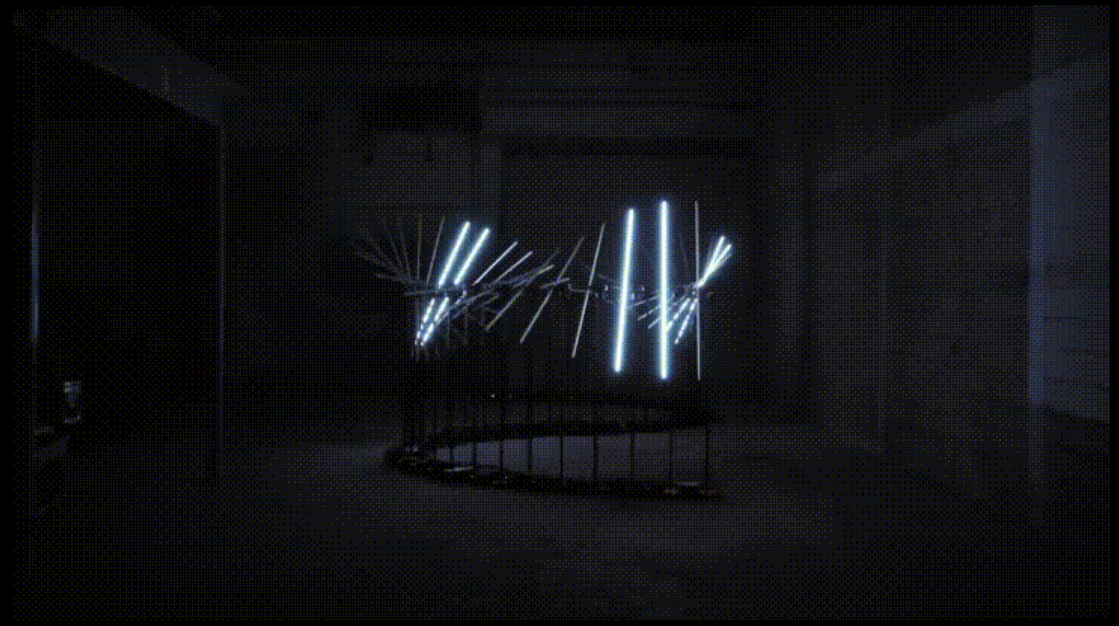
INTERACTION DESIGN

NEOPIXELS

Physical Computing HS21



Collectif Scale “Flux”

Workshop Madmapper Geneva 2014

“Tales of the Jedi” Lightsaber

LED

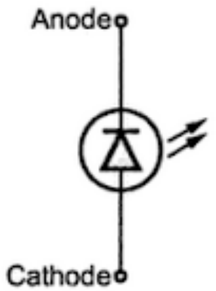


Fig. 1 Symbol of LED

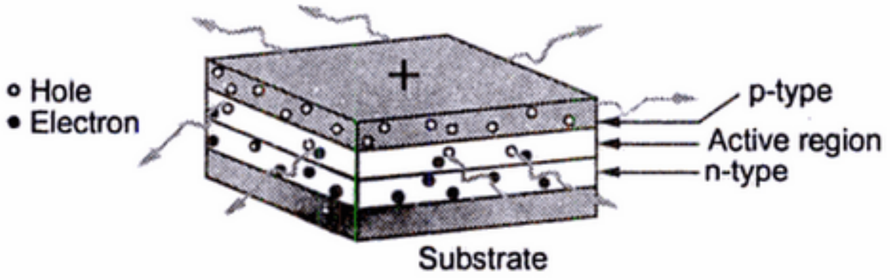
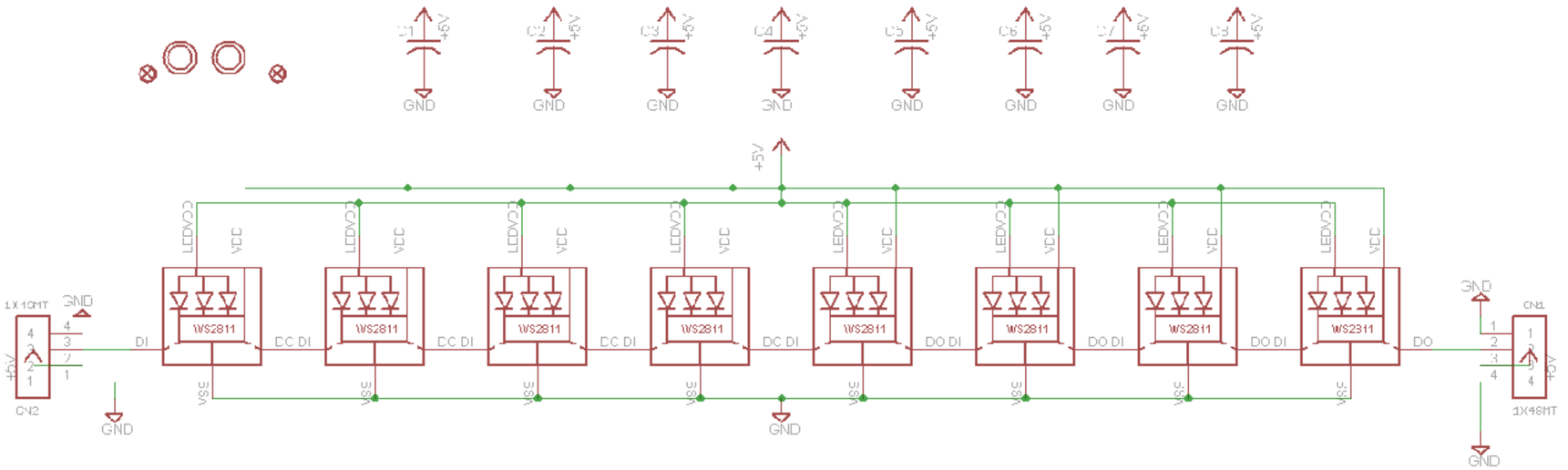


Fig. 3 LED construction

LED (Light Emitting Diode) emits light as a result of electric luminescence. The light is not produced by heating a metal filament, instead the diode, emits light when flowing through two specially coated silicon semiconductors.

Image source

NEOPIXELS



- Individually addressable RGB color pixels and strips based on the **WS2811, WS2812, WS2815, SK9822 and SK6812** integrated light source packages
- The term has become the standard name for addressable single wire controlled LEDs regardless of manufacturer
- NeoPixels cannot be lit with a simple circuit, they require a microcontroller to send the control signals

Image source

TYPES

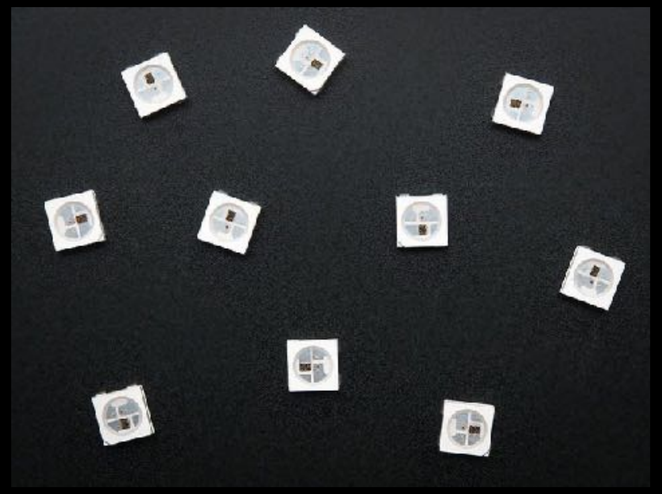
Through-Hole

NEO_RGB

TYPES

Through-Hole

NEO_RGB



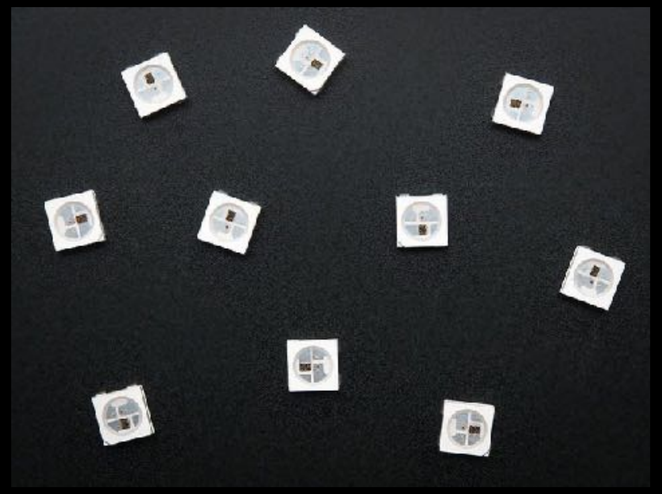
Surface Mount

NEO_GRB

TYPES

Through-Hole

NEO_RGB



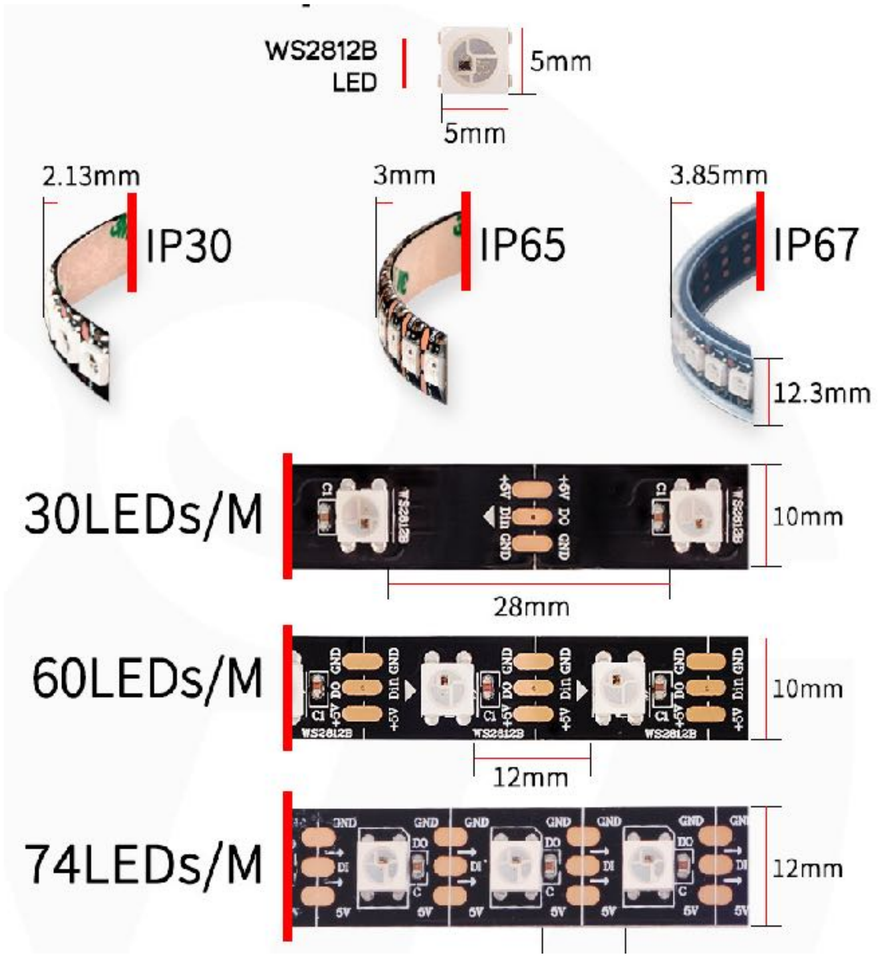
Surface Mount

NEO_GRB

Strip

NEO_GRB

TYPES



There’s principally no inherent limit in the maximum length of a chain but you’ll need to add more microcontrollers to supply the memory and inject power to maintain the same brightness.

Image source

POWER REQUIREMENTS

A simple formula to calculate power consumption and current:

I[A] = 0.036A(current of one GRB LED) *** number of LEDs * meters**
I[A] = 0.048A(current of one RGB LED) *** number of LEDs * meters**

LED consumption can be easily calculated with this formula:

P[W] = U[V] (5V in case we have 5V LED Strip) *** I[A]**

POWER INJECTION

After a certain length the pixels are getting less bright. In order to avoid it, there is a method called **power injection,** where a new power supply is added after each ≈**4A** of drawn current to output 100% brightness.

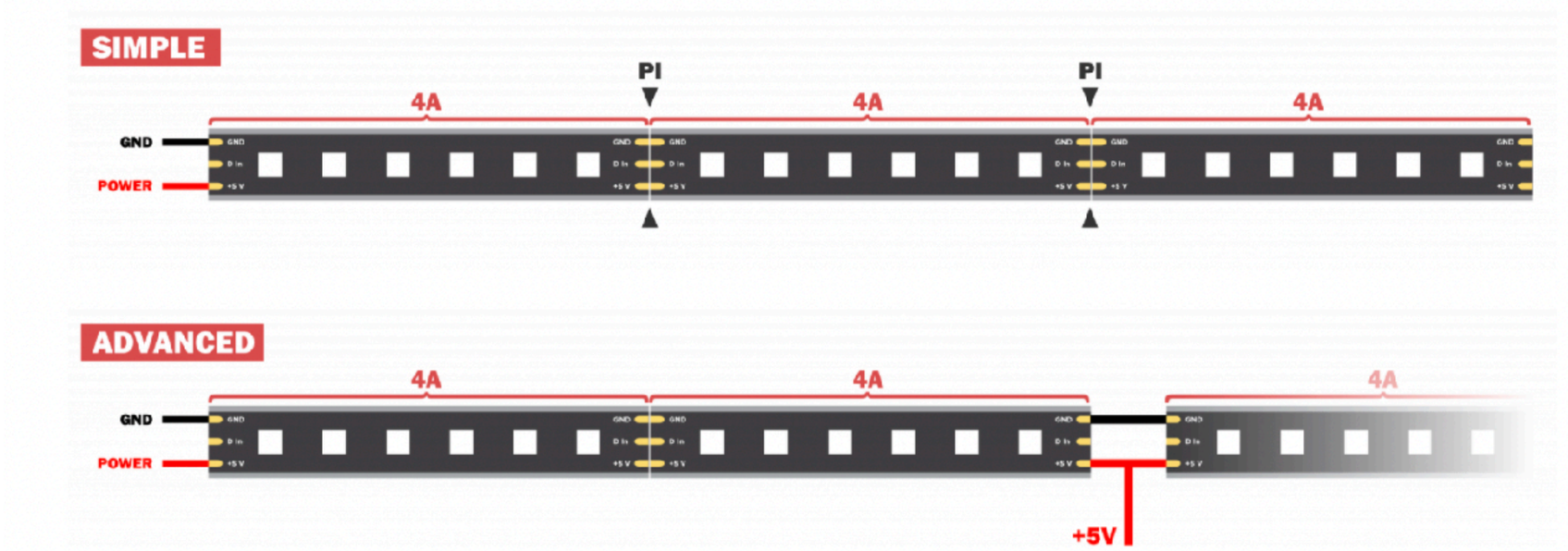
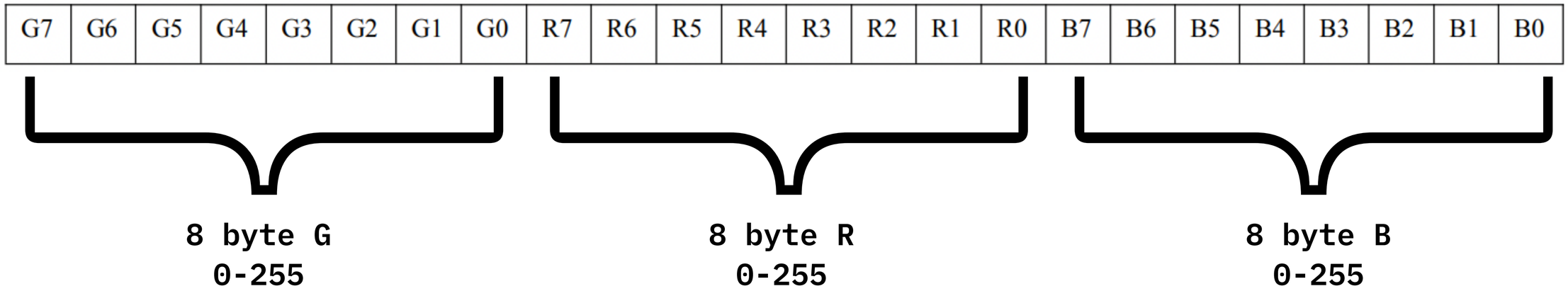


Image source

COLOR DATA

When Neopixels receive data from microcontroller, each pixel collects **24bit** of data that is composed of **3 bytes** of color, with the most-significant bit first.



256^3 = 16777216 colors per pixel

MEMORY REQUIREMENTS

AVR-BASED ARDUINO

Flash (program space) : 32k bytes (of which 0.5k is used for the bootloader)
Where the Arduino sketch is stored.

SRAM (static random access memory) : 2k bytes
Where the sketch creates and manipulates variables during runtime.

EEPROM 1k byte
Used to store long-term information

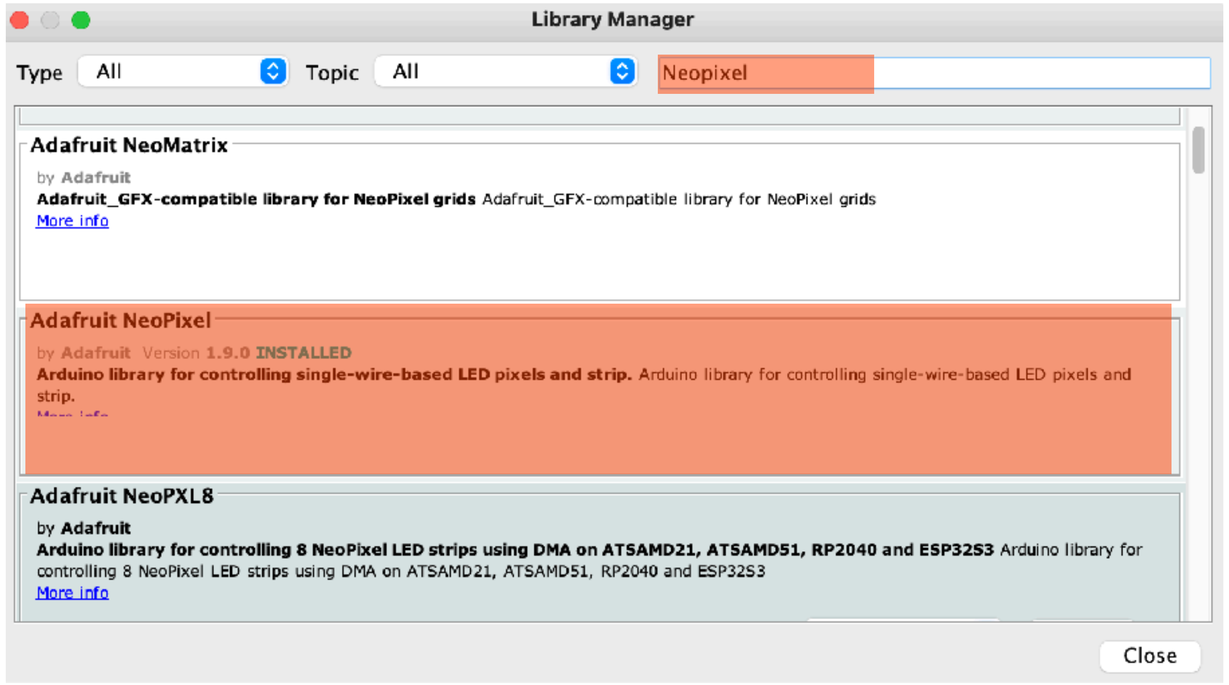
Each NeoPixel requires about 3 bytes of RAM. This means that you will need to add another Arduino after ≈600 LEDs (≈10m)

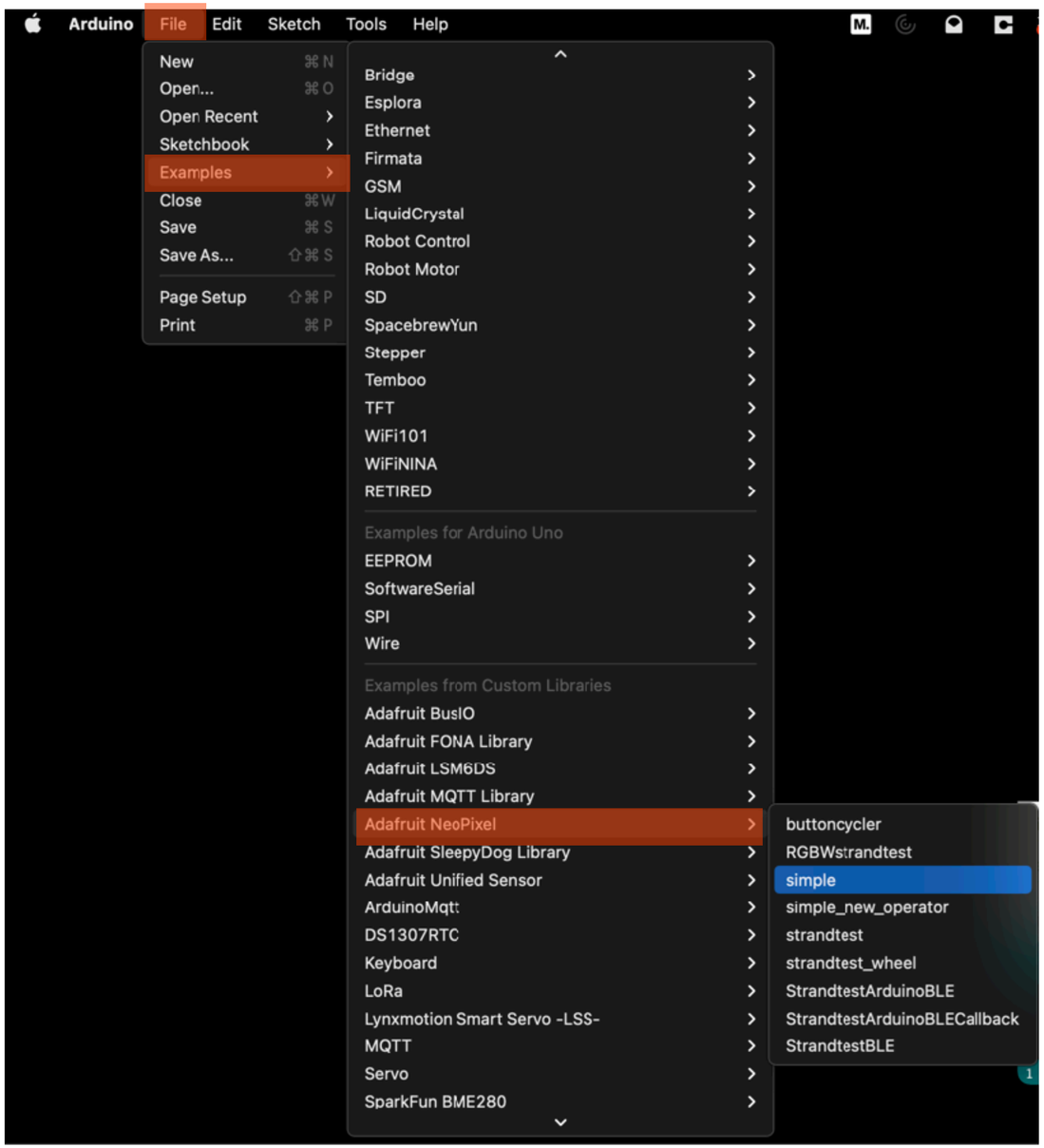
EXERCISE 1 (10min)

Calculate the power consumption and current needed to power up:

15m WS2812 strip with 60 LEDs/1m.
5m WS2812 strip with 30 LEDs/1m.

WIRING


Library Manager
Type All Topic All Neopixel
Adafruit NeoMatrix
by Adafruit
Adafruit_GFX-compatible library for NeoPixel grids Adafruit_GFX-compatible library for NeoPixel grids
More info
Adafruit NeoPixel
by Adafruit Version 1.9.0 INSTALLED
Arduino library for controlling single-wire-based LED pixels and strip. Arduino library for controlling single-wire-based LED pixels and strip.
Adafruit NeoPXL8
by Adafruit
Arduino library for controlling 8 NeoPixel LED strips using DMA on ATSAMD21, ATSAMD51, RP2040 and ESP32S3 Arduino library for controlling 8 NeoPixel LED strips using DMA on ATSAMD21, ATSAMD51, RP2040 and ESP32S3
More info
Close


Arduino File Edit Sketch Tools Help
New ⌘N
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Sketchbook
Examples
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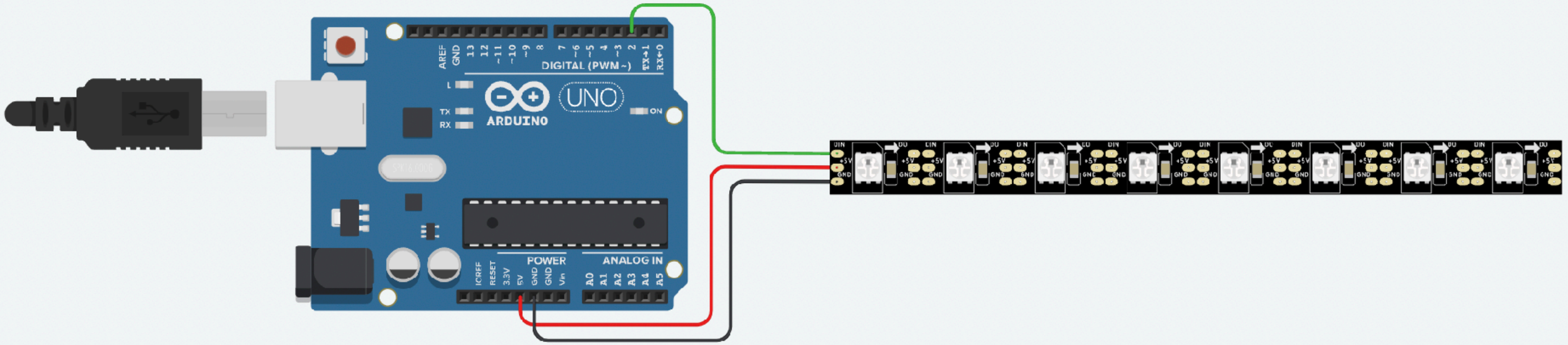
Firmata
GSM
LiquidCrystal
Robot Control
Robot Motor
SD
SpacebrewYun
Stepper
Temboo
TFT
WiFi101
WiFiNINA
RETIRED
Examples for Arduino Uno
EEPROM
SoftwareSerial
SPI
Wire
Examples from Custom Libraries
Adafruit BusIO
Adafruit FONA Library
Adafruit LSM6DS
Adafruit MQTT Library
Adafruit NeoPixel
Adafruit SleepyDog Library
Adafruit Unified Sensor
ArduinoMqtt
DS1307RTC
Keyboard
LoRa
Lynxmotion Smart Servo -LSS-
MQTT
Servo
SparkFun BME280
buttoncycler
RGBWstrandtest
simple
simple_new_operator
strandtest
strandtest_wheel
StrandtestArduinoBLE
StrandtestArduinoBLECallback
StrandtestBLE

WIRING (10 Min)



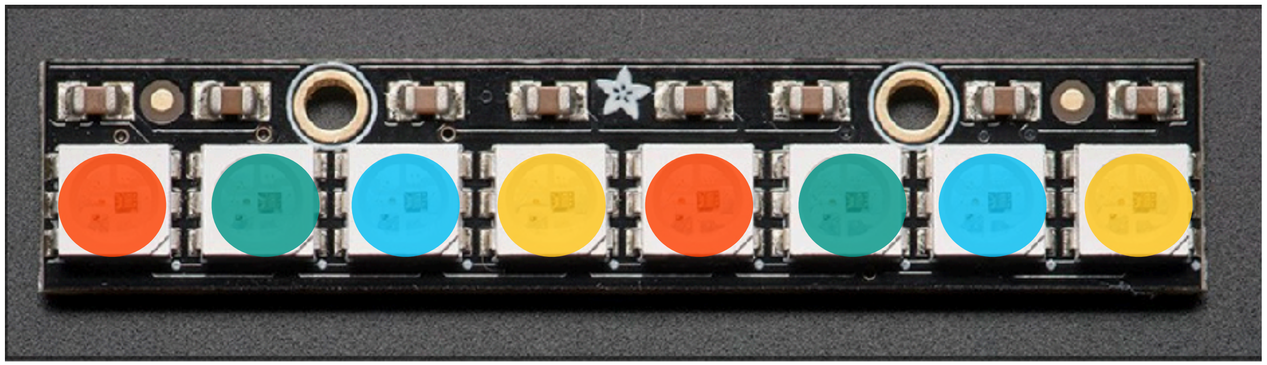
WIRING

- **Do not connect to a live circuit!**
- Use a resistor between 300 and 500Ω (at 5V)
- Add a capacitor before connecting to a stronger power source
- Minimise the distance between the first pixel and Arduino for a better signal
- When using external power source apply power to the pixels before applying power to the microcontroller.

EXERCISE 2 (30min)

Write a code that will make every fourth LED blink in the same color every 500ms:

LED 0 and 4 : RED
LED 1 and 5 : GREEN
LED 2 and 6 : BLUE
LED 3 and 7 : YELLOW



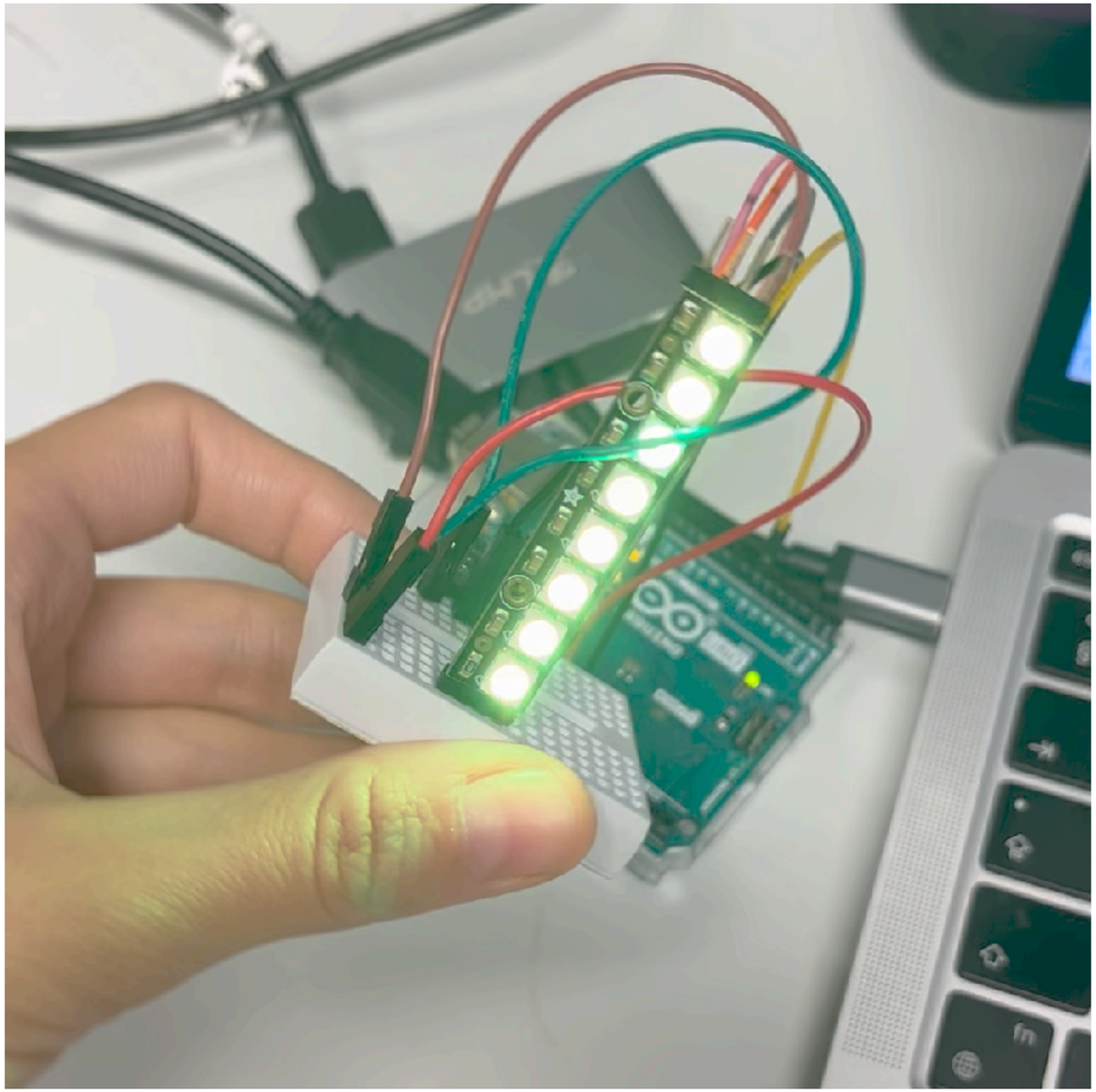
TIP: USE MODULO FUNCTION

EXERCISE 3 (30min)

Connect NeoPixel and a distance/ accelerometer sensor to control the LEDs.

For TOF: the closer an object is to the sensor, the more pixels turn on.

For IMU: choose one axis to change the colours.



Homework

Beginner: Using a button, make the LEDs turn on and off. Using a potentiometer change the colours.

Advanced: Change the behaviour of the buttons by making it turning the LEDs one by one. After 8 clicks start over again.