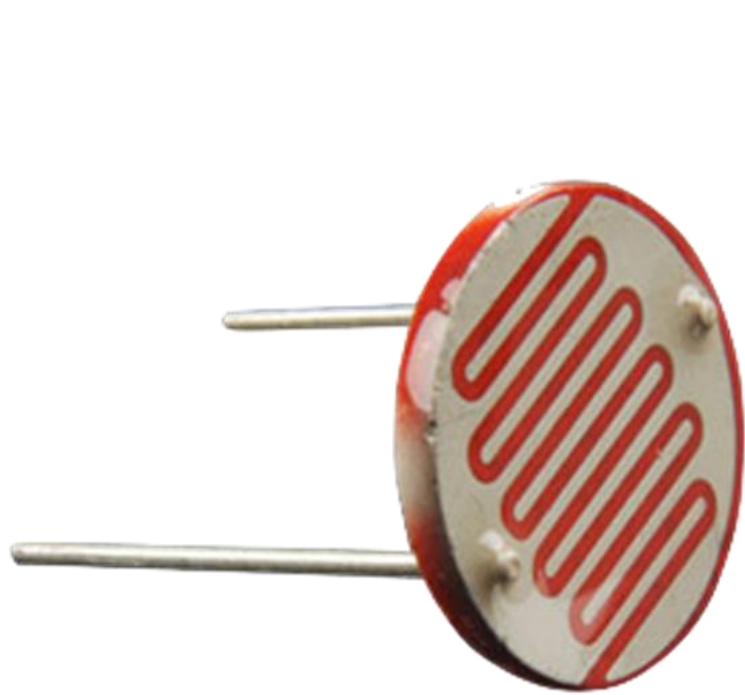


# 화재 경보기 실험 및 디지털 센서

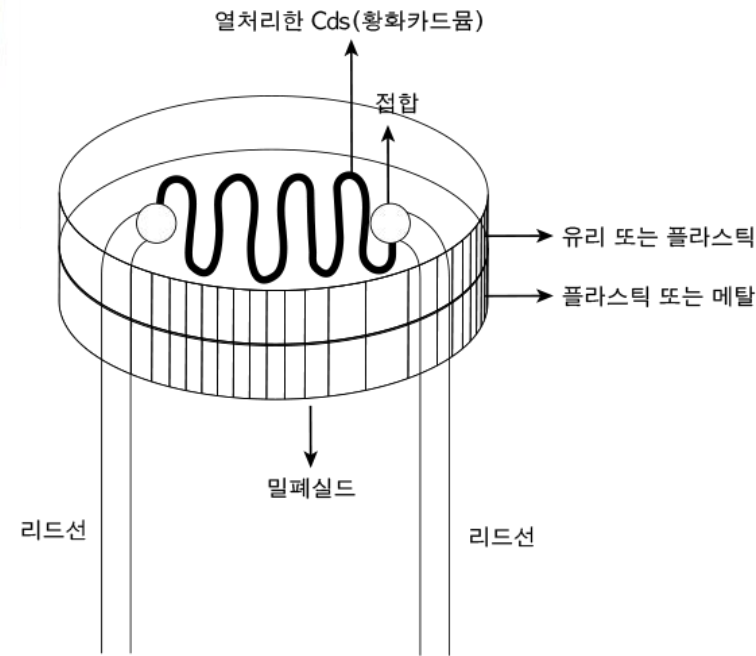
[https://github.com/juhong-rdv/2023\\_fall\\_du\\_sensor](https://github.com/juhong-rdv/2023_fall_du_sensor)



# 스마트 가로등 제작

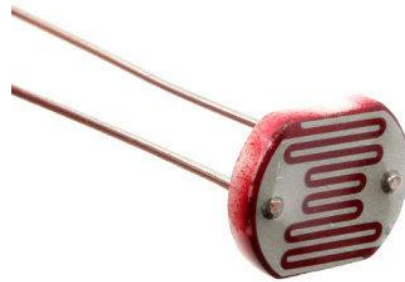


조도센서(Cds)

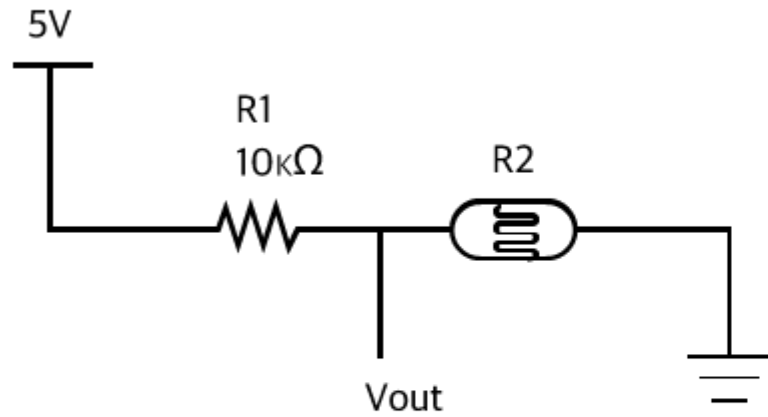


조도센서(Cds) 구조도

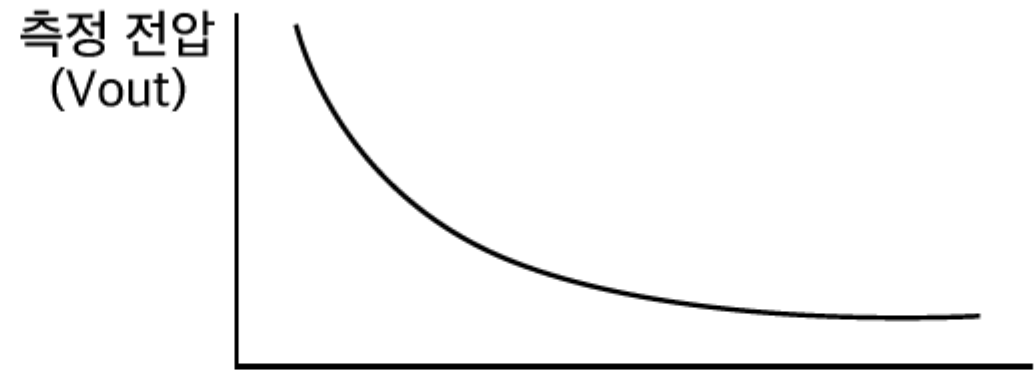
# 조도센서(CDS cell)



# 조도 센서(CDS cell)



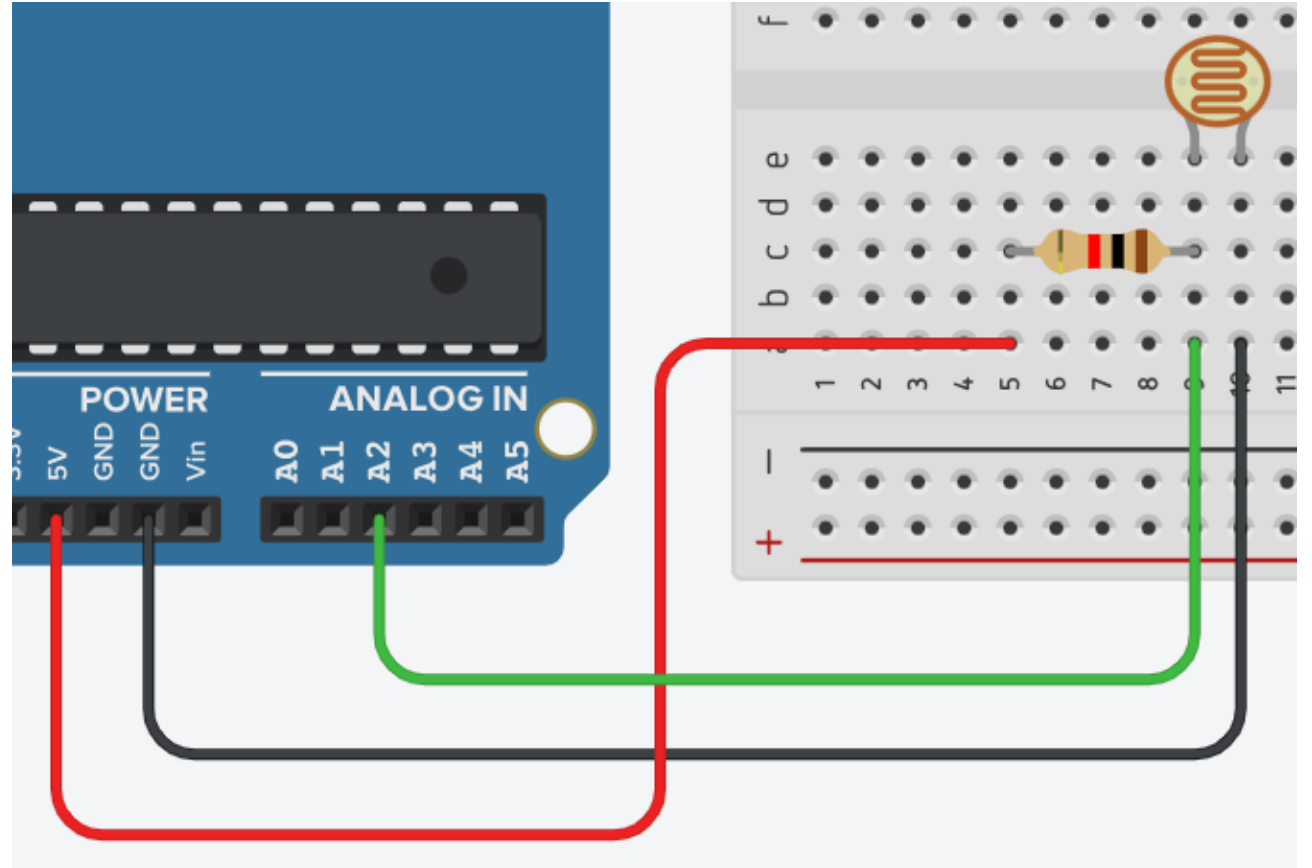
풀업 저항 사용



풀업 저항 사용시 밝기에 대한 측정 전압

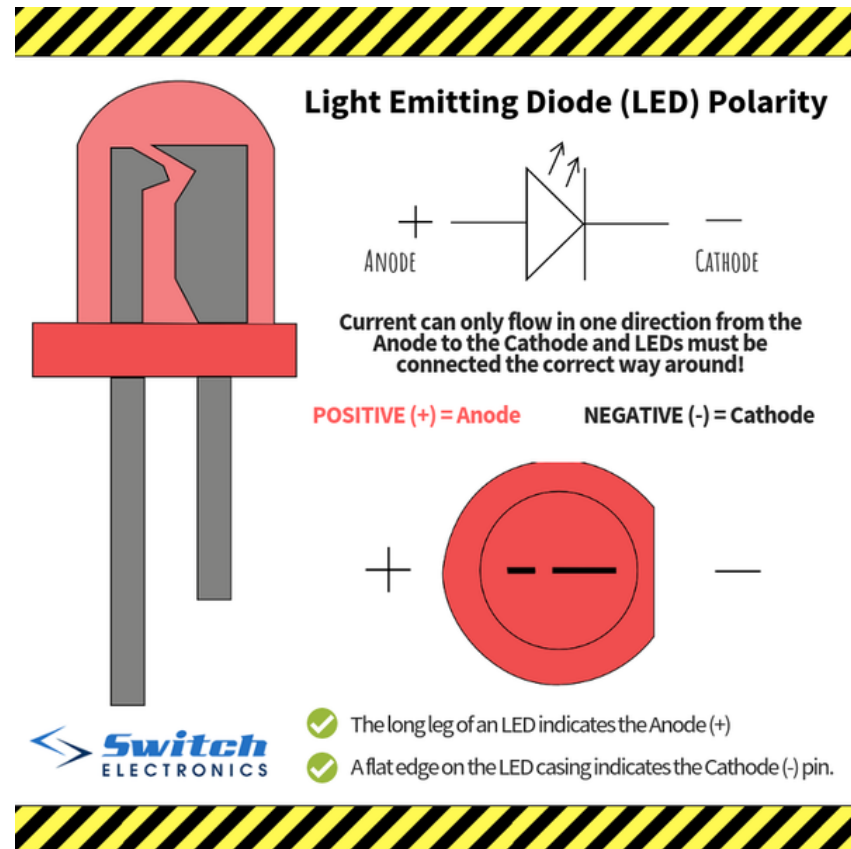
# CDS (포토레지스터)

```
void setup (){\n  Serial.begin(9600);\n}\n\nvoid loop(){\n  int val = analogRead(A2);\n  Serial.print("Analog : ");\n  Serial.println(val);\n}
```



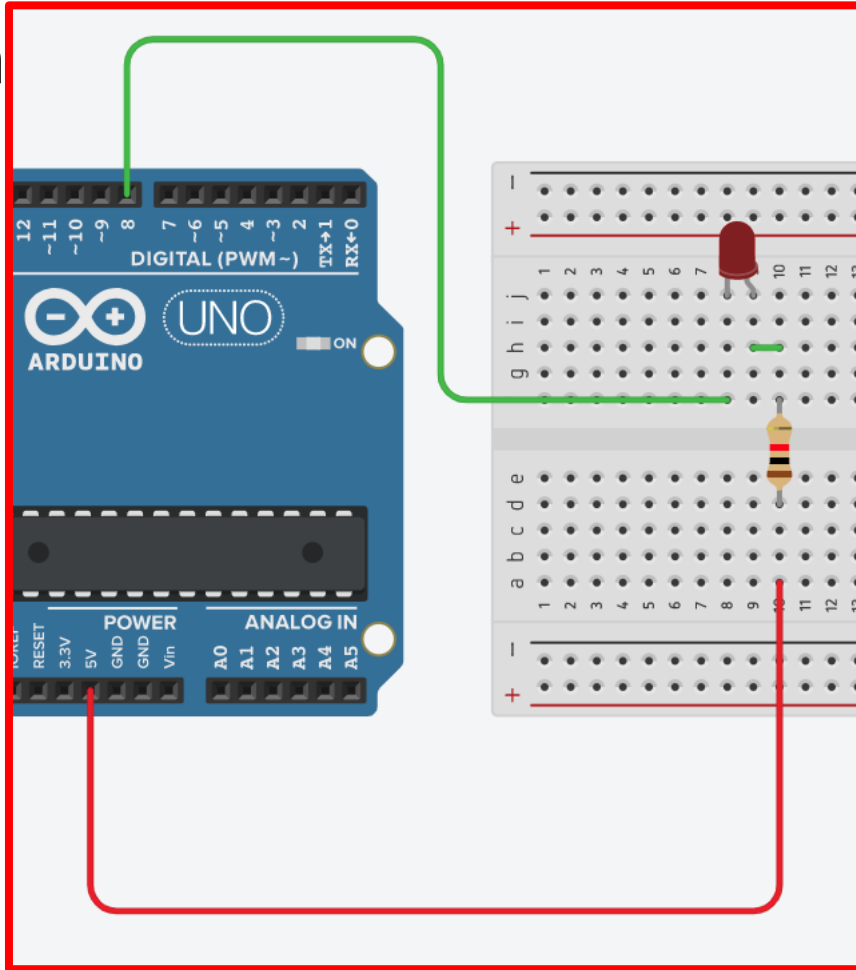
# 아두이노를 이용한 LED 실험

- LED를 이용한 포트 Output 테스트



# 아두이노를 이용한 LED 실험

• tin



구성

```
// C++ code
```

```
//
```

```
void setup()
```

```
{
```

```
    pinMode(8, OUTPUT);
```

```
}
```

```
void loop()
```

```
{
```

```
    digitalWrite(8, HIGH);
```

```
    delay(1000); // Wait for 1000 millisecond(s)
```

```
    digitalWrite(8, LOW);
```

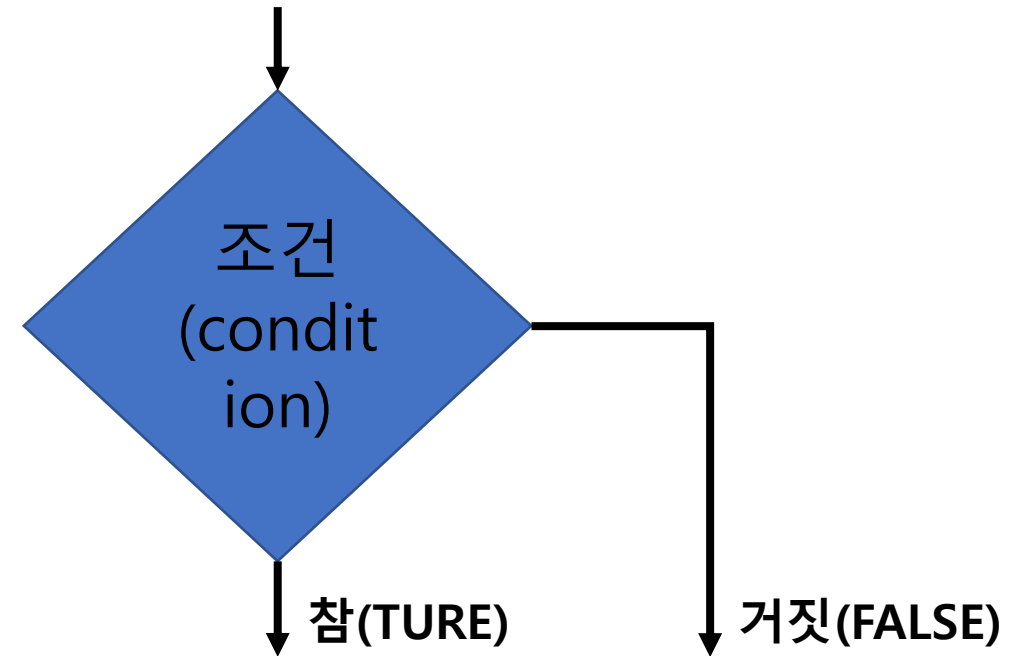
```
    delay(1000); // Wait for 1000 millisecond(s)
```

```
}
```

# 특정 조건일때 실행(조건문/분기문)

- if ~ else

```
if( 조건식1 )  
{  
    //조건식1이 참이면 실행  
}  
else  
{  
    //그렇지 않으면(조건식1이 거짓이면) 실행  
}
```





# 센서값이 특정 조건일때 실행

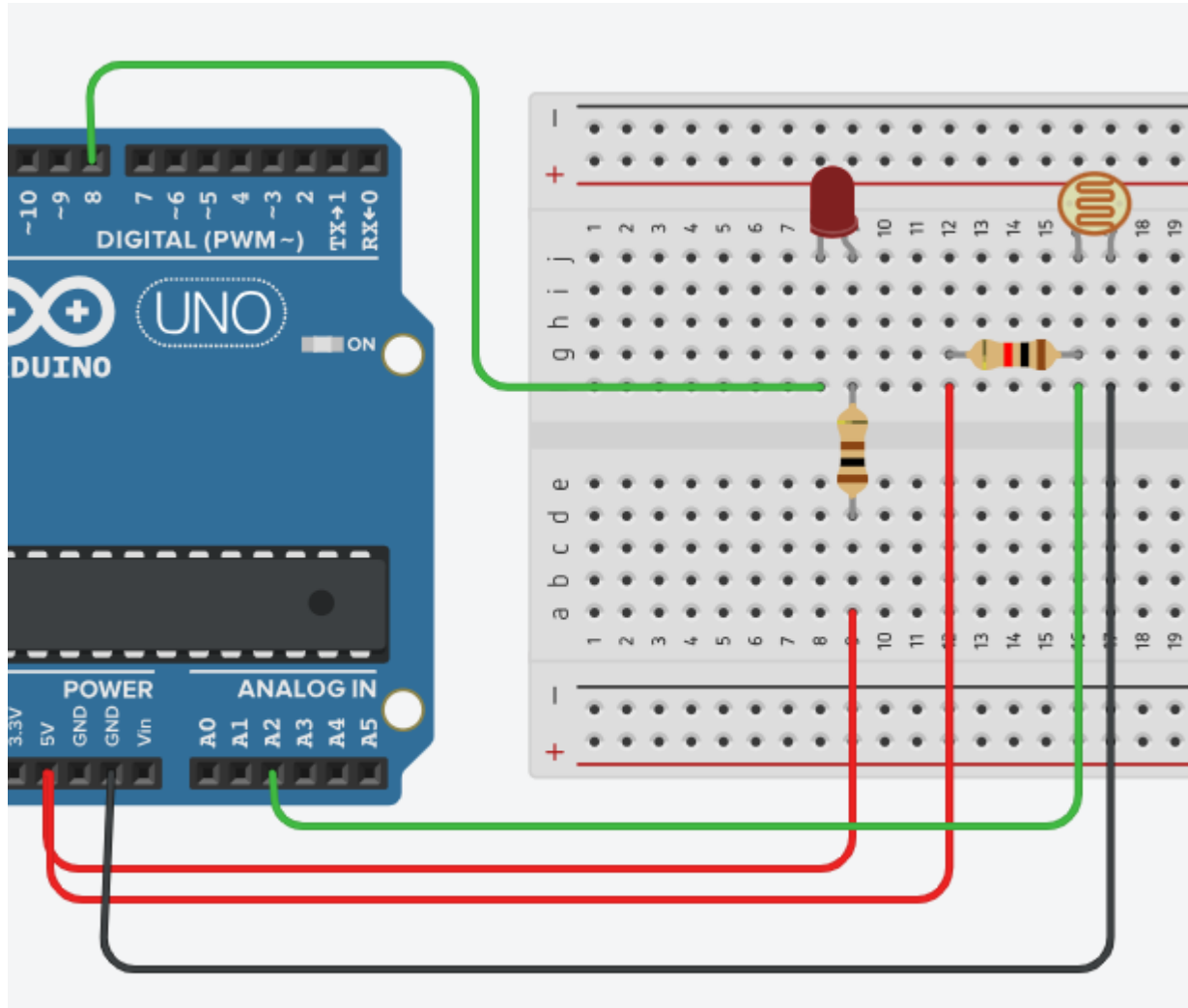
- if ~ else

```
if( 센서값 < 1000 )  
{  
    //불(LED)를 켜라  
}  
else  
{  
    //불(LED)를 꺼라  
}
```

## 조건식

- $A == B$  : A와 B가 같으면 참
- $A != B$  : A와 B가 다르면 참
- $A > B$  : A가 B보다 크면 참
- $A < B$  : A가 B보다 작으면 참
- $A \geq B$  : A가 B보다 크거나 같으면 참
- $A \leq B$  : A가 B보다 작거나 같으면 참

# 스마트 가로등 실험

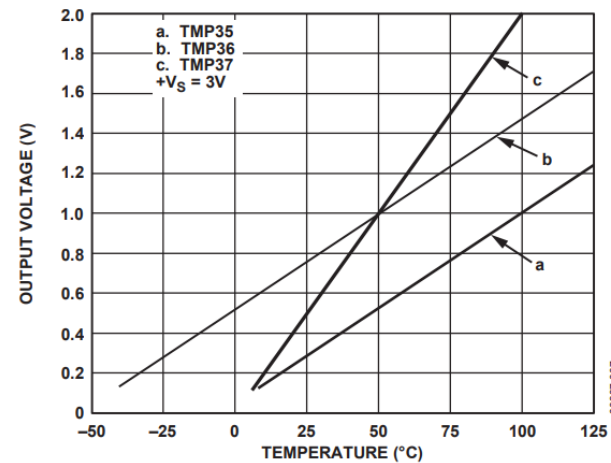


3. CDS로 빛이 어두운 경우 LED를 On  
그렇지 않으면 Off 자동 제어

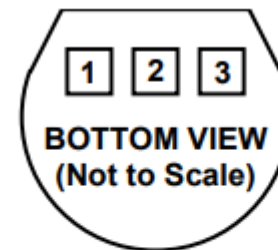
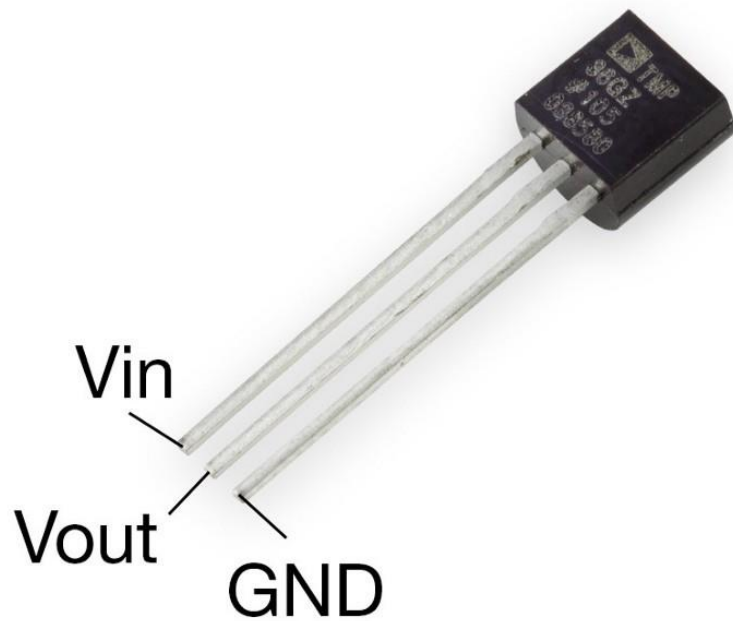
```
void setup () {  
  Serial.begin(9600);  
  pinMode(8, OUTPUT) ;  
}  
  
void loop() {  
  int val = analogRead(A2);  
  Serial.println(val);  
  
  if( val > [      ] )  
  {  
    digitalWrite(8, [      ] );  
  }  
  else  
  {  
    digitalWrite(8, [      ] );  
  }  
}
```

# TMP36

- 온도센서는 온도를 감지해 전기신호로 바꿔주는 센서를 의미
- TMP36
  - 상온에서 대략 750mV를 출력
  - 온도 1 °C가 변화하면 10mV의 출력 전압이 변화 함
  - 정밀도는  $\pm 1$  °C로 정밀한 온도 감지는 어려움.
  - 사용하기 쉽고 저렴하여 정밀한 온도 감지가 필요 없는 어플리케이션이 많이 사용 됨.



# TMP36 핀연결



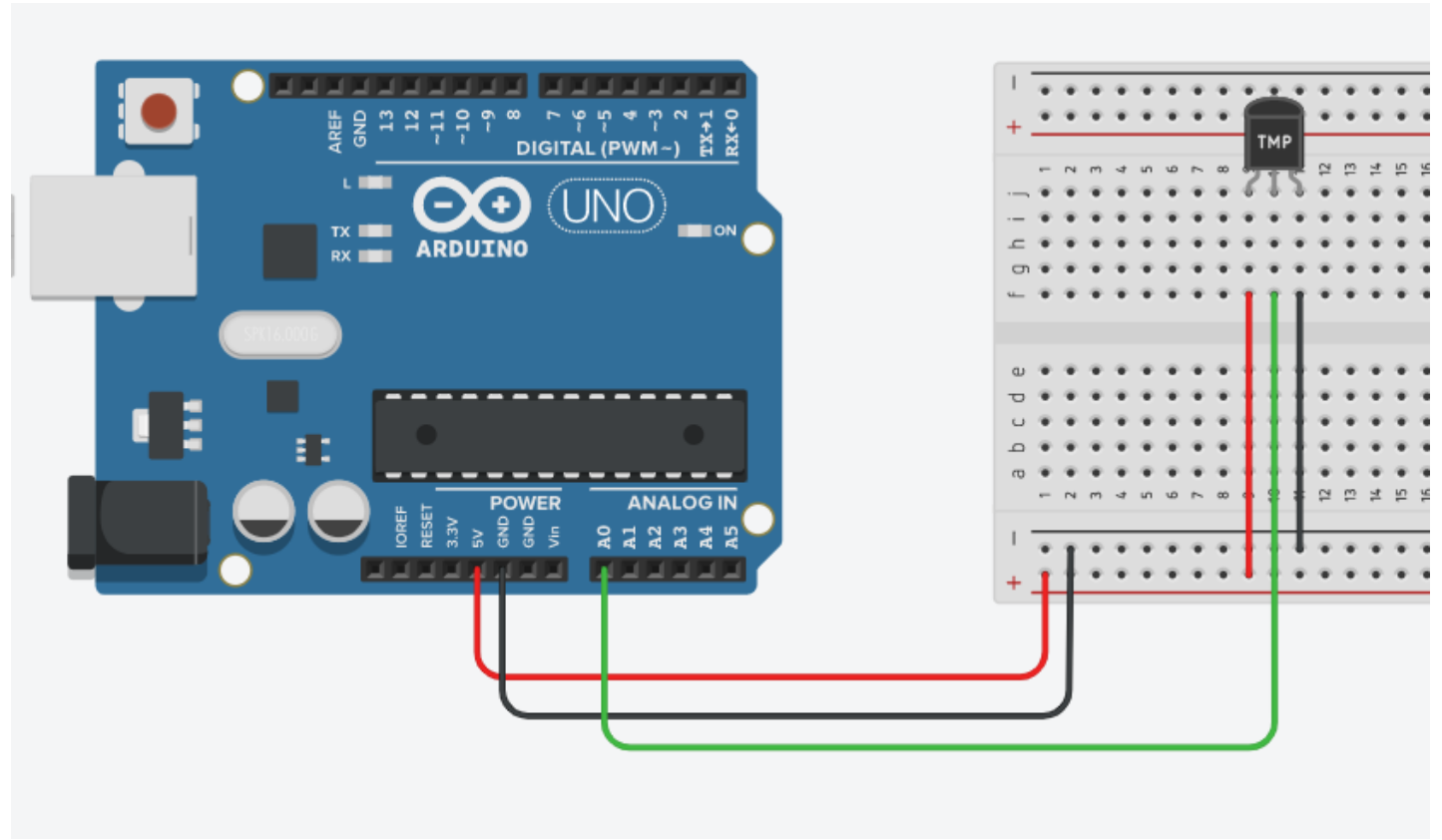
PIN 1,  $+V_S$ ; PIN 2,  $V_{OUT}$ ; PIN 3, GND

Figure 4. T-3 (TO-92)

00337-004

# TMP36 + 아두이노 실험

- TMP Vin <> 아두이노 5V
- TMP Vout <> 아두이노 A0
- TMP GND <> 아두이노 GND



# 코드 작성

**void setup()**

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

**void loop()**

```
{  
  int reading = analogRead(A0);  
  Serial.println(reading);  
}
```

The screenshot displays an Arduino IDE interface. At the top, a blue header reads '온도 센서 [TMP36]' (Temperature Sensor [TMP36]). Below it, a text box contains '이름 온도센서' (Name Temperature Sensor). The central part of the image shows a breadboard circuit. A TMP36 temperature sensor is connected to a breadboard. Its VCC pin is connected to a red wire leading to the positive terminal of a 5V power source. Its GND pin is connected to a green wire leading to the negative terminal. Its AO pin is connected to a black wire leading to analog input pin A0 on the Arduino board. A potentiometer is also connected to the breadboard, with its wiper connected to A0. The right side of the image shows the Arduino IDE code editor with the following code:

```
1 void setup()  
2 {  
3   Serial.begin(9600);  
4 }  
5  
6 void loop()  
7 {  
8   int reading = analogRead(A0);  
9  
10  float voltage = reading * 5.0;  
11  voltage /= 1024.0;  
12  
13  Serial.print(voltage); Serial.println(" volts");  
14  
15  float temperatureC = (voltage - 0.5) * 100 ;  
16  Serial.print(temperatureC); Serial.println(" degrees C");  
17  
18  float temperatureF = (temperatureC * 9.0 / 5.0) + 32.0;  
19  Serial.print(temperatureF); Serial.println(" degrees F");  
20  
21  delay(1000);  
22 }
```

Below the code editor, the '시리얼 모니터' (Serial Monitor) window is open, showing the following output:

```
0.00 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F
```

# 코드 작성

**void setup()**

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

**void loop()**

```
{  
  int reading = analogRead(A0);  
  
  float voltage = (reading / 1024.0) * 5.0;  
  
  Serial.print(voltage); Serial.println(" volts");  
  
  delay(1000);  
}
```

The screenshot displays an Arduino IDE interface. At the top, a blue header reads '온도 센서 [TMP36]'. Below it, a text box contains '이름 온도센서'. The main workspace shows a breadboard circuit with a TMP36 temperature sensor connected to an Arduino Uno R3. The sensor's VCC pin is connected to a 5V pin, GND to a GND pin, and the output pin to analog pin A0. A potentiometer is also connected to the 5V and GND pins. The code editor on the right contains the following code:

```
1 void setup()  
2 {  
3   Serial.begin(9600);  
4 }  
5  
6 void loop()  
7 {  
8   int reading = analogRead(A0);  
9  
10  float voltage = reading * 5.0;  
11  voltage /= 1024.0;  
12  
13  Serial.print(voltage); Serial.println(" volts");  
14  
15  float temperatureC = (voltage - 0.5) * 100;  
16  Serial.print(temperatureC); Serial.println(" degrees C");  
17  
18  float temperatureF = (temperatureC * 9.0 / 5.0) + 32.0;  
19  Serial.print(temperatureF); Serial.println(" degrees F");  
20  
21  delay(1000);  
22 }
```

At the bottom, the '시리얼 모니터' (Serial Monitor) window is open, showing the following output:

```
0.00 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F
```

# 코드 작성

**void setup()**

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

**void loop()**

```
{  
  int reading = analogRead(A0);  
  
  float voltage = (reading / 1024.0) * 5.0;  
  
  Serial.print(voltage); Serial.println(" volts");  
  
  float temperatureC = (voltage - 0.5) * 100 ;  
  Serial.print(temperatureC); Serial.println(" degrees C");  
  
  delay(1000);  
}
```

The screenshot displays an Arduino IDE interface. At the top, a blue header reads '온도 센서 [TMP36]' (Temperature Sensor [TMP36]), with a sub-header '이름 온도센서' (Name Temperature Sensor). Below this, a breadboard circuit is shown. A TMP36 temperature sensor is connected to a breadboard. Its VCC pin is connected to a red wire leading to a 5V pin on the breadboard. Its GND pin is connected to a green wire leading to a GND pin. Its AO pin is connected to a black wire leading to an analog input pin (A0) on the breadboard. A potentiometer is also connected to the breadboard. The main code area shows the following code:

```
1 void setup()  
2 {  
3   Serial.begin(9600);  
4 }  
5  
6 void loop()  
7 {  
8   int reading = analogRead(A0);  
9  
10  float voltage = reading * 5.0;  
11  voltage /= 1024.0;  
12  
13  Serial.print(voltage); Serial.println(" volts");  
14  
15  float temperatureC = (voltage - 0.5) * 100 ;  
16  Serial.print(temperatureC); Serial.println(" degrees C");  
17  
18  float temperatureF = (temperatureC * 9.0 / 5.0) + 32.0;  
19  Serial.print(temperatureF); Serial.println(" degrees F");  
20  
21  delay(1000);  
22 }
```

At the bottom, the '시리얼 모니터' (Serial Monitor) window is open, showing the following output:

```
0.00 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F  
0.83 volts  
33.01 degrees C  
91.41 degrees F
```



# 불꽃감지센서 (Flame sensor)

- 불꽃 또는 화염은 사람의 눈으로 확인 할 수 없는 자외선과 적외선의 파장이 발생
- 불꽃감지센서는 적외선 감지센서로서 760nm ~ 1100nm파장을 감지한다.

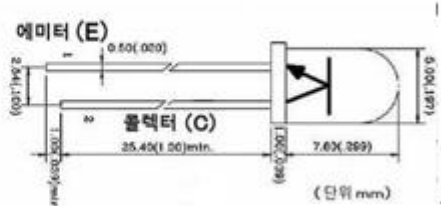
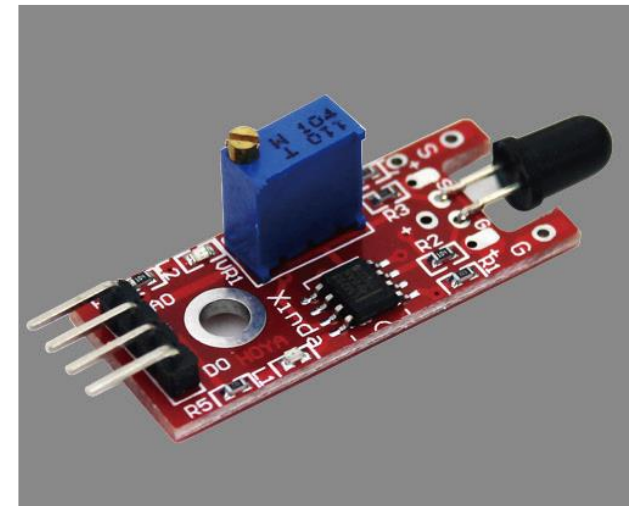
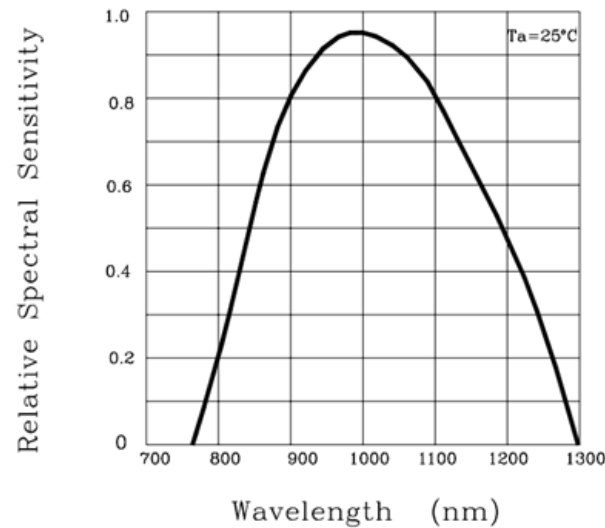
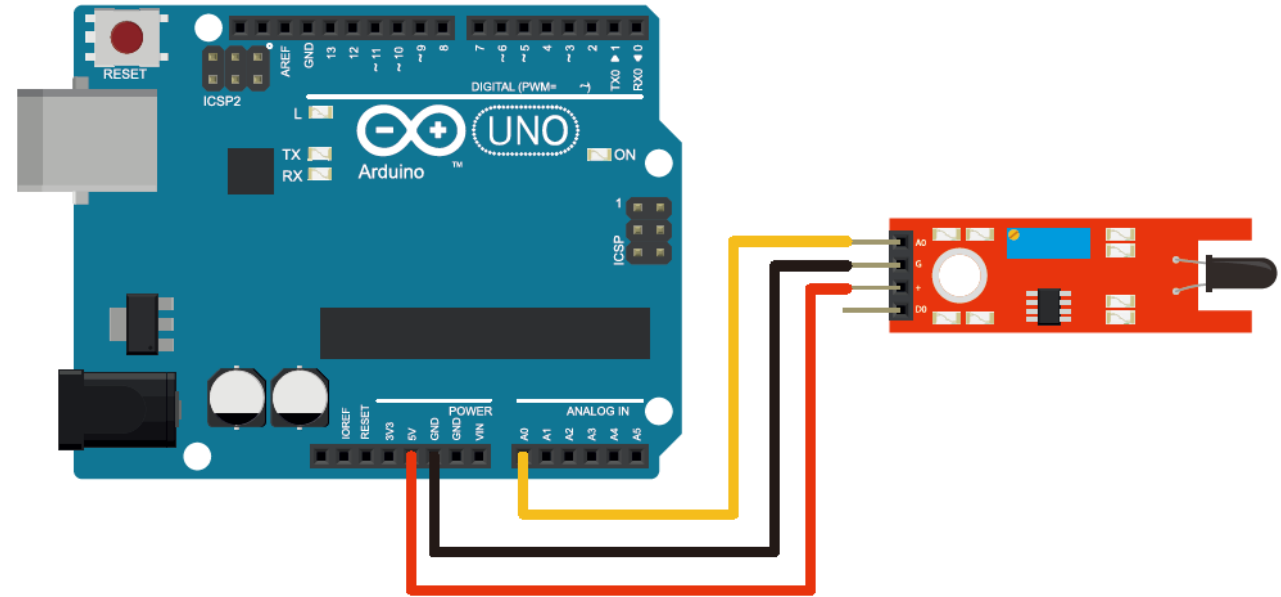


Fig. 5 Spectral Sensitivity



# 불꽃감지센서 (Flame sensor)

- 불꽃 감지 아두이노 실험 구성
  - 센서모듈 A0 <> 아두이노 A0
  - 센서모듈 G <> 아두이노 GND
  - 센서모듈 + <> 아두이노 5V



# 불꽃감지센서 (Flame sensor)

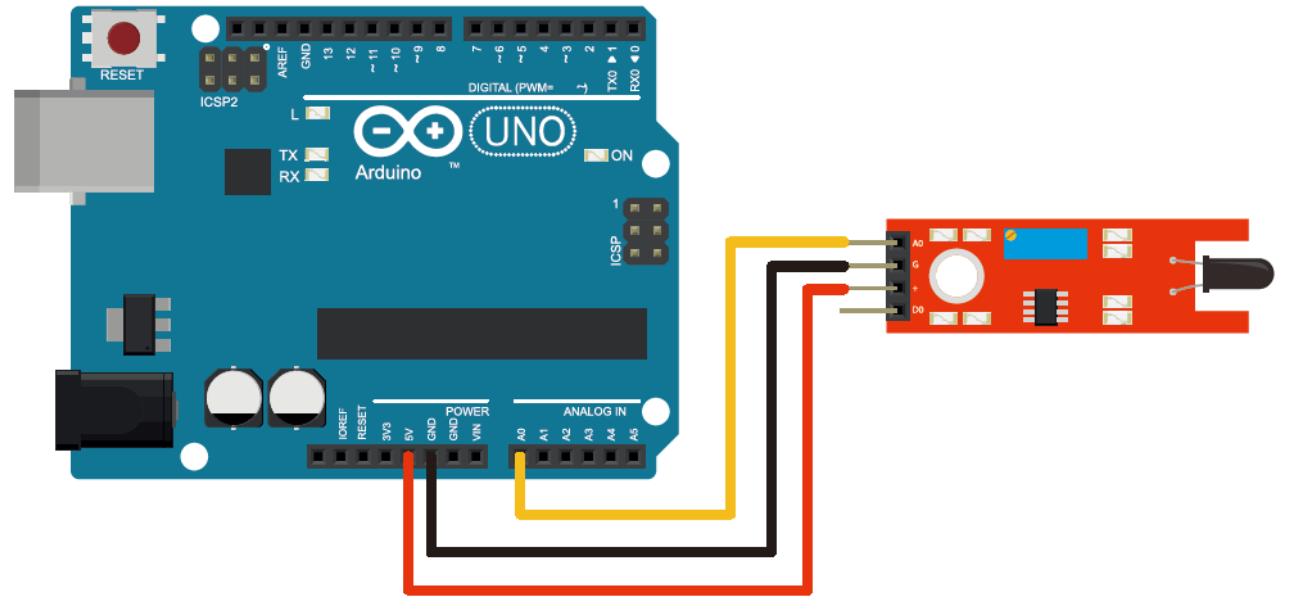
- 불꽃 감지 아두이노 실험 코드 작성

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

void loop()
{
  int analog_value = analogRead(A0);

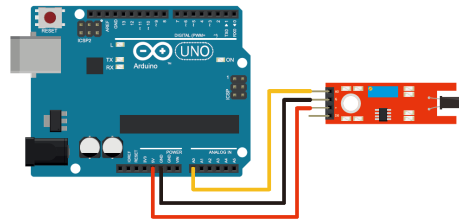
  Serial.println(analog_value);

  delay(100);
}
```



# 불꽃감지센서를 이용한 화재감지 응용

- 불꽃이 감지 되면 자동으로 경고를 발생시키자!



# 불꽃감지센서를 이용한 화재감지 응용

## • 부저(소리) 출력 실험

- 능동부저:전원을공급하면단음(빠)소리가출력
- 수동부저:진동을만들어특정주파수의소리를출력(다양한소리를출력할수있음,멜로디)



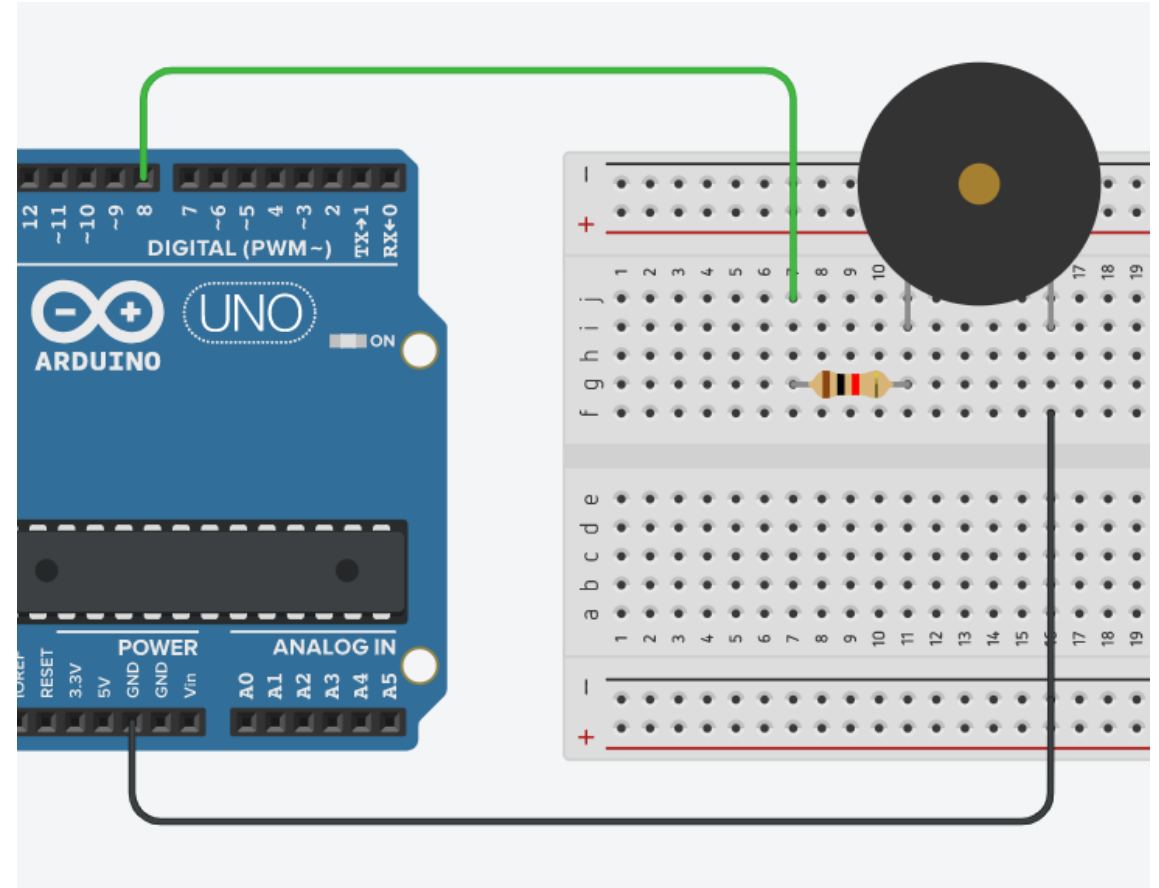
( 단위 : Hz )

음계 \ 옥타브	1	2	3	4	5	6	7	8
C(도)	32.7032	65.4064	130.8128	261.6256	523.2511	1046.502	2093.005	4186.009
C#	34.6478	69.2957	138.5913	277.1826	554.3653	1108.731	2217.461	4434.922
D(레)	36.7081	73.4162	146.8324	293.6648	587.3295	1174.659	2349.318	4698.636
D#	38.8909	77.7817	155.5635	311.1270	622.2540	1244.508	2489.016	4978.032
E(미)	41.2034	82.4069	164.8138	329.6276	659.2551	1318.510	2637.020	5274.041
F(파)	43.6535	87.3071	174.6141	349.2282	698.4565	1396.913	2793.826	5587.652
F#	46.2493	92.4986	184.9972	369.9944	739.9888	1479.978	2959.955	5919.911
G(솔)	48.9994	97.9989	195.9977	391.9954	783.9909	1567.982	3135.963	6271.927
G#	51.9130	103.8262	207.6523	415.3047	830.6094	1661.219	3322.438	6644.875
A(라)	55.0000	110.0000	220.0000	440.0000	880.0000	1760.000	3520.000	7040.000
A#	58.2705	116.5409	233.0819	466.1638	932.3275	1864.655	3729.310	7458.620
B(시)	61.7354	123.4708	246.9417	493.8833	987.7666	1975.533	3951.066	7902.133

- 도:261.6256Hz
- 레:293.1826Hz
- 미:329.6276 Hz
- 파:349.2282 Hz
- 솔:391.9954 Hz
- 라:440.0000 Hz
- 시:466.1638 Hz
- 도:523.2511 Hz

# 불꽃감지센서를 이용한 화재감지 응용

- 부저(소리) 출력 실험
  - 부저 + <> 아두이노 8번핀
  - 부저 - <> 아두이노 GND



# 불꽃감지센서를 이용한 화재감지 응용

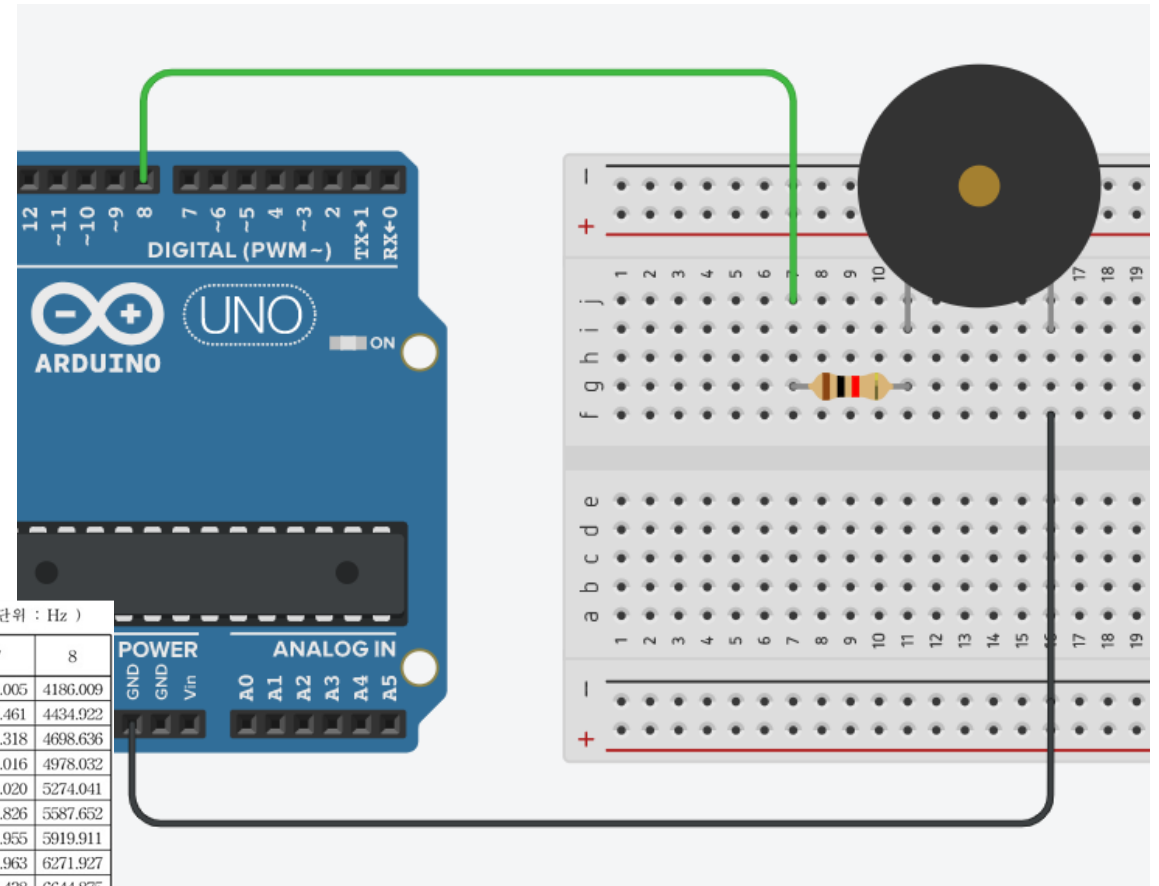
- 부저(소리) 출력 실험

```
void setup()
{
  pinMode(8, OUTPUT);
}

void loop()
{
  tone(8, 262, 500);
  delay(500);
}
```

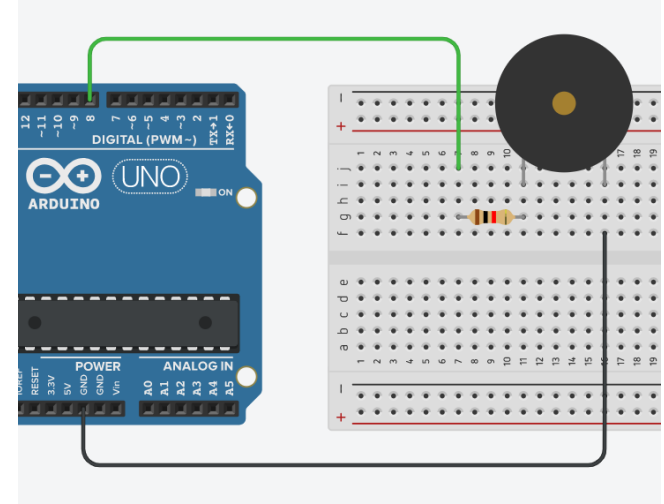
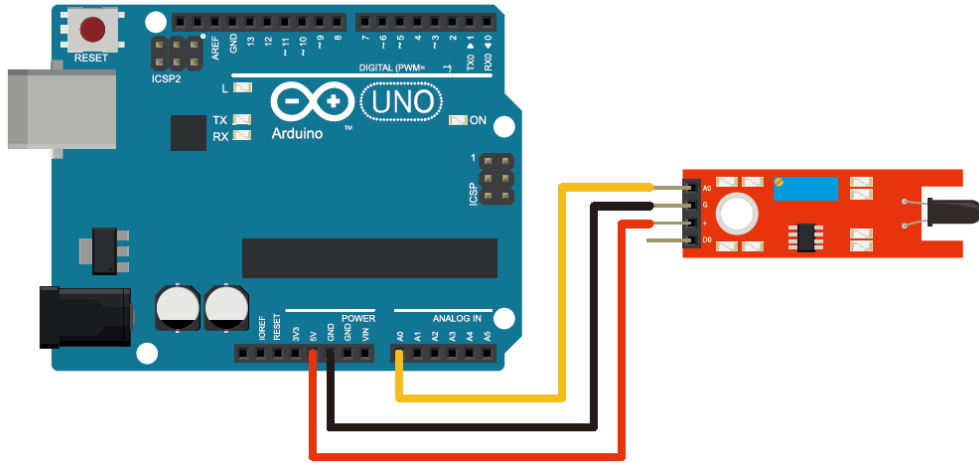
( 단위 : Hz )

음계 \ 옥타브	1	2	3	4	5	6	7	8
C(도)	32.7032	65.4064	130.8128	261.6256	523.2511	1046.502	2093.005	4186.009
C#	34.6478	69.2957	138.5913	277.1826	554.3653	1108.731	2217.461	4434.922
D(레)	36.7081	73.4162	146.8324	293.6648	587.3295	1174.659	2349.318	4698.636
D#	38.8909	77.7817	155.5635	311.1270	622.2540	1244.508	2489.016	4978.032
E(미)	41.2034	82.4069	164.8138	329.6276	659.2551	1318.510	2637.020	5274.041
F(파)	43.6535	87.3071	174.6141	349.2282	698.4565	1396.913	2793.826	5587.652
F#	46.2493	92.4986	184.9972	369.9944	739.9888	1479.978	2959.955	5919.911
G(솔)	48.9994	97.9989	195.9977	391.9954	783.9909	1567.982	3135.963	6271.927
G#	51.9130	103.8262	207.6523	415.3047	830.6094	1661.219	3322.438	6644.875
A(라)	55.0000	110.0000	220.0000	440.0000	880.0000	1760.000	3520.000	7040.000
A#	58.2705	116.5409	233.0819	466.1638	932.3275	1864.655	3729.310	7458.620
B(시)	61.7354	123.4708	246.9417	493.8833	987.7666	1975.533	3951.066	7902.133



# 불꽃감지센서를 이용한 화재감지 응용

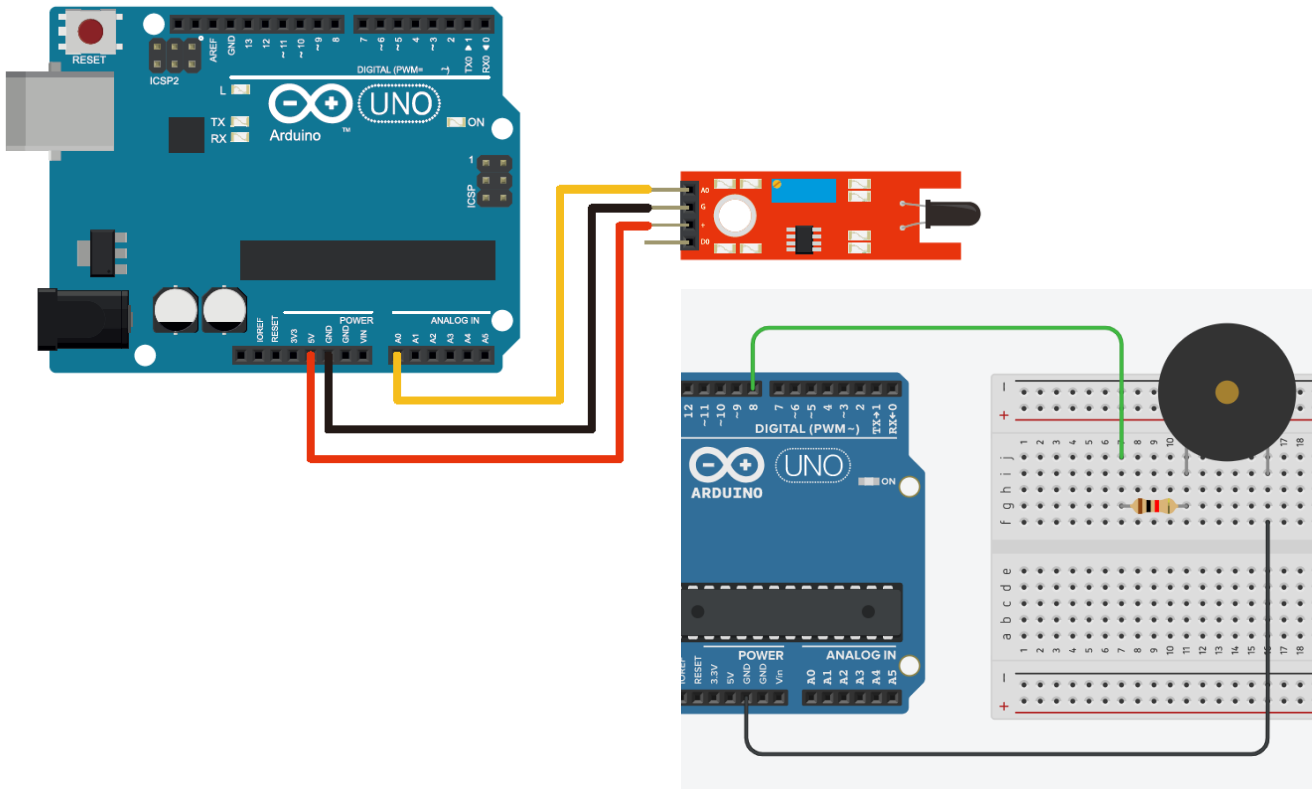
- 실험
  - 불꽃이 감지 되면 부저(소리)가 출력하는 회로와 코드를 작성 하시오





# 불꽃감지센서를 이용한 화재감지 응용

- 실험
  - 불꽃이 감지 되면
  - 부저(소리)가 출력하는 회로와 코드를 작성 하시오

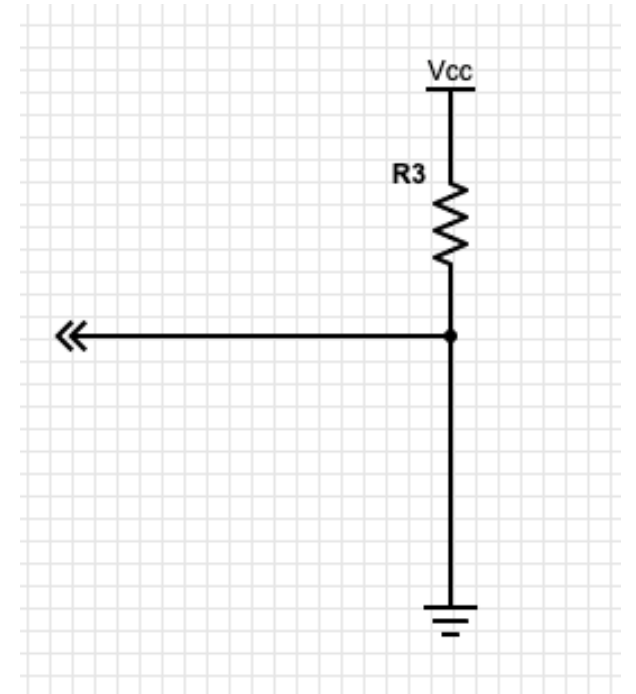
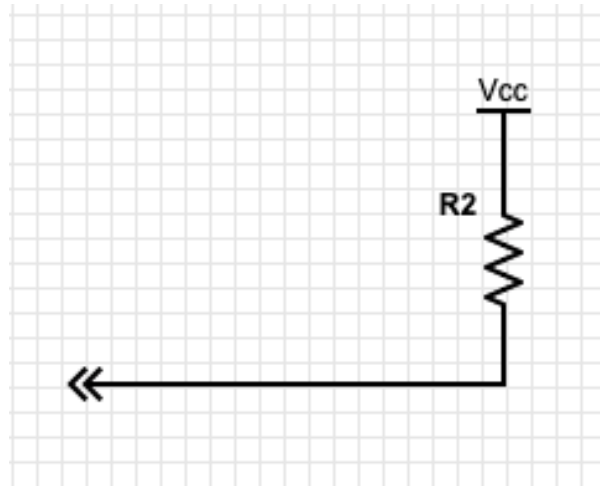
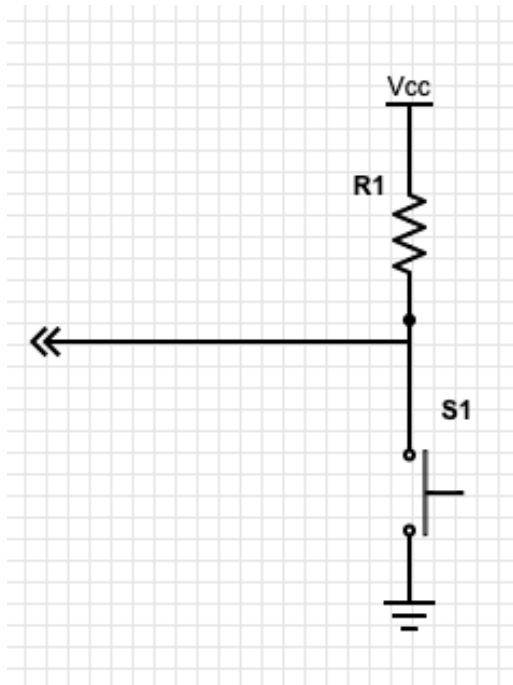


```
void setup()
{
    Serial.begin(9600);
    pinMode(8, OUTPUT);
}

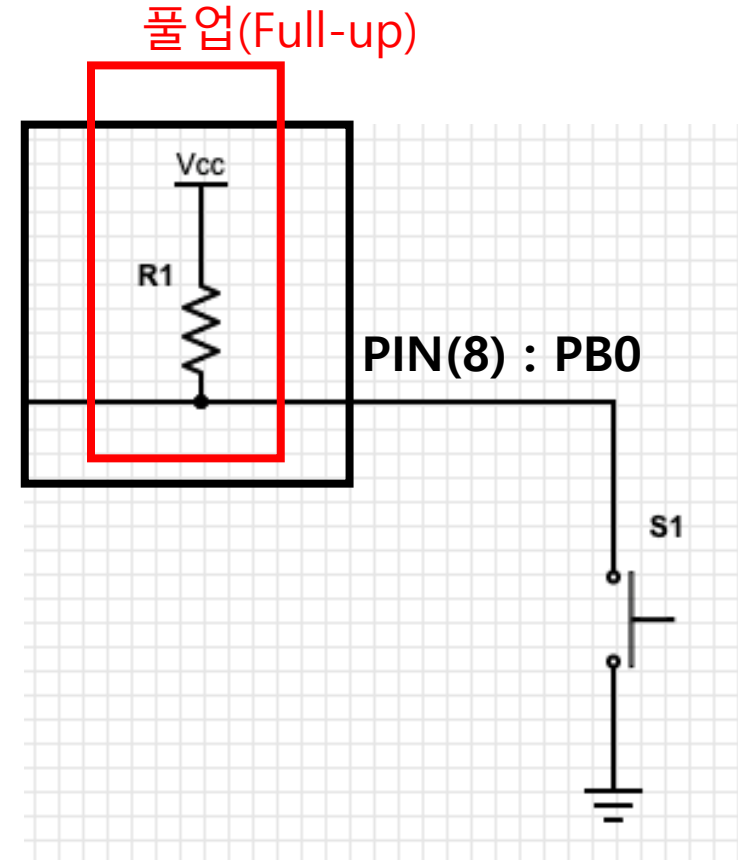
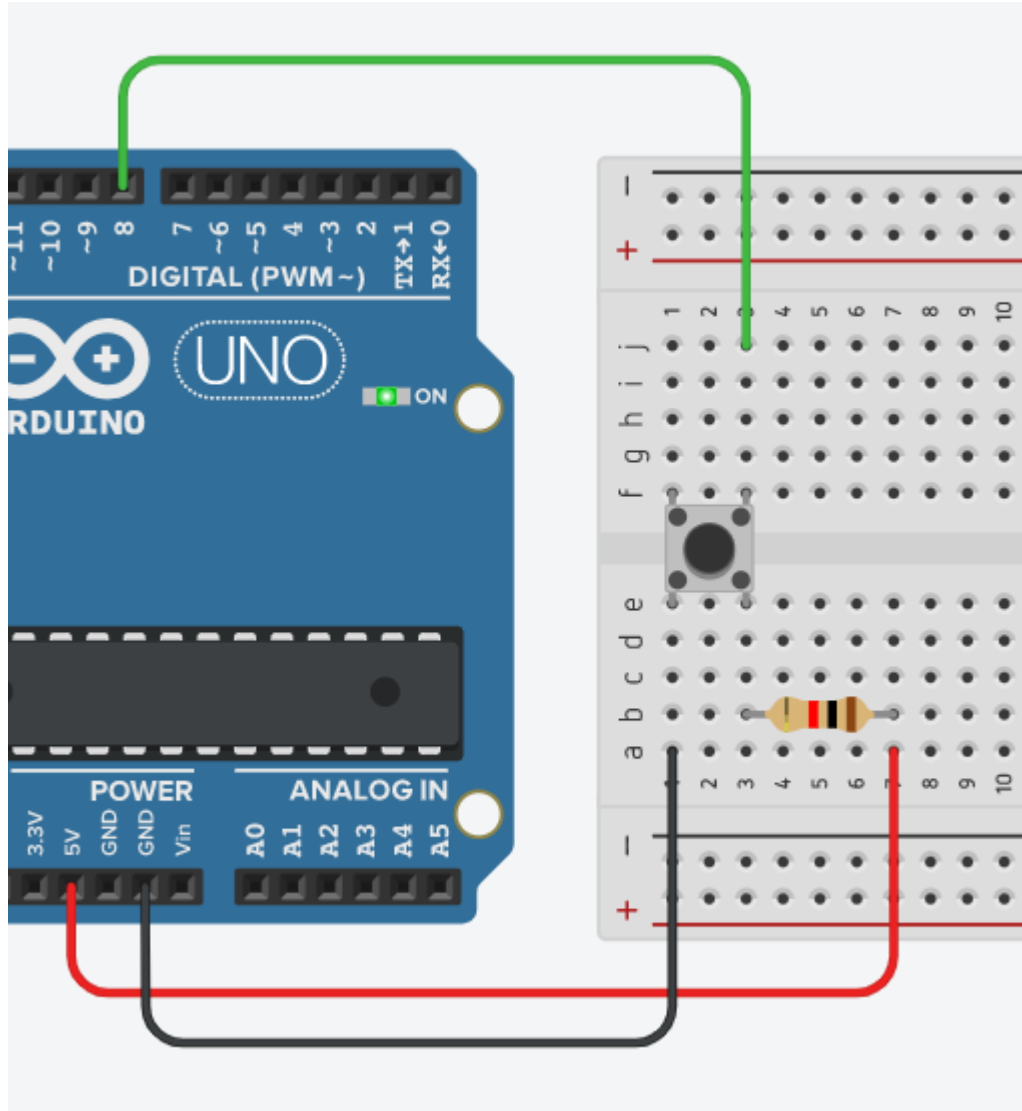
void loop()
{
    int analog_value = analogRead(A0);
    Serial.println(analog_value);

    if( analog_value < [          ] )
    {
        tone(8, 262, 500);
        delay(500);
    }
    else
    {
        tone(8, 0, 500);
        delay(500);
    }
}
```

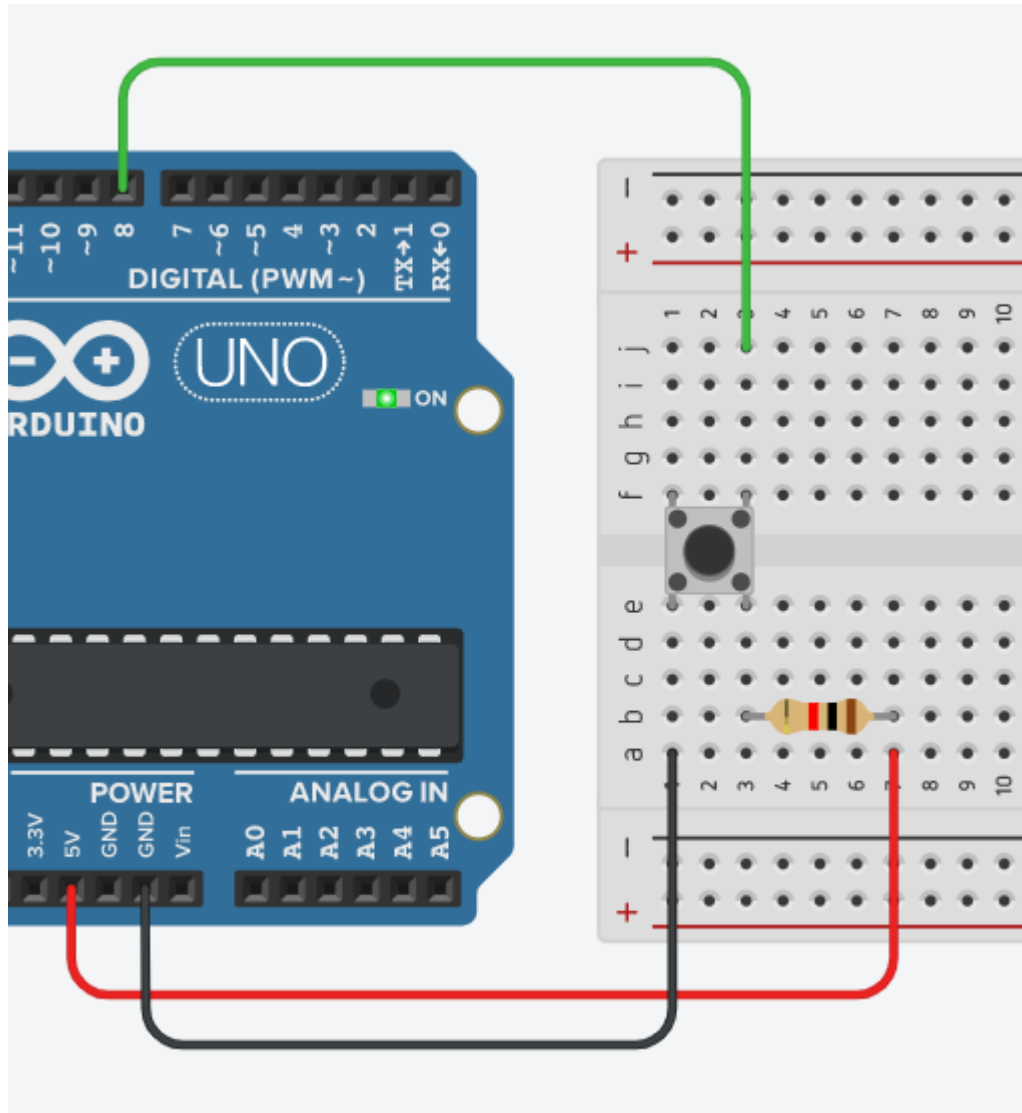
# 디지털 입력 실험(키 입력)



# 버튼을 이용한 Digital Input 실험



# 버튼을 이용한 Digital Input 실험



```
void setup()
{
    pinMode(8, INPUT) ;
    Serial.begin(9600) ;
}

void loop()
{
    int read = digitalRead(8) ;
    Serial.println(read) ;
}
```