Robotics

Analog Input

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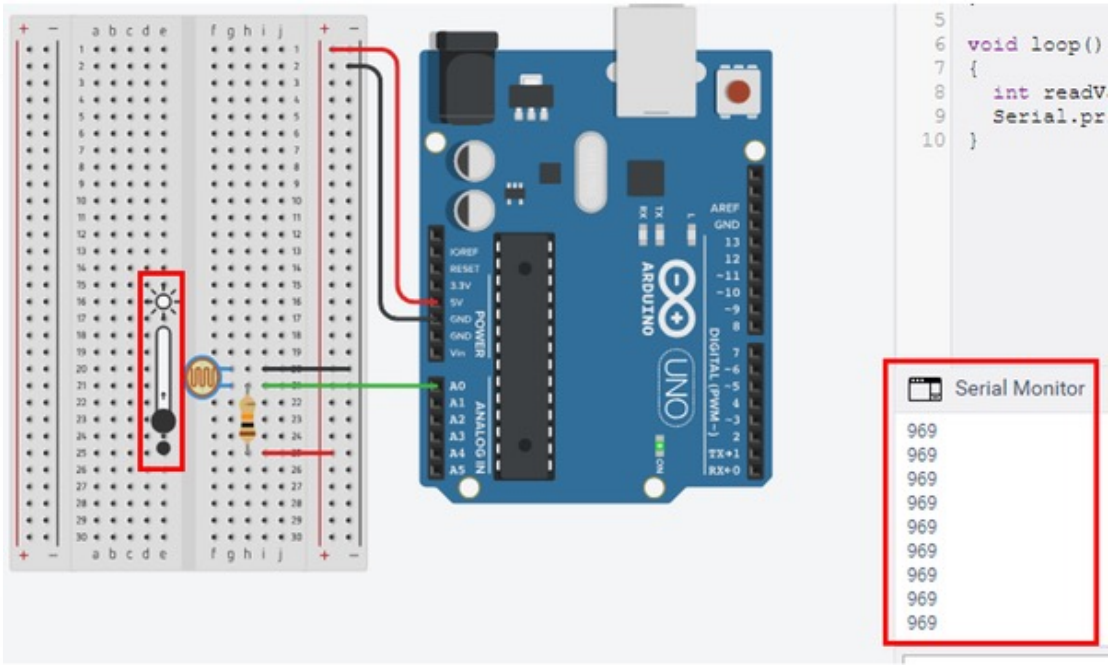
Basics

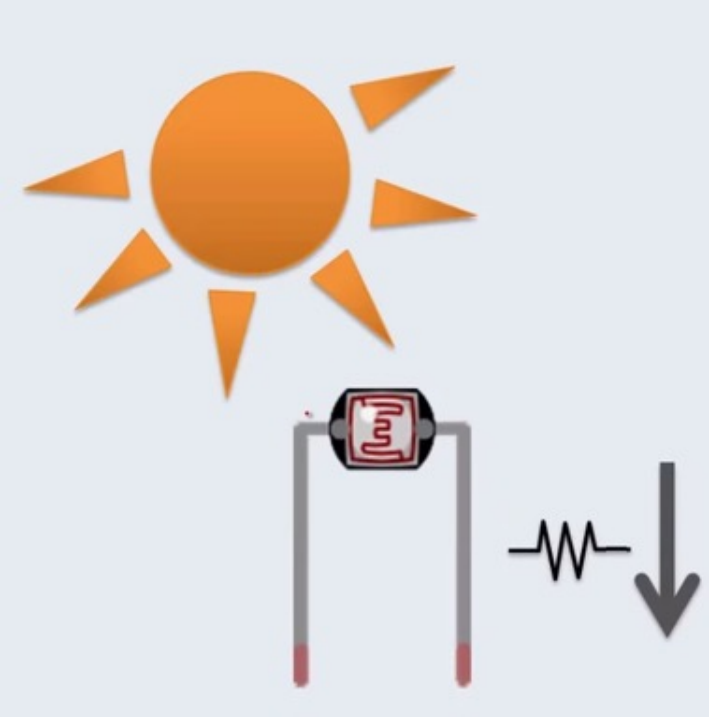
Photoresistor (Ambient Light Sensor)

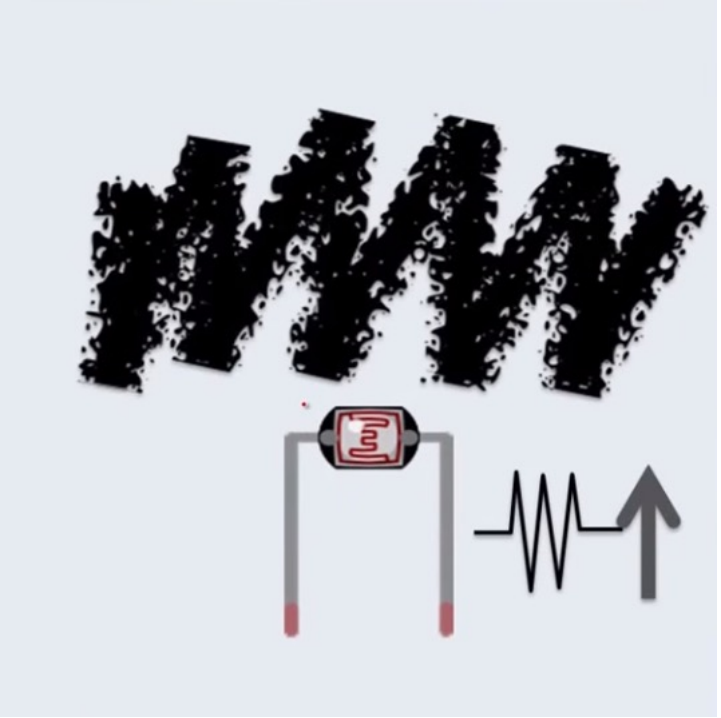
- A **photoresistor** (or **LDR**, or **photocell**) is a light-controlled variable resistor, which we can read into the Arduino board as an analog value between 0 and 1023.



Basics [cont.]

- In the dark environment, a photoresistor has high resistance, whereas in the light environment, a photoresistor has low resistance.
- A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

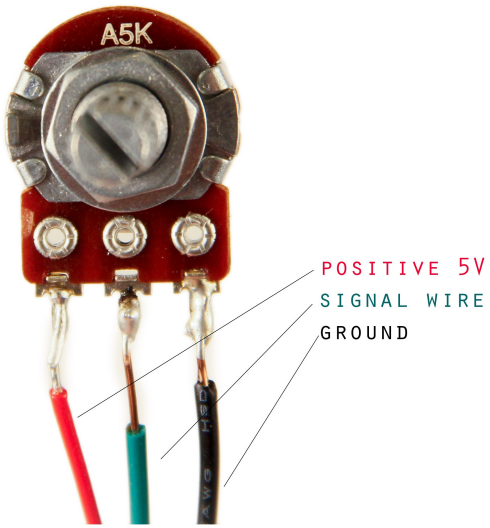


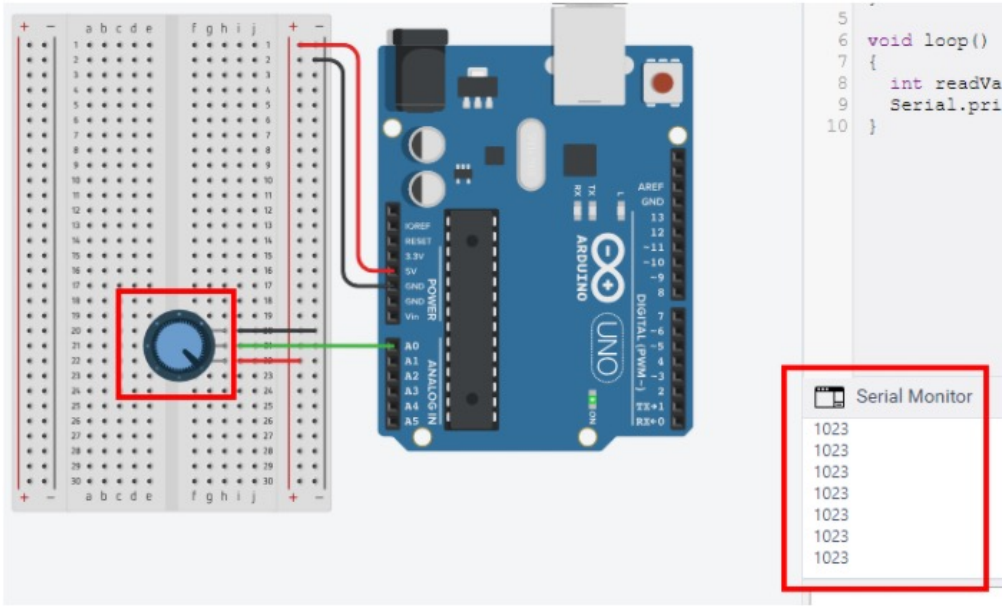


Basics [cont.]

●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.

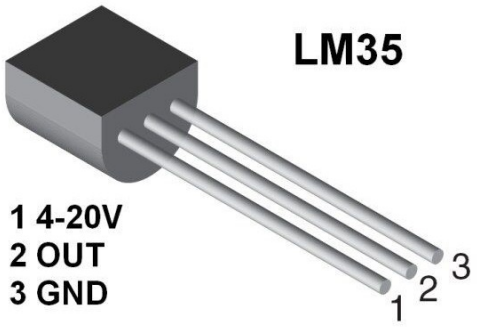


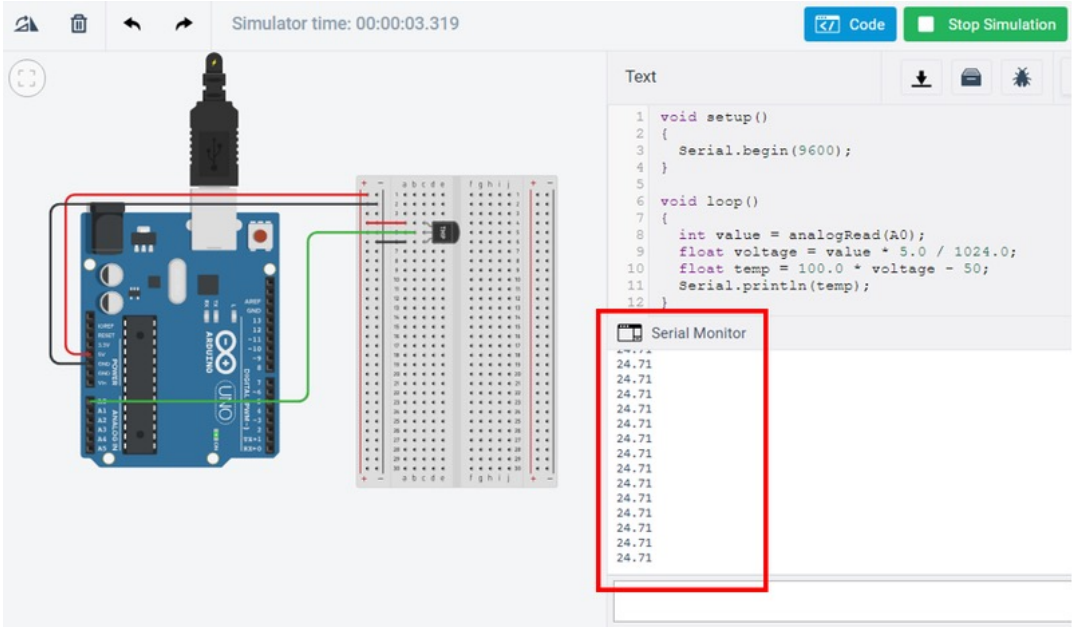


Basics [cont.]

Temperature sensor [LM35]

- LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature in Celsius.





Functions

- **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.]

- Example

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

Functions

- **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.]

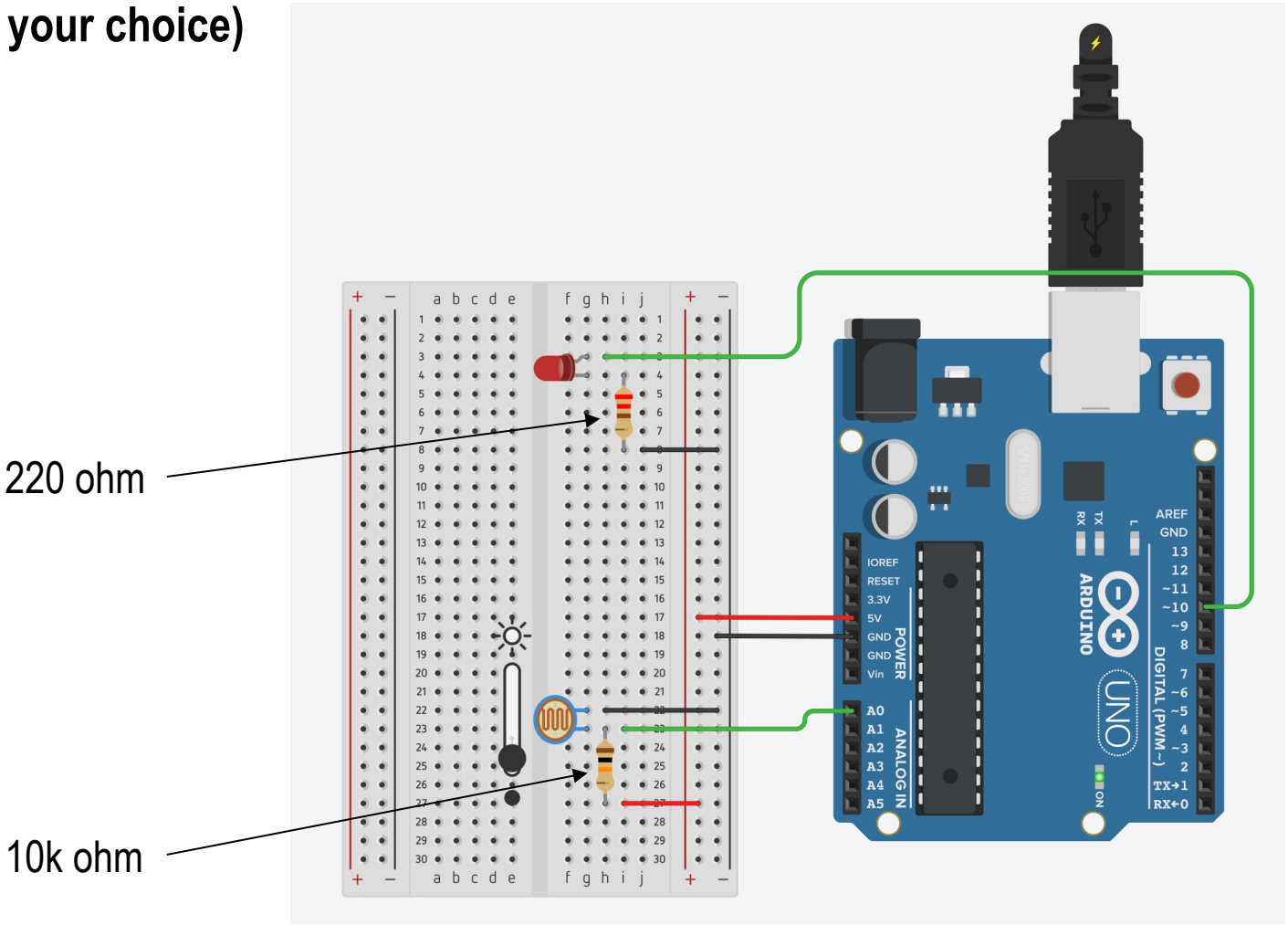
- Example

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

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

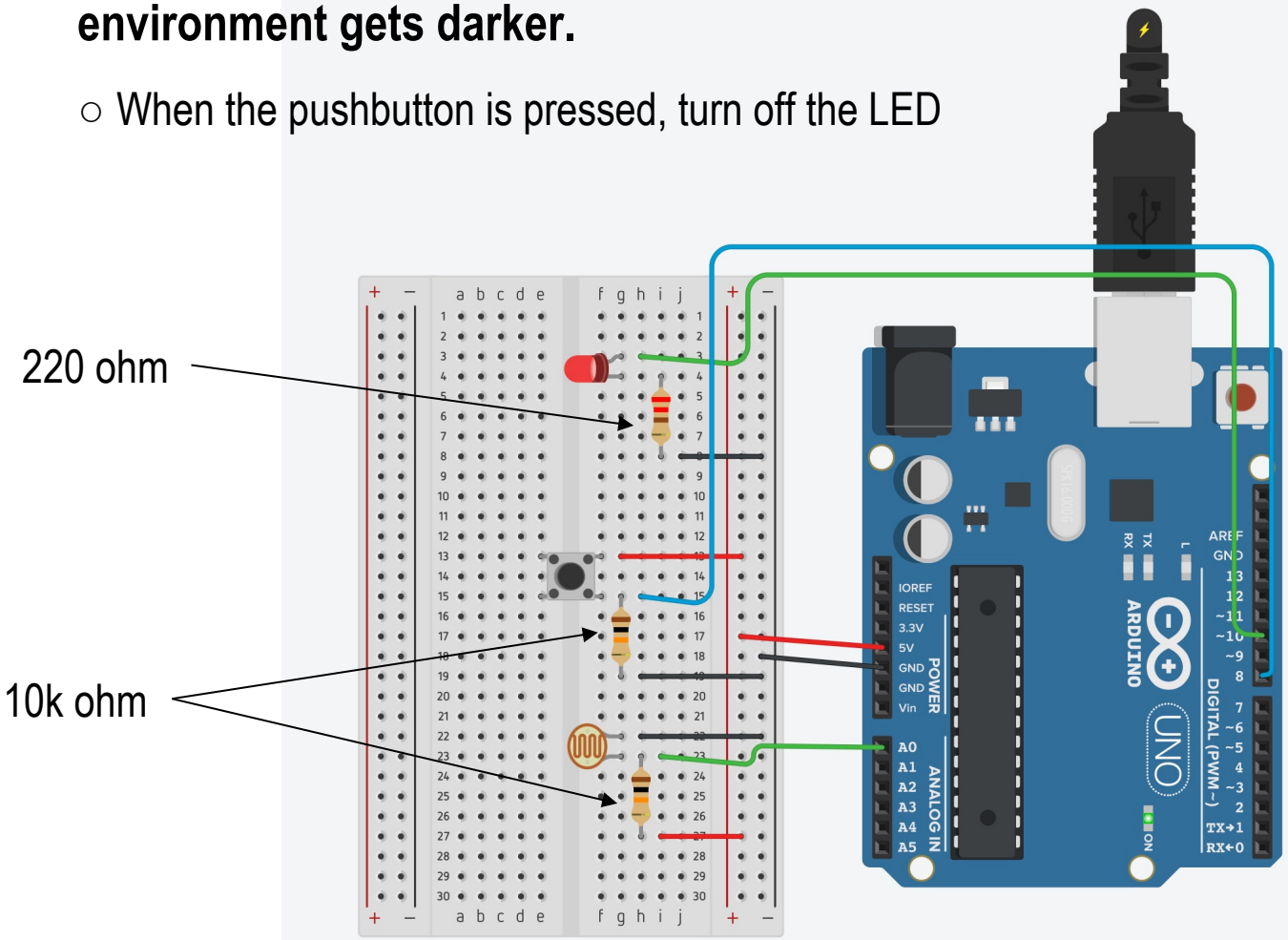
Lab. 1 - Ambient Light sensor I

- Using an ambient light sensor, turn on an LED when it is dark and turn it off when it is light. Determine light/dark condition by a threshold (an integer of your choice)



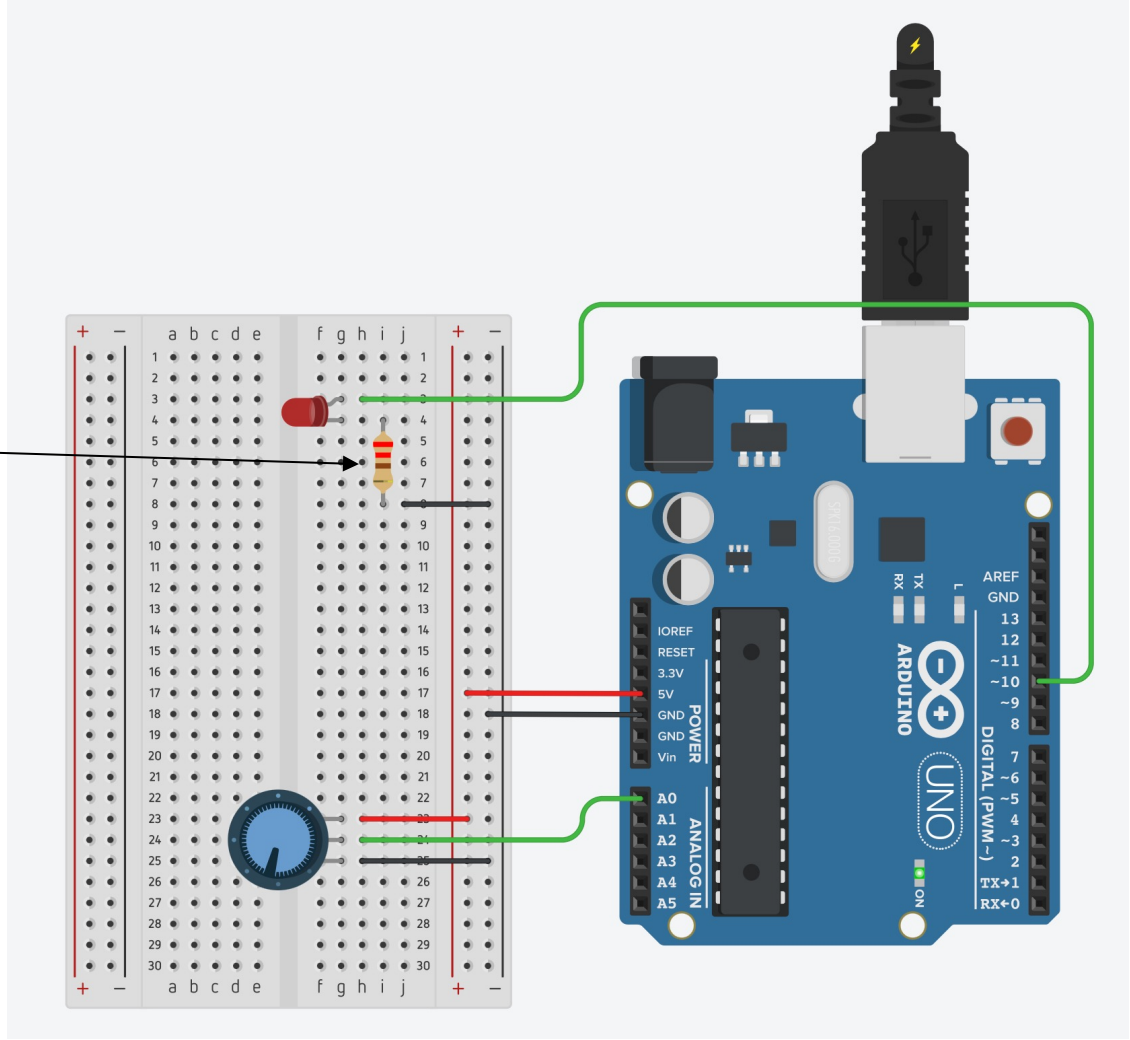
Lab. 2 - Ambient Light Sensor II

- **Control the brightness (0-255) of the LED depending on the value (0-1023) obtained by Ambient Light Sensor. Make the LED brighter when the environment gets darker.**
  - ○ When the pushbutton is pressed, turn off the LED



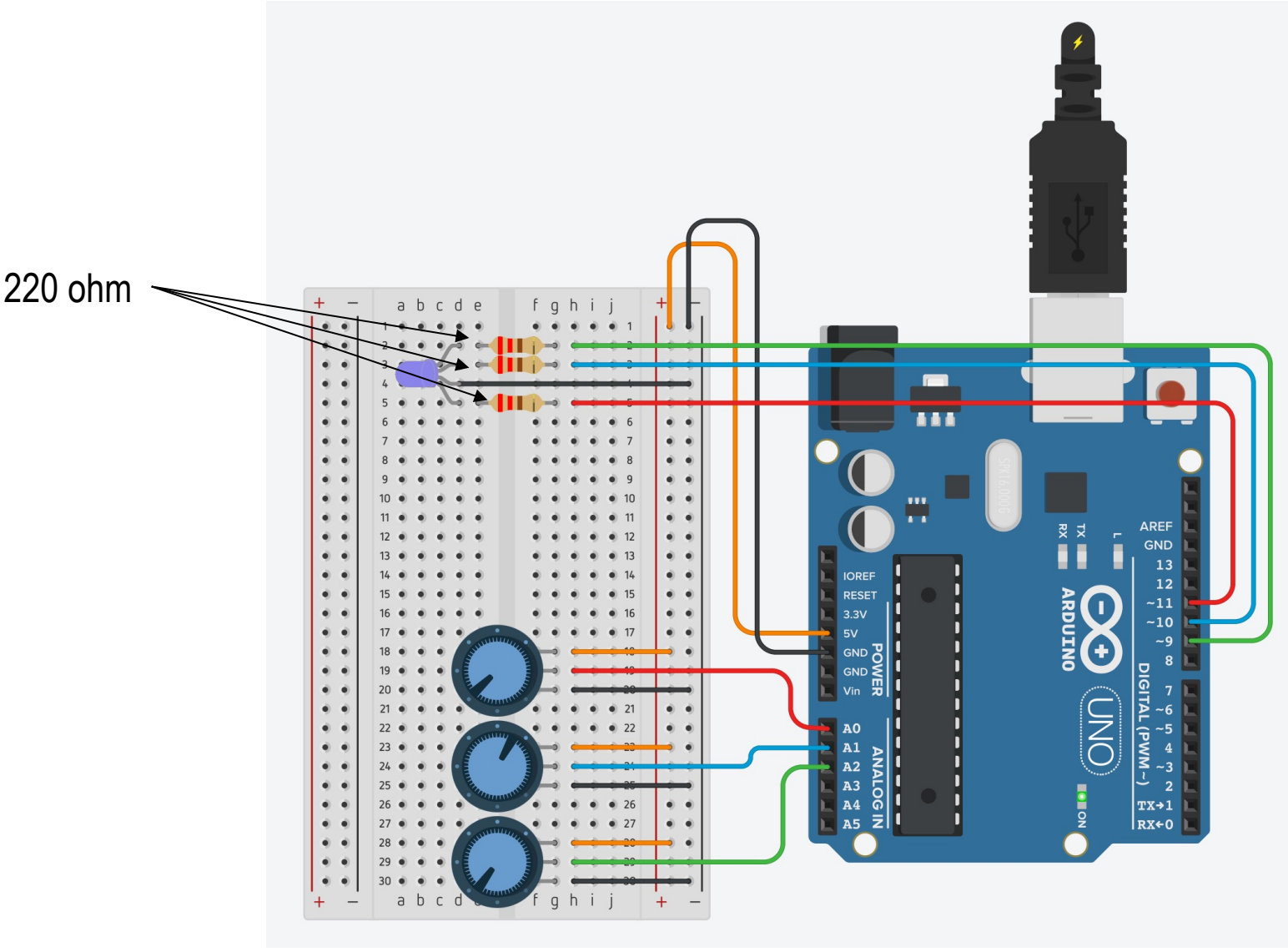
Lab. 3 - Potentiometer I

- **An analog value controls the rate at which an LED blinks.**
  - turns on and off a LED. The frequency of the LED blinks will be controlled by the potentiometer.



Lab. 4 - Potentiometer II

- Use three potentiometers for controlling the brightness of each LED color.



Lab. 5 - Temperature Sensor I

- **Measure surrounding temperature.**
  - Display the measured temperature to serial communication
  - temp = (5.0 X analogRead(value) X 100.0) / 1024