

Arduino Workshop



Project #3

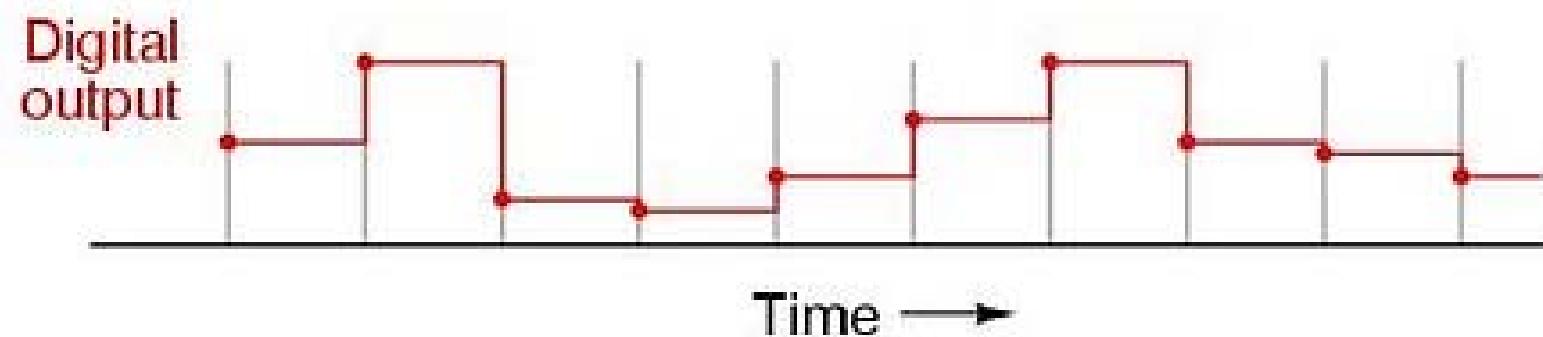
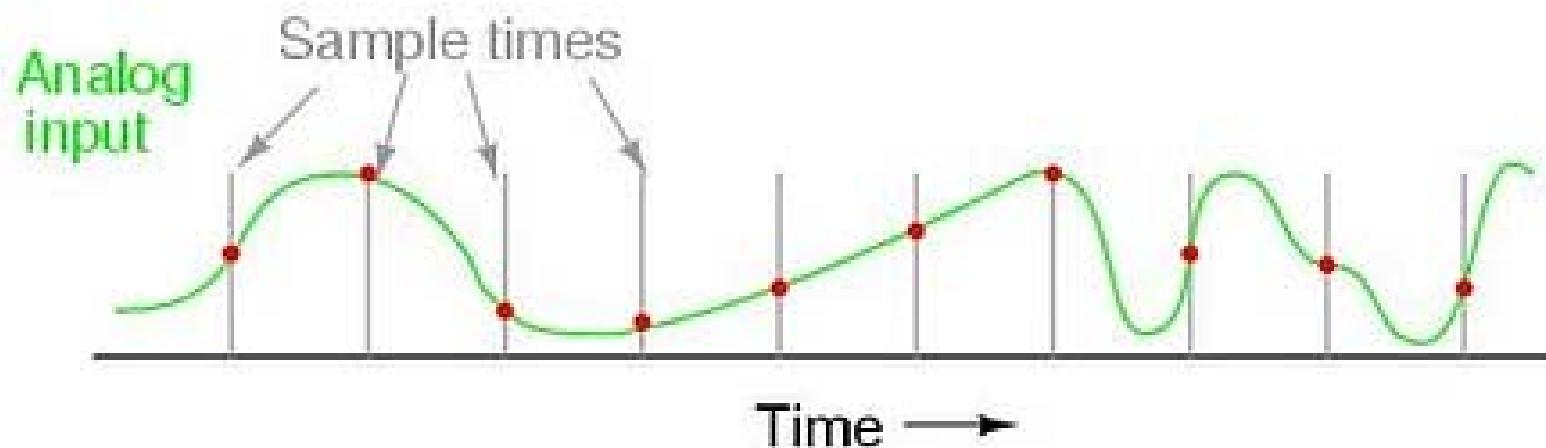
Love-O-meter

Discover analog Input, using the serial monitor

Introduction

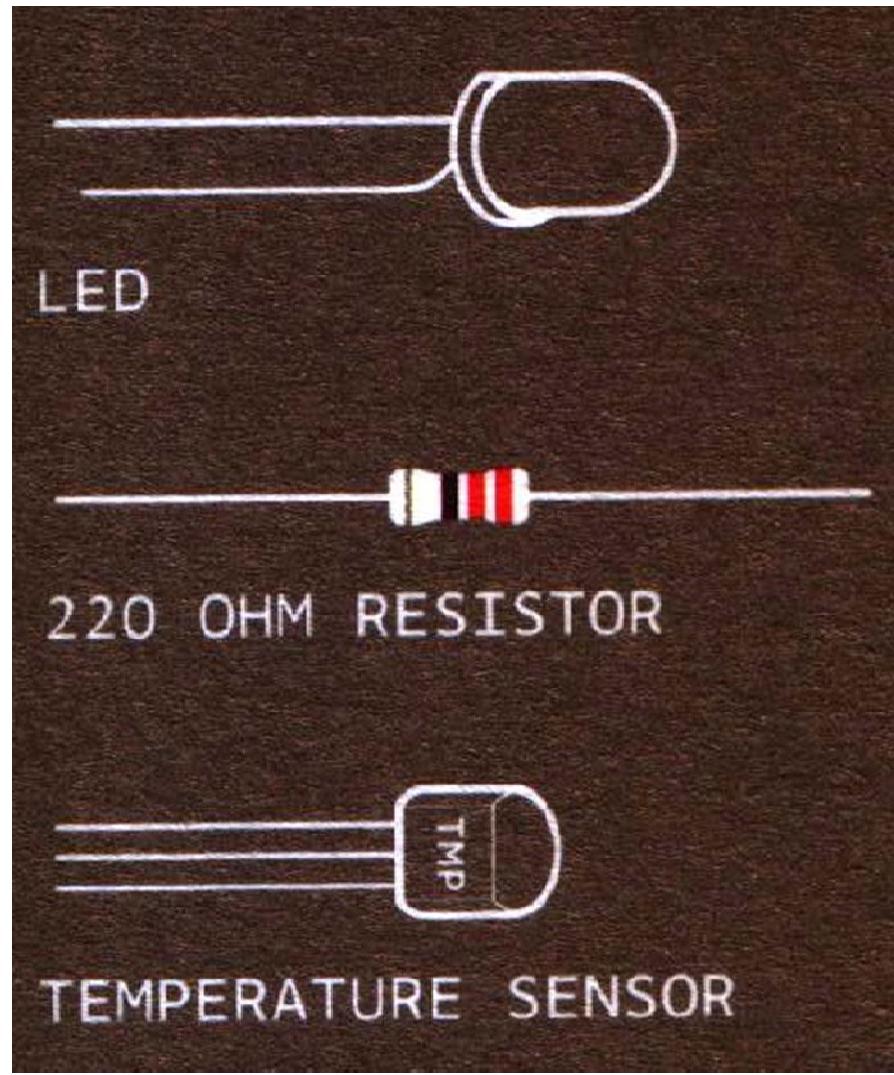
- Arduino has a Analog-to-Digital Converter (ADC) built in
 - pin from A0 to A5 are analogic and can report back a value between **0 and 1023**, which maps a range from 0V to 5V.
- The analogic sensor used: temperature sensor, pay attention to the polarity.
 - This model, the TMP36, is convenient because it outputs a voltage that changes directly proportional to the temperature in degrees Celsius
- Serial Monitor in Arduino's IDE can report back result from the microcontroller.

ADC: Analog Digital Converter

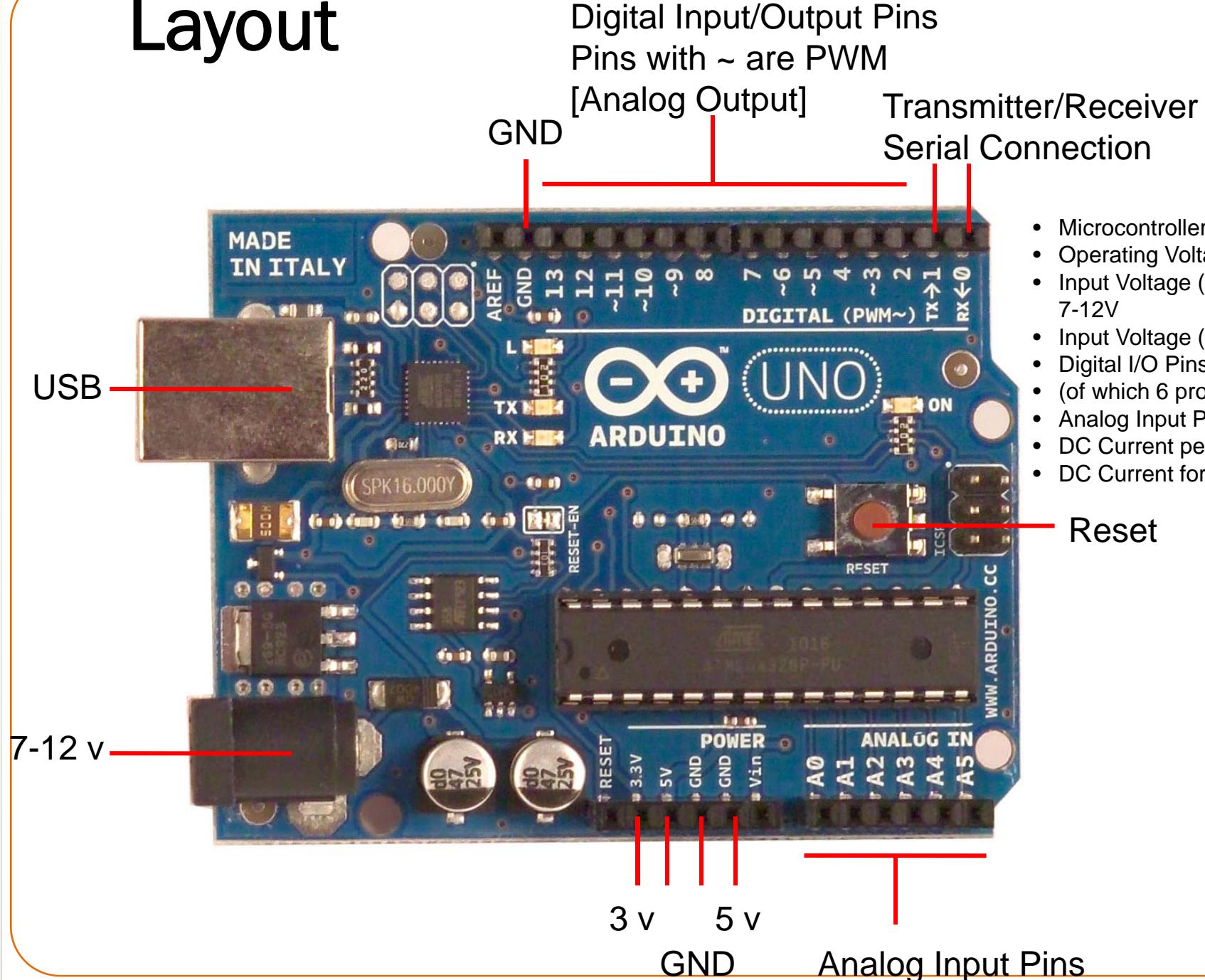


Ingredients

- 3個LED燈(紅)
- 3個 220Ω 電阻
- 溫度感測器

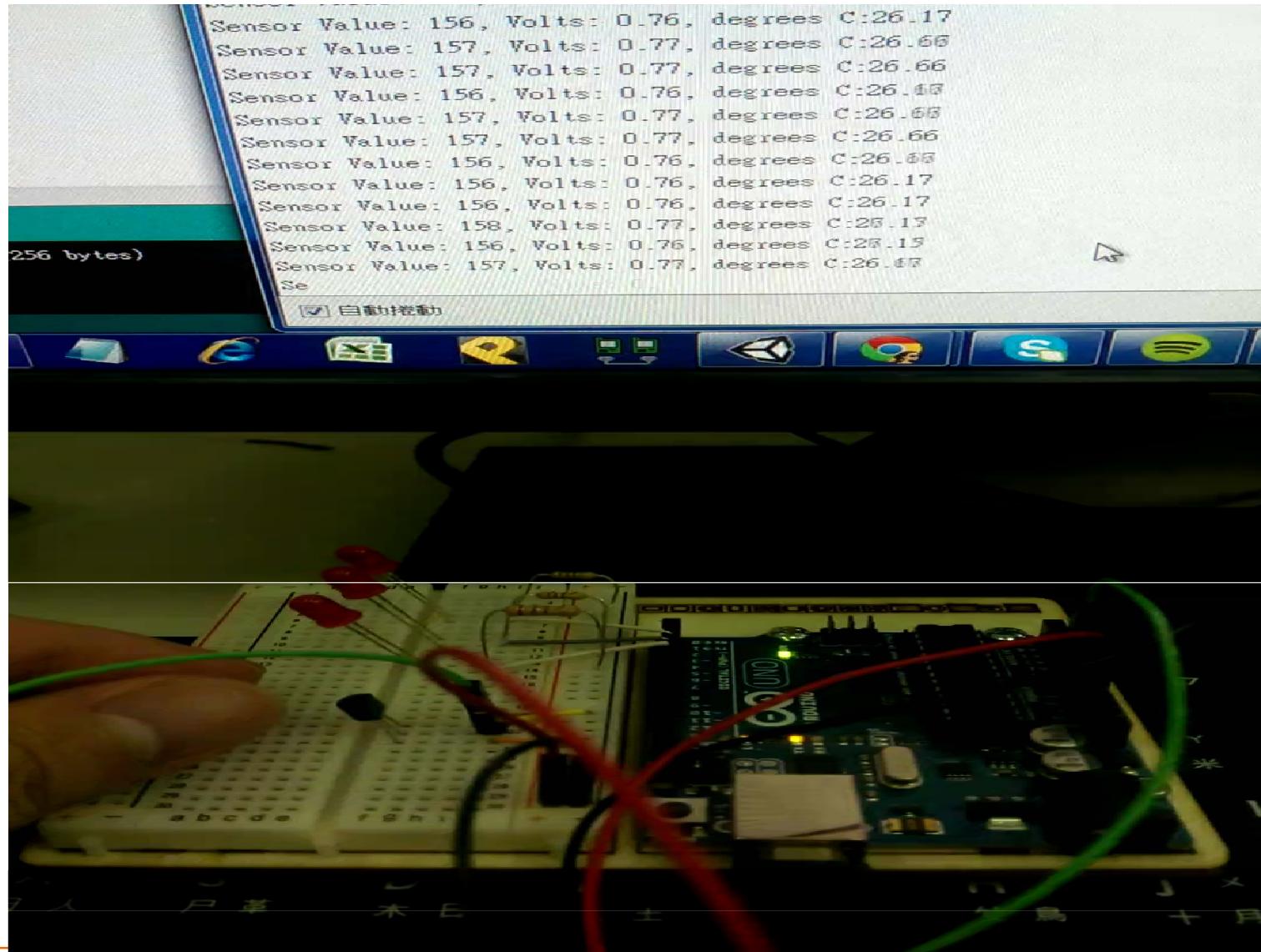


Layout

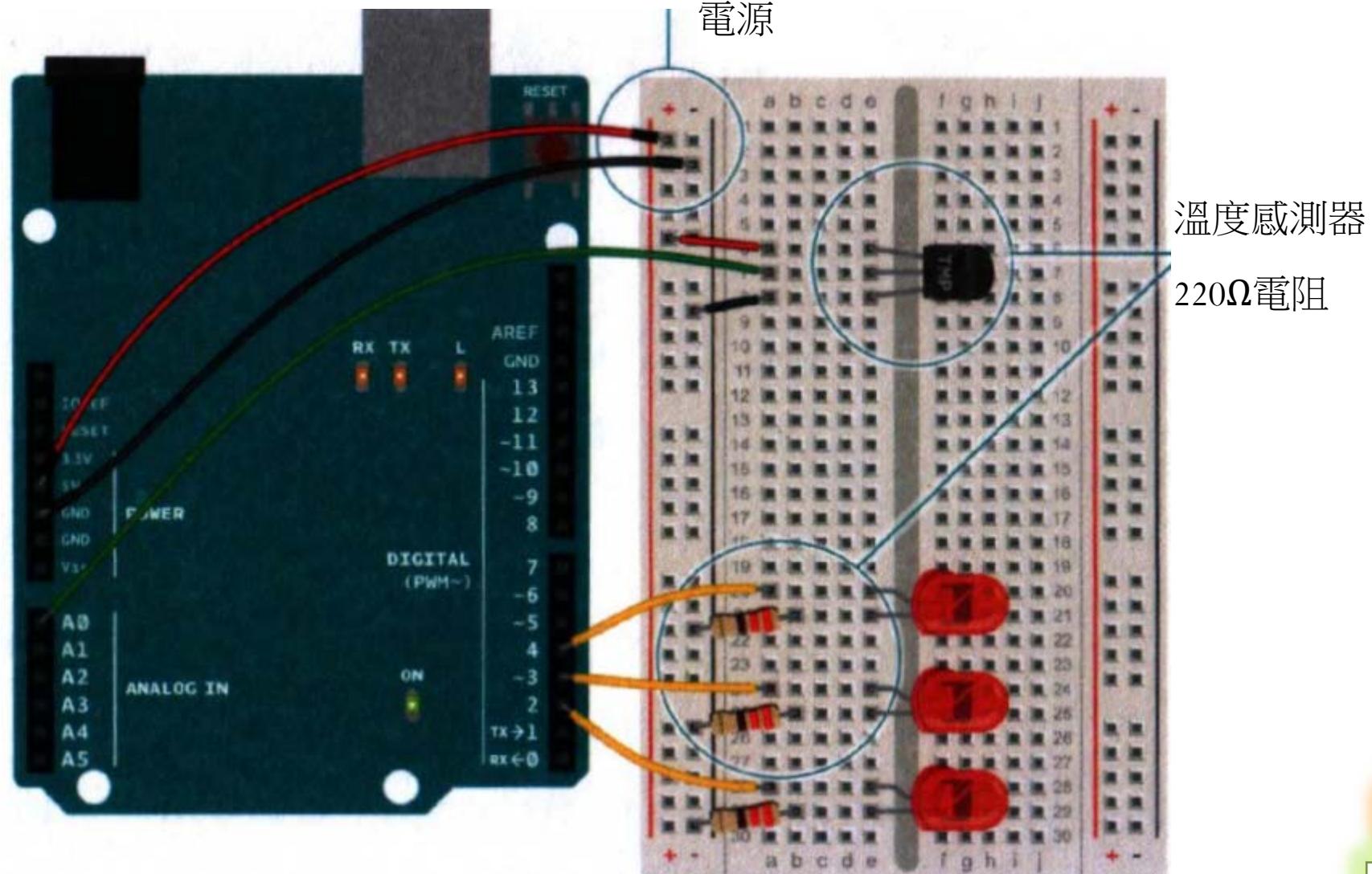


- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA

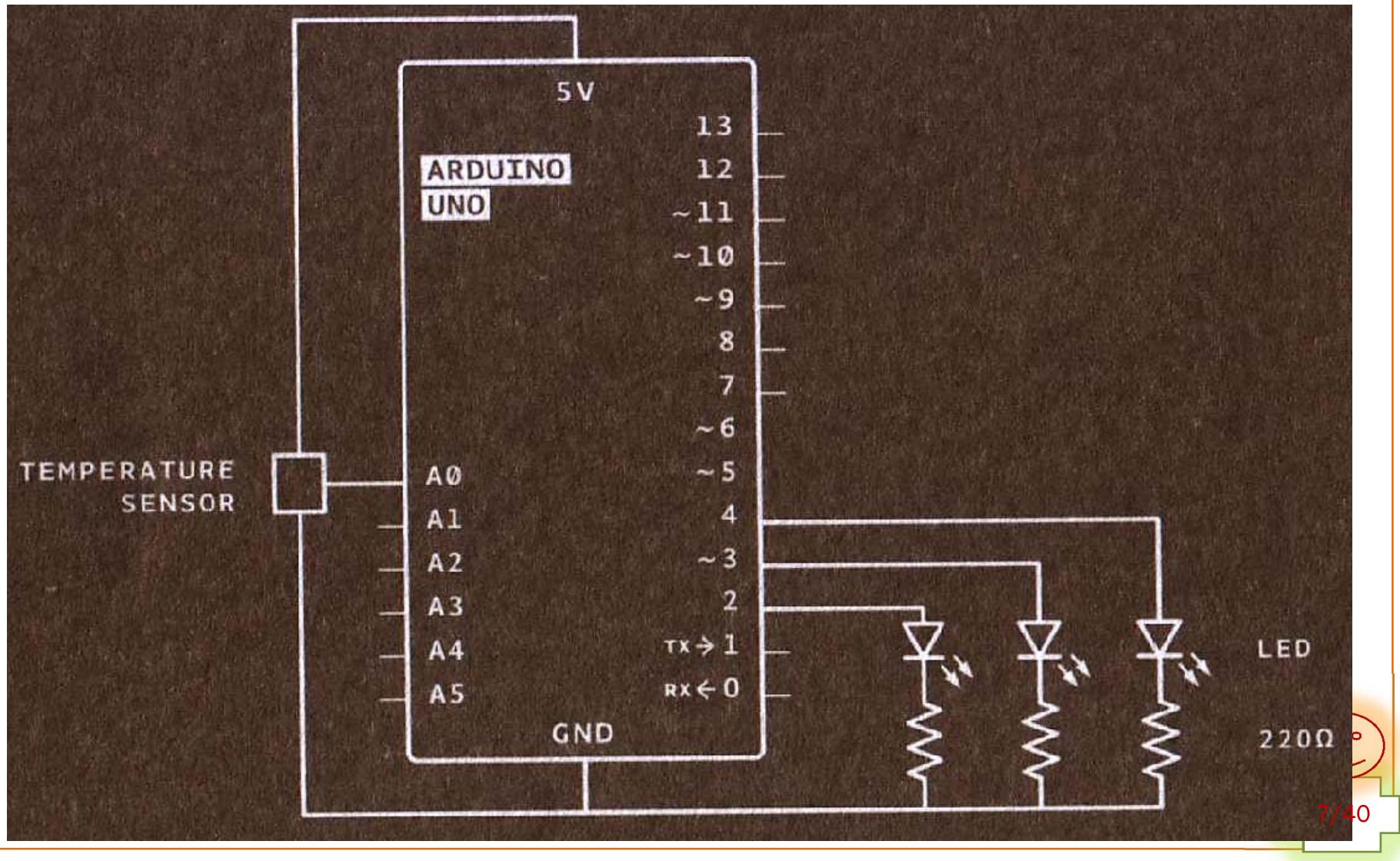
Demo (calibrate your settings)



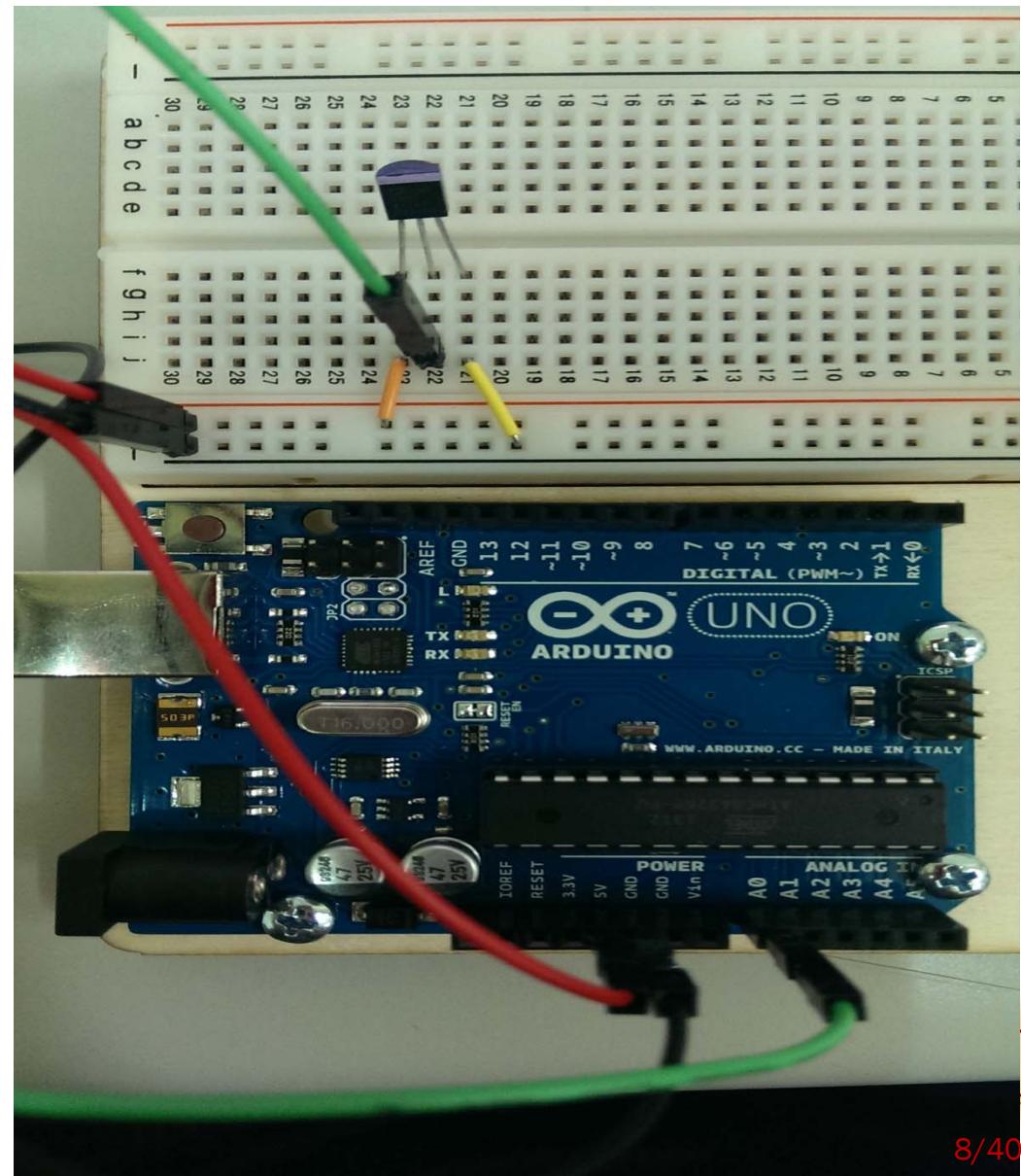
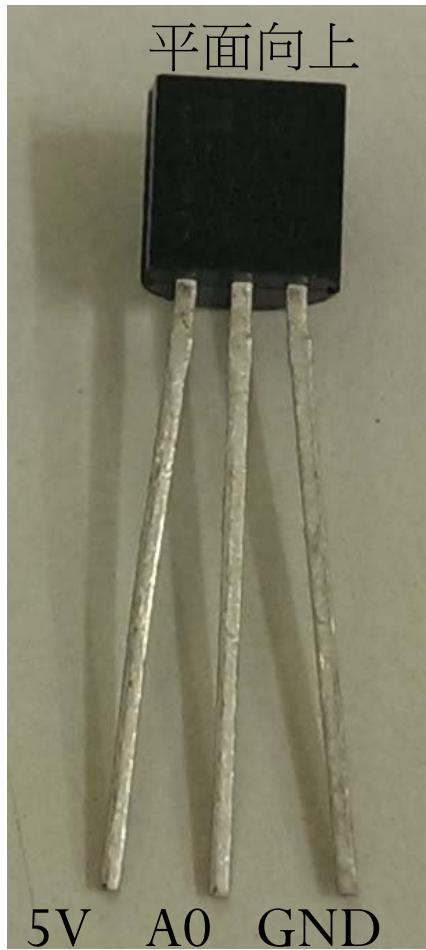
The Top View of the Circuit



Schematic Diagram



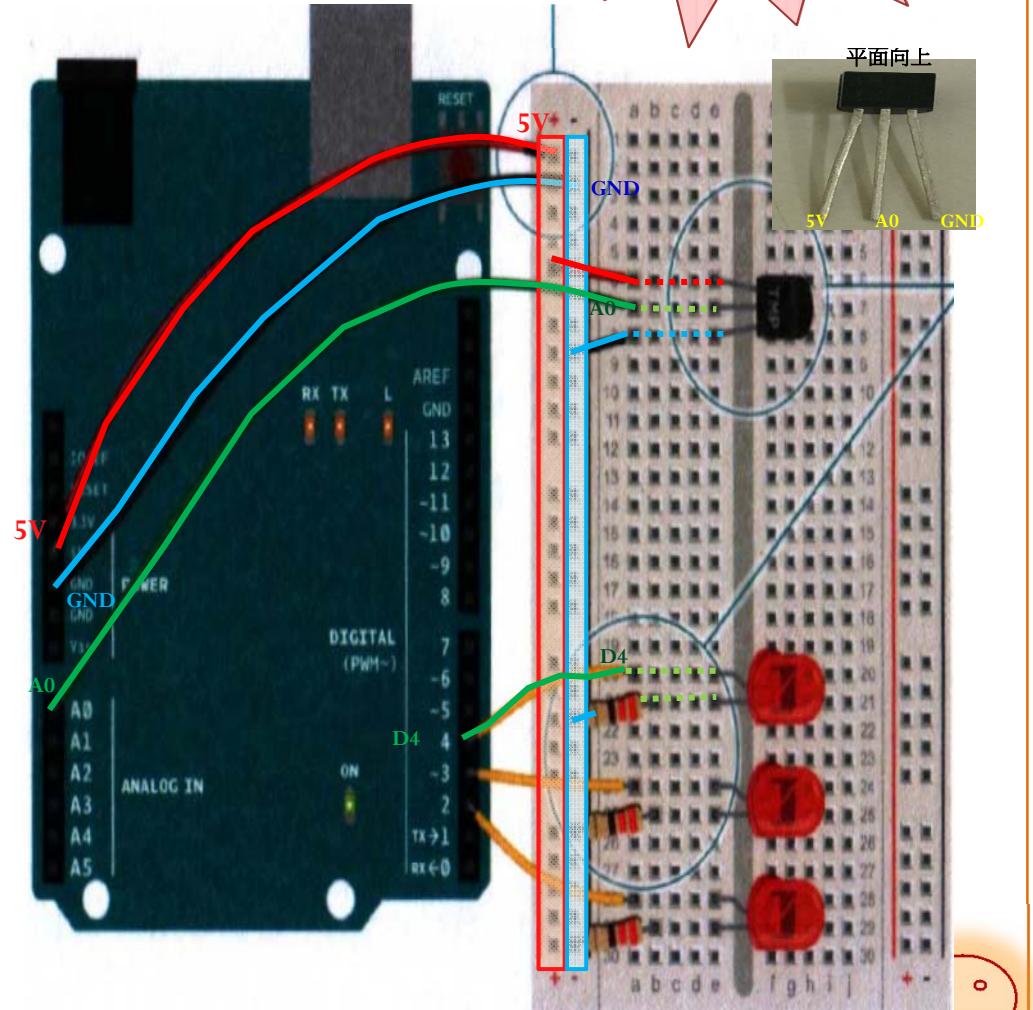
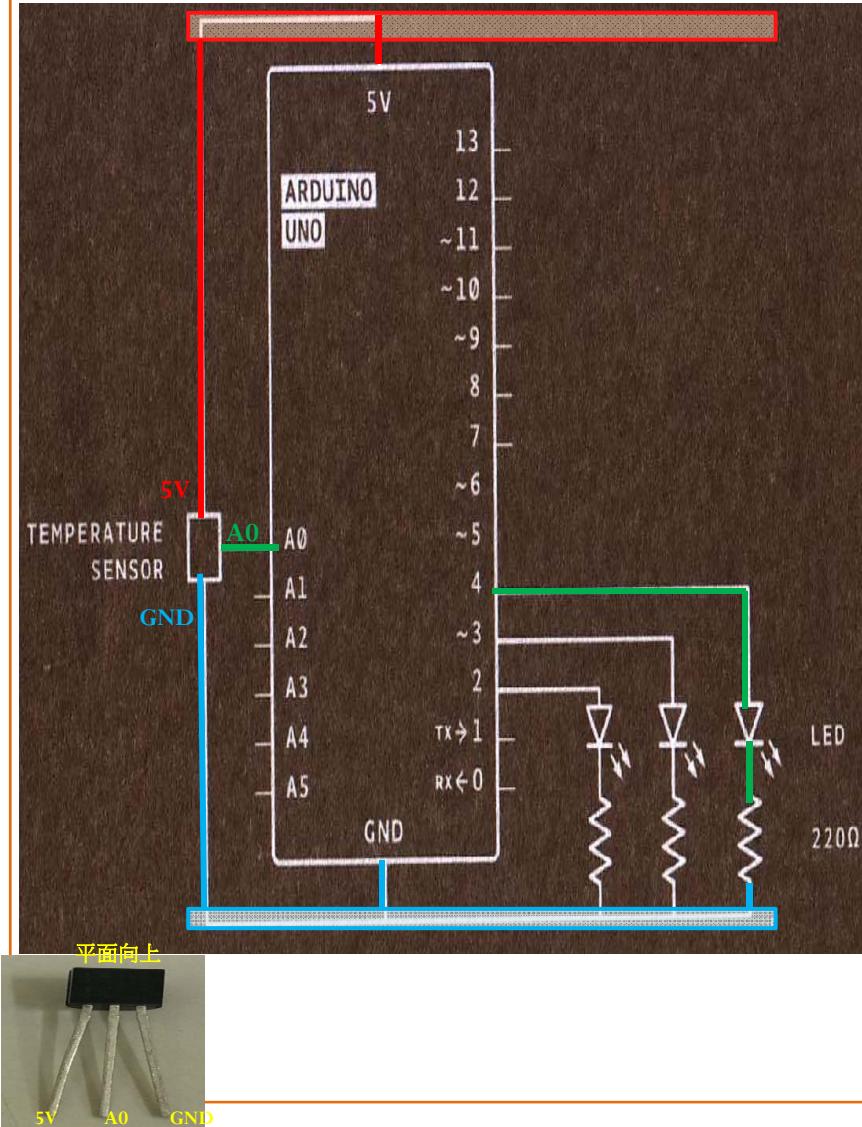
The Circuit



Schematic Diagram & Physical Circuit



Power the board after all finished!



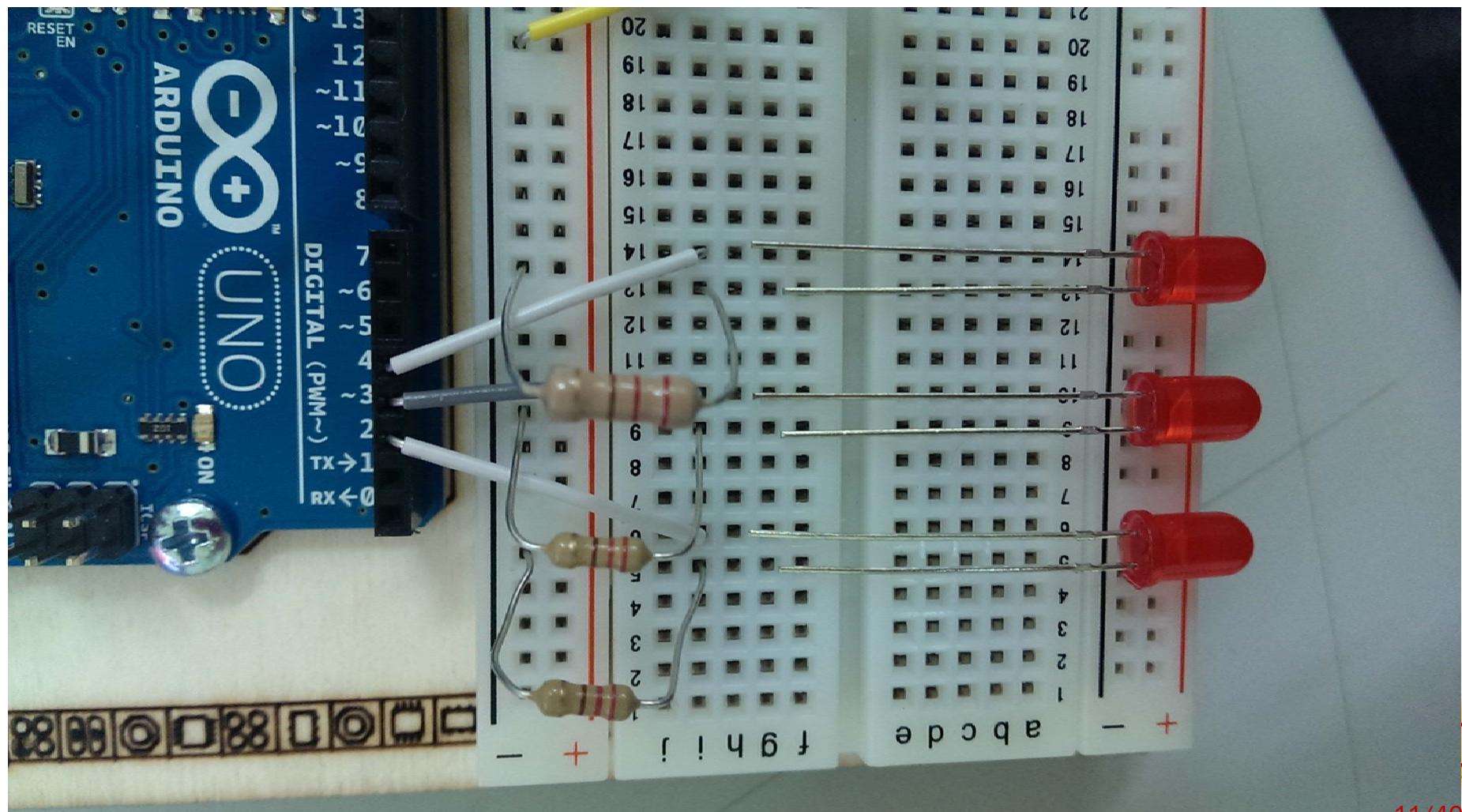
Convert the voltage to temperature

- float tempexatux = (voltage - **0.5**) • 100;
 - The datasheet for this sensor explains that every 10 millivolts of change from the sensor is equivalent to a temperature change of 1 degree Celsius.
 - The datasheet also indicates that the sensor need to create an offset for values (0 degrees below freezing).
 - If you take the voltage, subtract a 0.5, and multiply by 100, you get the accurate temperature in degrees Celsius





The Circuit

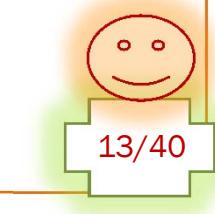


Serial 串列埠

- Baud rate (鮑率)
 - the unit for symbol rate or modulation rate in symbols per second or pulses per second.
 - Digital data modem manufacturers commonly define the baud as the modulation rate of data transmission and express it as bits per second
- In Arduino
 - `Serial.begin(9600)`, where 9600 is Baud rate, and it affects:
 - `Serial.read()`
 - `Serial.print()`
 - `Serial.println()`



Codes



Project #4

Color Mixing Lamp

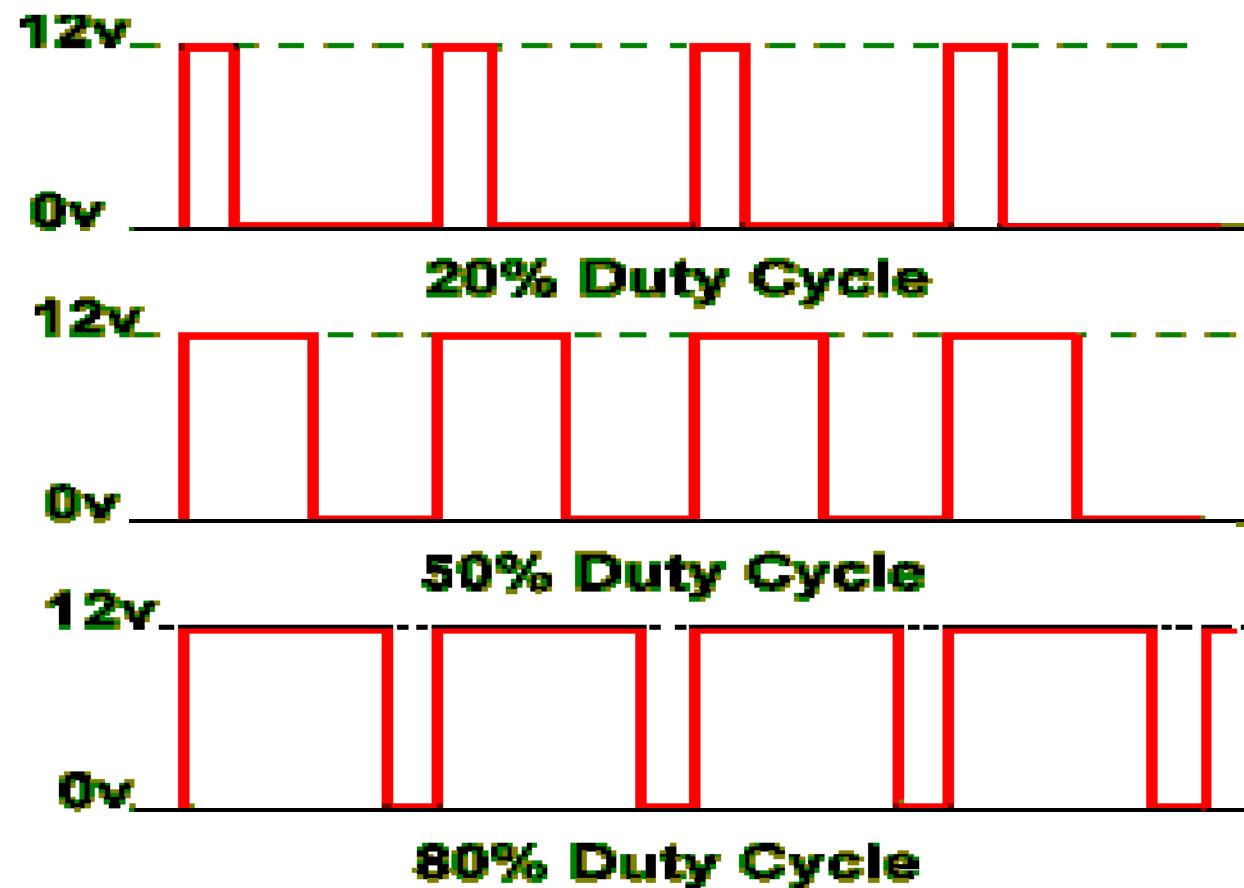
Discover: analog output, mapping values

Introduction

- Blinking LEDs can be fun, but what about fading them, or mixing colors?
 - You might expect that it's just a matter of providing less voltage to an LED to get it to fade.
- Pulse Width Modulation (PWM) to fade LEDs.
 - When you're rapidly turning the pin HIGH and LOW, it's as if you were changing the voltage. The percentage of time a pin is HIGH in a period is called duty cycle.



Pulse-Width Modulation (PWM)

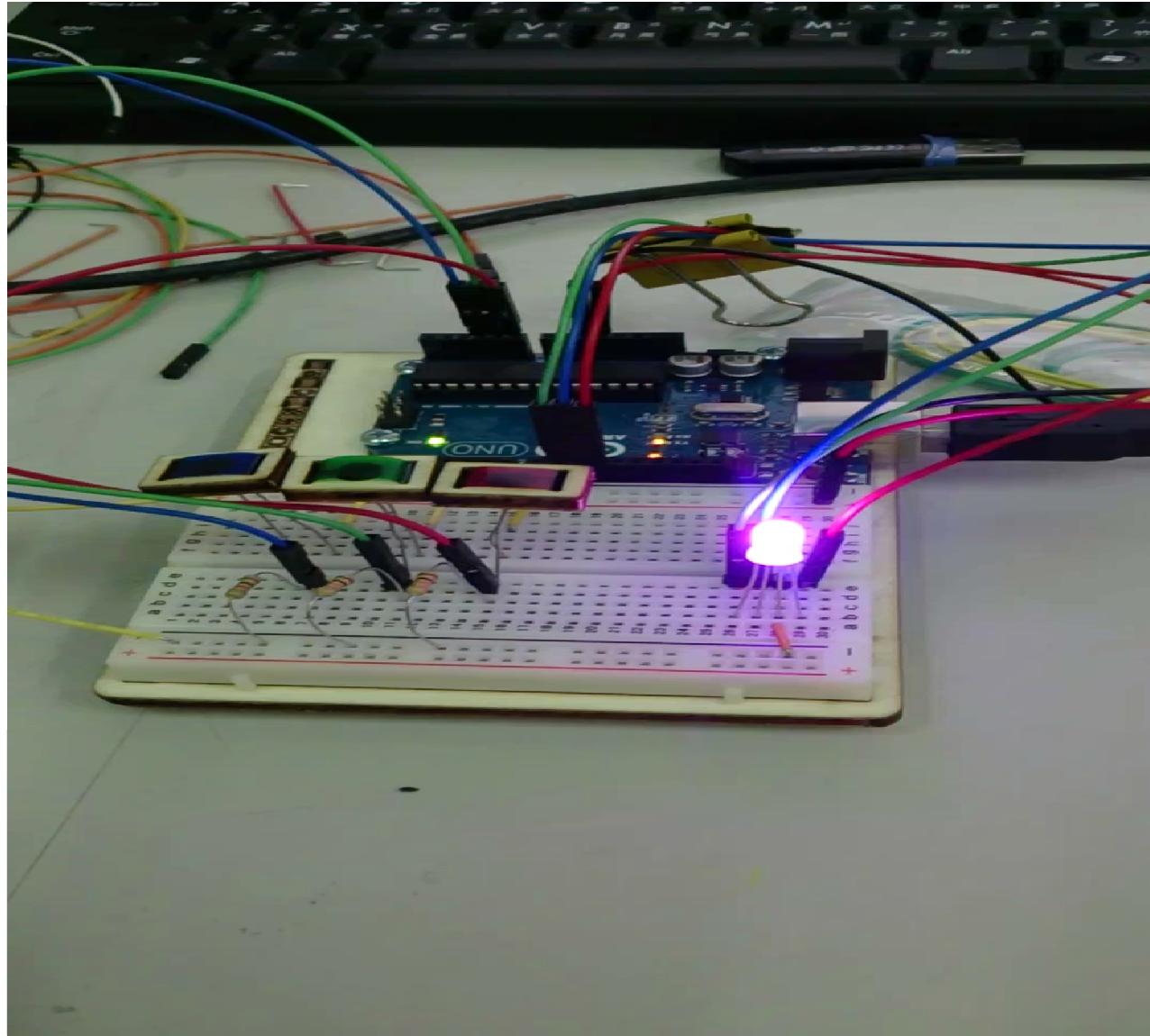


Photoresistors

- Sensors that change their resistance depending on the amount of light that hits them, also known as photocells or light-dependent resistors
- When the photoresistors are covered with a gel, they only react to light of a certain wavelength.



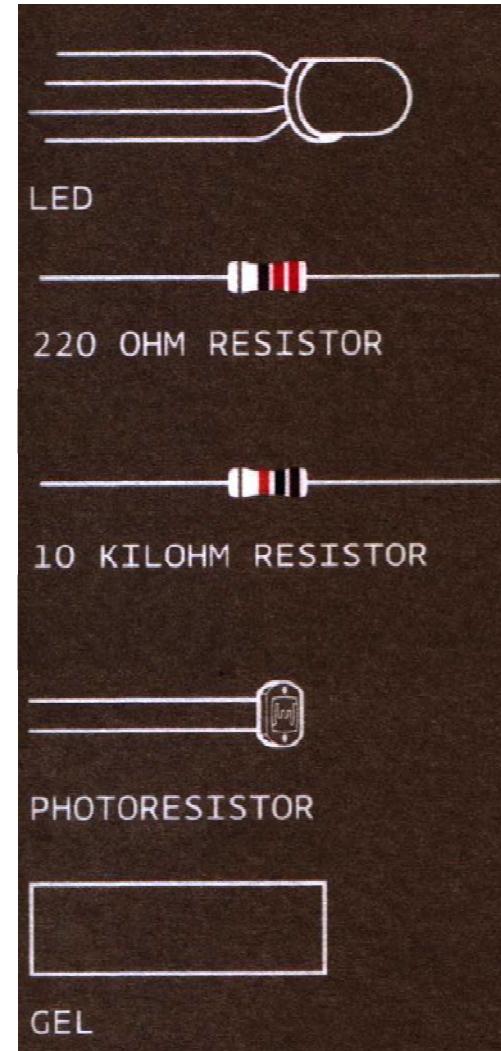
Demo



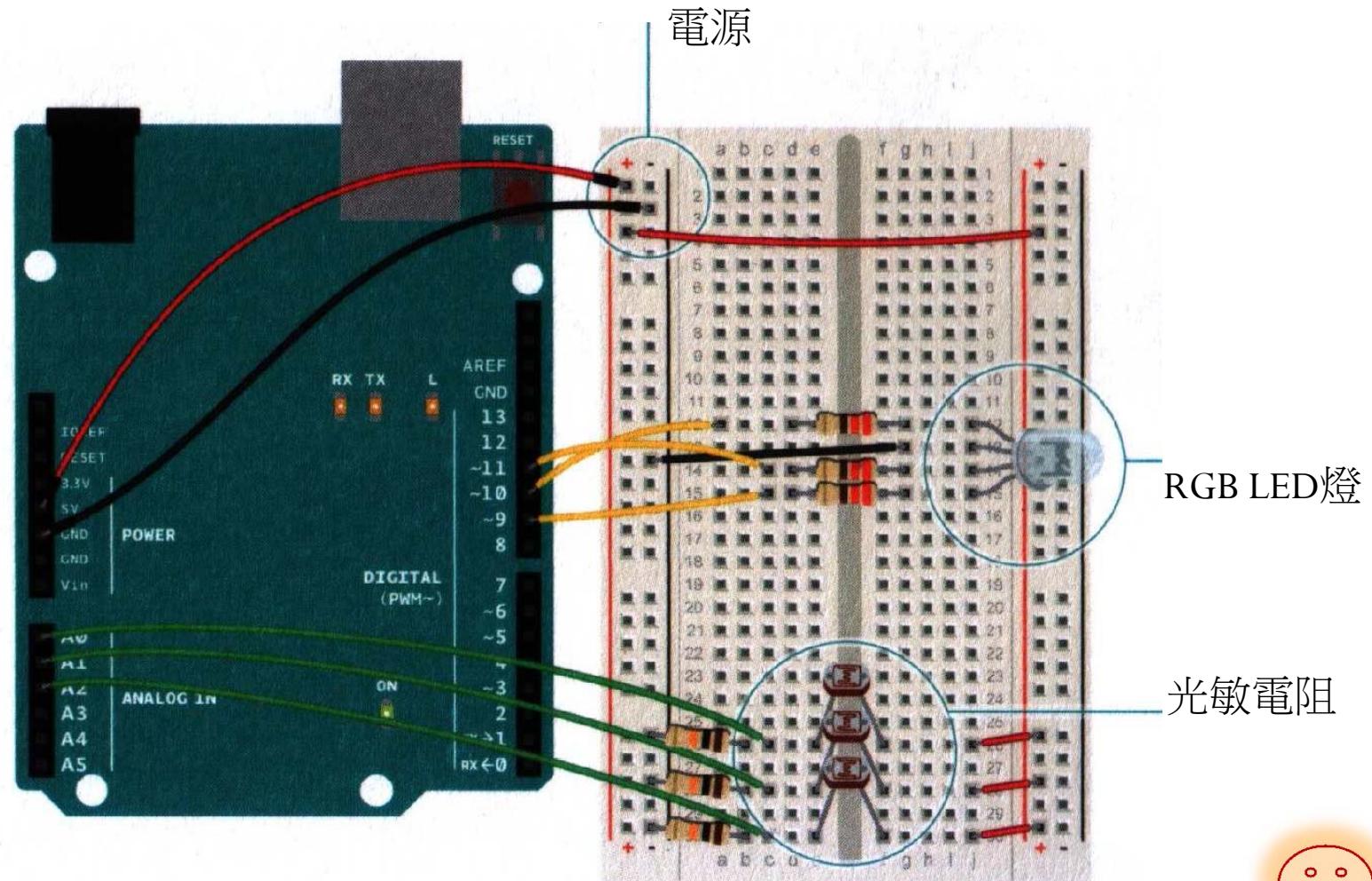
17/40

Ingredients

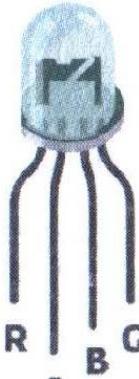
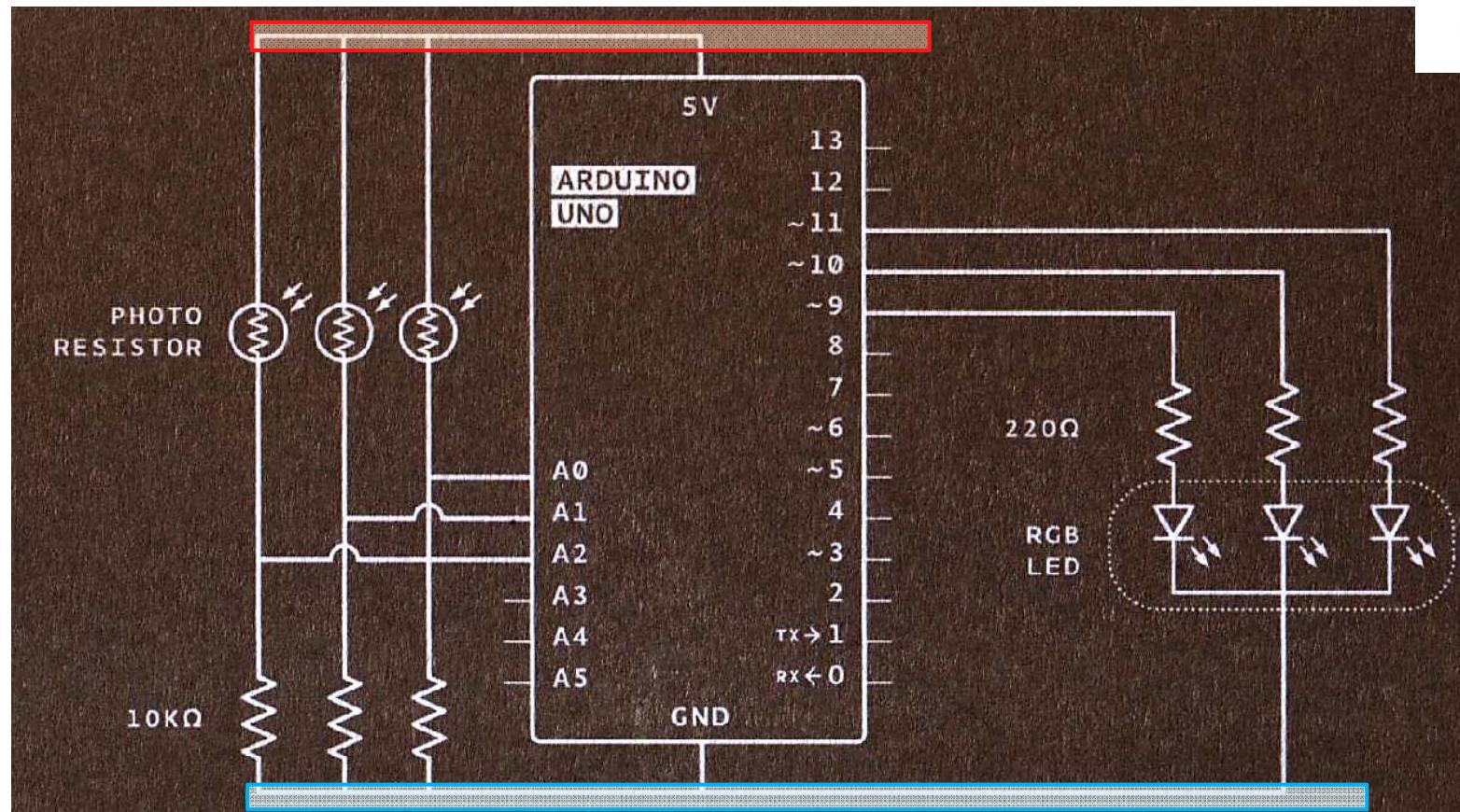
- 1個RGB LED燈(RGB)
- 3個 220Ω 電阻，3個 $10K$ 電阻
- 3個光敏電阻



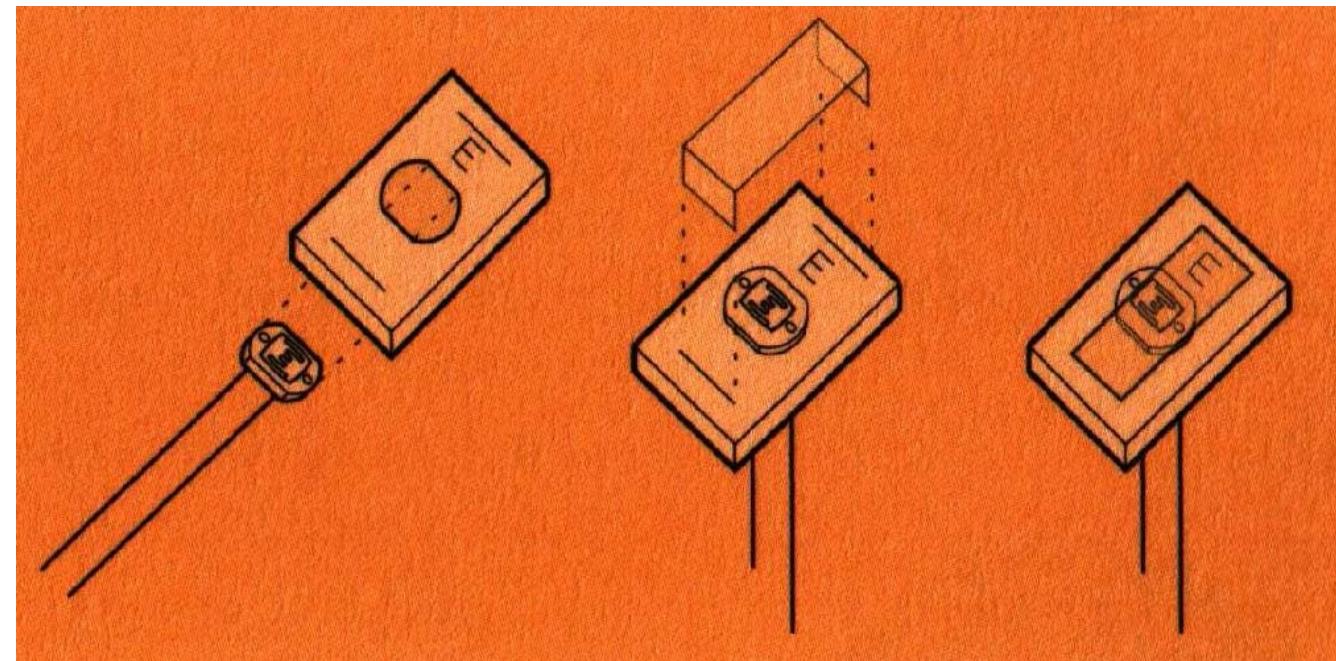
The Top View of the Circuit



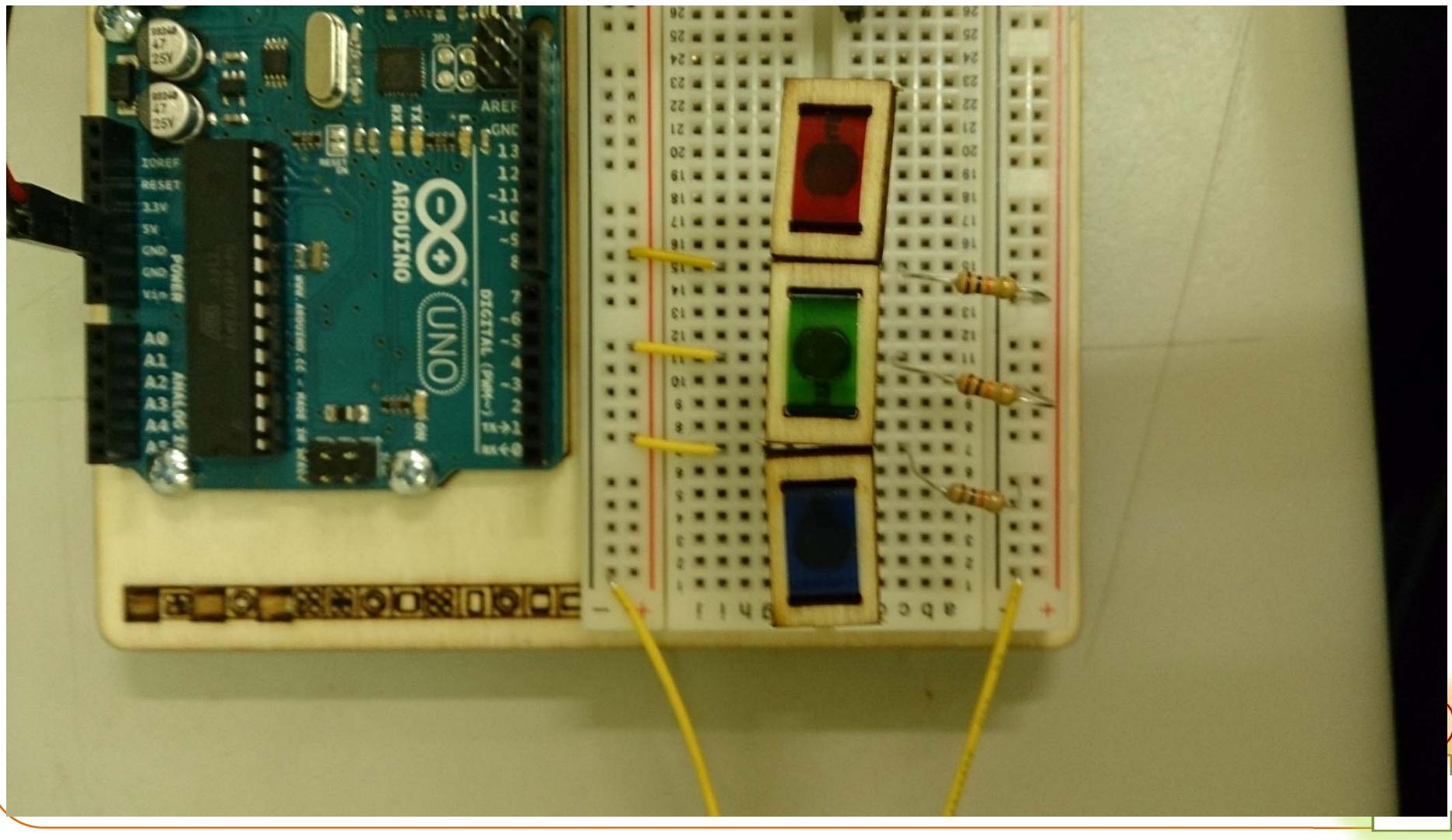
Schematic Diagram



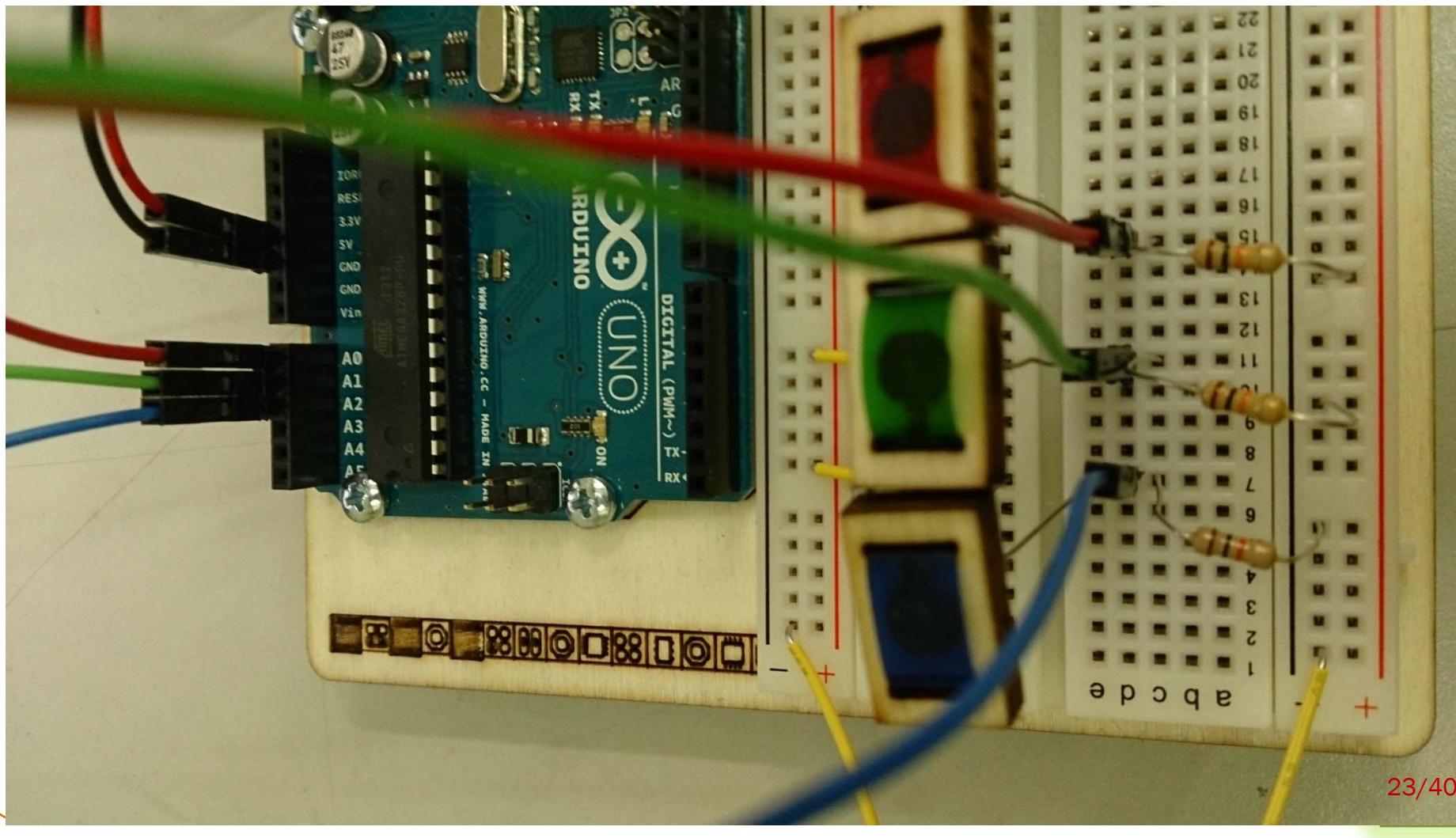
RGB LED



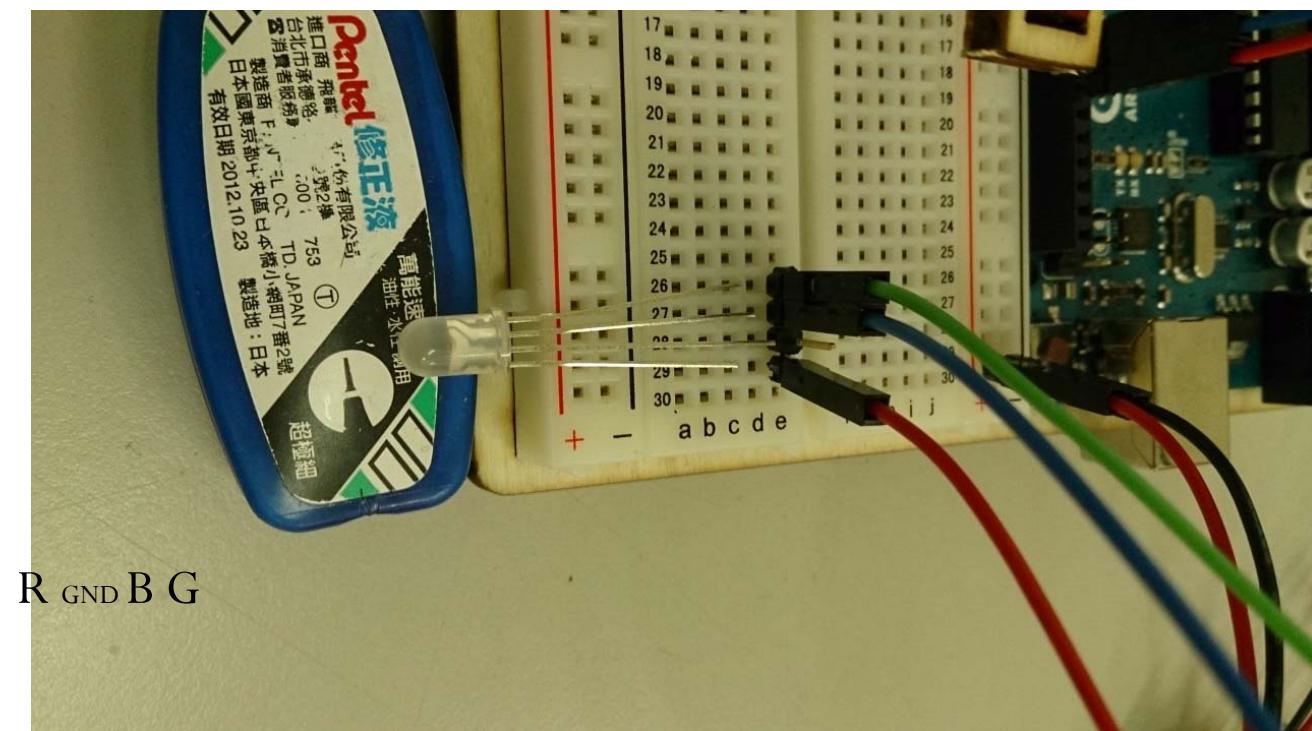
The Circuit



The Circuit (cont.)

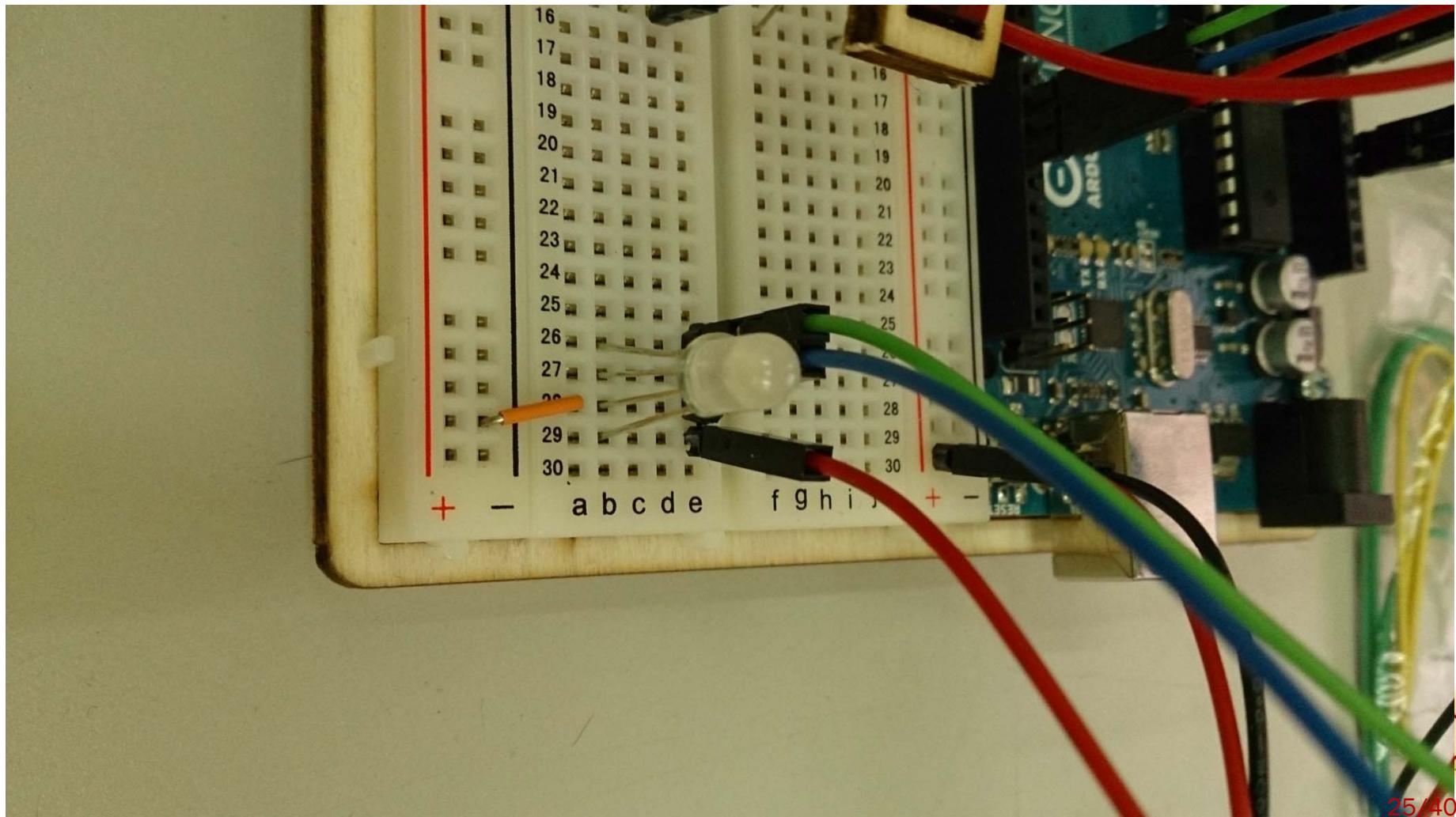


The Circuit (cont.)



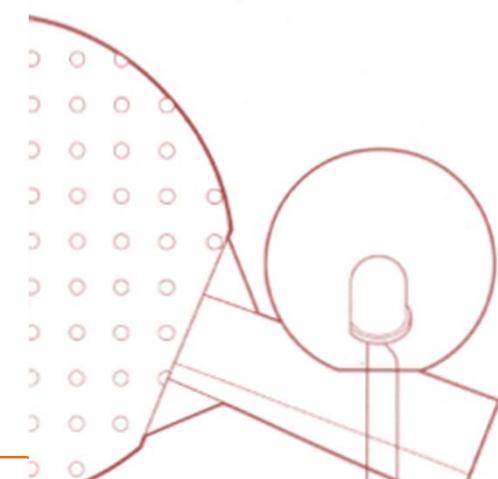
R GND B G

The Circuit (cont.)



LED issues?

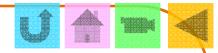
- You'll probably notice that the LED's fading is not linear.
 - When the LED is about at half brightness, it appears to stop getting much brighter.
 - This is because our eyes don't perceive brightness linearly, The brightness of the light depends not only on the level that you analogwrite() but also on:
 - the distance of the light from the diffuser
 - the distance of your eye from the light
 - the brightness of the light relative to other light in the room.
- A ping pong ball with a hole cut out for the LED to slide into makes for a nice diffuser



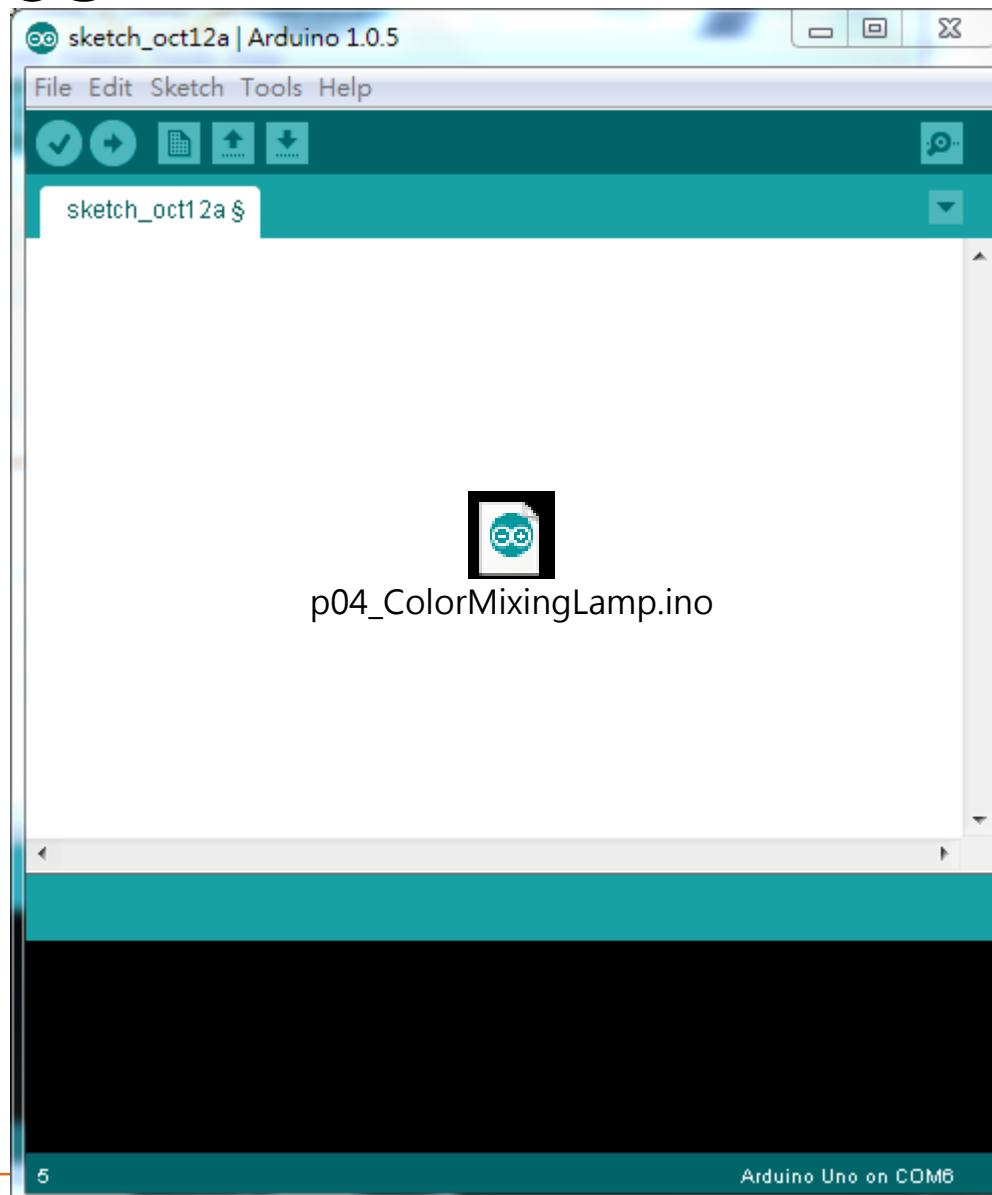
About the starter kit

- You can
 - Sell it
 - Give it to junior students





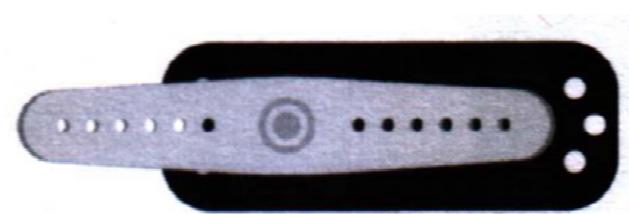
Codes



Project #5

Mood Cue

Discover: mapping values, servo motors, using
built-in libraries

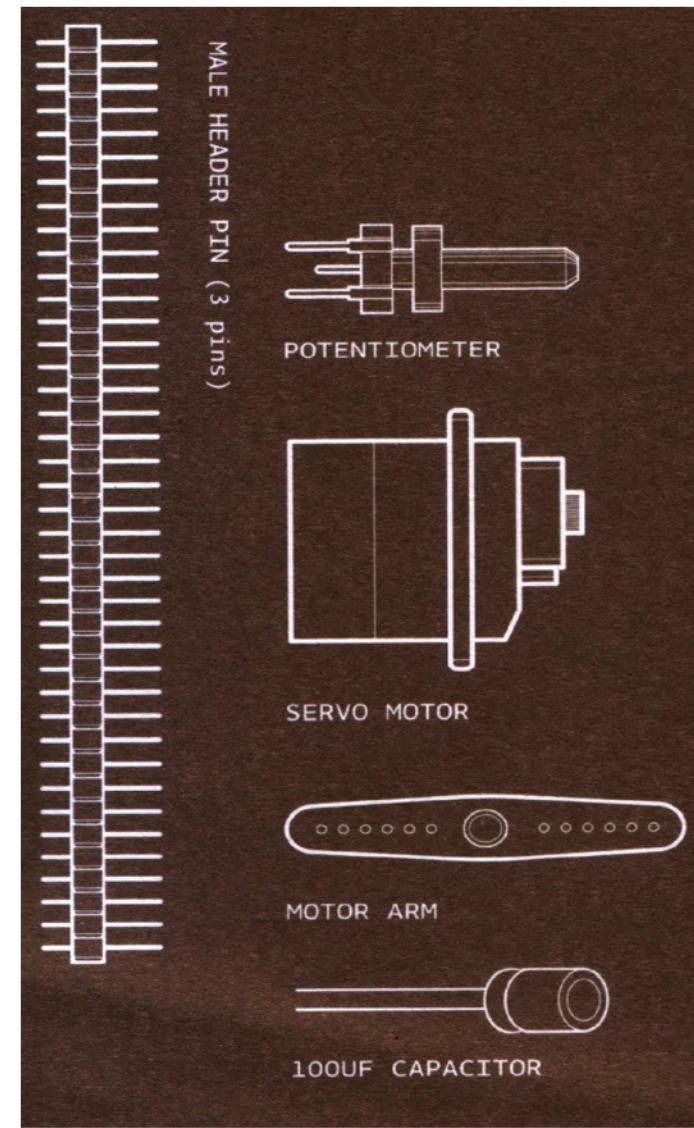


Introduction

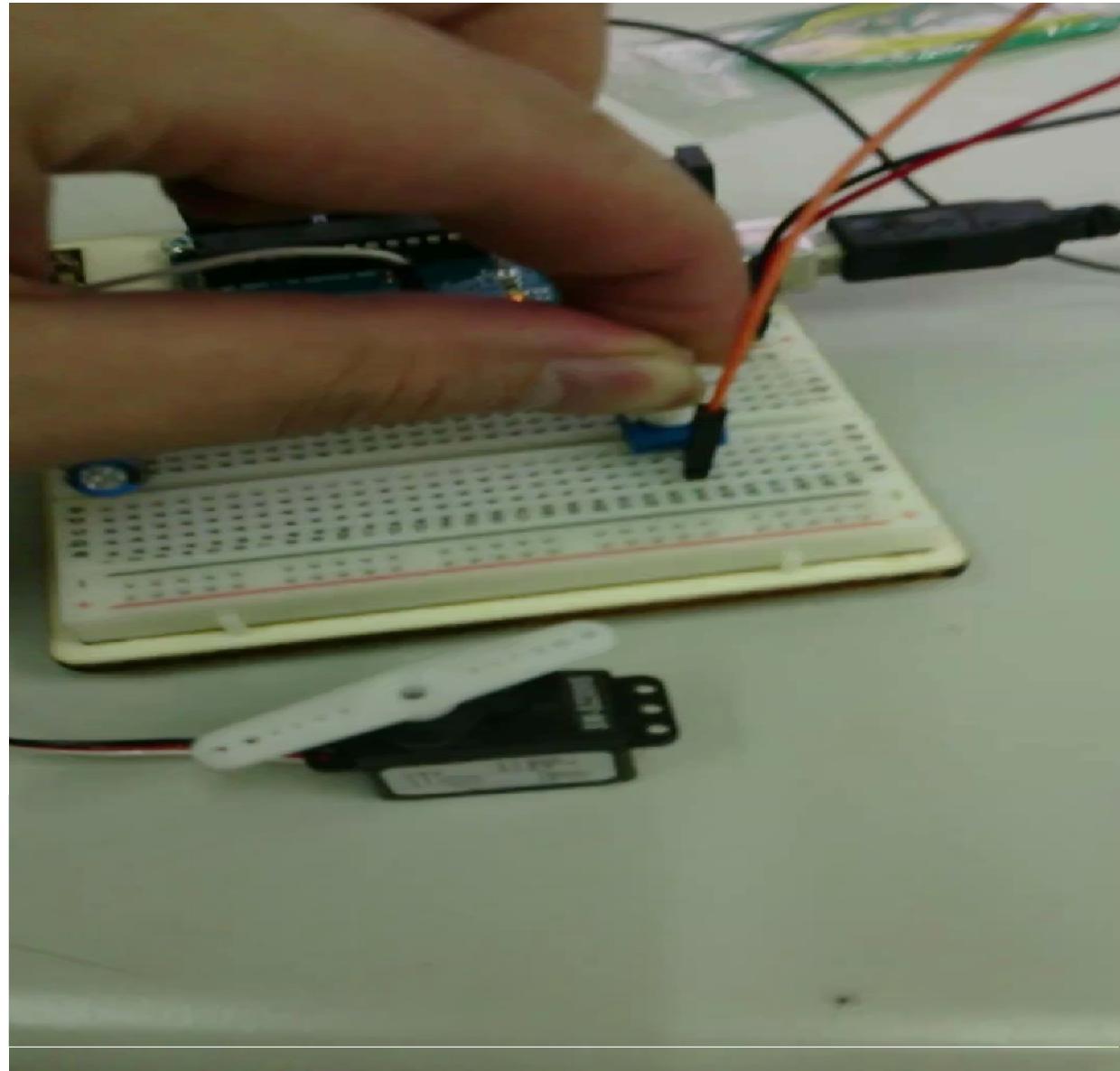
- Servo motors are a special type of motor that move to a specific position and stay there until you tell them to move again.
- Servo motors expect a number of PWM pulses that tell them what angle to move to.
 - The pulses always come at the same time intervals, but the width varies between 1000 and 2000 microseconds.
 - The Arduino software comes with a library that allows you to easily control the motor.
- The servo only rotates 180 degrees, and your analog input goes from 0-1023.
 - you'll map() to change the scale of the values coming from the potentiometer.

Ingredients

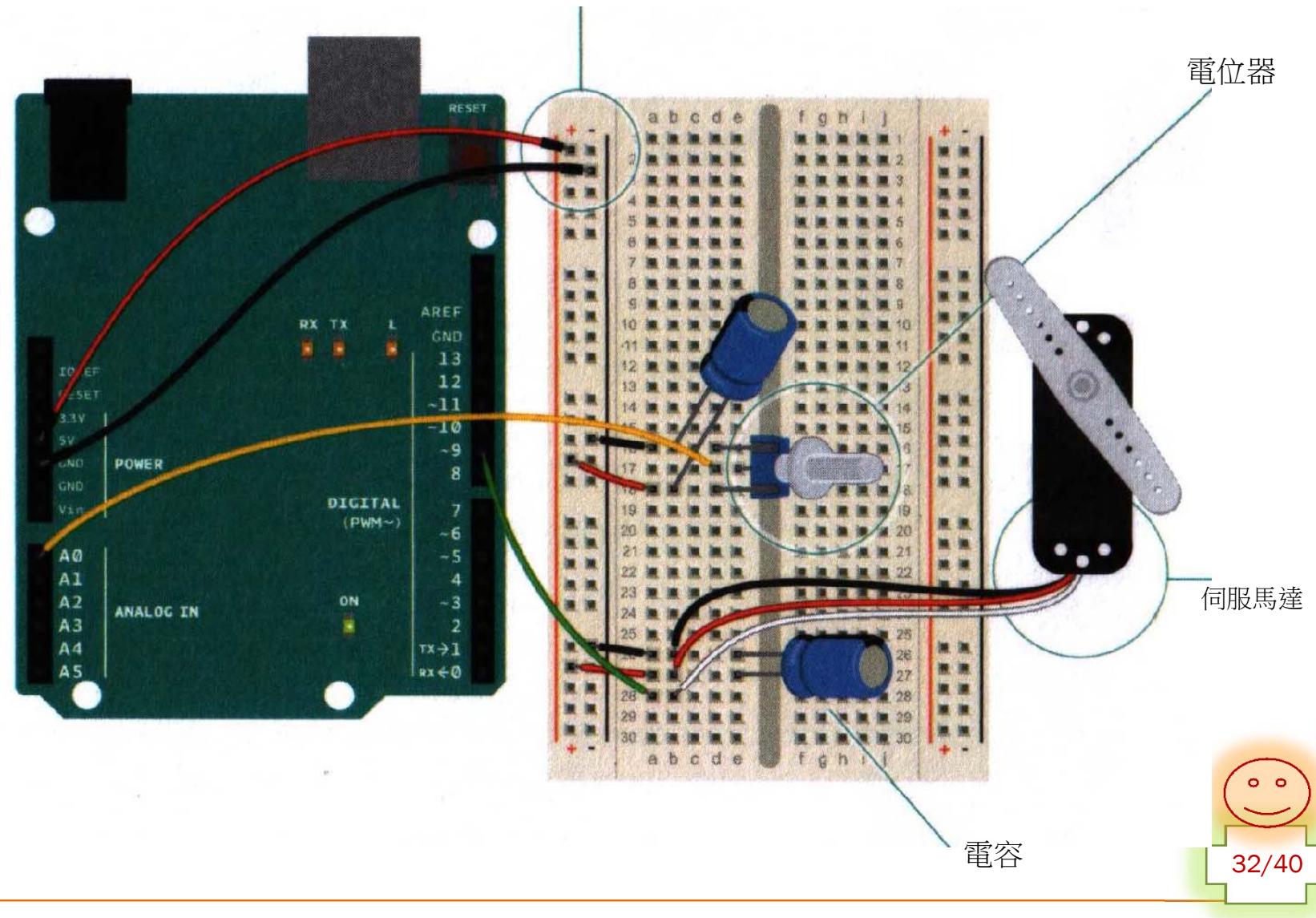
- 電位器(potentiometer)
- 同服馬達(servo motor)
- 2個電容(100UF)



Demo

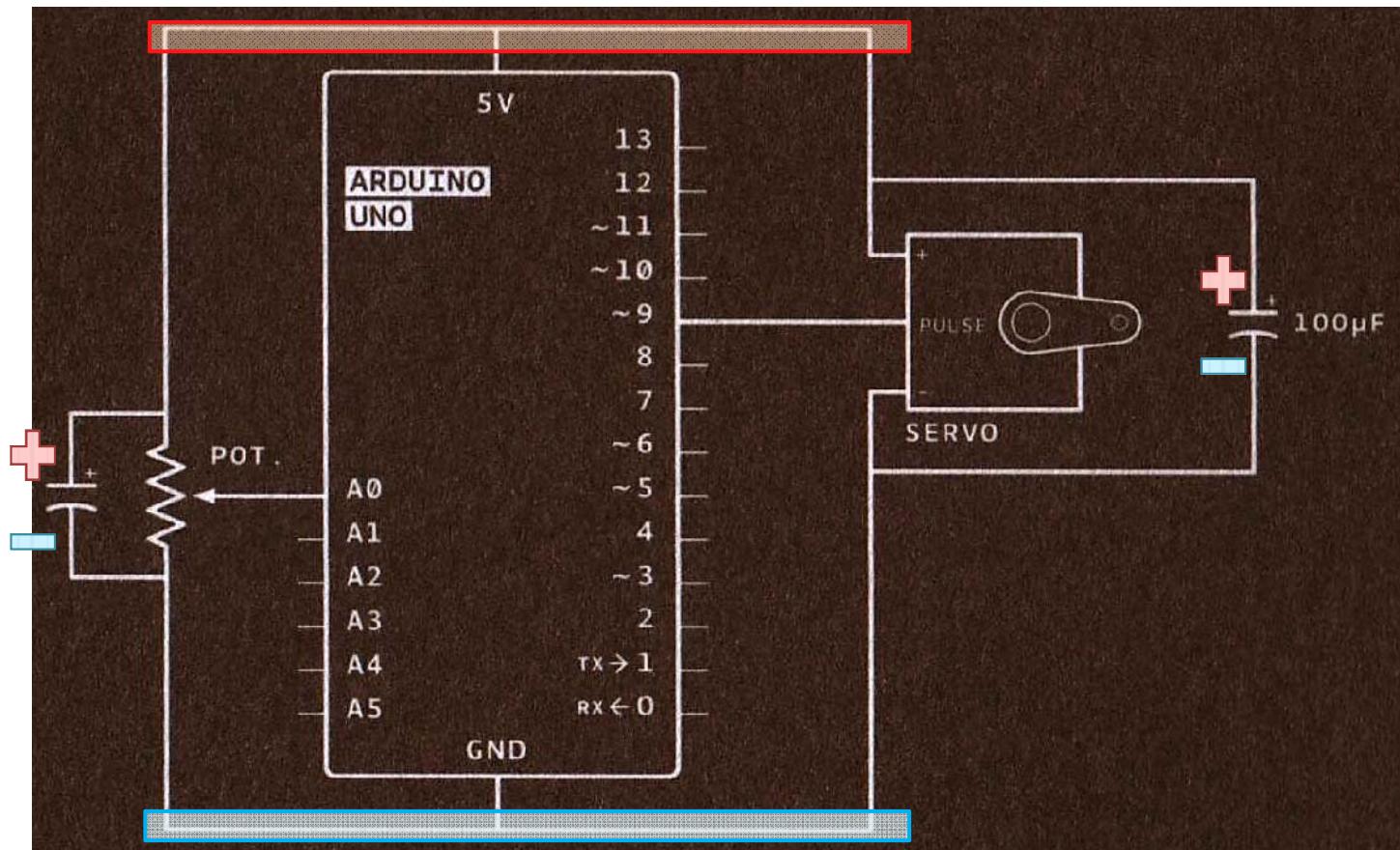


The Top View of the Circuit



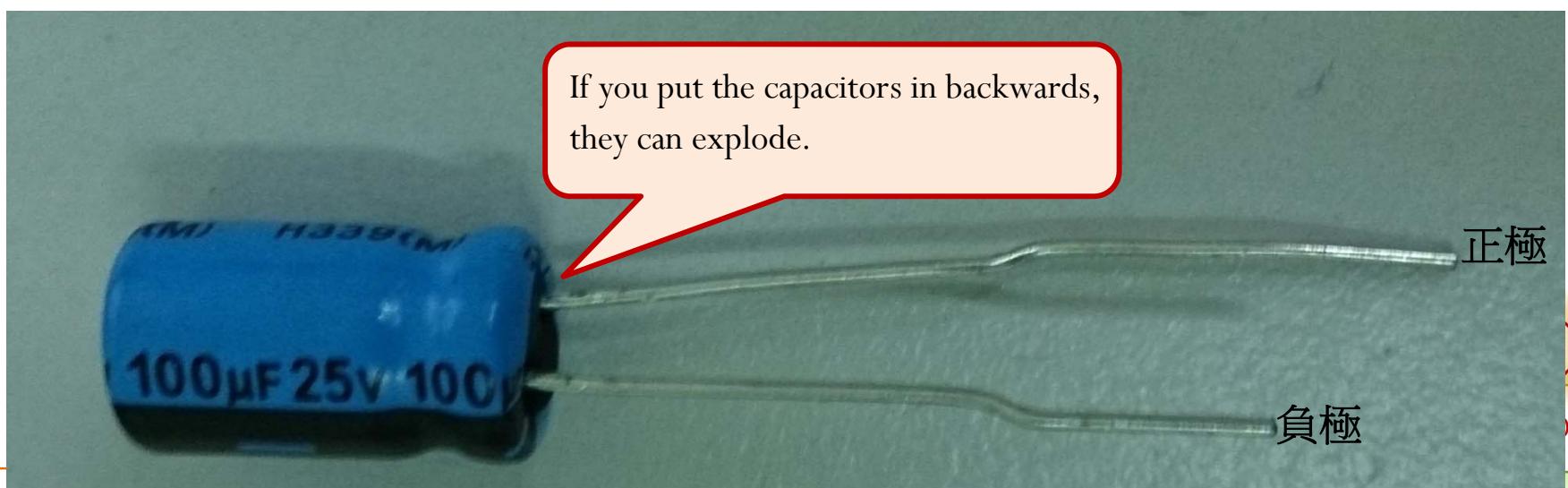
Schematic Diagram

- The servo has three wires coming out of it.
 - power (red), ground (black), and control line (white)

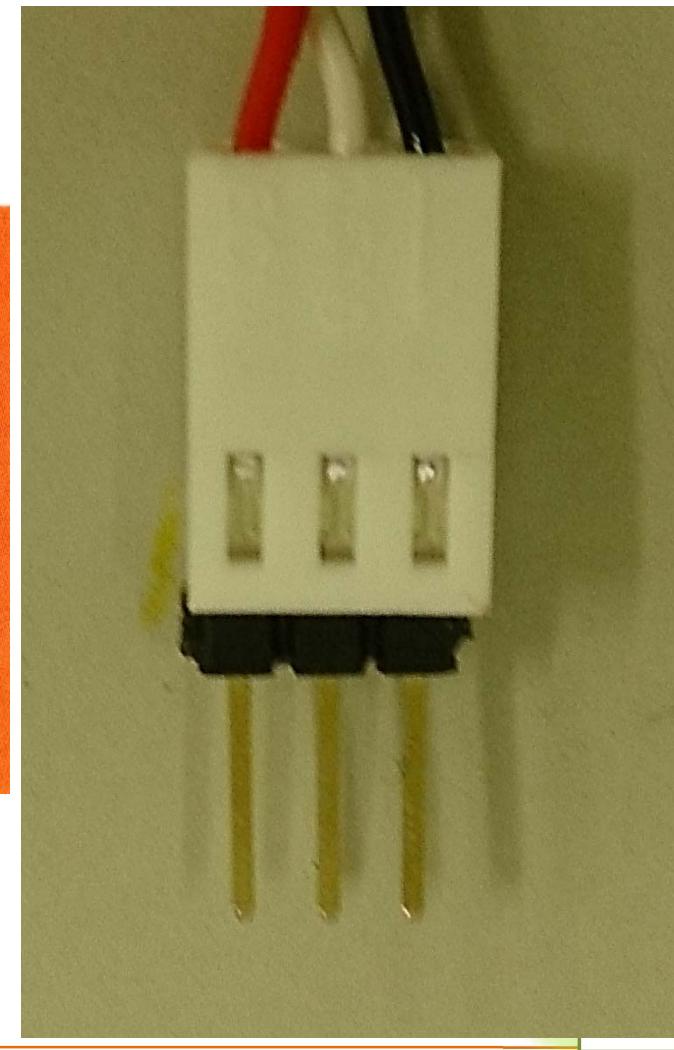
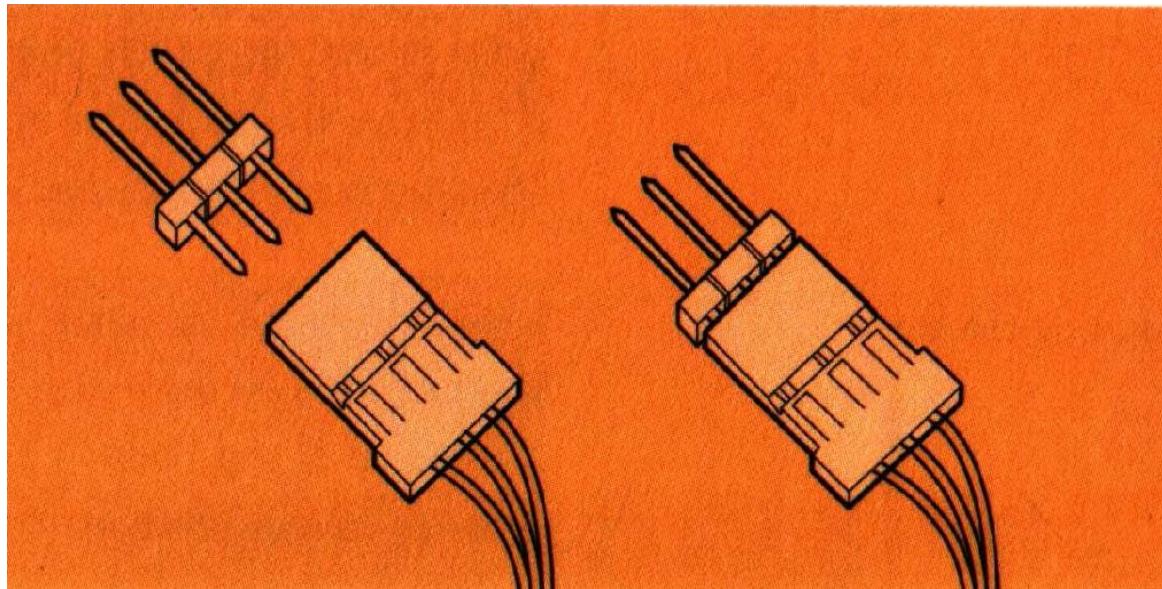


Decoupling Capacitors

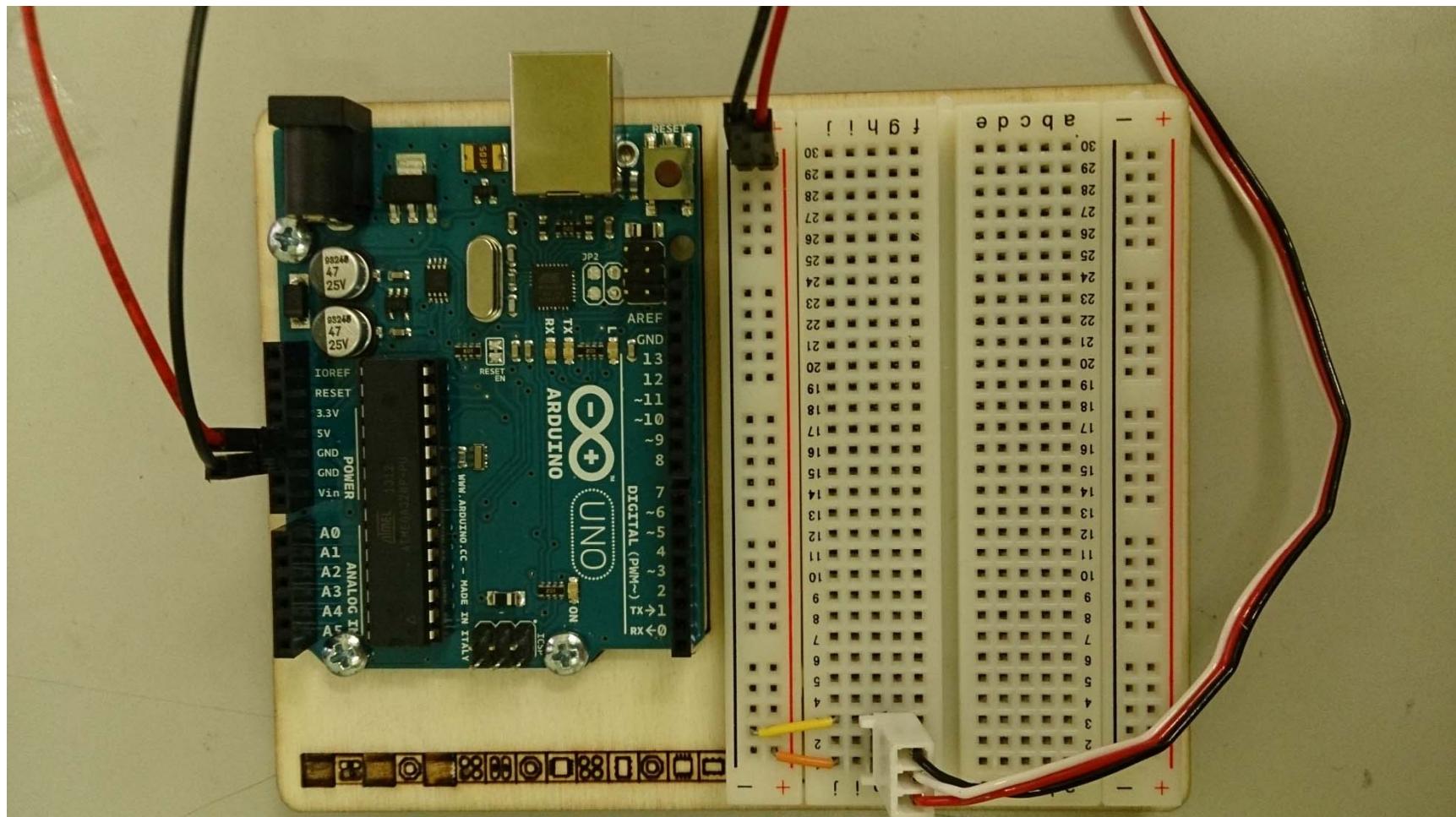
- When a servo motor starts to move, it draws more current than if it were already in motion.
 - This will cause a dip in the voltage on your board.
 - By placing a 100uf capacitor across power and ground, you can smooth out any voltage changes that may occur.
- These capacitors reduce, or decouple, changes caused by the components from the rest of the circuit.



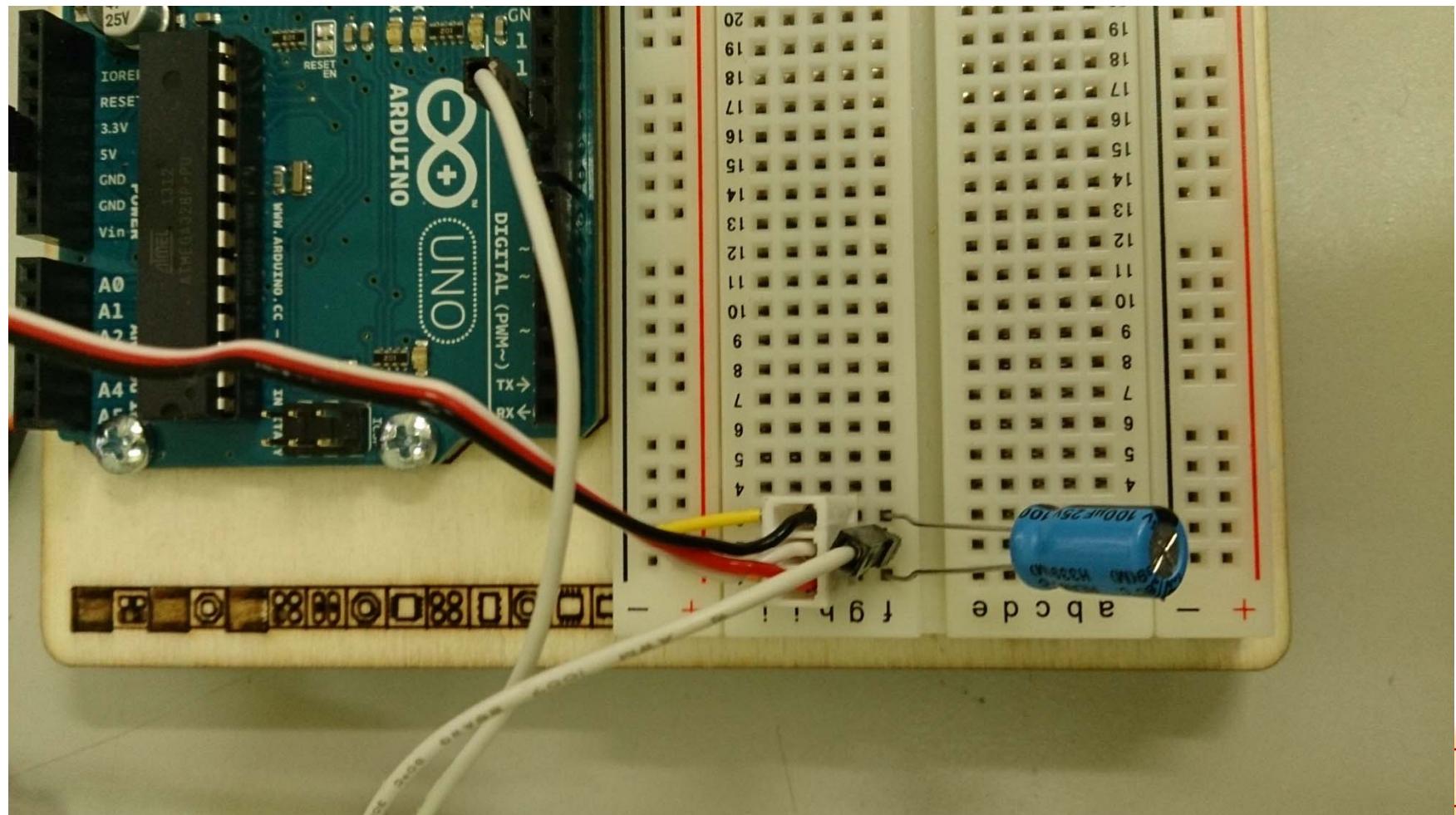
Connect the servo to the board



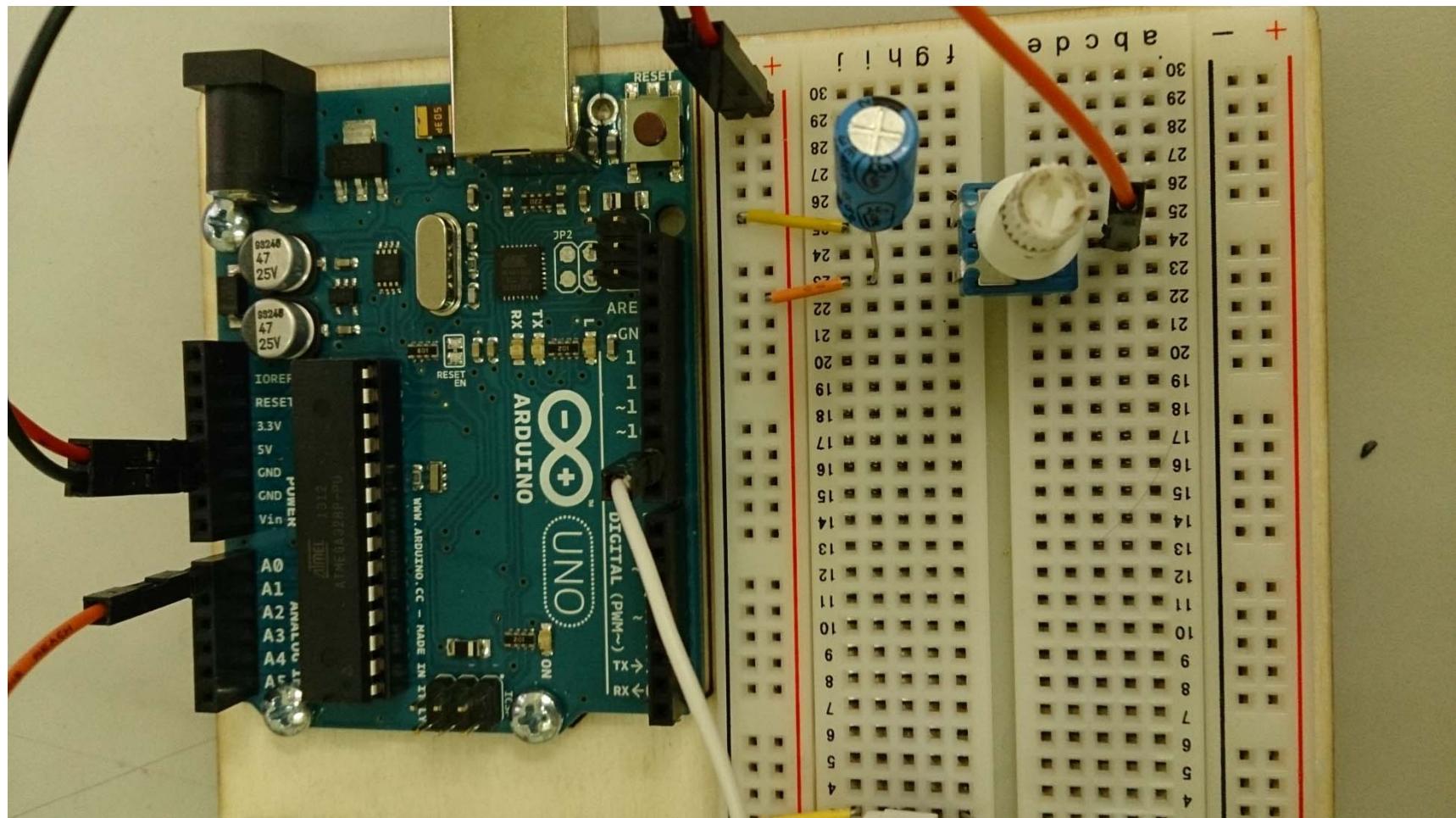
The Circuit



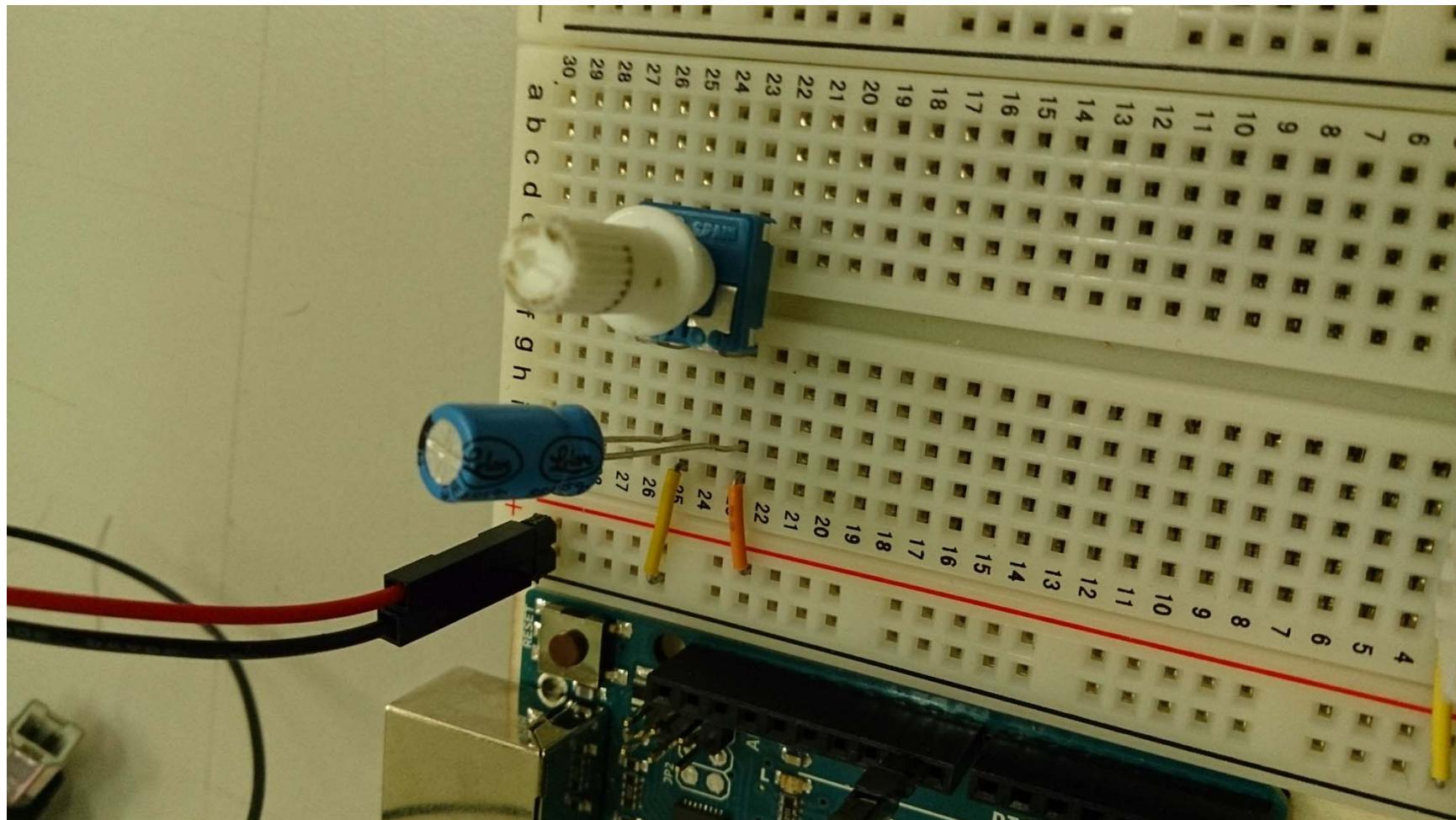
The Circuit (cont.)



The Circuit (cont.)



The Circuit (cont.)





Codes

