

ii. Next, implement the onRequestPermissionsResult() method so that it reads as follows:

```
@Override
public void onRequestPermissionsResult(int requestCode, String permissions[],
int[] grantResults) {
switch (requestCode) {
case RECORD_REQUEST_CODE: {
if (grantResults.length == 0
|| grantResults[0] !=
PackageManager.PERMISSION_GRANTED) {
Log.i(TAG, "Permission has been denied by user");
} else {
Log.i(TAG, "Permission has been granted by user");
}
}
}
}
```

Compile and run the app on an Android 6 or later emulator or device and note that a dialog seeking permission to record audio appears as shown in Figure 12.3 below:



Allow **PermissionDemo** to record audio?

Figure 12.3

Tap the While using the app button and check that the "Permission has been granted by user" message appears in the Logcat panel.
Once the user has granted the requested permission, the *checkSelfPermission()* method call will return a PERMISSION_GRANTED result on future app invocations until the user uninstalls and re-installs the app or changes the permissions for the app in Settings.

d) Providing a Rationale for the Permission Request

As is evident from, Figure 12.3, the user has the option to deny the requested permission. In this case, the app will continue to request the permission each time that it is launched by the user unless the user selected the “Never ask again” option prior to clicking on the Deny button. Repeated denials by the user may indicate that the user doesn’t understand why the permission is required by the app. The user might, therefore, be more likely to grant permission if the reason for the requirements is explained when the request is made. Unfortunately, it is not possible to change the content of the request dialog to include such an explanation.

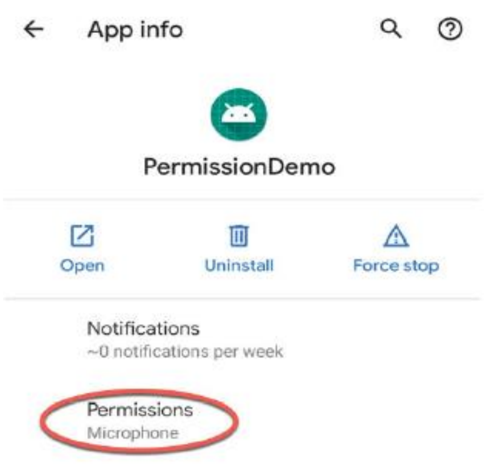
An explanation is best included in a separate dialog which can be displayed before the request dialog is presented to the user. This raises the question as to when to display this explanation dialog. The Android documentation recommends that an explanation dialog only be shown in the event that the user has previously denied the permission and provides a method to identify when this is the case.

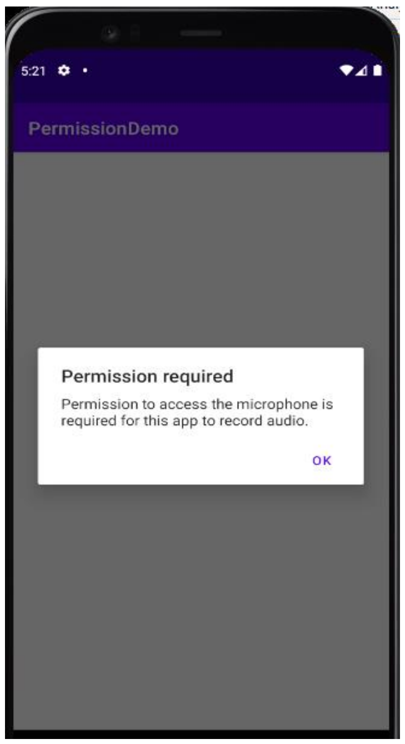
A call to the *shouldShowRequestPermissionRationale()* method of the ActivityCompat class will return a true result if the user has previously denied a request for the specified permission, and a false result if the request has not previously been made. In the case of a true result, the app should display a dialog containing a rationale for needing the permission and, once the dialog has been read and dismissed by the user, the permission request should be repeated.

i. To add this functionality to the example app, modify the *onCreate()* method so that it reads as follows:

```
..
import android.app.AlertDialog;
import android.content.DialogInterface;
..
private void setupPermissions() {
int permission = ContextCompat.checkSelfPermission(this,
Manifest.permission.RECORD_AUDIO);
if (permission != PackageManager.PERMISSION_GRANTED) {
Log.i(TAG, "Permission to record denied");
if(ActivityCompat.shouldShowRequestPermissionRationale(this,
Manifest.permission.RECORD_AUDIO)) {
AlertDialog.Builder builder =
new AlertDialog.Builder(this);
builder.setMessage("Permission to access the microphone is required
for this app to record audio.")
.setTitle("Permission required");
builder.setPositiveButton("OK",
new DialogInterface.OnClickListener() {
public void onClick(DialogInterface dialog, int id) {
Log.i(TAG, "Clicked");
makeRequest();
}
});
AlertDialog dialog = builder.create();
dialog.show();
} else {
makeRequest();
}
  }
    }
```

The method still checks whether or not the permission has been granted, but now also identifies whether a rationale needs to be displayed. If the user has previously denied the request, a dialog is displayed containing an explanation and an OK button on which a listener is configured to call the *makeRequest()* method when the button is tapped. In the event that the permission request has not previously been made, the code moves directly to seeking permission.





Permission required

Permission to access the microphone is required for this app to record audio.