Lab 0: Introducing Lab Sessions and Lab Materials

物聯網技術與應用(英) IoT/M2M Technologies and Applications

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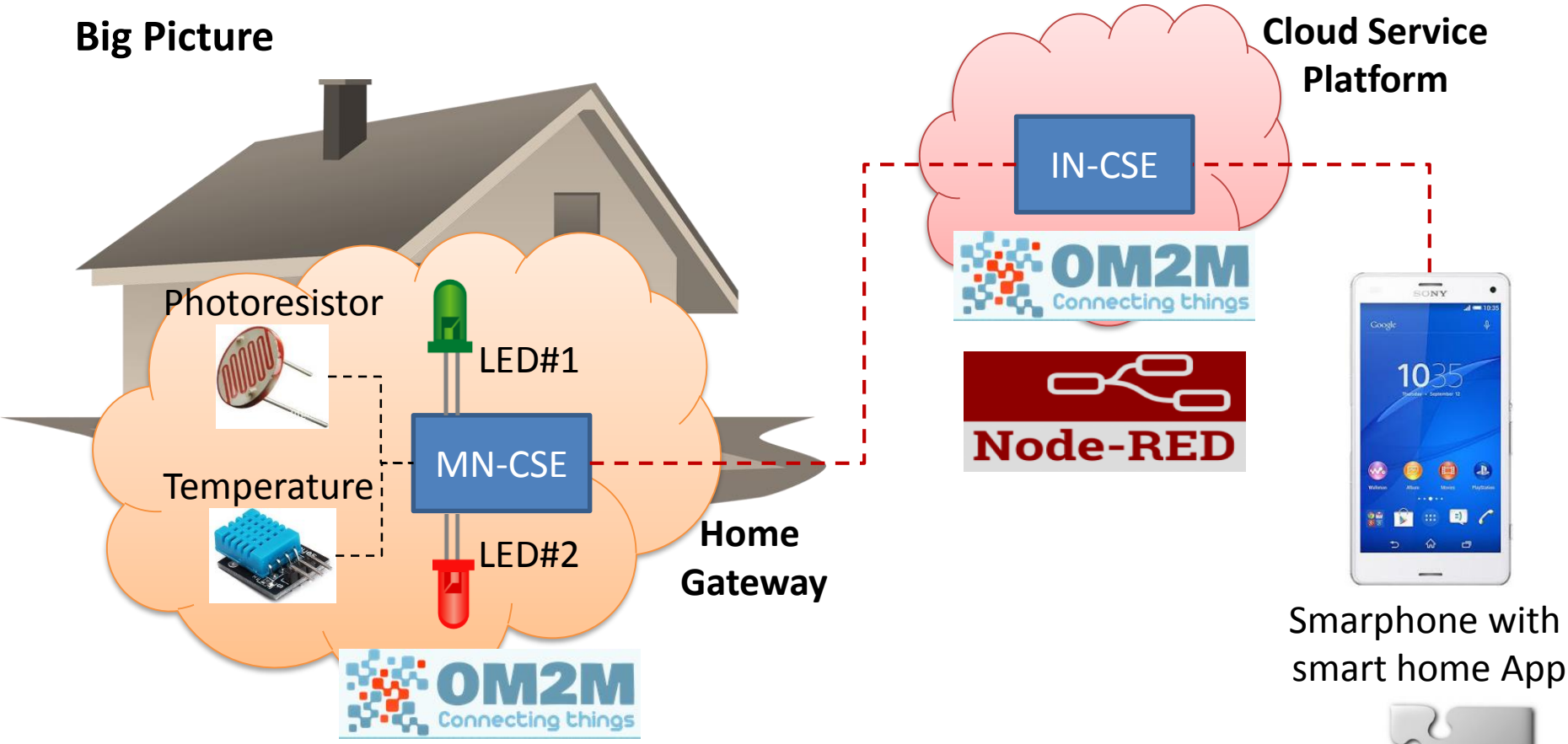
Outline

- Overview
- 5 Lab sessions
- Materials
  - VM
  - Electronic Components
- Basic Electronics
  - Arduino
    - Input, Output Ports
  - Raspberry Pi
    - Input, Output Ports
  - Breadboard
  - Sensors
    - Temperature
    - Photoresistor
  - Actuators
    - LED

Lab Sessions Goal

Big Picture



5 Lab Sessions

1. Lab 1: Managing Sensors and Actuators with Raspberry Pi & Arduino using Wyliodrin Studio (1)
2. Lab 2: Managing Sensors and Actuators with Raspberry Pi & Arduino using Wyliodrin Studio (2)
3. Lab 3: OM2M/REST API & Node-RED
4. Lab 4: Implementing a smart home using OM2M, Node-RED, and Wyliodrin
5. Lab 5: Smart Home Monitoring using OM2M, Node-RED, Wyliodrin, and App Inventor 2

Lab Execution Procedure

1. Follow instructions on handouts.
2. TA will guide you through each checkpoint.
3. Complete each checkpoint and demo to TA.
4. All checkpoints must be completed by a group. If completed, all group members will receive 100 points; otherwise 0 points.
5. Each lab is designed to be completed in 3 hours or less.
6. For those groups that can not finish all the checkpoints during the 3 hours, they are allowed to take the lab home and finish at home. However, you have to bring the equipment back and demo your results to the TAs before the deadline.

Materials

- **Virtual machine with all the software tools installed**
  - Wyliodrin
  - OM2M
  - Node-Red
  - Postman
- **Electronic components box**
  - Arduino UNO
  - Raspberry Pi 3 model B
  - Power adapter for Raspberry Pi
  - Photo resistor sensor KEYES 018
  - Temperature sensor KEYES 013
  - 1 breadboard
  - 2 green, 2 red, 1 yellow LEDs
  - 5 resistors 220
  - 1 switch button
  - 1 resistor 10K
  - 8 male to female cables
  - 13 male to male cables
  - Power-USB cable for Arduino
- **Google account**

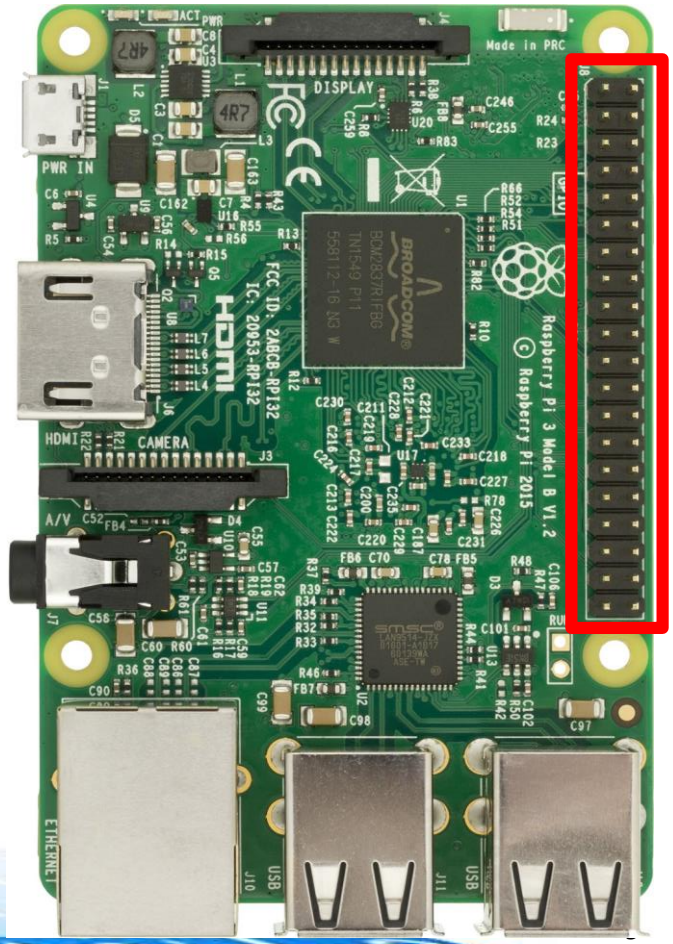
Additional notes

- Each group will be provided with a laptop and a box of components. TA will take care of giving you the same items on each lab session.
- You must return the laptop and the box of components after finishing each lab session.
- All components have been carefully tested to ensure they work. You are thus responsible for the correct utilization of the given components.
- Optionally, you may use your own laptop. If so, it is your responsibility to have it ready before each lab session.

BASIC ELECTRONICS

Raspberry Pi (1)

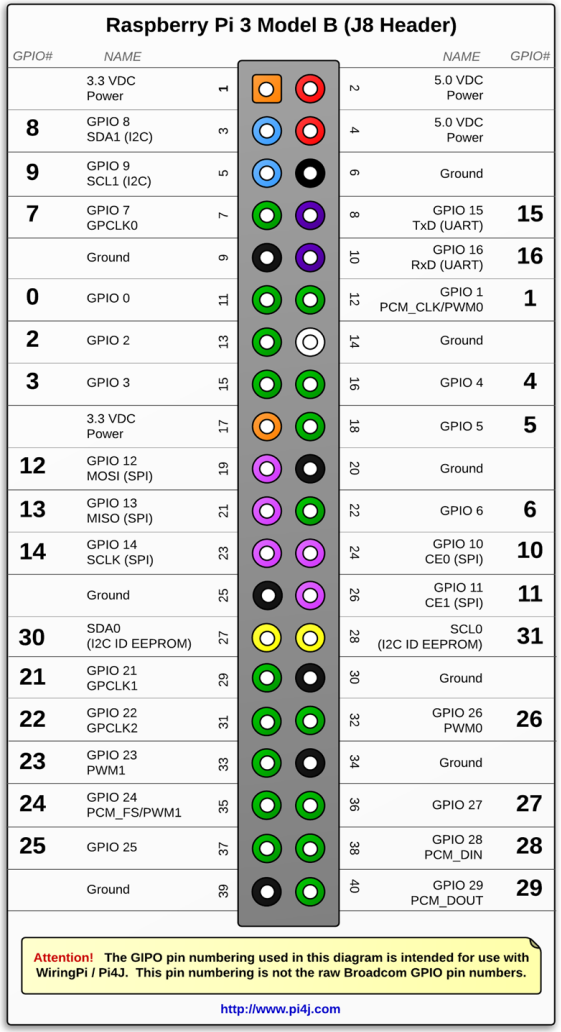
- The Raspberry Pi is a credit-card-sized computer with integrated Ethernet, Wi-Fi, Bluetooth 4, HDMI, USB, and audio.
- Capable of hosting an OS (Raspbian).
- Multipurpose: Office, Internet, games, etc.
- GPIO (control sensors).



Raspberry Pi

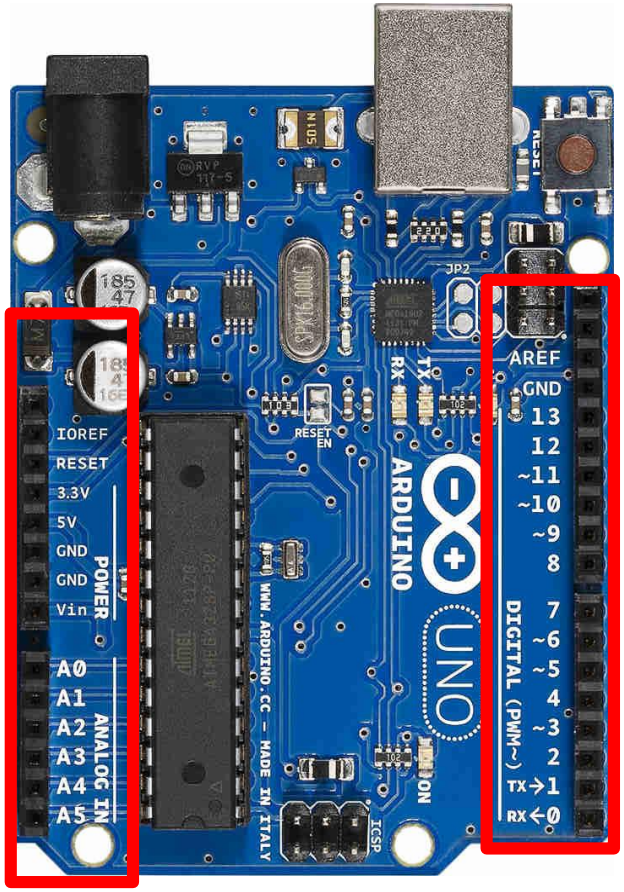
Raspberry Pi (2)

- Raspberry Pi can be directly used in electronics projects because it has a set of **general-purpose input/output (GPIO)** pins.
- These GPIO pins can be accessed for controlling sensors (temperature, light, motion, proximity, etc.) and actuators (LEDs, motors, relays, etc.).
- **All of these GPIO pins are digital IO**. In order to read/write analog inputs, an external ADC (analog-to-digital converter) or **Arduino** should be used.
- Other pins are **power and ground**.



Arduino

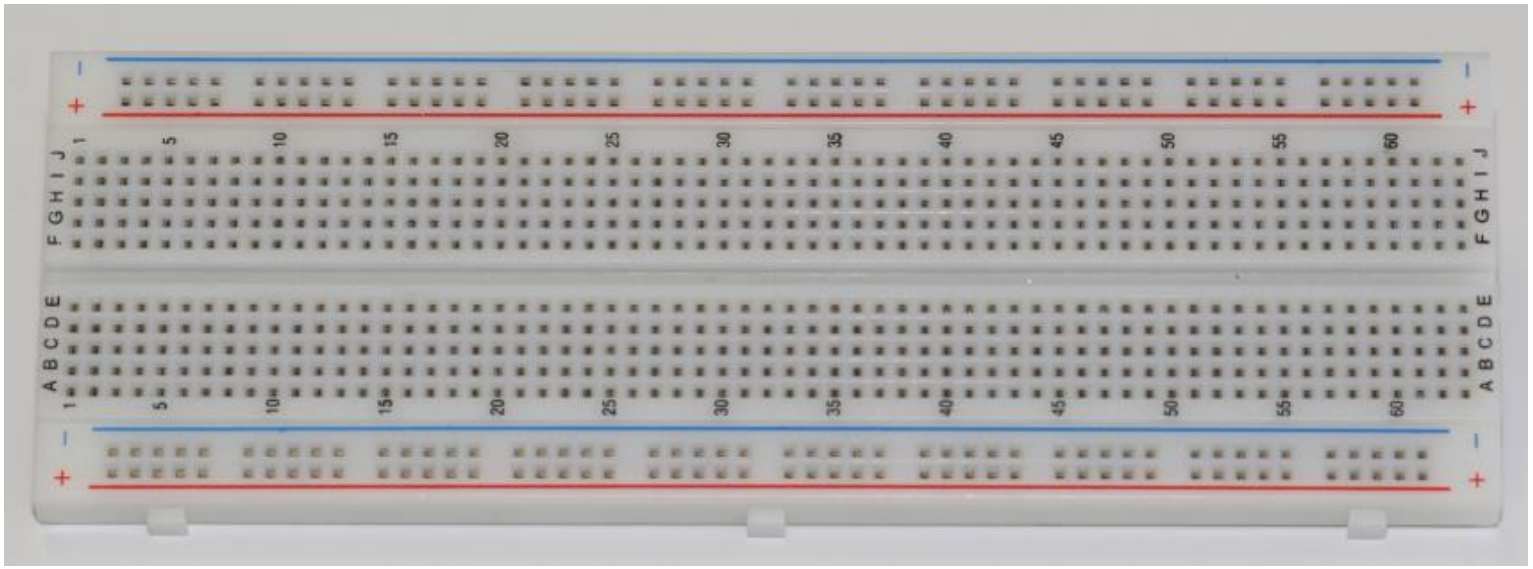
- Arduino is an open-source electronics platform.
- Consists of both a physical programmable circuit board (microcontroller) and an IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.
- **It has analog and digital GPIO**.
- It functionality can be extended via ArduinoShields.



ARDUINO

Breadboard

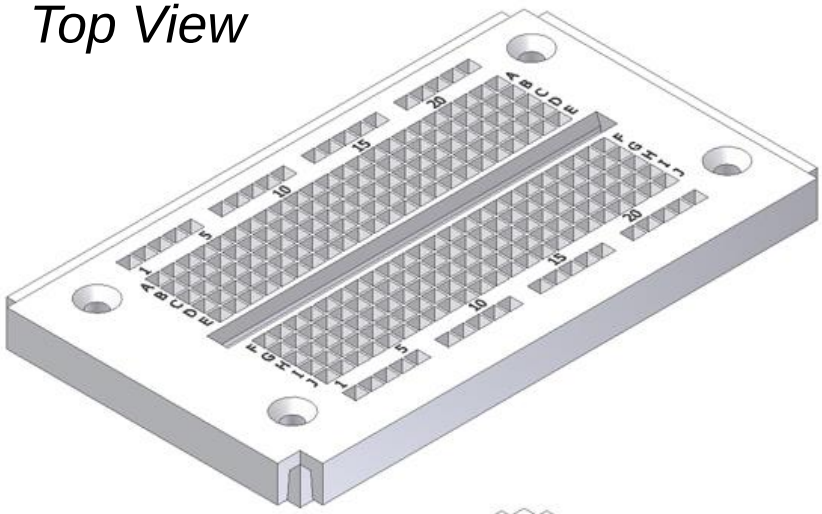
A breadboard, sometimes called a proto-board, is a reusable platform for temporarily built electronic circuits.



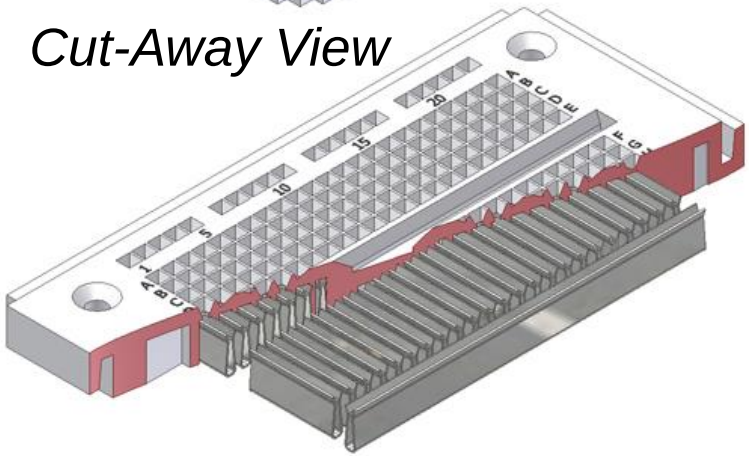
How A Breadboard Works

- Electric component leads and the wire used to connect them are inserted into holes that are arranged in a grid pattern on the surface of the breadboard.
- A series of internal metal strips serve as jumper wires. They connect specific rows of holes.

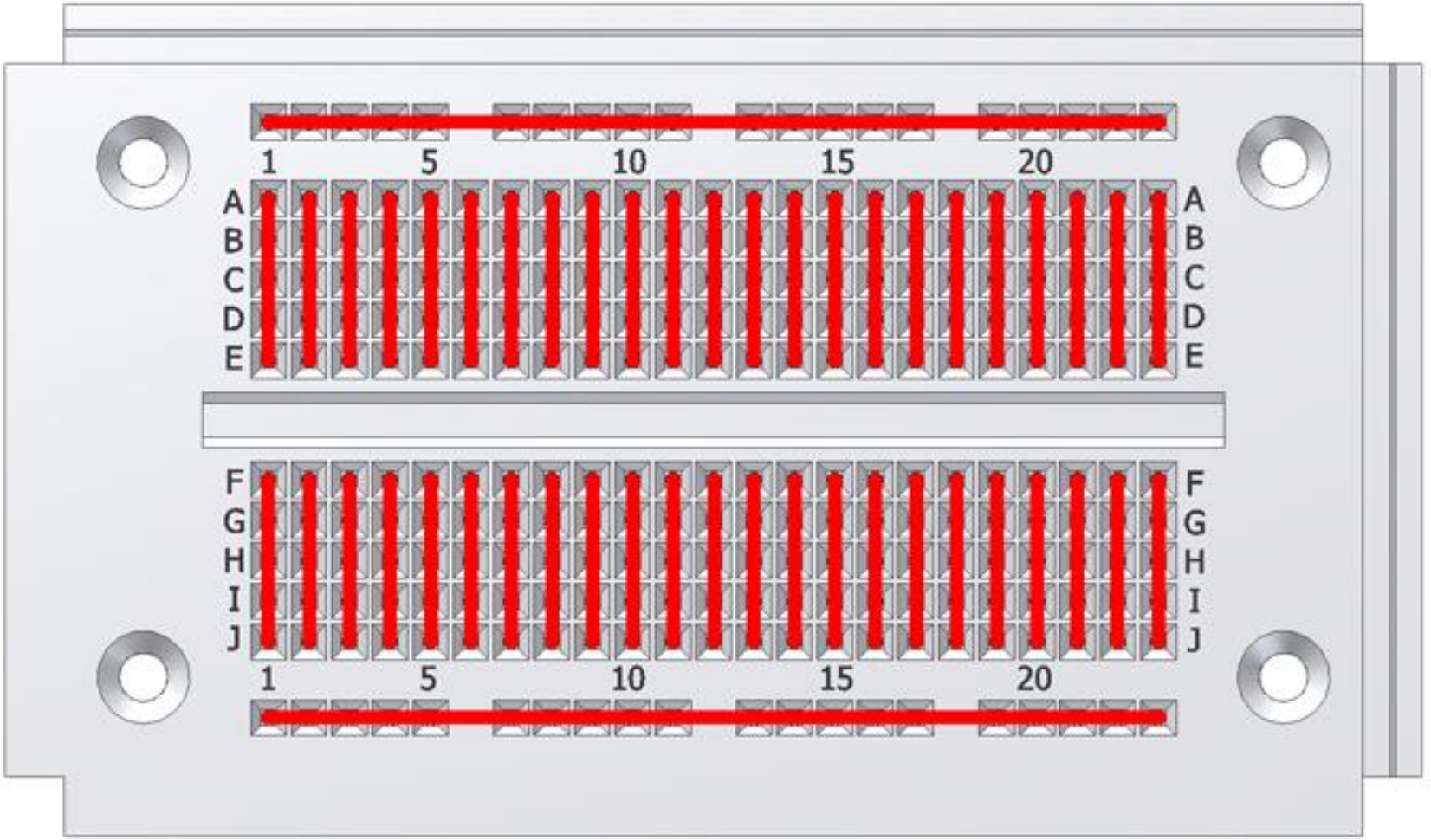
Top View



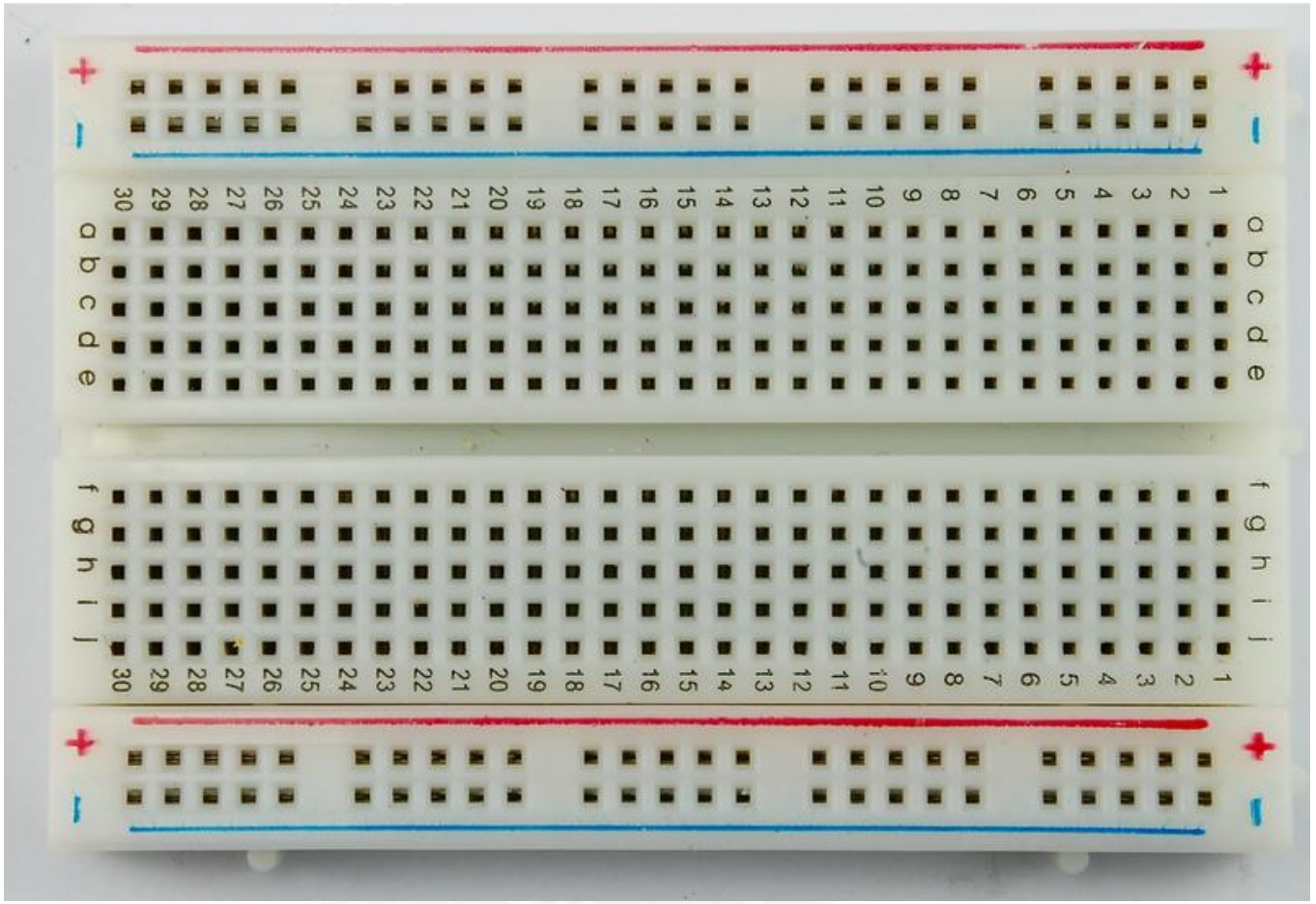
Cut-Away View



Breadboard Connections



Common Breadboard



Why Breadboard?

1) It takes less time (and money) to breadboard a circuit than to design and fabricate a printed circuit board (PCB).

2) As a complement to circuit simulation, breadboarding allows the designer to see how, and if, the actual circuit functions.

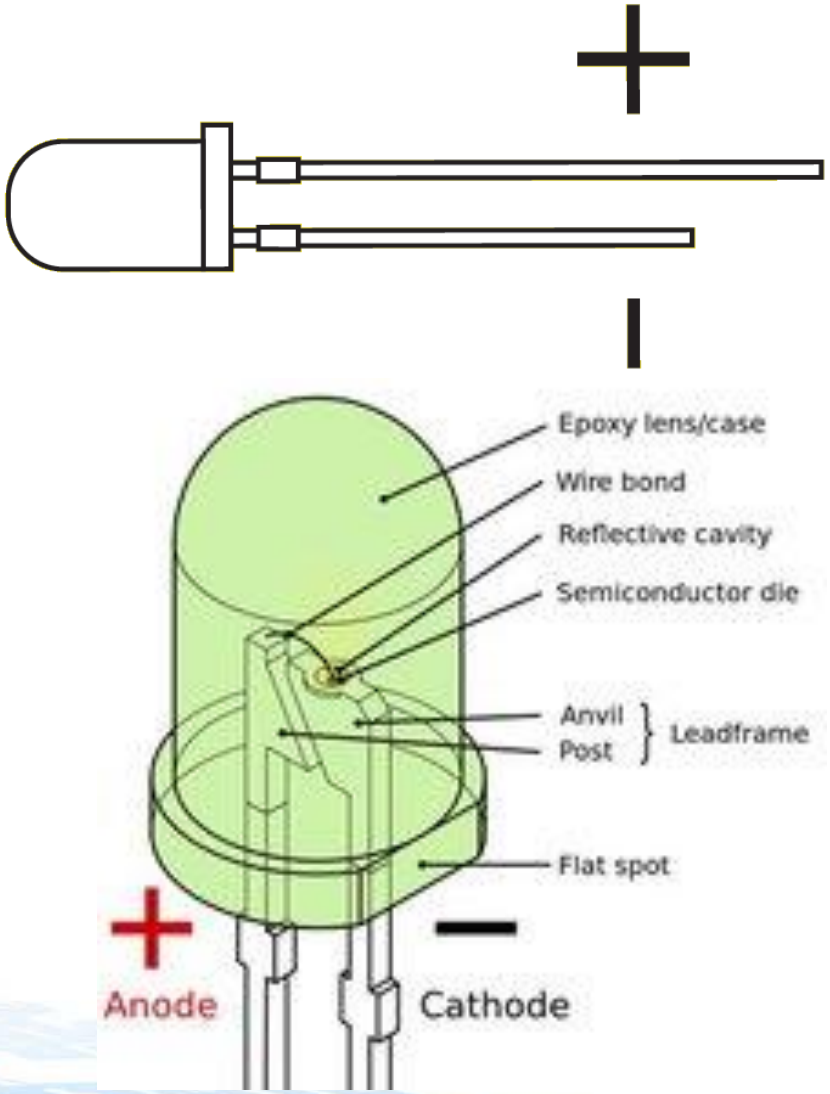
3) Allows the designer to easily modify a circuit to facilitate measurements of voltage, current, or resistance.

LED

- LED stands for **light-emitting diode**, which means that much like their diode cousins, they are polarized.

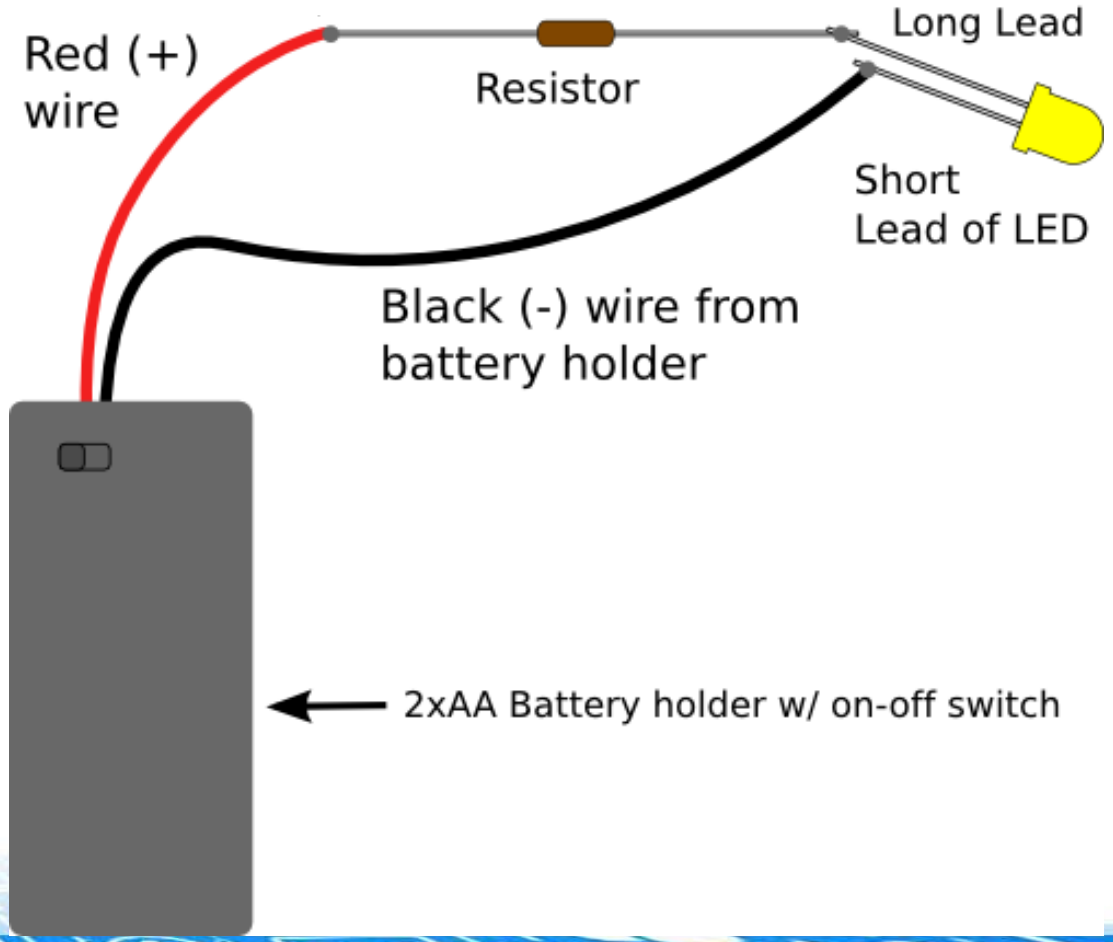
Positive, Negavite?

- The **longer leg** indicates the ***positive***, anode pin.
- The pin nearest the **flat edge** will be the ***negative***, cathode pin.



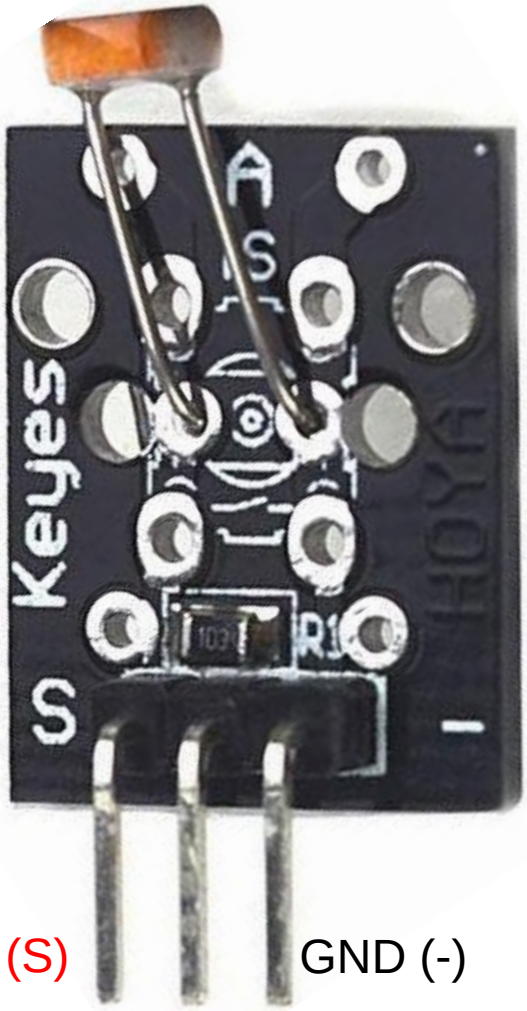
How to connect LED with a resistor and Power

We need to use a **resistor** to limit the current in the **LED** to a safe value.



Arduino KY-018 Photo resistor module

Signal (S) must be connected to an **analog** pin in Arduino.



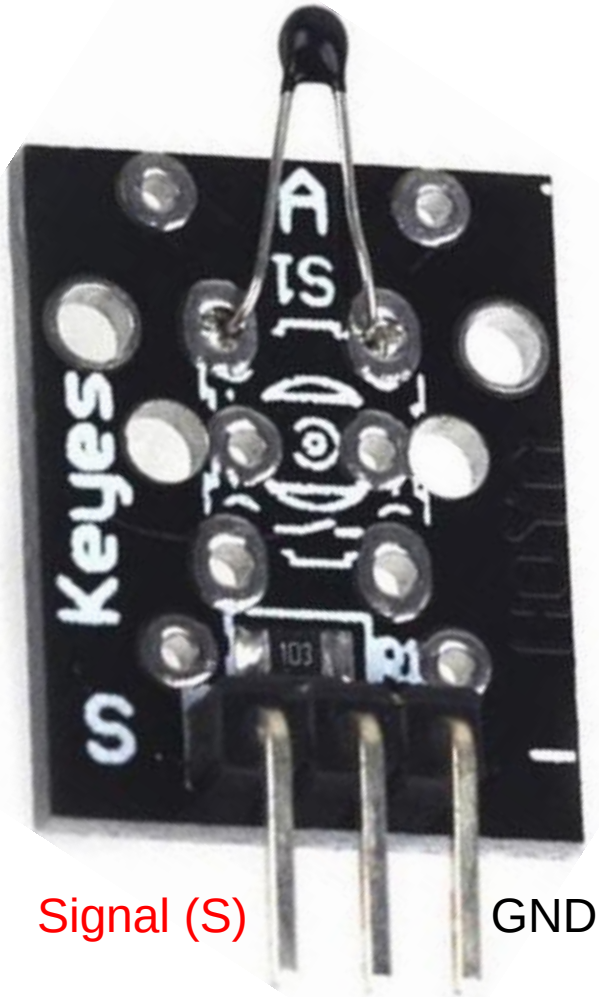
Signal (S)

GND (-)

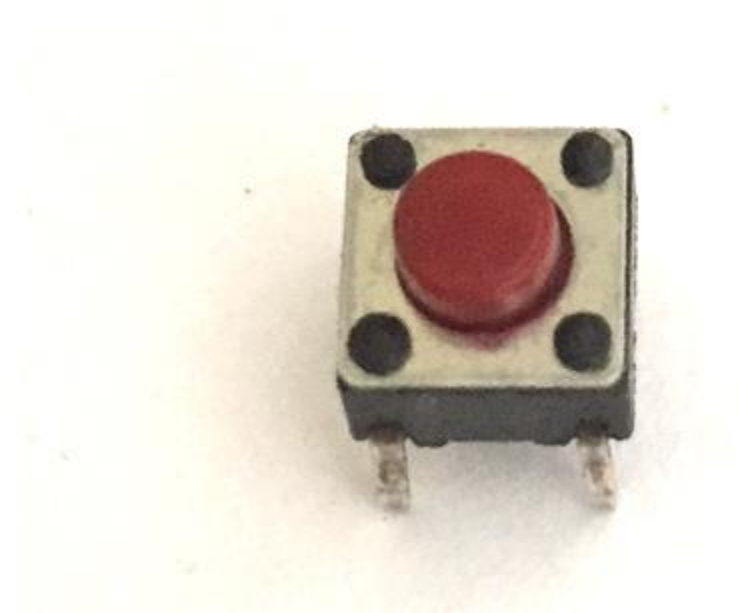
+5V

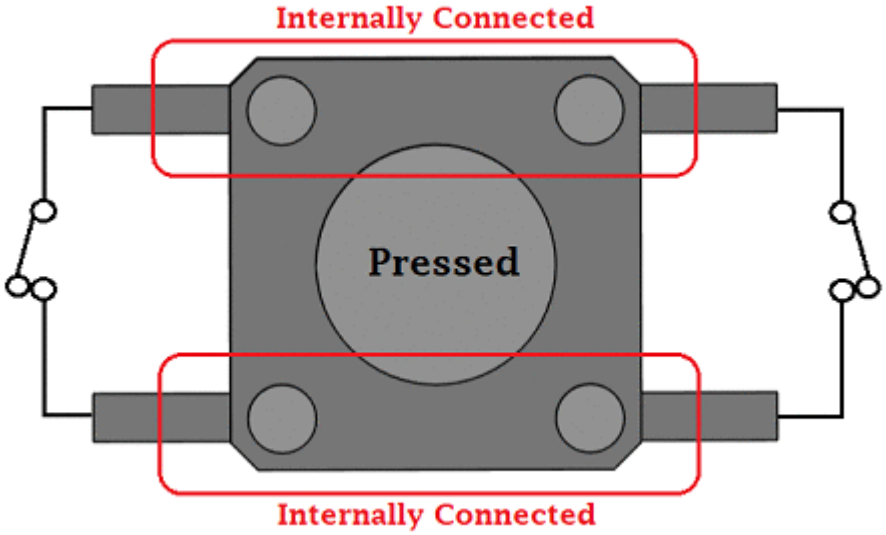
Arduino KY-013 Temperature module

Signal (S) must be connected to an **analog** pin in Arduino.

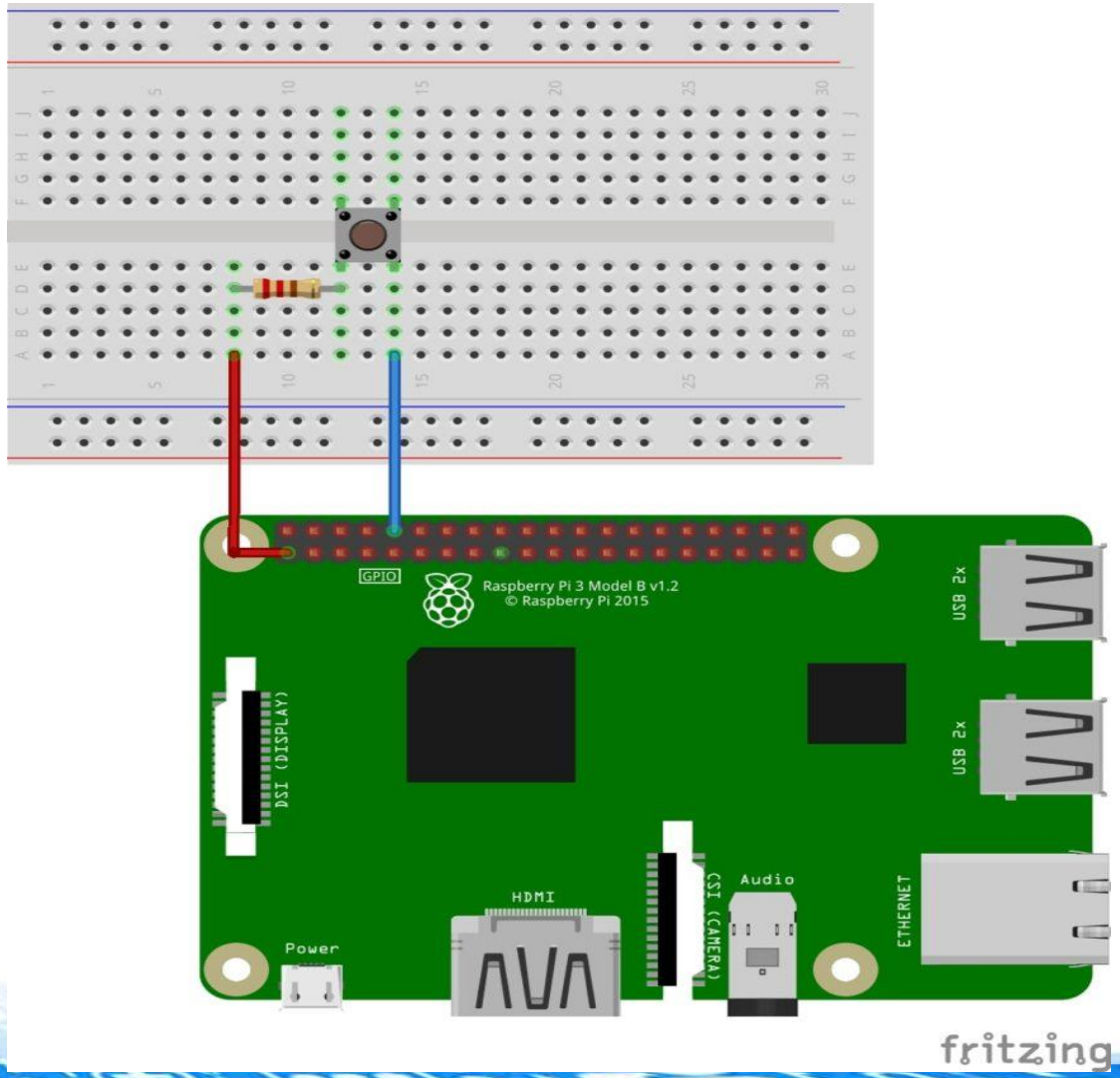


Push Button Switch (1)





Push Button Switch (2)



Q & A