MIT App Inventor Codi Bot: Complete

90 mins

Level: advanced

This tutorial combines all the previous tutorials together, you can interact with all Codi Bot functions, including LEDs, wings and sounds.

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

Function description

This project will show you how to control all the Codi Bot functions with App Inventor through BLE communication.

Hardware

Please follow this **building guide** to assemble your Codi Bot.

App Inventor

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

Since this app is the combination of the previous three, this tutorial will not describe everything in a very detailed way. But you are certainly can follow this tutorial to build the app step by step.

This app is composed of **four** different sections:

1. Connection (**Designer**/**Blocks**)
2. Wing (**Designer**/**Blocks**)
3. LED (**Designer**/**Blocks**)
4. Buzzer (**Designer**/**Blocks**)

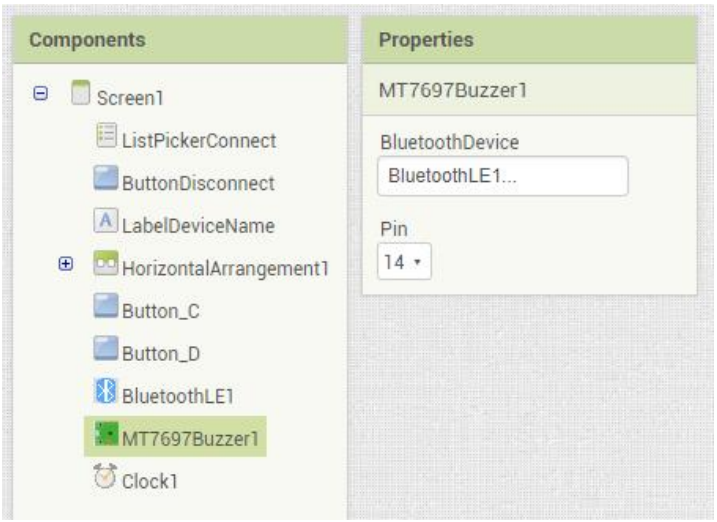
Designer

1. We need to import two extensions from this URL:
    - **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 use it to send commands to Codi Bot through Bluetooth communication.

3. Add seven **MT7697Pin** components to your project. Set their BluetoothDevice properties to **BluetoothLE1** and rename them as table below:

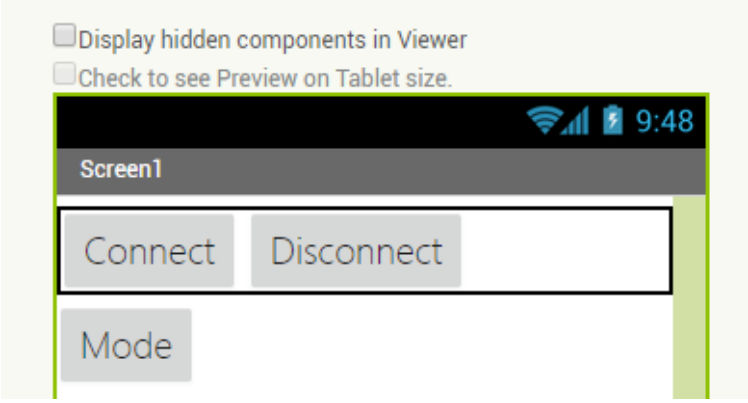
Rename as	**Mode**	**Pin**
MT7697_LeftWingServo	servo	2
MT7697_RightWingServo	servo	7
MT7697_LeftWingLED	analog output	3
MT7697_RightWingLED	analog output	9
MT7697_LED_R	analog output	15
MT7697_LED_G	analog output	16
MT7697_LED_B	analog output	11

4. Add a **MT7697Buzzer** component to your project, we use them to control the #14 pin of LinkIt 7697, which is connected with Robot Shield onboard buzzer.
    - Set its **BluetoothDevice** property to BluetoothLE1 (Step 2.) and set **Pin** to 14.



Connection

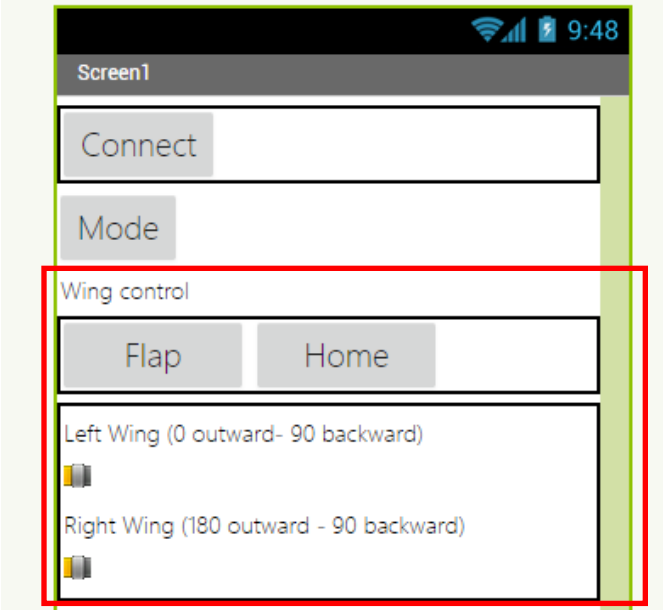
5. Add a LiskPicker to select available Bluethooth devices nearby. Rename it as "**ListPicker_Connect**", set Text to "**Connect**" and FontSize to **20**.
6. Add a button to close Bluetooth connection between your Android phone and LinkIt 7697. Rename it as "**Button_Disconnect**" and set Text to "**Disconnect**".
7. Add a Label to show messages of connection. Rename it to "**Label_Device"** and clear Text to “”.
8. Add a HorizontalArrangement component, set Width to **Fill parent**, the put components from Step 4 to 6 into it.
9. Add another LiskPicker to select one of the three control mode: Wing, LED and Sound. Rename it as "**ListPicker_Connect**", Text to "**Mode**" and FontSize to **20**.



Wing (Designer)

10. Add a Label to show message, rename it as "**Label_Wing**" and set Text to "**Wing control**".
11. Add two Buttons for wing actions. Rename them as "**Button_WingFlap**" and "**Button_Home**". Set FontSize to **20** and Text to "**Flap**" and "**Home**".
12. Add a HorizontalArrangement component, set Width to **Fill parent**, then put components of Step 11 into it.

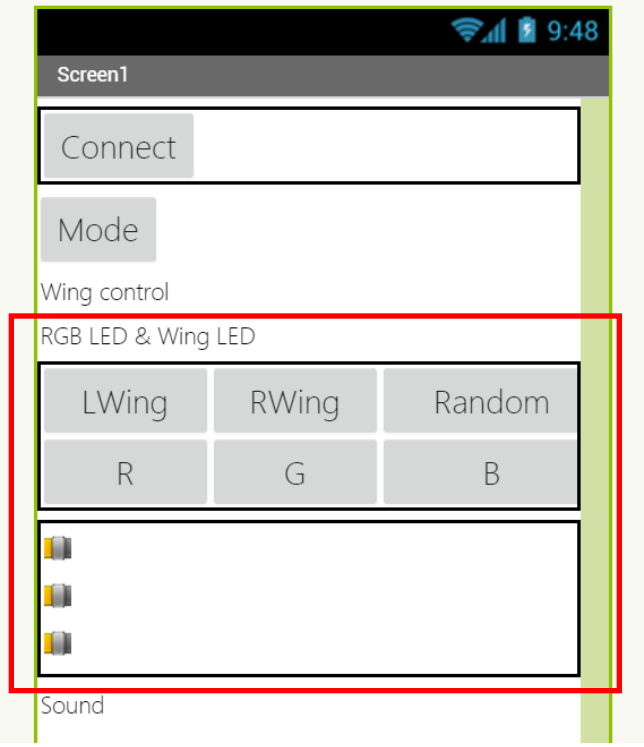
13. Add two labels to show messages. Rename them as "**Label_LeftWing**" and "**Label_RightWing**". Set their Text to "**Left Wing (0 outward- 90 backward)** " and "**Right Wing (180 outward - 90 backward)** ".
14. Add a slider to control left wing position. Rename it as "**Label_LeftWing**". Set MinValue to **0**, MaxValue to **90**, Width to **Fill parent** and ColorLeft to **Green**.
15. Add a slider to control right wing position. Rename it as "**Label_RightWing**". Set MinValue to **90**, MaxValue to **180**, Width to **Fill parent** and ColorLeft to **Purple**.
16. Add a VerticalArrangement component, set Width to **Fill parent**, the put components from Step 13 to 15 into it.
17. Wing section finish as below:



LED (Designer)

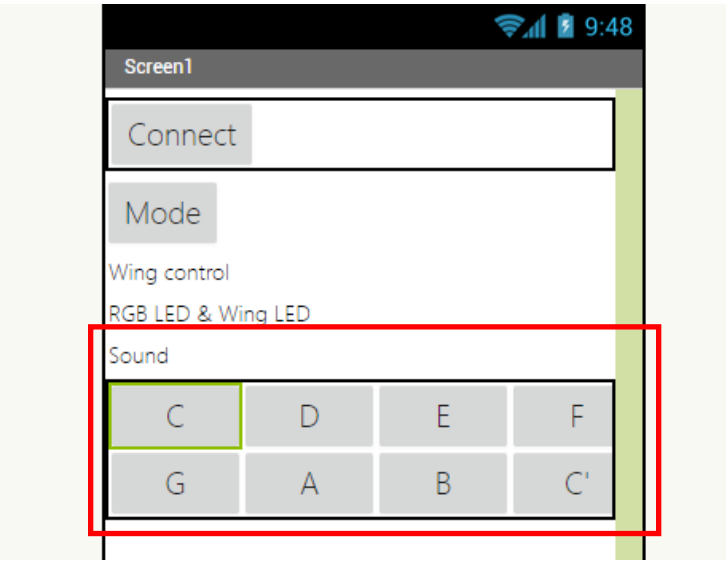
18. Add a Label to show message, rename it as "**Label_LED**" and set Text to "**RGB LED & Wing LED**".
19. Add four buttons for RGB LED actions. Rename them as "**Button_LED_R**", "**Button_LED_G**", "**Button_LED_B**" and "**Button_RGB_Random**". Set Text to "**R**", "**G**", "**B**" and "**Random**", Width to **30 percent** and FontSize to **20**.

20. Add two more buttons for wing LEDs actions. Rename them as "**Button_LED_LeftWin**" and "**Button_LED_RightWing**". Set Text to "**L**" and "**R**", Width to **30 percent** and FontSize to **20**.
21. Add a TableArrangement component, set Width to **Fill parent**, Columns to **3** and Rows to **2**. Then put components from Step 19 to 20 into it.
22. Add three sliders to control red/green/blue light intensity of RGB LED. Rename them as "**Slider_LED_R**", "**Slider_LED_G**" and "**Slider_LED_B**". Set ColorLeft to **Red**, **Green** and **Blue**; Set MinValue to **0**, MaxValue to **255** and Width to **Fill parent.**
23. Add a VerticalArrangement component, set Width to **Fill parent**, the put components of Step 22 into it.
24. LED section finish as below:



Sound (Designer)

25. Add a Label to show message, rename it as "**Label_Sound**" and set Text to "**Sound**".
26. Add eight buttons to make sounds. Rename them as "**Button_C**", "**Button_D**", "**Button_E**", "**Button_F**", "**Button_G**", "**Button_A**", "**Button_B**" and "**Button_C2**". Text to "**C**", "**D**", "**E**", "**F**", "**G**", "**A**", "**B**" and "**C'** ". Set Width to **25 percent** and FontSize to **20**.
27. Add a TableArrangement component, set Width to **Fill parent**, Columns to **4** and Rows to **2**. Then put components of Step 26 into it.
28. Sound section finish as below:



You should realize that not all the functions of previous tutorials are included here, for instance specifying sound frequency and time duration. However, you can always tinker this app and add as many App Inventor components as you like.

Blocks

Let's take a look at our blocks step by step. Notice this time we have

a different connect approach with previous projects. We use Listpicker to select available BluetoothLE device instead of a specified device.

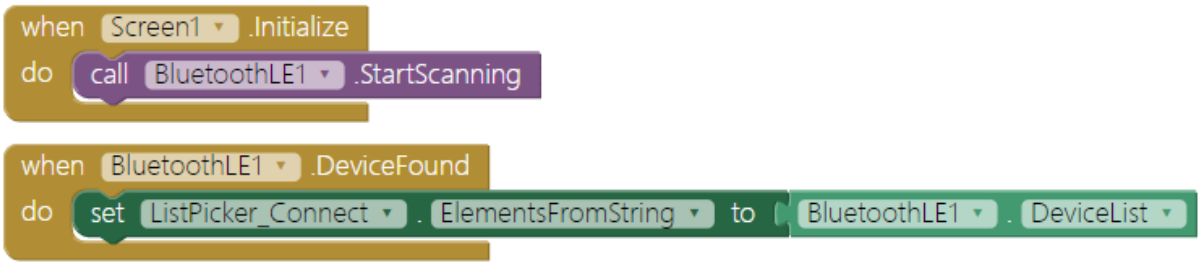
Similar to Designer, we use the same structure to guide you finish the blocks needed for this project.

Connection (Blocks)

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

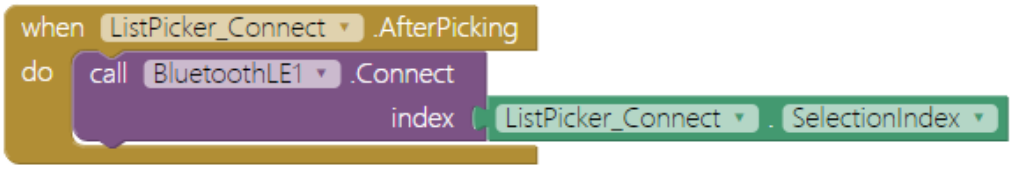
   In **Screen1.Initialize** event, we ask **BluetoothLE** component to scan for BLE devices nearby (**BluetoothLE1.StartScanning**).

   If any device is founded (**BluetoothLE1.DeviceFound** event), we put these devices into ListPicker.



2. **Choose device with ListPicker**

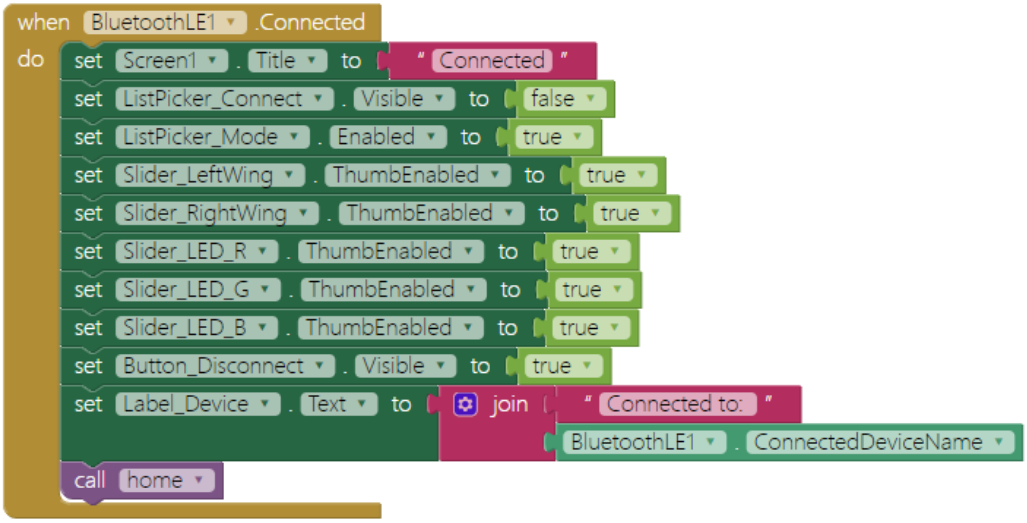
   In **ListPicker.AfterPicking** event, we use **BluetoothLE.Connect** method to connect with the device selected.



3. **BLE Connected**

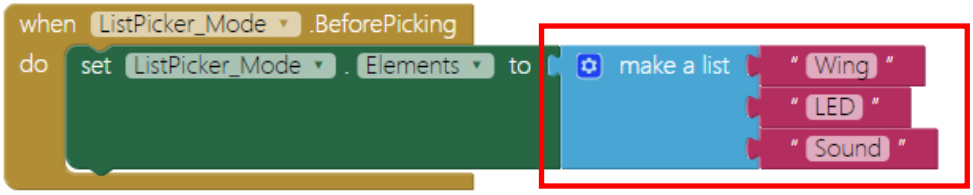
   When connected successfully (**BluetoothLE.Connected** event), we will see related messages on several components, hide the ListPicker and show other components. This is because if we send Bluetooth commands without connecting to something first,

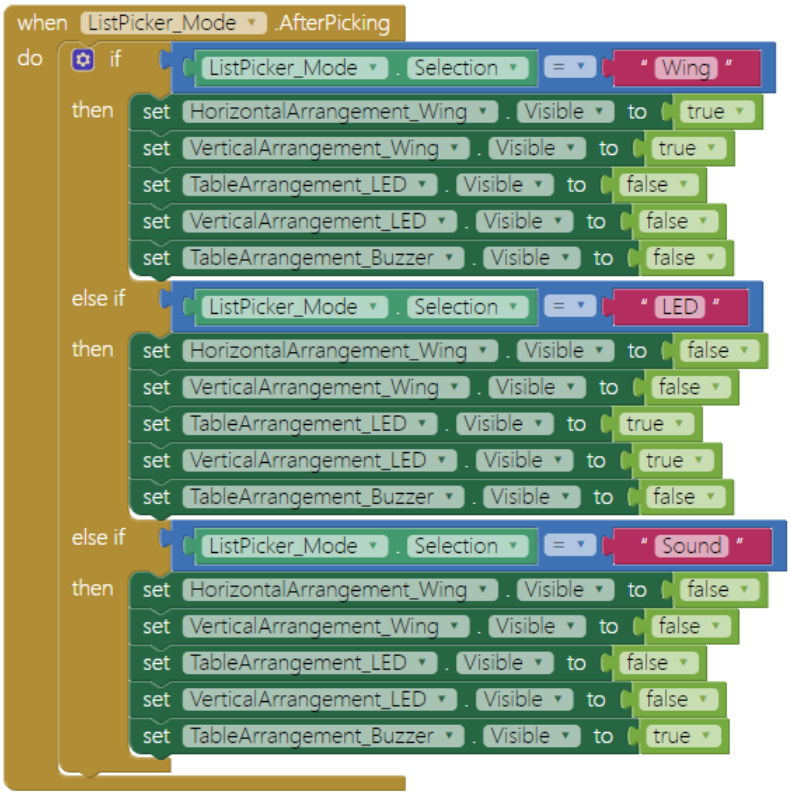
it may cause error.



4. **Another ListPicker to choose one of the modes**

   To simplify the interface, we separate related components into three groups: Wing, LEd and Sound instead of displaying all the components at the same time In **ListPicker.BeforePicking** event, we set ListPicker elements to a list (Wing, LED, Sound). Next, in **ListPicker.AfterPicking** event, we set related components to be visible or not according the selection result.

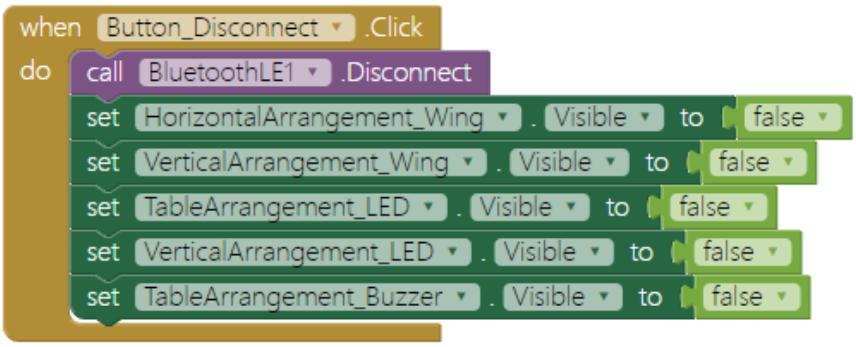


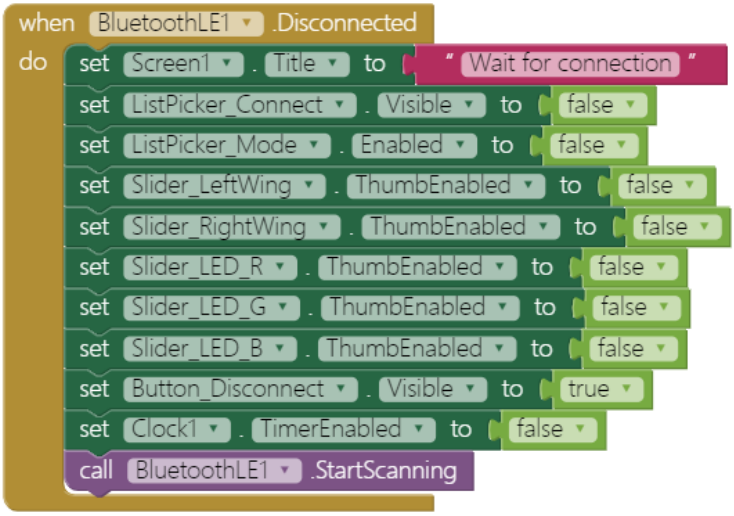


5. **Button to disconnect**

   When **Button_Disconnect** is pressed, we close the Bluetooth connection and hide all Layout components.

   And when disconnect successfully (**BluetoothLE.Disconnected** event), we set all components to their initial status and wait for next connection.



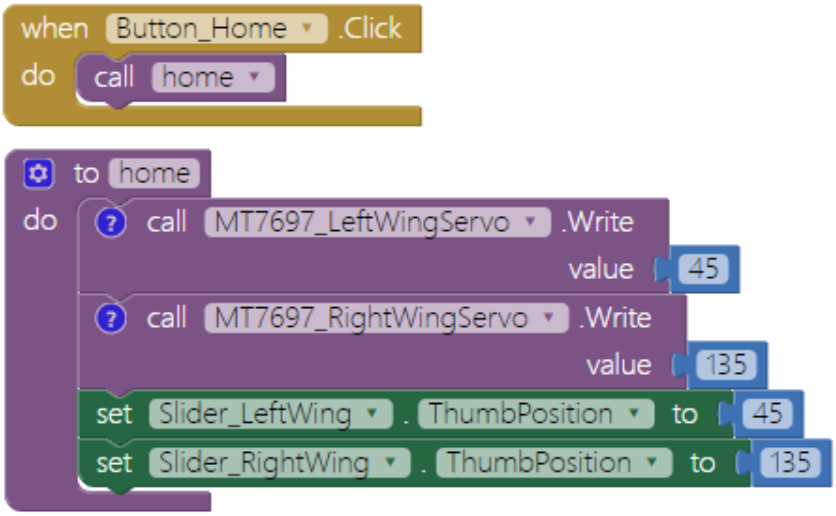


Wings (Blocks)

Here we are going to control the wings by buttons and sliders, which are exactly the same with [Codi Bot wing tutorial](#).

6. **Button to move wings to home position**

   We create a procedure (**home**) to move wings and sliders back to their home position, which is **45** for left wing and **135** for right wing.

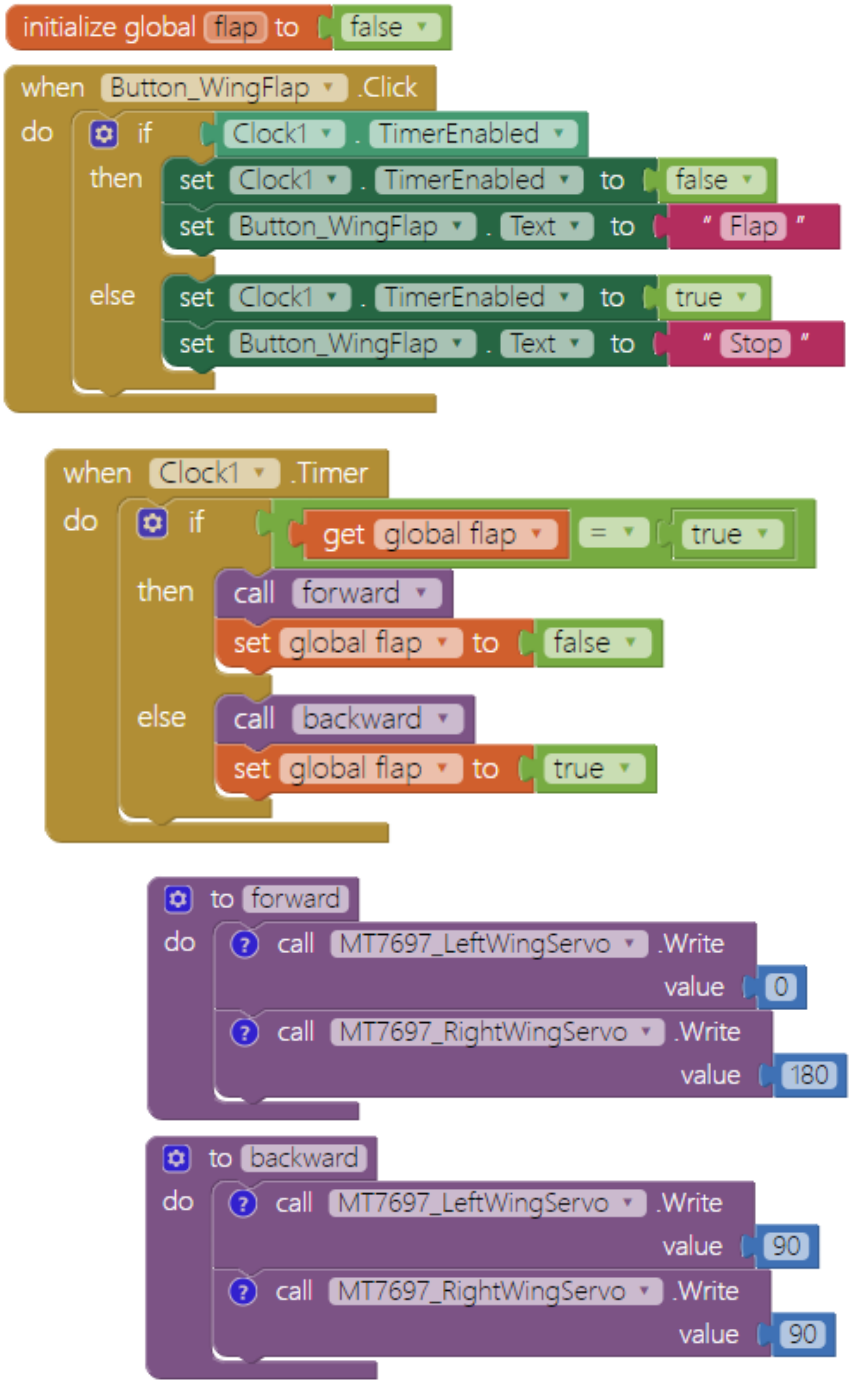


7. Button to flap wings

This section is exactly the same with [Codi Bot wing tutorial].

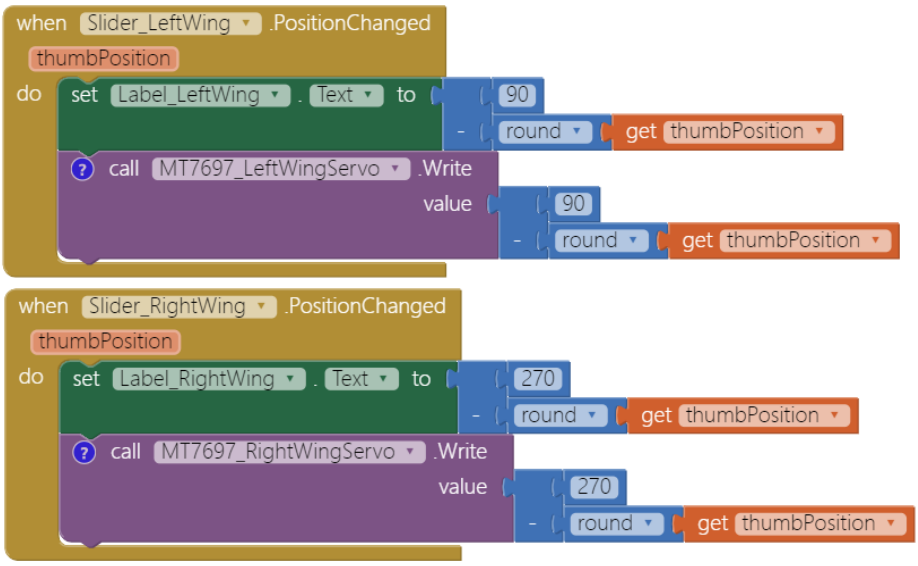
We use **Button_WingFlap** to control the clock timer, which in turns make wings flapping.

For simplicity, we create two procedures (**forward**, **backward**) to control servo motor positions.



8. **Sliders to move each wing**

   When you drag a slider, the corresponding servo motor will move to the specific position.

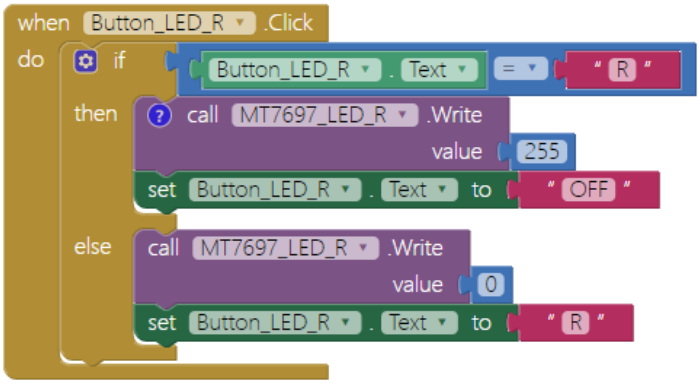


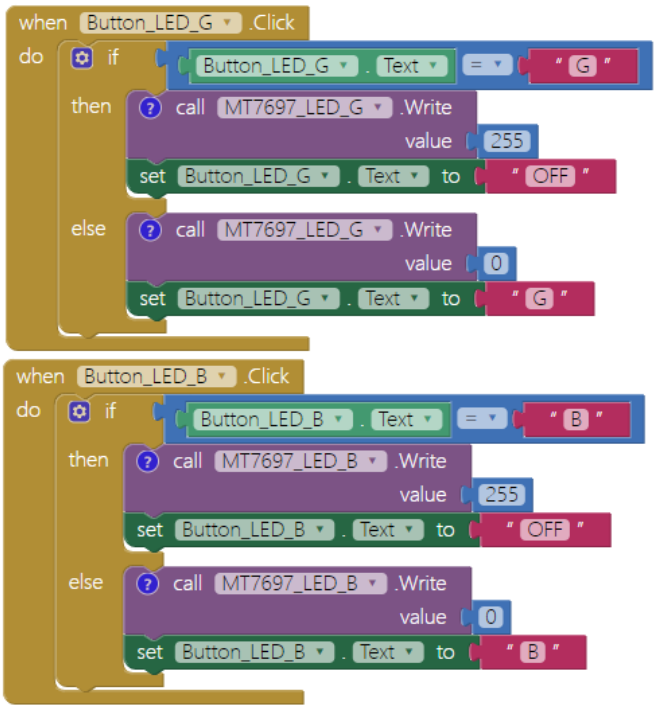
LED (Blocks)

Here we are going to control the LEDs by buttons and sliders, which are exactly the same with [Codi Bot LED tutorial](#).

9. **Button to control RGB LED**

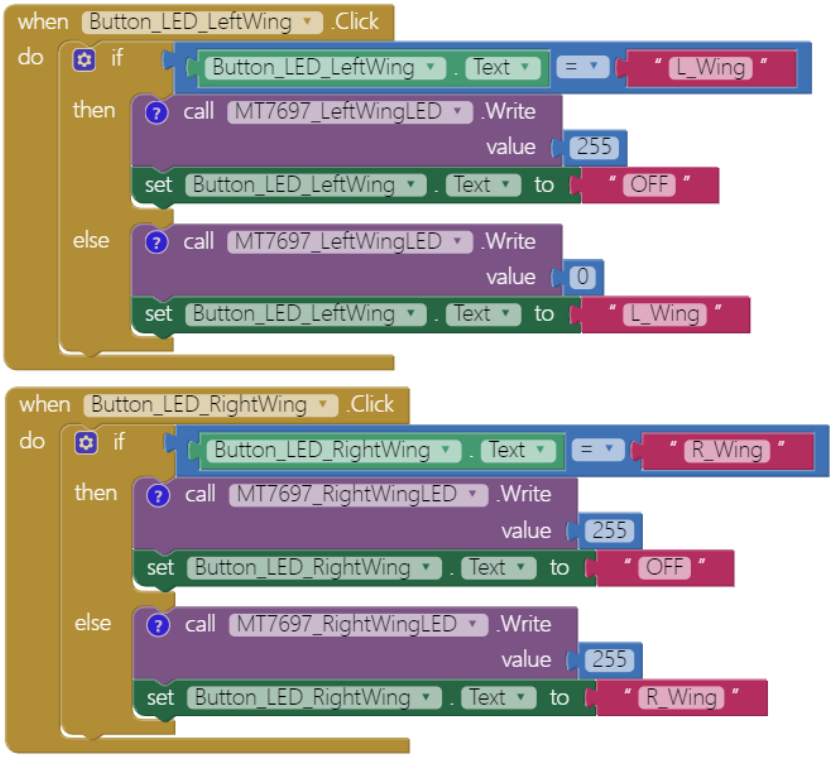
   These three buttons are used to control the red, green and blue color of RGB LED. For red light, we use **MT7697_LED_R.Write** method with value **255** to turn on the red light; and with value **0** to turn it off. Please finish other two button events in a same manner.





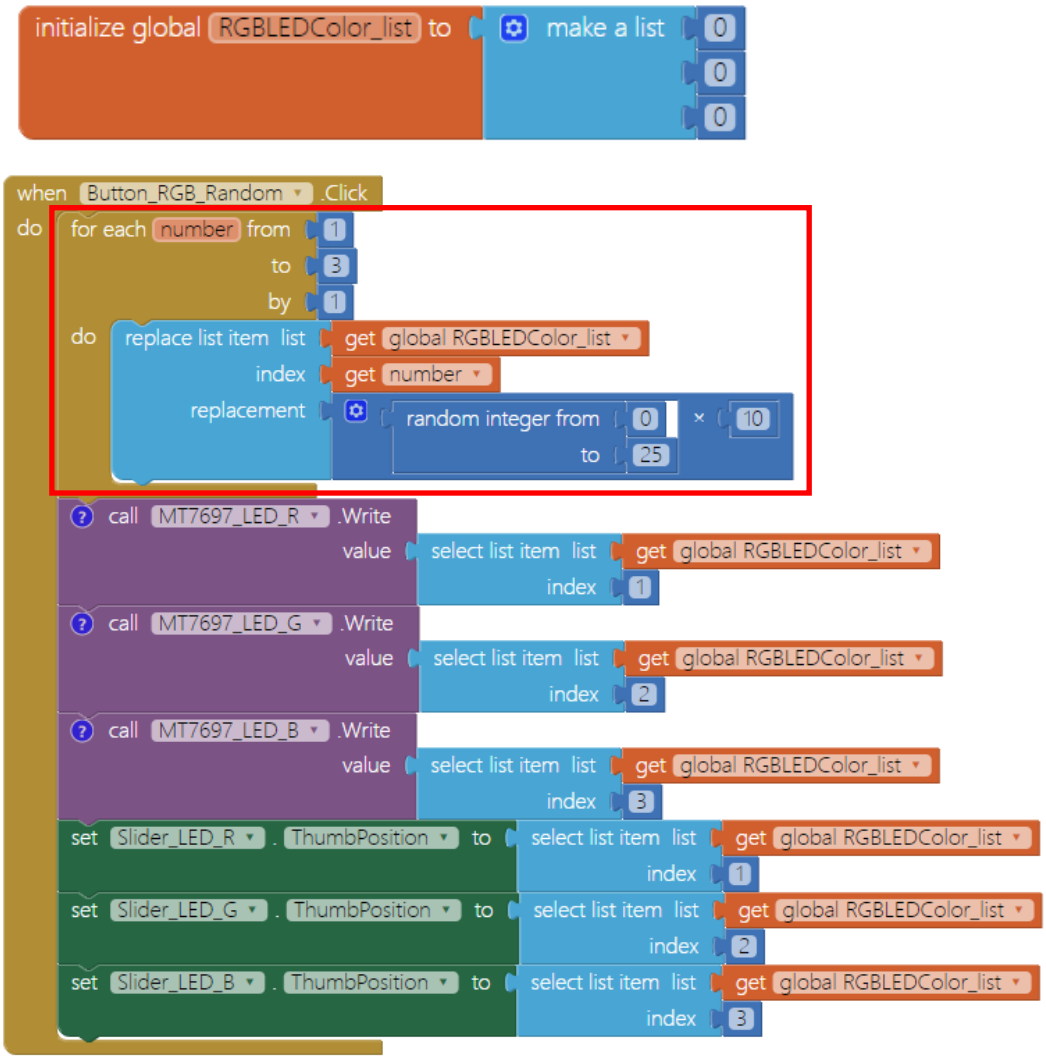
10. Button to control the green and purple wing LEDs

These two buttons are used to control the LED of both wings. The idea is same with the previous step.



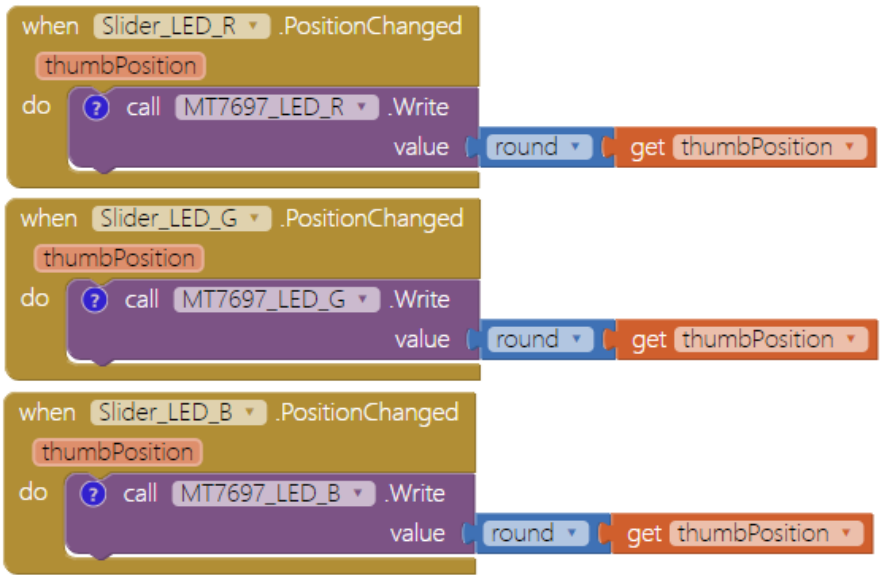
11. Button to randomize RGB LED color

We can also randomize the RGB LED color. When **Button_RGB_Random** is pressed, we first use a for each loop to replace the **RGBLEDColor_list** variable content with random number from **0** to **250** and control the corresponding color and slider thumbsposition by this variable.



12. Sliders to fine adjust RGB LED color

When slider is dragged, we simply control the corresponding color by slider thumbposition.

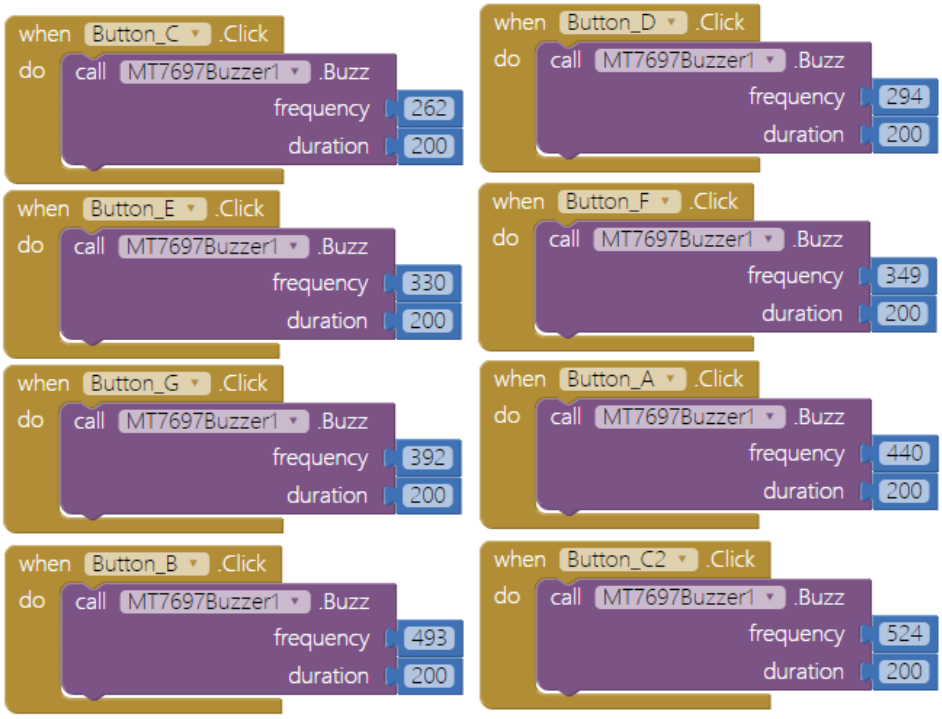


Sound (Blocks)

Here we are going to control the wings by buttons and sliders, which are exactly the same with **Codi Bot Sound tutorial**.

13. Buttons to make sounds of different notes

We have eight buttons here, each of them will tell the buzzer inside Codi Bot to make a different note. For example, when **Button_C** is pressed (**Button_C.Click** event), we use a **MT7697Buzzer.Buzz** method to make a sound of Note C by specifying **frequency** as 262 and **duration** as 200 (milliseconds). Please finish other seven button events in a same manner.



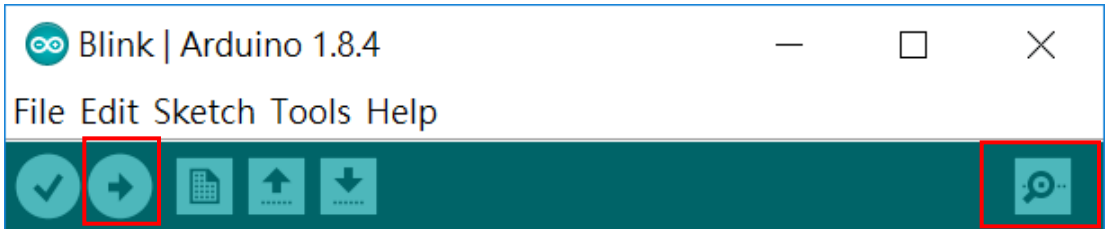
Arduino IDE and sketch

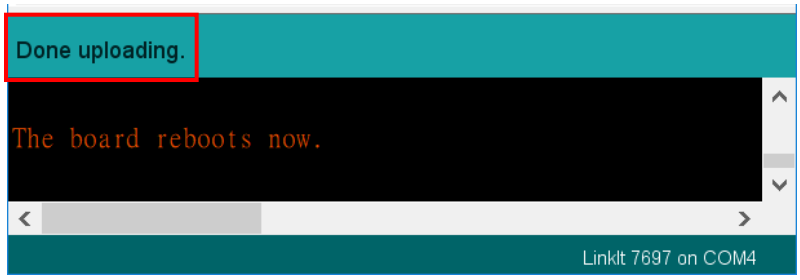
Make sure your computer has Arduino IDE installed and LinkIt 7697 SDK/driver are ready. If not, please check [Codi Bot Standalone tutorial].

Connect your computer and LinkIt 7697 with a microUSB cable.

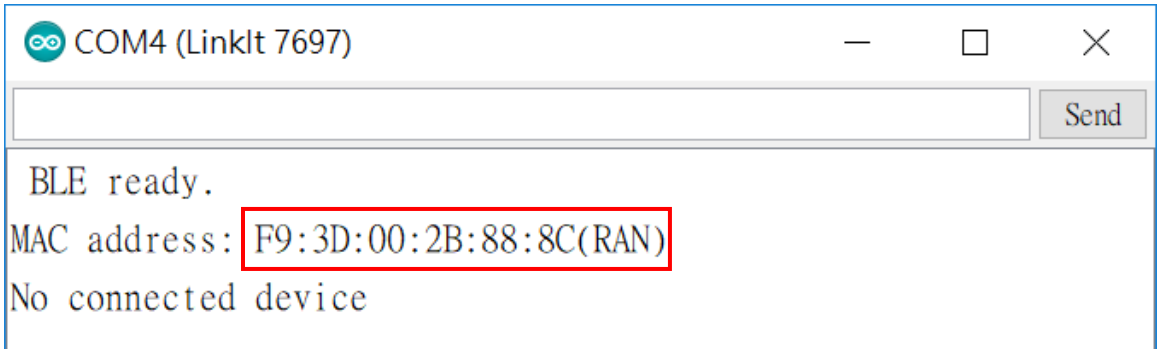
Please download the Arduino sketch from **here** and open in your Arduino IDE. This sketch can be used for all following Codi Bot projects, let you focus on building App Inventor projects.

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.



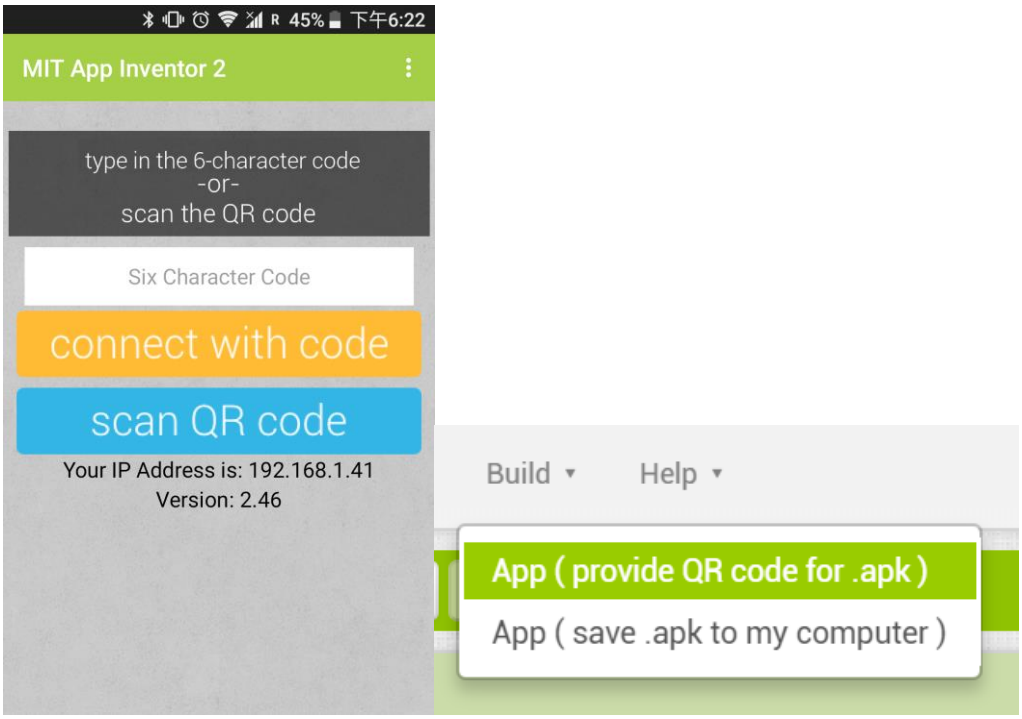


Click the magnifier icon at the up-right corner of Arduino IDE, you should see a message in the pop-up window. The [**XX:XX:XX:XX:XX:XX**] 12-digit string is the Bluetooth address of your LinkIt 7697. We will choose the device of this address in our app.



Tips

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



Open Codi Bot app (Fig 1.) and click **Connect** ListPicker, you'll see a list of available Bluetooth devices (Fig 2). In general, the first item is the Codi Bot where "**F9:3D:00:2B:88:8C**" is the Bluetooth address of my Codi Bot. Click it and your phone will try to connect with the Codi Bot, if connect successfully, you will see your app like Fig 3.

Click **Mode** ListPicker to choose which mode you want to play: **Wing**, **LED** and **Sound** (Fig. 4). Choose one to interact with your Codi Bot (Fig 5 to Fig 7). Remember to click **Disconnect** button when you finish with this project.

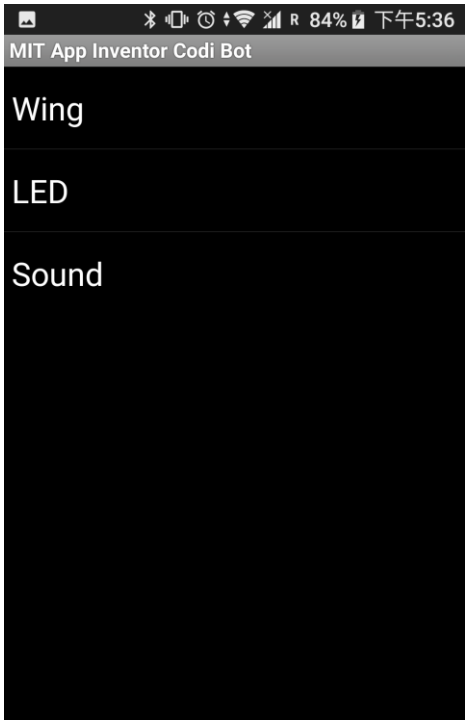
Fig 1. Initial screen	Fig 2. Select available Bluetooth device
	
Fig 3. Connected to Codi Bot (MT7697 for AI2)	Fig 4. Select mode
	

Fig 5. Wing mode	Fig 6. LED mode

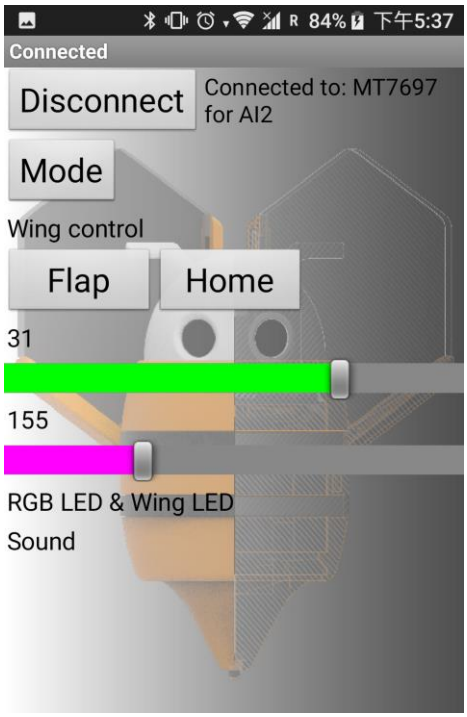
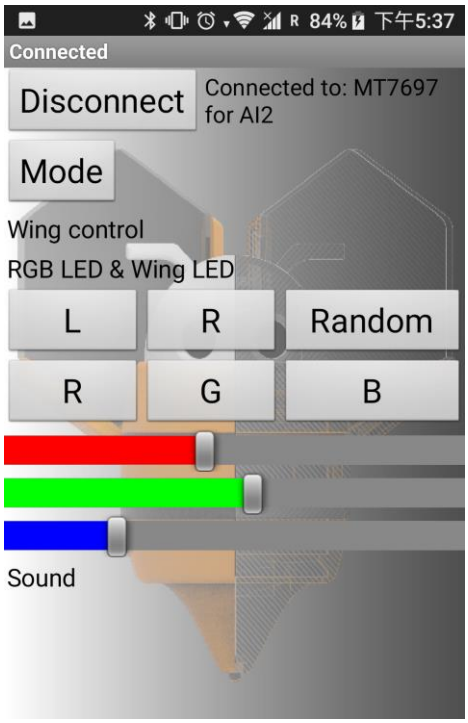

	

Fig 7. Sound mode