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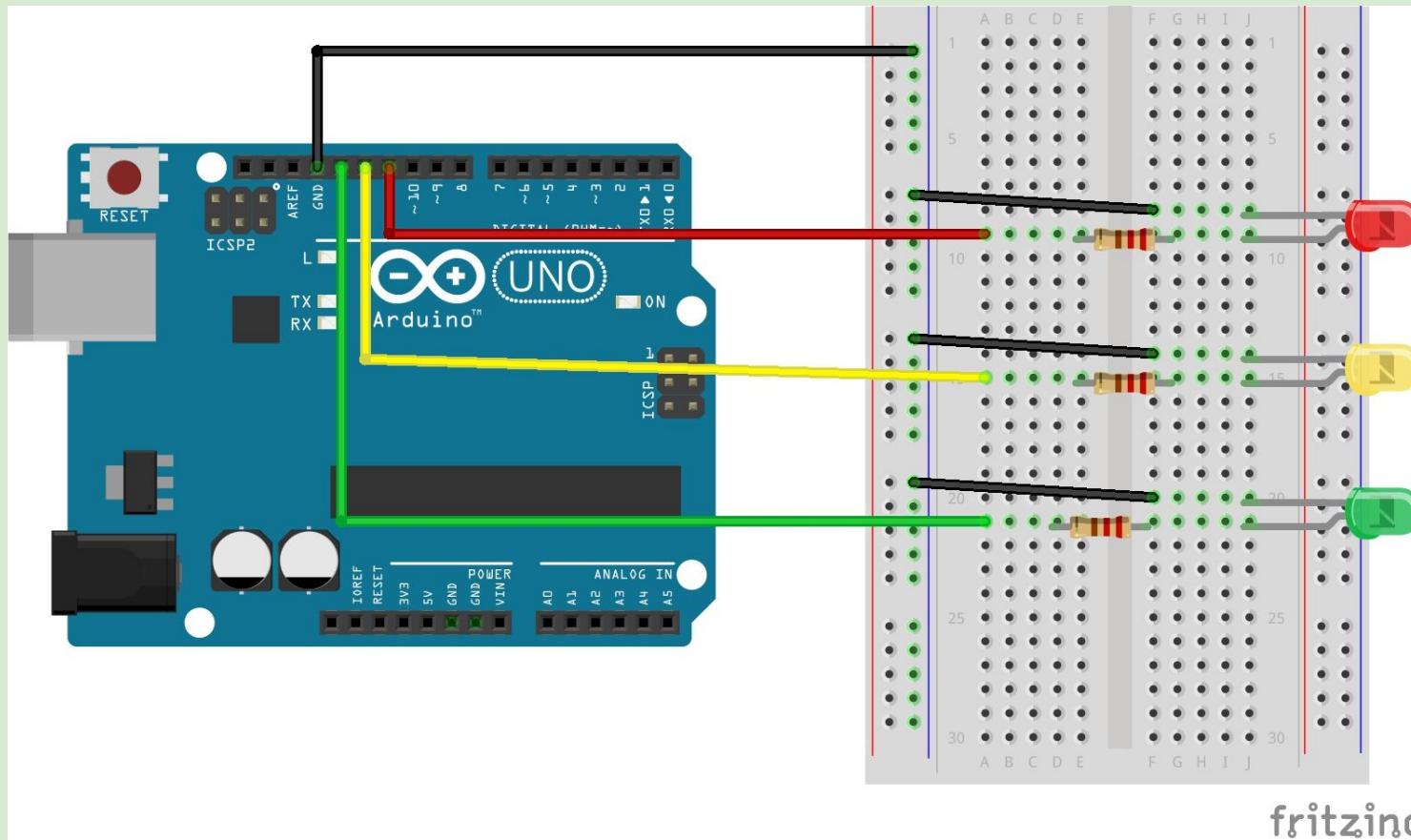
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### 1. Fritzing Layout

#### 1.1. example0101, example0102 :

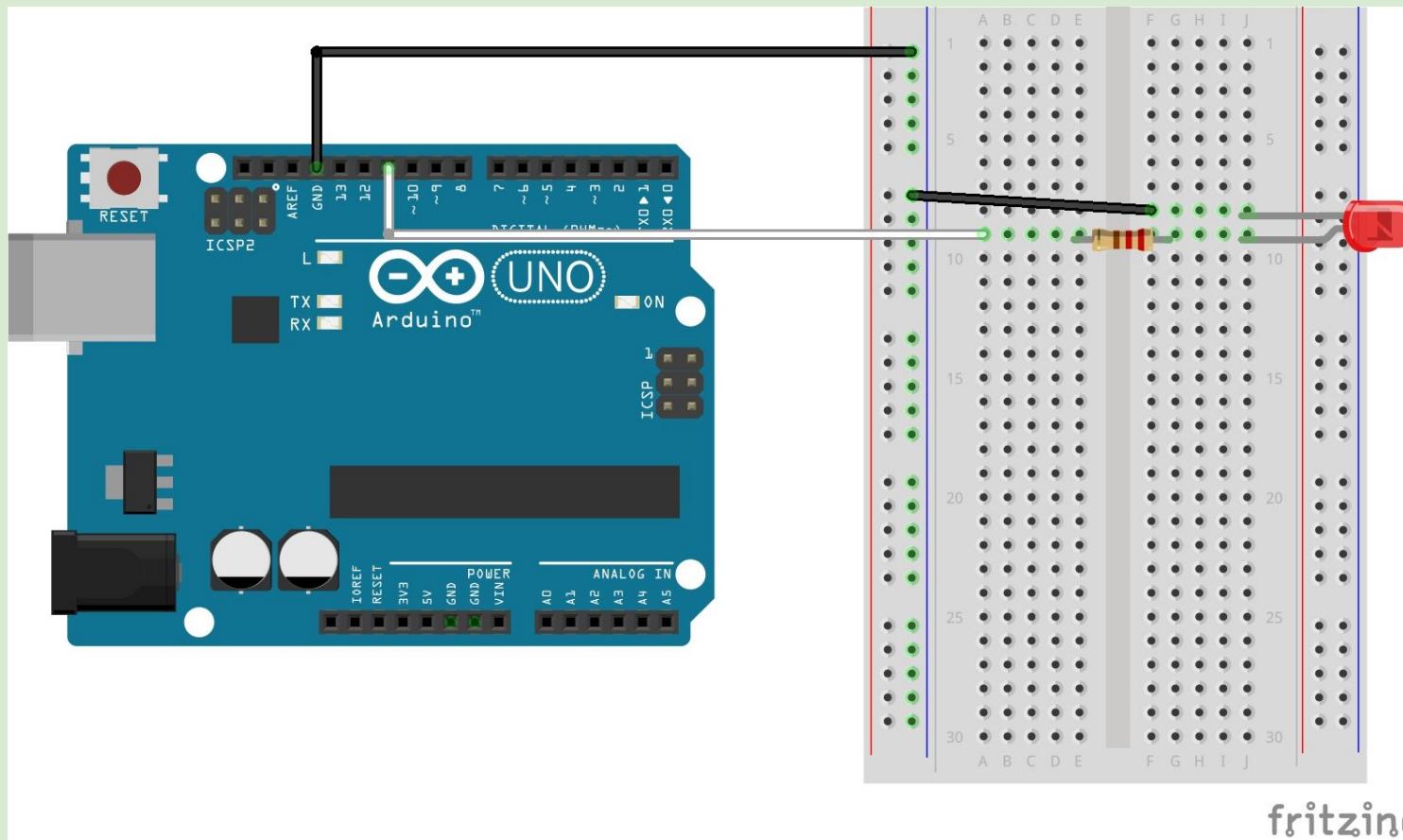


fritzing

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1.2. example0103 :

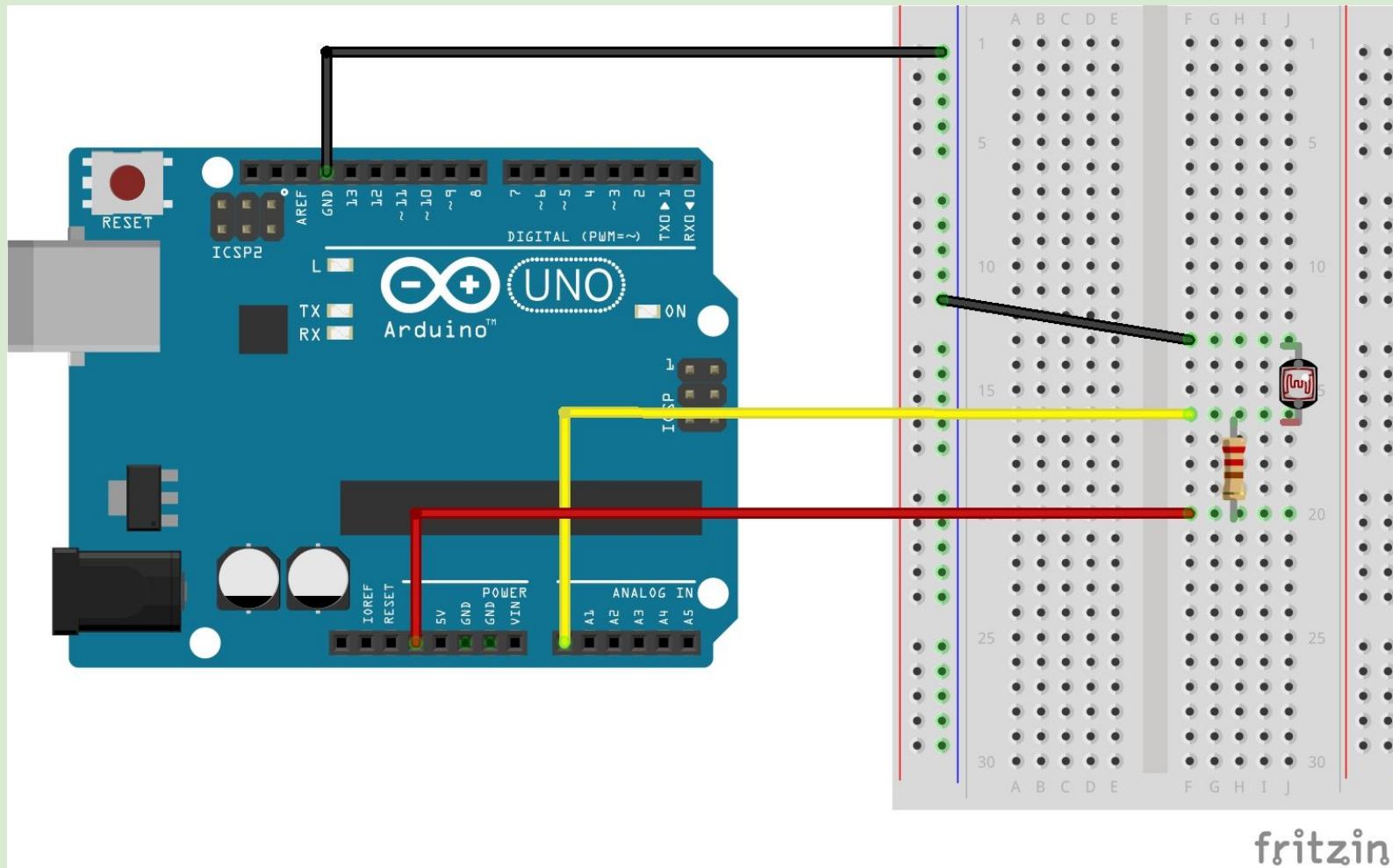


fritzing

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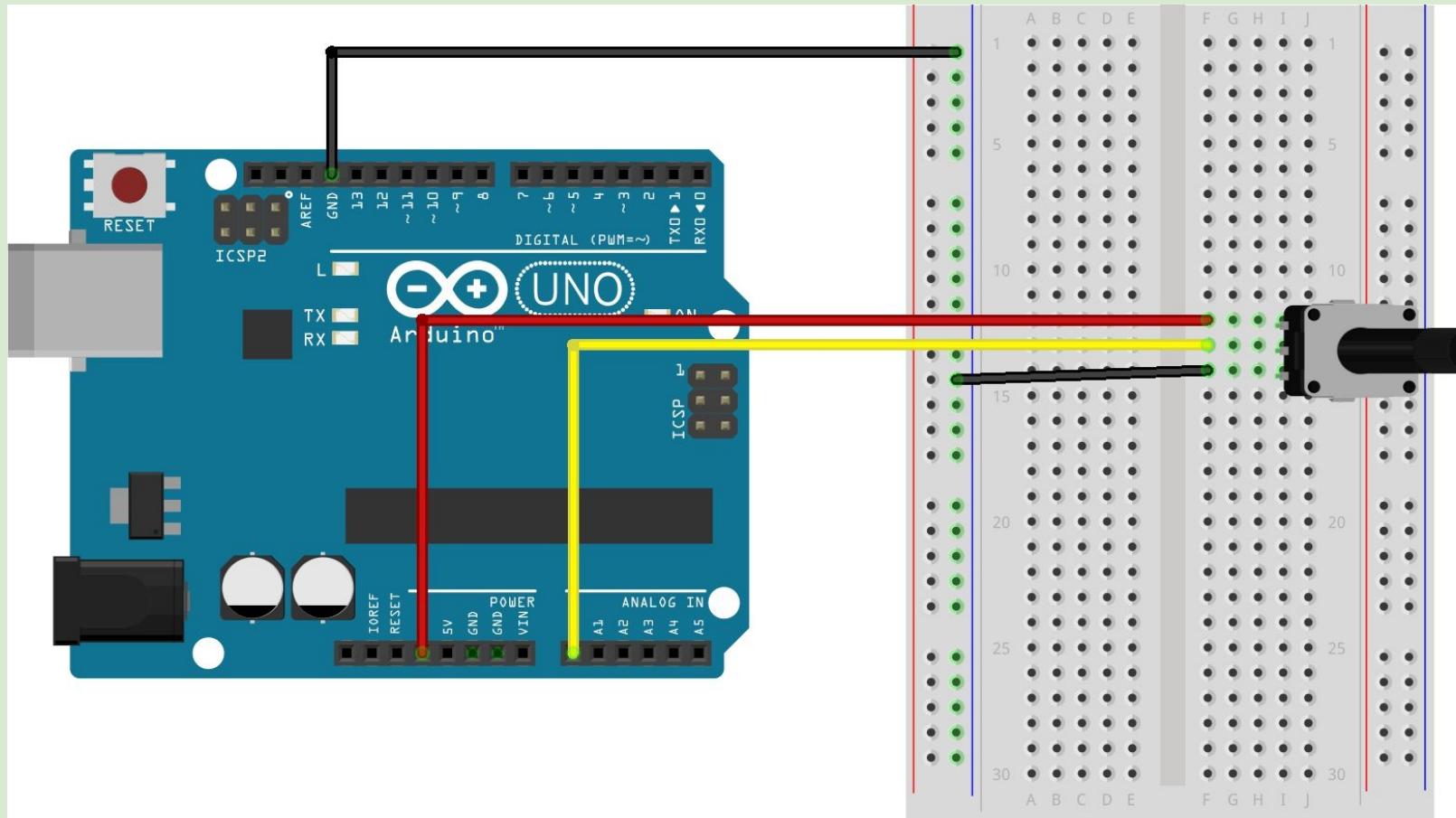
1.3. example0104 :



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1.4. example0105 :

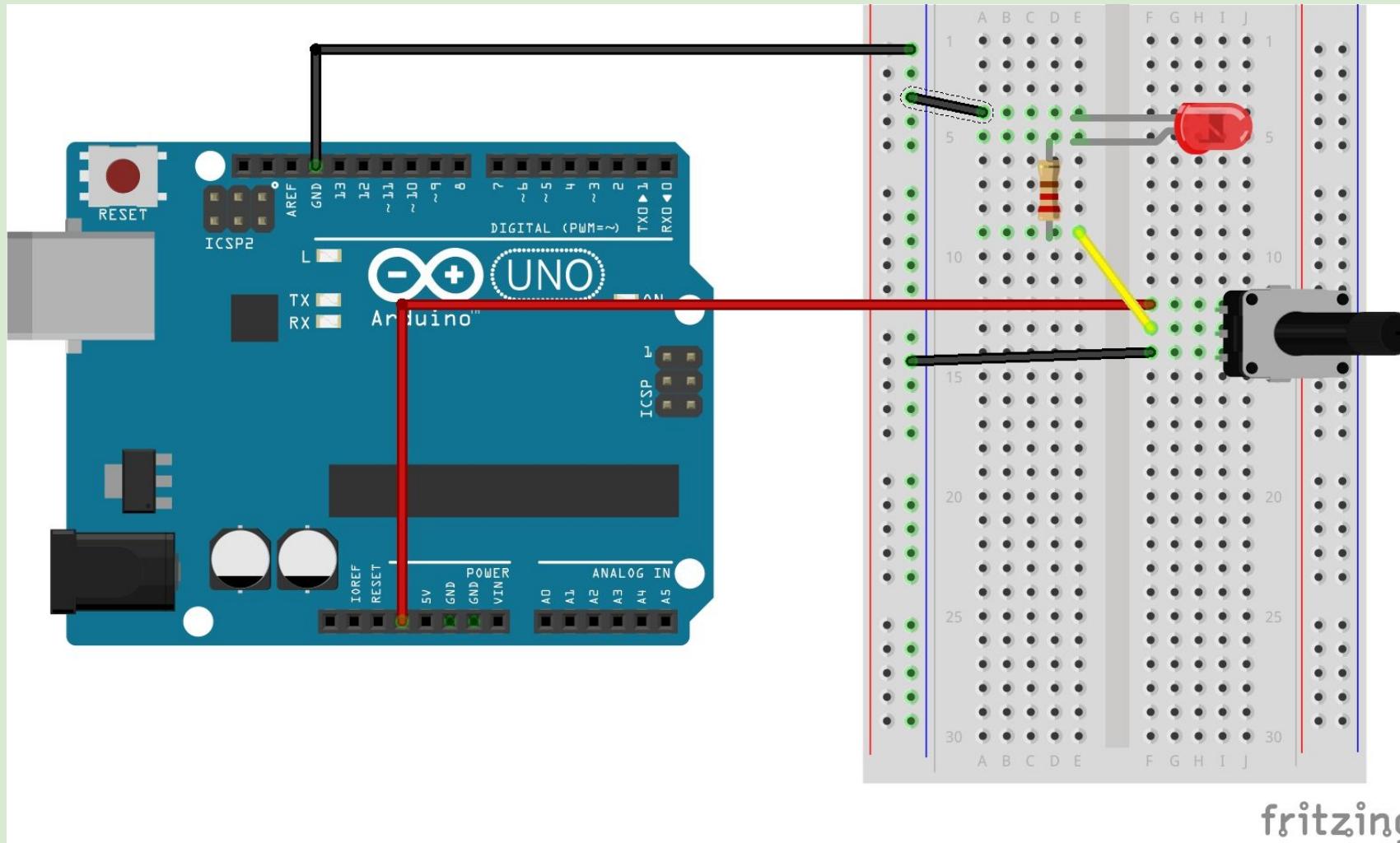


fritzing

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1.5. example0105\_010 :

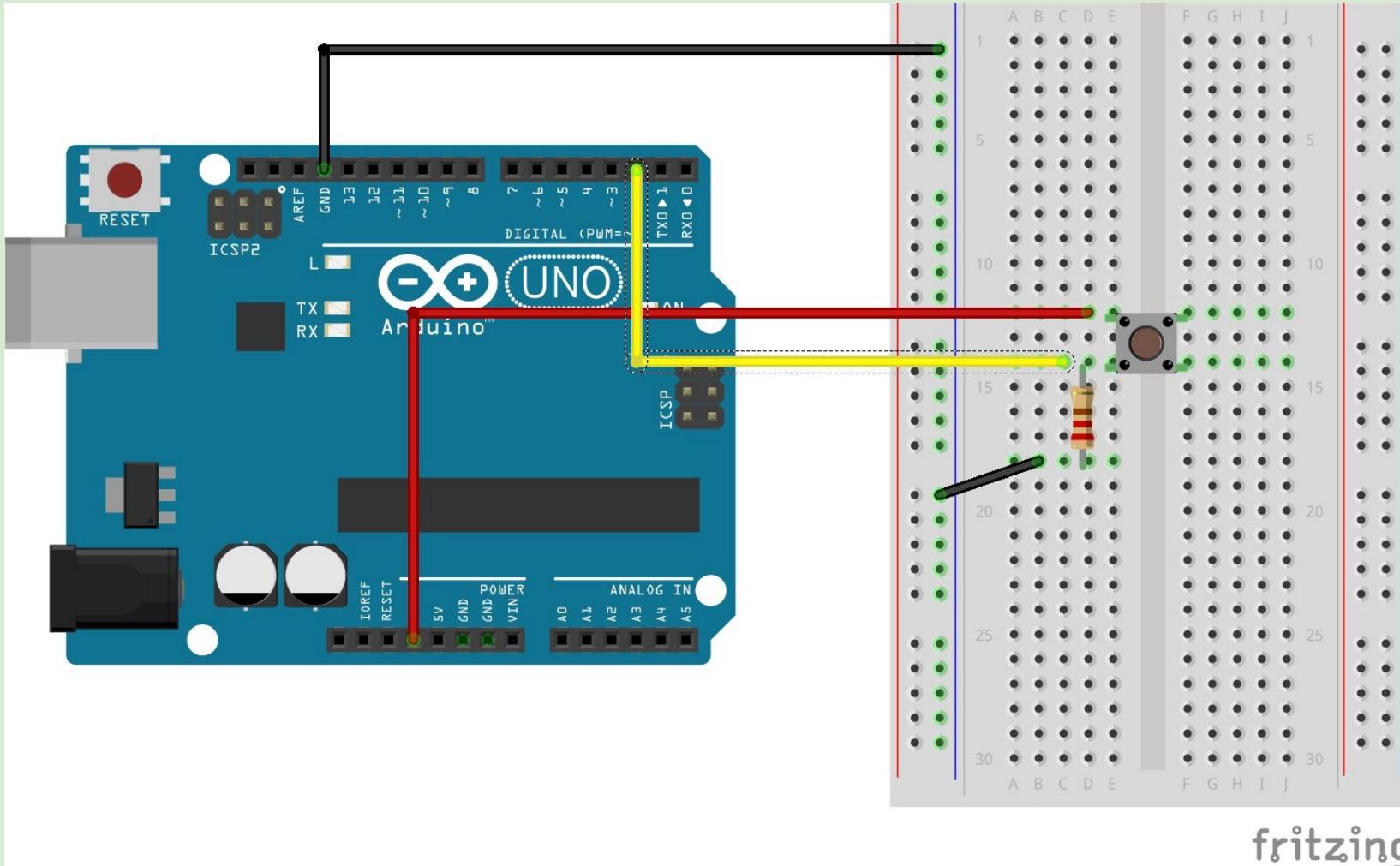


fritzing

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1.6. example0106 :

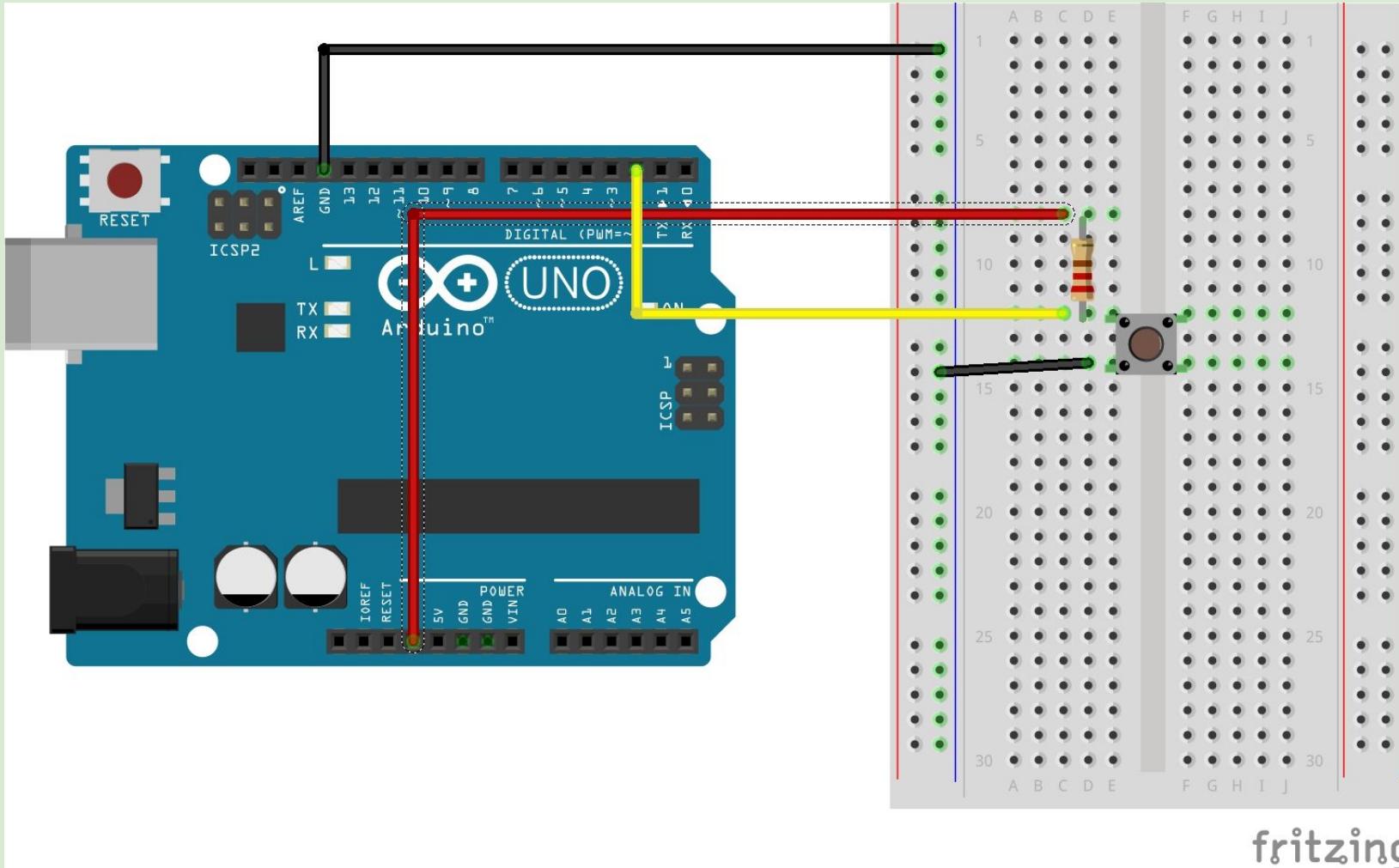


fritzing

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1.7. example0106\_010 :

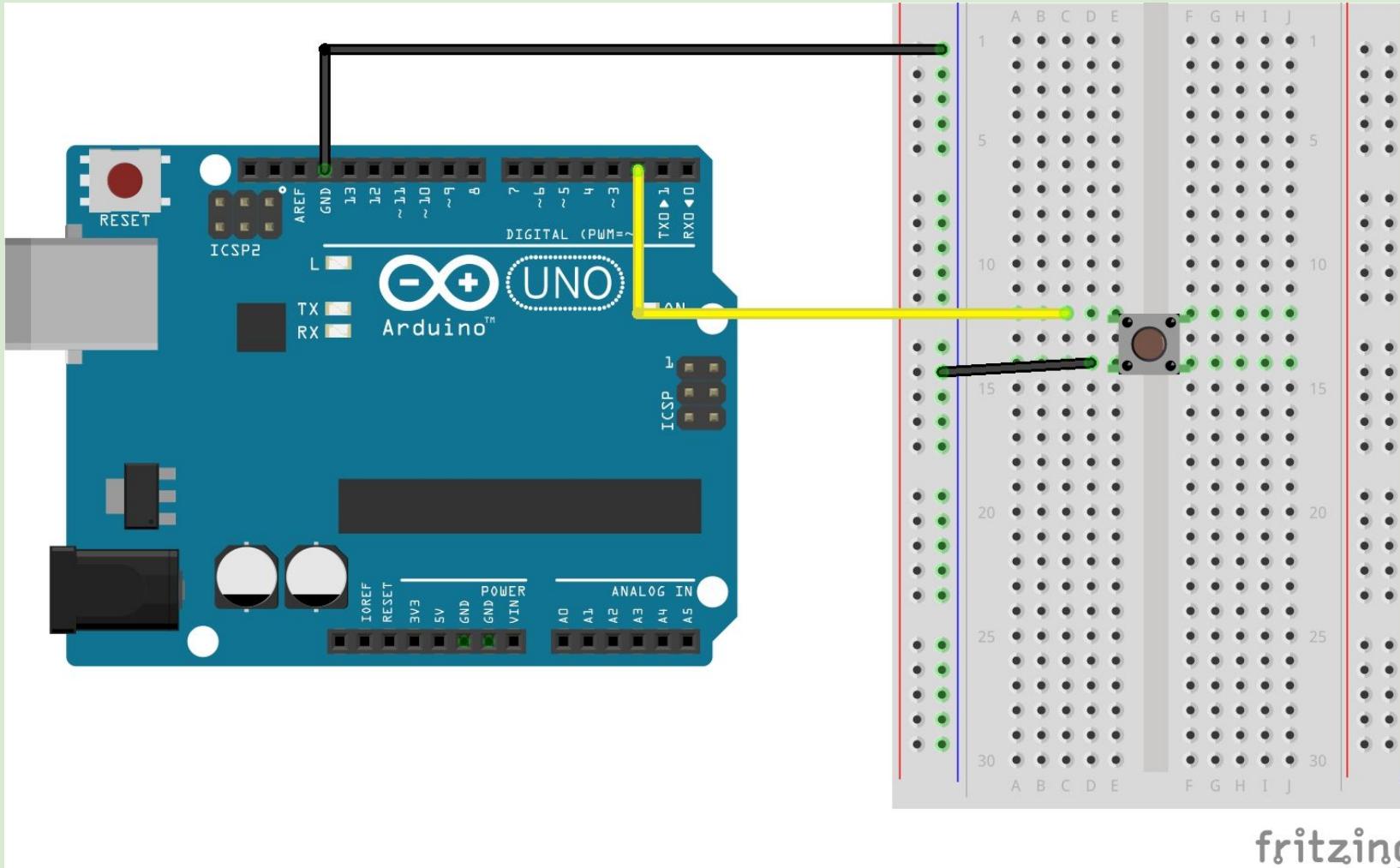


fritzing

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1.8. example0106\_020 :

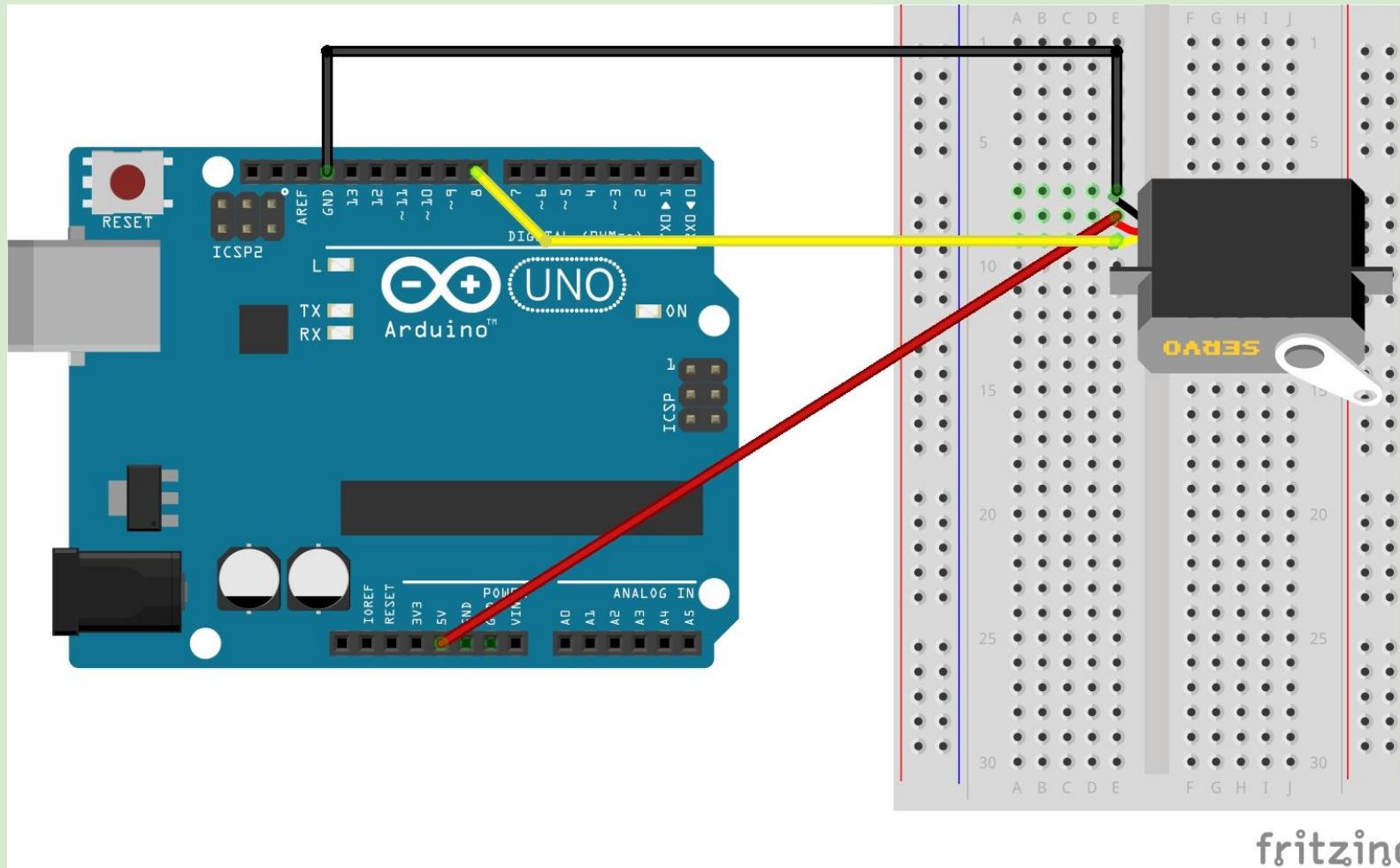


fritzing

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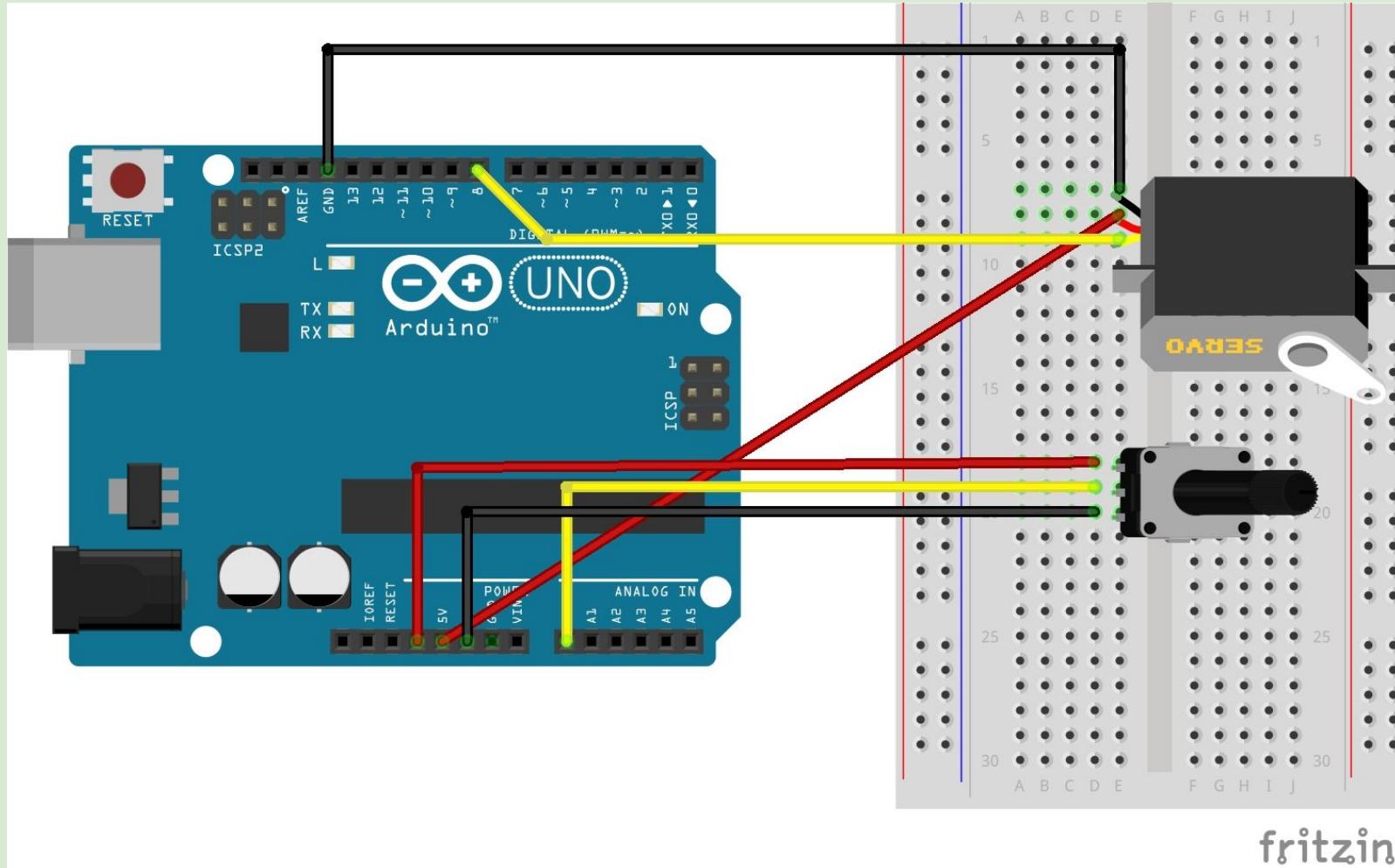
1.9. example0107 : +, - 의 극성을 잘 보고 핀을 연결합니다.



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1.10. example0107\_010 : +, - 의 극성을 잘 보고 핀을 연결합니다.



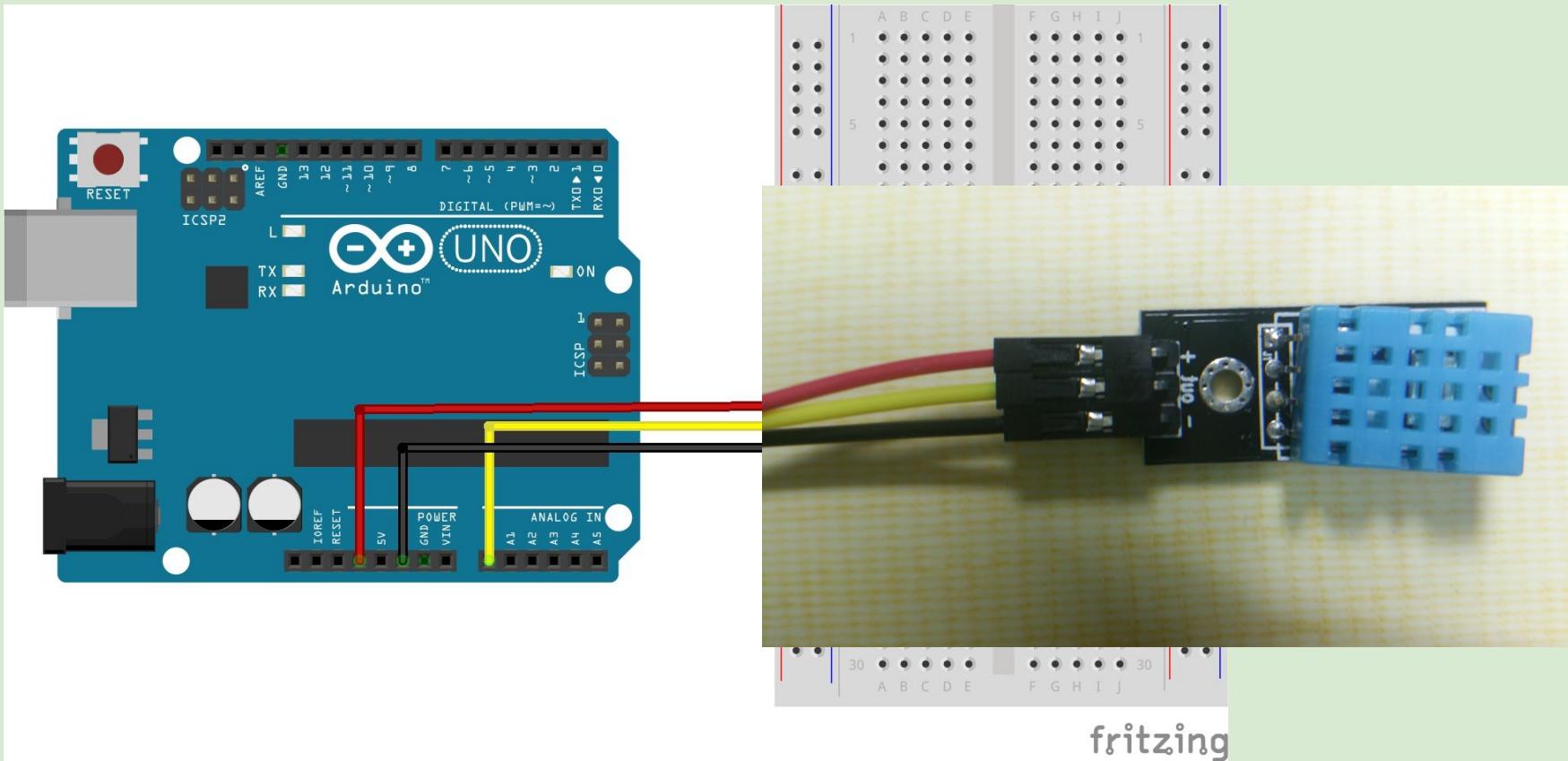
fritzing

# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

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1.11. example0108, example0108\_010, example0108\_020 : None.

1.12. example0109 : +, OUT, - 의 극성을 잘 보고 핀을 연결합니다.



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2. Usage :

3. C File : Lec\_JavaRasPi3\_0121/ex0100\_simpleLedOn/ex0100\_simpleLedOn.ino

3.1. example0101:

```
void setup() {  
    example0101_setup();  
}  
  
void loop() {  
    example0101();  
}  
  
void example0101() {
```

```
digitalWrite(13, 1);
digitalWrite(12, 0);
digitalWrite(11, 0);
delay(1000);
digitalWrite(13, 0);
digitalWrite(12, 1);
digitalWrite(11, 0);
delay(1000);
digitalWrite(13, 0);
digitalWrite(12, 0);
digitalWrite(11, 1);
delay(1000);
}
```

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```
void example0101_setup() {  
//...pinMode : https://www.arduino.cc/reference/en/language/functions/digital-io/pinmode/  
pinMode(13, OUTPUT);  
pinMode(12, OUTPUT);  
pinMode(11, OUTPUT);  
  
//...digitalWrite() :  
https://www.arduino.cc/reference/en/language/functions/digital-io/digitalwrite/  
digitalWrite(13, 0);  
digitalWrite(12, 0);  
digitalWrite(11, 0);  
}
```

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### 3.2. example0102 :

```
void setup() {  
    example0102_setup();  
}  
  
void loop() {  
    example0102();  
}  
  
void example0102() {  
    for (int i = 13; i >= 11; --i) {  
        digitalWrite(i, 1);  
        //...delay() : https://www.arduino.cc/reference/en/language/functions/time/delay/  
        delay(250);  
    }  
}
```

```
digitalWrite(i, 0);
delay(250);
}
}

void example0102_setup() {
pinMode(13, OUTPUT);
pinMode(12, OUTPUT);
pinMode(11, OUTPUT);

digitalWrite(13, 0);
digitalWrite(12, 0);
digitalWrite(11, 0);
}
```

3.3. example0103 :

```
void setup() {  
    example0103_setup(); //...': PWM.0~255.  
}  
  
void loop() {  
    example0103(); //...': PWM.0~255.  
}  
  
void example0103() {  
    for (int i = 0 ; i < 256; ++i) {  
        analogWrite(11, i);  
        delay(10);  
    }  
}
```

```
}
```

```
void example0103_setup() {
```

```
//...'~': PWM.0~255.
```

```
//...analogWrite :
```

```
https://www.arduino.cc/reference/en/language/functions/analog-io/analogwrite/
```

```
analogWrite(11, 10);
```

```
}
```

3.4. example0104 :

```
void setup() {  
    example0104_setup(); //...Photocell(LDR)  
}  
  
void loop() {  
    example0104(); //...Photocell(LDR)  
}  
  
void example0104() {  
    int a0 = analogRead(A0);  
    delay(250);  
    Serial.print("Photocell Value : ");  
    //...Serial.println();
```

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<https://www.arduino.cc/reference/en/language/functions/communication/serial/println/>

    Serial.println(a0);

}

void example0104\_setup() {

    //...AnalogPin : A0~A5 : 0~1023.

    //...Serial : <https://www.arduino.cc/reference/en/language/functions/communication/serial/>

    //...Serial.begin() :

<https://www.arduino.cc/reference/en/language/functions/communication/serial/begin/>

    Serial.begin(9600);

}

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### 3.5. example0105 :

```
void setup() {  
    example0105_setup(); //...Rotary Potentiometer(R2)  
}  
  
void loop() {  
    example0105(); //...Rotary Potentiometer(R2),  
}  
  
void example0105() {  
    int a0 = analogRead(A0);  
    //...map() : https://www.arduino.cc/reference/en/language/functions/math/map/  
    //map(a0, 0, 1023, 0, 255); //...convert value range of a0(0~1023) to value of PWM(0~255).  
    //int b0 = map(a0, 0, 1023, 0, 5); //...convert value range of a0(0~1023) to value of
```

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Voltage(0~5).

```
int b0 = map(a0, 0, 1023, 0, 50); //...convert value range of a0(0~1023) to value of  
Voltage(0.0~5.0).  
Serial.print("Rotary Potentiometer(R2) : ");  
Serial.println(b0 / 10.0f);  
delay(250);  
}
```

void example0105\_setup() {

```
/*  
...Rotary Potentiometer(R2) : 0 ~ 1023.  
GND, A0, 5V.  
PWM PIN : 3,5,6,9,10,11.  
LED connect with PWM PIN.
```

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```
*/  
Serial.begin(9600);  
}
```

3.6. example0105\_010 :

```
void setup() {  
example0105_setup_010();//...Rotary Pontentiometer(R2)  
}  
  
void loop() {  
example0105_010();//...Rotary Pontentiometer(R2) and LED, image  
}
```

```
void example0105_010() {  
    example0105();  
}  
  
void example0105() {  
    int a0 = analogRead(A0);  
    //...map() : https://www.arduino.cc/reference/en/language/functions/math/map/  
    //map(a0, 0,1023, 0,255); //...convert value range of a0(0~1023) to value of PWM(0~255).  
    //int b0 = map(a0, 0,1023, 0,5); //...convert value range of a0(0~1023) to value of  
    Voltage(0~5).  
    int b0 = map(a0, 0, 1023, 0, 50); //...convert value range of a0(0~1023) to value of  
    Voltage(0.0~5.0).  
    Serial.print("Rotary Pontentiometer(R2) : ");  
    Serial.println(b0 / 10.0f);
```

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```
delay(250);
}

void example0105_setup_010() {
    example0105_setup();
}

void example0105_setup() {
    /*
        ...Rotary Potentiometer(R2) : 0 ~ 1023.
        GND, A0, 5V.
        PWM PIN : 3,5,6,9,10,11.
        LED connect with PWM PIN.
    */
}
```

```
Serial.begin(9600);  
}
```

3.7. example0106 :

```
void setup() {  
    example0106_setup(); //...Push Button::PullDown  
}  
  
void loop() {  
    example0106(); //...Push Button::PullDown  
}  
  
void example0106() {
```

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```
int d2 = digitalRead(2);
delay(100);
Serial.print("Pushbutton : ");
Serial.println(d2);
}

void example0106_setup() {
    Serial.begin(9600);
    pinMode(2, INPUT);
}
```

3.8. example0106\_010 :

```
void setup() {  
    example0106_setup_010(); //...Push Button::Pull Up  
}  
  
void loop() {  
    example0106_010(); //...Push Button::Pull Up  
}  
  
void example0106_010() {  
    example0106();  
}  
  
void example0106() {
```

# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

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```
//...digitalRead():
```

<https://www.arduino.cc/reference/en/language/functions/digital-io/digitalread/>

```
int d2 = digitalRead(2);
delay(100);
Serial.print("Pushbutton : ");
Serial.println(d2);
}
```

```
void example0106_setup_010() {
example0106_setup();
}
```

```
void example0106_setup() {
Serial.begin(9600);
```

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```
pinMode(2, INPUT);  
}
```

### 3.9. example0106\_020 :

```
void setup() {  
    example0106_setup_020(); //...Pushbutton::INPUT_PULLUP(Arduino's inner resistance)  
}  
  
void loop() {  
    example0106_020(); //...Pushbutton::INPUT_PULLUP(Arduino's inner resistance)  
}
```

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## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

```
void example0106_020() {
  //...digitalRead():

https://www.arduino.cc/reference/en/language/functions/digital-io/digitalread/
  int d2 = digitalRead(2);
  delay(100);
  Serial.print("Pushbutton : ");
  Serial.println(d2);

  // Keep in mind the pull-up means the pushbutton's logic is inverted. It goes
  // HIGH when it's open, and LOW when it's pressed. Turn on pin 13 when the
  // button's pressed, and off when it's not:
  if (d2 == HIGH) {
    digitalWrite(13, LOW);
```

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```
} else {
    digitalWrite(13, HIGH);
}

void example0106_setup_020() {
    Serial.begin(9600);
    //...INPUT_PULLUP :
https://www.arduino.cc/reference/en/language/variables/constants/constants/
    //...Input Pullup Serial tutorial : https://www.arduino.cc/en/Tutorial/InputPullupSerial
    pinMode(2, INPUT_PULLUP);
    pinMode(13, OUTPUT);
}
```

3.10. example0107 :

```
//...S.example0107_setup, example0107_setup_010.  
#include <Servo.h>  
Servo servo0107;  
int angle = 0;  
//...E.example0107_setup, example0107_setup_010.  
  
void setup() {  
    example0107_setup(); //...Basic Servo  
}  
  
void loop() {  
    example0107(); //...Basic Servo  
}
```

```
void example0107() {  
    for (angle = 0; angle < 90; angle += 1) {  
        servo0107.write(angle);  
        delay(100);  
    }  
}  
  
void example0107_setup() {  
    /*  
     ...Basic Servo : angle range : 0~180degreen  
    */  
    servo0107.attach(8);  
}
```

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3.11. example0107\_010 :

```
//...S.example0107_setup, example0107_setup_010.  
#include <Servo.h>  
Servo servo0107;  
int angle = 0;  
//...E.example0107_setup, example0107_setup_010.  
  
void setup() {  
    example0107_setup_010(); //...Basic Servo + Rotary Potentiometer(R2)  
}  
  
void loop() {  
    example0107_010(); //...Basic Servo + Rotary Potentiometer(R2), image :  
    https://drive.google.com/open?id=1g-b48qlIR9j7i5ul83Udqm8WmXt\_lafk
```

```
}
```

```
void example0107_010() {
    int a0 = analogRead(A0);
    int a0_map = map(a0, 0, 1023, 0, 180); //...convert value range of a0(0~1023) to value of
angle(0~180).
```

```
    Serial.print("Rotary Potentiometer(R2) : ");
```

```
    Serial.println(a0_map);
```

```
    servo0107.write(a0_map);
```

```
    delay(100);
```

```
}
```

```
void example0107_setup_010() {
```

```
    Serial.begin(9600);
```

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```
example0107_setup();  
}  
  
void example0107_setup() {  
/*  
...Basic Servo : angle range : 0~180degreen  
*/  
servo0107.attach(8);  
}
```

3.12. example0108 :

```
void setup() {  
    example0108_setup(); //...Serial Tx  
}  
  
void loop() {  
    example0108(); //...Serial Tx  
}  
  
void example0108() {  
    //...nothing.  
}  
  
void example0108_setup() {
```

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```
/*
 ...Serial.write : number is printed as ascii code, not number.

*/
Serial.begin(9600);
Serial.write("\nHi, Serial from Arduino to PC\nJoyWins!\n");
Serial.println(65); //...print number 65.
Serial.write(65); //...print AsciiCode, not Number. 0(48)...,A(65)...,a(97)...,\n(10),\r(13,return).
}
```

### 3.13. example0108\_010 :

```
void setup() {
    example0108_setup_010(); //...Serial Rx
}
```

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```
void loop() {
    example0108_010(); //...Serial Rx, choose 'no line ending' at Serial Monitor.
}

void example0108_010() {
    if (Serial.available()) { //...exclude -1.
        int a = Serial.read();
        //Serial.print("Serial read value : ");
        Serial.println(a);
    }
}

void example0108_setup_010() {
```

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```
Serial.begin(9600);  
}
```

3.14. example0108\_020 :

```
void setup() {  
    example0108_setup_020(); //...Serial RxTx  
}  
  
void loop() {  
    example0108_020(); //...Serial RxTx  
}  
  
void example0108_020() {
```

# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

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```
//...Number(AsciiCode) : 0(48)...,A(65)...,a(97)...\\n(10),\\r(13,return).
if (Serial.available()) { //...exclude -1.

    int a = Serial.read();

    if (a == 49) //...a = 1.
        digitalWrite(13, 1);

    if (a == 48) //...a = 0.
        digitalWrite(13, 0);

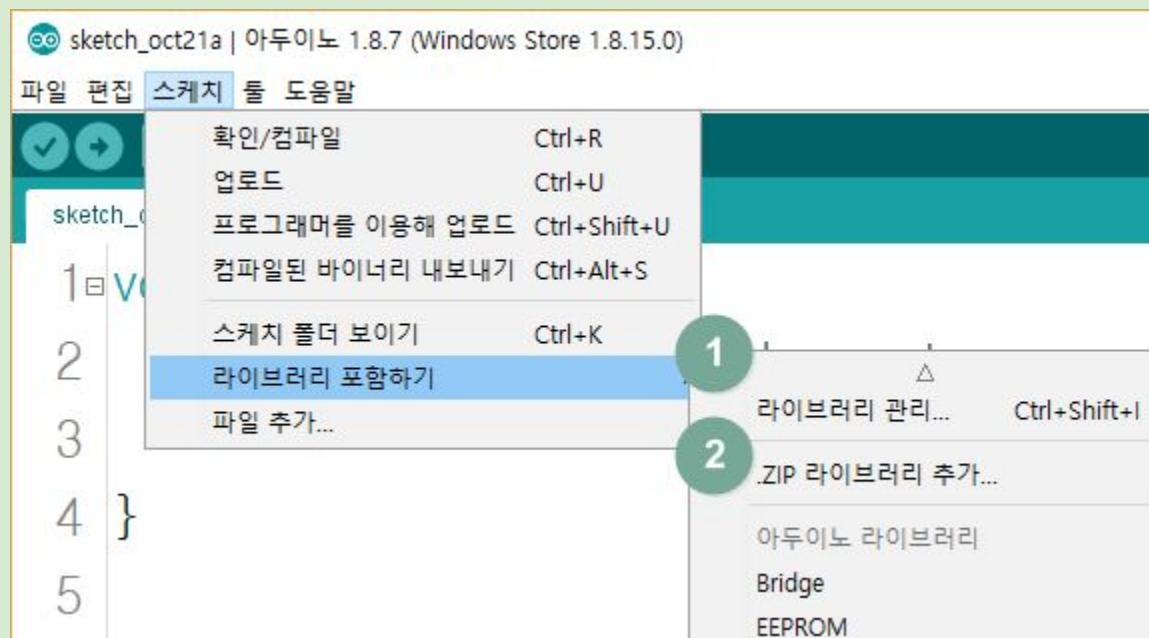
}

void example0108_setup_020() {
    Serial.begin(9600);
    pinMode(13, OUTPUT);
}
```

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

3.15. example0109<sup>1</sup> :

3.15.1. 실습에 사용되는 DHT11<sup>2</sup> 라이브러리를 다운로드<sup>3</sup> 받아 아두이노에 추가합니다.



3.15.2. 아두이노에

라이브러리를 추가하는 방법에는 그림처럼 ① '라이브러리 관리'<sup>4</sup>를 이용하는 방법, ② '.ZIP 라이브러리 추가'<sup>5</sup>를 이용하는 방법, ③ '압축을 풀고 생성한 라이브러리 폴더를 직접 아두이노 라이브러리 폴더에 붙여넣는 방법'<sup>6</sup> 등이 있습니다.

3.15.3. 라즈베리파이에서는 ③

'압축을 풀고 생성한 라이브러리 폴더를 직접 아두이노 라이브러리 폴더에 붙여넣는 방법'을 이용합니다.

<sup>1</sup> <https://www.brainy-bits.com/dht11-tutorial/> How to use the DHT11 Temperature – Humidity Sensor with Arduino

<sup>2</sup> <https://blog.naver.com/roboholic84/221186233842> [출처] DHT11 아두이노 온도, 습도 센서 알아보기 / 아두이노 코딩 교육|작성자 오픈랩

<sup>3</sup> <https://blog.naver.com/lego7407/221331174434> [출처] 아두이노02\_dht11\_라이브러리추가하기|작성자 허니피그

<sup>4</sup> <https://youtu.be/067U0dNF8Ao> 아두이노 라이브러리 추가 방법

<sup>5</sup> <https://blog.naver.com/lego7407/221331174434> [출처] 아두이노02\_dht11\_라이브러리추가하기|작성자 허니피그

<sup>6</sup> <https://blog.naver.com/roboholic84/220780110340> [출처] [아두이노 강좌] 22. 온도, 습도 측정 센서 DHT11 모듈 사용하기 / 라이브러리 추가하기 (2)|작성자 오픈랩

# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

3.15.4. 라즈베리파이에서 앱축을 해제한 폴더를 추가하는 과정에서 You don't have the right permissions to extract the files to the directory "/usr/share/arduino/libraries" 라는 오류가 발생하면 터미널에서 sudo pcmanfm<sup>7</sup> 을 실행하면 나타나는 탐색기에서 방법③을 실행합니다.

```
pi@raspberrypi:~ $ sudo pcmanfm  
** Message: x-terminal-emulator has very limited support, consider choose another terminal
```

```
//...S.example0109_setup.  
  
#include <DHT.h>  
  
#define DHT_APIN A0 //...set data pin to A0.  
  
#define DHTTYPE DHT11  
  
DHT dht(DHT_APIN, DHTTYPE);  
  
//...E.example0109_setup.  
  
  
void setup() {
```

<sup>7</sup> <https://stackoverflow.com/questions/17930250/raspberry-pi-arduino-libraries-folder> Raspberry pi Arduino Libraries folder

```
example0109_setup(); //...DHT11.  
}  
  
void loop() {  
    example0109(); //...DHT11  
}  
  
void example0109() {  
    float h = dht.readHumidity();  
    float t = dht.readTemperature();  
  
    Serial.print("Humidity: ");  
    Serial.print((byte)h);  
    Serial.print("%\t");
```

```
Serial.print("Temperature: ");
Serial.print((byte)t);
Serial.println(" C");
delay(1000);
}

void example0109_setup() {
    Serial.begin(9600);
    delay(500);//Delay to let system boot
    Serial.println("DHT11 Humidity & temperature Sensor\n\n");
    delay(1000);//Wait before accessing Sensor
}
```

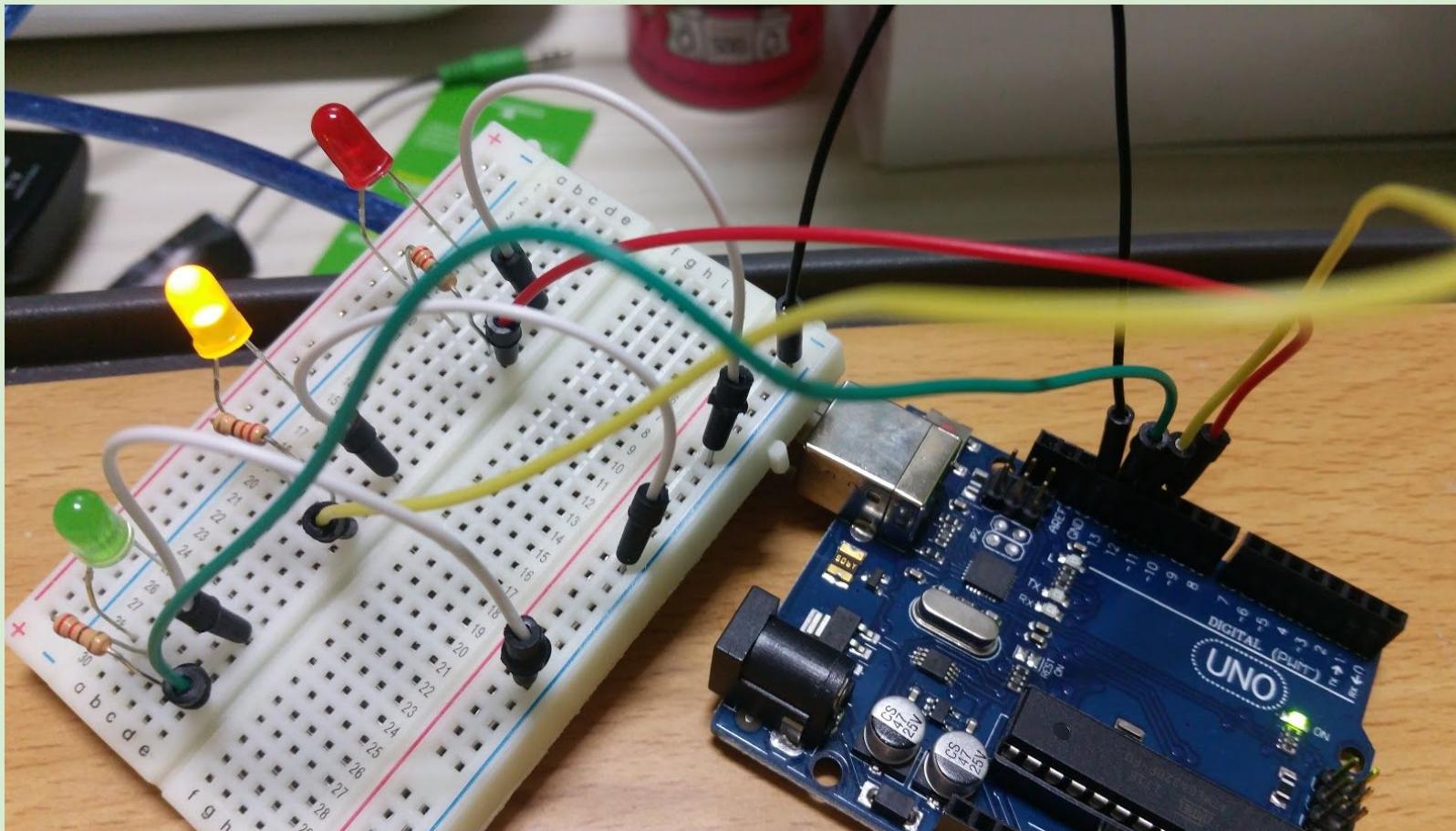
Arduino :: C :: Lec\_JavaRasPi3\_0121 ::  
ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

### 4. Result Image :

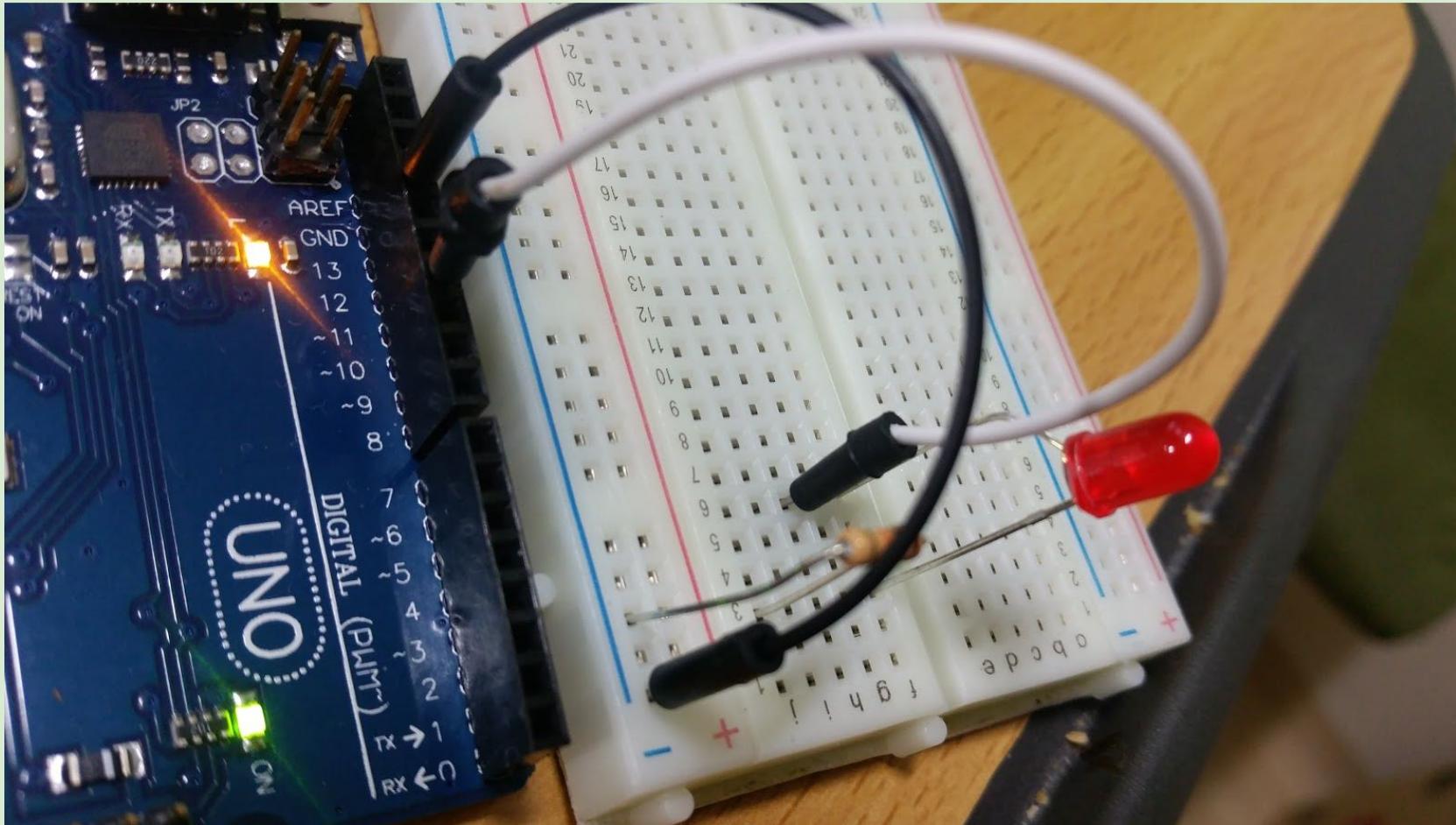
#### 4.1. example0101, example0102 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

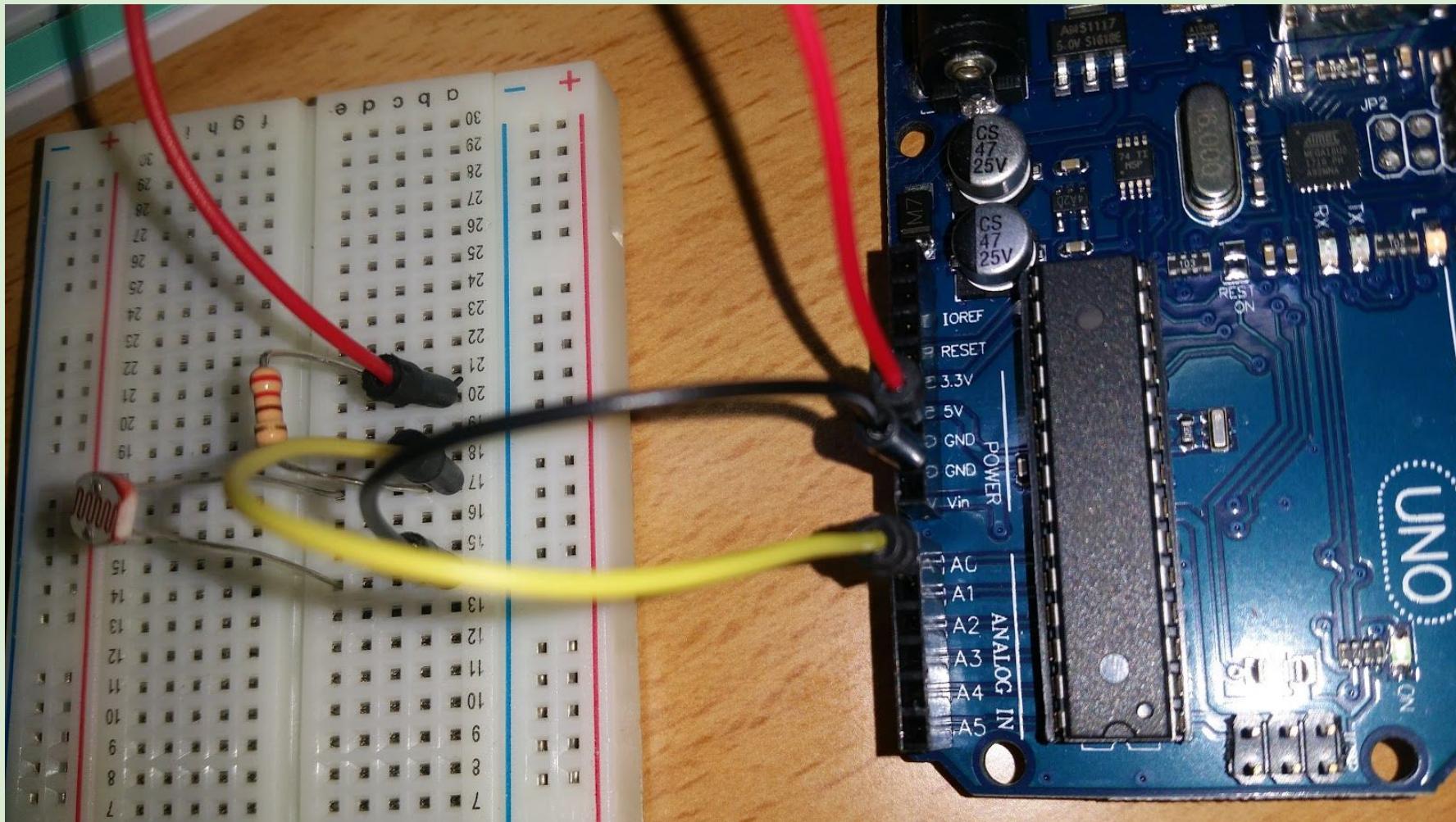
4.2. example0103 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

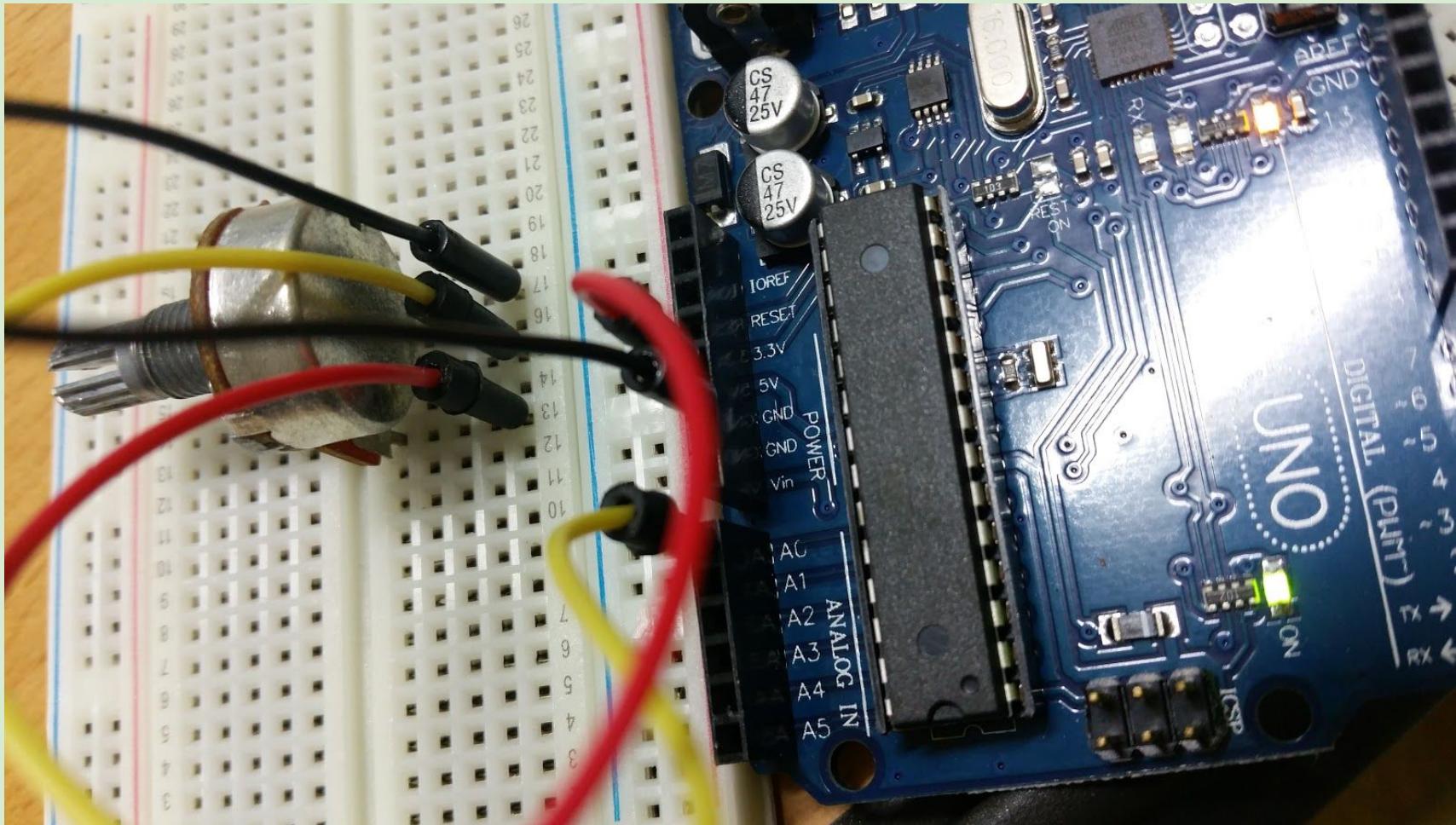
4.3. example0104 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

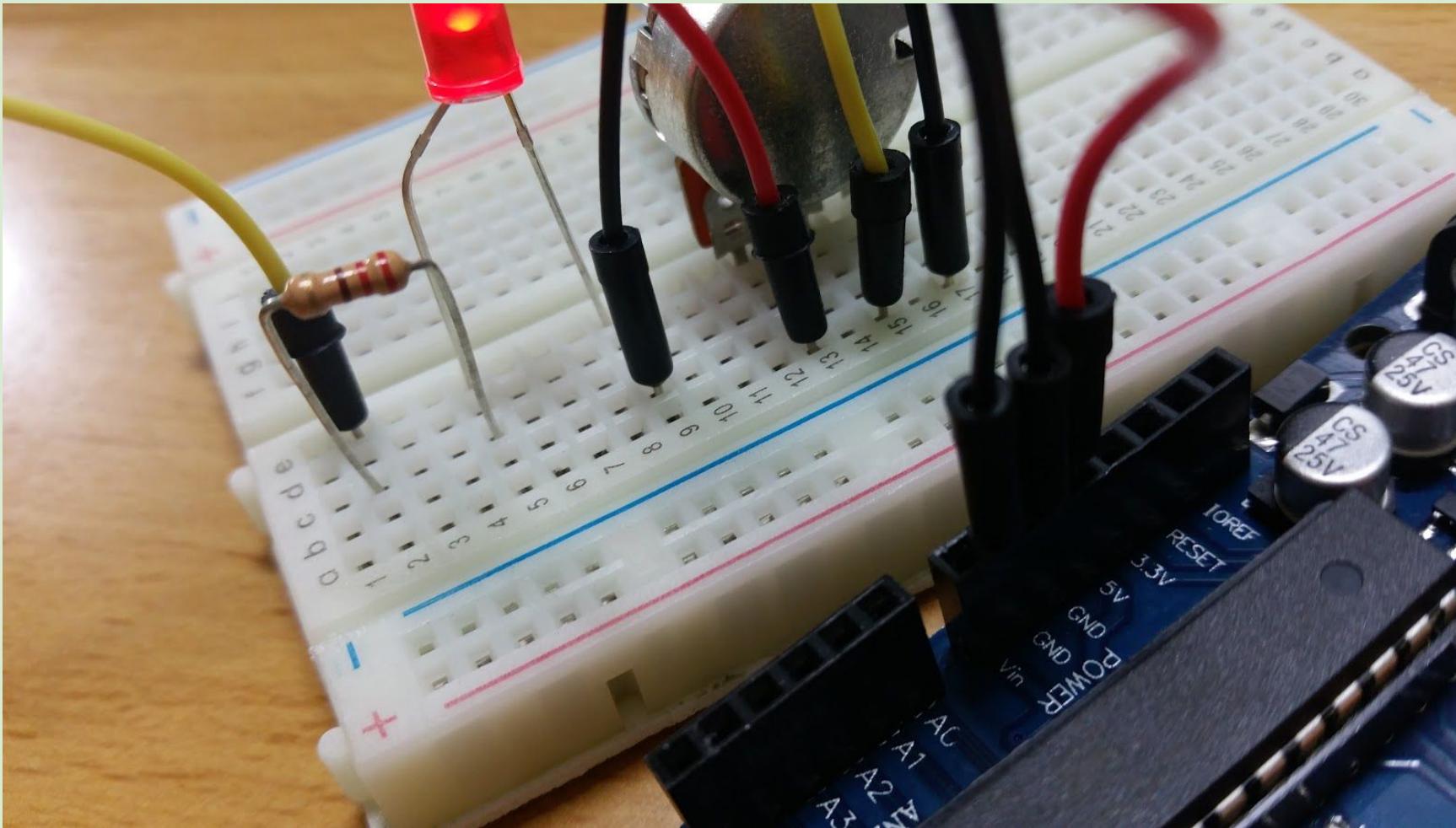
4.4. example0105 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

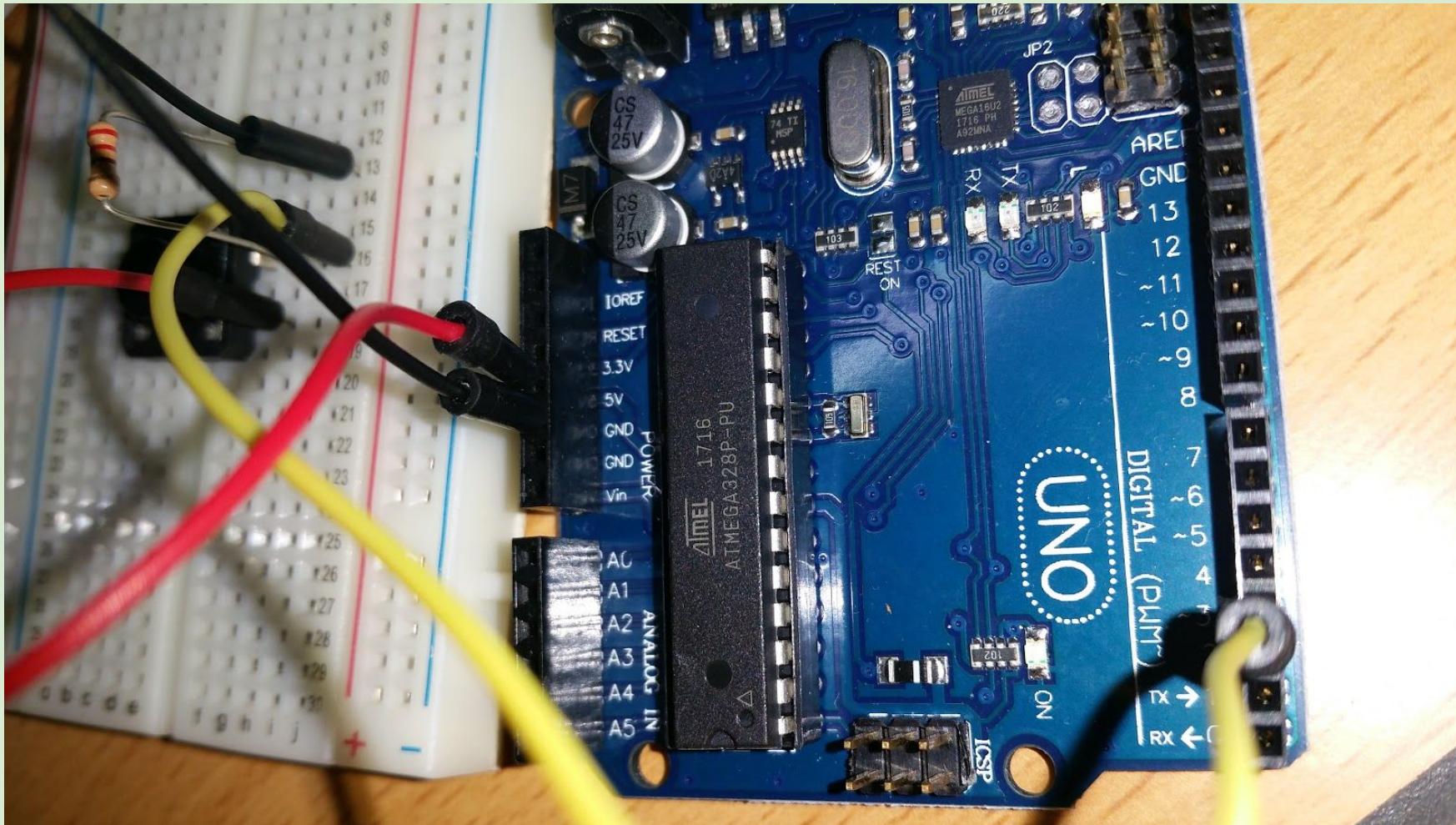
4.5. example0105\_010:



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

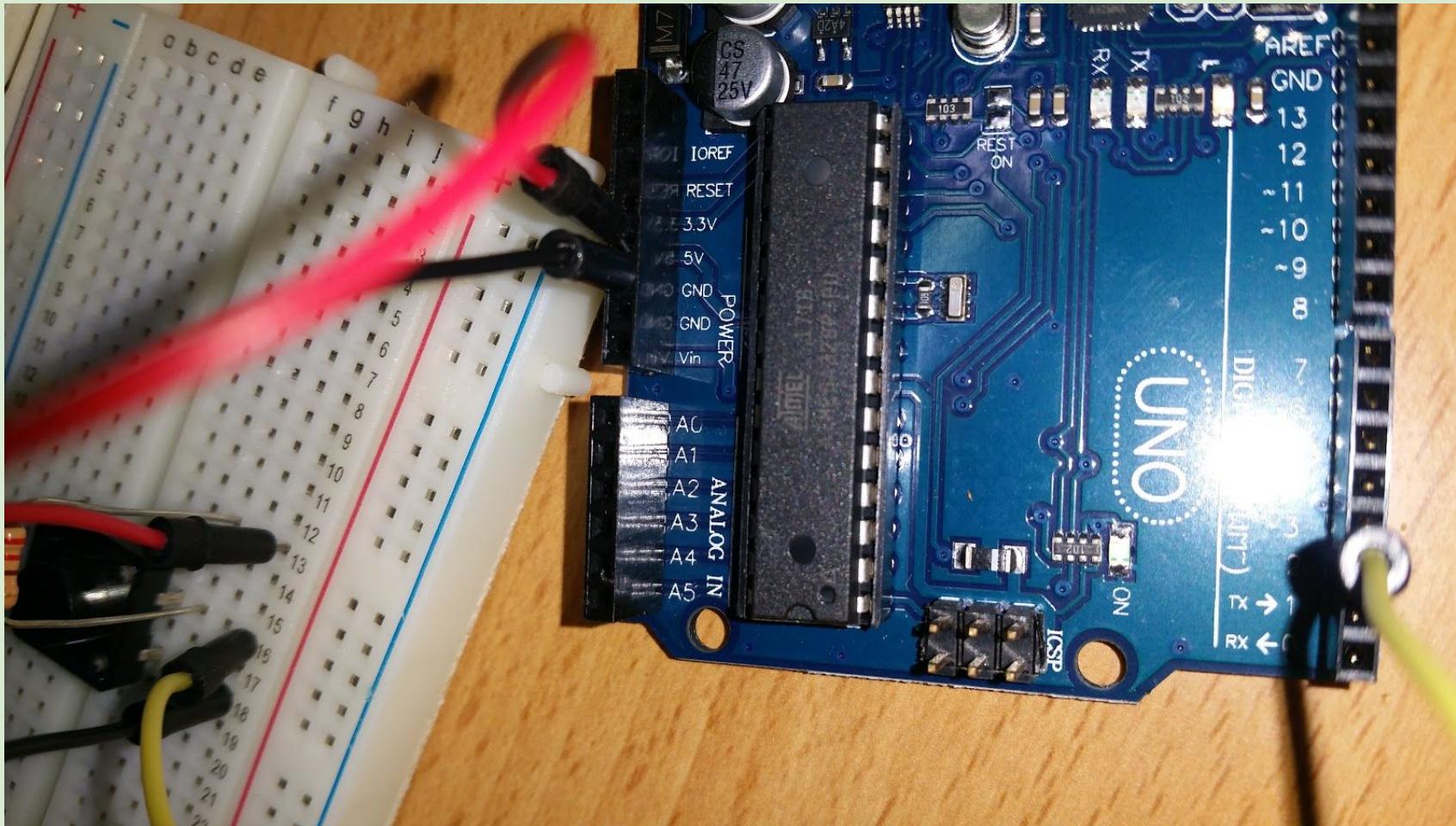
4.6. example0106 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

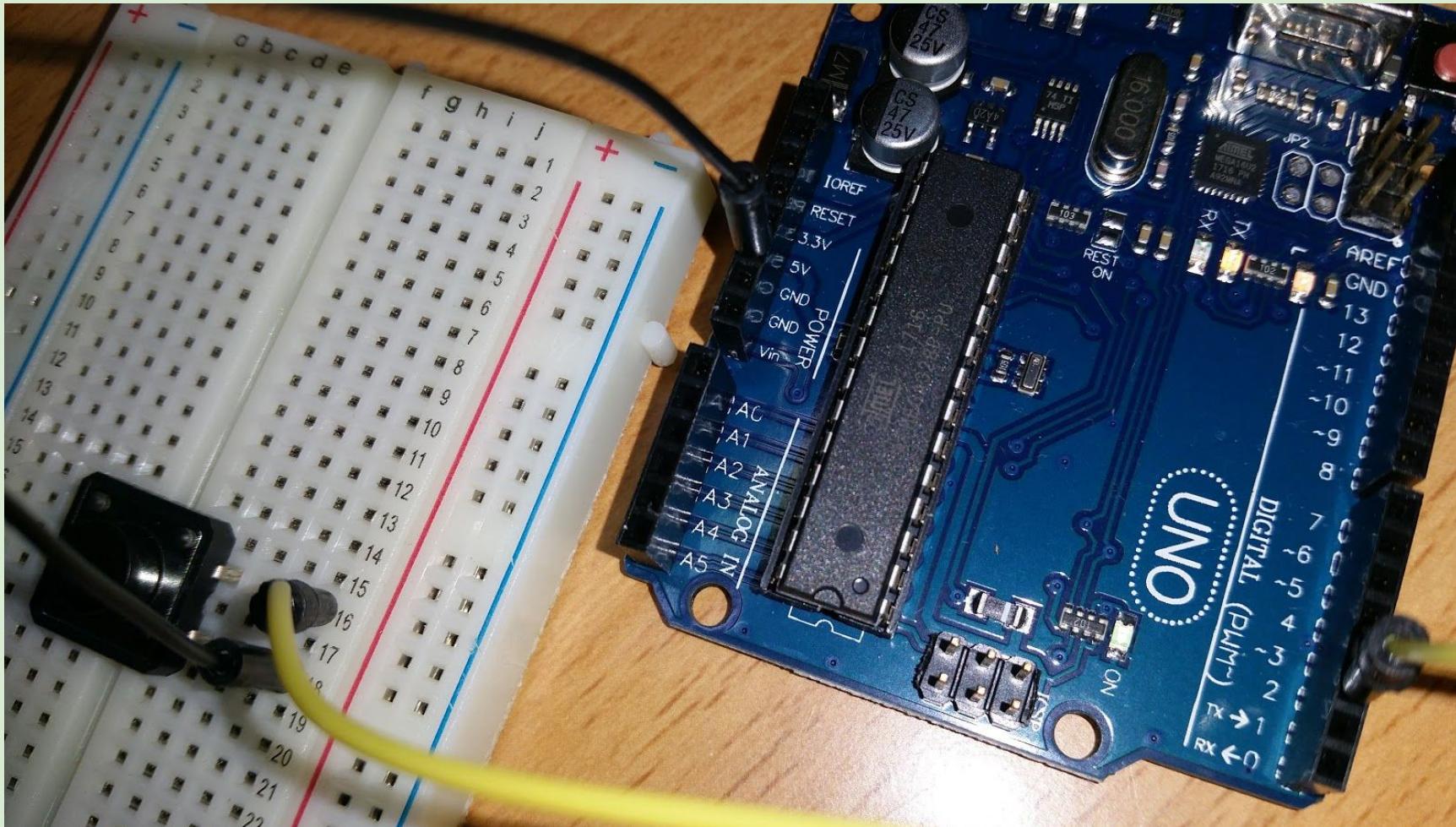
4.7. example0106\_010:



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

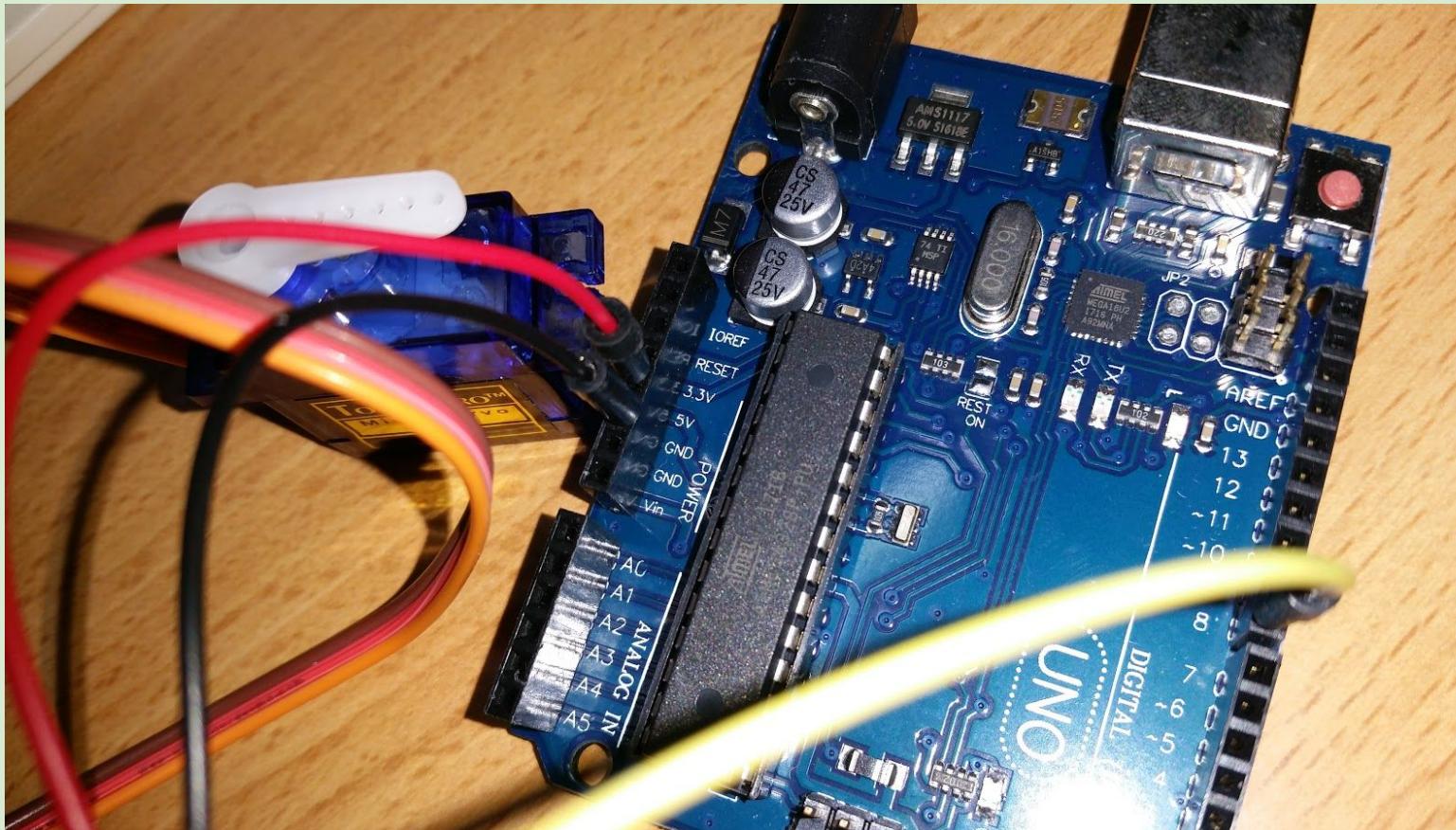
4.8. example0106\_020 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

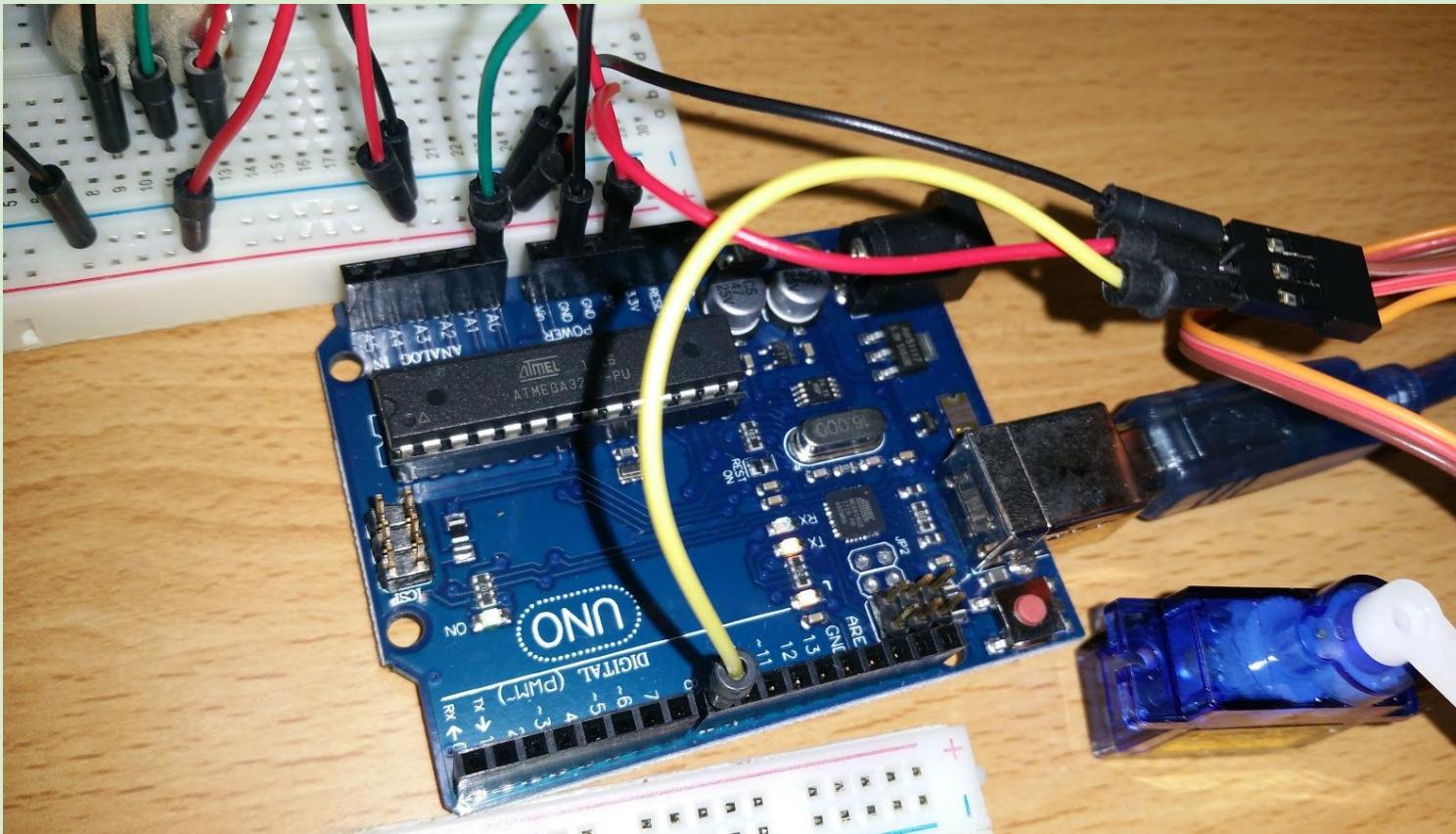
4.9. example0107 :



# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

4.10. example0107\_010 :

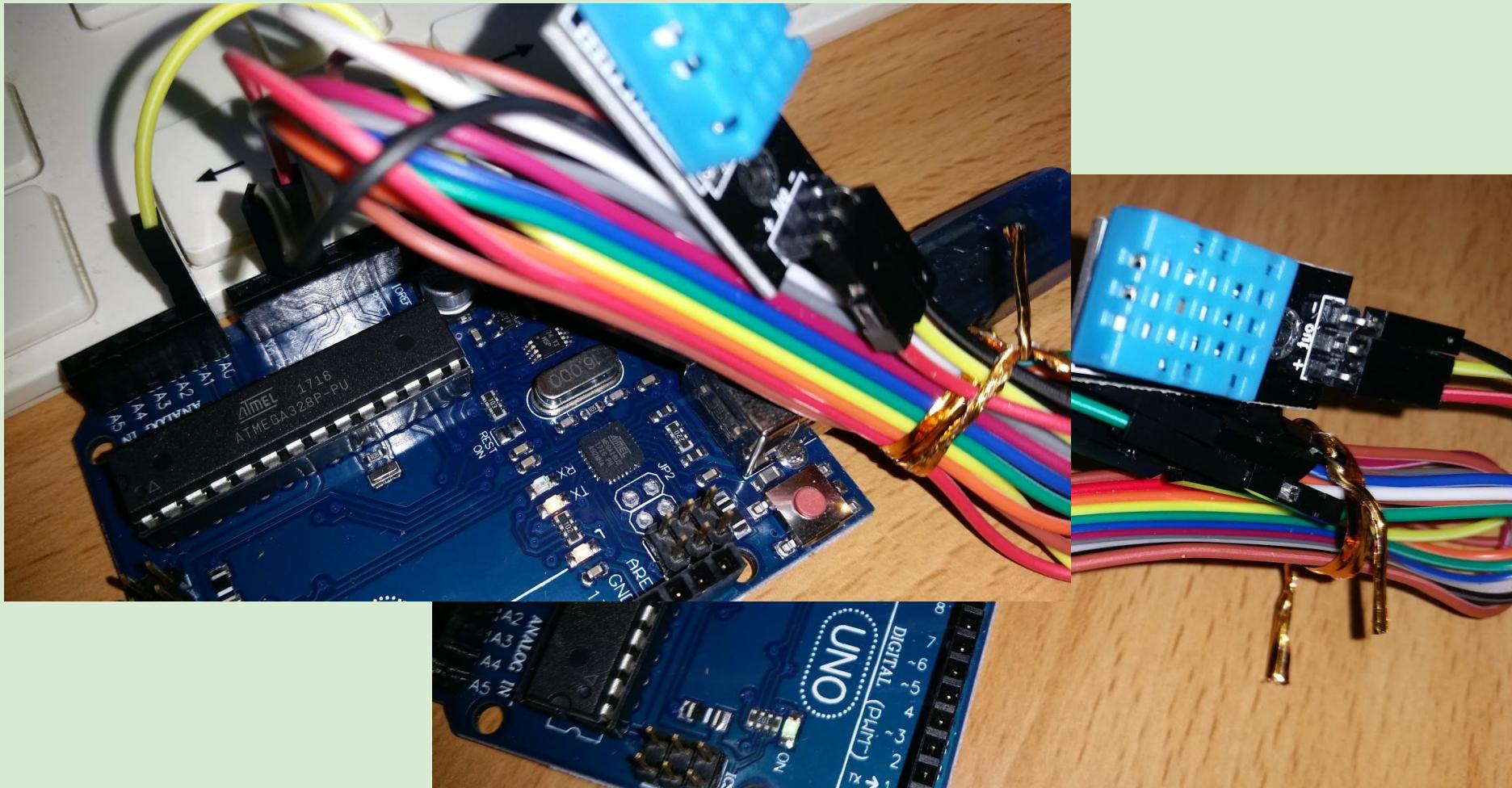


4.11. example0108, example0108\_010, example0108\_020 : None.

# Arduino :: C :: Lec\_JavaRasPi3\_0121 ::

## ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

4.12. example0109 :



Arduino :: C :: Lec\_JavaRasPi3\_0121 ::  
ex0100\_simpleLedOn.ino :: Ch04013\_DHT11\_Adafruit

