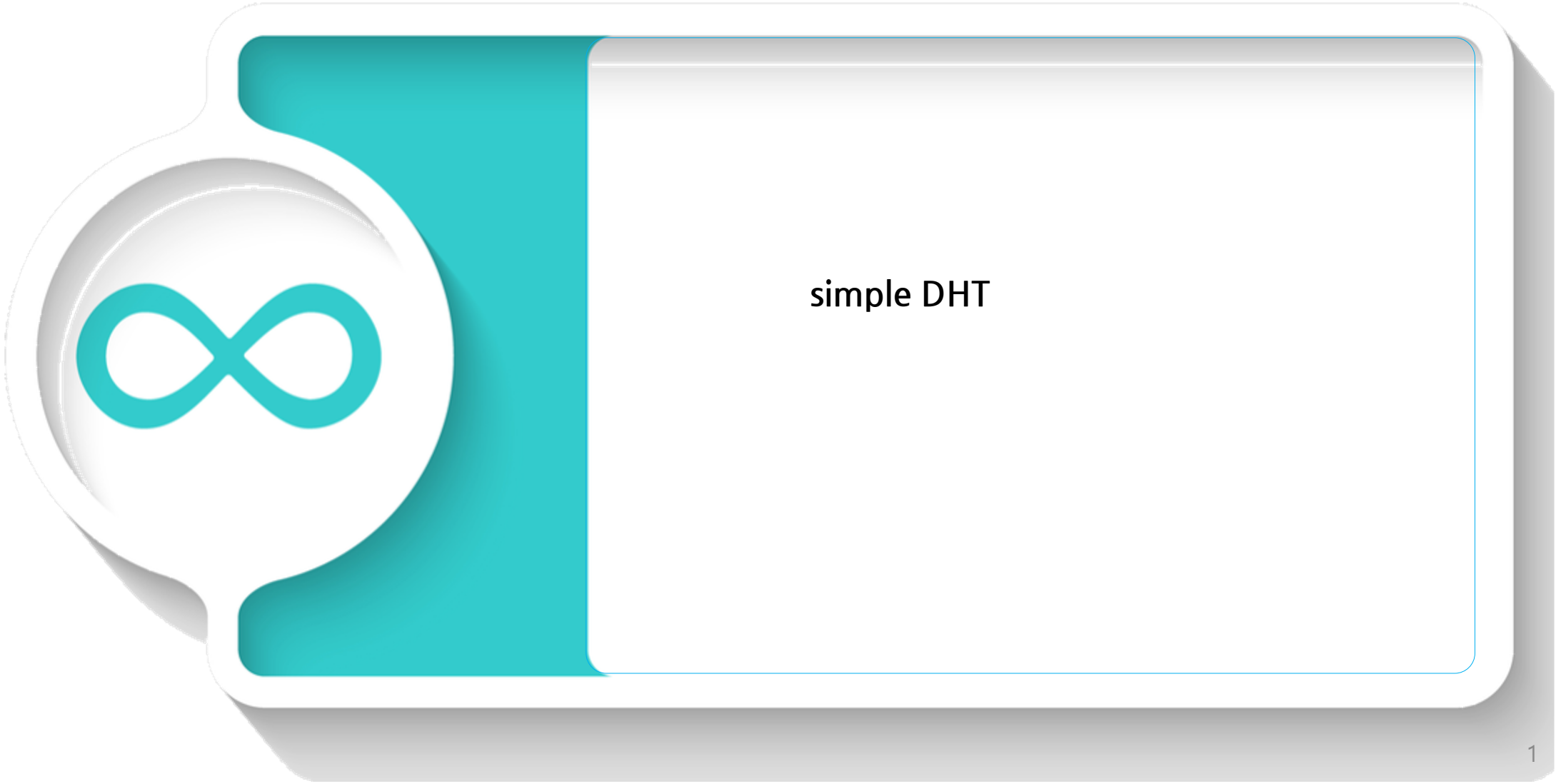
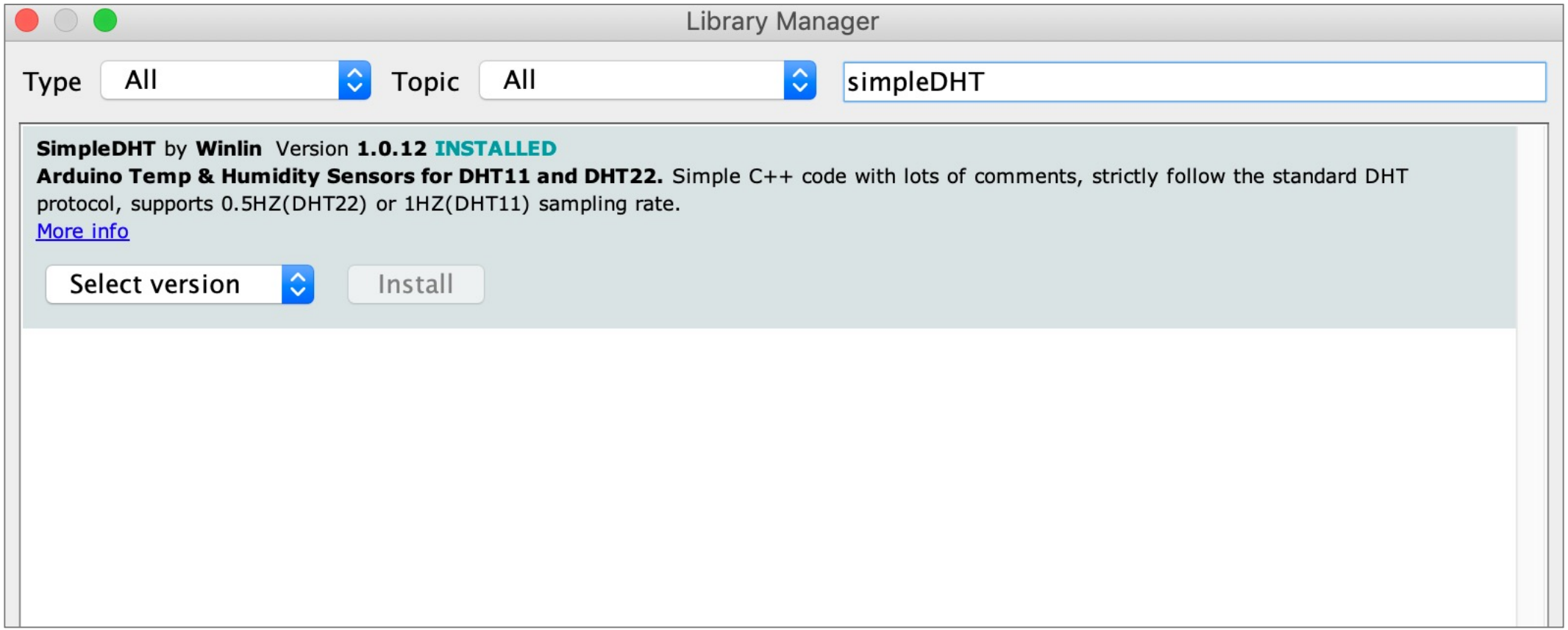
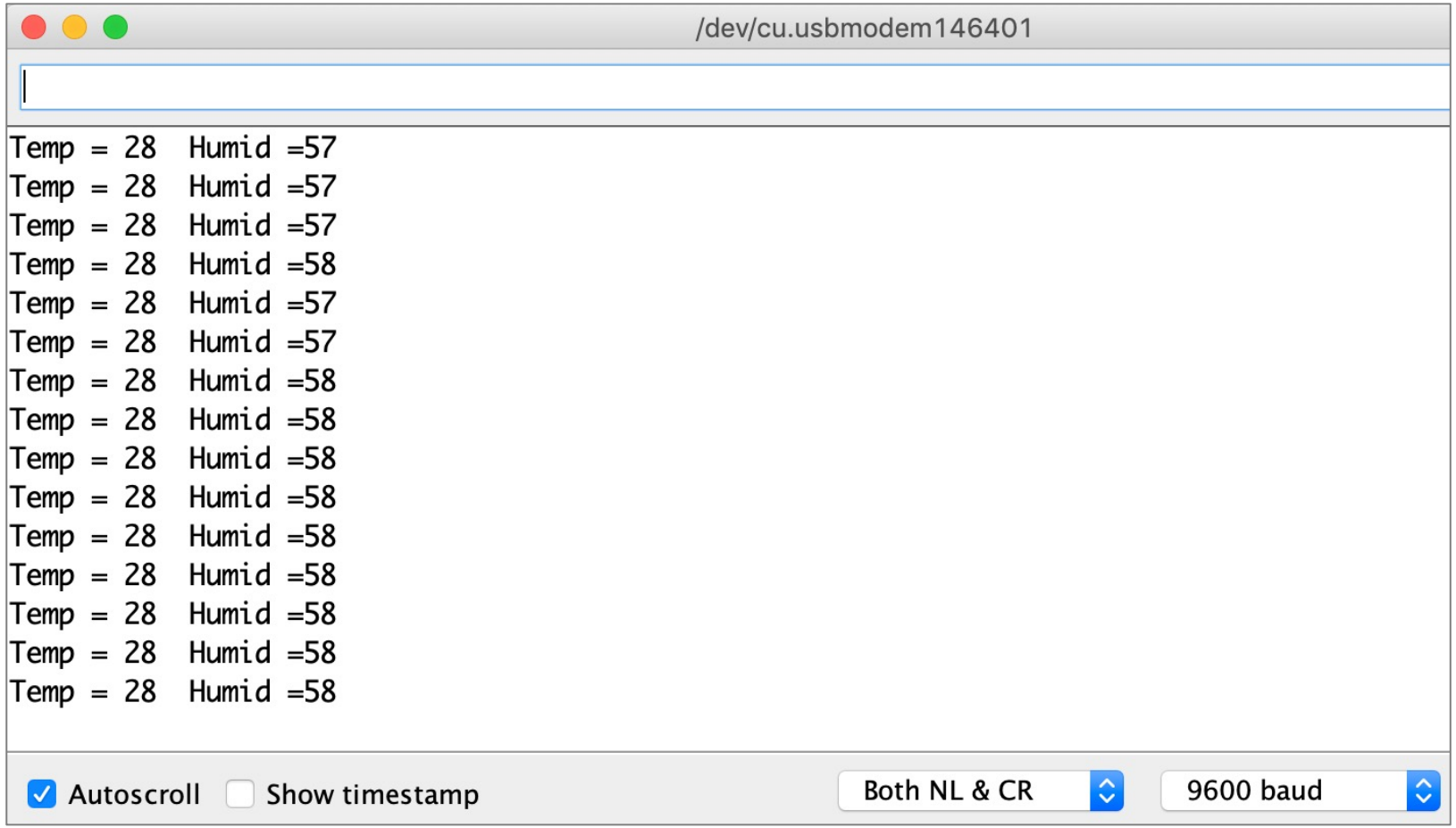


simple DHT


Library Manager
Type
All
Topic
All
simpleDHT
SimpleDHT by Winlin Version 1.0.12 INSTALLED
Arduino Temp & Humidity Sensors for DHT11 and DHT22. Simple C++ code with lots of comments, strictly follow the standard DHT protocol, supports 0.5HZ(DHT22) or 1HZ(DHT11) sampling rate.
More info
Select version
Install

Simple_DHT11

```
# include <SimpleDHT.h> // DHT at D2

SimpleDHT11 dht11;
int pinDHT11 = 2;

void setup() {
Serial.begin(9600);
}

void loop() {

 byte temperature = 0;
 byte humidity = 0;

 int result = dht11.read(pinDHT11, &temperature, &humidity, 0) ;

Serial.print("Temp = ");
Serial.print(temperature);
Serial.print("  Humid =");
Serial.println(humidity);
delay(1000); // DHT11 sampling rate is 1HZ.
}
```


/dev/cu.usbmodem146401
Temp = 28 Humid =57
Temp = 28 Humid =57
Temp = 28 Humid =57
Temp = 28 Humid =58
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Temp = 28 Humid =57
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Temp = 28 Humid =58
Temp = 28 Humid =58
Temp = 28 Humid =58
Autoscroll
Show timestamp
Both NL & CR
9600 baud

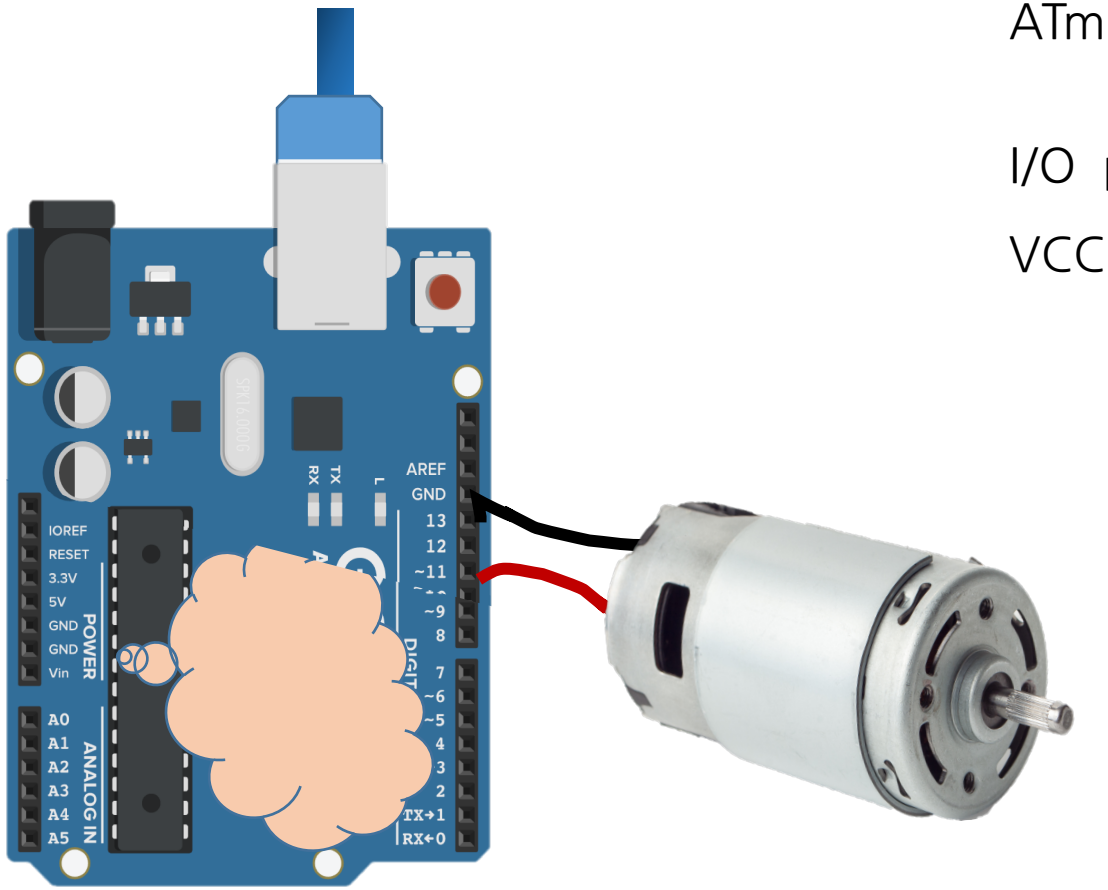
Ch5. Relay, Interrupt, Pullup, Debounce

양 세훈

SEOUL NATIONAL UNIVERSITY

1) Relay for high power control

BIG 모터 컨트롤 하려면 ?



ATmega328P Maximum Current

I/O pins = 40 mA

VCC and GND pins = 200 mA

1) Relay for high power control

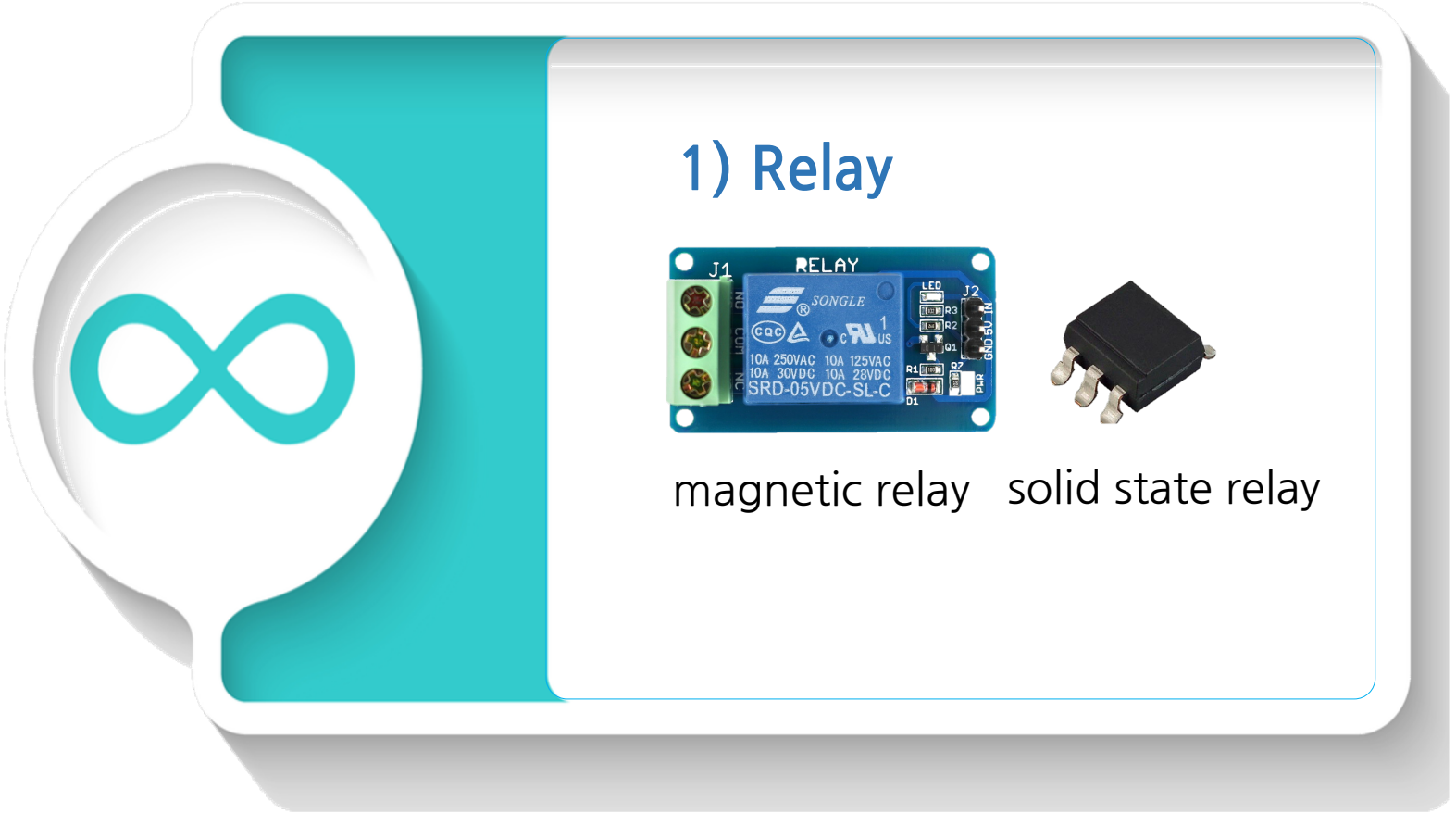
릴레이 :

마이크로 컨트롤러를 사용하여 큰 전기를 컨트롤 할때 사용된다.

프로젝트 : 마그네틱 릴레이를 사용하여 모터를 구동 시키는 회로와 코딩

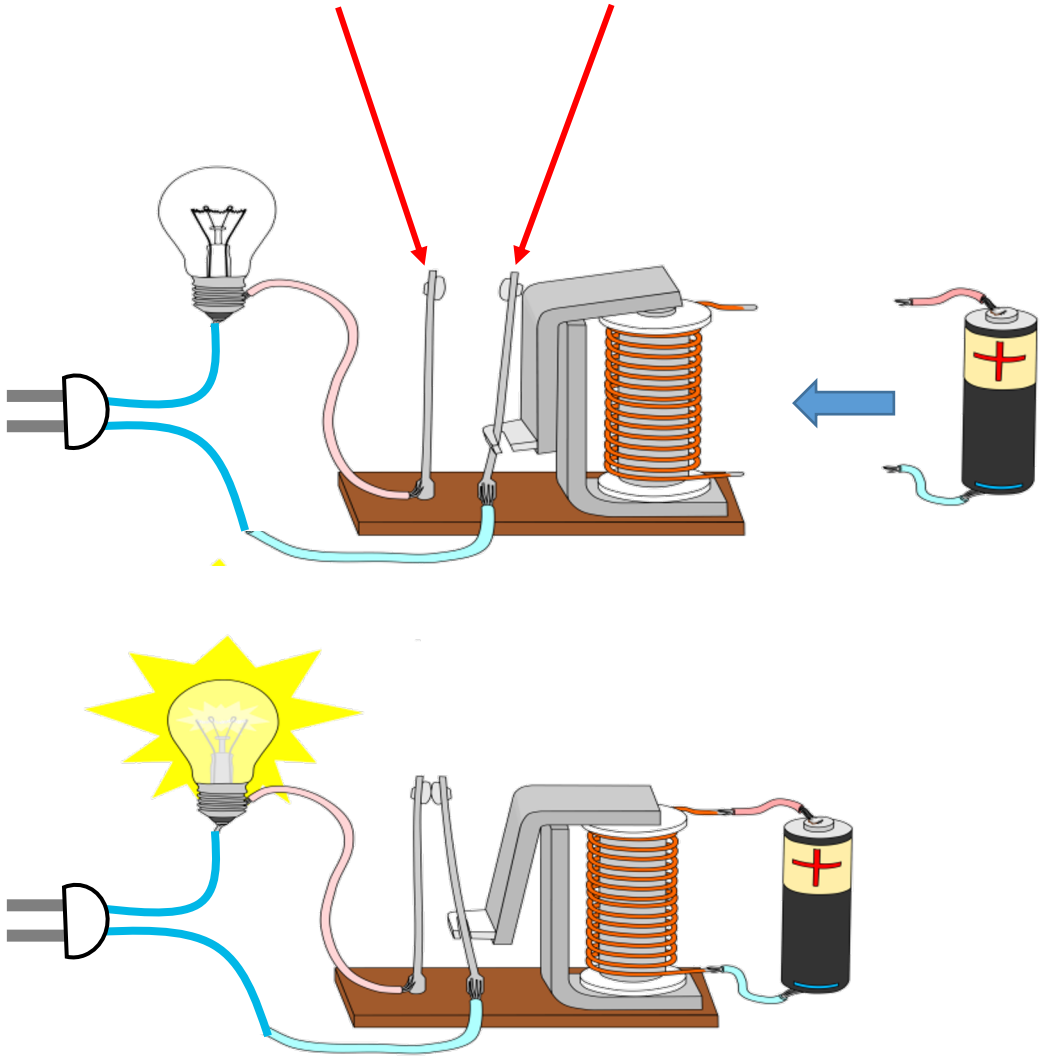
준비물 :

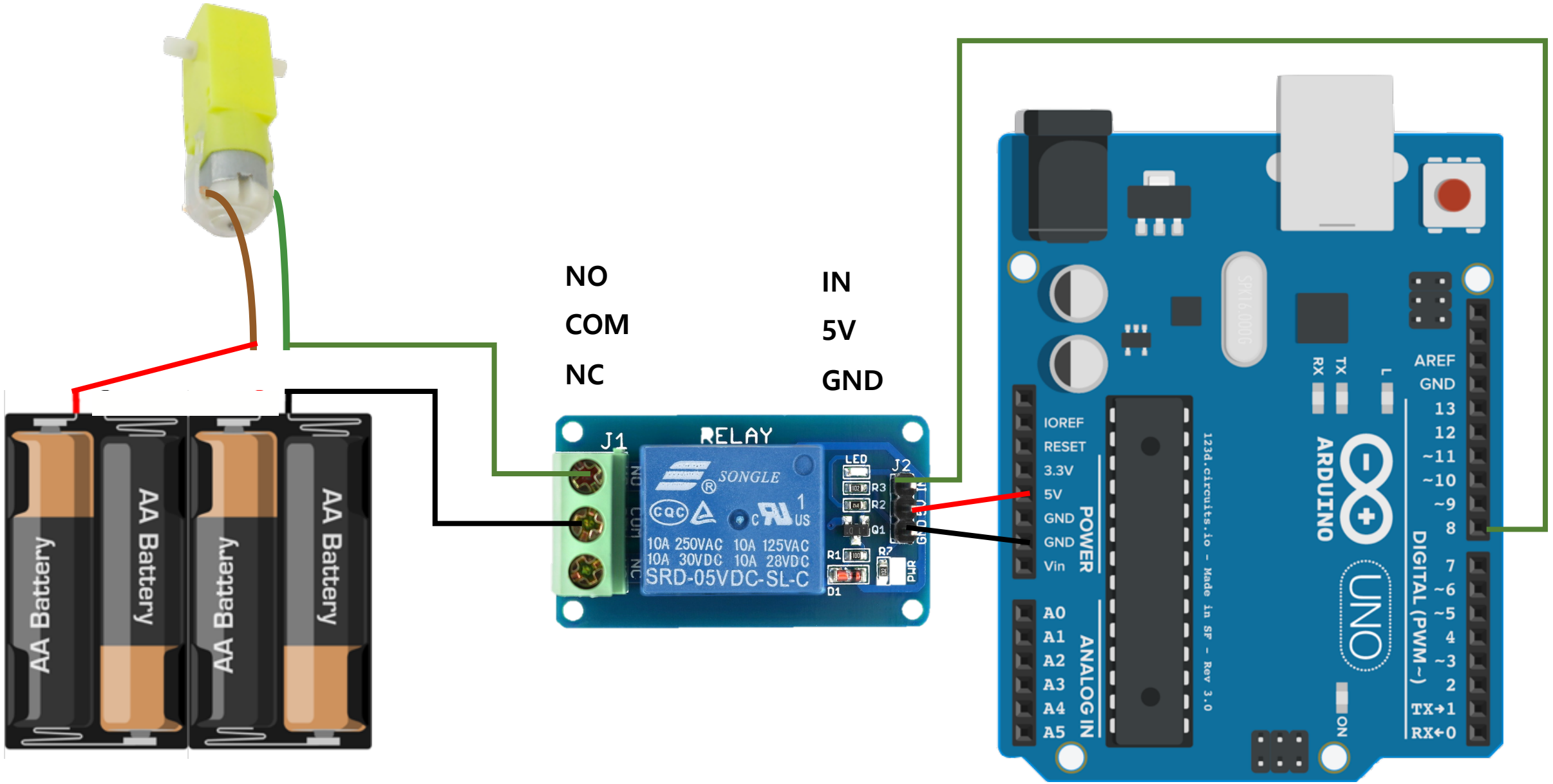
아두이노 우노 1개
마그네틱 릴레이 1개
점퍼 케이블



1) Relay for high power control

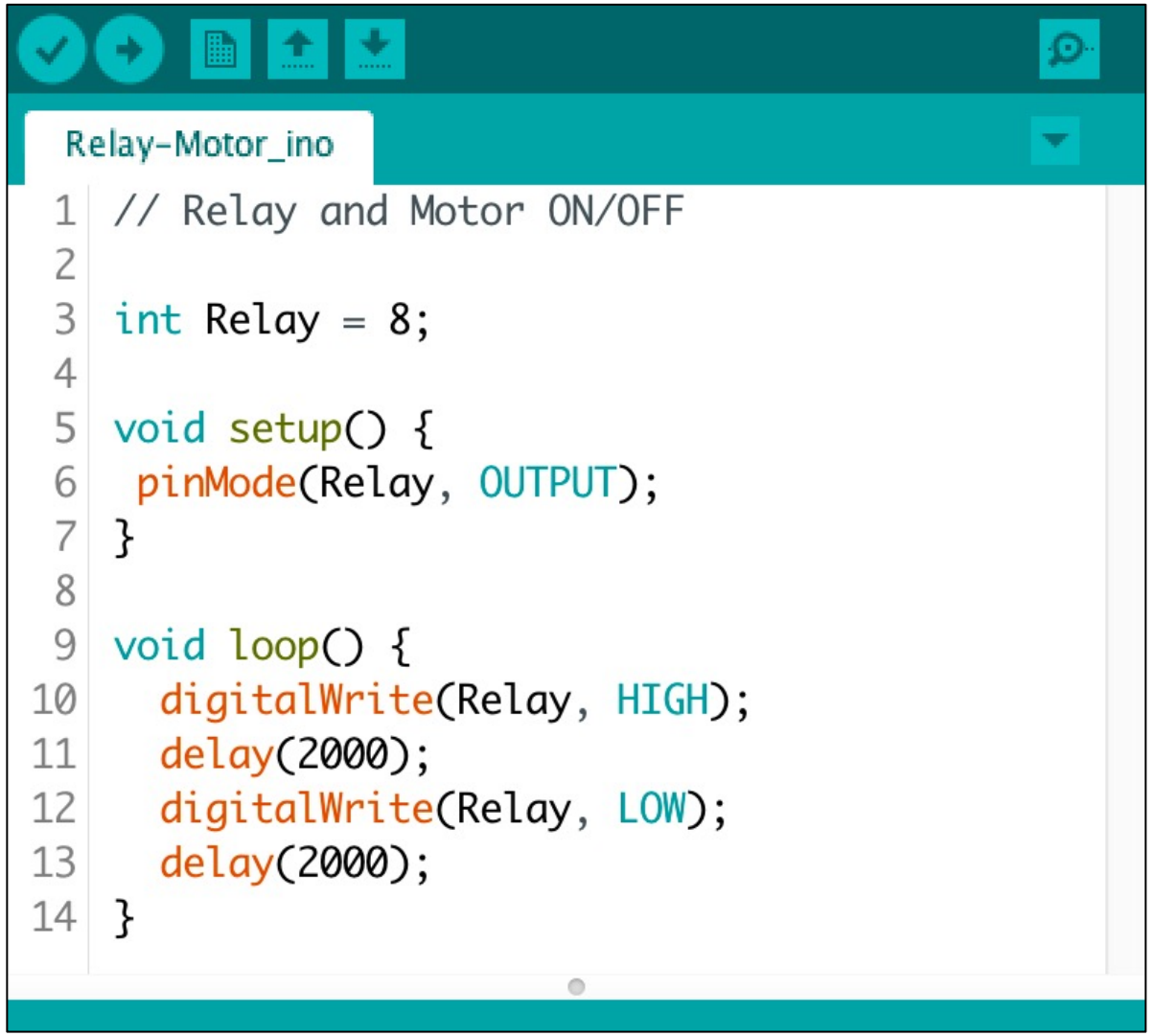
릴레이 구조 및 작동원리



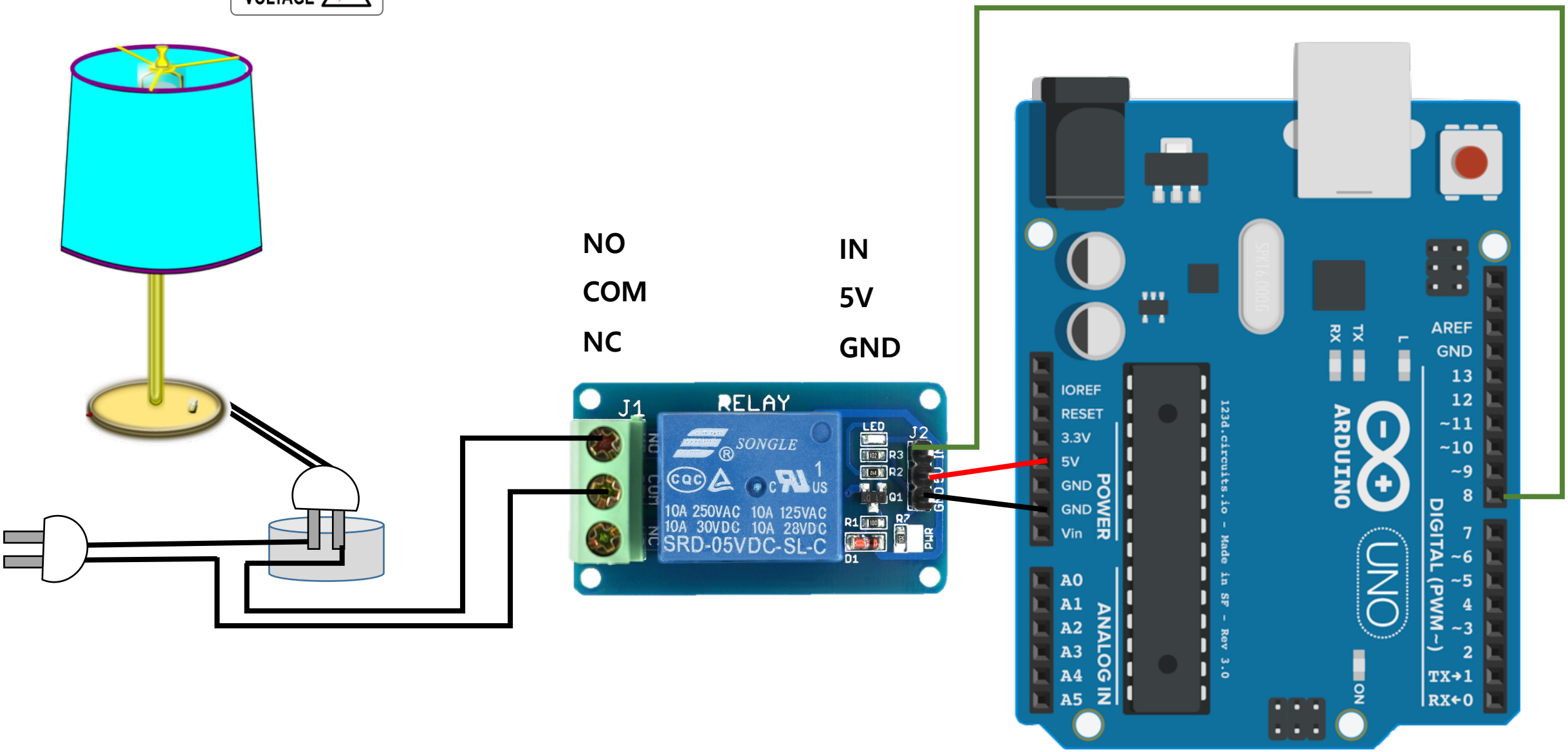

NO
COM
NC
IN
5V
GND
AA Battery
AA Battery
AA Battery
AA Battery
J1
RELAY
SONGLE
10A 250VAC 10A 125VAC
10A 30VDC 10A 28VDC
SRD-05VDC-SL-C
LED
J2
R3
R2
Q1
R1
R7
D1
NO
COM
NC
IN
GND
5V
IOREF
RESET
3.3V
5V
GND
GND
Vin
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
ARDUINO
UNO
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM~)
TX
RX
L
ON
123d.circuits.io - Made in SF - Rev 3.0

1) Relay for high power control

Motor ON/OFF control through Relay Sketch

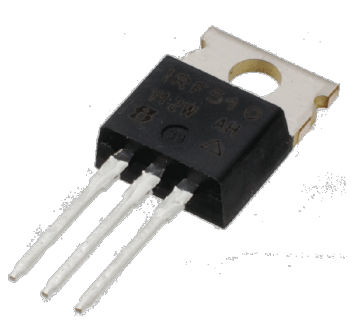


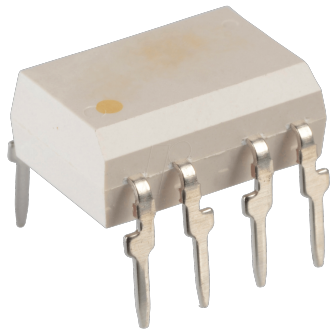
220 볼트를 다루는 일이기 때문에
전기에 대하여 잘 아는 분의 도움을 받으세요

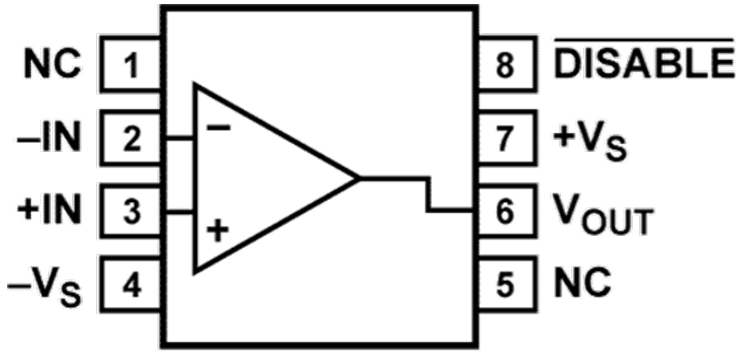


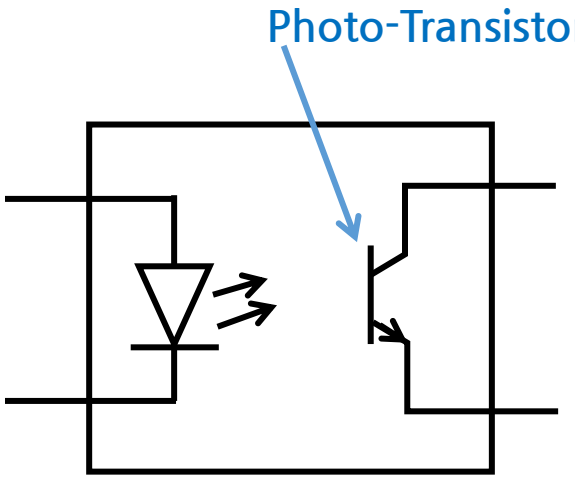
Transistor : BJT, MOFET

Opto-coupler(Opto isolator)

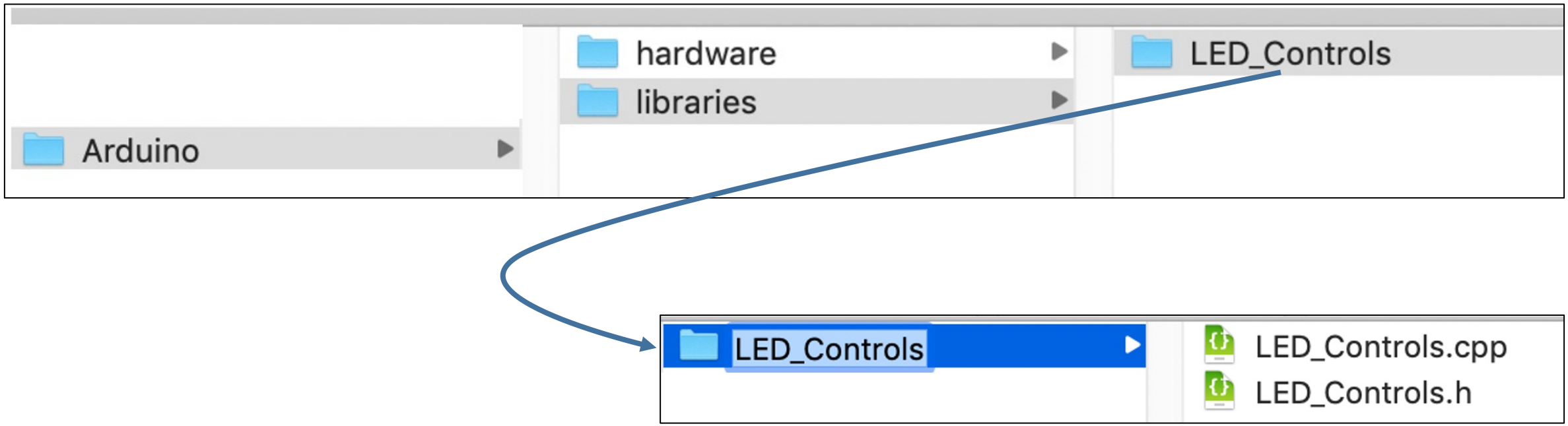


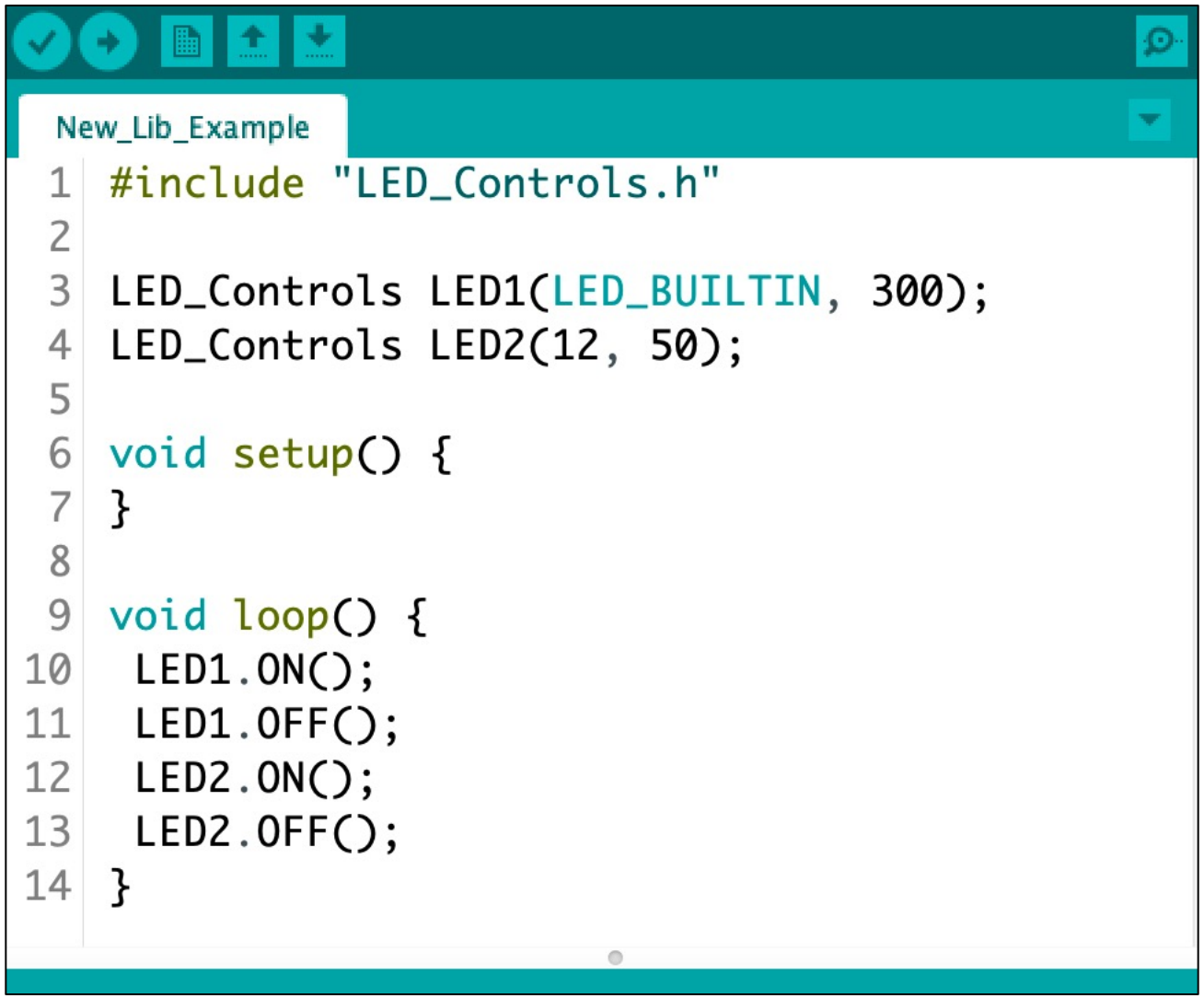






Arduino Library making


hardware
libraries
Arduino
LED_Controls
LED_Controls
LED_Controls.cpp
LED_Controls.h


New_Lib_Example
#include "LED_Controls.h"
LED_Controls LED1(LED_BUILTIN, 300);
LED_Controls LED2(12, 50);
void setup() {
}
void loop() {
LED1.ON();
LED1.OFF();
LED2.ON();
LED2.OFF();
}

LED_Controls.h

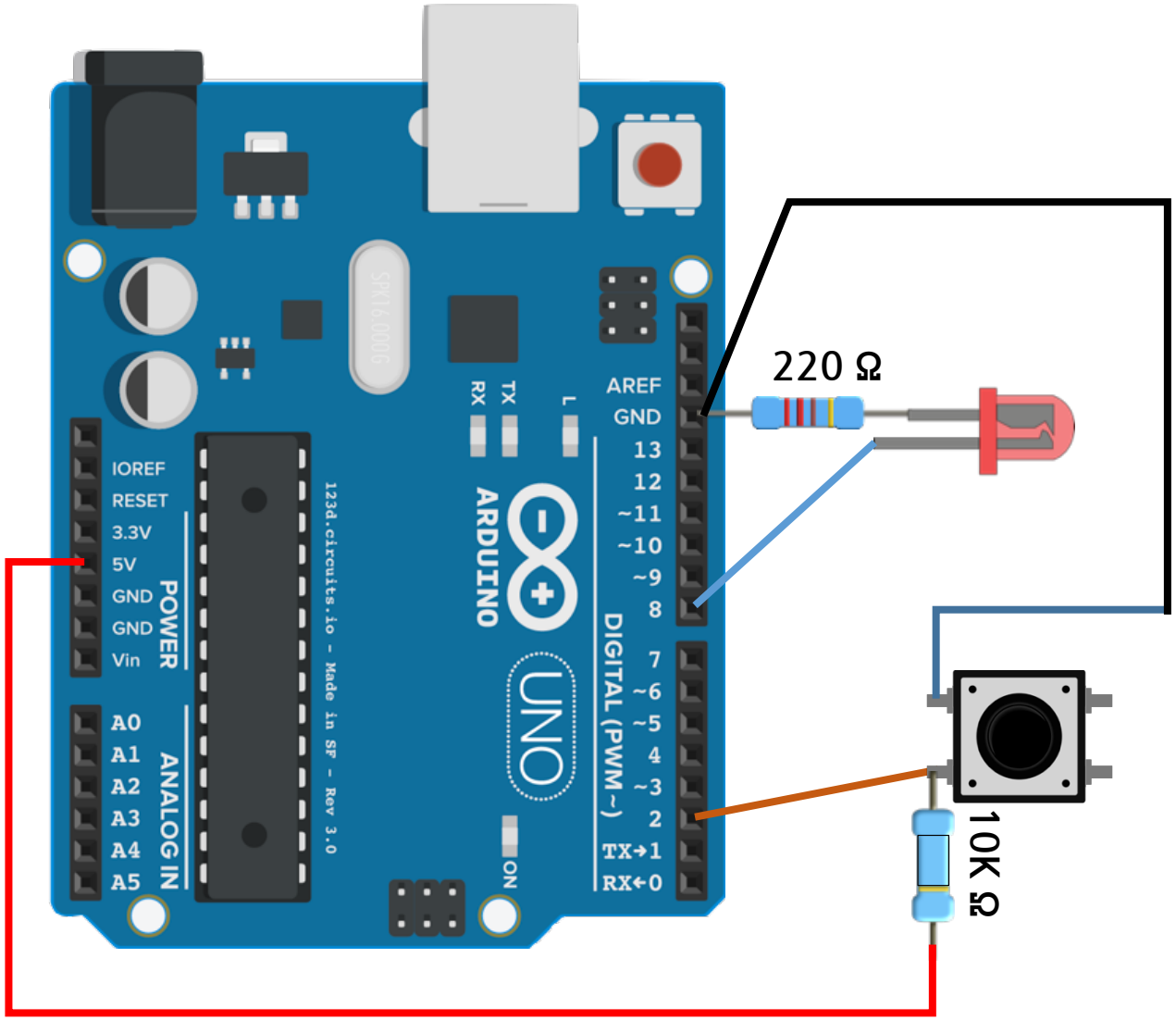
```h
#ifndef LED_Controls_H
#define LED_Controls_H
#include "arduino.h"

class LED_Controls {
  public:
    LED_Controls(int pin, int delay);
    void ON();
    void OFF();
    int _pin;
    int _delay;
};

#endif

```

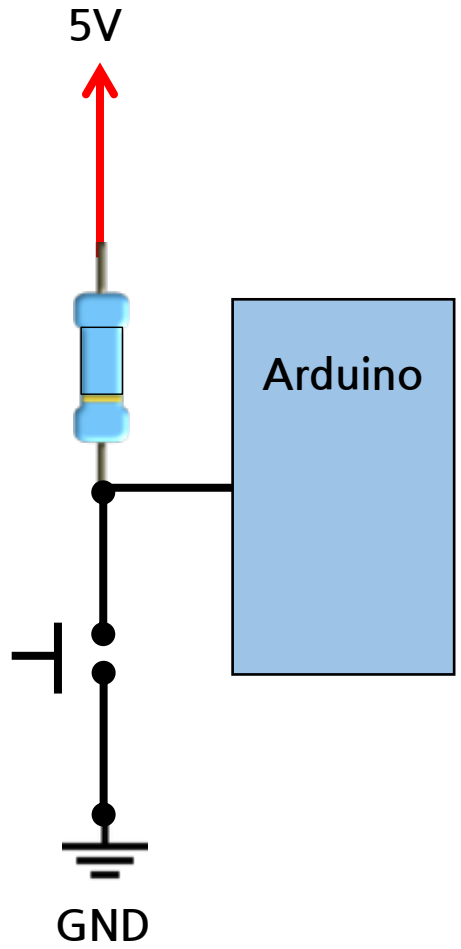
LED_Controls.cpp

```cpp
#include "LED_Controls.h"

LED_Controls::LED_Controls(int pin,  int led_delay){
  pinMode(pin, OUTPUT);
  _pin   = pin;
  _delay = led_delay;
}

void LED_Controls::ON(){
  digitalWrite(_pin,HIGH);
  delay(_delay);
}

void LED_Controls::OFF(){
  digitalWrite(_pin,LOW);
  delay(_delay);
}

```


2) Pull up resistor

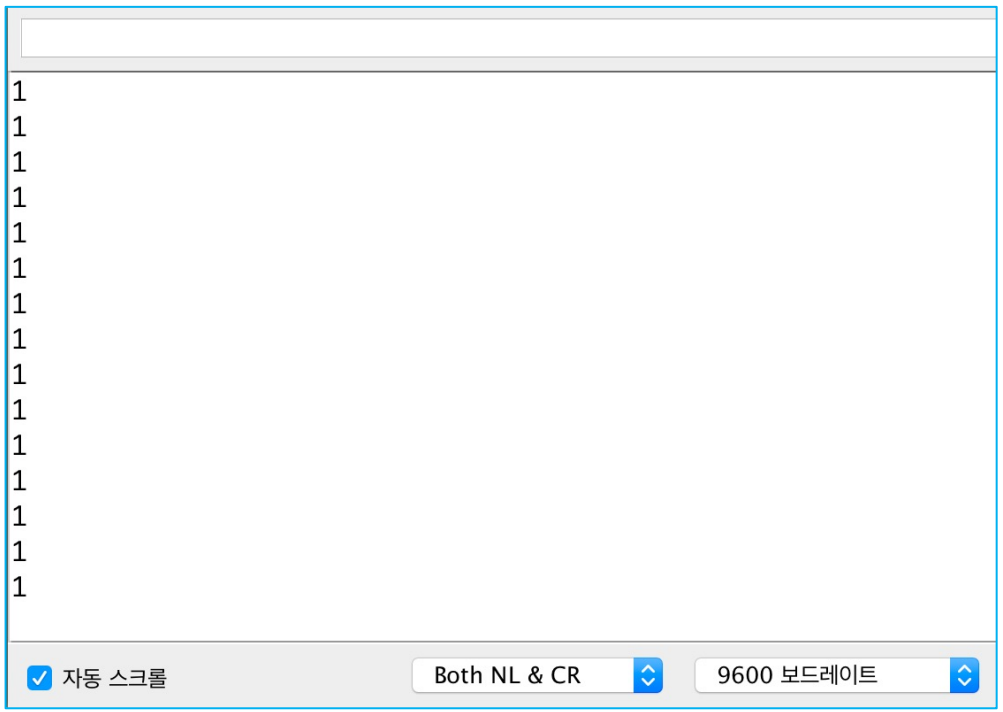
PULL UP circuit



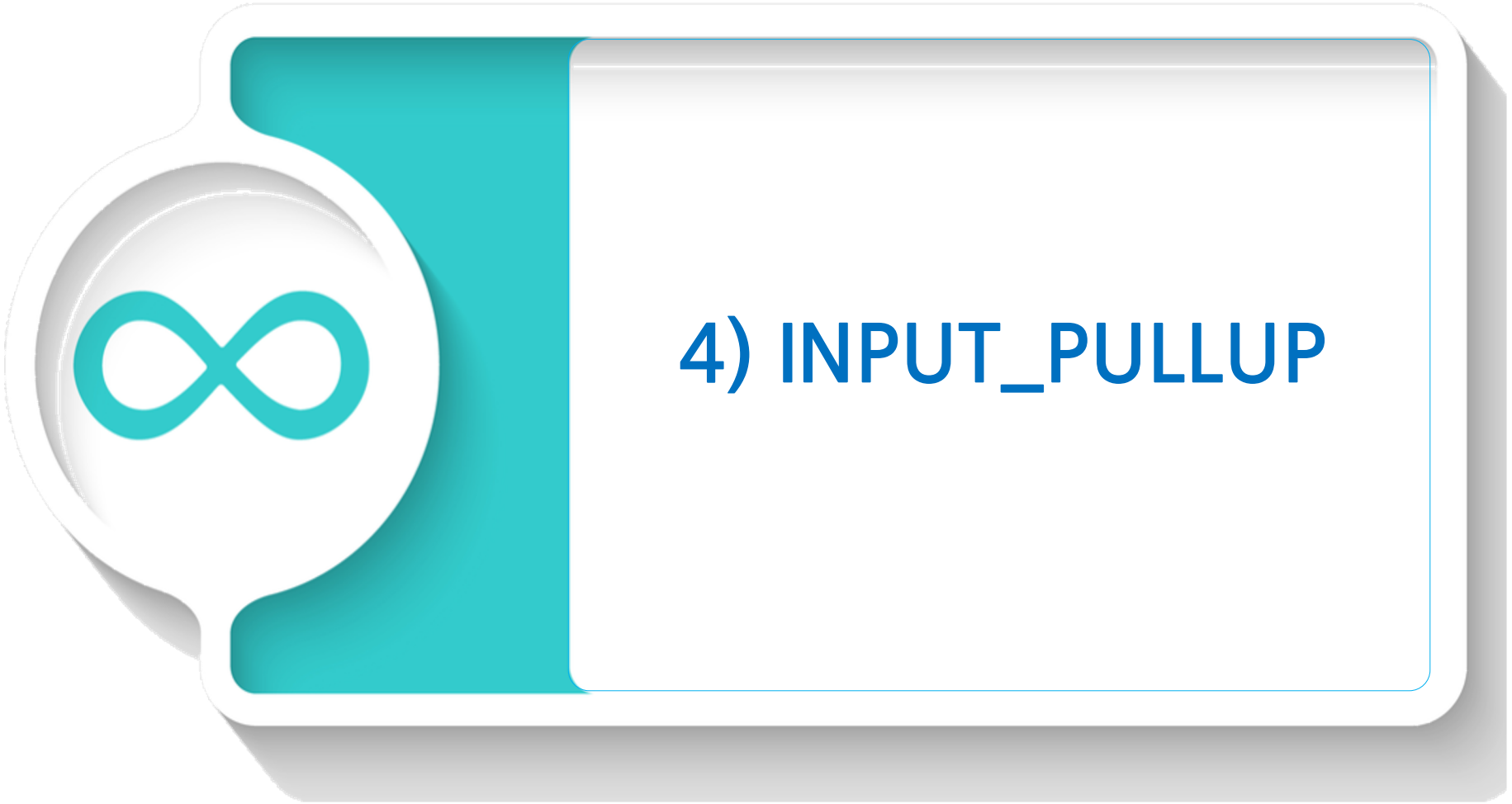


Push_button_PULLUP

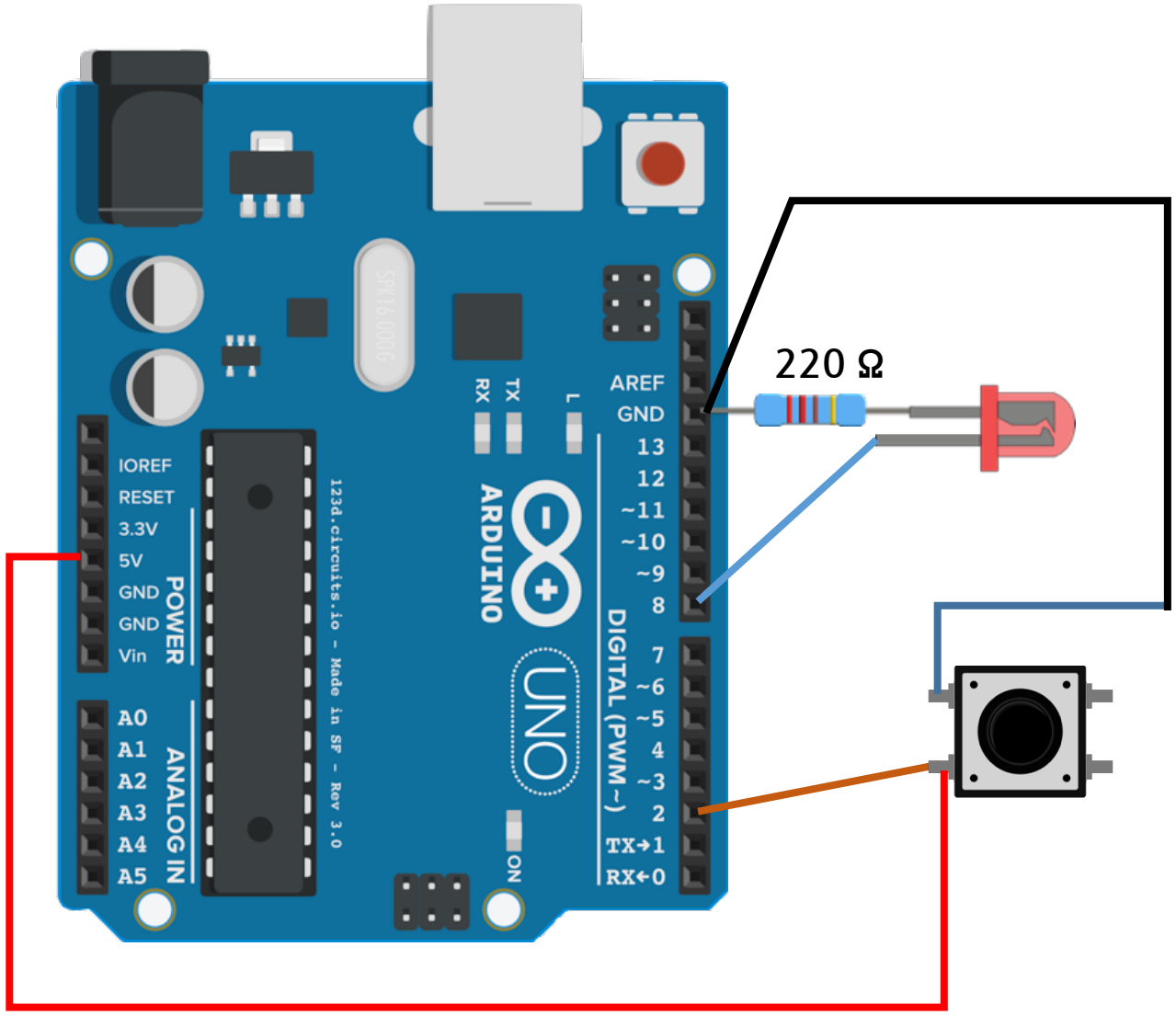
```
// Push button to turn ON/OFF LED

int LED = 8 ;  // Global variable
int inputPin = 2 ; // Global variable

void setup() {
 pinMode(LED, OUTPUT) ;
 pinMode(inputPin, INPUT_PULLUP) ;
 Serial.begin(9600) ;
}

void loop() {
 int value = digitalRead(2) ; // Local variable

 if( value == 1 ) {
   digitalWrite(LED, 1) ;
 }
   else {
     digitalWrite(LED, 0) ;
   }
   Serial.println(value) ;
   delay(1000) ;
 }
```

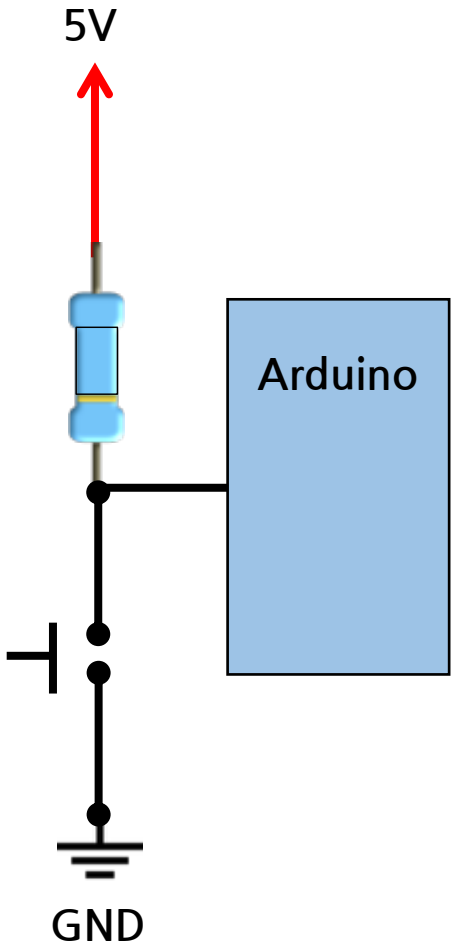


4) Internal Pull Up



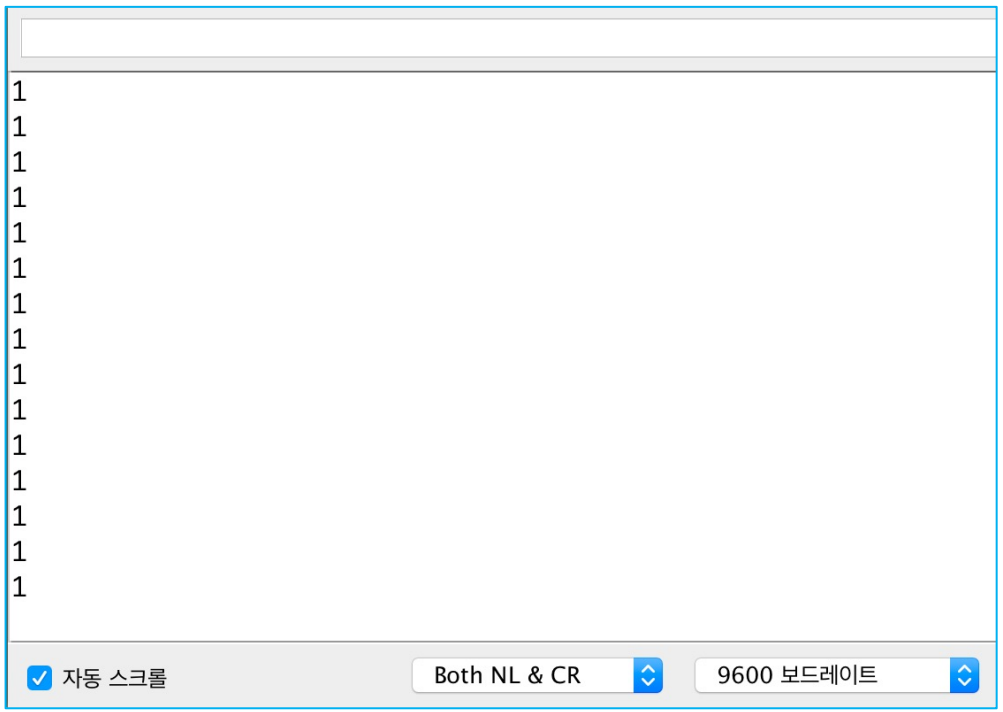
PULL UP circuit





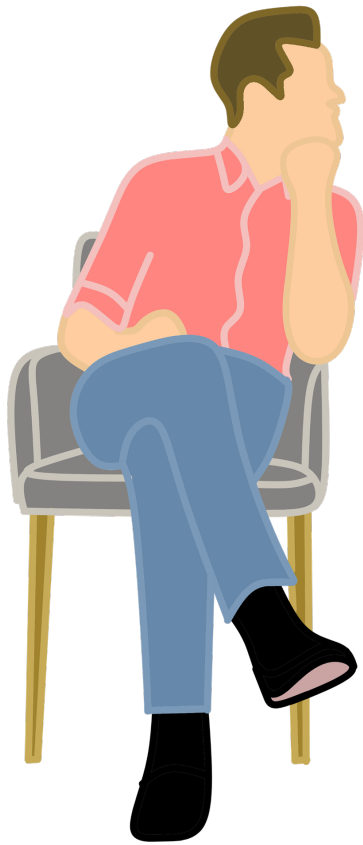
Push_button_PULLUP

```
// Push button to turn ON/OFF LED

int LED = 8 ;  // Global variable
int inputPin = 2 ; // Global variable

void setup() {
 pinMode(LED, OUTPUT) ;
 pinMode(inputPin, INPUT_PULLUP) ;
 Serial.begin(9600) ;
}

void loop() {
 int value = digitalRead(2) ; // Local variable

 if( value == 1 ) {
   digitalWrite(LED, 1) ;
 }
   else {
     digitalWrite(LED, 0) ;
   }
   Serial.println(value) ;
   delay(1000) ;
 }
```



3) Interrupt

Polling



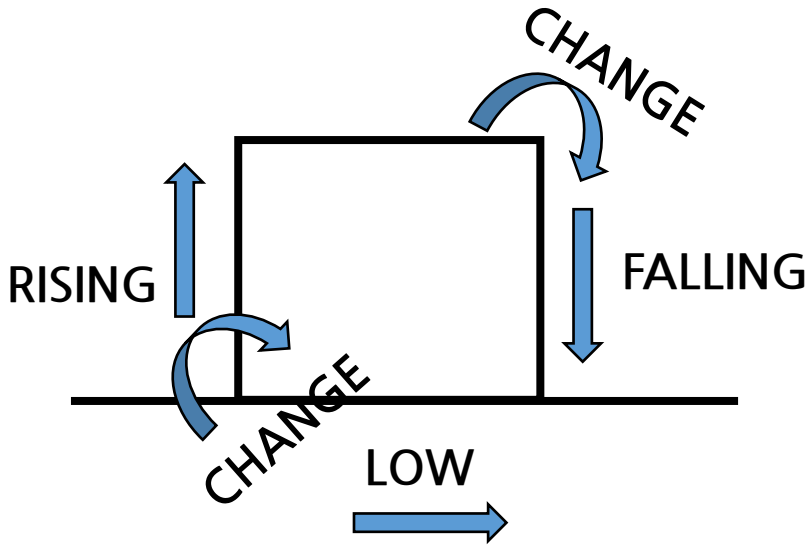
Interrupt

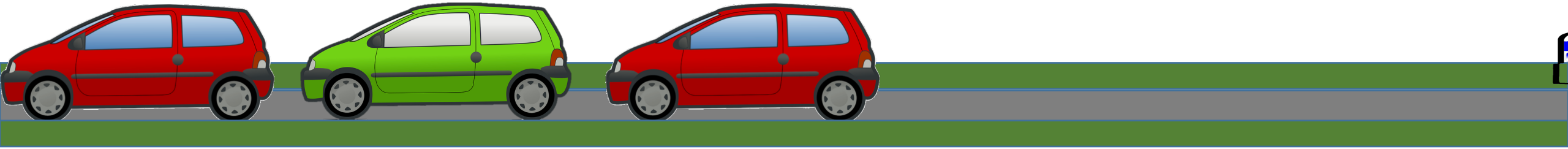
2) Interrupt

우선 통행

attachInterrpt(pin#, function name, condition)

pin# = attach interrupt pin number
condition: LOW, RISING, FALLING, CHANGE





2) Interrupt

아두이노 우노 보드 경우 attachInterrpt 0 번 과 1번은 디지털 핀 D2 와 D3 이다.

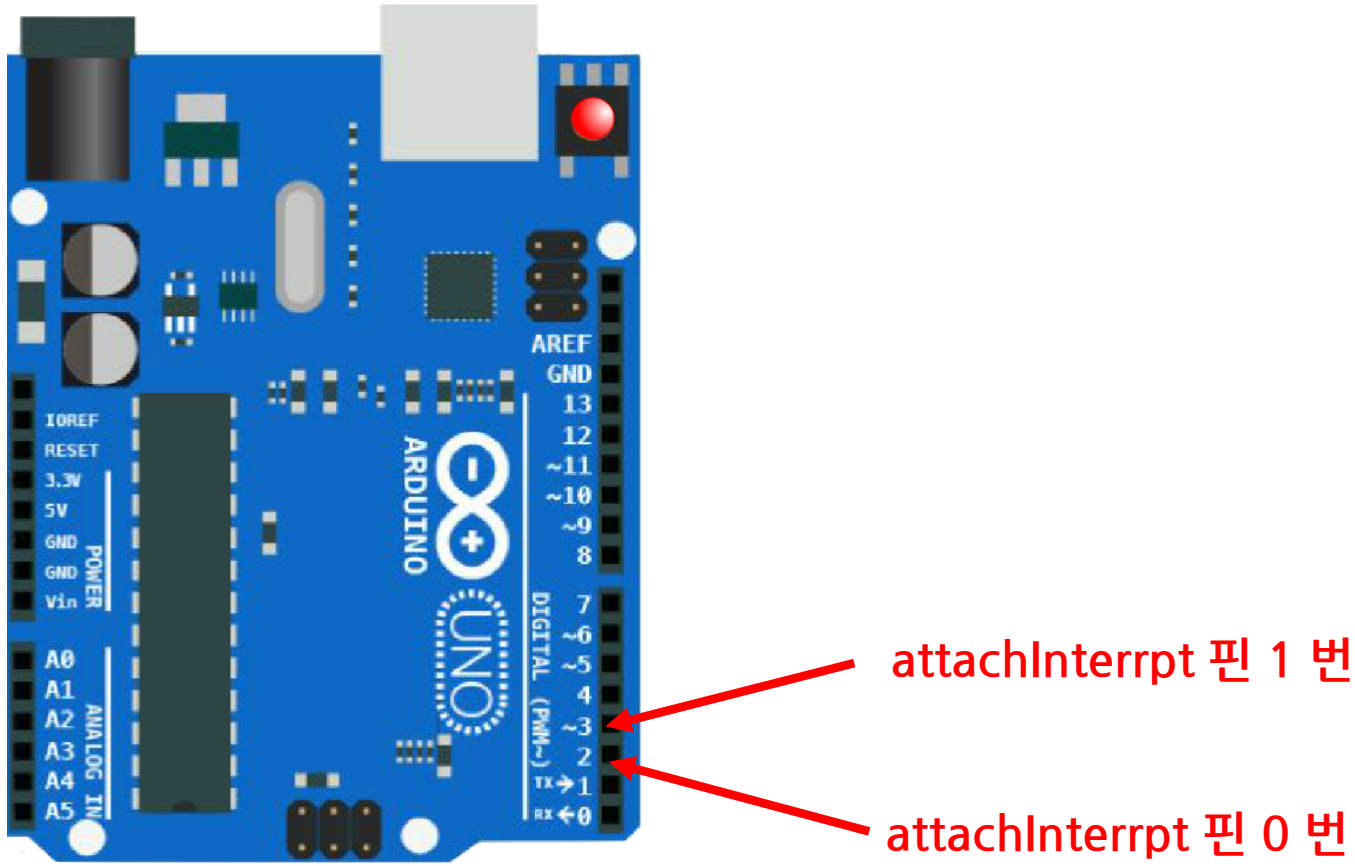
프로젝트 :

13번 핀에 연결한 LED 는 켜져 있는 상태를 유지한다.

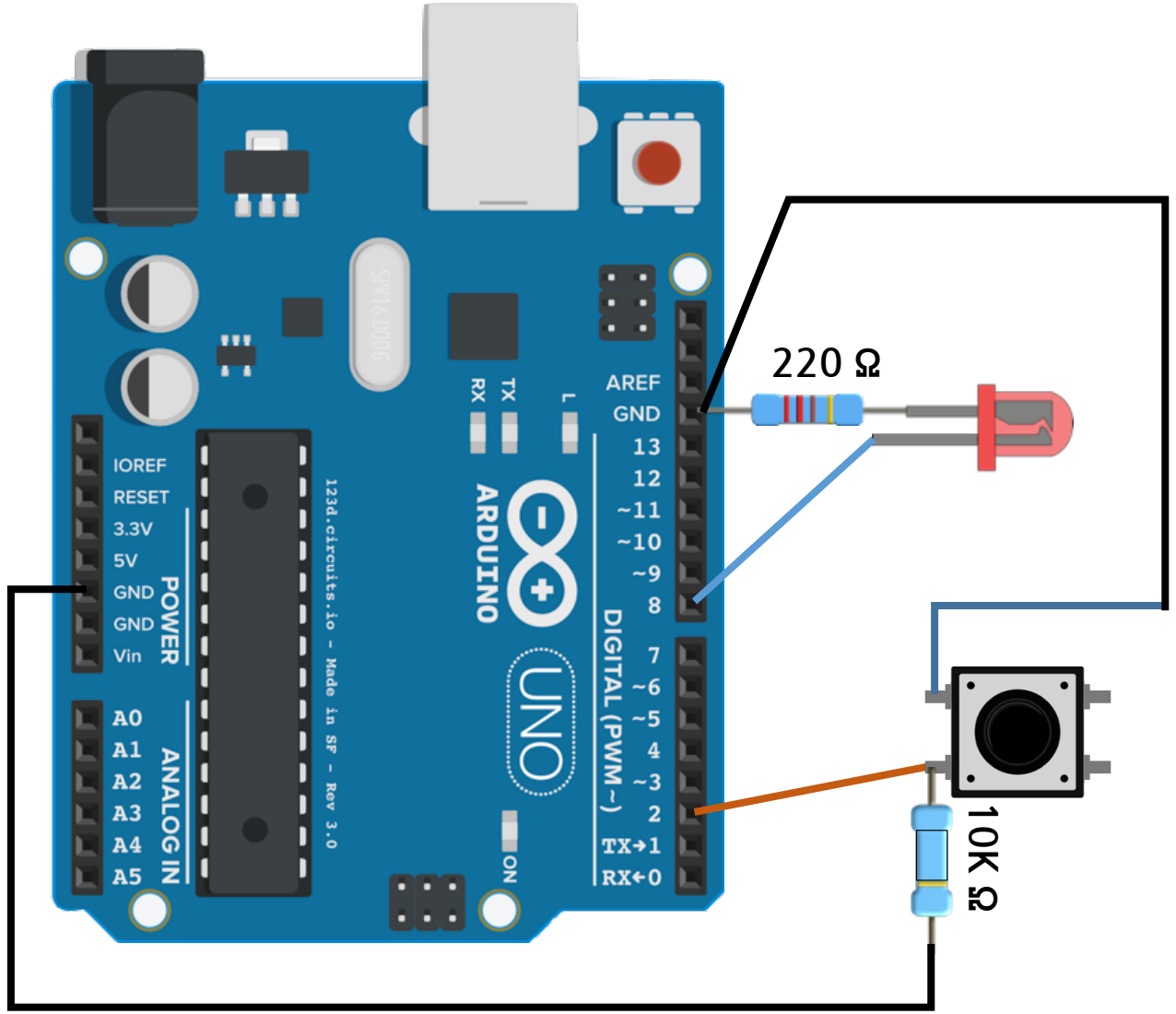
푸쉬 버튼을 attachInterrpt 0 번 에

연결하고, 푸시 했을 때 8 번핀과 연결된

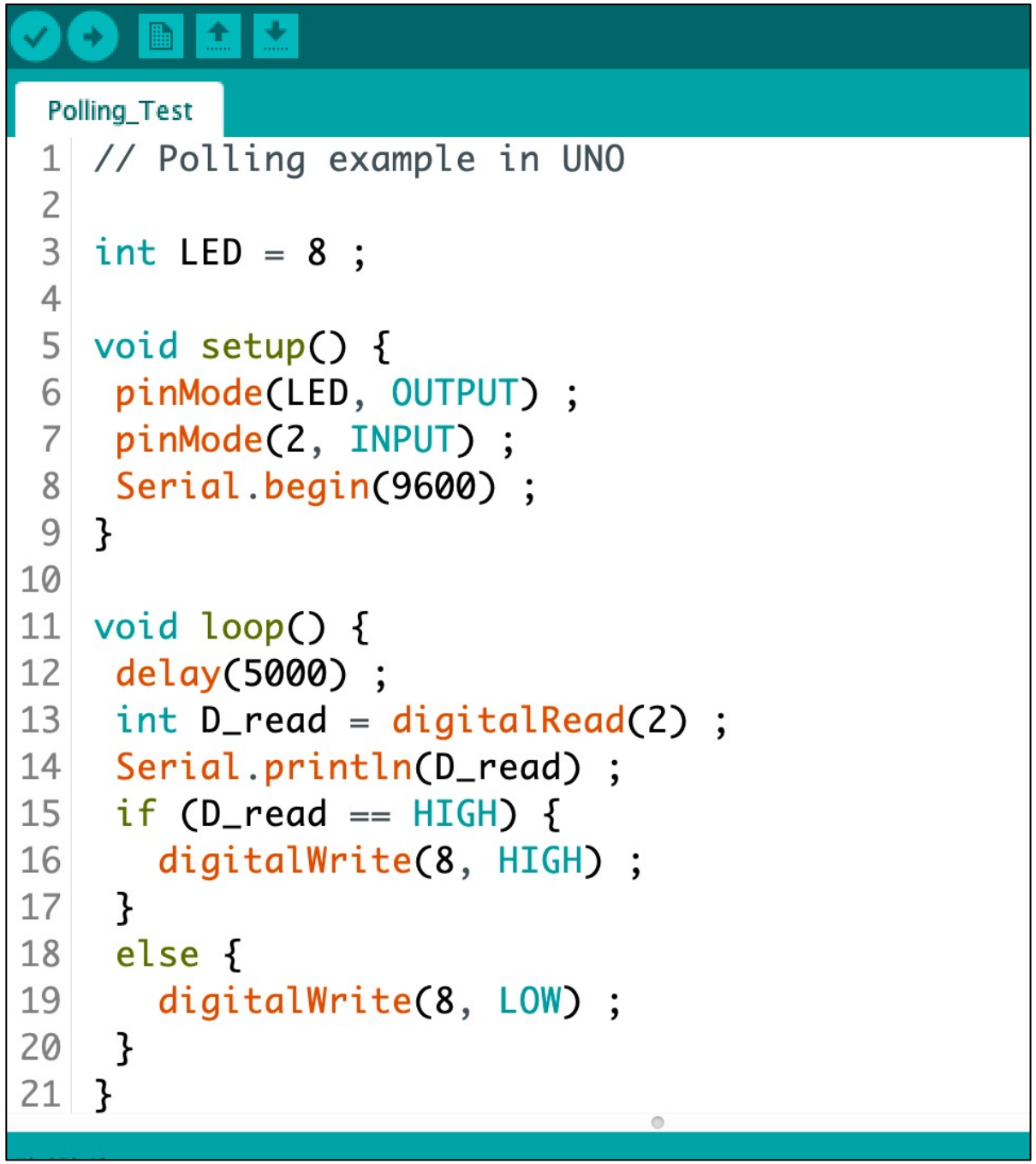
LED 가 켜지는 회로와 스케치 작성한다.



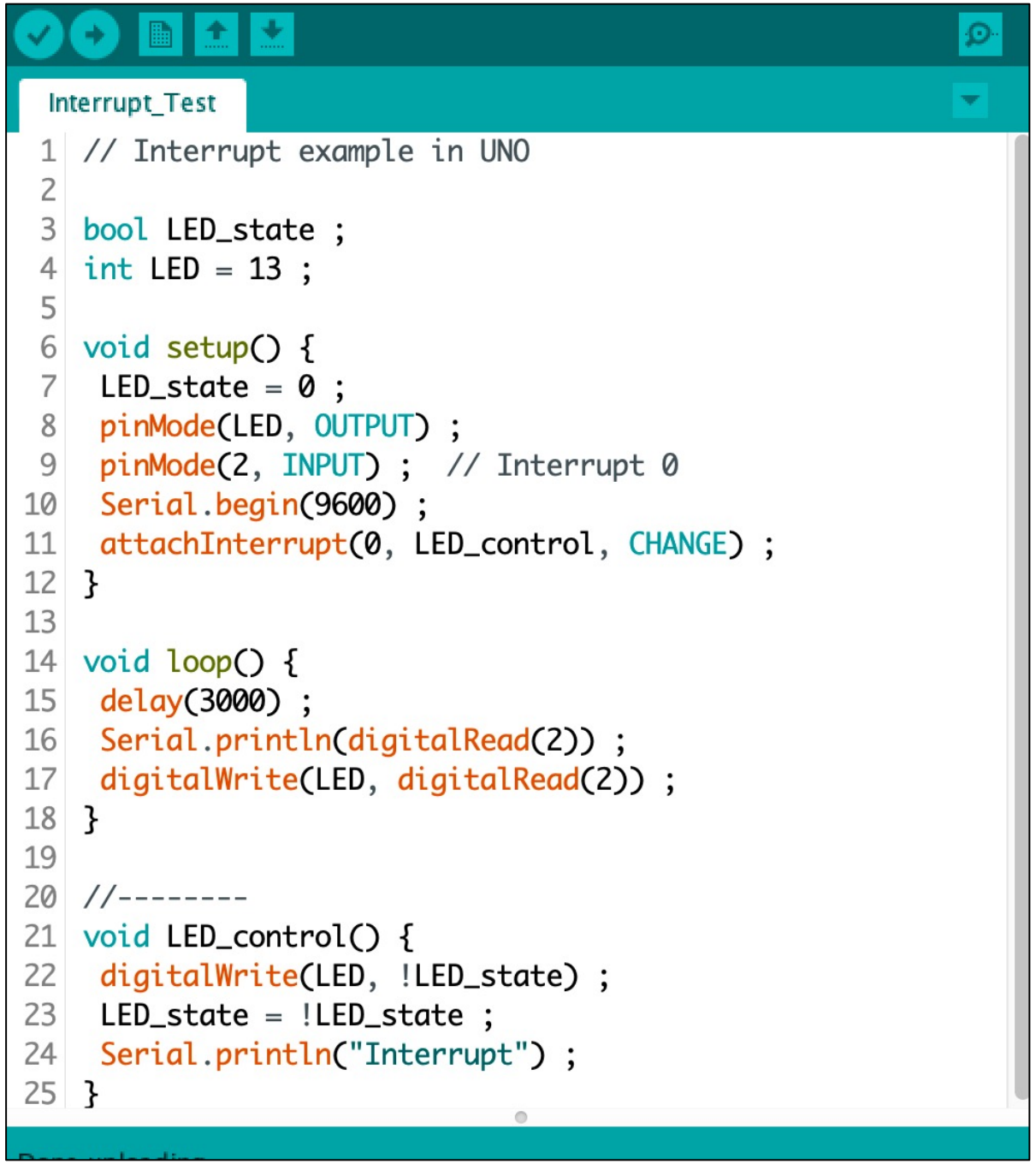
PULL DOWN circuit

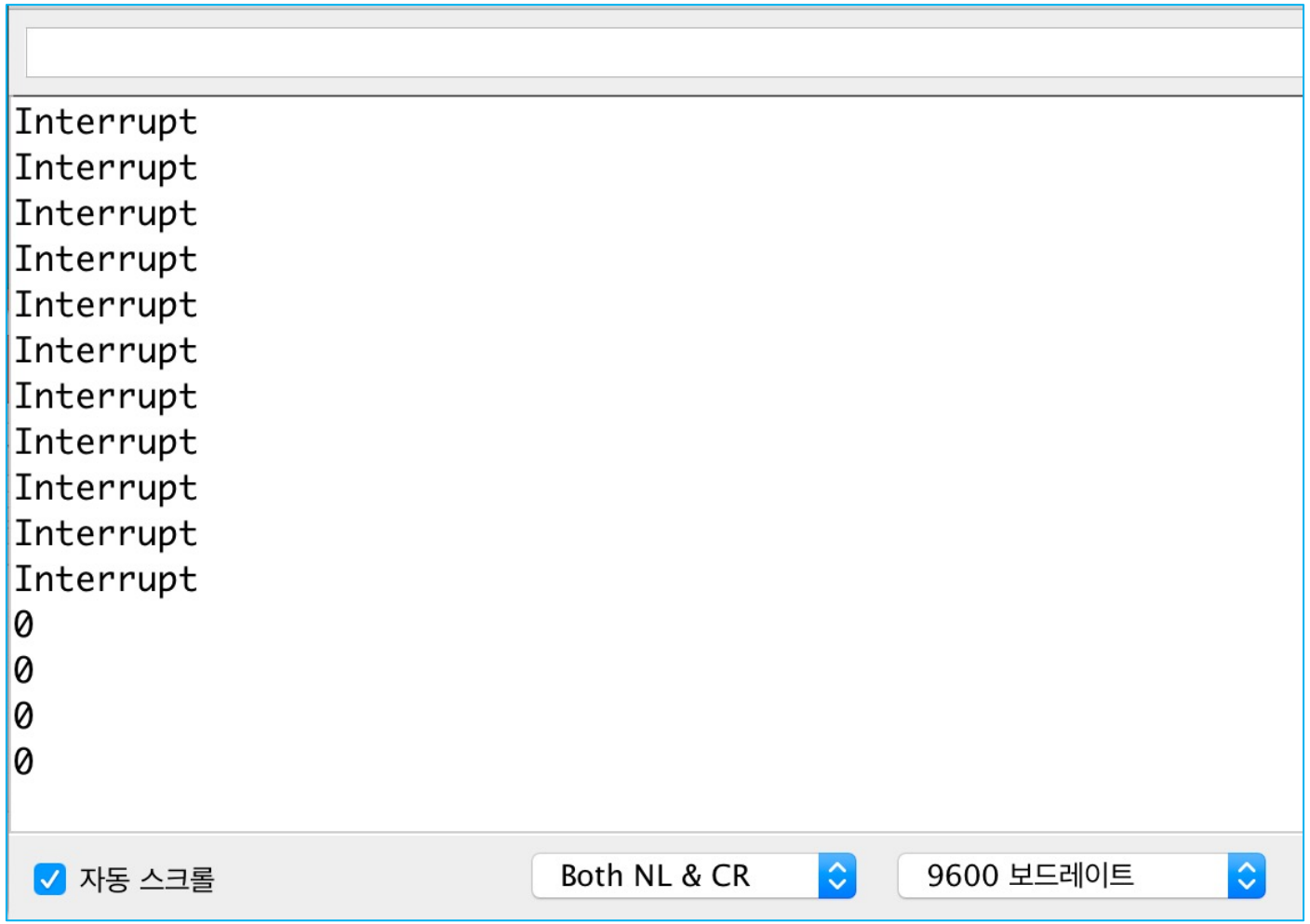


Polling

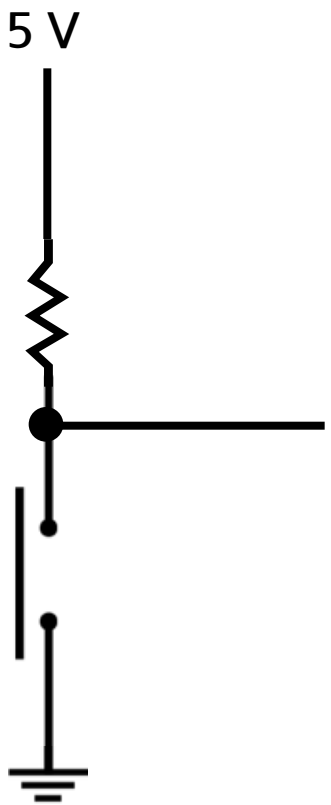

Polling_Test
1 // Polling example in UNO
2
3 int LED = 8 ;
4
5 void setup() {
6 pinMode(LED, OUTPUT) ;
7 pinMode(2, INPUT) ;
8 Serial.begin(9600) ;
9 }
10
11 void loop() {
12 delay(5000) ;
13 int D_read = digitalRead(2) ;
14 Serial.println(D_read) ;
15 if (D_read == HIGH) {
16 digitalWrite(8, HIGH) ;
17 }
18 else {
19 digitalWrite(8, LOW) ;
20 }
21 }

Interrupt

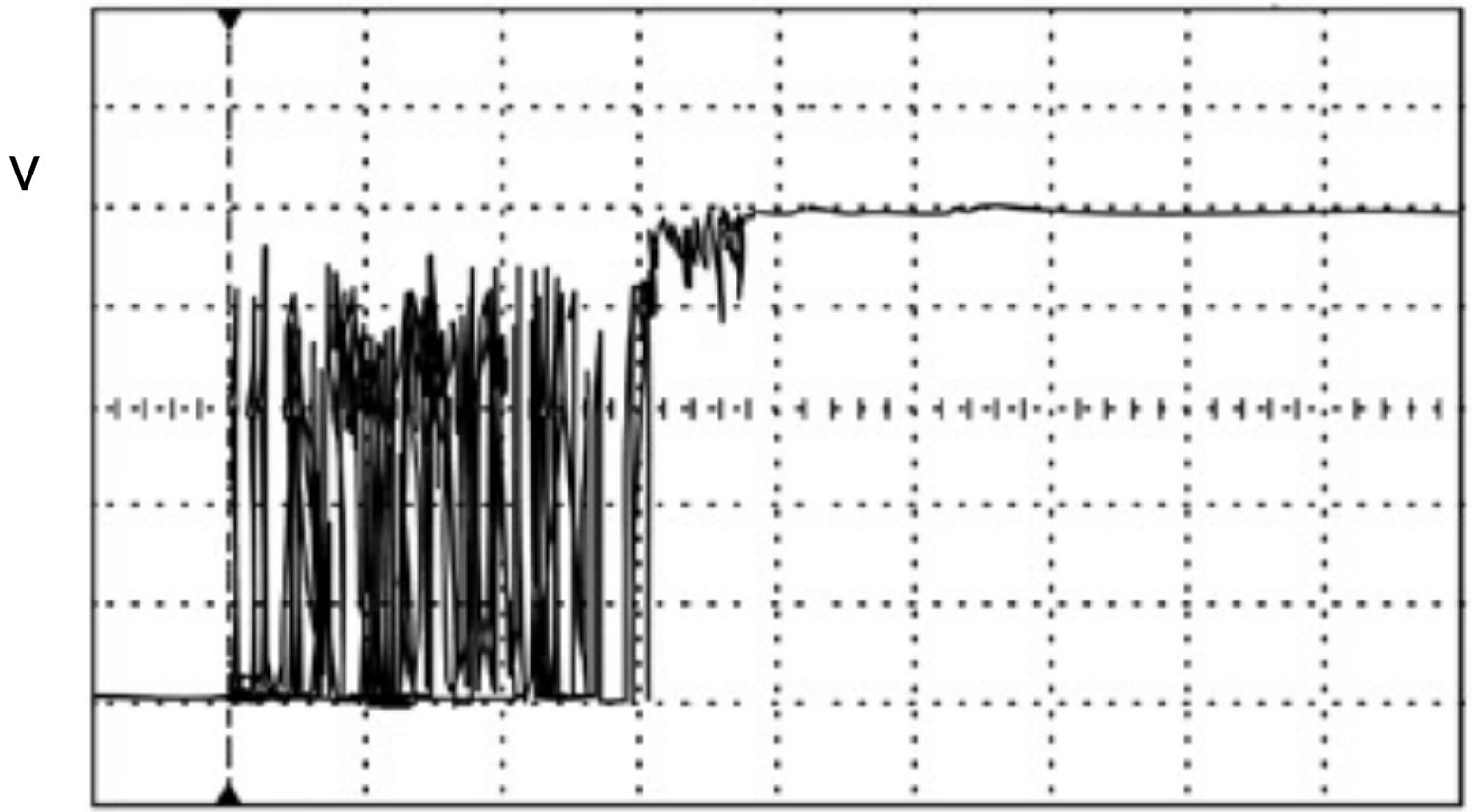

Interrupt_Test
1 // Interrupt example in UNO
2
3 bool LED_state ;
4 int LED = 13 ;
5
6 void setup() {
7 LED_state = 0 ;
8 pinMode(LED, OUTPUT) ;
9 pinMode(2, INPUT) ; // Interrupt 0
10 Serial.begin(9600) ;
11 attachInterrupt(0, LED_control, CHANGE) ;
12 }
13
14 void loop() {
15 delay(3000) ;
16 Serial.println(digitalRead(2)) ;
17 digitalWrite(LED, digitalRead(2)) ;
18 }
19
20 //--------
21 void LED_control() {
22 digitalWrite(LED, !LED_state) ;
23 LED_state = !LED_state ;
24 Serial.println("Interrupt") ;
25 }


Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
Interrupt
0
0
0
0
자동 스크롤
Both NL & CR
9600 보드레이트


5) Debouncing
S/W
H/W



Bouncing signal



Brown University

Software Debounce

Software_Debounce

```
1  //  http://www.arduino.cc/en/Tutorial/Debounce
2
3  const int ledPin = 13; //led  pin
4  const int buttonPin = 2; //push button pin
5
6  int buttonState = LOW; //low if not pressed, high if pressed
7  int ledState = -1; //state of the LED, negative if off, positive if on
8
9  long lastDebounceTime = 0;  // the last time the output pin was toggled
10 long debounceDelay = 50;    // the debounce time; increase if the output flickers
11
12 void setup() {
13
14  //set the mode of the pins...
15  pinMode(ledPin, OUTPUT);
16  pinMode(buttonPin, INPUT);
17 }
18
```

```
19 void loop() {
20  buttonState = digitalRead(buttonPin);
21
22  //filter out any noise by setting a time buffer
23  if ( (millis() - lastDebounceTime) > debounceDelay) {
24
25    //if the button has been pressed, lets toggle the LED from "off to on" or "on to off"
26    if ( (buttonState == HIGH) && (ledState < 0) ) {
27
28      digitalWrite(ledPin, HIGH); //turn LED on
29      ledState = -ledState; //now the LED is on, we need to change the state
30      lastDebounceTime = millis(); //set the current time
31    }
32    else if ( (buttonState == HIGH) && (ledState > 0) ) {
33
34      digitalWrite(ledPin, LOW); //turn LED off
35      ledState = -ledState; //now the LED is off, we need to change the state
36      lastDebounceTime = millis(); //set the current time
37    }
38  }
39 } //===  End of loop  ==================
```

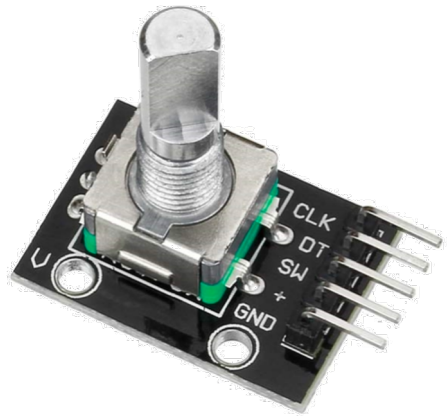
6) Rotary Encoder

프로젝트 : **Rotary Encoder**

목적 : Encoding 이해, 위치 및 길이 측정 방법

준비물 :

- 아두이노 우노 1 개
- 브래드보드 1개
- KY040 Encoder 1 개
- 점퍼케이블



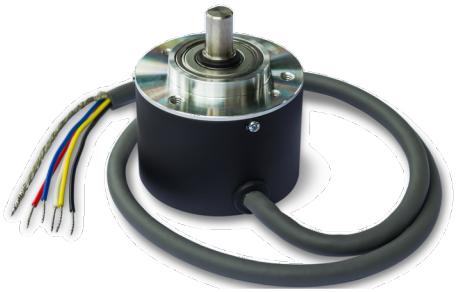
6) Rotary Encoder

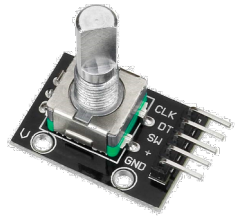
인코더 : 포지션 및 회전수 측정

저항 사용 방법 : 저항 크기 변화로 위치와 회전 방향

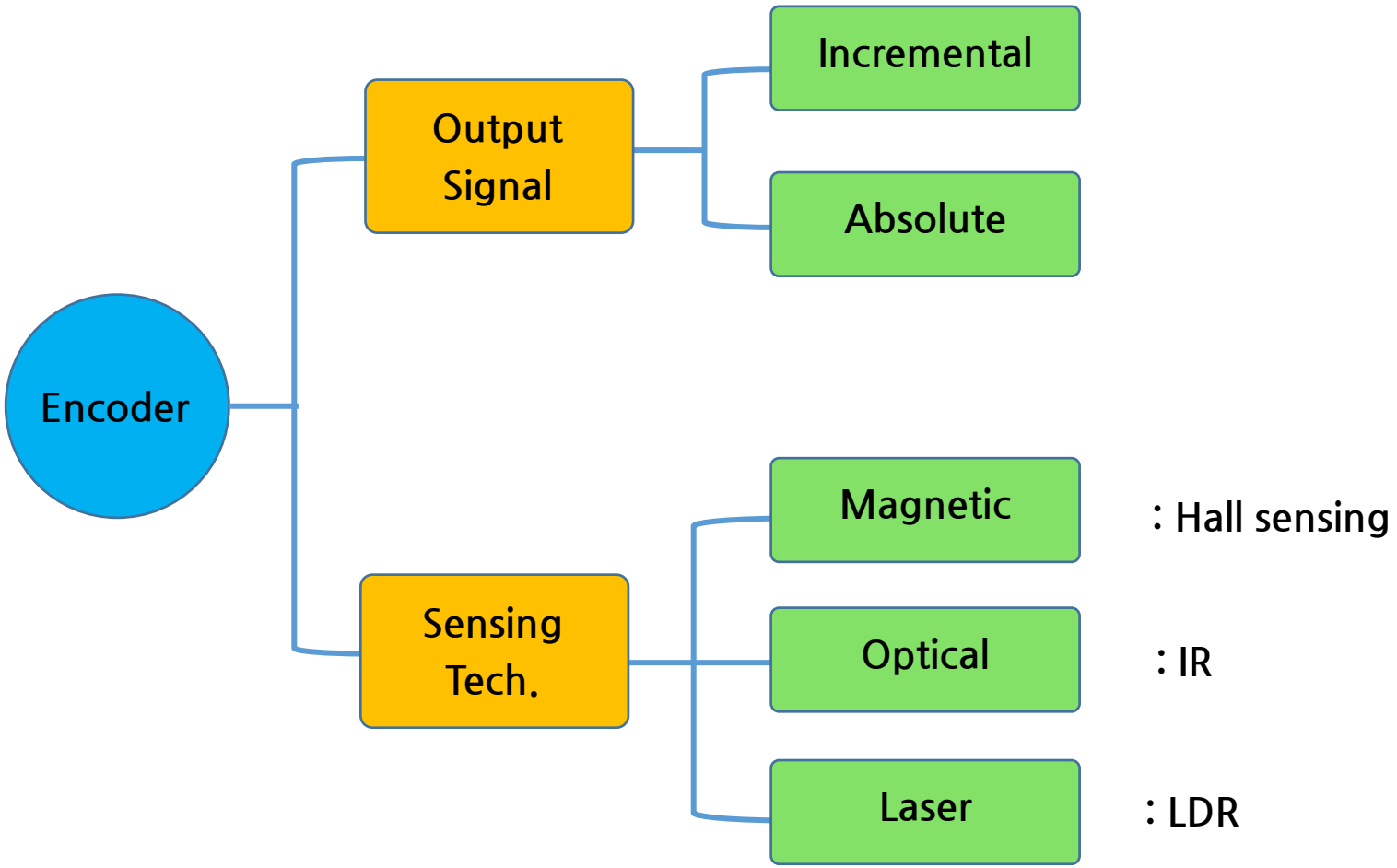
Optic 사용 방법 : 펄스 변화로 위치와 회전 방향

Incremental vs absolute encoder

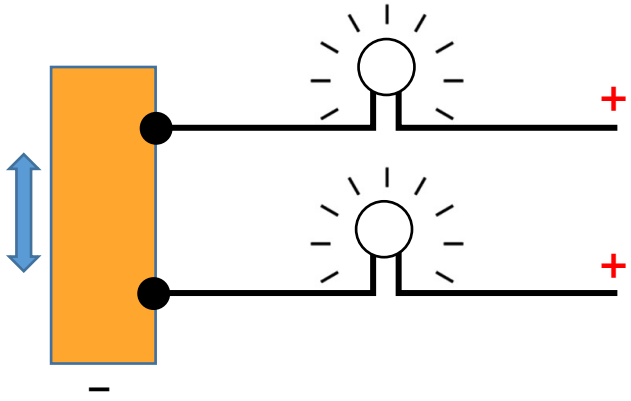


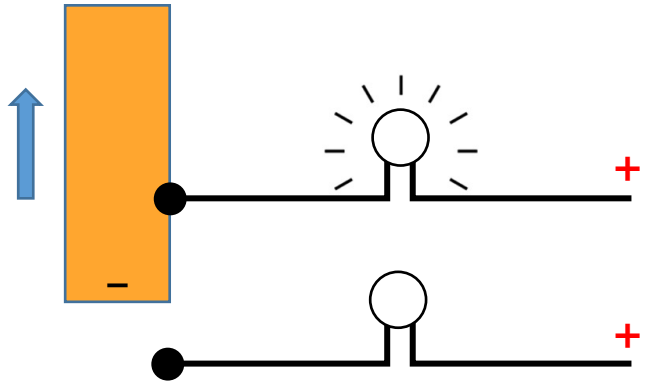


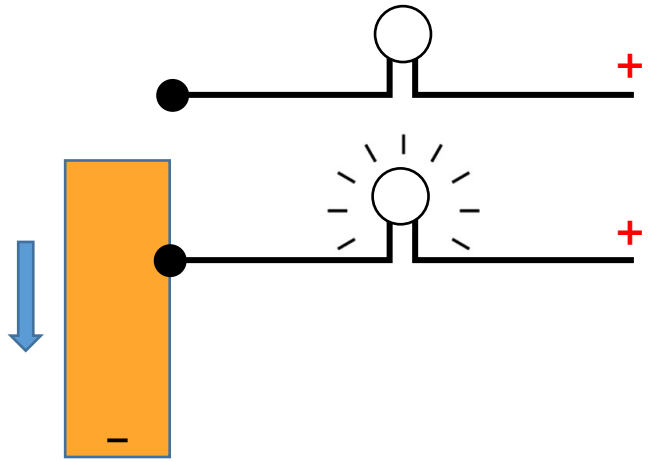
6) Rotary Encoder



인코더로 방향 확인



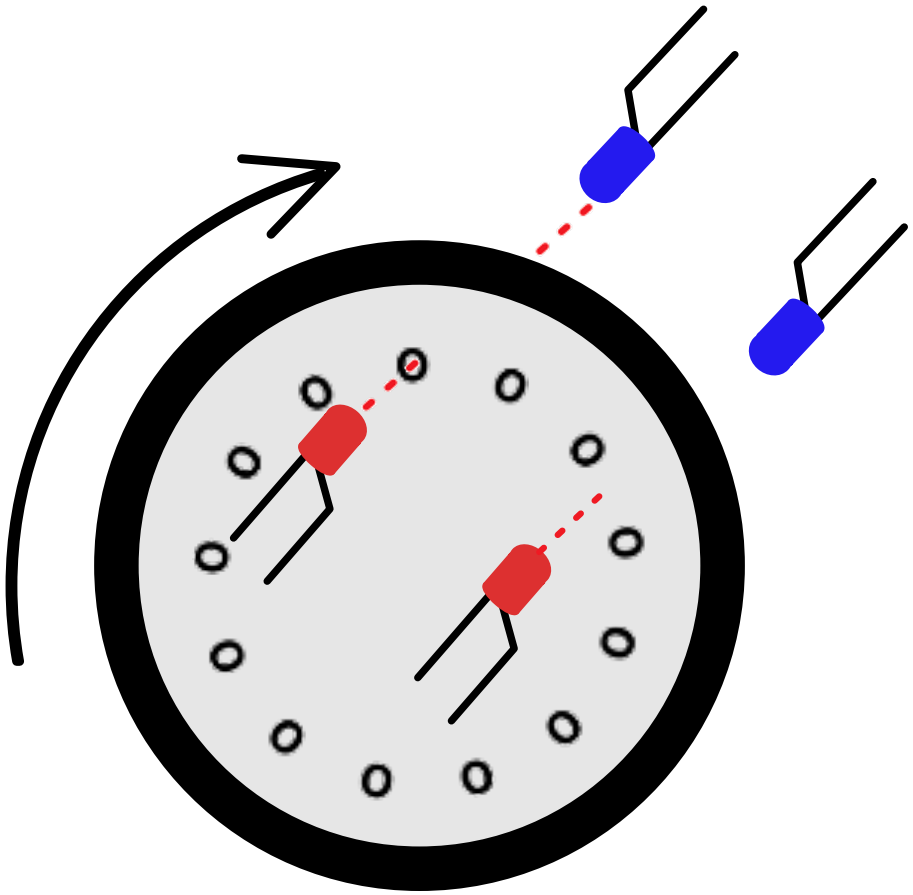




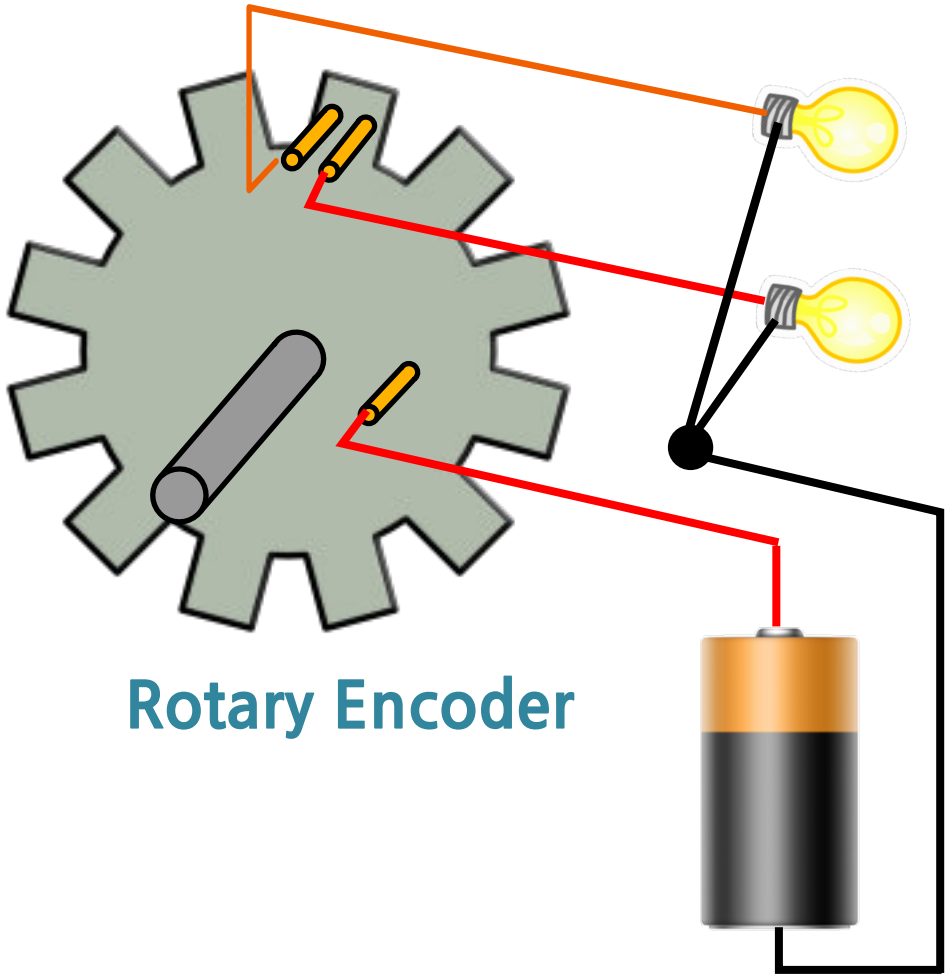
6) Rotary Encoder

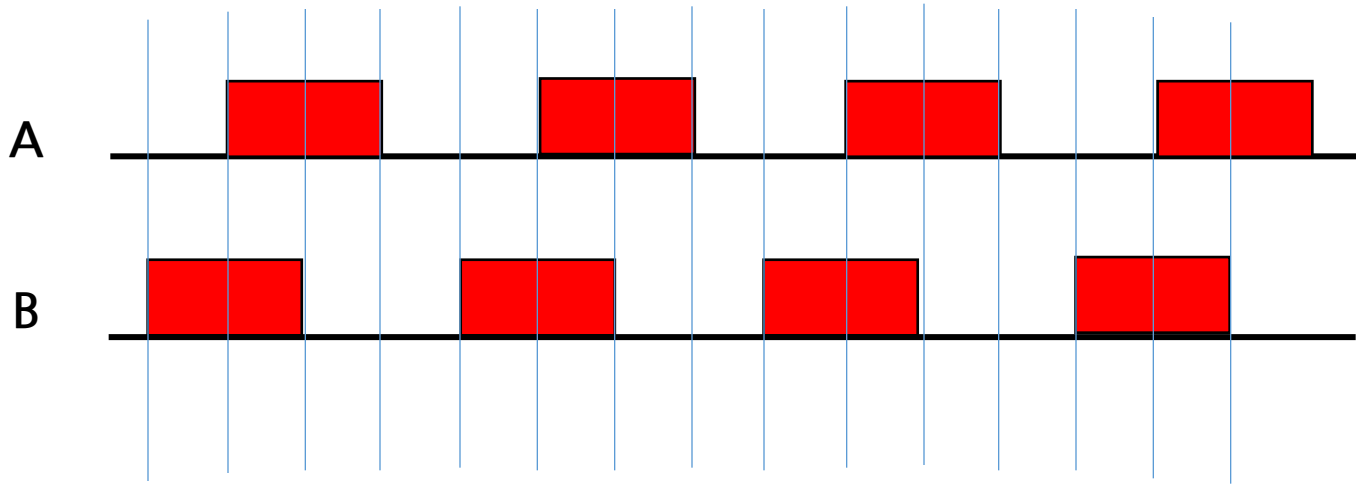
Rotary Encoder

Optical type

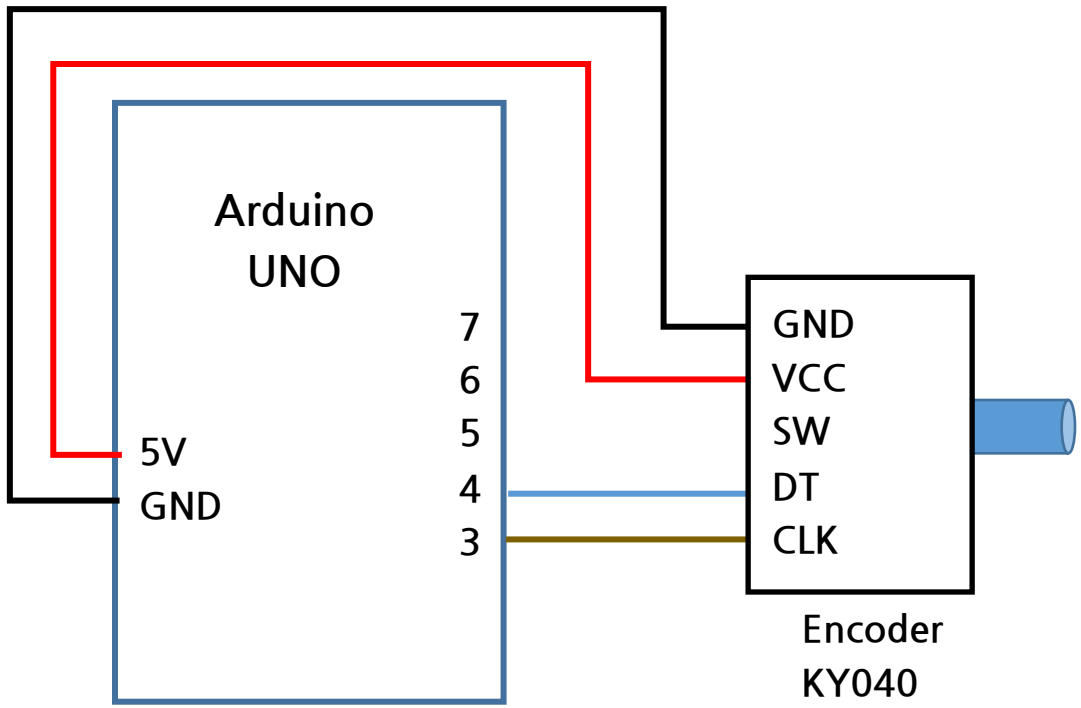


6) Rotary Encoder





6) Rotary Encoder



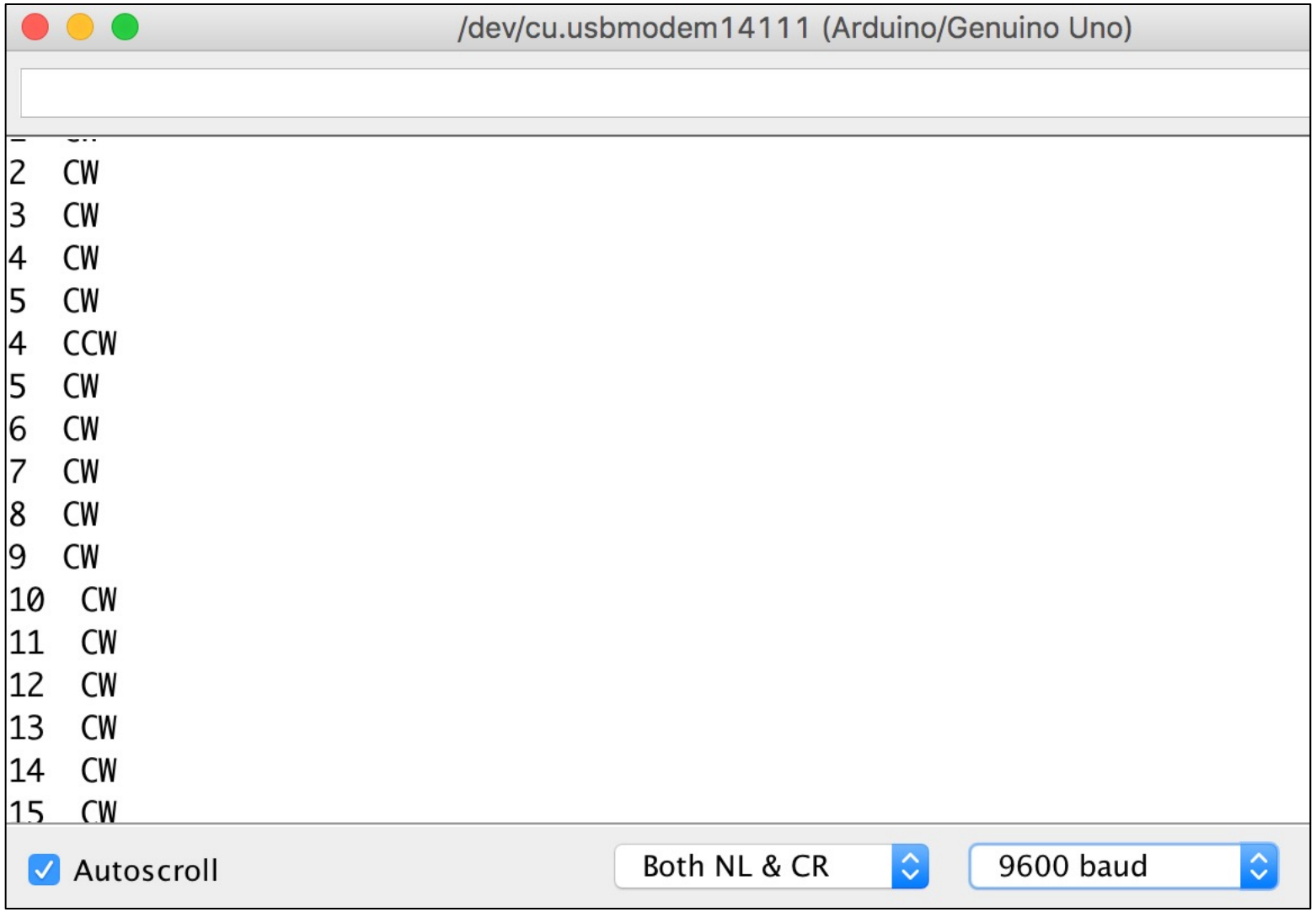
Rotary Encoder

6) Rotary Encoder

Rotary Encoder

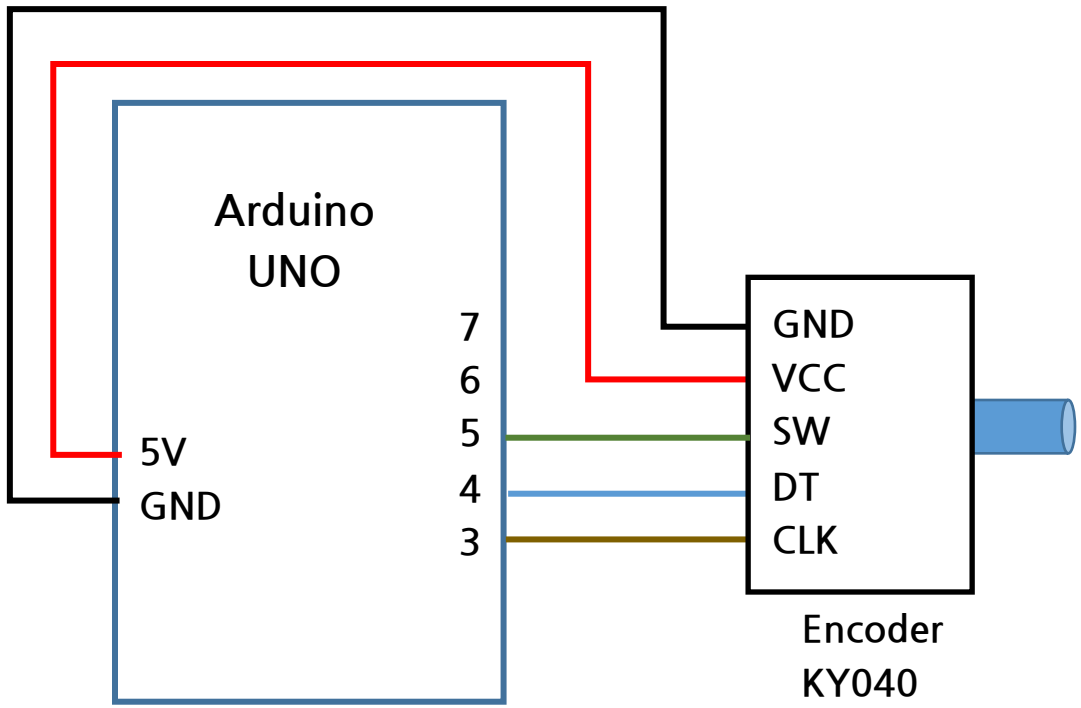
Encoder_Rotary

```
// Incremental encoder KY-040

int CLK = 3;  // Arduino D3-Encoder CLK
int DT = 4;   // Arduino D4-Encoder DT

int CLK_Last;  // Clock Last
int CLK_Present;
int Count = 0 ;  // Encoder movement Count

void setup() {
  pinMode (CLK,INPUT);
  pinMode (DT,INPUT);

  CLK_Last = digitalRead(CLK);
  Serial.begin (9600);
}

void loop() {
  CLK_Present = digitalRead(CLK);
  if (CLK_Present != CLK_Last){ // if postion is changed

    if (digitalRead(DT) != CLK_Present) {  // if CLK Changed first - it is CW
      Count ++ ;
      Serial.print(Count);
      Serial.println ("  CW");

    } if (digitalRead(DT) == CLK_Present) {  // if DT Changed first - it is CCW
      Count -- ;
      Serial.print(Count);
      Serial.println("  CCW");
    }
  }
  CLK_Last = CLK_Present ;  // CLK reset
}
```


/dev/cu.usbmodem14111 (Arduino/Genuino Uno)
2 CW
3 CW
4 CW
5 CW
4 CCW
5 CW
6 CW
7 CW
8 CW
9 CW
10 CW
11 CW
12 CW
13 CW
14 CW
15 CW
Autoscroll
Both NL & CR
9600 baud

6) Rotary Encoder

With Switch



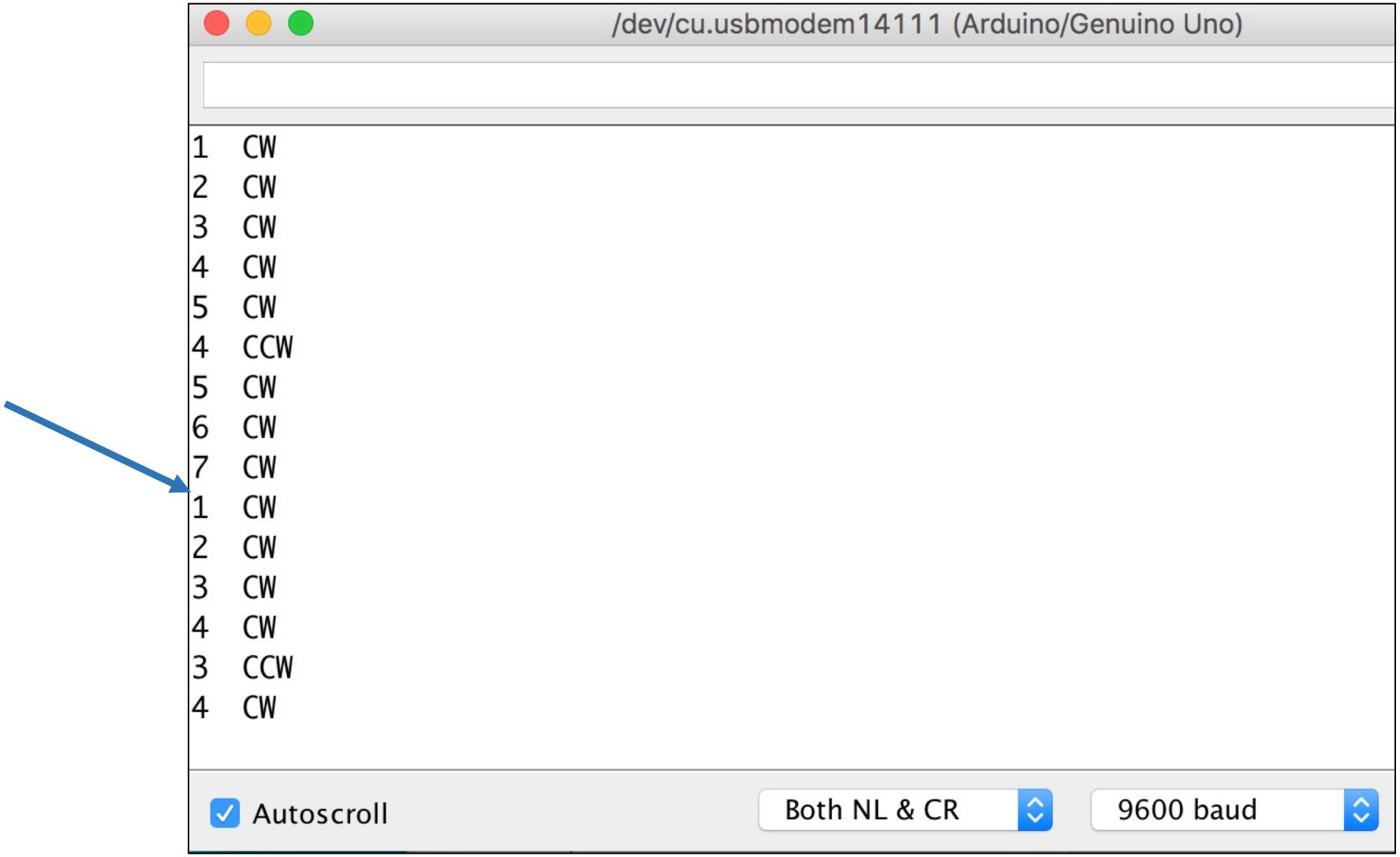
Rotary Encoder

6) Rotary Encoder

With Switch

Encoder_Rotary_SW

```
// Incremental encoder KY-040,  Written by SH Yang

int CLK = 3;  // Arduino D3-Encoder CLK
int DT = 4;   // Arduino D4-Encoder DT
int SW = 5 ;  // Switch for reset Count

int CLK_Last;  // Clock Last
int CLK_Present;
int Count = 0 ;  // Encoder movement Count

void setup() {
  pinMode (CLK,INPUT);
  pinMode (DT,INPUT);
  pinMode (SW,INPUT);
  digitalWrite (SW,HIGH);

  CLK_Last = digitalRead(CLK);
  Serial.begin (9600);
}

void loop() {
  CLK_Present = digitalRead(CLK);

  int T_Count = digitalRead(SW) ;
  if (T_Count==LOW) { Count=0 ; } // if switch is pressed Count=0

  if (CLK_Present != CLK_Last){ // if postion is changed

    if (digitalRead(DT) != CLK_Present) {  // if CLK Changed first - it is CW
      Count ++ ;
      Serial.print(Count);
      Serial.println ("  CW");

    } if (digitalRead(DT) == CLK_Present) {  // if DT Changed first - it is CCW
      Count -- ;
      Serial.print(Count);
      Serial.println("  CCW");
    }
  }
  CLK_Last = CLK_Present ;  // CLK reset
}
```


/dev/cu.usbmodem14111 (Arduino/Genuino Uno)
1 CW
2 CW
3 CW
4 CW
5 CW
4 CCW
5 CW
6 CW
7 CW
1 CW
2 CW
3 CW
4 CW
3 CCW
4 CW
Autoscroll
Both NL & CR
9600 baud

6) Rotary Encoder

Rotary Encoder

Optical type