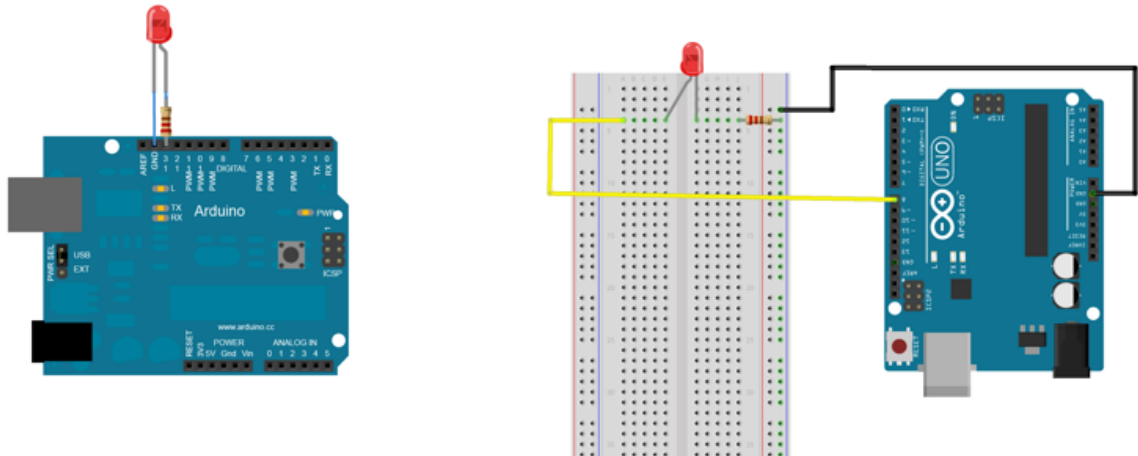**Useful Circuit Assemblies for Projects**

1. **Digital Output –** Controlling digital actuators (LED, Relay, High Current Devices through Relays such as AC light, Door Bell, etc):
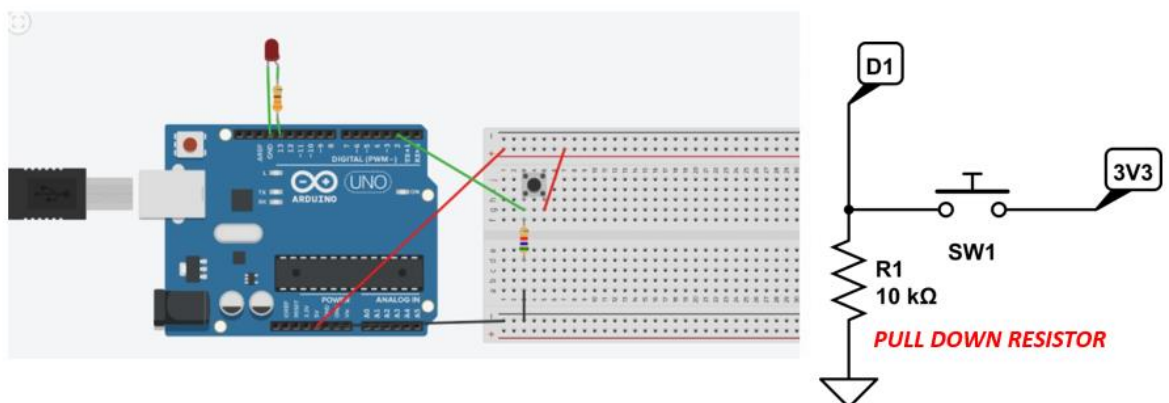
Digital Output: Control LED : Exercise #4

2. **Digital Input –** Reading digital sensors (switch, proximity, IR, motion sensor, bump switch, etc):

Digital Input : Switch

D1

3V3

SW1

R1
10 kΩ

PULL DOWN RESISTOR

Digital Input : IR – Obstruction/Proximity Sensing: Exercise #6
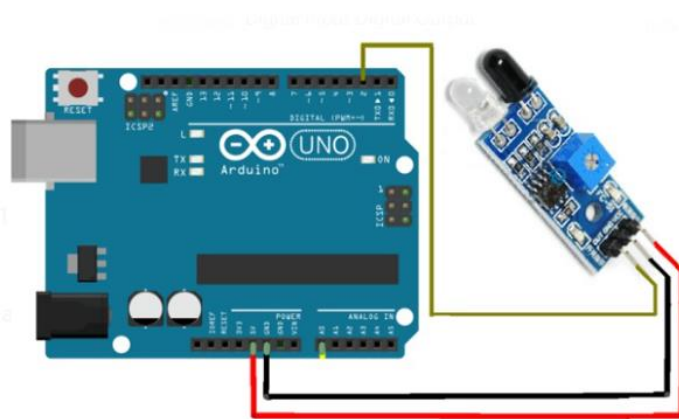
Digital Input : Switch – PIR – Motion Sensing
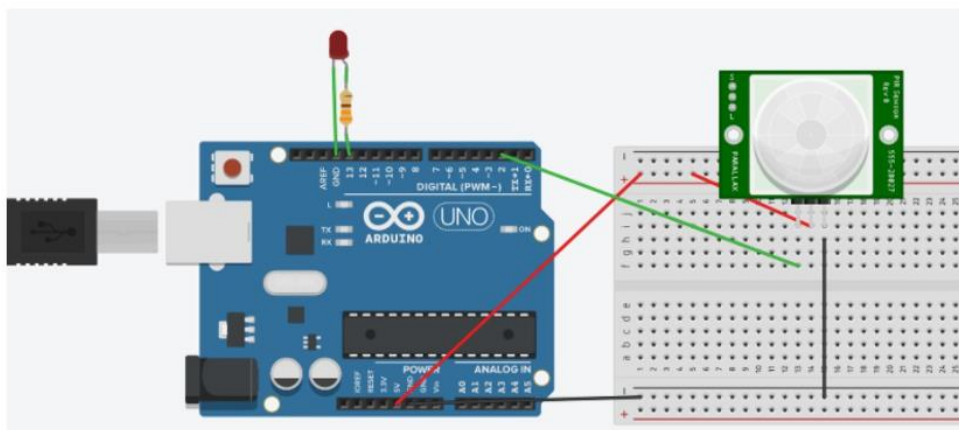
Continued …

3. Ultrasound Sensor – Measure distance of object in range (could be used for door opening, smart dustbin, etc):

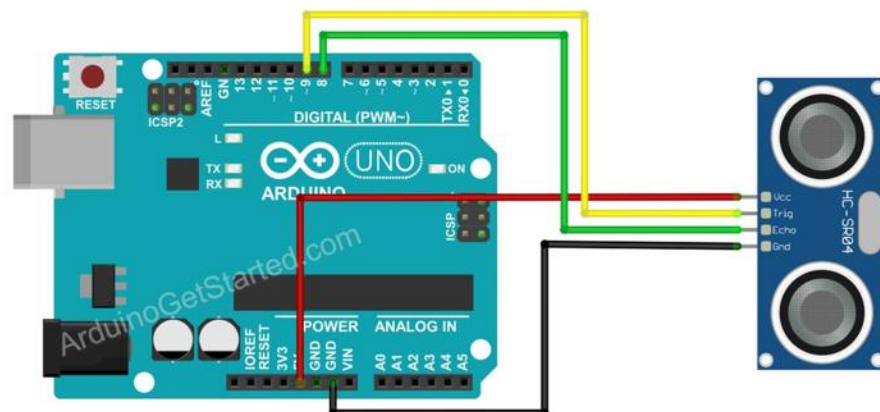Digital Input : Ultrasound Distance Sensor: Exercise #7
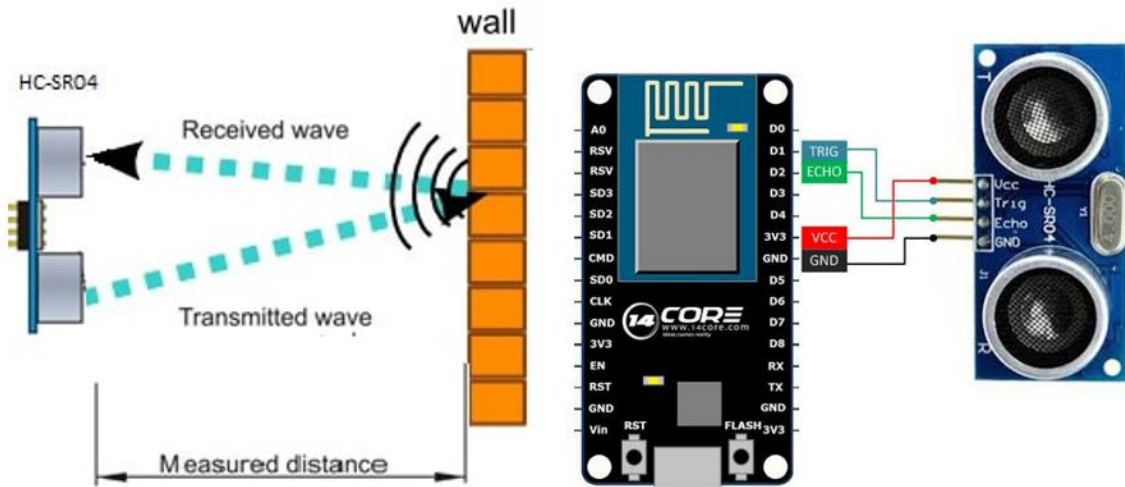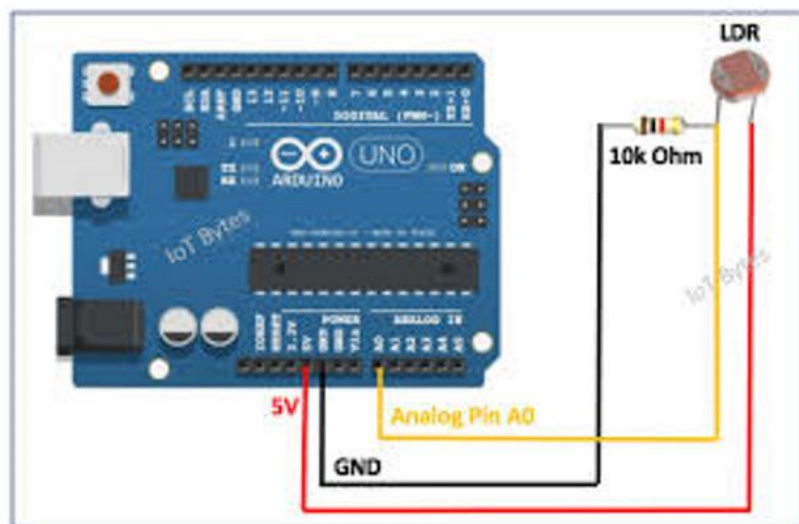
Digital Input : Ultrasound Distance Sensor

Continued …

4. **Reading Analog Sensors –** for temperature sensor, light intensity, air quality, water quality, biomedical sensors, etc:

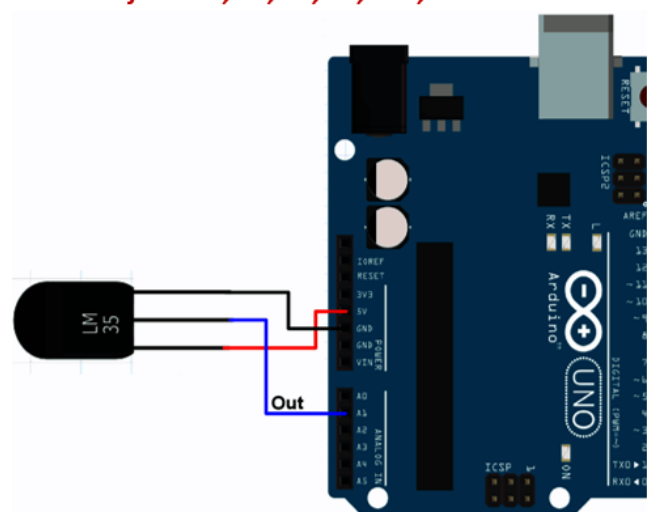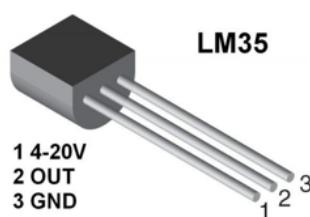**Analog Input**

VALUE / TIME

VALUE / TIME

5V / 1024 = .0048V.
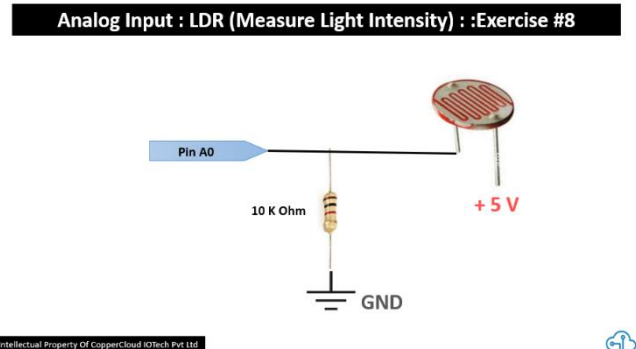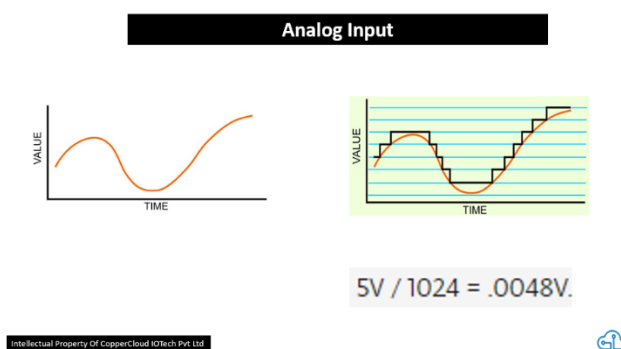
Analog Input : LDR (Measure Light Intensity) : :Exercise #8

Pin A0

10 K Ohm

+ 5 V

GND

Analog Input : LDR (Measure Light Intensity)

LDR

10k Ohm

5V   Analog Pin A0

GND

Exercise #14: Analog Sensor (Temp LM35)

Relevant for ESIOT Projects #2, #3, #8, #9, #10, #13
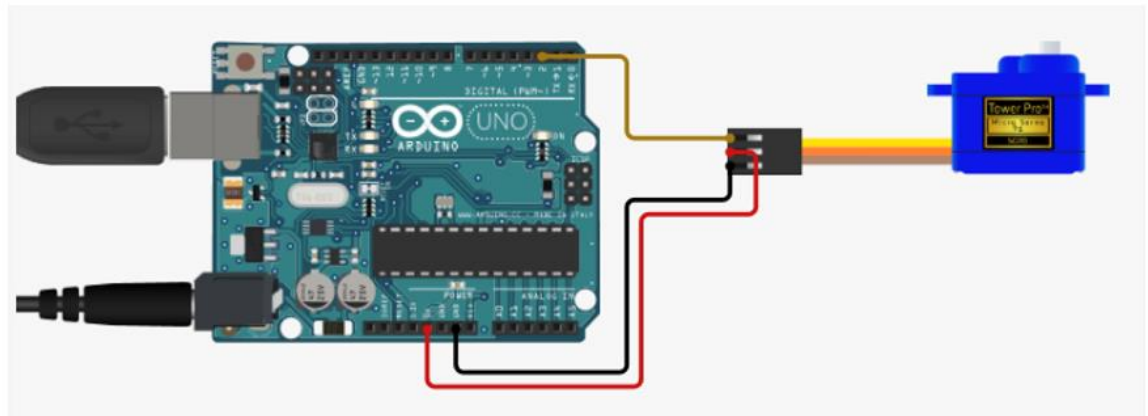
LM35

1 4-20V
2 OUT
3 GND

Out

5. **PWM Output (Simulating Analog Output) –** for delivering varying output power for fading leds, varying speed of motors, sirens, servo motors, etc:

Analog Output : LED Fading : Exercise #9
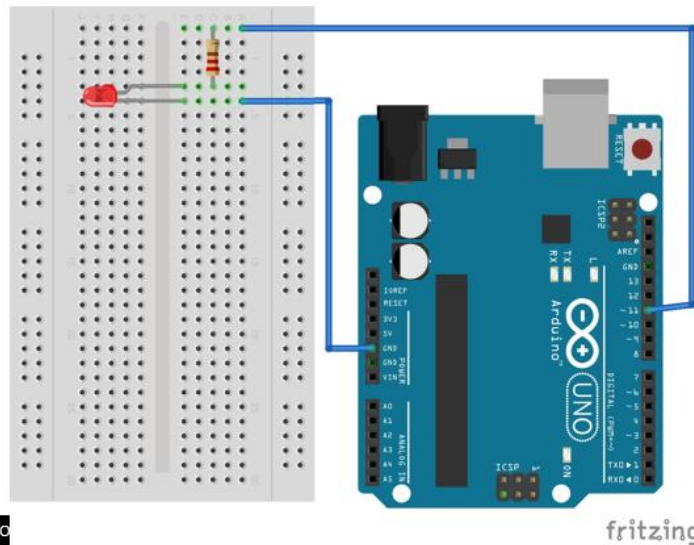
Servo: Special Case (Analog Output) : Exercise #10

Continued …

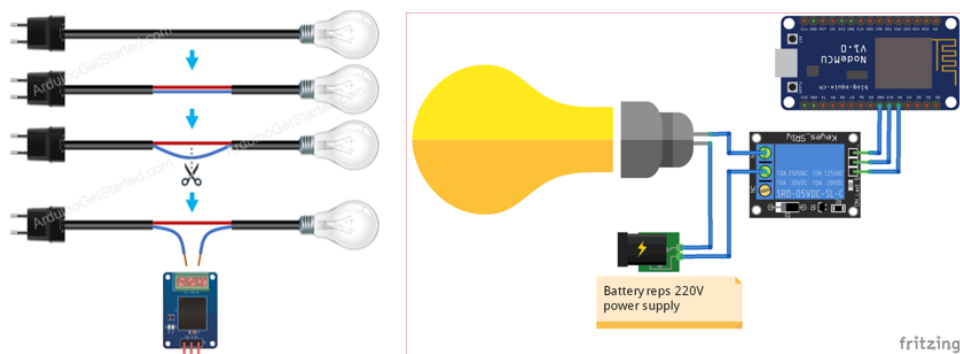6. **Relays –** Controlling high current devices (AC lights, DC or AC motors, Solenoids, heating coils, etc):

Digital Output : Relay
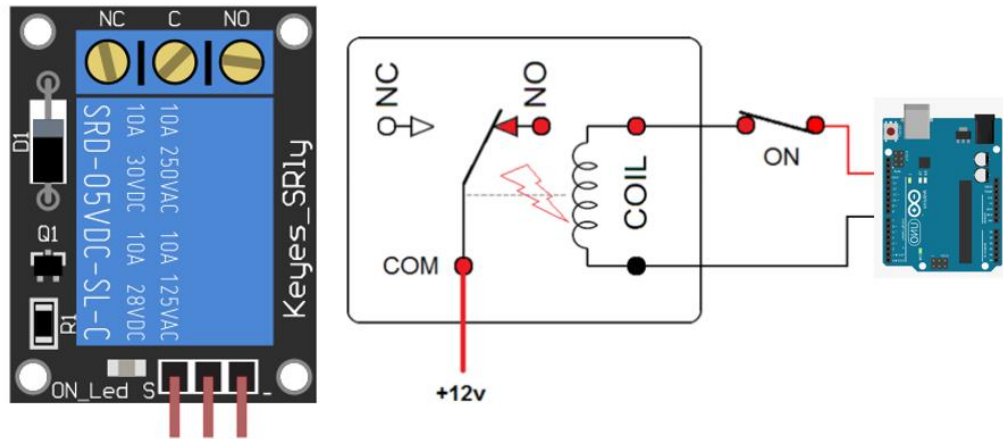
Digital Output : Relay

Battery reps 220V power supply

Digital Output : Relay

12V DC
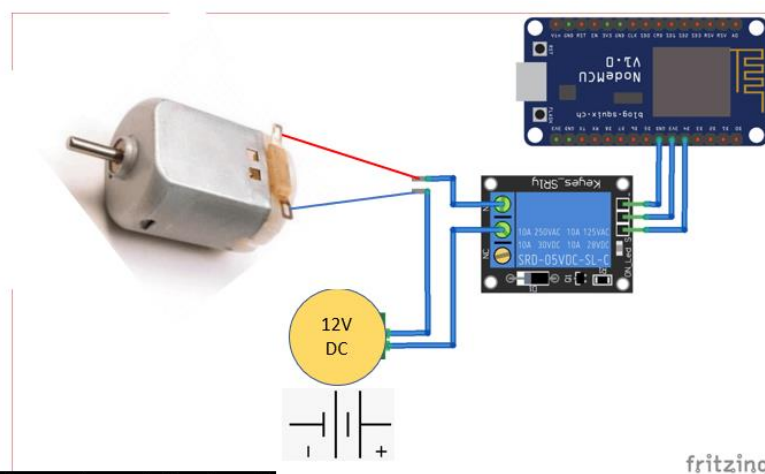
7. **Combining Sensors & Actuators** - to achieve Real-World Solutions:

Digital Input : Switch controlling an LED
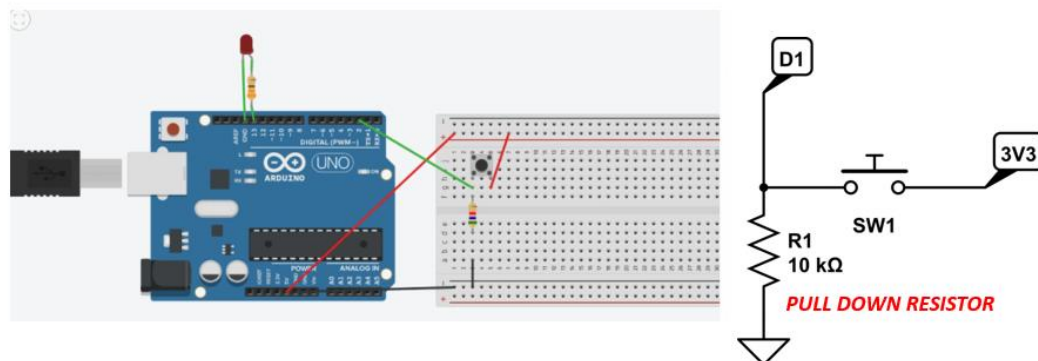
Digital Input : Combination – U/S + Relay
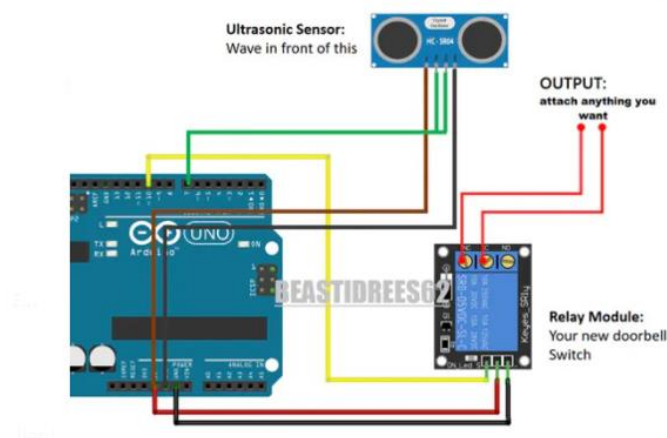
Exercise #12: Proximity Sensor + DC Actuator (Relay)

Relevant for ESIOT Projects #1, #12, #16, #17
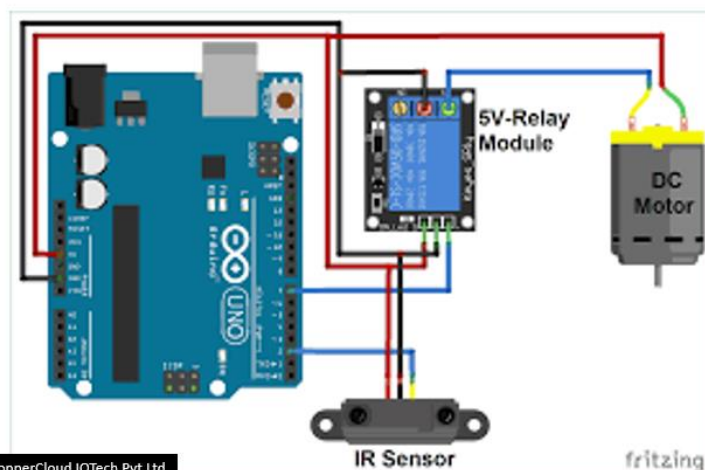
Exercise #13: Proximity Sensor + AC Actuator (Relay)
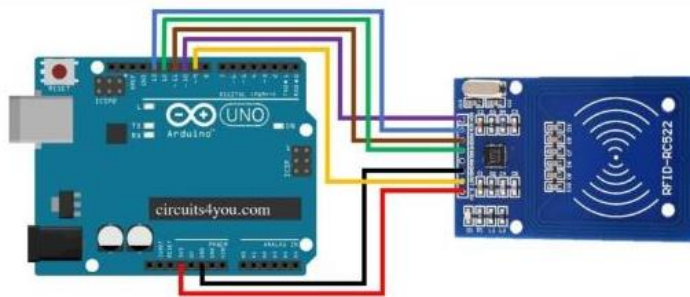
Relevant for ESIOT Projects #7

AC 220V
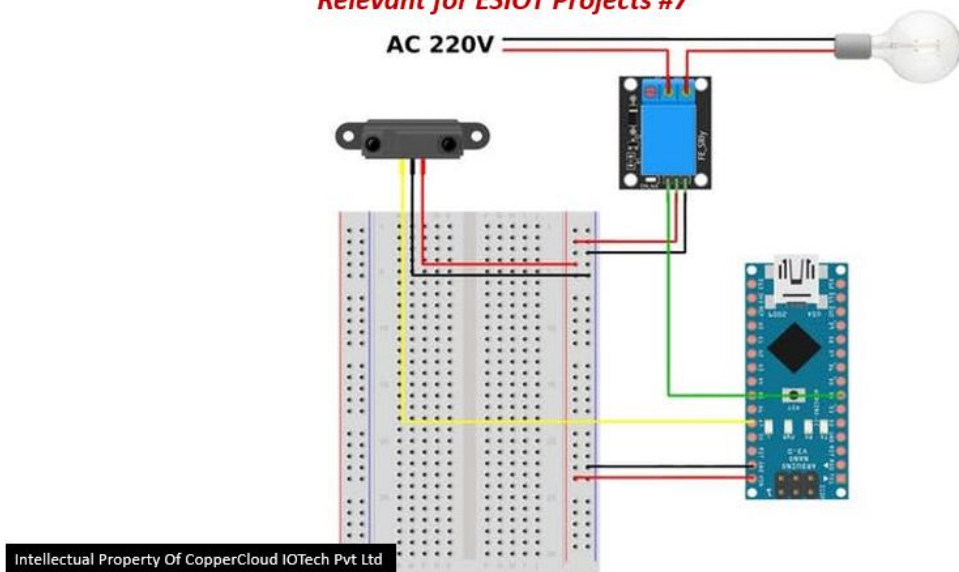
8. **Special sensor integration #1 – RFID Scanner (SPI Interface)**

Connections of MFRC522 RF ID Reader With Arduino UNO

https://circuits4you.com/2018/10/03/interfacing-of-rfid-rc522-with-arduino-uno/
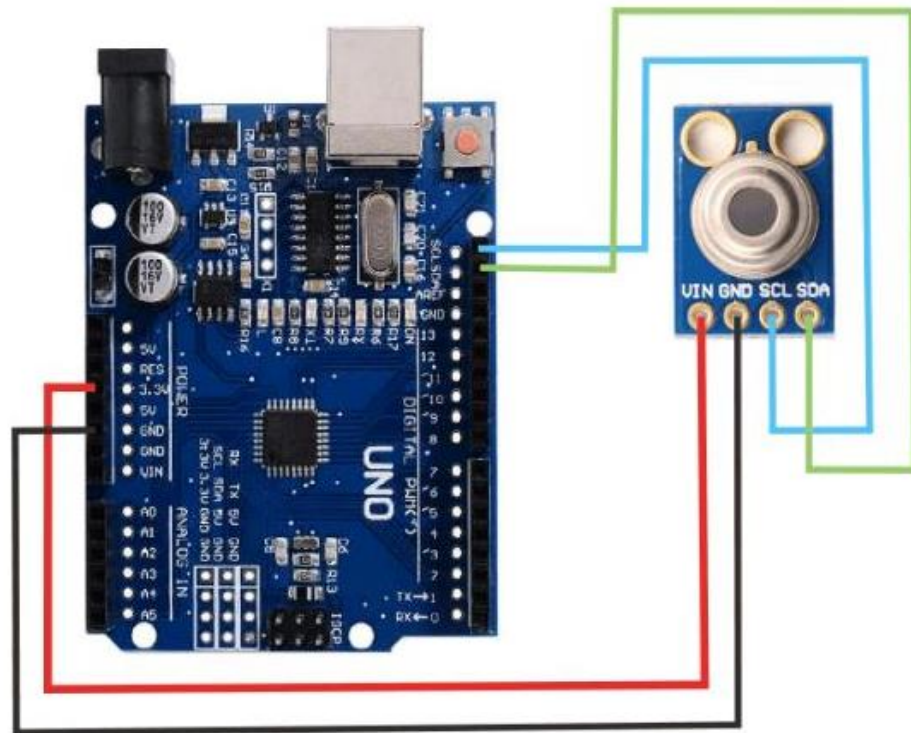
Continued …

9. Special sensor integration #2 – Contactless Temperature Sensor

GY 906 TEMPRATURE SENSOR WITH ARDUINO:-

https://www.nn-digital.com/en/blog/2019/11/09/interfacing-gy-906-mlx90614-non-contact-ir-infra-red-temperature-sensor-with-arduino/