MIT App Inventor Codi Bot: Sound

Level: advanced

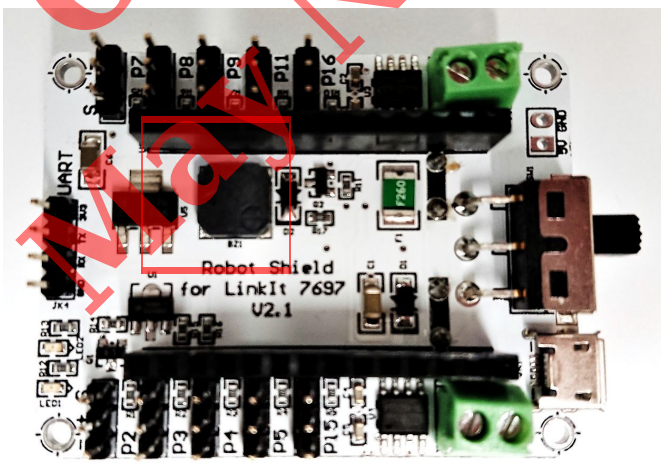
This tutorial will help you use App Inventor + IoT to tell Codi Bot to make different kinds of sounds. We also provide a completed version of the app for you.

Note that the frequency range for the onboard buzzer of **Robot Shield** is 30 ~ 6500 (Hz).

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

Function description

This project will show you how to control Codi Bot buzzer with App Inventor through BLE communication. This buzzer is the onboard buzzer of **Robot Shield**, which is connected to the #14 pin of LinkIt 7697 dev board. The components used in this tutorial are mostly buttons.



Hardware

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

App Inventor

Log in to your App Inventor account and create a new project. Or, if you prefer, you can directly import **this aia file**.

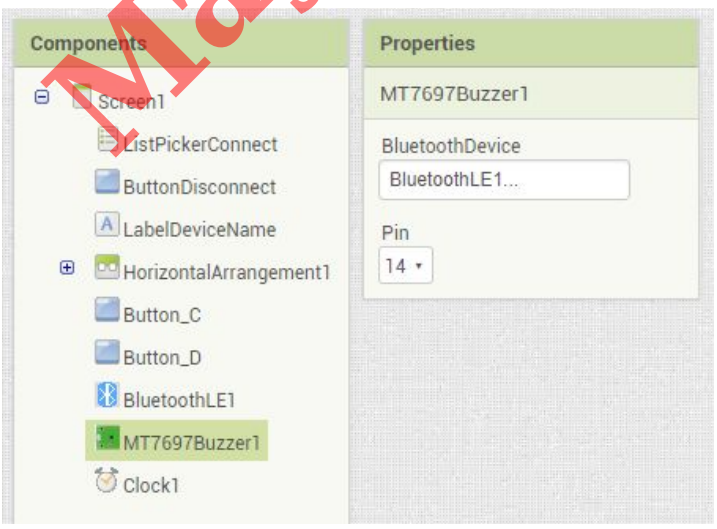
Designer

1. We need to import two extensions from this URL:
    - **Bluetooth low energy**: http://iot.appinventor.mit.edu/assets/resources/edu.mit.ap

pinventor.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 this to send commands to Codi Bot through Bluetooth.
3. Add an **MT7697Buzzer** component to your project. We use this to control the Robot Shield onboard buzzer, which is connected with pin #14 of the LinkIt 7697.
    - Set its BluetoothDevice property to **BluetoothLE1** (Step 2.) and set Pin to **14**.

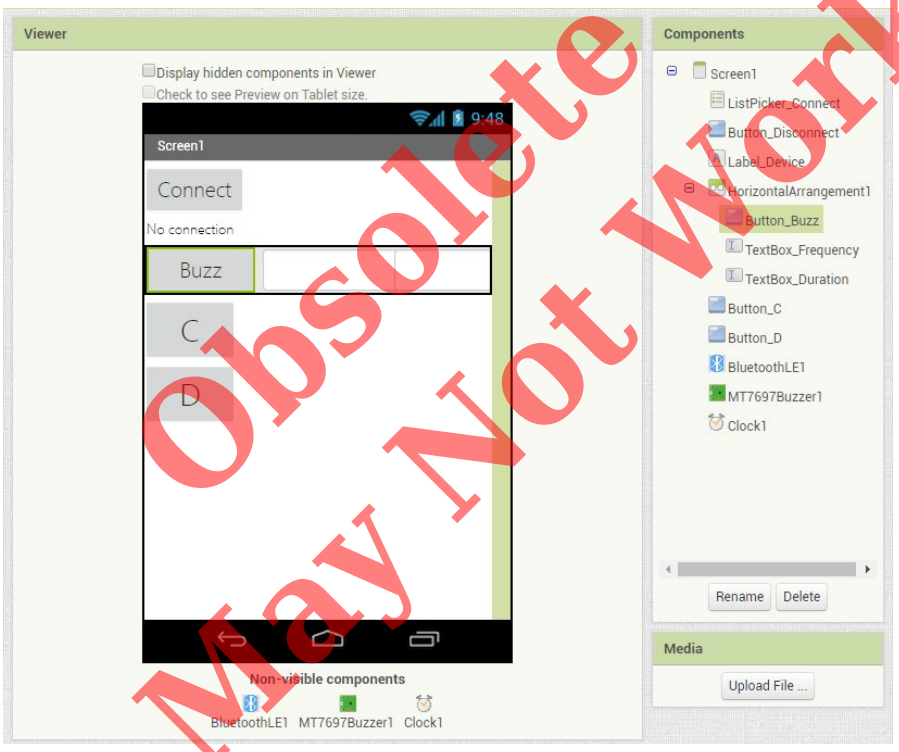


4. Add a ListPicker to select available Bluetooth devices nearby, set Text to "**Connect**" and FontSize to **20**.
5. Add a button to close the Bluetooth connection between your Android phone and LinkIt 7697. Rename it as "**Button_Disconnect**" and set Text to "**Disconnect**".
6. Add a Label to show messages of connection. Rename it as "**Label_Device**" and set the **Text** to "**No connection**".
7. Add a button to make sounds. Rename it as "**Button_Buzz**"; the set **Text** to "**Buzz**", **Width** to "**30 percent**" and **FontSize** to

20.

8. Add two TextBox components to specify sound frequency and time duration. Rename them as "**TextBox_Frequency**" and "**TextBox_Duration**". And set their Hint to "**frequency**" and "**time(ms)**" accordingly, clear their **Text** to "", **Width** to **35 percent**, **FontSize** to **20** and check the **numbersOnly** property.
9. Add a HorizontalArrangement component, set its Width to "**Fill parent...** " and uncheck **Visible** property. It will show up after it is connected to the Codi Bot. And put components of Step 7~8 into this HorizontalArrangement component.
10. Add another two buttons to make the notes C and D by specifying the frequency. Rename them as "**Button_C**" and "**Button_D**". And set their **Text** to "**C**" and "**D**" accordingly. Finally set their **FontSize** to **30**.

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



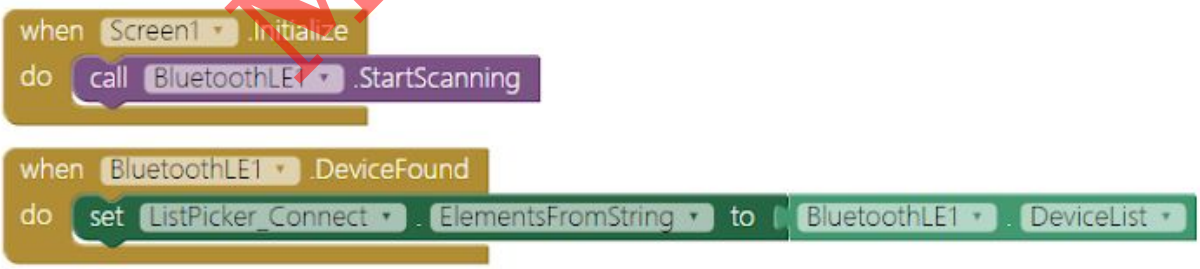
Blocks

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 a Listpicker to select an available BluetoothLE devices nearby instead of a specified device.

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

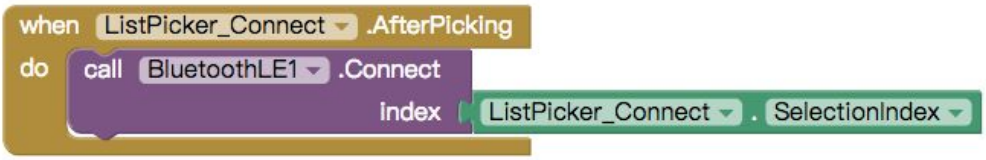
In **Screen1.Initialize** event, we ask **BluetoothLE** component to scan for BLE devices nearby (**BluetoothLE1.StartScanning**).

If any device is found (**BluetoothLE1.DeviceFound** event), we display these devices in ListPicker.



2. **Choose device with ListPicker**

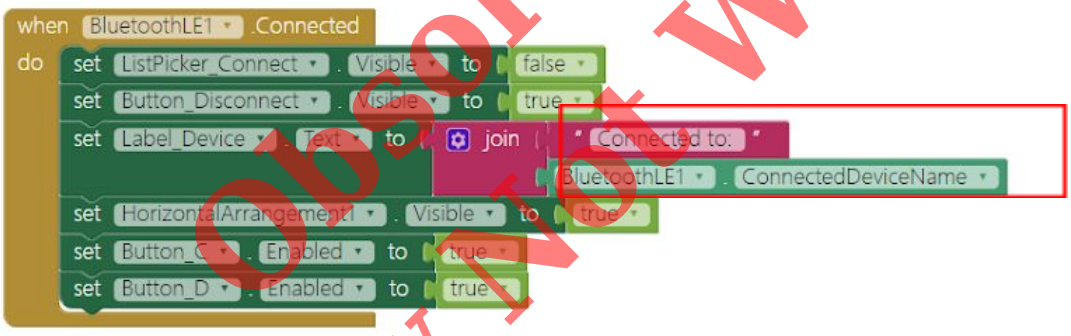
We choose which device to connect in Listpicker. In ListPicker.AfterPicking event, we use the BluetoothLE.Connect method to connect with device selected.



3. **BLE Connected**

When we have connected successfully via the **BluetoothLE.Connected** event, we will see related messages on several components. The ListPicker is hidden and we see

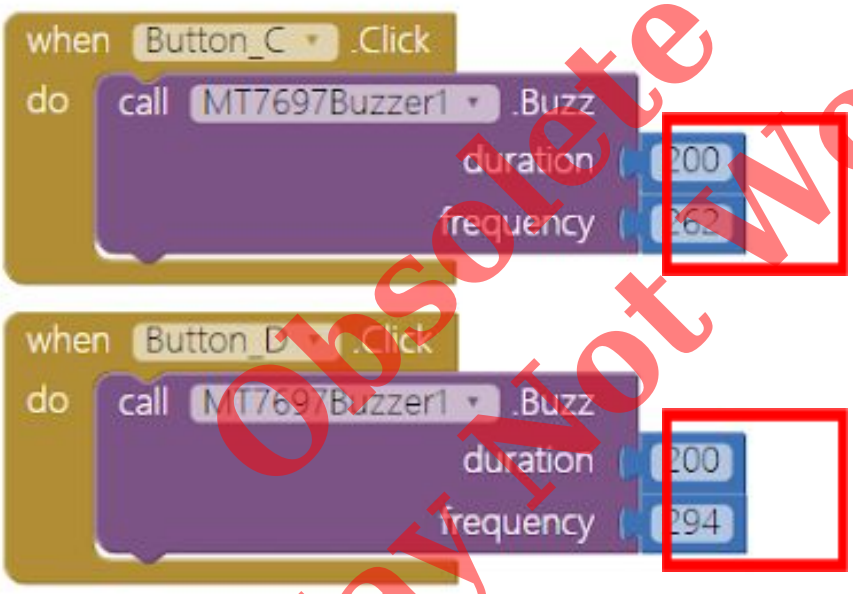
other components. This is because if we send Bluetooth commands without connecting to something first, it may cause an error.



4. **Buttons to make sounds of different notes**

When **Button_C** is pressed (**Button_C.Click** event), we use **MT7697Buzzer.Buzz** method to play the C note by specifying the frequency as **262** and the duration as **200** (milliseconds).

To set **Button_D** to play D note, modify the frequency to 294. Different frequencies make different pitches, therefore we can make many notes by modifying the frequencies. For other note frequencies please refer to the table below.

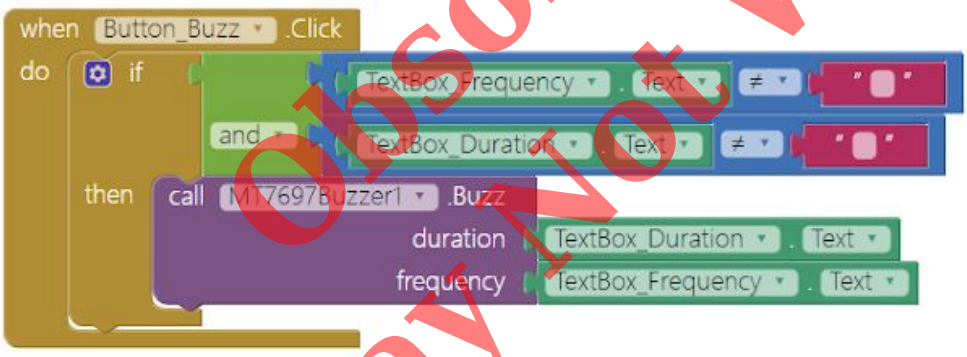


Note	Great	Small	One-lined	Two-lined	Three-lined	Four-lined
A	55.00	110.00	220.00	440.00	880.00	1760.00
A♯/B♭	58.27	116.54	233.08	466.16	932.33	1864.66
B/C♭	61.74	123.47	246.94	493.88	987.77	1975.53
B♯/C	65.41	130.81	261.63	523.25	1046.50	2093.00
C♯/D♭	69.30	138.59	277.18	554.37	1108.73	2217.46
D	73.42	146.83	293.66	587.33	1174.66	2349.32
D♯/E♭	77.78	155.56	311.13	622.25	1244.51	2489.02
E/F♭	82.41	164.81	329.63	659.26	1318.51	2637.02
E♯/F	87.31	174.61	349.23	698.46	1396.91	2793.83
F♯/G♭	92.50	185.00	369.99	739.99	1479.98	2959.96
G	98.00	196.00	392.00	783.99	1567.99	3135.96
G♯/A♭	103.83	207.65	415.30	830.61	1661.22	3322.44

Source: https://en.wikipedia.org/wiki/Pitch_(music)

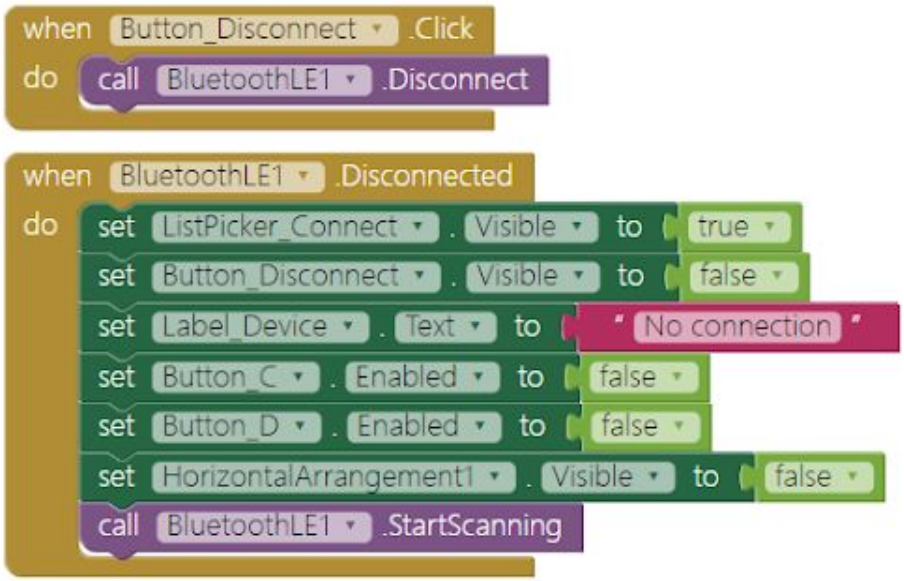
5. **Button to make a custom sound**

When **Button_Buzz** is pressed, we first check whether the two TextBoxes are empty, then play a C note by specifying **frequency** and **duration** as the numbers in these two Textboxes.



6. Disconnect

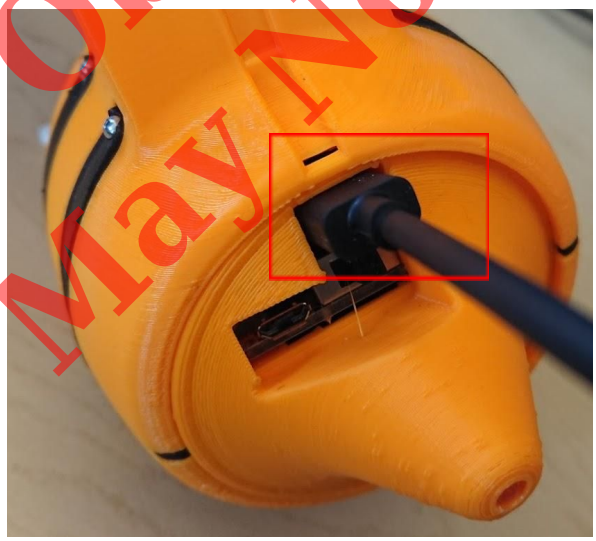
We press **Button_Disconnect** to close the Bluetooth communication. After Bluetooth communication is closed successfully (**BluetoothLE1.disconnected** event), we reset the app to its initial state to wait for the next connection request.



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 the Codi Bot Standalone tutorial.

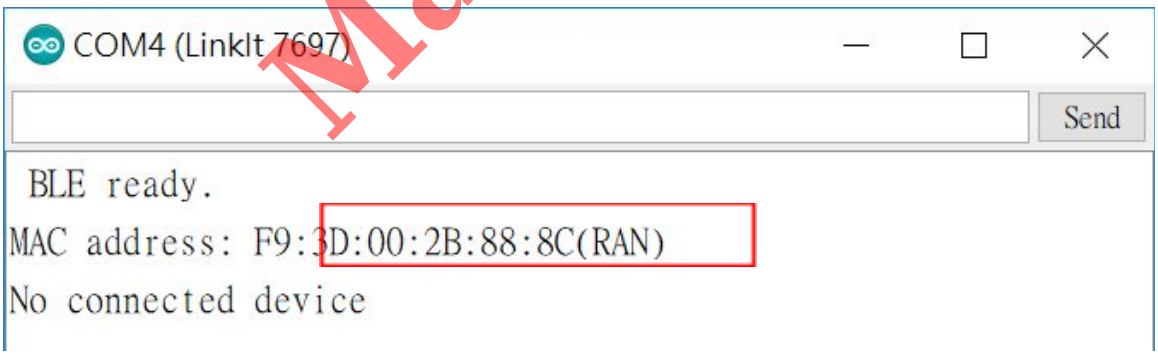
Connect your computer and the LinkIt 7697 with a microUSB cable.



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

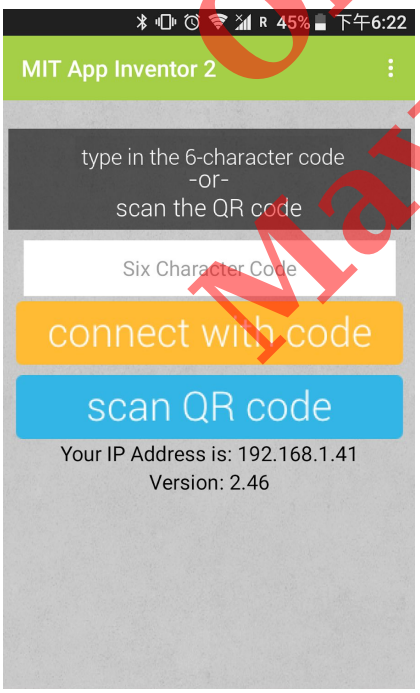
Press the "**Upload**" right-arrow button of Arduino IDE, this will compile and upload the Arduino sketch to your LinkIt 7697. Please make sure you see the "**done uploading**" message in the console.

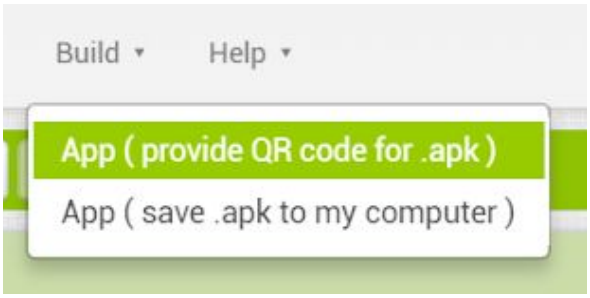
Click the magnifier icon at the up-right corner of Arduino IDE. You should see a message in the pop-up window. The [**XX:XX:XX:XX:XX:XX**] 12-digit string is the Bluetooth address of your LinkIt 7697. We will choose the Bluetooth address of this device in our app.



Tips

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





Open your 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 Codi Bot).

Click it and your phone will try to connect with the Codi Bot. If your connection is successful, your app should look like Fig 3. Press **Button_C** and **Button_D** to play the C and D notes. Or, you can input different numbers to specify frequency and time duration, then press **Button_Buzz** to make sound.

Remember to click the **Disconnect** button when you finish with this project. According to our test, the buzzer frequency range is 30 ~ 6000 Hz. We do not recommend frequencies higher than 2000 Hz.

Fig 1. Initial screen	Fig 2. Select available Bluetooth device

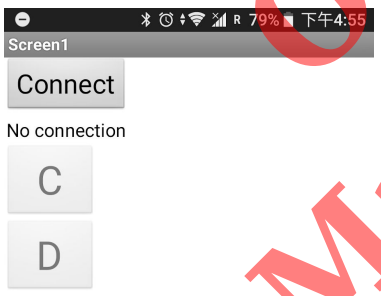
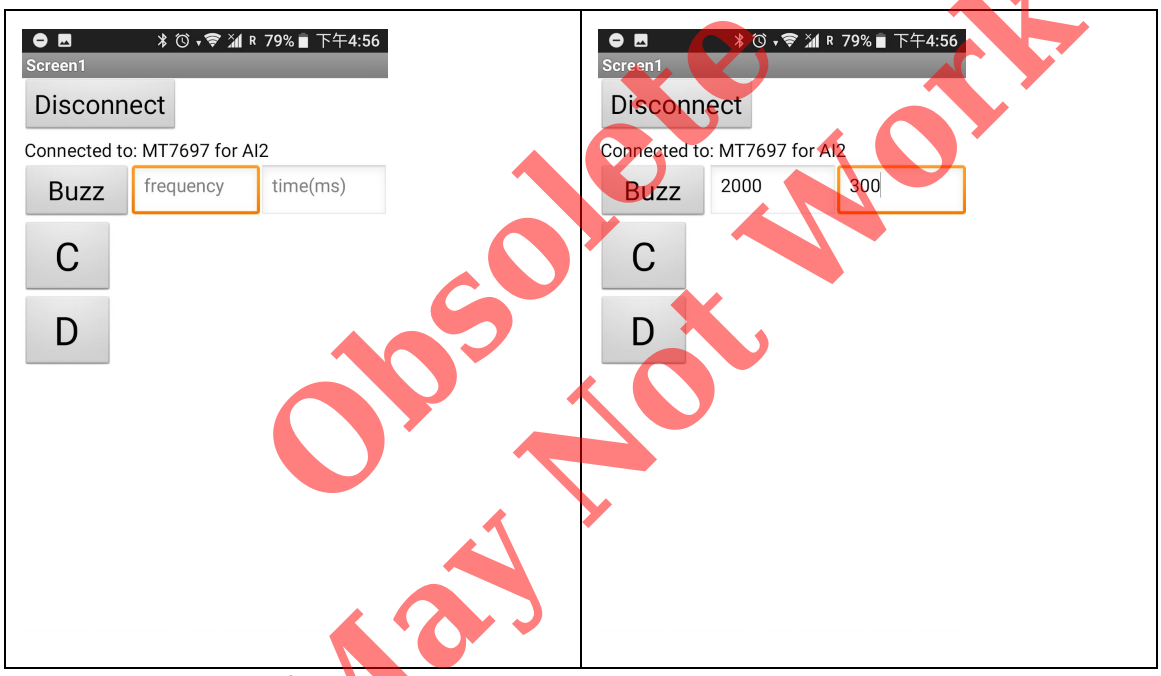
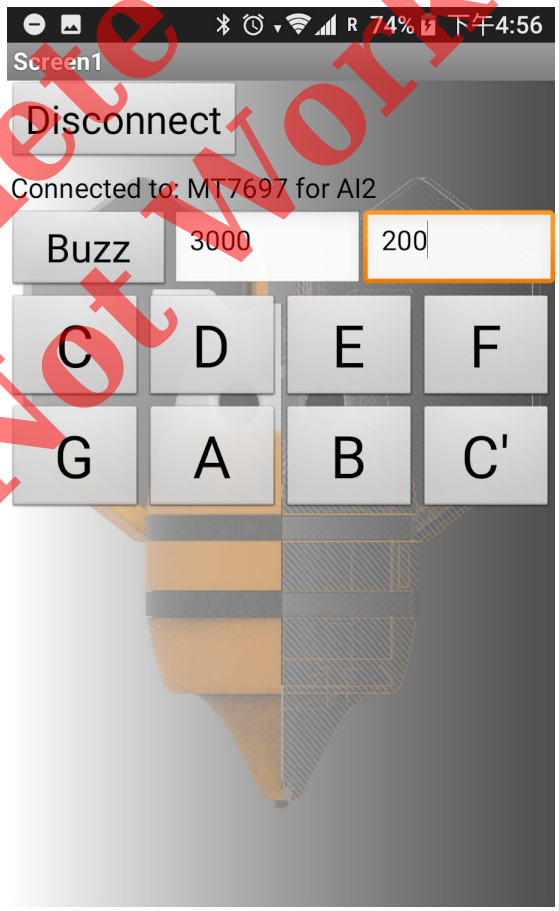



Fig 3. Connected to Codi Bot (MT7697 for AI2)	Fig 4. Set frequency and duration



Complete Buzzer app

We have provided a complete app to control all Codi Bot LEDs, please import this **complete .aia** to your App Inventor.



Brainstorming

1. Add more buttons to play more notes.
2. Tell Codi Bot to play your favorite songs (*hint: use procedure to manage your blocks!*)