

Making with Meaning exercise guide

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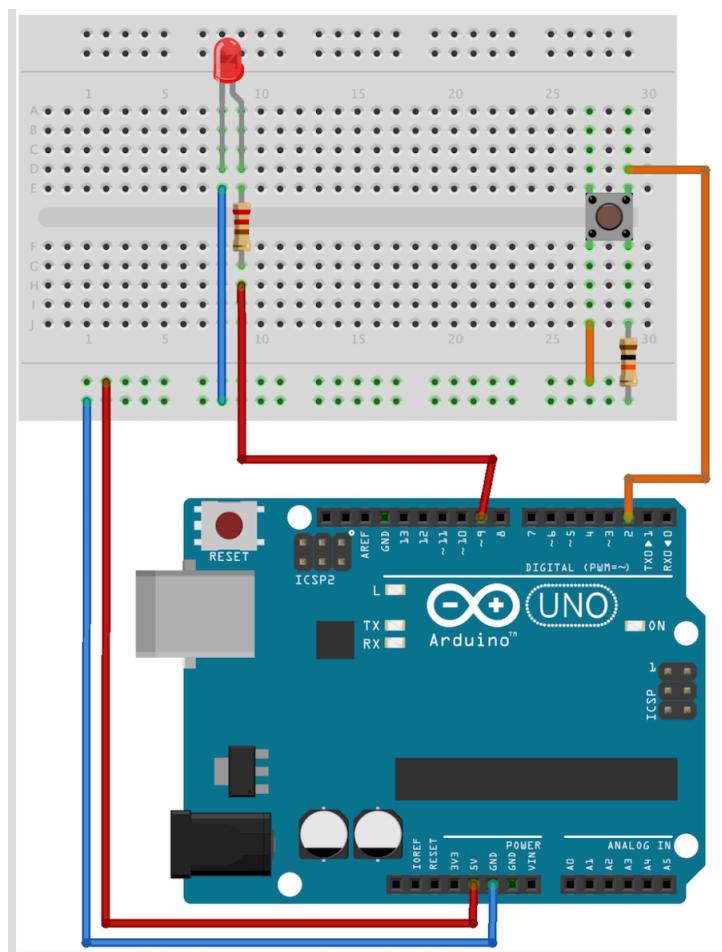
Making with meaning exercise 1: turning LED on and off

Introduction

In this exercise we will be showing you how to create a on off switch for the Arduino.
For this exercise you will need:

- Arduino
- Bread board
- 6 leads
- 2 1K Ω Resistor
- LED
- Switch

Plug in the Arduino and breadboard so that it looks like this:



Plug in the Arduino into the power and it you will be able to demonstrate the voltage.

Source code:

```
// constants won't change. They're used here to set pin numbers:  
const int buttonPin = 2;    // the number of the pushbutton pin  
const int ledPin = 9;      // the number of the LED pin  
  
// variables will change:  
int buttonState = 0;        // variable for reading the pushbutton status  
  
void setup() {  
    // initialize the LED pin as an output:  
    pinMode(ledPin, OUTPUT);  
    // initialize the pushbutton pin as an input:  
    pinMode(buttonPin, INPUT);  
}  
  
void loop() {  
    // read the state of the pushbutton value:  
    buttonState = digitalRead(buttonPin);  
  
    // check if the pushbutton is pressed. If it is, the buttonState is HIGH:  
    if (buttonState == HIGH) {  
        // turn LED on:  
        digitalWrite(ledPin, HIGH);  
    } else {  
        // turn LED off:  
        digitalWrite(ledPin, LOW);  
    }  
}
```

Making with Meaning exercise 2: Raspberry pi Time-lapse Camera

Introduction

In this exercise we will be showing you how to build your own time lapse camera on the raspberry pi. This camera will take a photo every 30 seconds and will save the image to the raspberry pi, a pause button and status lights.

For this project you will need:

- Raspberry pi and power supply
- SD Card (16gb or larger)
- Raspberry pi camera unit
- 3 1K Ω Resister
- 3 LED (We are using red, green and blue).
- A microswitch
- 6 cables
- Breadboard
- A computer running either:
 - Windows 7 or newer with putty (free download)
 - Linux running Debian, Ubuntu, Red Hat, Fedora or SUSE
 - macOS 10 or newer
 - Running Microsoft Visual Studio Code (free download)

What does each part do?

Raspberry Pi

The raspberry pi is a £30 computer that is designed to teach people how to program. The raspberry pi has a 1.4ghz 64 bit processor, 1gb of RAM, 40 pin GPIO header and a HDMI port. [1] The parts that go into a raspberry pi are the same that you would find in a 2015 smartphone, which allows them to be cheap. (For example most smart phones today have more than 2GB of RAM. It uses a SD card as its storage, making it very easy to program.



[5]

Our models will be running the Raspbian operating system which is based off Linux, the same operating system that android uses. We wont be using a monitor for these although we will be contacting to them by the terminal (or putty for windows).

Raspberry pi username – pi

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Raspberry pi Camera

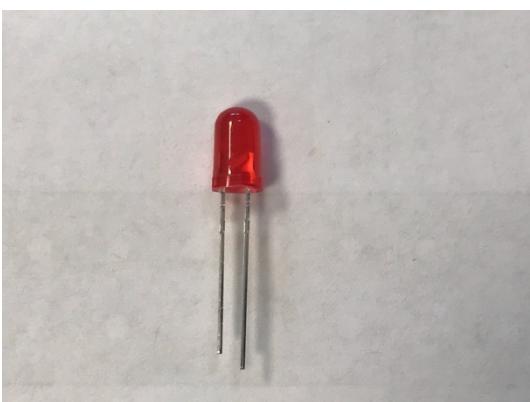
The raspberry pi camera module is a 5mp camera that can also film in 1080p (HD quality). It contains a 15cm ribbon cable that's connects to its own port on the raspberry pi [3]

Resistors

A resistor limits the flow of current through a circuit. Think of the circuit as a pipe, we need to bring down the voltage (pressure) as otherwise it will damage the LED.

For our circuit we will be using a fixed resistor at $1\text{K }\Omega$ (omega). You can say which resistor which by their colours. For example $1\text{K }\Omega$ resistors have brown, 2 black followed by 2 red stripes on them as can be seen in the picture.

A diagram showing how to read the voltage of a resistor is available in the appendix



LED

An LED (or Light Emitting Diode) is a semiconductor light source. It is a very efficient light source and is also used in light bulbs, TV remotes, Screens, heart rate sensors and in hundreds of other places. LED can only work if plugged in the right way (longest leg is positive), but placing it the wrong way will not damage them. LED come in several colours and we will be using green, red and blue for our LED.

The green LED will be used to show when the raspberry pi is running our program, red will show when it's not paused and blue will come on 3 seconds before a picture is taken.

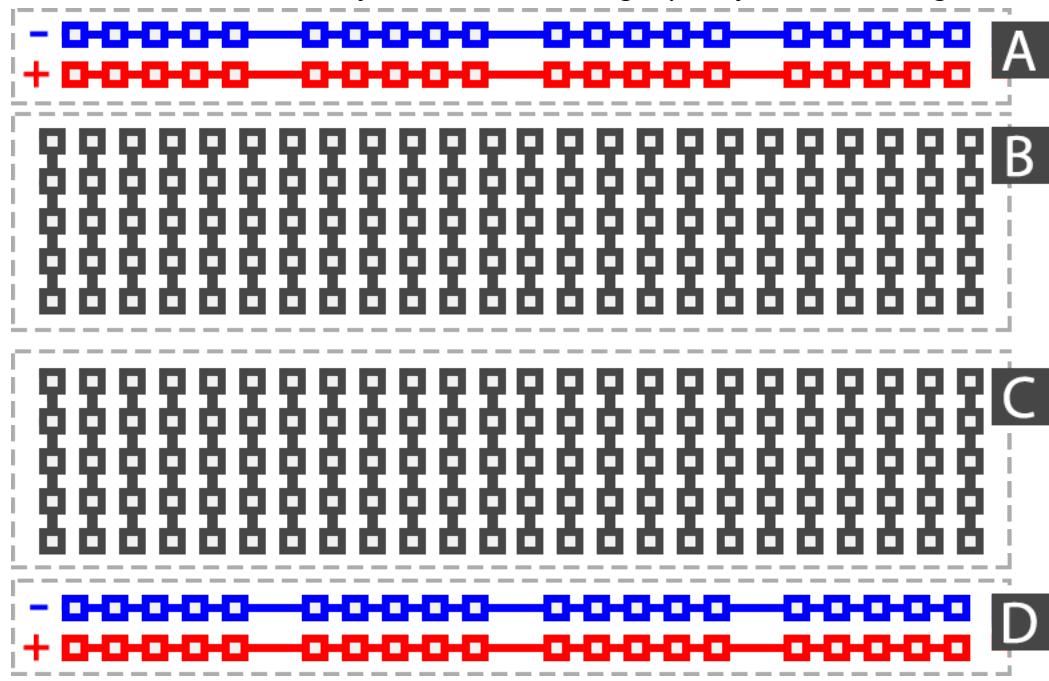
Micro switch

A micro switch is a switch that we will be using to control whether the camera will be paused or not. A micro switch works by allowing or breaking a circuit that the raspberry pi can detect and then tell us that whether its pressed or not. We will be using a while loop in our program that will hold the program until the switch is pressed twice.



Bread Board

A bread board is a board that we use to wire up our components without having to solder to it. This means that it is easy for us to build things quickly without having to solder.



On both sides, there are two rails (for positive and negative) that run parallel. There are then 2 larger rails that run the power horizontally. Below you can see how the bread board cables run. [4]

Computer

The computer we will be using will be used to connect to the raspberry pi easily. This makes it easier to set up the raspberry pi. This is because the raspberry pi isn't that powerful and many software tools require more power.

We won't need to plug anything into the raspberry pi as we are going to connect to the raspberry pi through our own network.

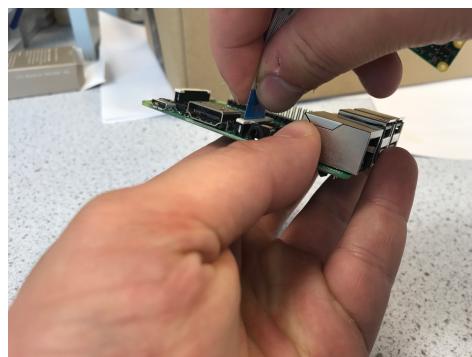
We can use a piece of software SSH to access the raspberry pi. This is built into macOS and Linux but for Windows we will need to use putty. It's accessible by the command line.

How to build the time laps camera

1. First of all plug in the camera strip into the raspberry pi. It plugs the white port on the Center of the raspberry pi

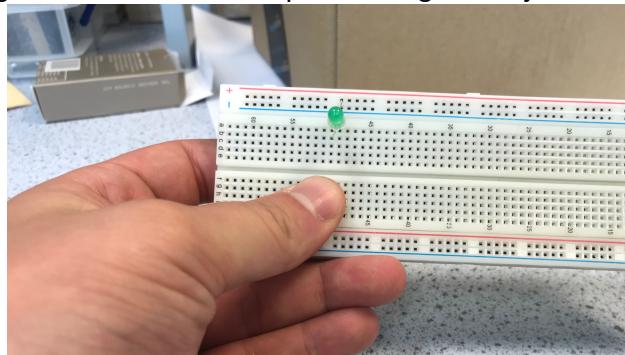


Insert as such:



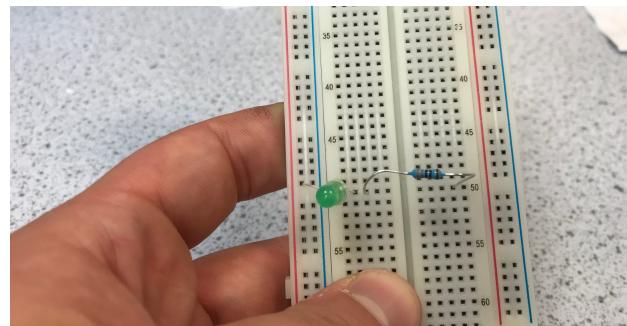
Push it in until the connectors are all in and secure. The raspberry pi will now start taking time lapse when turned on.

2. Insert LED - insert the positive leg into the "A" column of the rail and insert the negative leg into the "+" or "-" column of the breadboard. It does not matter whether the negative leg goes horizontal to the positive leg as they will share a common

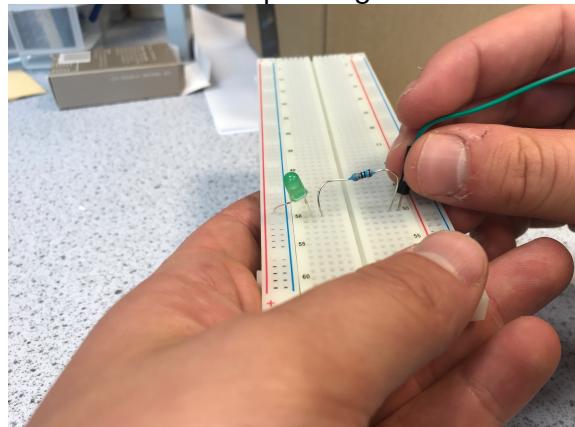


negative cable back to the pi.

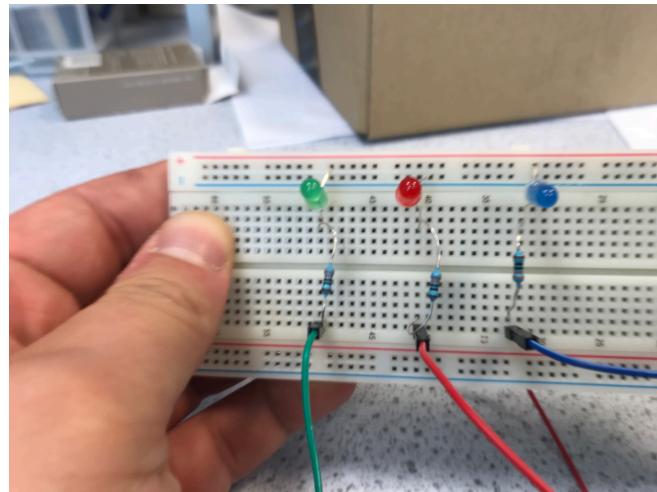
3. Insert the resistor horizontal to the LED on the breadboard into the “B” and “I” column. It does not matter what way that it faces unlike the LED.



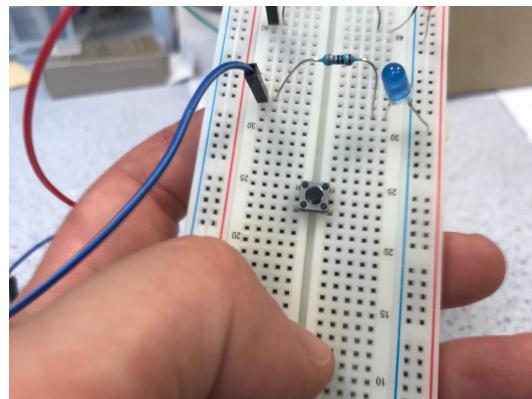
4. In the “J” column insert the corresponding colour cable for the LED.



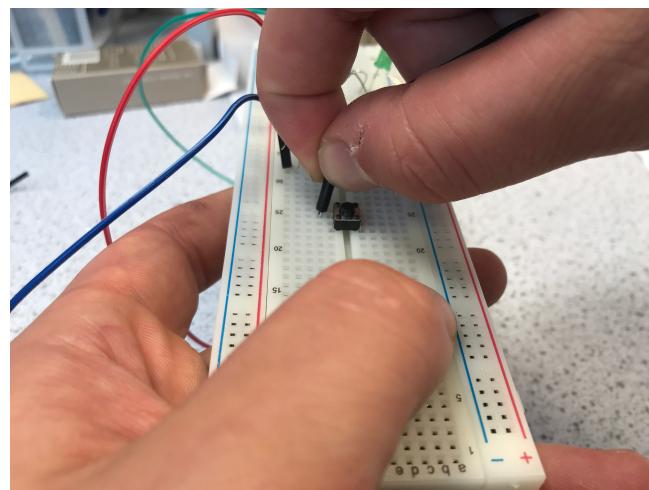
5. Repeate Stage 2-4 for the rest of the LED until you have something that looks like this:



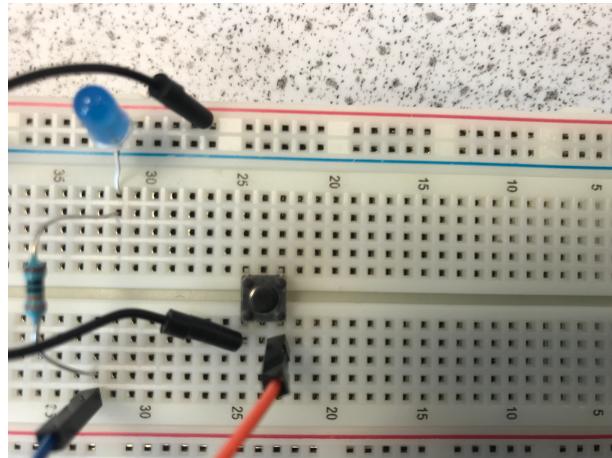
6. Insert the switch so that the 4 legs fit into the bread board between column “e” and “f” where the bent legs face the end of the board. It should look like this:



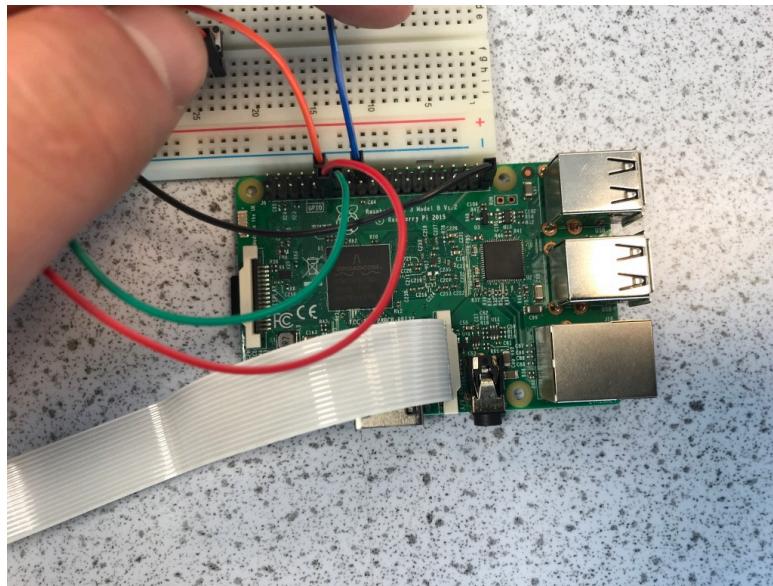
7. Plug in a black cable into port “g” horizontal to one of the legs. Plug the other end into the ground leg.



8. On column “G” plug the cable horizontally to the other leg of the switch. You should end up with the switch laid out such as:



9. Place a black cable from the “+” or “-.” This will then connect to ground.
10. We now need to wire these cables into the raspberry pi. We should end up wire them up like this:



We want ground (black cable) to go to pin 39, switch to pin 12, green cable to pin 13, red to pin 11 and blue to pin 18. A diagram of the pin layouts is available in the appendix of this document.

Plug the Raspberry Pi in and it should work

Appendix:

Resistor colour code:

Resistor Color Code			
1st Band (F)	2nd Band (S)	Color	Value
Black		Black	0
Brown		Brown	1
Red		Red	2
Orange		Orange	3
Yellow		Yellow	4
Green		Green	5
Blue		Blue	6
Violet		Violet	7
Gray		Gray	8
White		White	9
Multiplier (M)		Band 3 Divide by	
.22 ohm	F	Gold	10
.27 ohm	S	Silver	100
.33 ohm	M		
.39 ohm			
.47 ohm			
.56 ohm			
.68 ohm			
.82 ohm			
4- Band Code			
1.0 ohm	10 ohm	100 ohm	1.0 k
1.1 ohm	11 ohm	110 ohm	1.1 k
1.2 ohm	12 ohm	120 ohm	1.2 k
1.3 ohm	13 ohm	130 ohm	1.3 k
1.5 ohm	15 ohm	150 ohm	1.5 k
1.6 ohm	16 ohm	160 ohm	1.6 k
1.8 ohm	18 ohm	180 ohm	1.8 k
2.0 ohm	20 ohm	200 ohm	2.0 k
2.2 ohm	22 ohm	220 ohm	2.2 k
2.4 ohm	24 ohm	240 ohm	2.4 k
2.7 ohm	27 ohm	270 ohm	2.7 k
3.0 ohm	30 ohm	300 ohm	3.0 k
3.3 ohm	33 ohm	330 ohm	3.3 k
3.6 ohm	36 ohm	360 ohm	3.6 k
3.9 ohm	39 ohm	390 ohm	3.9 k
4.3 ohm	43 ohm	430 ohm	4.3 k
4.7 ohm	47 ohm	470 ohm	4.7 k
5.1 ohm	51 ohm	510 ohm	5.1 k

[5]

Raspberry Pi GPIO header:

Raspberry Pi 3 GPIO Header

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1 , I ² C)		DC Power 5v	04
05	GPIO03 (SCL1 , I ² C)		Ground	06
07	GPIO04 (GPIO_GCLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)		Ground	20
21	GPIO09 (SPI_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)		(SPI_CE0_N) GPIO08	24
25	Ground		(SPI_CE1_N) GPIO07	26
27	ID_SD (I ² C ID EEPROM)		(I ² C ID EEPROM) ID_SC	28
29	GPIO05		Ground	30
31	GPIO06		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40

29/02/2016

[6]

References

- [1] <https://www.raspberrypi.org/products/raspberry-pi-3-model-b-plus/>
- [2] https://uk.rs-online.com/web/p/products/1373331/?grossPrice=Y&cm_mmc=UK-PLA-DS3A- -google- -PLA UK EN Case Studies- -Raspberry- -PRODUCT+GROUP&matchtype=&pla-306036484078&gclid=CjwKCAjwns_bBRBCEiwA7AVGHgRmgTsS5CI2rkRV3YlabOkQ-6YMwDOt2xi_CB1Ic2AMntvGulTs1RoC1m0QAvD_BwE&qclsrc=aw.ds
- [3] <https://www.raspberrypi.org/products/camera-module-v2/>
- [4] <https://www.tweaking4all.com/hardware/breadboard/>
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- [6] <https://myelectronicslab.com/raspberry-pi-3-gpio-model-b-block-pinout/>