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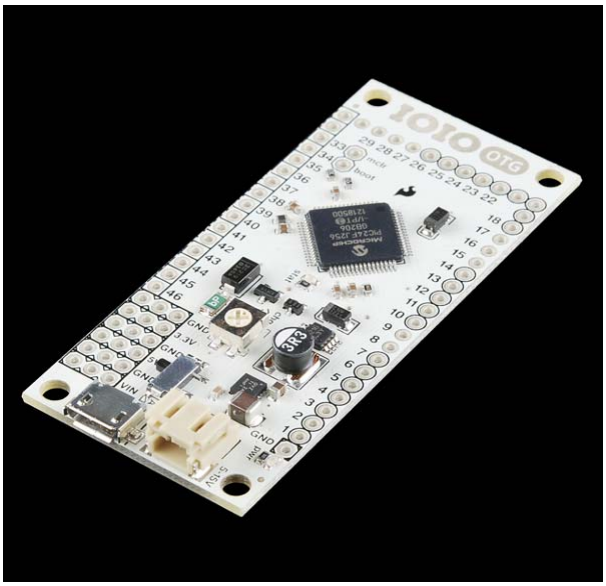
IOIO-OTG Beginners Guide

by a1ronzo | March 21, 2011 | Skill Level: ★ Beginner

Introduction

This is the beginners guide for using the IOIO-OTG board in Android mode and is intended for users that have never written an Android app. The goal of this tutorial is to show how to write a simple app that communicates with the IOIO board. If you are interested in using the IOIO-OTG in PC mode, please refer to this wiki.



IOIO-OTG

The programming language used to write an Android app is Java. If you are not familiar with Java, this tutorial will only go over writing a simple Java app using the IOIO library. This tutorial will *not* cover how to write Java code nor will it cover how to use the rich features within your Android device, like GPS, accelerometer, touch screen, etc. Once you get to the point where you want to use the vast array of features on your Android, we suggest first looking at the technical resource section on developer.android.com. If you still can't find the examples you are looking for, simply browsing the web will result in a ton of information and examples that show you how to communicate with all of the great pieces of hardware within your Andriod device.

In general, the holy grail for developing Android apps is developer.android.com. There, you will find most of the information on Android development. For documentation/downloads specific to the IOIO and for more advanced discussions about the IOIO, see these links:

- IOIO-OTG Wiki
- All of the Downloads you need
- IOIO discussion group

Gathering Your Hardware

Here are the pieces of hardware you will need to complete this tutorial:

- Android enabled device using OS 1.5 or greater
- IOIO-OTG board, with adapter cable
- USB cable that is compatible with your Android device
- 5-10V power supply with at least 1A of current. You will need to power the IOIO through the VIN and GND pins or there is an optional JST connector, which

can be used with this adapter and wall wart power supply. More information at the end of the tutorial found here.

Installing the Development Environment

The Eclipse IDE (integrated development environment), the Android SDK (software development kit), and the JDK (Java development kit) are the primary pieces of software that you will need to install. The page developer.android.com has written thorough instructions on what exactly you will need to download. Please read the instructions carefully, they are found in the link below:

- Installing Eclipse and the Android SDK

ATTENTION: You must use **JDK v6** (not v5 or v7) for Android development.

If you have any problems, see the Troubleshooting section from developer.android.com.

When you reach Step 4 in the Android SDK tutorial, you will at least need to install the SDK components relevant to the Android device you will be working with. For example, if you have an Android phone, goto **Settings > About Phone** and scroll down to Android Version. You must install the SDK platform corresponding to the Android version of your device.

Import the HelloIOIO Example

Instead of creating a new project from scratch, we can import an existing IOIO project that has all of the files ready to go. If you need instruction on creating a new project, see the Hello World example on developer.android.com.

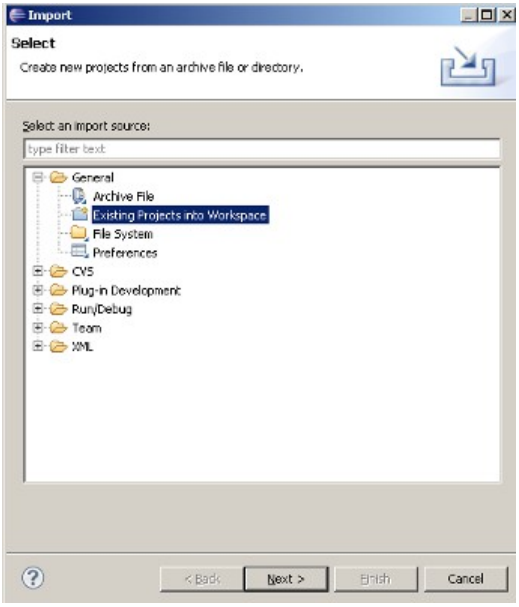
To import an existing project...

1) Download the latest 'Android Software and IOIO Application Firmware Image' zip file (App-IOIOxxxx, where xxxx is the software/library version number).

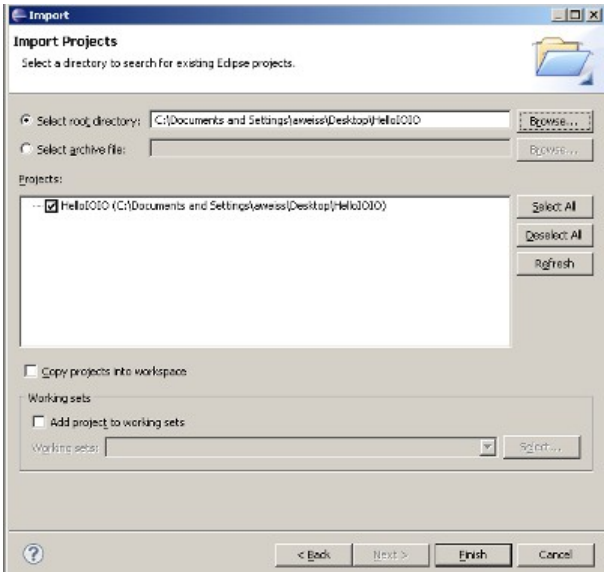
Note: *If you are using an older IOIO board*, make sure the version number of your IOIO library is less than or equal to the version number of your firmware. In other words, if you can't get the sample app to work with an older IOIO, use one of the older library versions or upgrade the firmware on your IOIO using the IOIO Manager and then use the latest download.

2) Unzip the downloaded package into a safe location where you want to keep your project files.

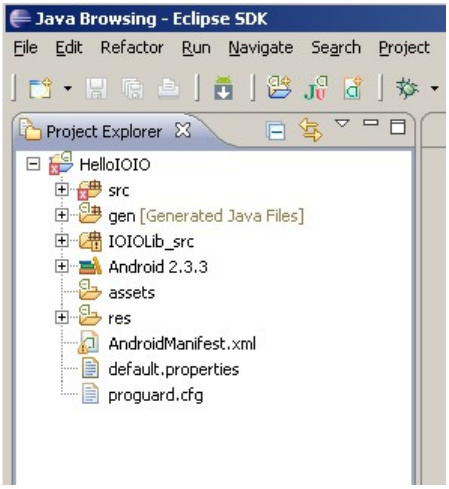
3) Next, open Eclipse, then goto **File > Import,** and select **Existing Projects Into Workspace**. Then hit **Next**.



4) Another window will pop up (as shown below). Select 'Select Root Directory' and navigate to the file you just unzipped and point to the HelloIOIO folder found in /applications/HelloIOIO. Be sure the check box is selected for your project. Now hit **Finish**.



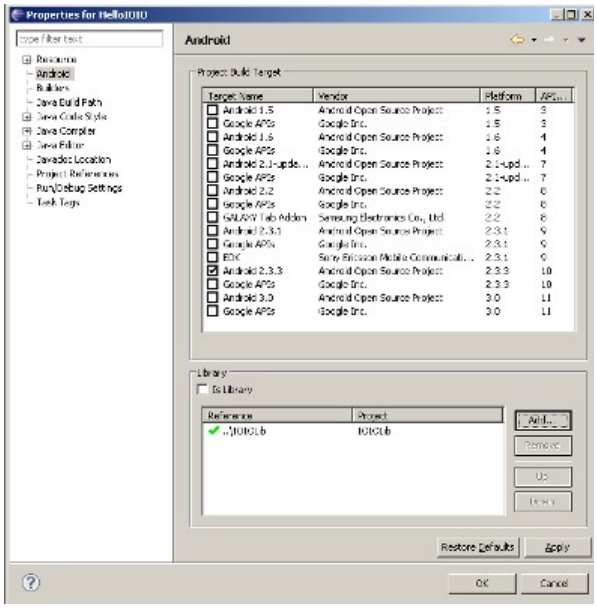
5) You should now have HelloIOIO in your project explorer in Eclipse. Notice that there is a small red x next to the project name. This means there are build errors, so whenever you see this, you know something needs to be fixed. In this situation, we need to link the IOIO library to our project, as outlined in the next step.



6) Now we need to link the IOIO library and IOIO Bluetooth library to your project which will give you full access to the IOIO API. The IOIOLib and IOIOLibBT directories contains the libraries that allow you to communicate to the IOIO board.

Follow the exact same steps in 3 and 4 above, except use the IOIOLib file and then the IOIOLibBT instead of the HelloIOIO file.

After you added the library files into the workspace, select the HelloIOIO project, then on the top toolbar goto: **Project > Properties**. Then, select 'Android' in the list to the left. In the 'Library' section, click add, then add both the IOIOLib and IOIOLibBT libraries. You should see both of them with a green check mark as shown below (note: image doesn't show the IOIOLibBT, but it should be there if using Bluetooth).

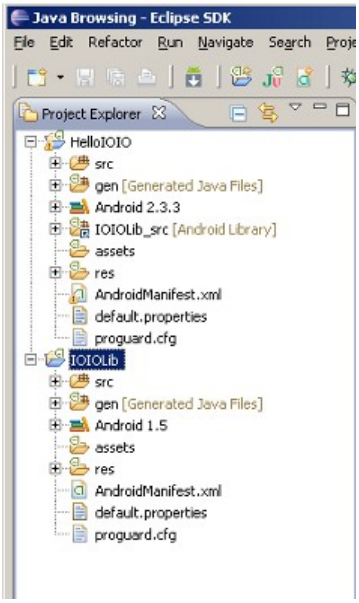


Also, make sure the 'Project Build Target' is properly selected according to the specific Android OS you are using.

Note: If you ever need to change your build target (say you are using a device with a different Android OS), you can change it here.

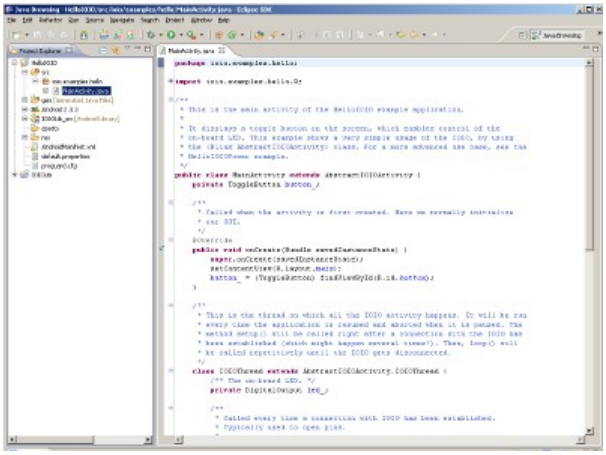
7) The next thing you need to do is make sure your app has internet permissions. To do this, open the AndroidManifest.xml file located in the main project tree. Make sure you are in the permissions tab, then click **Add > Usage Permissions**, then make sure the 'Name' field is android.permission.INTERNET. See the picture below for reference:

After you have done this and saved your project, the projects explorer window should look something like this:



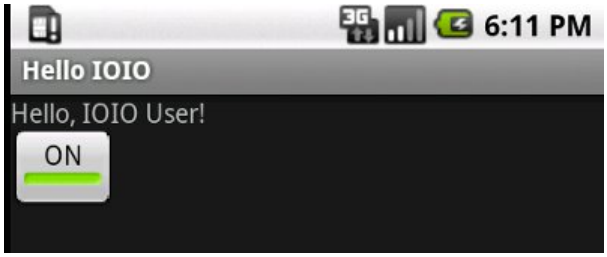
Notice the red x error flags are gone.

The project tree has many files. You really don't need to mess with the IOIOLib project tree so you can minimize that one. The file that contains the java code for the IOIO is in **HelloIOIO > scr > ioio.examples.hello > MainActivity.java**. Double click on the MainActivity.java file and you should see this:



Here you can start writing code and changing the HelloIOIO sketch. At this point you can keep reading or jump immediately to setting up your IOIO board and testing the app.

The MainActivity.java file contains the code that talks to the IOIO board. If you want to change the UI (user interface or graphics) of your app, the **res > layout > main.xml** file is where you make the changes. The main.xml file in the HelloIOIO example uses an interface that looks like this:



For more information on XML layouts, see the hello world example on developer.android.com, then scroll down to the 'Upgrade the UI to XML Layout' section.

At this point you should be ready to write your own Android IOIO app. You can now keep reading or jump immediately to setting up your IOIO board and testing the app.

Troubleshooting Project Errors

Eclipse has the ability to compile your code in real time. When there is an error, you will see a red x somewhere in your project. This can mean many things. To figure out what the errors are, Eclipse has tab called 'Problems' that shows you what errors you are getting. This tab is usually found towards the bottom of the Eclipse window. Sometimes the error will tell you exactly what's wrong and sometimes the errors are more obscure.

If you are getting unknown errors in your project, please refer to the IOIO-OTG troubleshooting guide.

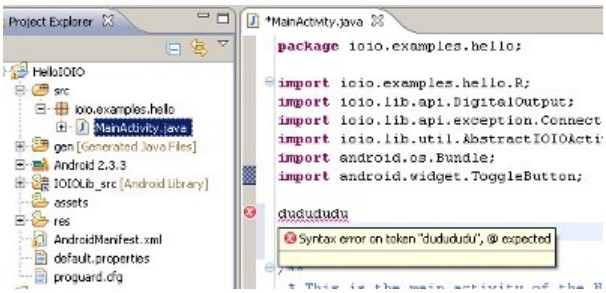
The Example IOIO Sketch

After you have imported the HelloIOIO file and linked the IOIOLib file, you are ready to start writing code. The example sketch displays a toggle button on the screen, which enables control of the on-board LED. This example shows a very simple usage of the IOIO and will give you an idea of what to expect when programming.

The code in the MainActivity.java file is shown below.

In the code above, there are plenty of comments that explain what each line does. This app is a great starting point for making sure your development environment and the IOIO board is working correctly.

Eclipse is a very powerful tool and gives debugging information in real time. For instance, if you write code that doesn't make sense, Eclipse will show a red x next to the line in question and even give you suggestions as to how to change the line of code. Simply hover your mouse cursor over the line and you will see something like this:



Keep in mind, if you have errors, you will not be able to compile and run your code, you will need to fix any errors.

Also, the IOIOLib has thorough JavaDocs that can be generated and browsed via Eclipse. Goto **Project > Generate Javadocs**.

Here are some more resources to help you out with writing code:

- For all Android types, see the Android package index.
- For IOIO types and examples, see the IOIO-OTG Wiki.

Compiling, Loading, and Running the App on Your Android Device

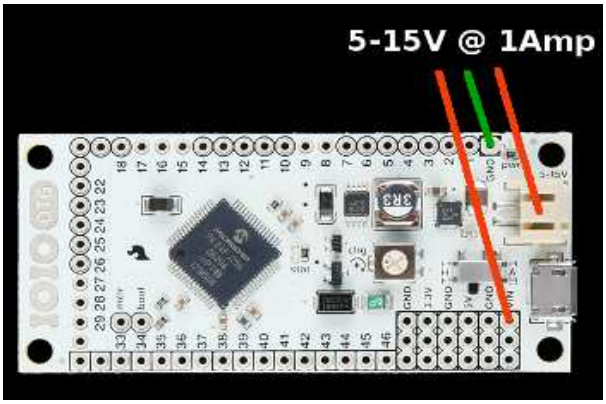
If you change any part of the code, simply saving the project compiles the program and creates a new HelloIOIO.apk file. An apk file is a compressed Android Package file, similar to zip and jar. files, that is used to create an app on your Android device. This file can be found in the HelloIOIO project tree within the bin directory.

Here are the steps to get the example app working on an N1 Android phone running the 2.3.3 platform.

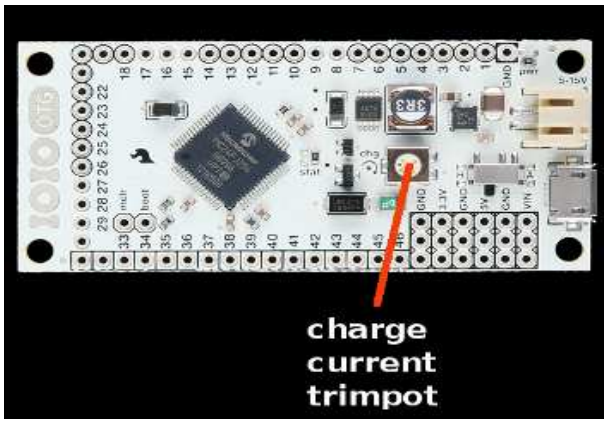
1. Enable USB debugging. **Settings > Applications > Development > Enable USB Debugging**

2. Install the apk file. The easiest way to get the apk file on your device is to plug the device into your computer. When prompted to install drivers, point to the driver located in **Android** (should be in Program Files for Windows users) **> android-sdk > extras > google > usb_driver**. Next, right click on the HelloIOIO project in the project explorer within Eclipse goto **Run As > Android Application** (or hitting the green play button on the top tool bar runs your application as well). Your apk file should now be installed on your android device. Unplug your android device from your computer, then move to the next step. More information on the Google USB driver is found here.

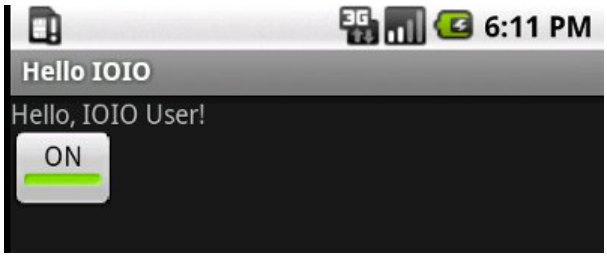
3. Prepare the IOIO board. The only thing you need to do for the HelloIOIO example is power the IOIO board. Keep in mind, the IOIO board will always need an external power supply between 5-10V. *Single cell LiPos batteries will NOT work, you need a 5-10V input.* You can connect the power supply to the VIN and GND pins (headers will need to be soldered in place) or to the JST connector. If using the JST connector, you might want this adapter cable.



4. With the IOIO powered, you can plug the USB cable into the IOIO and into your Android device. The Android device should show that USB debugging is connected in the notification bar, in addition, the Android should indicate it is charging. If you don't see either of these two notifications, try adjusting the 'chg' potentiometer next to the USB connector on the IOIO board. The potentiometer changes how much current is being used by the power supply to charge the phone. If there isn't enough, then the phone might not be detected by the IOIO.



5. Open the Hello IOIO app and toggle the button, you should see the yellow stat LED come on and off. Congratulations! You are now on your way to creating your very own IOIO apps!



Note: The best way to develop IOIO apps is to have your phone plugged into your computer while writing and editing the code. Then running the application (as shown in step 2) will erase the old app and load the newly edited app onto your phone. You can now unplug your phone from your computer, then plug it into the IOIO to test what you have done.

Example Projects

We have a blog post that shows or has links to many well documented example projects, with source code. It is a great resource, so please check it out (and be sure to read through the text for links)! Also, check out this collection of IOIO based projects.

Updating the IOIO Firmware

The IOIO firmware is code that sits on the PIC microncontroller located on the IOIO board. Sometimes new changes will be pushed out and you might have an board with older firmware. There is a very simple way to update the IOIO firmware.

- IOIO Manager Wiki