

# Robotics

Analog Input

School of Computing, Gachon University

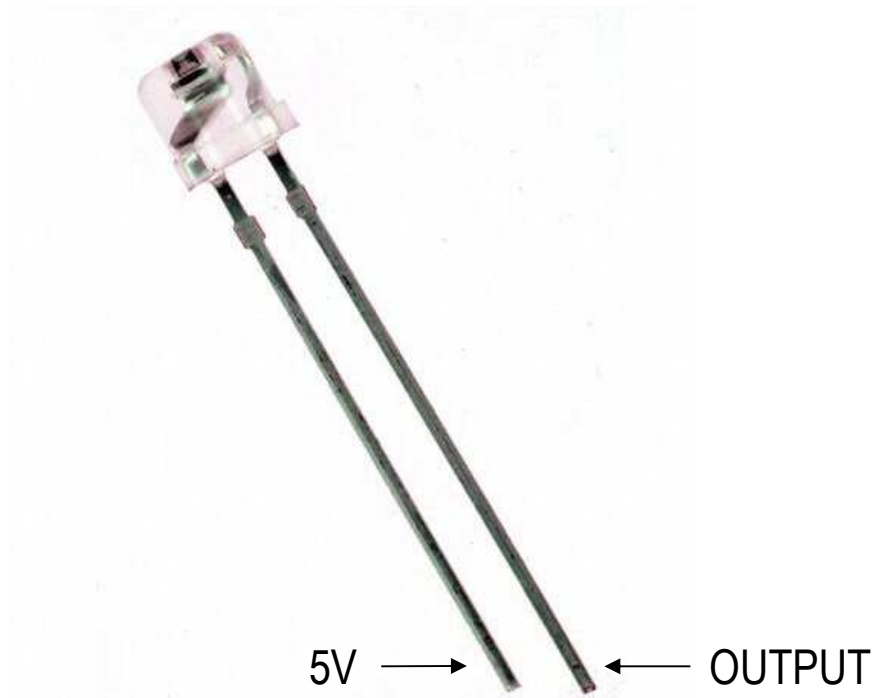
Kang, Sangwoo



# Basics

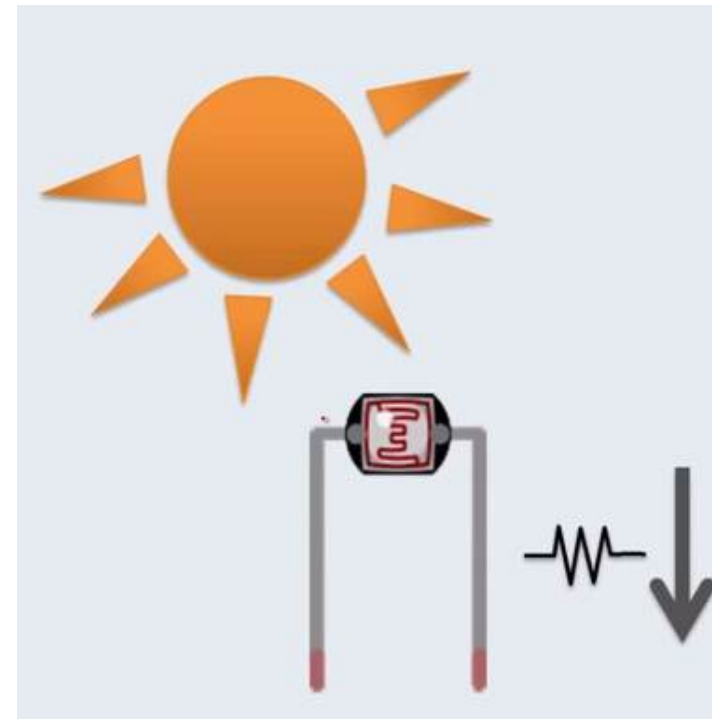
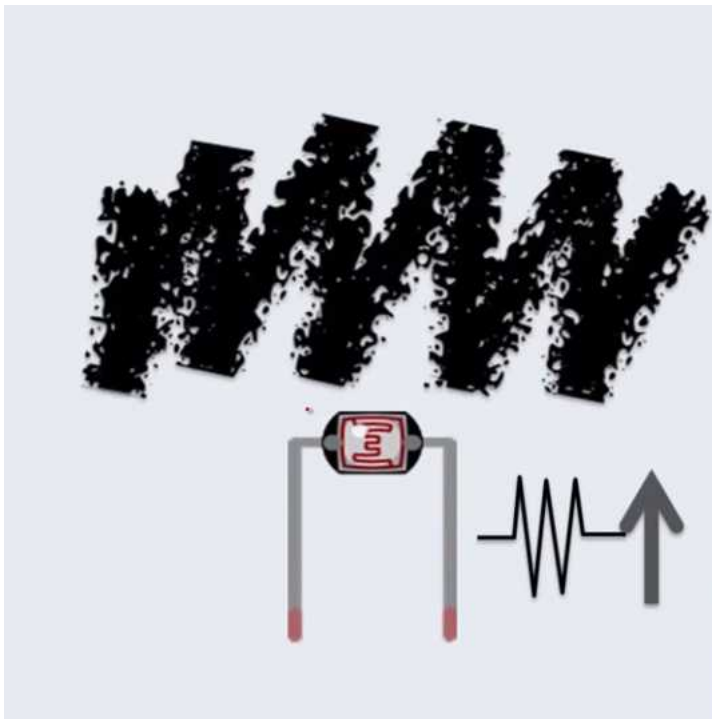
## ● Photoresistor (Ambient Light Sensor)

- A **photoresistor** (or **LDR**, or **photocell**) is a light-controlled variable resistor, which we can read into the Arduino board as an **analog value between 0 and 1023**



# Basics [cont'd]

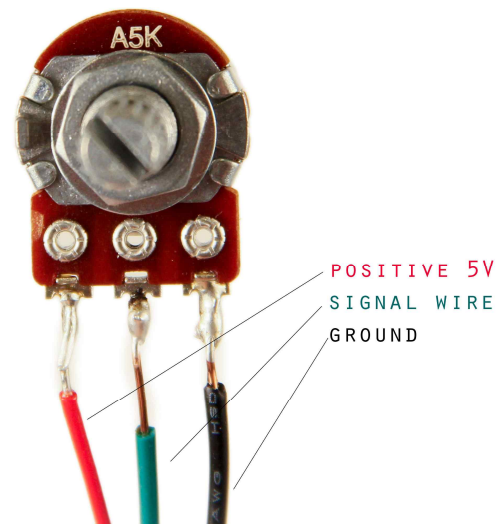
- In the dark, a Photoresistor can have a resistance as high, while in the light, a ambient light sensor can have a resistance as low
- A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits



# Basics [cont'd]

## ● POTENTIOMETER

- A potentiometer is a simple **knob** that **provides a variable resistance** with a sliding or rotating, which we can read into the Arduino board as an **analog value between 0 and 1023**



# Basics [cont'd]

- **Temperature sensor [LM36]**

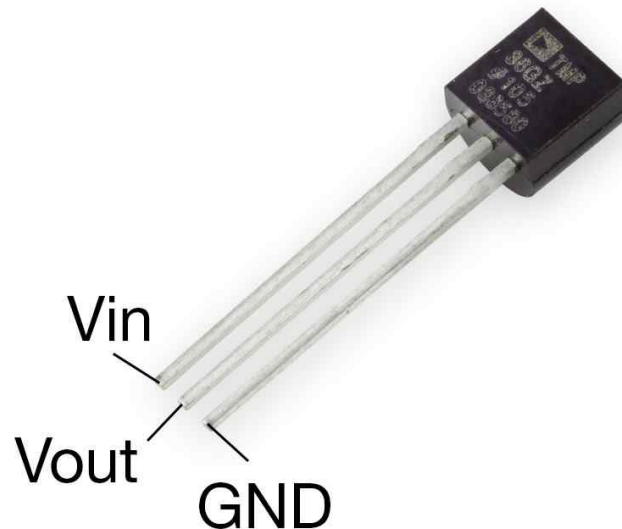
- LM36 is an integrated circuit sensor that can be used to measure temperature with an electrical output **proportional to the temperature in Celsius.**



# Basics [cont'd]

## ● Temperature sensor [TMP36]

- The TMP36 is low voltage, precision centigrade temperature sensors. That provides a voltage output that is linearly proportional to the Celsius (Centigrade) temperature.
- Voltage = value \* 5 / 1024.0
- Celsius temperature = (Voltage - 0.5) X100



# Functions

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## ● `analogRead()`

- Reads the value from the specified analog pin. The Arduino board contains a 6 channel (8 channels on the Mini and Nano, 16 on the Mega), 10-bit analog to digital converter. This means that it will map input voltages between 0 and 5 volts into integer values between 0 and 1023.
- Syntax
  - `analogRead(pin)`
    - pin: the number of the analog input pin to read from
    - (0 to 5 on most boards, 0 to 7 on the Mini and Nano, 0 to 15 on the Mega)

# Functions [cont'd]

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- Example

```
void loop()  
{  
  val = analogRead(A0);  // read the input pin  
  Serial.println(val);  
}
```



# Functions

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- **map()**

- Re-maps a number from one range to another. That is, a value of **fromLow** would get mapped to **toLow**, a value of **fromHigh** to **toHigh**, values in-between to values in-between, etc.
- Syntax
  - **map(value, fromLow, fromHigh, toLow, toHigh)**
    - value: the number to map
    - fromLow: the lower bound of the value's current range
    - fromHigh: the upper bound of the value's current range
    - toLow: the lower bound of the value's target range
    - toHigh: the upper bound of the value's target range

# Functions [cont'd]

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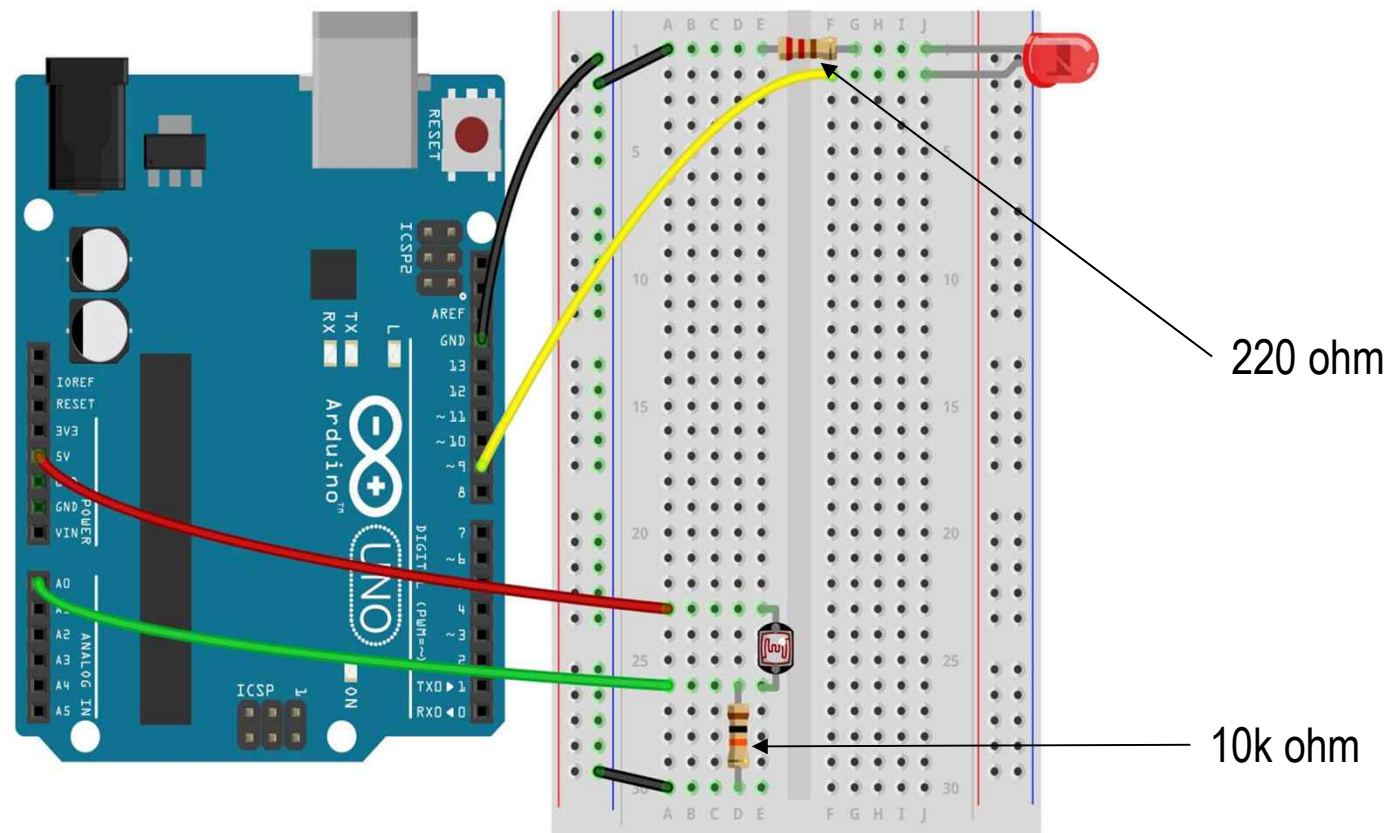
- Example

```
void loop()
{
  int val = analogRead(A0);
  val = map(val, 0, 1023, 0, 255);
  analogWrite(9, val);
}
```

- To control on each LED depends on the value obtained by analog sensors
  - The potentiometer/ambient light sensor reading is a number from 0 to 1023.
  - The brightness of the LED is set a number between 0 to 255.

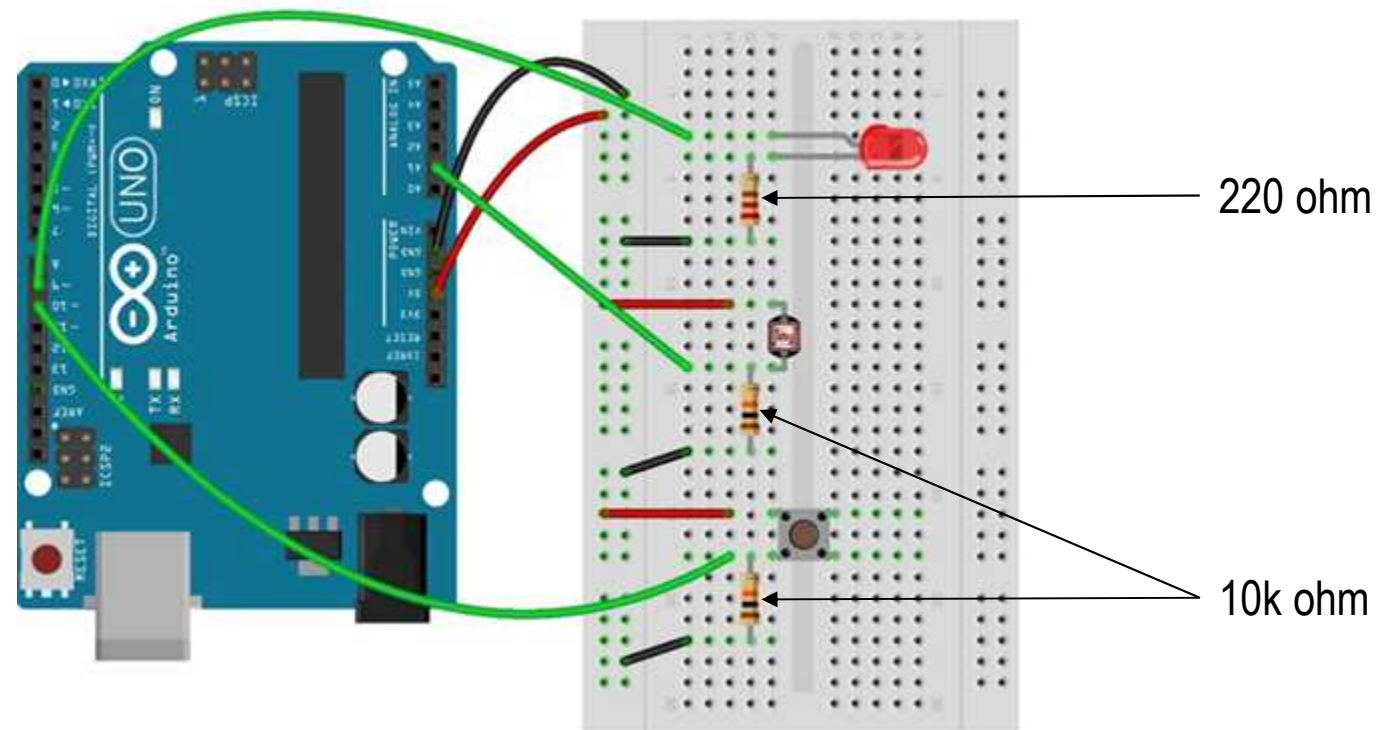
# Lab. 1 - photoresistor I

- Using a photoresistor, Turn on an LED when it is dark and Turn it off when it is light.
- Circuit diagram:



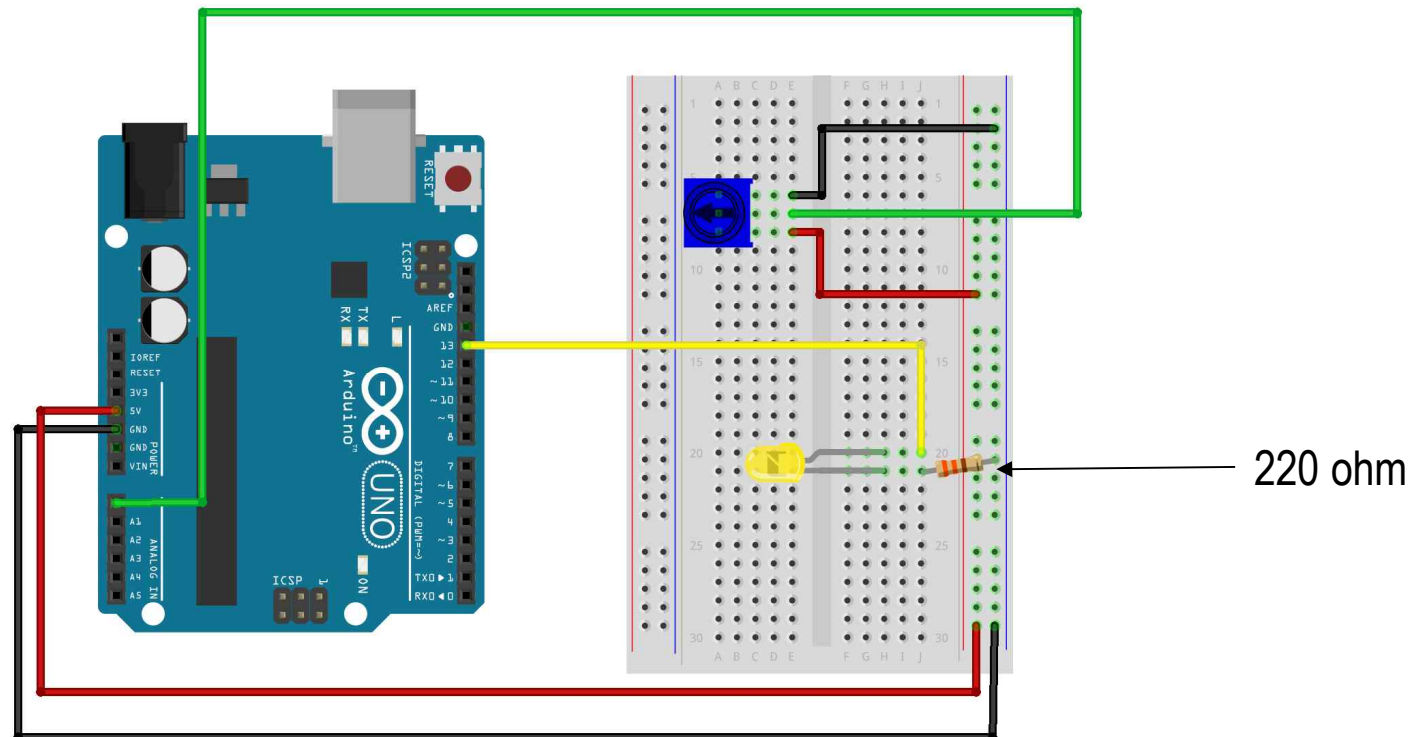
## Lab. 2 - photoresistor II

- Control the brightness (0-255) of the LED depends on the value (0-1023) obtained by a photoresistor.
  - When the pushbutton is pressed, turn off the LED
- Circuit diagram:



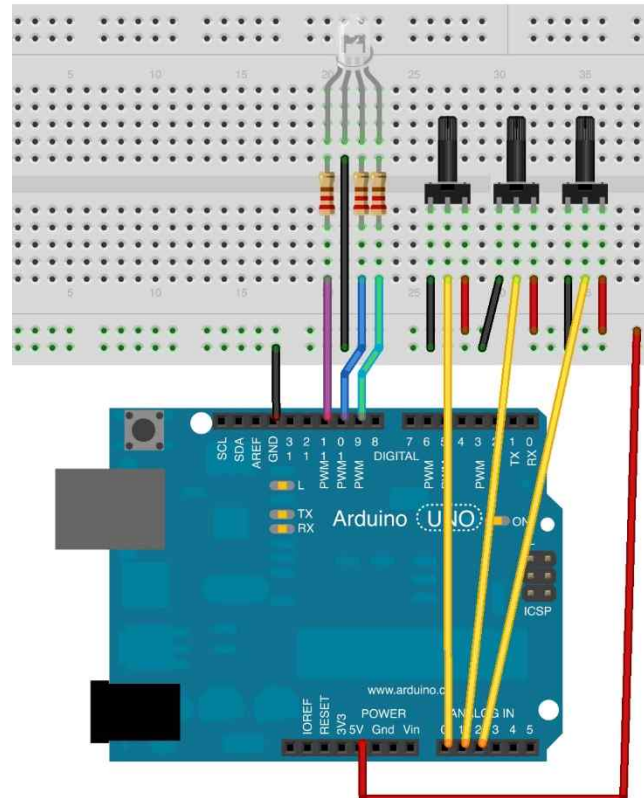
# Lab. 3 - Potentiometer I

- An analog value controls the rate at which an LED blinks.
  - turns on and off a LED. The amount of time the LED will be on and off depends on the value obtained by potentiometer.
  - **Circuit diagram:**



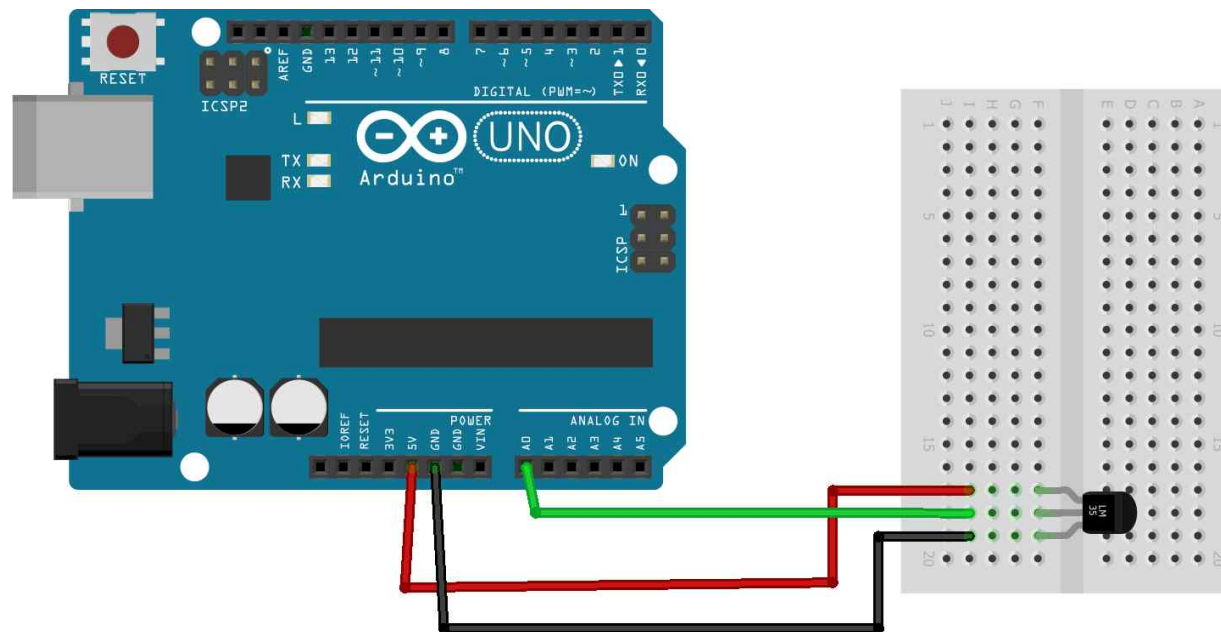
## Lab. 4 - Potentiometer II

- This device combines a RGB LED and due to the additive properties of the light.
  - Use three potentiometers for controlling the brightness of each LED, the signal of each one will be read by the Arduino as an input.
  - **Circuit diagram:**



# Lab. 5 - Temperature Sensor I

- Measure surrounding temperature.
  - Display the measured temperature to serial communication
- Circuit diagram:



## Lab. 6 - Temperature Sensor II

- The sensed temperature is displayed with 6 LEDs in a range from 20 – 31°C.
- Circuit diagram:

