1 Arduino Intermediate Class

In this class each week will go over a specific circuit from the vilros book, going over some electronics and programming before building and testing the circuits. Students are welcome to try other circuits from the book if they have already completed this exercises, and we will try and provide tips as time allows.

1.1 This weeks Circuit: Led strips

1.2 how do they work?

1.3 Libraries for uisng led Strips

1.4 Power considerations

1.5 Building the circuit

1.6 Running the code

2 LED strips

LED strips are extremely popular in hobby electronics. People combine them to make displays, put them on costumes and other projects. In this class we will show you how to get started with as short LED strip.

3 how do they work?

Different LED strips have different specific ways of working, but they all have one thing in common in that they uses some sort of serial protocol. What's a serial protocol? It's basically a way of taking multiple pieces of information (or bits) and sending them over a wire (or possibly a few wires, or a fiber optic cable or radio channel) one piece as a time. The ones we are going to use are called WS2812, or by the Adafruit brand name neopixel.

4 Ok - but how does this one work?

If you have a new piece of electronics and what to get specific information on that one, the best approach is to look for the datasheet on google. Let's take a quick look at that datasheet.

4.1 WS2812 Datasheet

5 Power considerations

So as we say in the datasheet, each led draws 20mA. But that's each color so if they are all on that's 60mA. The maximum current the USB can support is 500mA, but that also has to power the arduino. Generally when I think about a circuit I want at least 20% headroom, with 50% being very safe. Ignoring the the Arduino power consumption how many LEDs can you safely power and use less than 250mA? If you want to make a circuit with a lot of LEDs, you should consider getting a dedicated power supply for the LEDs. If addition to the lenght of wire is long, you have to consider the fact that there will be some voltage drop across it, and it will affect the color of the LEDs. You can connect the power on both ends of an LED strip adn that will half the voltage drop. Adafruit had a good guide here.

6 Installing the library

Before we build the circuit, lets install the library that lets use the LED strips. There are two popular libraries for using LEDs. One is the Adafruit neopixel library, and the other is the FastLed library. The Fastled library is more capable than the Adafruit library, and supports more type of leds and boards. For this class though I'm going to use the Adafruit library. To install either library you can use the "manage libraries" function under sketch->include library to add it to your system.

7 NeoPixel Library

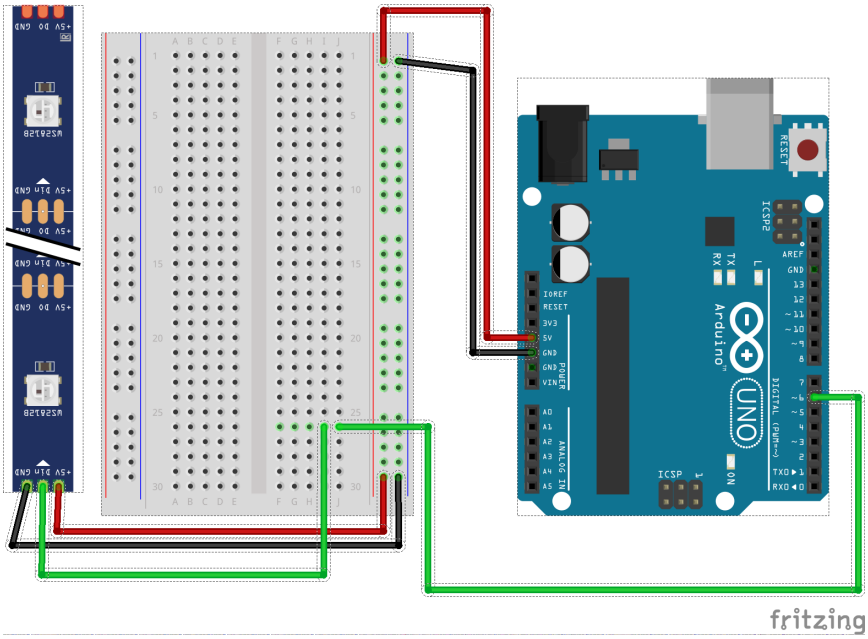
To use the neopixel library you need to create the neopixel object first, telling it, which pin is connected to the data, how many LEDS, and some info about the type of LED Strip you are using.

```
//  A few example commands
// Create a neopixel object
Adafruit_NeoPixel pixels = \
   Adafruit_NeoPixel(NUMPIXELS, PIN, NEO_GRB + NEO_KHZ800);
// This initializes the NeoPixel library.
pixels.begin();
// Set the zeroth (first) led to a bright green color.
pixels.setPixelColor(0, pixels.Color(0,150,0));
```

```
// This sends the updated pixel color to the hardware.
pixels.show();
```

8 Building the circuit

Building the led strips is really pretty simple in this case. We simple connect the red and black to 5V and Ground and connect the middle one to our pin, in this case pin 6. Note the LED solder joints are not super strong you might want to put those in last.



9 The Code

We are going to use the "simple" example from the Adafruit Neopixel library. Select File->Examples->Adafruit NeoPixel->simple to select it. Change the number of pixels to match our example (3)

```
// NeoPixel Ring simple sketch (c) 2013 Shae Erisson
// released under the GPLv3 license to match the rest
// of the AdaFruit NeoPixel library

#include <Adafruit_NeoPixel.h>
```

```
#ifdef __AVR__
  #include <avr/power.h>
#endif

// Which pin on the Arduino is connected to the NeoPixels?
// On a Trinket or Gemma we suggest changing this to 1
#define PIN            6

// How many NeoPixels are attached to the Arduino?
#define NUMPIXELS      16

// When we setup the NeoPixel library, we tell it how many
// pixels, and which pin to use to send signals.
// Note that for older NeoPixel strips you might need to
// change the third parameter--see the strandtest
// example for more information on possible values.
Adafruit_NeoPixel pixels = Adafruit_NeoPixel(NUMPIXELS, PIN, NEO_GRB + NEO_KHZ800);

int delayval = 500; // delay for half a second

void setup() {
  // This is for Trinket 5V 16MHz, you can remove these
  //three lines if you are not using a Trinket
#if defined (__AVR_ATtiny85__)
  if (F_CPU == 16000000) clock_prescale_set(clock_div_1);
#endif
  // End of trinket special code

  pixels.begin(); // This initializes the NeoPixel library.
}

void loop() {

  // For a set of NeoPixels the first NeoPixel is 0,
  // second is 1, all the way up to the count of pixels minus one.

  for(int i=0;i<NUMPIXELS;i++){

    // pixels.Color takes RGB values, from 0,0,0 up to 255,255,255
    pixels.setPixelColor(i, pixels.Color(0,150,0)); // Moderately bright green color.
```

```
    pixels.show(); // This sends the updated pixel color to the hardware.

    delay(delayval); // Delay for a period of time (in milliseconds).

  }
}
```

10 Excercise - Changing the routines

1. Can you change the light from green to red or blue?
2. How about white? Can you make it dimmer?
3. Can you make one red, one green and one blue?
4. What happens if we make NUMPIXELS > 3?