Networking Academy

Lab – Blinking an LED Using Blockly Objectives

Part 1: Open Packet Tracer and Examine Blockly Program for LED Blinking

Part 2: Control a RGB LED using Blockly

Background

Blockly is a visual programming language that lets users create programs by connecting blocks, that represent different logic language structures, rather than by writing the actual code. Blockly runs within a web browser and can translate the visually created program as JavaScript, PHP, or Python. In this lab, you will use Blockly to examine Blockly programming and to control an LED.

Scenario

Using Blockly programming to control an IoT object LED. In this lab, Cisco Packet Tracer is used as it provides Blockly support with IoT objects.

Required Resources

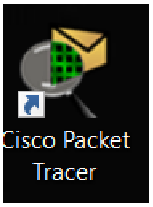
- Cisco Packet Tracer 7.1.1 and above is installed and available.

Part 1: Launch Cisco Packet Tracer (PT) and Use Blockly

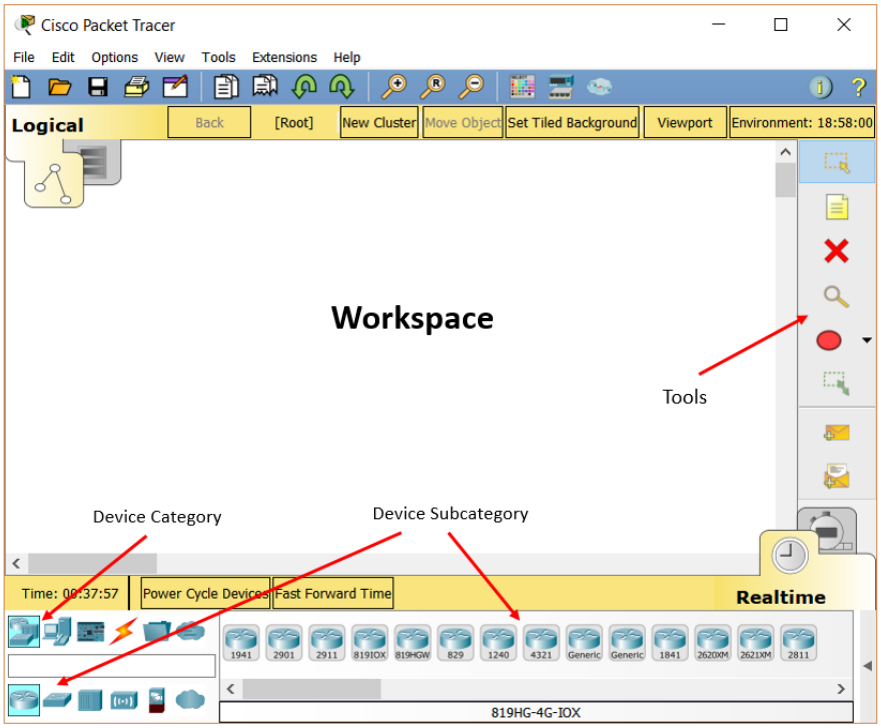
In Part 1, you will access the Cisco Packet Tracer program and examine LED control using Blockly programming.

Step 1: Launch Packet Tracer.

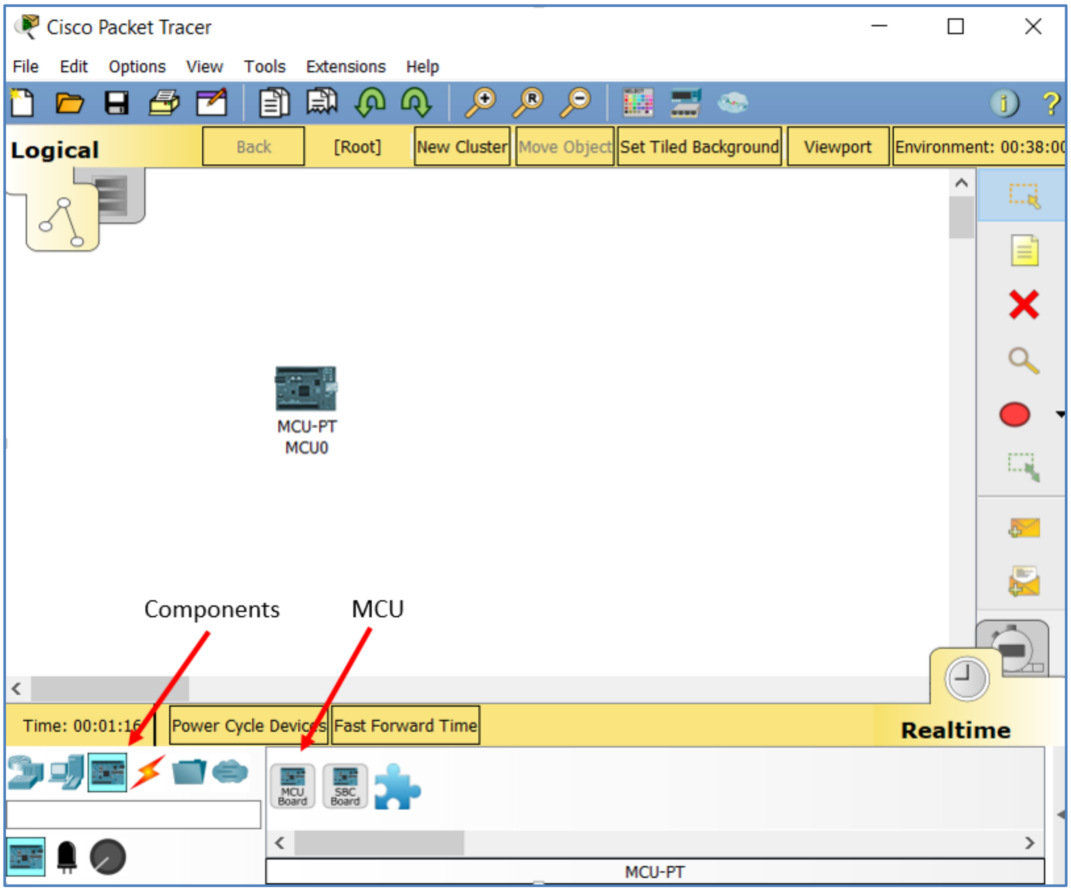
a. Double click the Cisco Packet Tracer icon to open the PT program.



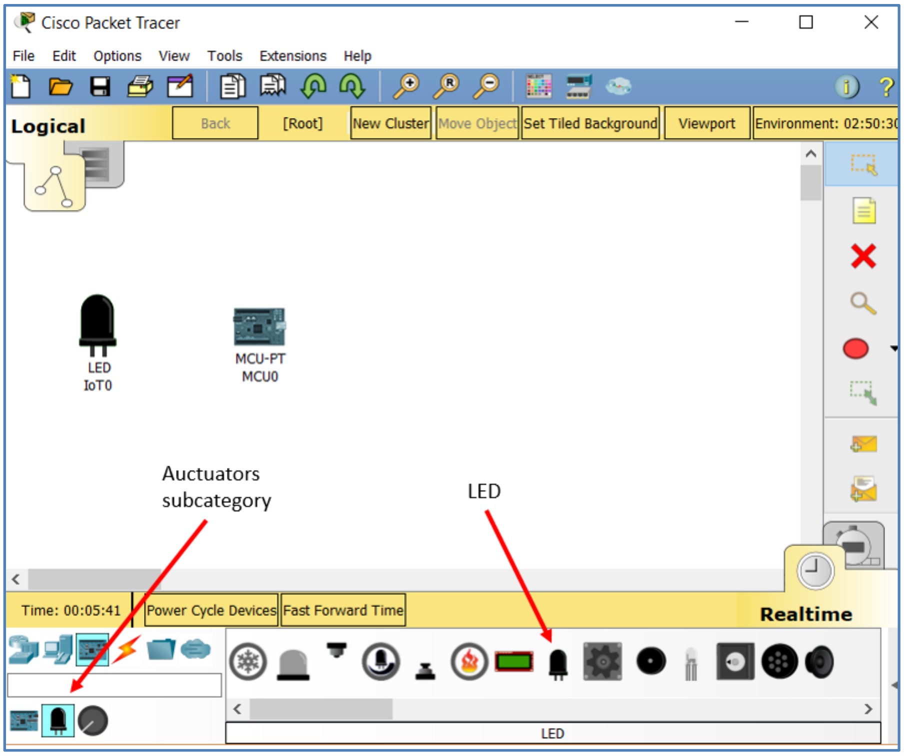
b. The user interface is shown.



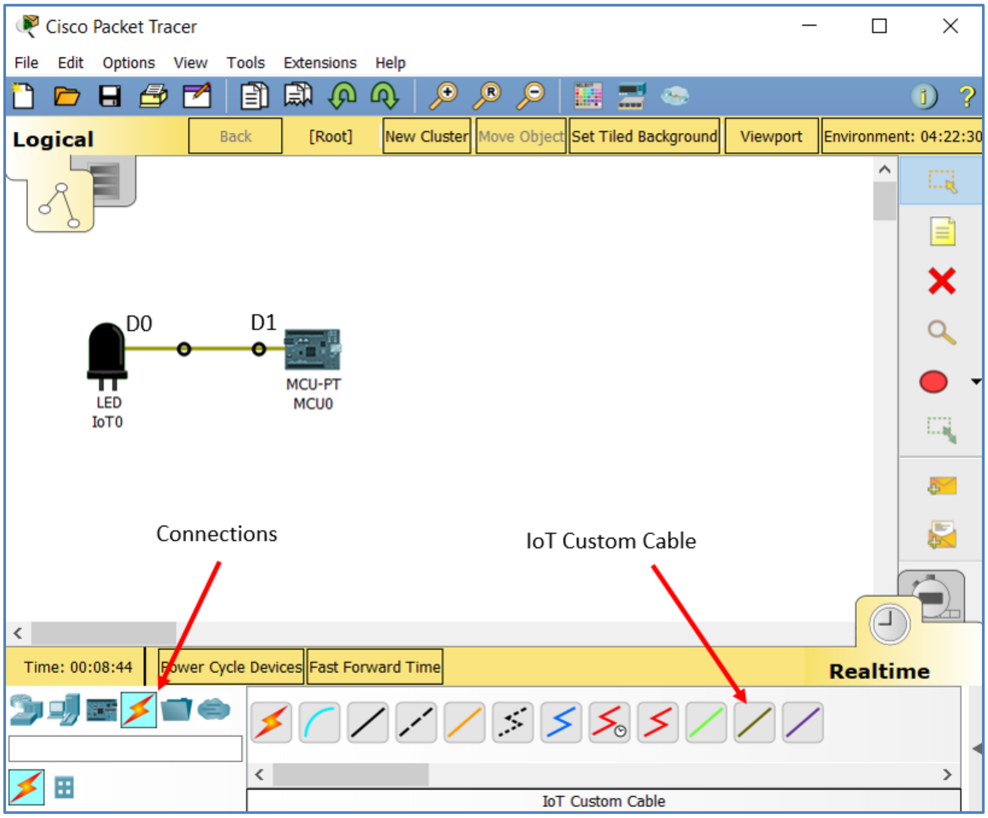
c. Click on the **Components** category, then click **MCU Board** and drag it to the workspace.



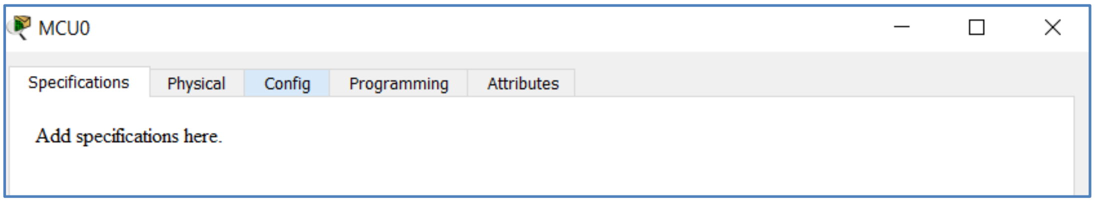
d. Click the subcategory **Actuators**, select **LED** and drag it to the workspace.



e. Click the **Connections** category, select **IoT Custom Cable** to link MCU at port **D1** and LED at port **D0**.

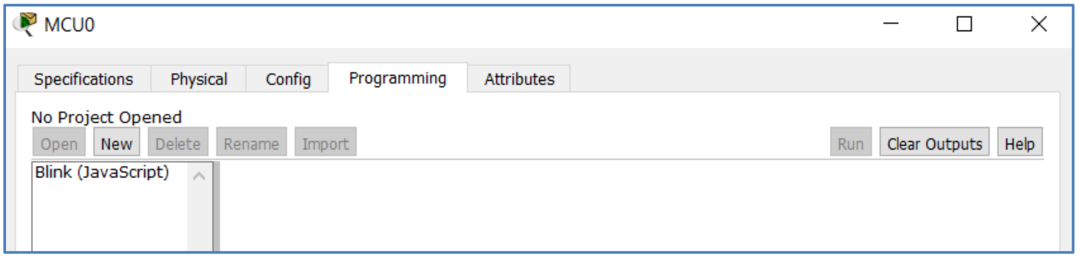


f. Double click the **MCU**. Its configuration window displays.



Add specifications here.

g. Click the **Programming** tab. (If you do not see the Programming tab, click the **Advanced** button at the lower right corner.)

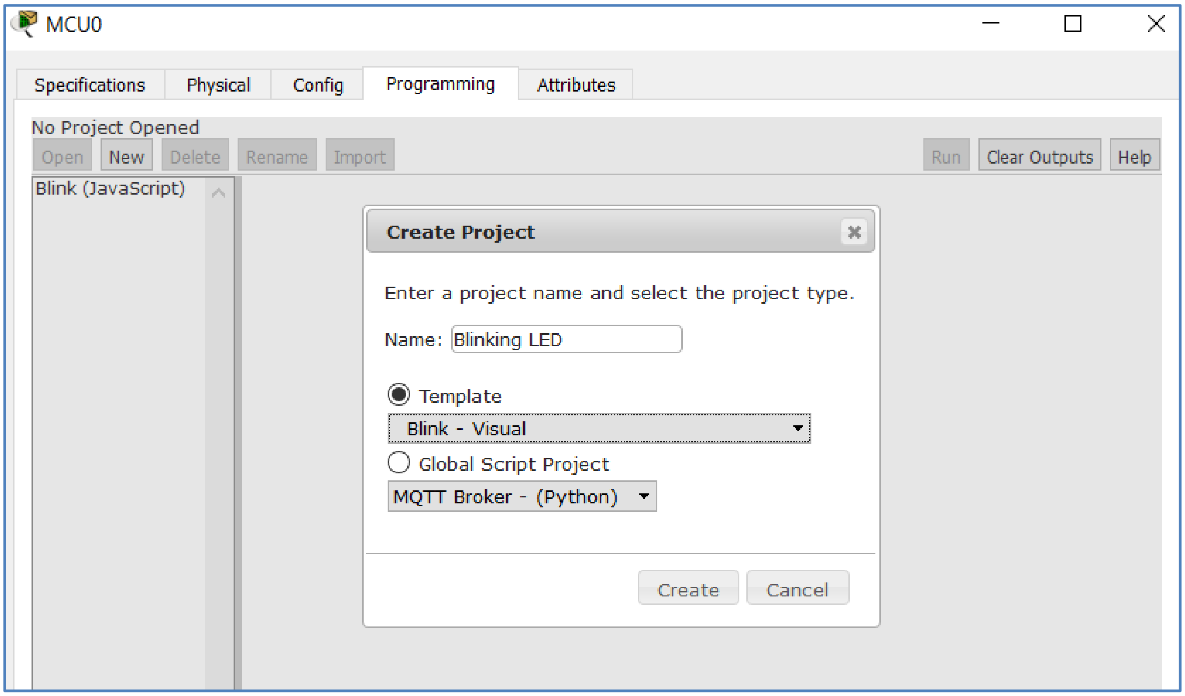


No Project Opened

Blink (JavaScript)

Step 2: Examine a prebuilt Blockly program

a. Under the note **No Project Opened**, click **New**. In the **Create Project** window, enter **Blinking LED** as the project name. In the **Template** dropdown menu, select **Blink – Visual**.



No Project Opened

Blink (JavaScript)

Enter a project name and select the project type.

Name: Blinking LED

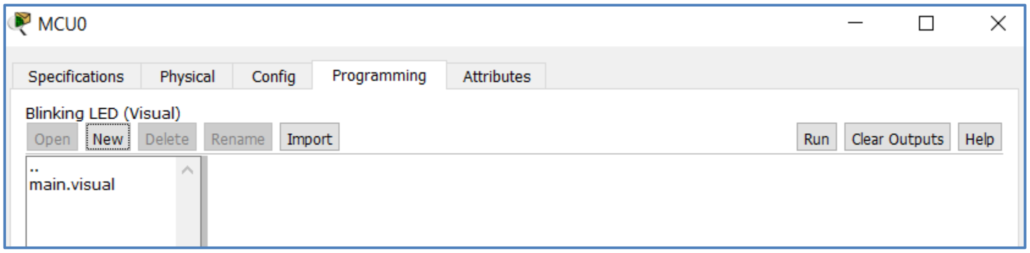
● Template

Blink - Visual

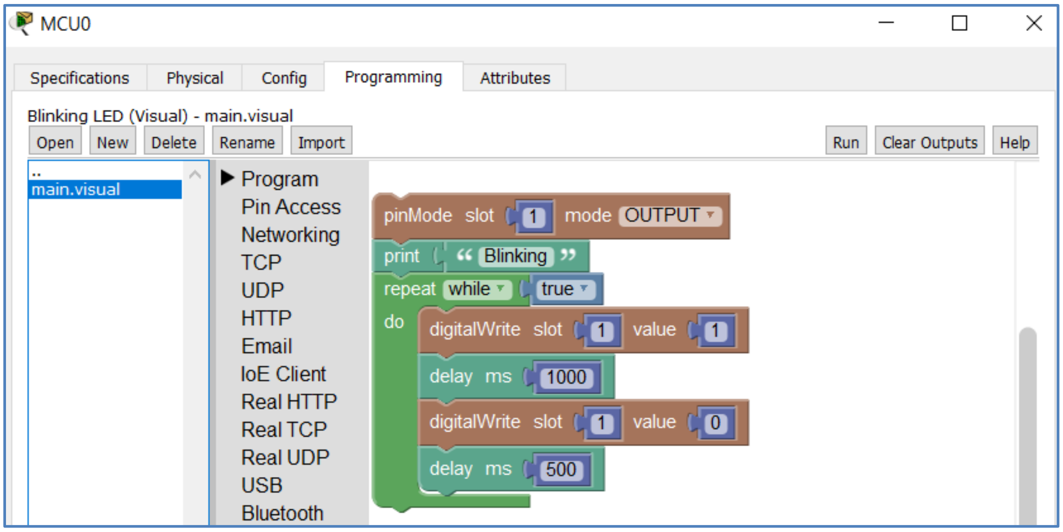
○ Global Script Project

MQTT Broker - (Python)

b. Click **Create**.



c. Double-click **main.visual**. The prebuilt Blockly program displays.

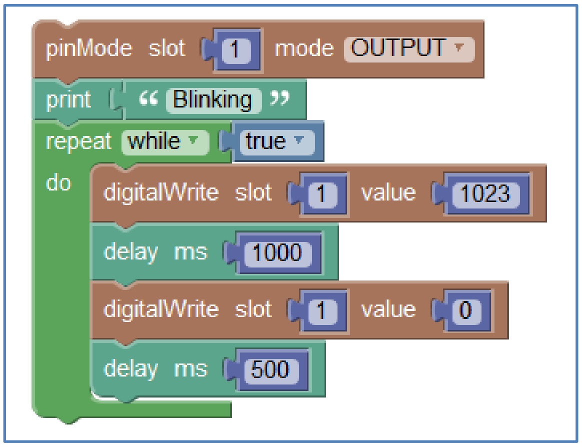


```
pinMode slot 1 mode OUTPUT
print " Blinking "
repeat while true
do  digitalWrite slot 1 value 1
    delay ms 1000
    digitalWrite slot 1 value 0
    delay ms 500
```

d. Click **Run**. Does the LED blink?

____

e. Click **Stop**, and change the **Value** field of the first **digitalWrite** block to 1023.



```
pinMode slot 1 mode OUTPUT
print " Blinking "
repeat while true
do  digitalWrite slot 1 value 1023
    delay ms 1000
    digitalWrite slot 1 value 0
    delay ms 500
```

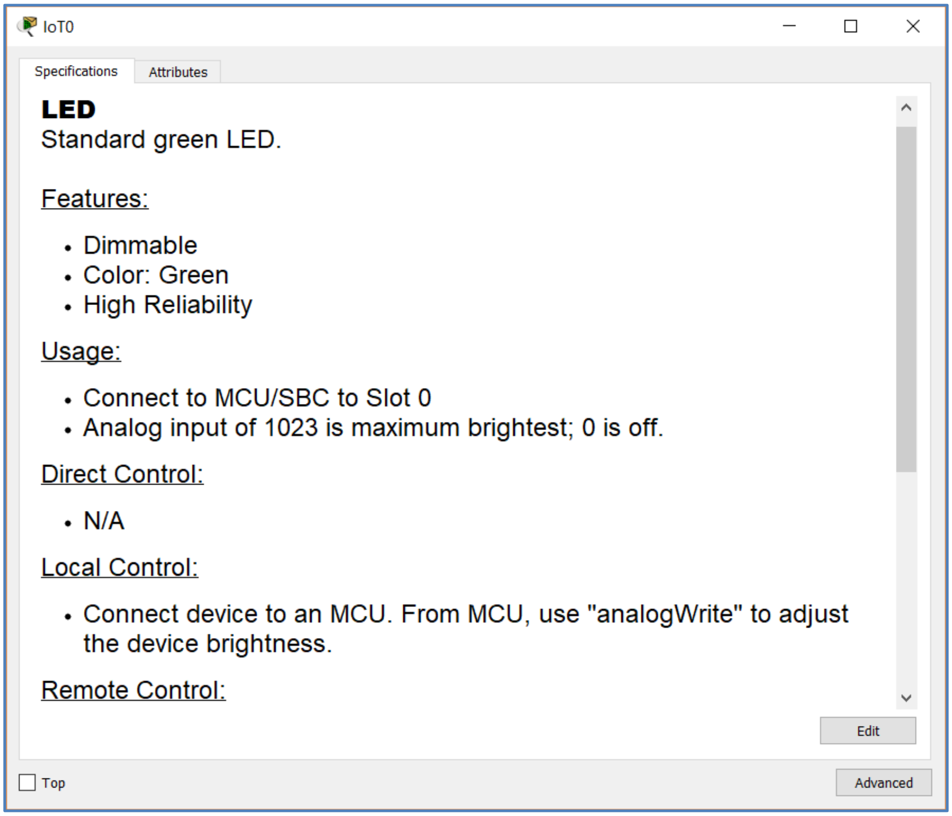
f. Click **Run**, does the LED blink?

____

Why was it not blinking when the value was not set to 1023?

____

g. Click the LED and study its specification.



LED

Standard green LED.

Features:

- Dimmable
- Color: Green
- High Reliability

Usage:

- Connect to MCU/SBC to Slot 0
- Analog input of 1023 is maximum brightest; 0 is off.

Direct Control:

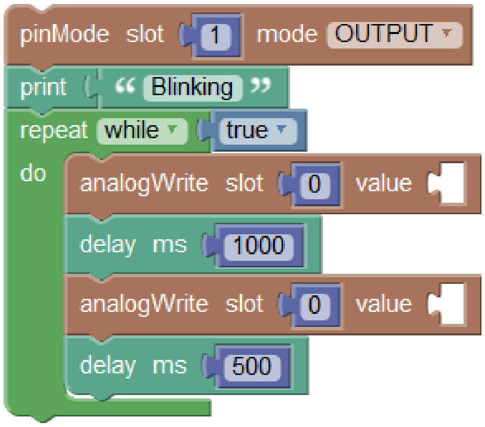
- N/A

Local Control:

- Connect device to an MCU. From MCU, use "analogWrite" to adjust the device brightness.

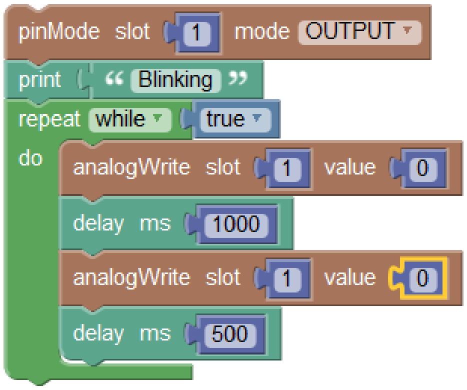
Remote Control:

h. It indicates that we can use "analogWrite" to adjust the device brightness. Click the first **digitalWrite** block and press **Delete**. Expand the **Pin Access** group and drag an **analogWrite** block to to where the **digitalWrite** block was. Do the same for the second **digitalWrite** block.



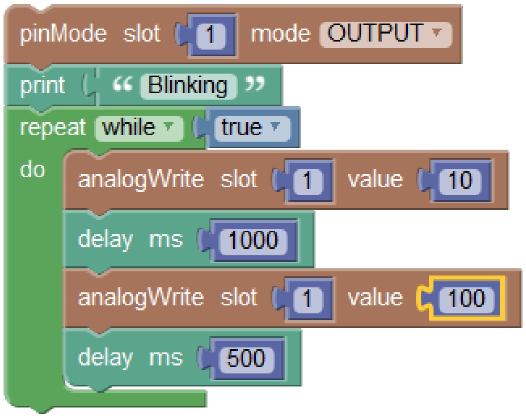
```
pinMode slot 1 mode OUTPUT
print "Blinking"
repeat while true
do  analogWrite slot 0 value
    delay ms 1000
    analogWrite slot 0 value
    delay ms 500
```

i. Change the **slot** value for each of the **analogWrite** blocks to **1**. Right-click the small block with the value of zero (0) and click **duplicate**. Drag the new block into the empty space next to **value.** Do the same for the second **analogWrite** slot.



```
pinMode slot 1 mode OUTPUT
print " Blinking "
repeat while true
do  analogWrite slot 1 value 0
    delay ms 1000
    analogWrite slot 1 value 0
    delay ms 500
```

j. Change the **values** of the first and second **analogWrite** blocks and observe the different LED brightness levels.



```
pinMode slot 1 mode OUTPUT
print " Blinking "
repeat while true
do  analogWrite slot 1 value 10
    delay ms 1000
    analogWrite slot 1 value 100
    delay ms 500
```

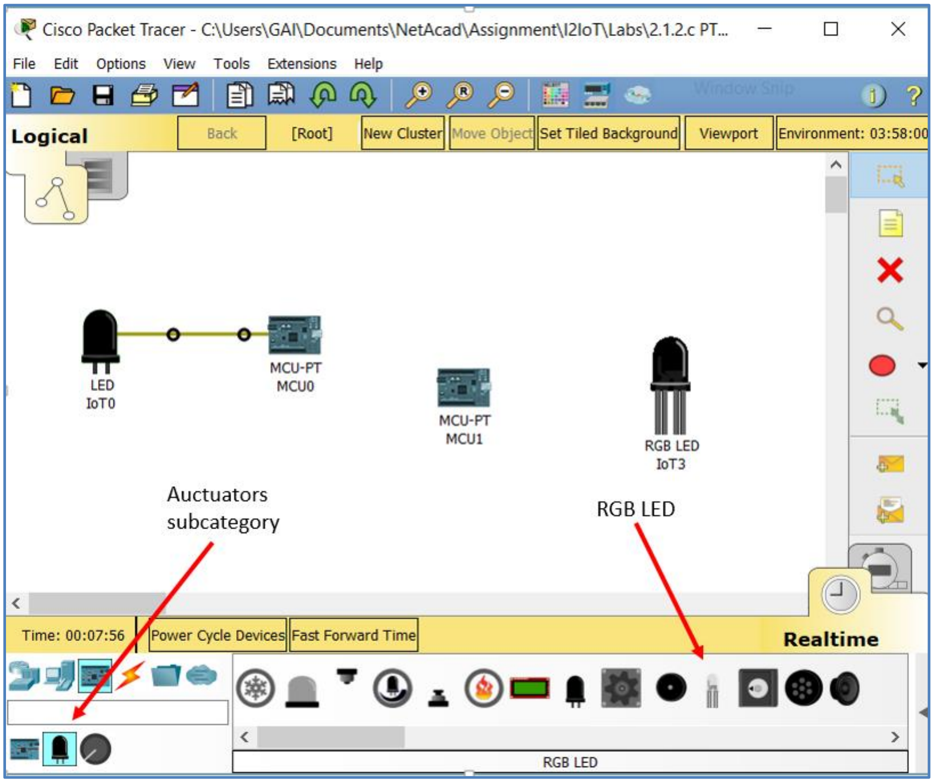
Part 2: Control an RGB LED using Blockly

In Part 2, you used Blockly to control an RGB LED. An RGB can display different colors with the combination of red, green, and blue.

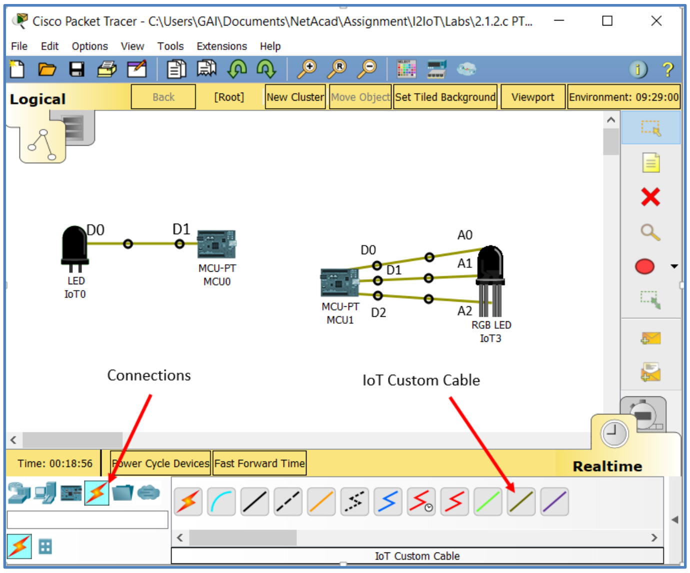
Step 1: Add an MCU and an RGB LED.

In Step 1, you add another MCU board and a RGB LED into the workspace.

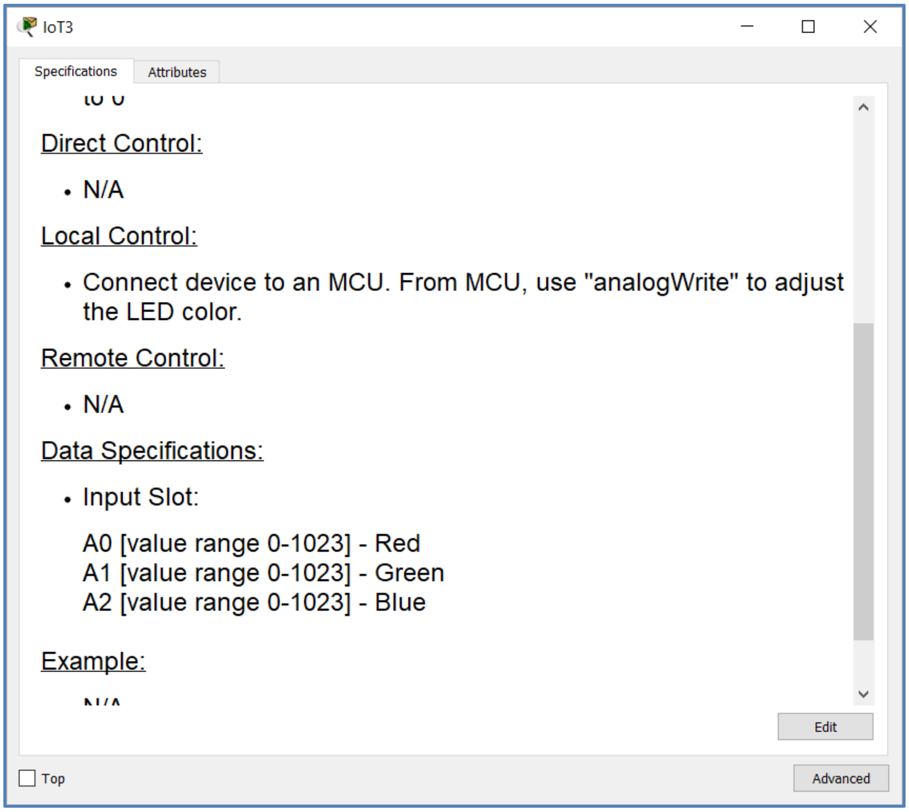
a. Click the subcategory **Actuators,** select **RGB LED** and drag it to the workspace. Add another MCU board.



b. Click the **Connections** category, select three **IoT Custom Cable**s to link MCU and RGB LED.



c. Click **RGB LED** and review its specification. Note different pin inputs represent different colors.



Direct Control:

- N/A

Local Control:

- Connect device to an MCU. From MCU, use "analogWrite" to adjust the LED color.

Remote Control:

- N/A

Data Specifications:

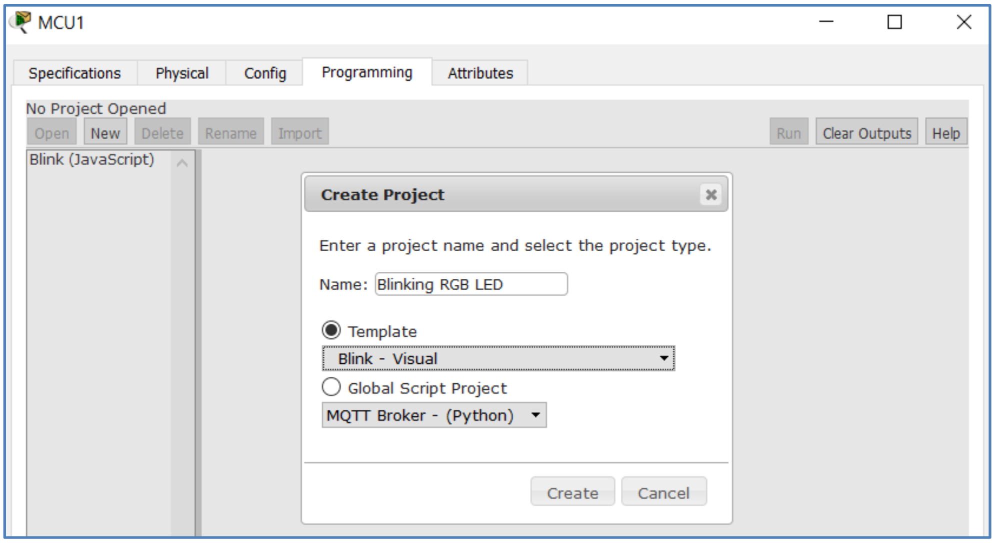
- Input Slot:

  A0 [value range 0-1023] - Red
  A1 [value range 0-1023] - Green
  A2 [value range 0-1023] - Blue

Example:

N/A

d. Open the prebuilt Blockly program. Click MCU -> Programming. Under the note **No Project Opened**, click **New**. In the **Create Project** window, enter **Blinking RGB LED** as the project name. In the Template dropdown menu, select **Blink – Visual**.



Enter a project name and select the project type.

Name: Blinking RGB LED

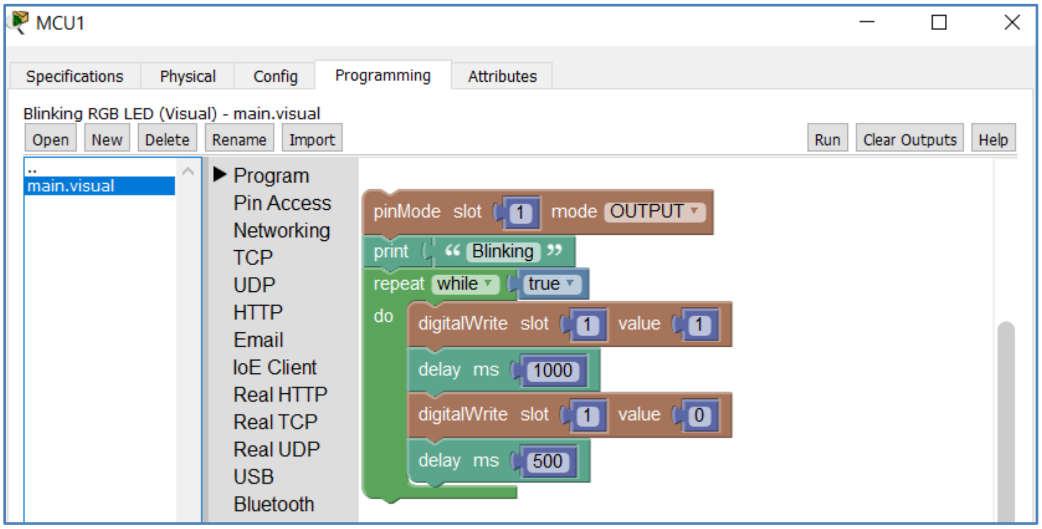
● Template

Blink - Visual

○ Global Script Project

MQTT Broker - (Python)

e. Click **Create**. Double-click main.visual. The prebuilt Blockly program displays.

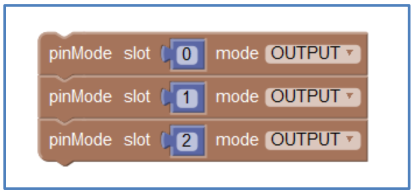


Blinking RGB LED (Visual) - main.visual

```
pinMode slot 1 mode OUTPUT
print "Blinking"
repeat while true
do
    digitalWrite slot 1 value 1
    delay ms 1000
    digitalWrite slot 1 value 0
    delay ms 500
```

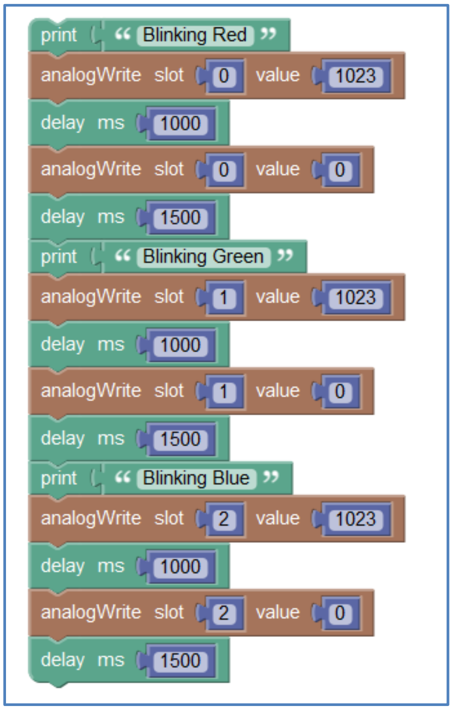
Step 2: Modify the Blockly program

a. Expand **Pin Access** group, and add two more **pinMode** blocks to set three slots as **OUTPUT** (from MCB to send a signal to RGB LED).



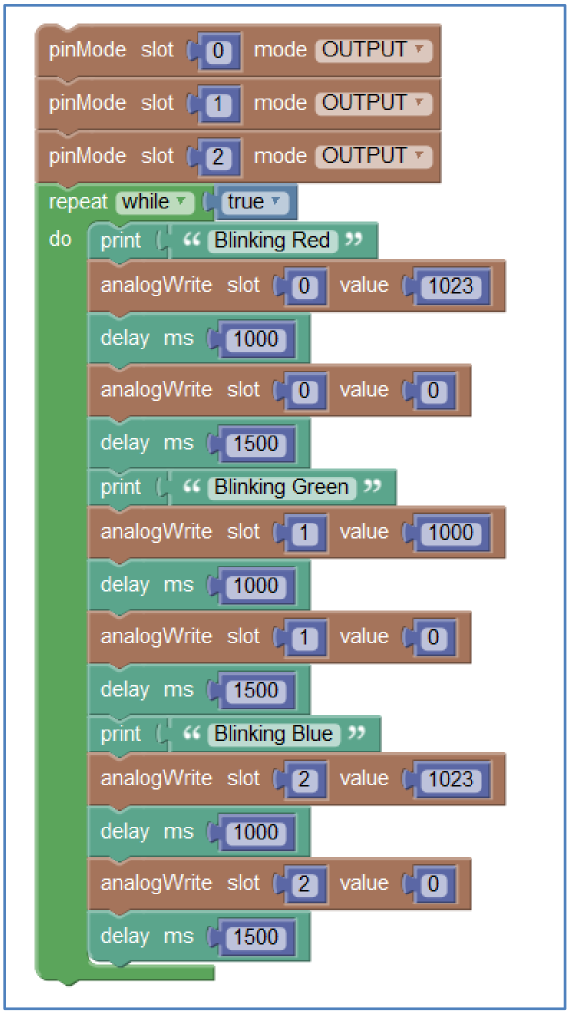
```
pinMode slot 0 mode OUTPUT
pinMode slot 1 mode OUTPUT
pinMode slot 2 mode OUTPUT
```

b. From the **Pin Access group**, select **analogWrite** blocks to replace **digitalWrite** blocks. Also, add a few **print** blocks.



```
print "Blinking Red"
analogWrite slot 0 value 1023
delay ms 1000
analogWrite slot 0 value 0
delay ms 1500
print "Blinking Green"
analogWrite slot 1 value 1023
delay ms 1000
analogWrite slot 1 value 0
delay ms 1500
print "Blinking Blue"
analogWrite slot 2 value 1023
delay ms 1000
analogWrite slot 2 value 0
delay ms 1500
```

c. The final program is as follows:



```
pinMode slot 0 mode OUTPUT
pinMode slot 1 mode OUTPUT
pinMode slot 2 mode OUTPUT
repeat while true
do  print " Blinking Red "
    analogWrite slot 0 value 1023
    delay ms 1000
    analogWrite slot 0 value 0
    delay ms 1500
    print " Blinking Green "
    analogWrite slot 1 value 1000
    delay ms 1000
    analogWrite slot 1 value 0
    delay ms 1500
    print " Blinking Blue "
    analogWrite slot 2 value 1023
    delay ms 1000
    analogWrite slot 2 value 0
    delay ms 1500
```

d. Run the program. The LED should display RED, GREEN, and BLUE in sequence.

Challenge

Modify the program to show a combined color from all three inputs with different, randomly generated values for each slot.