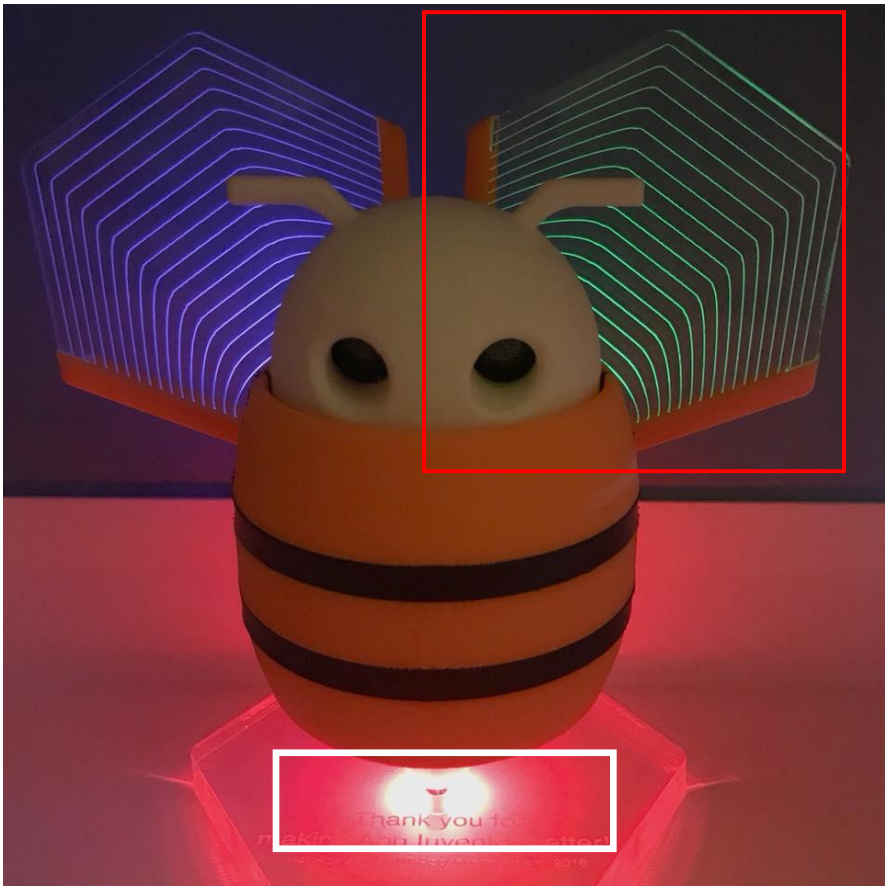
MIT App Inventor Codi Bot: LED control

60 mins

Level: advanced

This tutorial will help you control Codi Bot LEDs by buttons and a slider, using App Inventor IoT. We have also provided a complete app so you can control all Codi Bot LEDs.

- **source .ino / source .aia**
- **complete .aia**



Function description

This project will show you how to control Codi Bot LEDs with App Inventor through BLE communication, including the red light intensity of RGB LED and the state of the green LED (on/off). The components used in this tutorial are buttons and a slider. There are many other components in AI2, you can also use them with the same concepts.

Hardware

Please follow this **user manual** to assemble your Codi Bot.

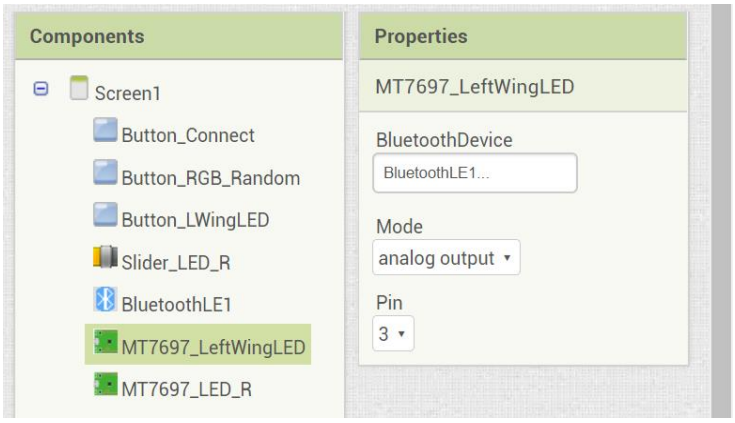
App Inventor

Log in to your App Inventor account and create a new project, or directly import **this aia file**.

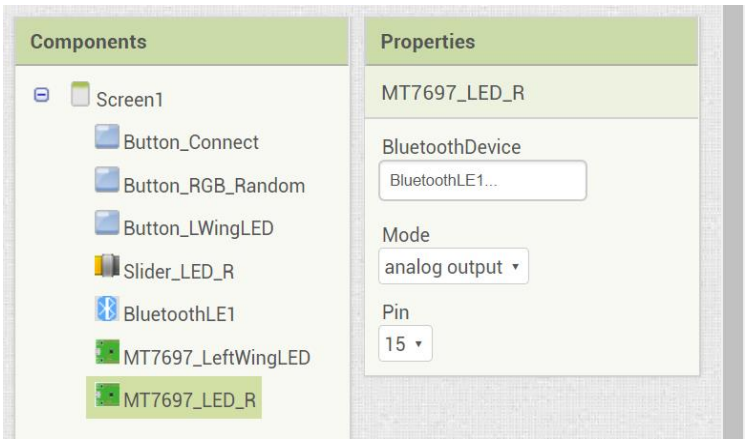
Designer

1. We need to import two extensions from these URLs:
    - **Bluetooth low energy**: http://iot.appinventor.mit.edu/assets/resources/edu.mit.appinventor.ble.aix
    - **MT7697pin**: http://iot.appinventor.mit.edu/assets/resources/edu.mit.appinventor.iot.mt7697.aix
2. Add a **BluetoothLE** component to your project. We will use it to send commands to the Codi Bot through Bluetooth communication.
3. Add two **MT7697pin** components to your project. We will use them to control different pins of LinkIt 7697 - in this case the green LED in the left wing and the red pin of the RGB LED at the base.
    - Rename one **MT7697pin** component to "**MT7697_LeftWingLED**". Set its **BluetoothDevice**

property to **BluetoothLE1** (Step 2.), **Mode** to "**analog output**" and **Pin** to **3**. This is because we have connected the red pin of RGB LED to the LinkIt 7697 #3 pin.



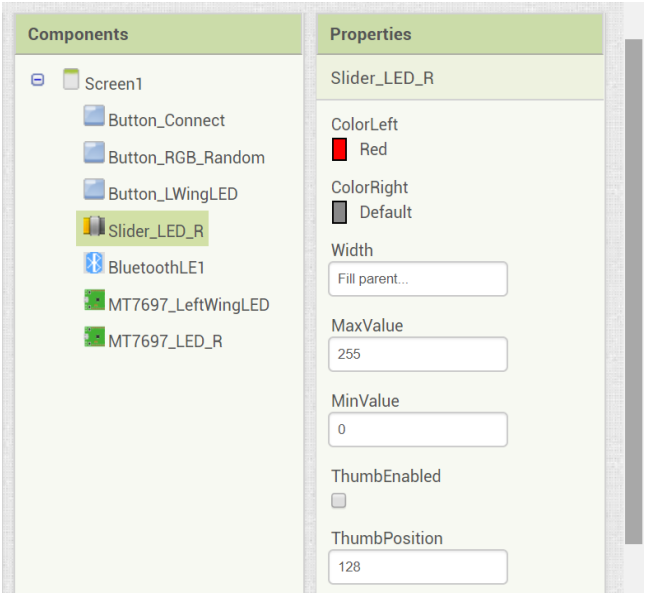
- Rename the other **MT7697pin** component to "**MT7697_LED_R**". Set the **BluetoothDevice** property to **BluetoothLE1** (Step 2.), **Mode** to "**analog output**" and **Pin** to **15**. This is because we have connected the red pin of RGB LED to the LinkIt 7697 #15 pin.



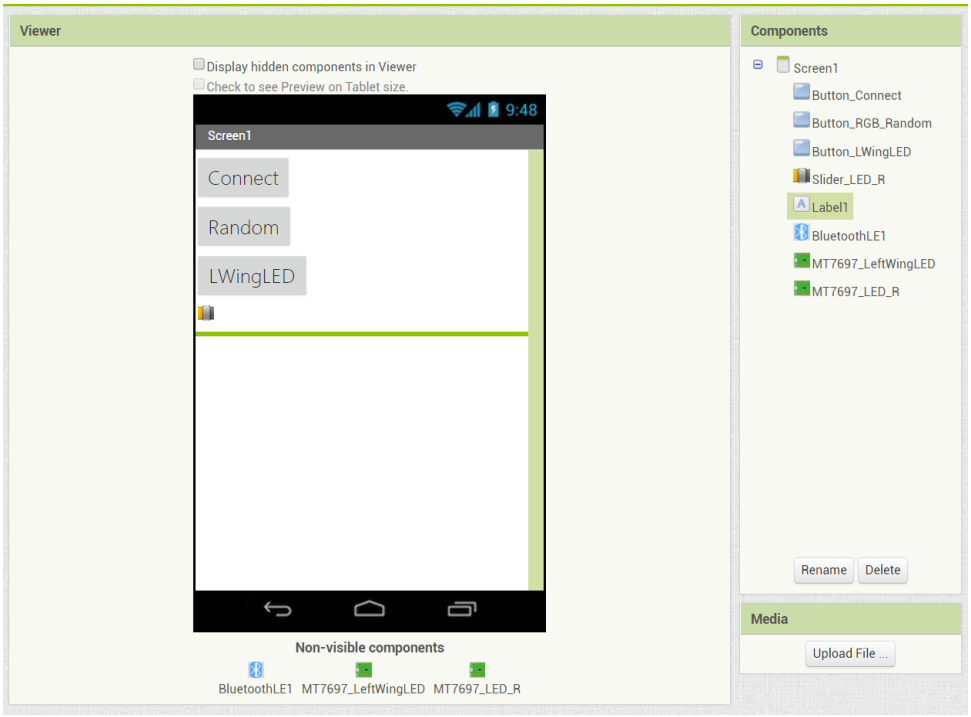
4. Add a button to establish Bluetooth connection between your Android phone and LinkIt 7697. Rename it to "**Button_Connect**" and set Text to "**Connect**".
5. Add another two buttons to control the LEDs. Rename them to "**Button_RGB_Random**" and "**Button_LWingLED**". Set their **Text** to "**Random**" and "**LWingLED**" accordingly.
6. Add a slider to control the red light intensity of RGB LED. Rename it to "**Slider_LED_R**". Set its **MaxValue** to **255**,

MinValue to **0** and **ThumbPosition** to **128**.

7. Add a label to show red light intensity (0 - 255). Set its Text to "" (no text).



After some adjusting, your designer page should look similar to the image below. It doesn't have to be exactly the same. Feel free to modify the components background color, position and text size.



Blocks

Let's take a look at our blocks step by step:

1. **Variable for Bluetooth address**

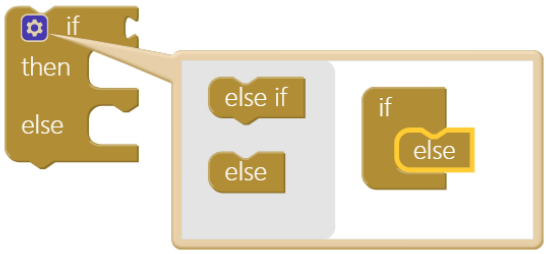
   Please replace the **addr** variable value with what you get from Arduino Serial Monitor. This is the Bluetooth address of LinkIt 7697. We will show you how to check this information in **Arduino IDE and sketch** section.

2. **Initialize app and scan for nearby Bluetooth devices**

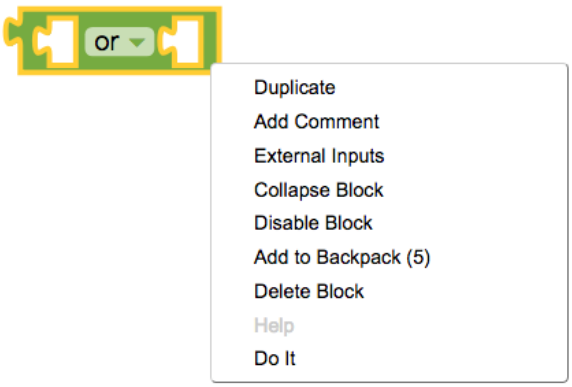
   In **Screen1.Initialize** event, we tell the **BluetoothLE** component to scan for BLE devices nearby (**BluetoothLE1.StartScanning**).

3. **Connect and disconnect from Bluetooth device**

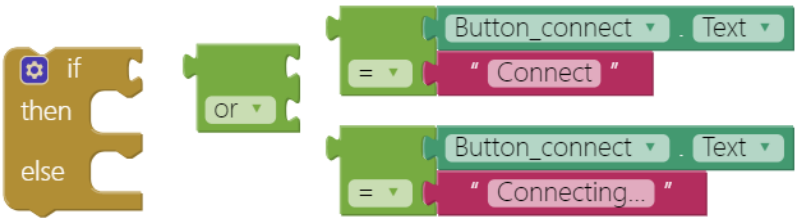
   In **Button_Connect.Click** event, we are going to connect to or disconnect from Bluetooth device depending on the button text. First, add an **if** condition, then click its blue gear to add an **else**.



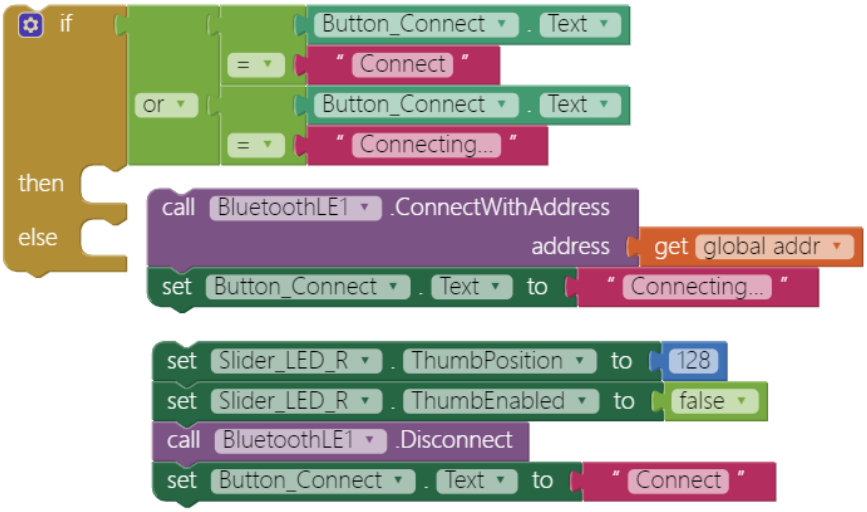
   Add an **or** command from logic block, then right-click it and select "**External Inputs**". This will make it into more rectangular shape with input on the right-hand side.



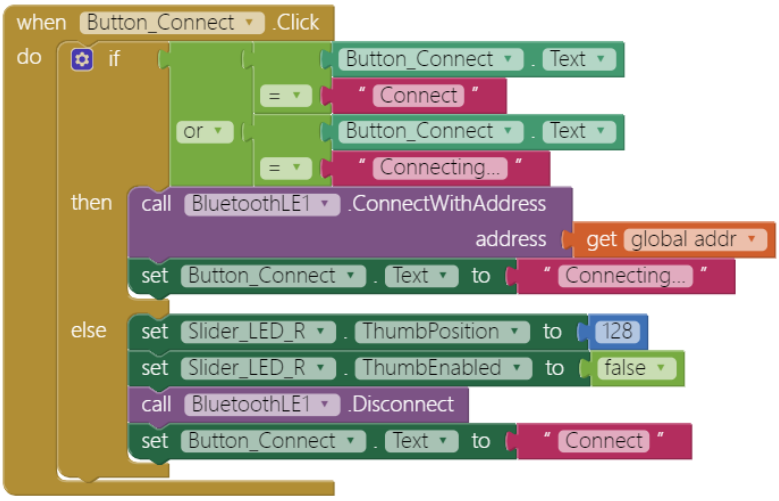
Now we want to check whether the **Button_Connect.Text** status is "**Connect**" OR "**Connecting...**", this is how App Inventor decides to connect or disconnect Bluetooth connection with LinkIt 7697. Please combine these blocks.



Good! When the **Button_Connect** text reads "**Connect**" or "**Connecting...**", the app will connect to the specified Bluetooth device (**BluetoothLE1.ConnectwithAddress**), which is our LinkIt 7697.
If the text does not read "**Connect**", then set slider to default position/disabled, disconnect (**BluetoothLE1.Disconnect**) and show message on Button_Connect.

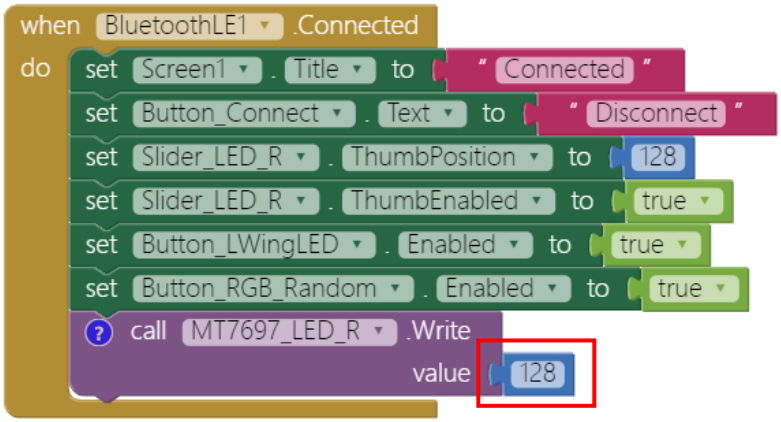


Put everything into **Button_Connect.Click** event, and finish like this:

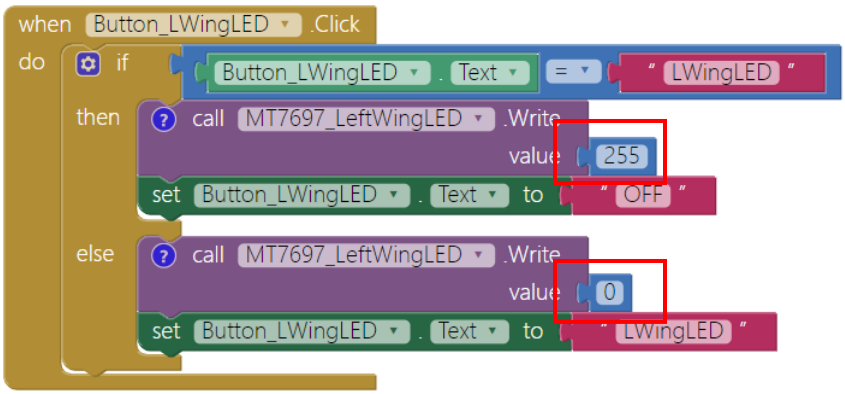


4. **BLE Connected**

   When connected successfully (**BluetoothLE.Connected** event), we will see related messages on several components. This also enables **Button_LED** to be clicked and Slider_LED_R to middle position and to be dragged. Finally we use **MT7697_LED_R.Write** method with value **128** to light on the red light with half of the maximum intensity (255), indicating we've connected to Codi Bot successfully.



5. **Button_LWingLED turn on the green LED**
   We use same button to toggle the green LED on left wing. When **Button_LWingLED** is touched (**Button_LWingLED.Click** event), we turn the green LED on (**MT7697_LeftWingLED.Write** with **255**) or off (with **0**) according the button text.

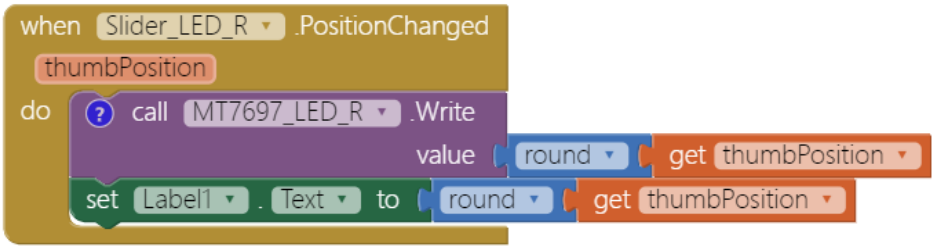


6. **Button_RGB_Random to randomize red light intensity**
   For a more interesting effect, we use a button to randomize the red light intensity. First create a variable named **lightIntensity** with value **0**.
   When **Button_RGB_Random** is touched (**Button_RGB_Random.Click** event), we will set **lightIntensity** variable value with a **random integer** between 0 and 255, set the red light intensity, modify label text and move slider

thumbposition according to this variable value.

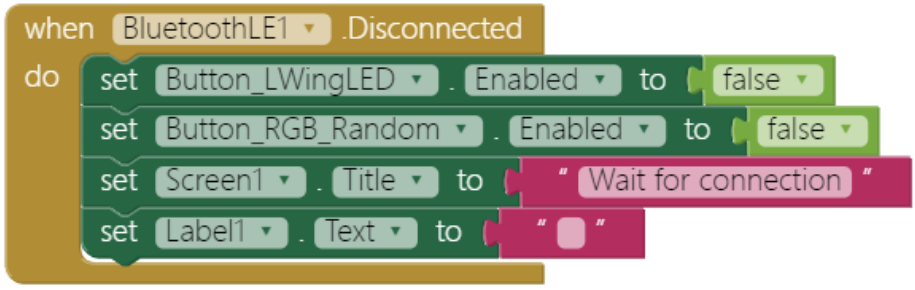
7. **Drag slider to change red light intensity**

   When the slider is dragged (**Slider_LED_R.PositionChanged event**), we set the red light intensity and label text according to the slider **thumbpostion**.



8. **Disconnect**

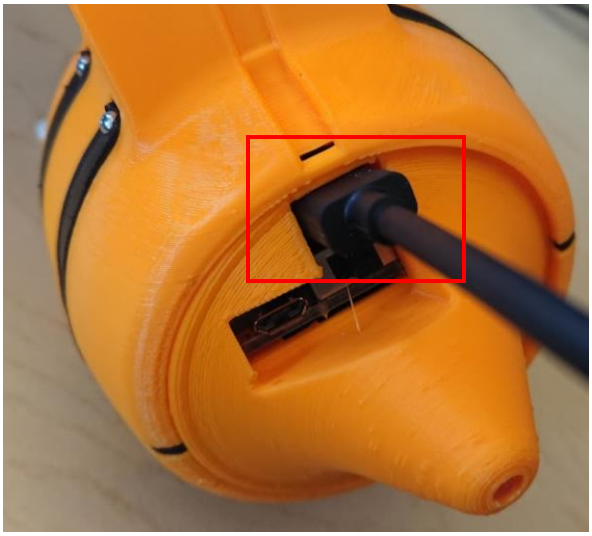
   After Bluetooth communication is closed (trigger in Step1), we reset the app to its initial state to wait for the next connect request in **BluetoothLE1.disconnected** event.



Arduino IDE and sketch

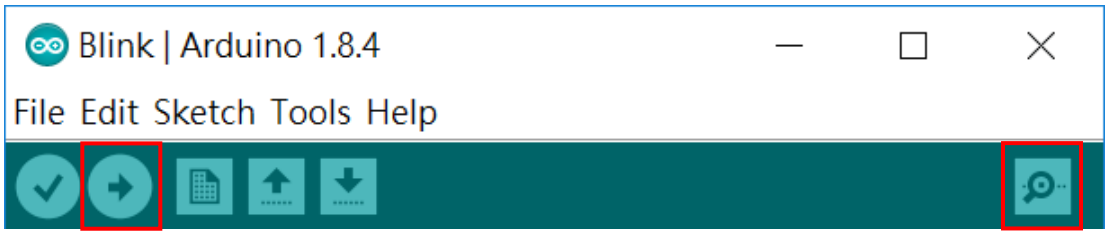
Make sure your computer has Arduino IDE installed and that the LinkIt 7697 SDK and driver are ready. If not, please check Codi Bot Standalone tutorial.

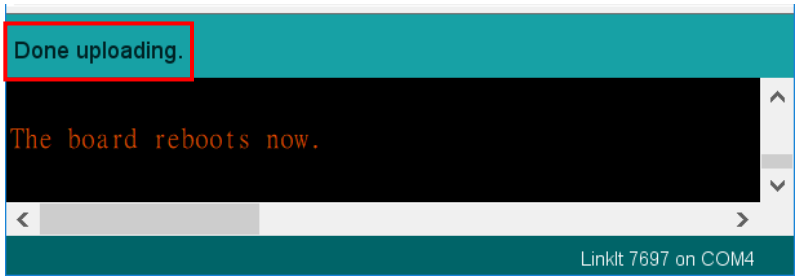
Connect your computer and the LinkIt 7697 with a microUSB cable.



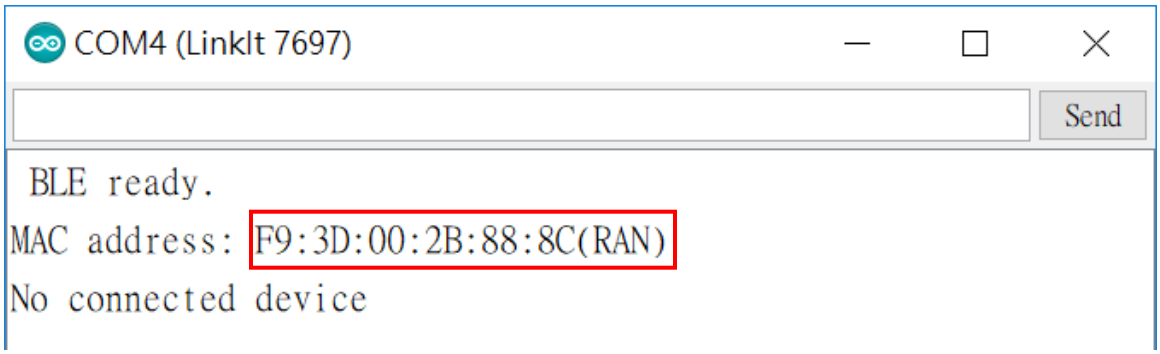
Please download the Arduino sketch **here** and open it in your Arduino IDE. This sketch can be used for all your Codi Bot projects except the first one "**Standalone demo**", allowing you to focus on building App Inventor projects you will enjoy.

Press the "**Upload**" right-arrow button of Arduino IDE. This will compile and upload the Arduino sketch to your LinkIt 7697. Please make sure you see the "**done uploading**" message in the console.



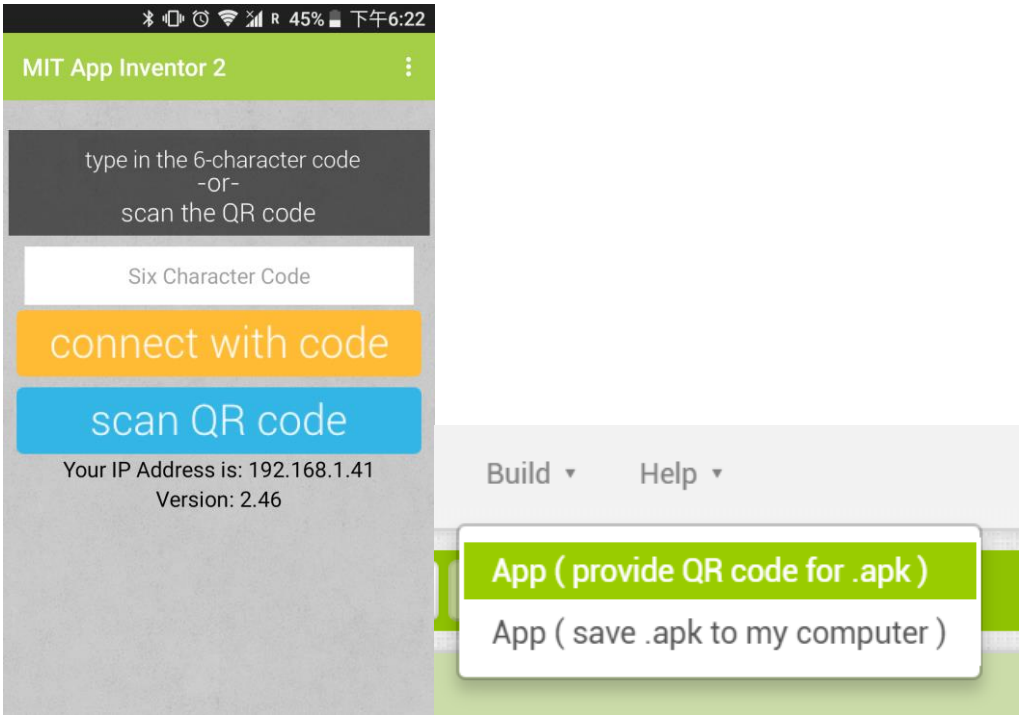


Click the magnifier icon at the upper-right corner of Arduino IDE. You should see a message in the pop-up window. The [**XX:XX:XX:XX:XX:XX**] 12-digit string is the Bluetooth address of your LinkIt 7697. We need to modify the **addr** variable value of your AI2 project.



Tips

Make sure your LinkIt 7697 is running correctly. Install App Inventor project on your Android phone by clicking Build / App (provide QR code for .apk). This will show a QR code for the .apk file of this project. Use MIT AI2 Companion to scan this QR code, download the app, and install it.



Open your app (Fig. 1) and click **Connect** button. After a few moments, your app screen title should show "**Connected**", meaning your connected successfully.

Click the **LWingLED** button to see if Codi Bot left wing lights green. Also try to drag the slider from left to right. You should see the red light intensity RGB LED at the bottom changes according to the slider.

Remember to click **Disconnect** button when you finish with this project.

Fig 1. Initial screen	Fig 2. Press **LWingLED** button to turn on green LED on the left wing (see if its text changes to **OFF**).

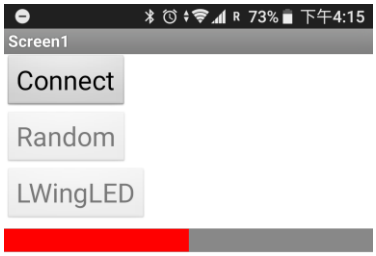
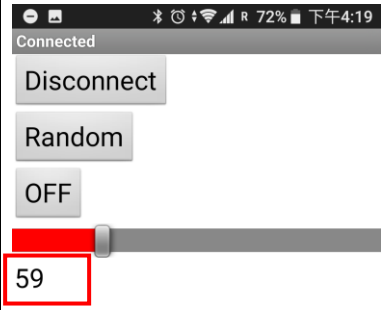
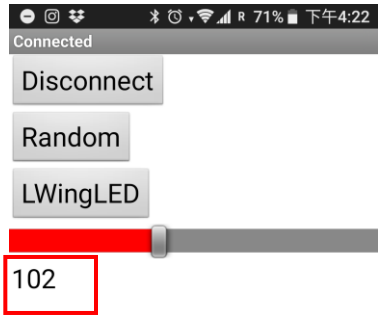
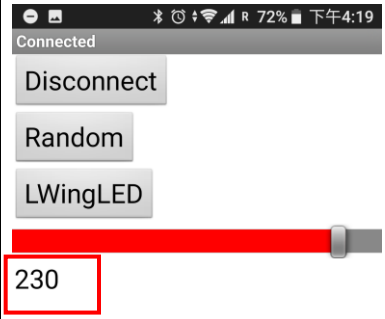
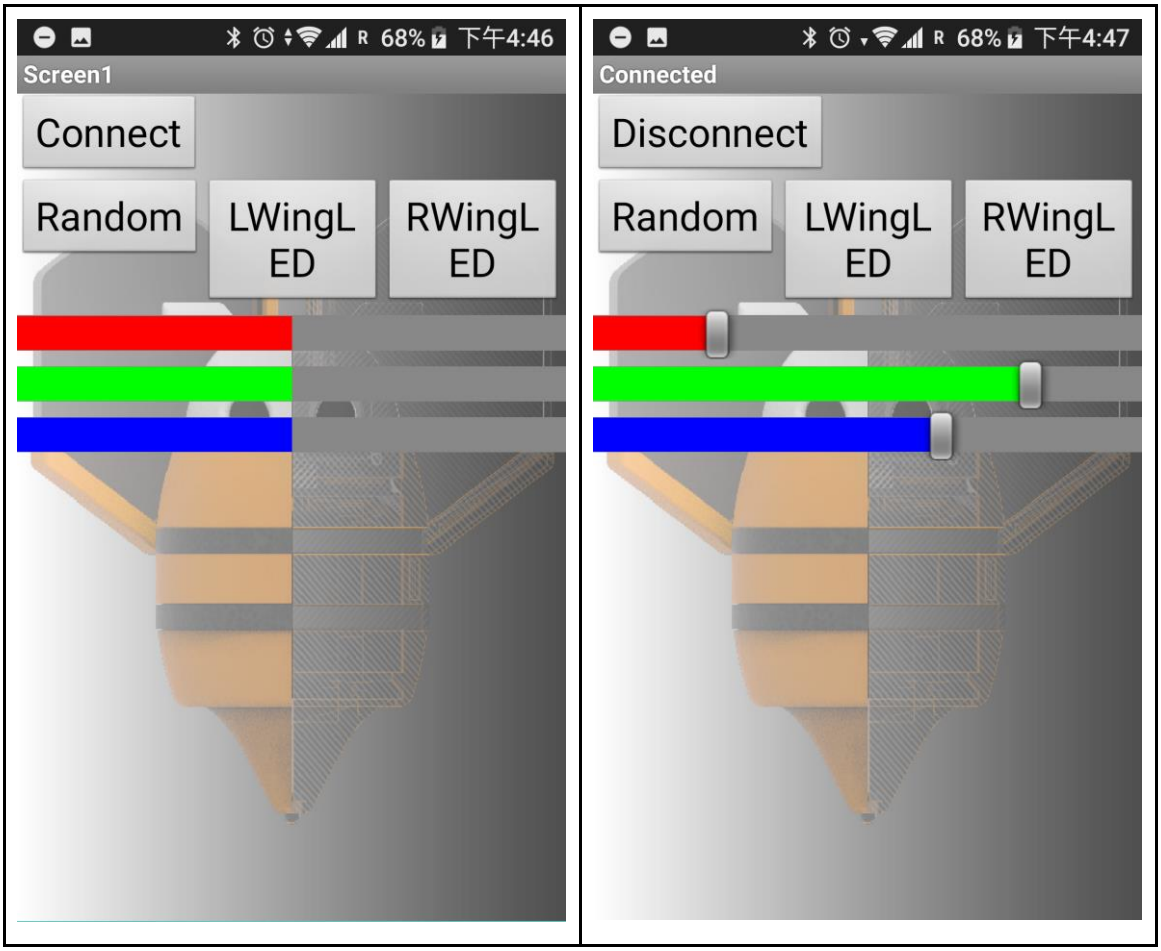

	

Fig 3. Drag slider to make a moderate light intensity (**102**)	Fig 4. Drag slider to make LED brighter (**230**)
	

Complete LED control app

We have provided a complete app to control both Codi Bot LEDs. You can import this **complete .aia** to your MIT App Inventor account and use it to control your Codi Bot.



Brainstorming

1. Use App Inventor **SpeechRecodnizer** component to turn the green LED on/off.
2. Replace slider with App Inventor **OrientationSensor** component to control the red light intensity.