

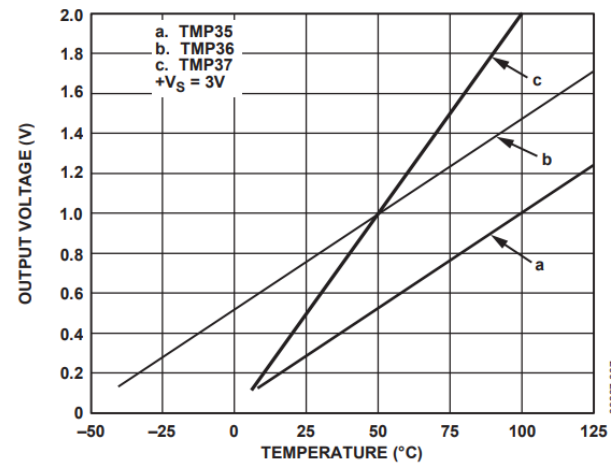
이미지 센서 및 analog 센서의 활용

목표

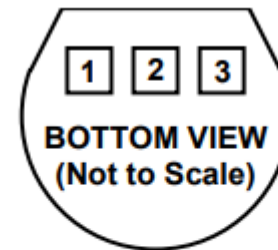
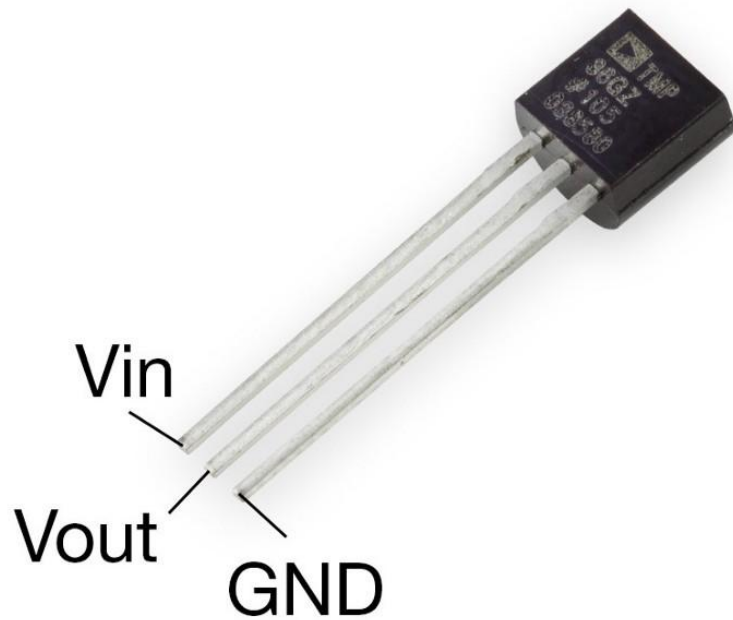
- TMP36 온도 센서의 데이터 확인 및 활용
- 3색LED 실험 → CCD센서(이미지) 수집의 이해
- analogRead를 통한 Full Color 만들기

TMP36

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



TMP36 핀연결



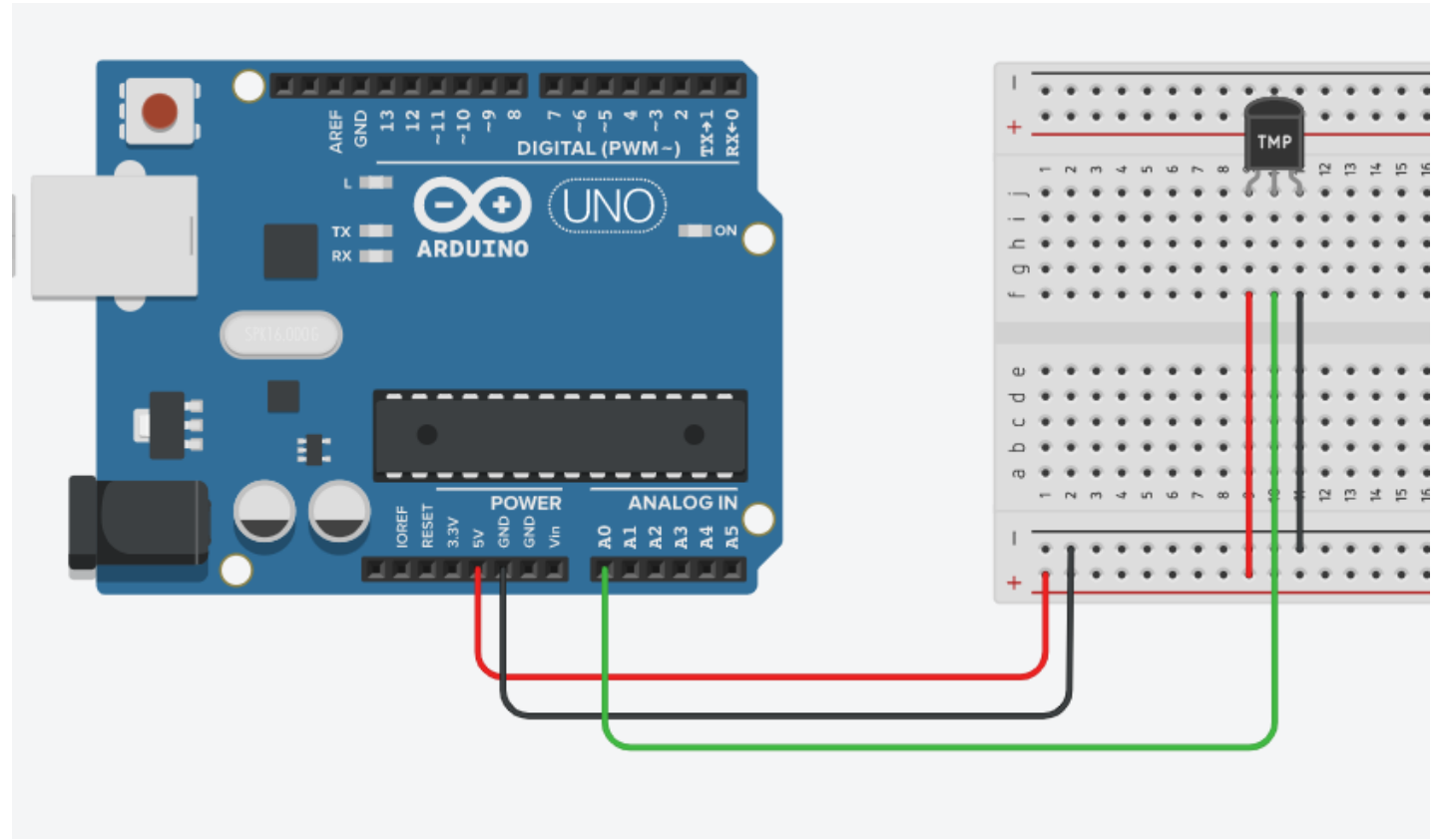
PIN 1, +V_S; PIN 2, V_{OUT}; PIN 3, GND

00337-004

Figure 4. T-3 (TO-92)

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. A red wire connects the sensor's ground pin to the ground rail of the breadboard. A green wire connects the sensor's VCC pin to the 5V rail. A black wire connects the sensor's signal pin to analog pin A0 of the Arduino Uno R3. The code editor on the right 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 right, the '시리얼 모니터' (Serial Monitor) window is open, showing the output of the program:

```
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()

```
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void loop()

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  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 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 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 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 {  
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21  delay(1000);  
22 }
```

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{  
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  Serial.print(voltage); Serial.println(" volts");  
  
  float temperatureC = (voltage - 0.5) * 100 ;  
  Serial.print(temperatureC); Serial.println(" degrees C");  
  
  delay(1000);  
}
```

온도 센서 [TMP36]

이름 온도센서

```
1 void setup()  
2 {  
3   Serial.begin(9600);  
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시리얼 모니터

0.00 volts
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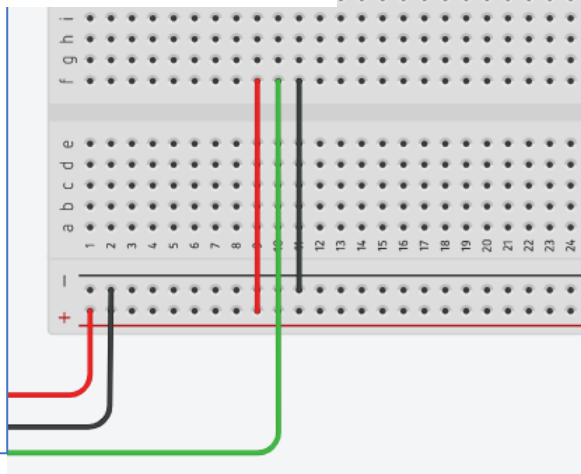
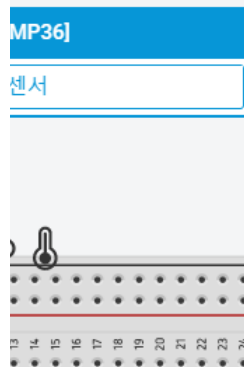
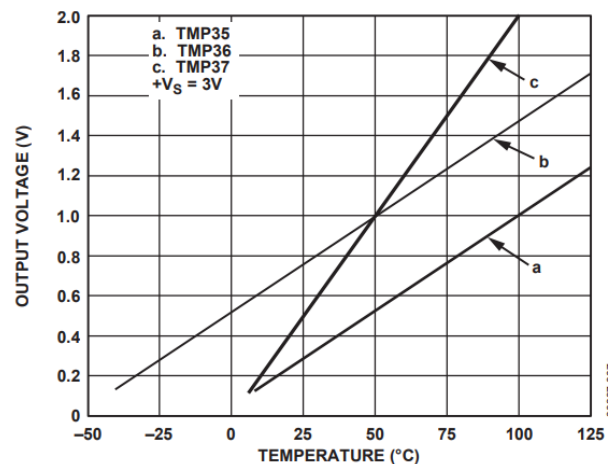
코드 작성

```
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);  
}
```



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시리얼 모니터

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

- TMP36은 10mV에 1°C
- 50°C일때 1.0V → 0°C 일때는 - 10mV * 50 = 500mV를 빼줘야 한다. 500mV는 0.5Volt
- 10mV당 1°C → 100을
- 10mV : 1 °C = yV : x °C → x °C = (y*1000mV * 1 °C) / 10mV → **x °C = y * 100**

코드 작성

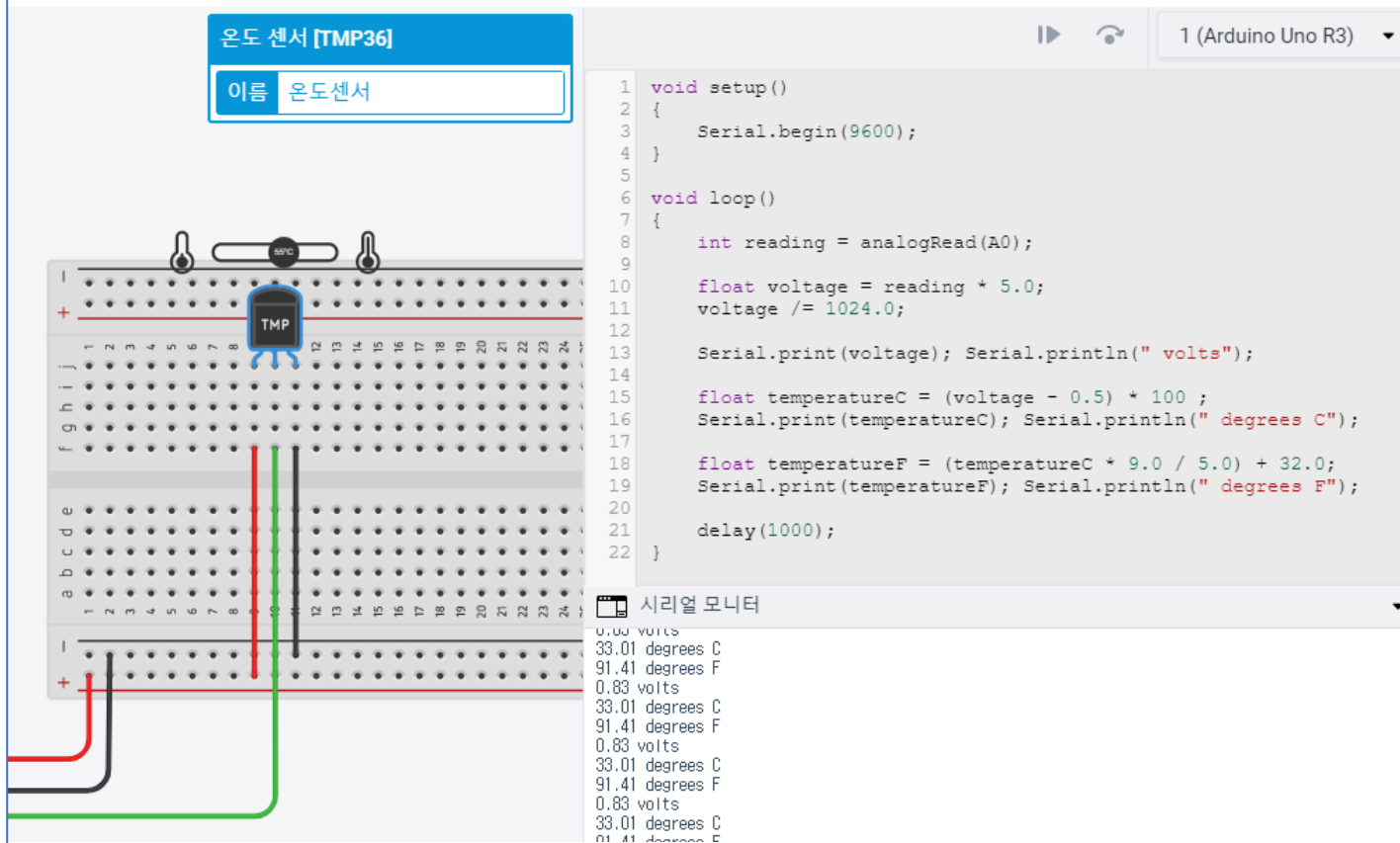
void setup()

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

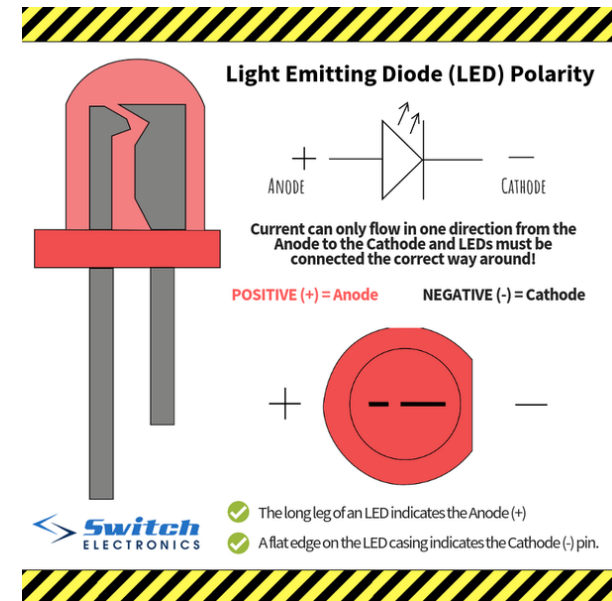
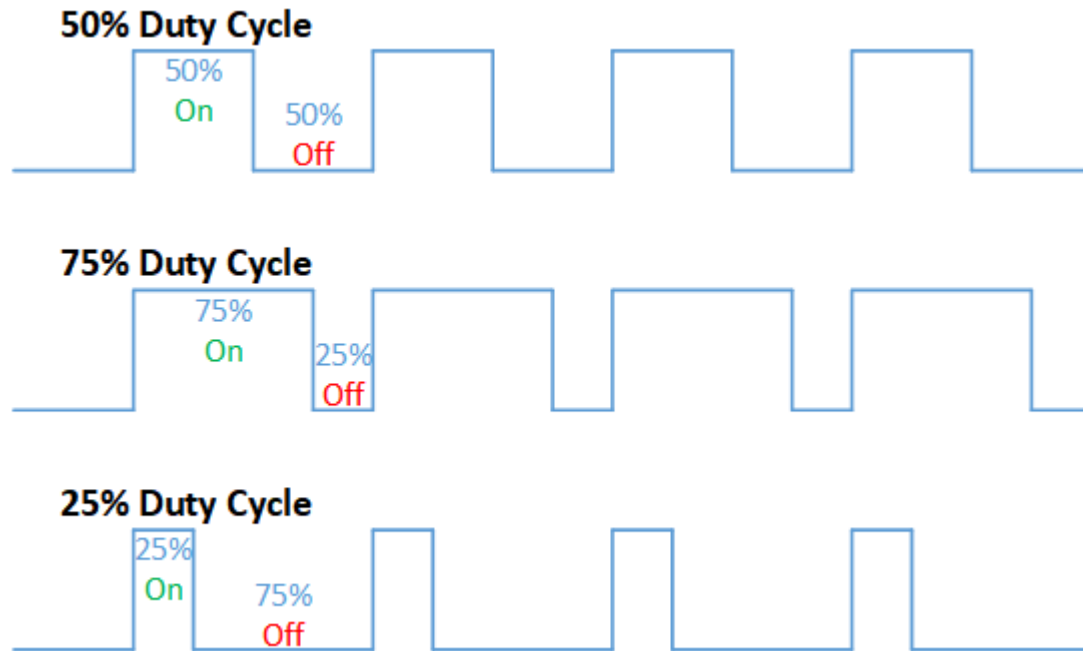
void loop()

```
{  
  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");  
  
  float temperatureF = (temperatureC * 9.0 / 5.0) + 32.0;  
  Serial.print(temperatureF); Serial.println(" degrees F");  
  
  delay(1000);  
}
```

$$^{\circ}F = \left(^{\circ}C \times \frac{9}{5}\right) + 32$$

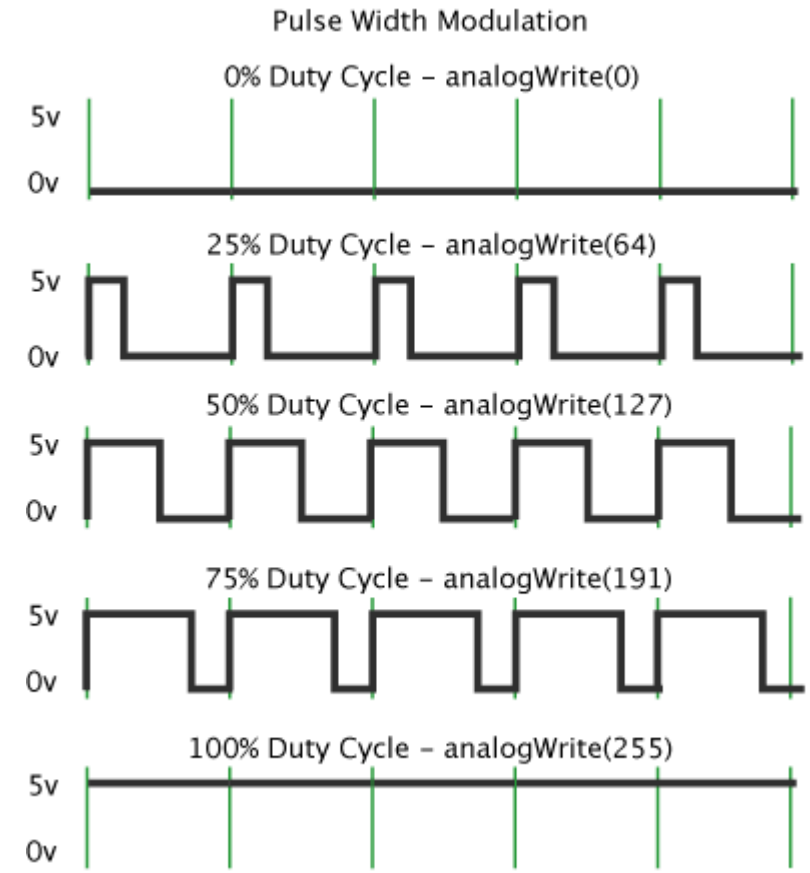
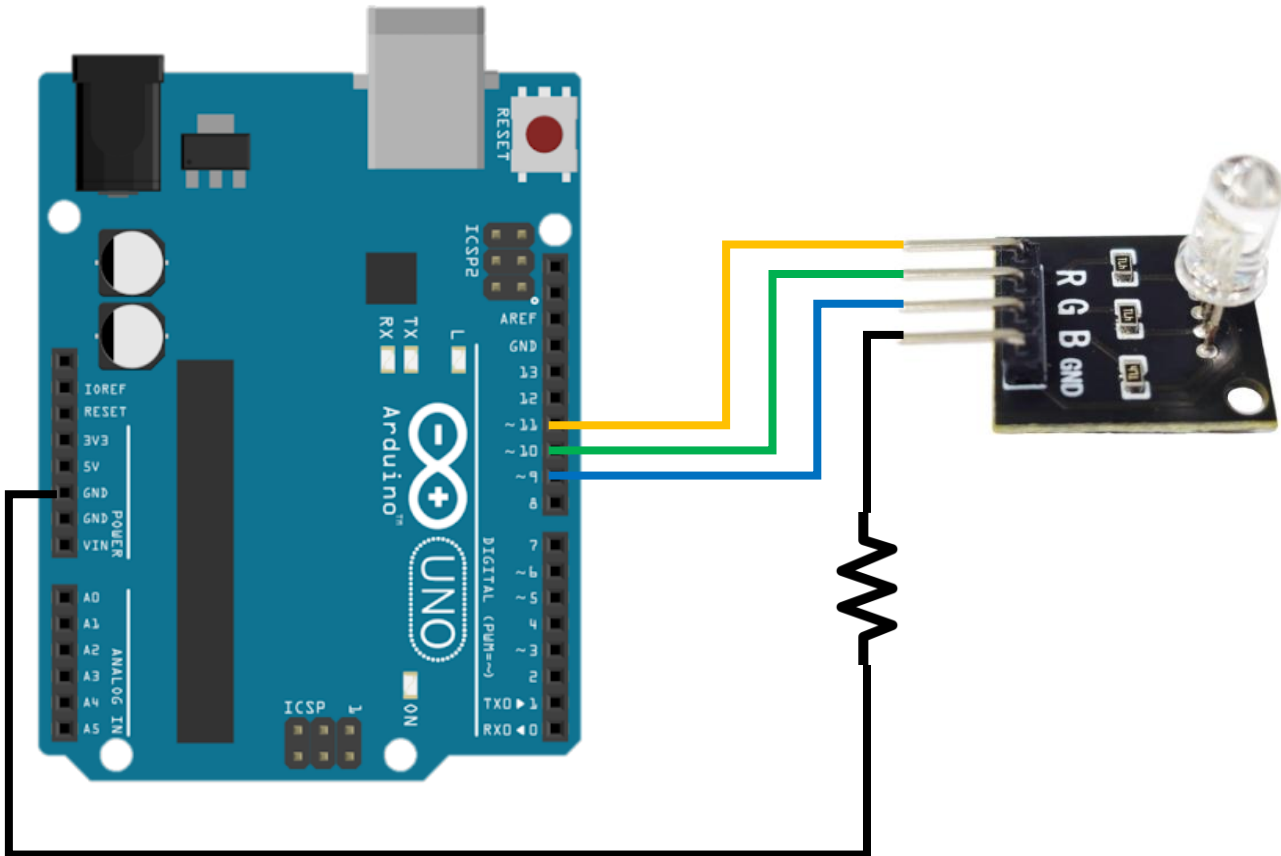


PWM을 이용한 LED 밝기 제어 (analogWrite)



아두이노를 이용한 LED 밝기제어 예제

- 함수 : `analogWrite(핀번호, duty cycle)`



아두이노를 이용한 LED 밝기제어 예제

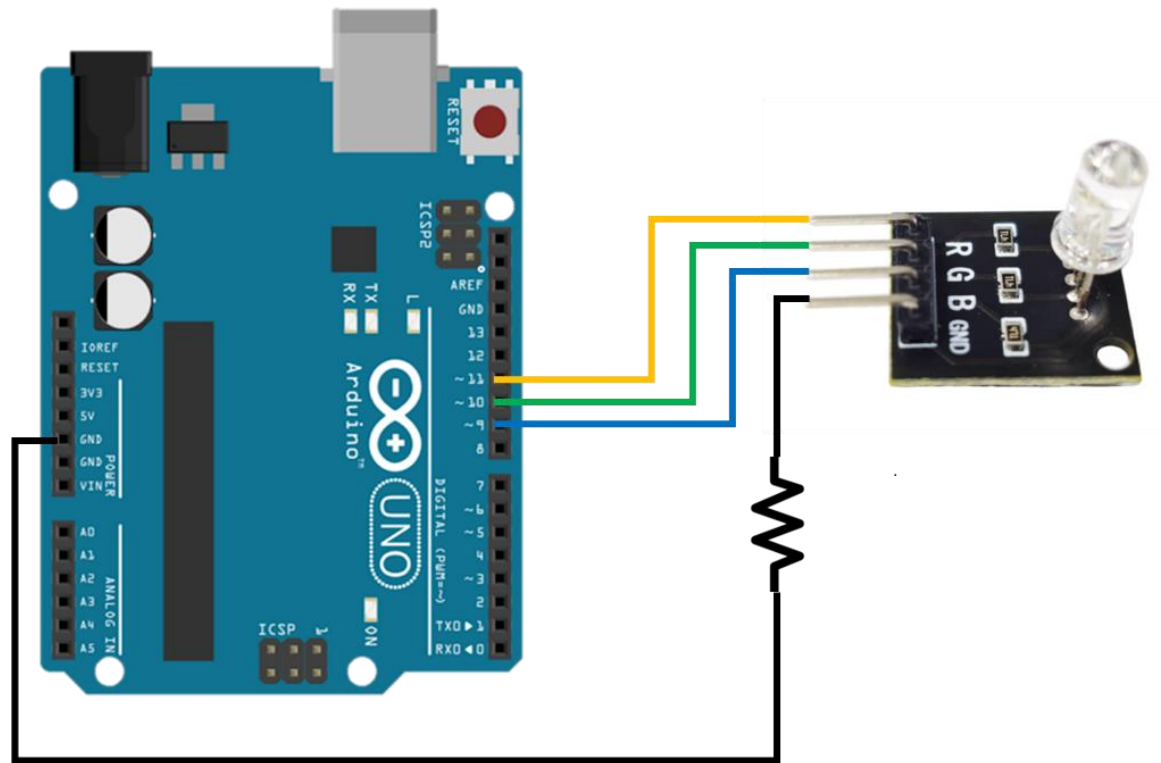
- 함수 : analogWrite(핀번호, duty cycle)

```
void setup()
{
  pinMode(9, OUTPUT) ;
}

void loop()
{
  analogWrite(9, 0) ;
}
```

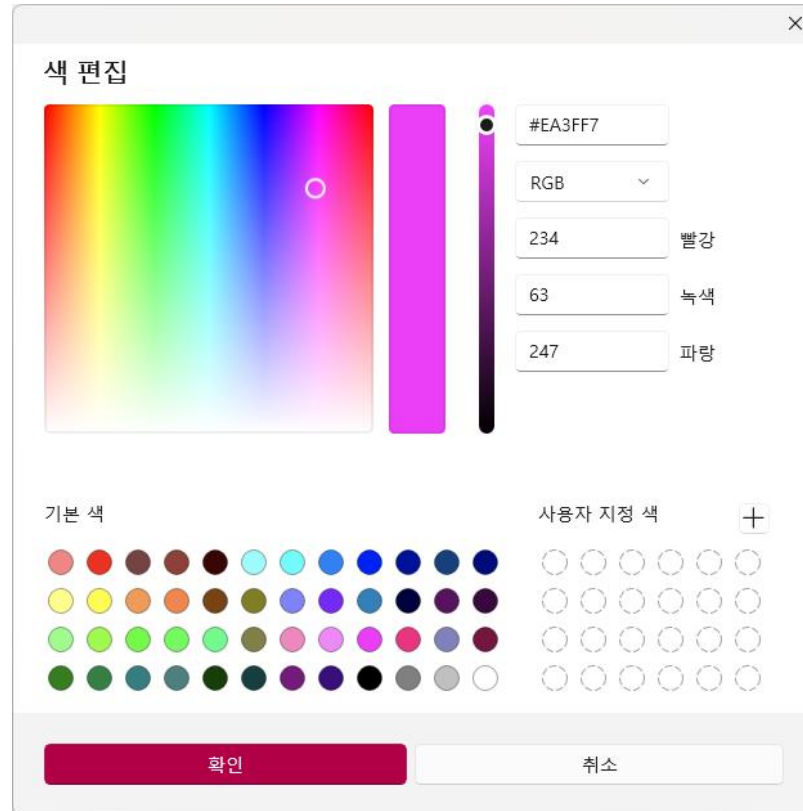
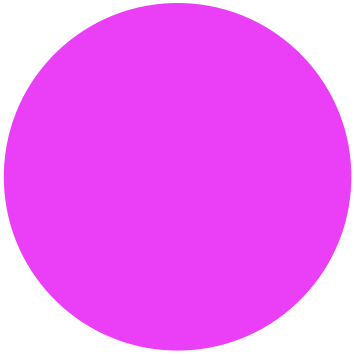
```
void setup()
{
  pinMode(9, OUTPUT) ;
}

void loop()
{
  analogWrite(9, 255) ;
}
```



QUIZ : 다양한 색상 표현하기

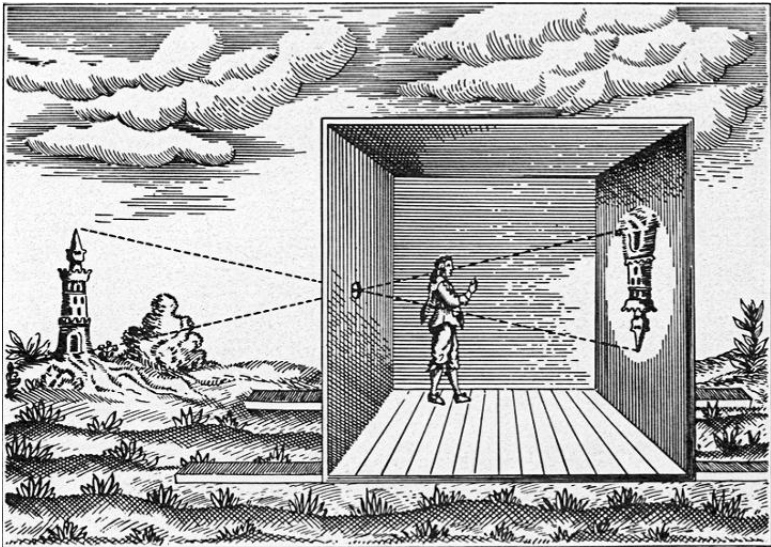
- 3색(RGB) LED를 이용하여 아래의 색을 표현하시오



[그림 1] 빛의 3원색인 Red, Blue, Green. 세 가지 색상을 조합하면 White가 된다.

카메라 센서의 원리

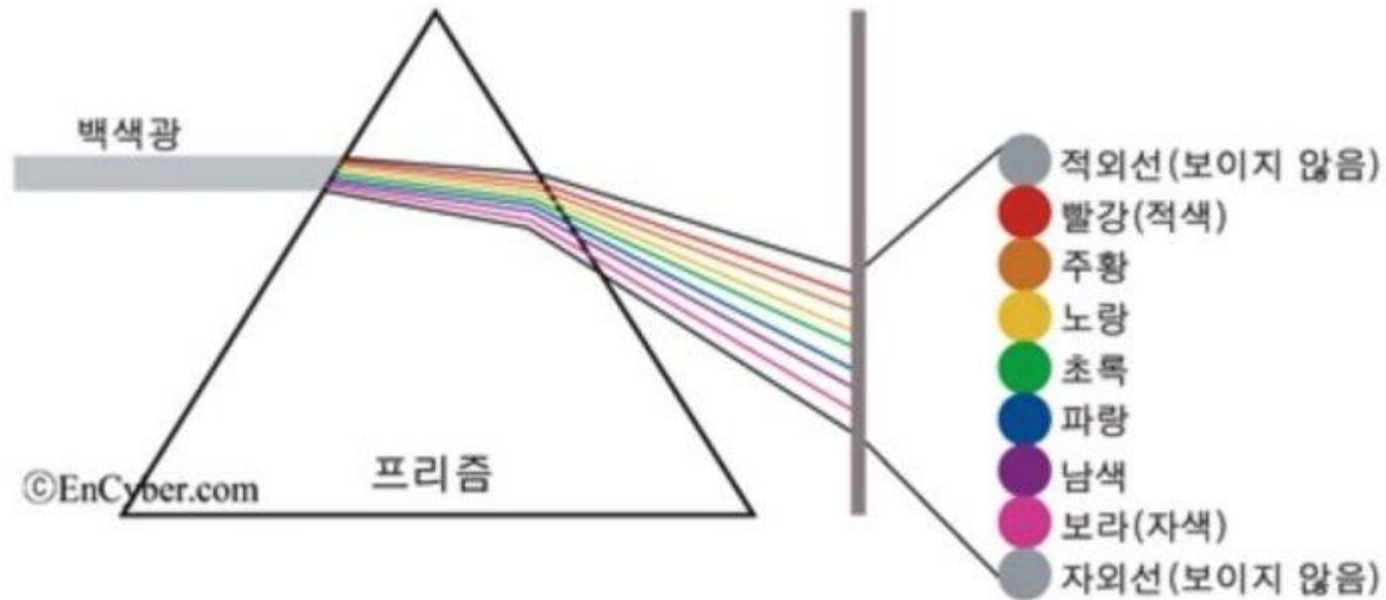
- 카메라 이미지 센서의 원리
 - 카메라의 이미지는 어떻게 수집 될까?
 - 빛 → 렌즈 → CCD센서 → Memory



최초의 카메라 원리 '카메라 옵스큐라'

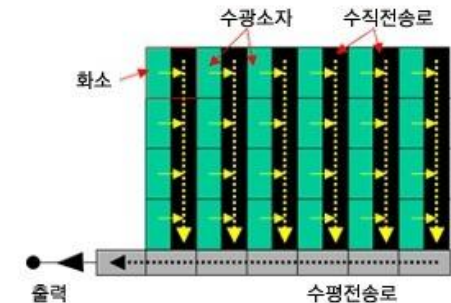
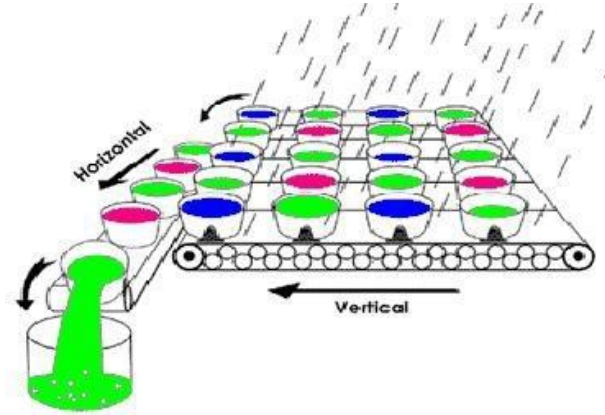
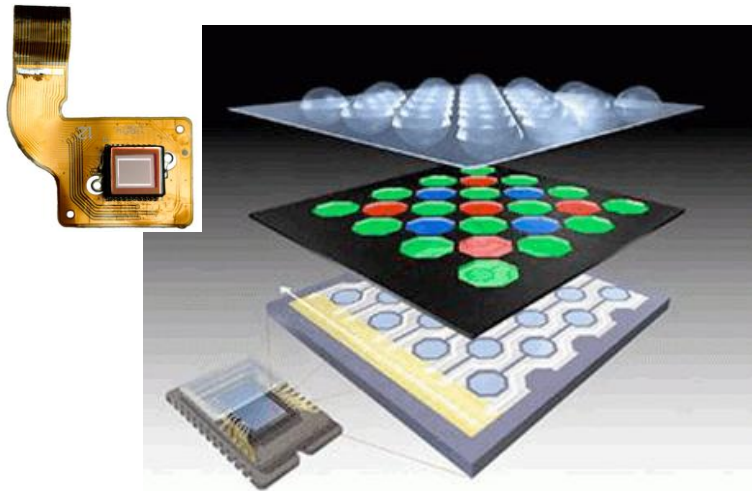
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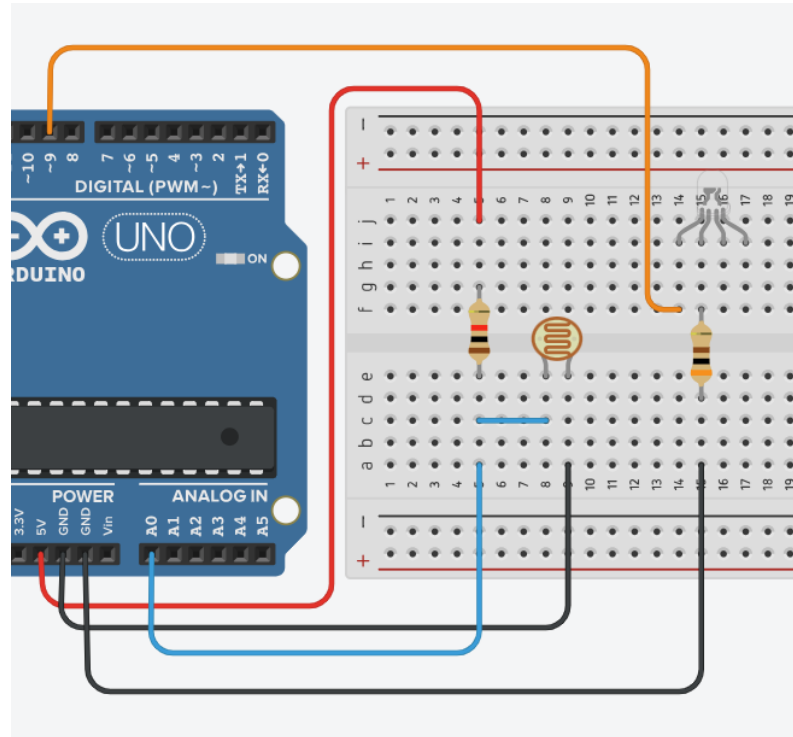
카메라 센서의 원리

- 카메라 이미지 센서의 원리
 - 카메라의 이미지는 어떻게 수집 될까?
 - 빛 → 렌즈 → 센서 → Memory



카메라 센서의 원리(실험)

- CDS를 이용하여 빛의 세기에 따른 LED 변화하기



카메라 센서의 원리(실험)

- 3개의 가변 저항을 이용하여 Full Color 표현하기

