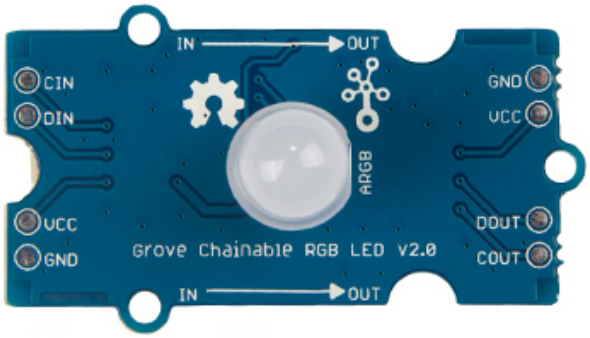
Grove - Chainable RGB LED



Grove - Chainable RGB LED is based on P9813 chip which is a full-color LED driver. It provides 3 constant-current drivers as well as modulated output of 256 shades of gray. It communicates with a MCU using 2-wire transmission (Data and Clock). This 2-wire transmission can be used to cascade additional **Grove - Chainable RGB LED** modules. The built-in clock regeneration enhances the transmission distance. This Grove module is suitable for any colorful LED based projects.

Version

Revision	Descriptions	Release	How to Buy
v1	Initial public release (beta)	May 5, 2011	Get One Now [https://www.seeedstudio.com/Grove-Chainable-RGB-LED-p-850.html]
v2	Replace P9813S16 with P9813S14 and change Grove connector from Vertical to horizontal	Apr 19, 2016	Get One Now [https://www.seeedstudio.com/Grove-%E2%80%93-Chainable-RGB-Led-V2.0-p-2903.html]

Specifications

- Operating Voltage: 5V
- Operating Current: 20mA
- Communication Protocol: Serial

Tip
More details about Grove modules please refer to Grove System [http://wiki.seeedstudio.com/Grove_System/]

Platforms Supported

Arduino	Raspberry Pi	BeagleBone	Wio	LinkIt ONE
	TO DO		TO DO	

Caution
The platforms mentioned above as supported is/are an indication of the module's software or theoritical compatibility. We only provide software library or code examples for Arduino platform in most cases. It is not possible to provide software library / demo code for all possible MCU platforms. Hence, users have to write their own software library.

Usage

Play with Arduino [../Arduino]

When you get Grove - Chainble RGB LED, you may think how I can light up it. Now we will show you this demo: all colors of RGB cycles in an uniform way.

To complete this demo, you can use one or more Grove - Chainable RGB LED. Note that the IN interface of one Grove - Chainable RGB LED should be connect to D7/D8 of Grove - Base Shield [../Base_Shield_V2] and its OUT interface connect to IN interface of another Grove - Chainable RGB LED, chainable more LED in this way.

- Download Chainable LED Library [https://github.com/pjpmarques/ChainableLED] and install it to Arduino Library. There is the course about how to install Arduino Library [../How_to_install_Arduino_Library] in wiki page.
- Open the example CycleThroughColors by the path:File->Examples->ChainableLED_master and upload it to Seeeduino.

```
/*
 * Example of using the ChainableRGB library for controlling a
```

```
 * This code cycles through all the colors in an uniform way. T
 */
#include <ChainableLED.h>

#define NUM_LEDS  5

ChainableLED leds(7, 8, NUM_LEDS);

void setup()
{
}

float hue = 0.0;
boolean up = true;

void loop()
{
  for (byte i=0; i<NUM_LEDS; i++)
    leds.setColorHSB(i, hue, 1.0, 0.5);

  delay(50);

  if (up)
    hue+= 0.025;
  else
    hue-= 0.025;

  if (hue>=1.0 && up)
    up = false;
  else if (hue<=0.0 && !up)
    up = true;
}
```

You can observe this scene: colors of two LED will gradient consistently.

Extended application: Based on Chainable LED Library [https://github.com/pjpmarques/ChainableLED], we have designed this demo: RGB color varies with the temperature measured by Grove - temperature. The RGB color vary from green to red when the temperature is from 25 to 32. The test code is shown below. Do it if you are interested in it.

```
// demo of temperature -> rgbLED
```

```
    // temperature form 25 - 32, rgbLed from green -> red
    // Grove-temperature plu to A0
    // LED plug to D7,D8

    #include <Streaming.h>
    #include <ChainableLED.h>

    #define TEMPUP 32
    #define TEMPDOWN 25

    ChainableLED leds(7, 8, 1); // connect to pin7 and pin8 , one l

    int getAnalog() // get value from A0
    {
        int sum = 0;
        for(int i=0; i<32; i++)
        {
            sum += analogRead(A0);
        }

        return sum>>5;
    }

    float getTemp() // get temperature
    {
        float temperature = 0.0;
        float resistance = 0.0;
        int B = 3975; //B value of the thermistor

        int a = getAnalog();

        resistance = (float)(1023-a)*10000/a; //get the resistance
        temperature = 1/(log(resistance/10000)/B+1/298.15)-273.15;
        return temperature;
    }

    void ledLight(int dta) // light led
    {

        dta = dta/4; // 0 - 255

        int colorR = dta;
        int colorG = 255-dta;
        int colorB = 0;

```

```
        leds.setColorRGB(0, colorR, colorG, colorB);
    }

    void setup()
    {
        Serial.begin(38400);
        cout << "hello world !" << endl;
    }

    void loop()
    {
        float temp = getTemp();
        int nTemp = temp*100;

        nTemp = nTemp > TEMPUP*100 ? TEMPUP*100 : (nTemp < TEMPDOWN
        nTemp = map(nTemp, TEMPDOWN*100, TEMPUP*100, 0, 1023);
        ledLight(nTemp);
        delay(100);
    }
```

Play with Codecraft

Hardware

Step 1. Connect Grove - Chainanle RGB LED to port D7 in a Base Shield

Step 2. Plug the Base Shield to your Seeeduino/Arduino.

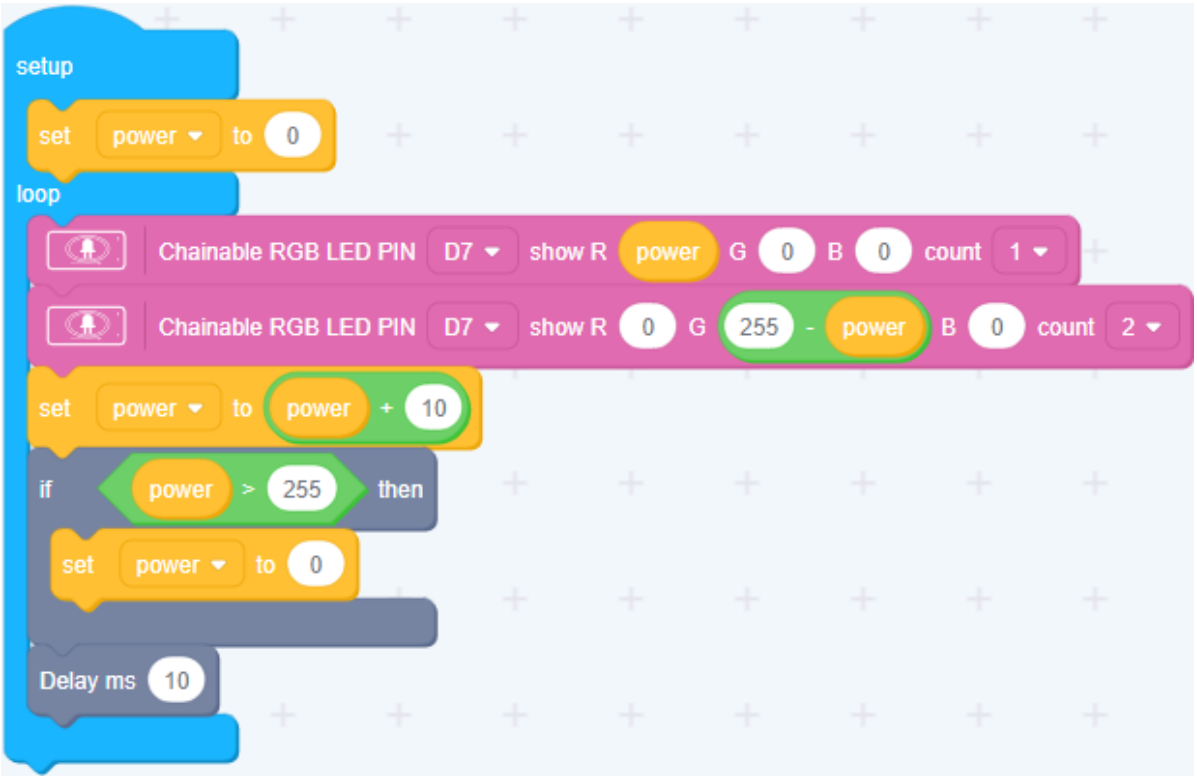
Step 3. Link Seeeduino/Arduino to your PC via an USB cable.

Software

Step 1. Open Codecraft [https://ide.chmakered.com/], add Arduino support, and drag a main procedure to working area.

> **Note**
> If this is your first time using Codecraft, see also Guide for Codecraft using Arduino [http://wiki.seeedstudio.com/Guide_for_Codecraft_using_Arduino/].

Step 2. Drag blocks as picture below or open the cdc file which can be downloaded at the end of this page.



Upload the program to your Arduino/Seeeduino.

> **Success**
> When the code finishes uploaded, you will see the LED fade in and fade out.

Play with Raspberry Pi

1.You should have got a raspberry pi and a grovepi or grovepi+.

2.You should have completed configuring the development enviroment, otherwise follow here [../GrovePi_Plus].

3.Connection

- Plug the sensor to grovepi socket D7 by using a grove cable.

4.Navigate to the demos' directory:

```
cd yourpath/GrovePi/Software/Python/
```

- To see the code

```
nano grove_chainable_rgb_led.py   # "Ctrl+x" to exit #
```

```
import time
import grovepi

# Connect first LED in Chainable RGB LED chain to digital
# In: CI,DI,VCC,GND
# Out: CO,DO,VCC,GND
pin = 7

# I have 10 LEDs connected in series with the first connec
# First LED input socket connected to GrovePi, output sock
numleds = 1

grovepi.pinMode(pin,"OUTPUT")
time.sleep(1)

# Chainable RGB LED methods
# grovepi.storeColor(red, green, blue)
# grovepi.chainableRgbLed_init(pin, numLeds)
# grovepi.chainableRgbLed_test(pin, numLeds, testColor)
# grovepi.chainableRgbLed_pattern(pin, pattern, whichLed)
# grovepi.chainableRgbLed_modulo(pin, offset, divisor)
# grovepi.chainableRgbLed_setLevel(pin, level, reverse)

# test colors used in grovepi.chainableRgbLed_test()
testColorBlack = 0   # 0b000 #000000
testColorBlue = 1    # 0b001 #0000FF
testColorGreen = 2   # 0b010 #00FF00
testColorCyan = 3    # 0b011 #00FFFF
testColorRed = 4     # 0b100 #FF0000
testColorMagenta = 5 # 0b101 #FF00FF
testColorYellow = 6  # 0b110 #FFFF00
testColorWhite = 7   # 0b111 #FFFFFF

# patterns used in grovepi.chainableRgbLed_pattern()
```

```
    thisLedOnly = 0
    allLedsExceptThis = 1
    thisLedAndInwards = 2
    thisLedAndOutwards = 3

    try:

        print "Test 1) Initialise"

        # init chain of leds
        grovepi.chainableRgbLed_init(pin, numleds)
        time.sleep(.5)

        # change color to green
        grovepi.storeColor(0,255,0)
        time.sleep(.5)

        # set led 1 to green
        grovepi.chainableRgbLed_pattern(pin, thisLedOnly, 0)
        time.sleep(.5)

        # change color to red
        grovepi.storeColor(255,0,0)
        time.sleep(.5)

        # set led 10 to red
        grovepi.chainableRgbLed_pattern(pin, thisLedOnly, 9)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 2a) Test Patterns - black"

        # test pattern 0 - black (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(1)


        print "Test 2b) Test Patterns - blue"
```

```

        # test pattern 1 blue
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(1)


        print "Test 2c) Test Patterns - green"

        # test pattern 2 green
        grovepi.chainableRgbLed_test(pin, numleds, testColorGr
        time.sleep(1)


        print "Test 2d) Test Patterns - cyan"

        # test pattern 3 cyan
        grovepi.chainableRgbLed_test(pin, numleds, testColorCy
        time.sleep(1)


        print "Test 2e) Test Patterns - red"

        # test pattern 4 red
        grovepi.chainableRgbLed_test(pin, numleds, testColorRe
        time.sleep(1)


        print "Test 2f) Test Patterns - magenta"

        # test pattern 5 magenta
        grovepi.chainableRgbLed_test(pin, numleds, testColorMa
        time.sleep(1)


        print "Test 2g) Test Patterns - yellow"

        # test pattern 6 yellow
        grovepi.chainableRgbLed_test(pin, numleds, testColorYe
        time.sleep(1)


        print "Test 2h) Test Patterns - white"

        # test pattern 7 white
        grovepi.chainableRgbLed_test(pin, numleds, testColorWh
```

```
        time.sleep(1)


        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 3a) Set using pattern - this led only"

        # change color to red
        grovepi.storeColor(255,0,0)
        time.sleep(.5)

        # set led 3 to red
        grovepi.chainableRgbLed_pattern(pin, thisLedOnly, 2)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 3b) Set using pattern - all leds except th

        # change color to blue
        grovepi.storeColor(0,0,255)
        time.sleep(.5)

        # set all leds except for 3 to blue
        grovepi.chainableRgbLed_pattern(pin, allLedsExceptThis
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)
```

```


        print "Test 3c) Set using pattern - this led and inwar

        # change color to green
        grovepi.storeColor(0,255,0)
        time.sleep(.5)

        # set leds 1-3 to green
        grovepi.chainableRgbLed_pattern(pin, thisLedAndInwards
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 3d) Set using pattern - this led and outwa

        # change color to green
        grovepi.storeColor(0,255,0)
        time.sleep(.5)

        # set leds 7-10 to green
        grovepi.chainableRgbLed_pattern(pin, thisLedAndOutward
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 4a) Set using modulo - all leds"

        # change color to black (fully off)
        grovepi.storeColor(0,0,0)
        time.sleep(.5)

        # set all leds black
```

```
        # offset 0 means start at first led
        # divisor 1 means every led
        grovepi.chainableRgbLed_modulo(pin, 0, 1)
        time.sleep(.5)

        # change color to white (fully on)
        grovepi.storeColor(255,255,255)
        time.sleep(.5)

        # set all leds white
        grovepi.chainableRgbLed_modulo(pin, 0, 1)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 4b) Set using modulo - every 2"

        # change color to red
        grovepi.storeColor(255,0,0)
        time.sleep(.5)

        # set every 2nd led to red
        grovepi.chainableRgbLed_modulo(pin, 0, 2)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)


        print "Test 4c) Set using modulo - every 2, offset 1"

        # change color to green
        grovepi.storeColor(0,255,0)
        time.sleep(.5)

        # set every 2nd led to green, offset 1
        grovepi.chainableRgbLed_modulo(pin, 1, 2)
        time.sleep(.5)

```

```
        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 4d) Set using modulo - every 3, offset 0"

        # change color to red
        grovepi.storeColor(255,0,0)
        time.sleep(.5)

        # set every 3nd led to red
        grovepi.chainableRgbLed_modulo(pin, 0, 3)
        time.sleep(.5)

        # change color to green
        grovepi.storeColor(0,255,0)
        time.sleep(.5)

        # set every 3nd led to green, offset 1
        grovepi.chainableRgbLed_modulo(pin, 1, 3)
        time.sleep(.5)

        # change color to blue
        grovepi.storeColor(0,0,255)
        time.sleep(.5)

        # set every 3nd led to blue, offset 2
        grovepi.chainableRgbLed_modulo(pin, 2, 3)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 4e) Set using modulo - every 3, offset 1"

        # change color to yellow
```

```
        grovepi.storeColor(255,255,0)
        time.sleep(.5)

        # set every 4nd led to yellow
        grovepi.chainableRgbLed_modulo(pin, 1, 3)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)


        print "Test 4f) Set using modulo - every 3, offset 2"

        # change color to magenta
        grovepi.storeColor(255,0,255)
        time.sleep(.5)

        # set every 4nd led to magenta
        grovepi.chainableRgbLed_modulo(pin, 2, 3)
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)


        print "Test 5a) Set level 6"

        # change color to green
        grovepi.storeColor(0,255,0)
        time.sleep(.5)

        # set leds 1-6 to green
        grovepi.write_i2c_block(0x04,[95,pin,6,0])
        time.sleep(.5)

        # pause so you can see what happened
        time.sleep(2)

        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        time.sleep(.5)
```

```


        print "Test 5b) Set level 7 - reverse"

        # change color to red
        grovepi.storeColor(255,0,0)
        time.sleep(.5)

        # set leds 4-10 to red
        grovepi.write_i2c_block(0x04,[95,pin,7,1])
        time.sleep(.5)


    except KeyboardInterrupt:
        # reset (all off)
        grovepi.chainableRgbLed_test(pin, numleds, testColorBl
        break
    except IOError:
        print "Error"
```

- Notice that there's something you have to concern of:

```
    pin = 7         #setting up the output pin
    numleds = 1     #how many leds you plug
```

- Also all methods you can see in grovepi.py is:

```
    storeColor(red, green, blue)
    chainableRgbLed_init(pin, numLeds)
    chainableRgbLed_test(pin, numLeds, testColor)
    chainableRgbLed_pattern(pin, pattern, whichLed)
    chainableRgbLed_modulo(pin, offset, divisor)
    chainableRgbLed_setLevel(pin, level, reverse)
```

5.Run the demo.

```
    sudo python grove_chainable_rgb_led.py
```

6.This demo may not work if your grovepi dosen't have the newest firmware, update the firmware.

```
cd yourpath/GrovePi/Firmware
sudo ./firmware_update.sh
```

With Beaglebone Green

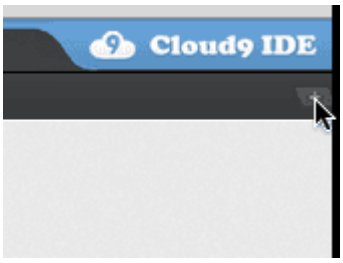
To begin editing programs that live on BBG, you can use the Cloud9 IDE.

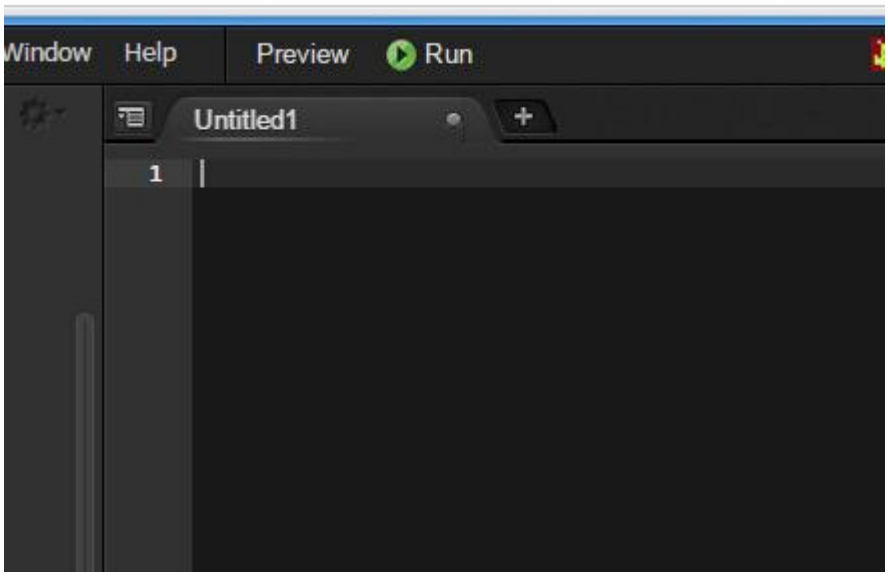
As a simple exercise to become familiar with Cloud9 IDE, creating a simple application to blink one of the 4 user programmable LEDs on the BeagleBone is a good start.

If this is your first time to use Cloud9 IDE, please follow this **link** [../BeagleBone_Green].

Step1: Set the Grove - UART socket as a Grove - GPIO Socket, just follow this **link** [http://www.seeedstudio.com/recipe/362-how-to-use-the-grove-uart-port-as-a-gpio-on-bbg.html].

Step2: Click the "+" in the top-right to create a new file.





Step3: Copy and paste the following code into the new tab

```
import time
import Adafruit_BBIO.GPIO as GPIO

CLK_PIN = "P9_22"
DATA_PIN = "P9_21"
NUMBER_OF_LEDS = 1

class ChainableLED():
    def __init__(self, clk_pin, data_pin, number_of_leds):
        self.__clk_pin = clk_pin
        self.__data_pin = data_pin
        self.__number_of_leds = number_of_leds

        GPIO.setup(self.__clk_pin, GPIO.OUT)
        GPIO.setup(self.__data_pin, GPIO.OUT)

        for i in range(self.__number_of_leds):
            self.setColorRGB(i, 0, 0, 0)

    def clk(self):
        GPIO.output(self.__clk_pin, GPIO.LOW)
        time.sleep(0.00002)
        GPIO.output(self.__clk_pin, GPIO.HIGH)
        time.sleep(0.00002)

```

```
    def sendByte(self, b):
        "Send one bit at a time, starting with the MSB"
        for i in range(8):
            # If MSB is 1, write one and clock it, else write 0 ar
            if (b & 0x80) != 0:
                GPIO.output(self.__data_pin, GPIO.HIGH)
            else:
                GPIO.output(self.__data_pin, GPIO.LOW)
            self.clk()

            # Advance to the next bit to send
            b = b << 1

    def sendColor(self, red, green, blue):
        "Start by sending a byte with the format '1 1 /B7 /B6 /G7
        #prefix = B11000000
        prefix = 0xC0
        if (blue & 0x80) == 0:
            #prefix |= B00100000
            prefix |= 0x20
        if (blue & 0x40) == 0:
            #prefix |= B00010000
            prefix |= 0x10
        if (green & 0x80) == 0:
            #prefix |= B00001000
            prefix |= 0x08
        if (green & 0x40) == 0:
            #prefix |= B00000100
            prefix |= 0x04
        if (red & 0x80) == 0:
            #prefix |= B00000010
            prefix |= 0x02
        if (red & 0x40) == 0:
            #prefix |= B00000001
            prefix |= 0x01
        self.sendByte(prefix)

        # Now must send the 3 colors
        self.sendByte(blue)
        self.sendByte(green)
        self.sendByte(red)

    def setColorRGB(self, led, red, green, blue):
        # Send data frame prefix (32x '0')
        self.sendByte(0x00)
```

```
        self.sendByte(0x00)
        self.sendByte(0x00)
        self.sendByte(0x00)

        # Send color data for each one of the leds
        for i in range(self.__number_of_leds):
            '''
            if i == led:
                _led_state[i*3 + _CL_RED] = red;
                _led_state[i*3 + _CL_GREEN] = green;
                _led_state[i*3 + _CL_BLUE] = blue;
            sendColor(_led_state[i*3 + _CL_RED],
                      _led_state[i*3 + _CL_GREEN],
                      _led_state[i*3 + _CL_BLUE]);
            '''
            self.sendColor(red, green, blue)

        # Terminate data frame (32x "0")
        self.sendByte(0x00)
        self.sendByte(0x00)
        self.sendByte(0x00)
        self.sendByte(0x00)


# Note: Use P9_22(UART2_RXD) and P9_21(UART2_TXD) as GPIO.
# Connect the Grove - Chainable RGB LED to UART Grove port of Beag
if __name__ == "__main__":
    rgb_led = ChainableLED(CLK_PIN, DATA_PIN, NUMBER_OF_LEDS)

    while True:
        # The first parameter: NUMBER_OF_LEDS - 1; Other parameter
        rgb_led.setColorRGB(0, 255, 0, 0)
        time.sleep(2)
        rgb_led.setColorRGB(0, 0, 255, 0)
        time.sleep(2)
        rgb_led.setColorRGB(0, 0, 0, 255)
        time.sleep(2)
        rgb_led.setColorRGB(0, 0, 255, 255)
        time.sleep(2)
        rgb_led.setColorRGB(0, 255, 0, 255)
        time.sleep(2)
        rgb_led.setColorRGB(0, 255, 255, 0)
        time.sleep(2)
        rgb_led.setColorRGB(0, 255, 255, 255)
        time.sleep(2)
```

Step4: Save the file by clicking the disk icon and giving the file a name with the .py extension.

Step5: Connect Grove Chainable RGB LED to Grove UART socket on BBG.

Step6: Run the code. You'll find the RGB LED is changing color every 2 seconds.

Resources

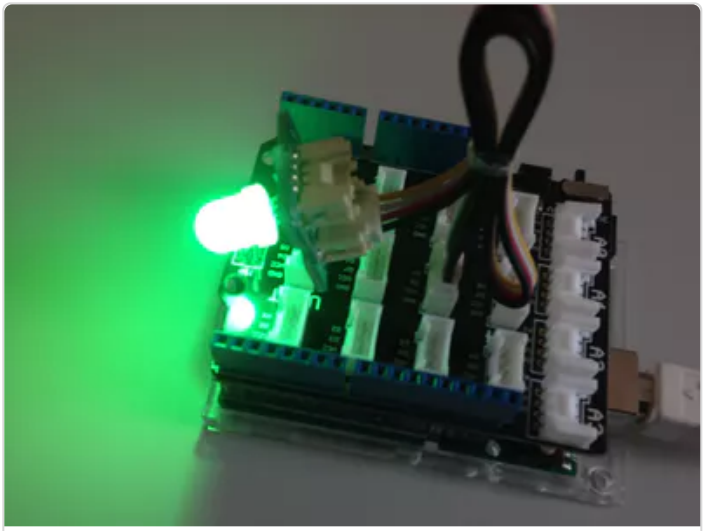
- **[Library]**Chainable RGB LED Library for the P9813 [https://github.com/pjpmarques/ChainableLED]
- **[Library]**Github repository for Chainable RGB LED Library (new) [https://github.com/Seeed-Studio/Grove_Chainable_RGB_LED]
- **[Library]** CodeCraft Code [https://github.com/SeeedDocument/Grove-Chainable_RGB_LED/raw/master/res/Chainable%20RGB%20LED.zip]
- **[Eagle]**Chainable RGB LED eagle file V1 [https://github.com/SeeedDocument/Grove-Chainable_RGB_LED/raw/master/res/Chainable_RGB_LED_eagle_file%20V1.zip]
- **[Eagle]**Chainable RGB LED eagle file V2 [https://github.com/SeeedDocument/Grove-Chainable_RGB_LED/raw/master/res/Grove%20-%20Chainable%20RGB%20LED%20v2.0.zip]
- **[PDF]**Chainable RGB LED SCH file V1 [https://github.com/SeeedDocument/Grove-Chainable_RGB_LED/raw/master/res/CRGBled%20v1_SCH.pdf]
- **[PDF]**Chainable RGB LED SCH file V2 [https://github.com/SeeedDocument/Grove-Chainable_RGB_LED/raw/master/res/Grove%20-%20Chainable%20RGB%20LED%20v2.0%20SCH.pdf]
- **[PDF]**Chainable RGB LED PCB file V1 [https://github.com/SeeedDocument/Grove-

Chainable_RGB_LED/raw/master/res/CRGBled%20V1_PCB.pdf]

- **[PDF]**Chainable RGB LED PCB file V2 [https://github.com/SeeedDocument/Grove-Chainable_RGB_LED/raw/master/res/Grove%20-%20Chainable%20RGB%20LED%20v2.0%20PCB.pdf]
- **[Datasheet]**P9813 Datasheet [https://raw.githubusercontent.com/SeeedDocument/Grove-Chainable_RGB_LED/master/res/P9813_datasheet.pdf]

Projects

Grove - Introduction to Chainable LED: This project shows how to connect a chainable LED to Grove.

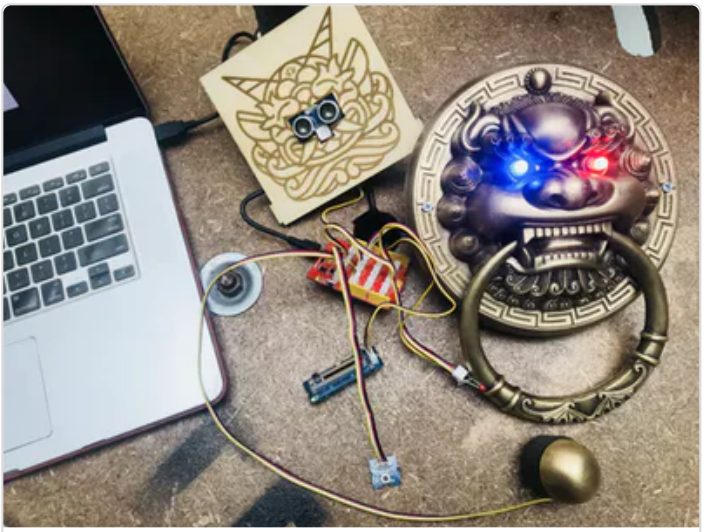


(https://www.hackster.io/ingo-lohs/grove-introduction-to-chainable-led-d668b7)

DIY a device for explaining RGB color model

(https://www.hackster.io/kevin-lee2/diy-a-device-for-explaining-rgb-color-model-496cbc)

Security Access Using Seeeduino Lotus When you knock on the door or close to the door, the door will open automatically.



(https://www.hackster.io/limanchen/security-access-using-seeeduino-lotus-7eb90f)

Tech Support

Please submit any technical issue into our forum [http://forum.seeedstudio.com/] or drop mail to techsupport@seeed.cc [mailto:techsupport@seeed.cc].