Licenciatura em Engenharia Informática

TECNOLOGIA DOS COMPUTADORES Year 2018/2019

Laboratorial assignment # 5

Mood Lamp

Components list:

- Arduino UNO
- 1 USB cable
- 1 white breadboard
- 1 RGB LED (with 4 pins: generates red, green or blue colours)
- 3 220 Ohm resistors
- Software: Arduino IDE

A colour can be generated from the combination of other base colours. This is the basic principle used in monitors, tablets and other electronic equipments that display images to the user. In this work, we will exploit and demonstrate this property using an RGB (red, green and blue) LED, by mixing the 3 colours to produce any colour we wish. In the end we will be able to develop a mood lamp similar to those we can find in home decoration/utility stores.

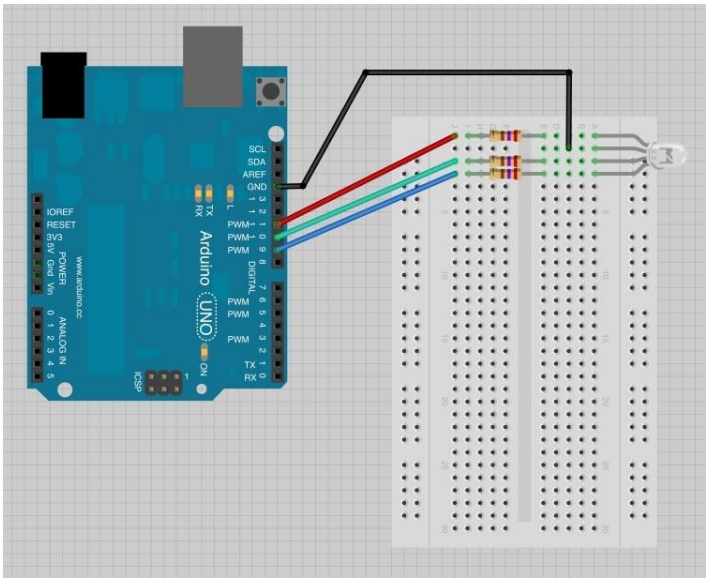

Figure 1 – An RGB LED has 3 pins for generating red, green or blue lights, or the combined effect of them. The common pin 2 (the longest pin) should be connected to ground (GND). (**Note:** the break in the middle of the breadboard indicates that there is an **electrical interruption** between lines in the upper and lower parts of the board, and also in the two top and bottom lines; please have this in mind when mounting your circuit.)

1. Mood Lamp Effect

Observe the circuit in figure 1. Implement it and write a program for your UNO system that is able to control the lights in an RGB LED using the `digitalWrite()` function. The operating mode should be as follows:

- During 4 seconds each base colour (red, green and blue) should blink (½ second cycle; duty cycle 50%).
- Then, colours should start lightening for periods of 2 seconds in groups of two. Make sure you test at least all the possible combinations described in table 1. Finally, you should lighten all the 3 colours in simultaneous. What's the obtained colour? Why?

Note: the light generated by the LED can be quite intensive. Please use a small paper tape around the LED in order to decrease the light's intensity.

Upload and test your program.

Table 1 shows the different colours that you achieve when turning on and off certain combinations of LEDs (for example, green and blue produce cyan).

Red	Green	Blue	Colour
255	0	0	Red
0	255	0	Green
0	0	255	Blue
255	255	0	Yellow
0	255	255	Cyan
255	0	255	Magenta
255	255	255	White

Table 1 – How to combine colours.

2. Rainbow Colours Mode

You can now change your program so that the LEDs may cycle through the all rainbow colours, turning each colour on during 0.5 seconds. Once a rainbow cycle is completed, LEDs should start blinking with random colours (as depicted in the example of figure 2) for periods of 2 seconds each.

Upload and test you program.

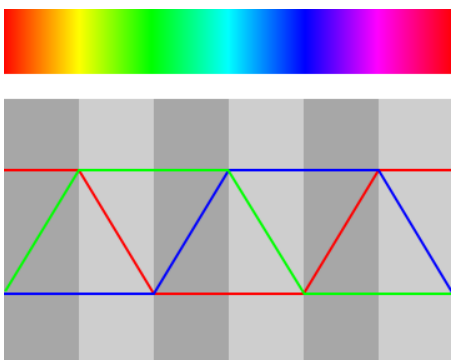

Figure 2 – RGB combinations for generating the 7 different rainbow colours in table 1.

3. Mood Lamp Effect

Now, instead of what we did in the previous work using the `digitalWrite()` function, this time we will output an analog value between 0 and 255 to control the LED's lightening intensity by using the `analogWrite()` command. Please see the code example in figure 3.

```
int redVal, greenVal, blueVal;
int redPin=9;
int greenPin=10;
int bluePin=11;

void setup(){
  pinMode(redPin, OUTPUT);
  pinMode(greenPin, OUTPUT);
  pinMode(bluePin, OUTPUT);
  randomSeed(analoRead(0));
}

void loop(){
  redVal=random(256);
  greenVal=random(256);
  blueVal=random(256);

  analogWrite(redPin, redVal);
  analogWrite(greenPin, greenVal);
  analogWrite(bluePin, blueVal);

  delay(300);
}
```

Figure 3 – Example code for generating random colours using the analog write outputs (output values may range from 0 to 255).