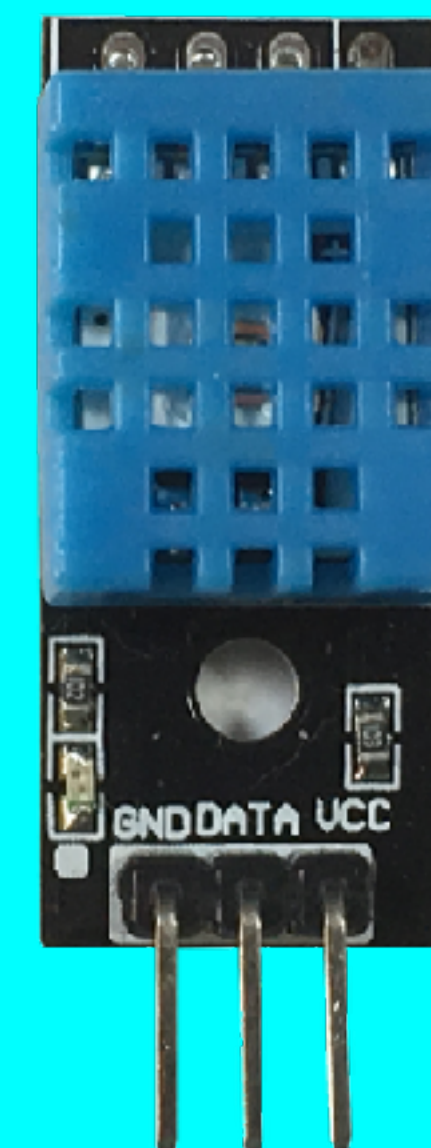
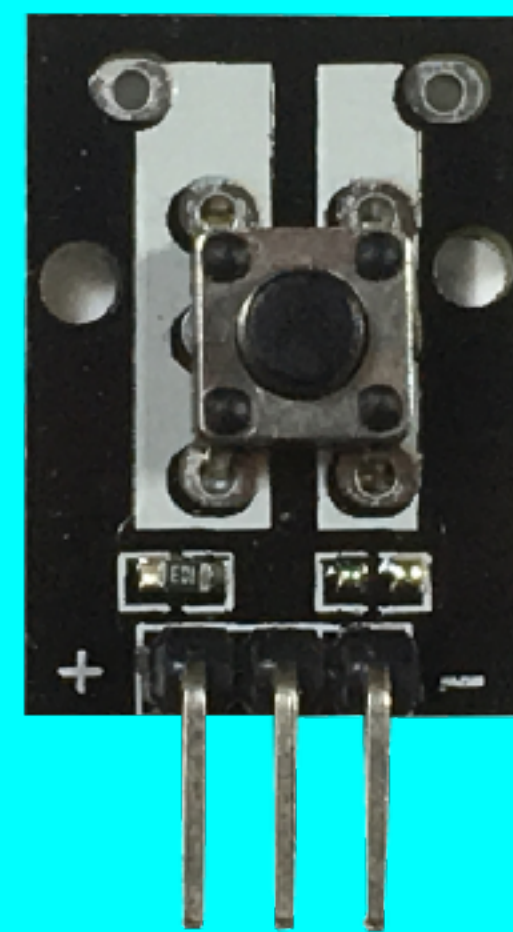


# LORA / LORAWAN TUTORIAL 26

## Sending Sensor Data To The Things Network



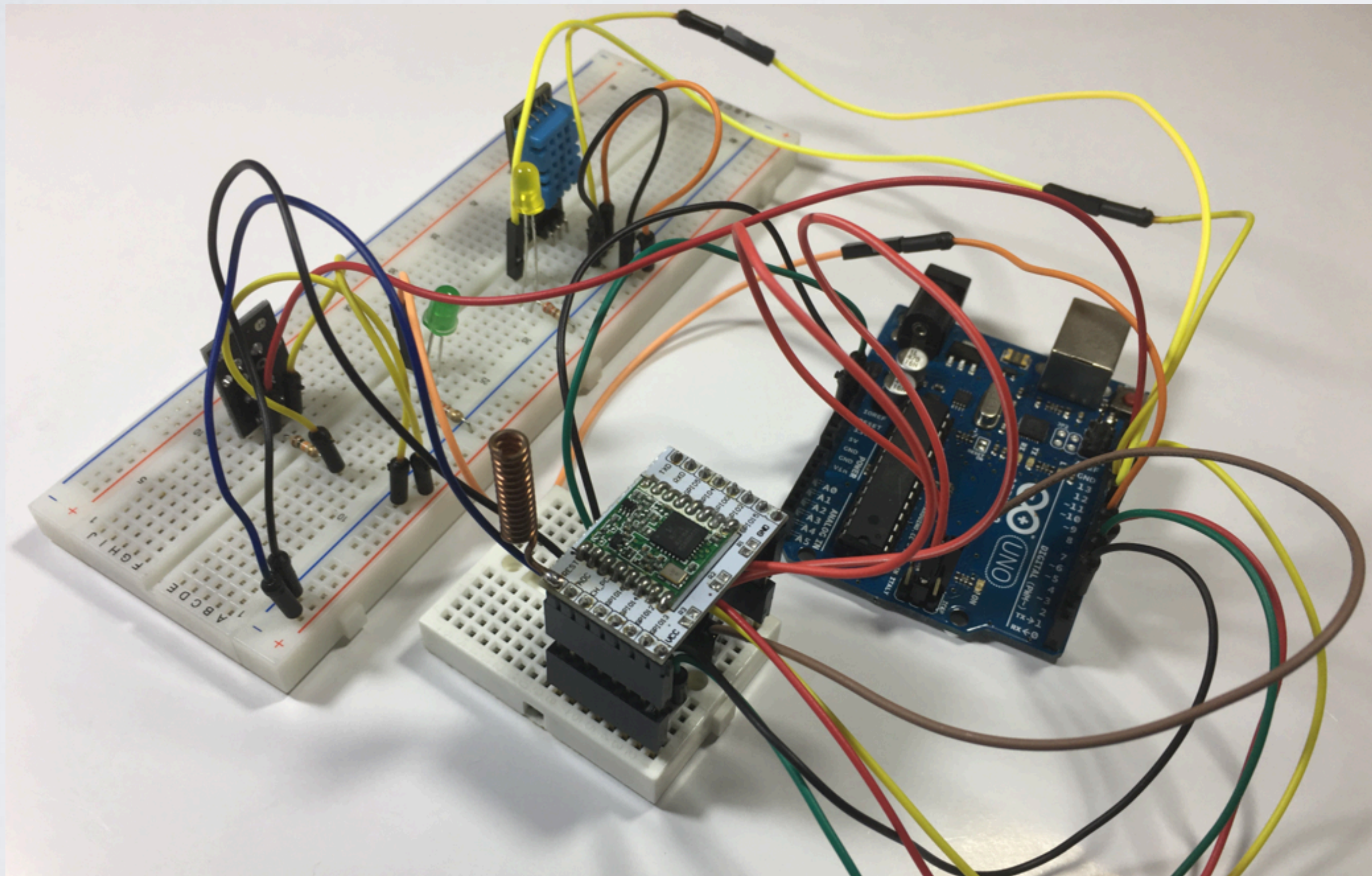
# INTRO

- In this tutorial I will demonstrate how to send sensor data to The Things Network using my self build LoRa development board.
- A button switch is used to detect a button press and a DHT11 sensor is used to measure the temperature and humidity.



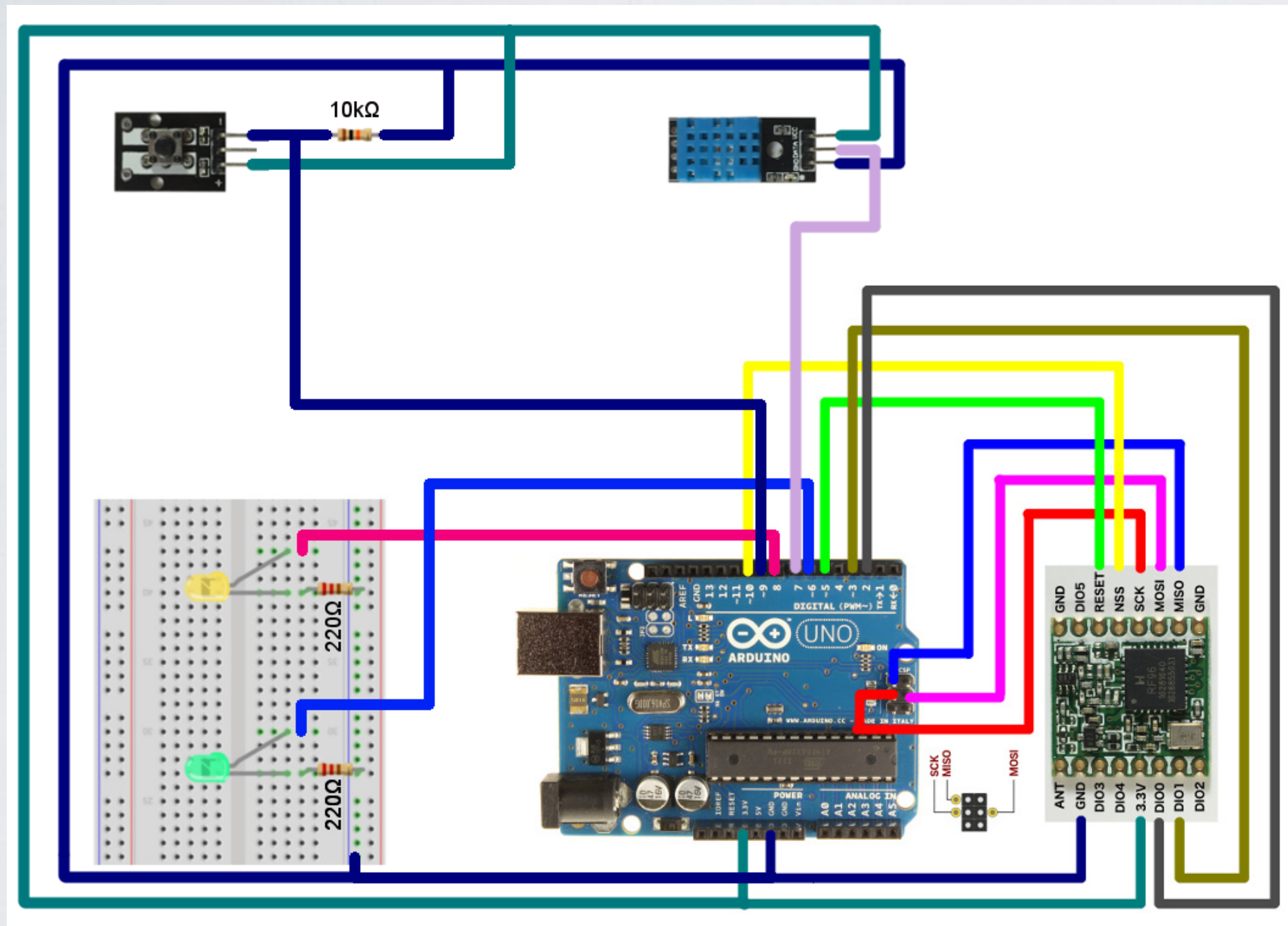
# HARDWARE SETUP

- [https://www.mobilefish.com/images/developer/lorawan\\_rfm95\\_arduino\\_leds\\_and\\_sensors.png](https://www.mobilefish.com/images/developer/lorawan_rfm95_arduino_leds_and_sensors.png)  
[https://www.mobilefish.com/images/developer/lorawan\\_rfm95\\_arduino\\_leds\\_sensors\\_overview.png](https://www.mobilefish.com/images/developer/lorawan_rfm95_arduino_leds_sensors_overview.png)





# HARDWARE SETUP



Using the Tutorial 25 setup, two sensors were added to the breadboard:

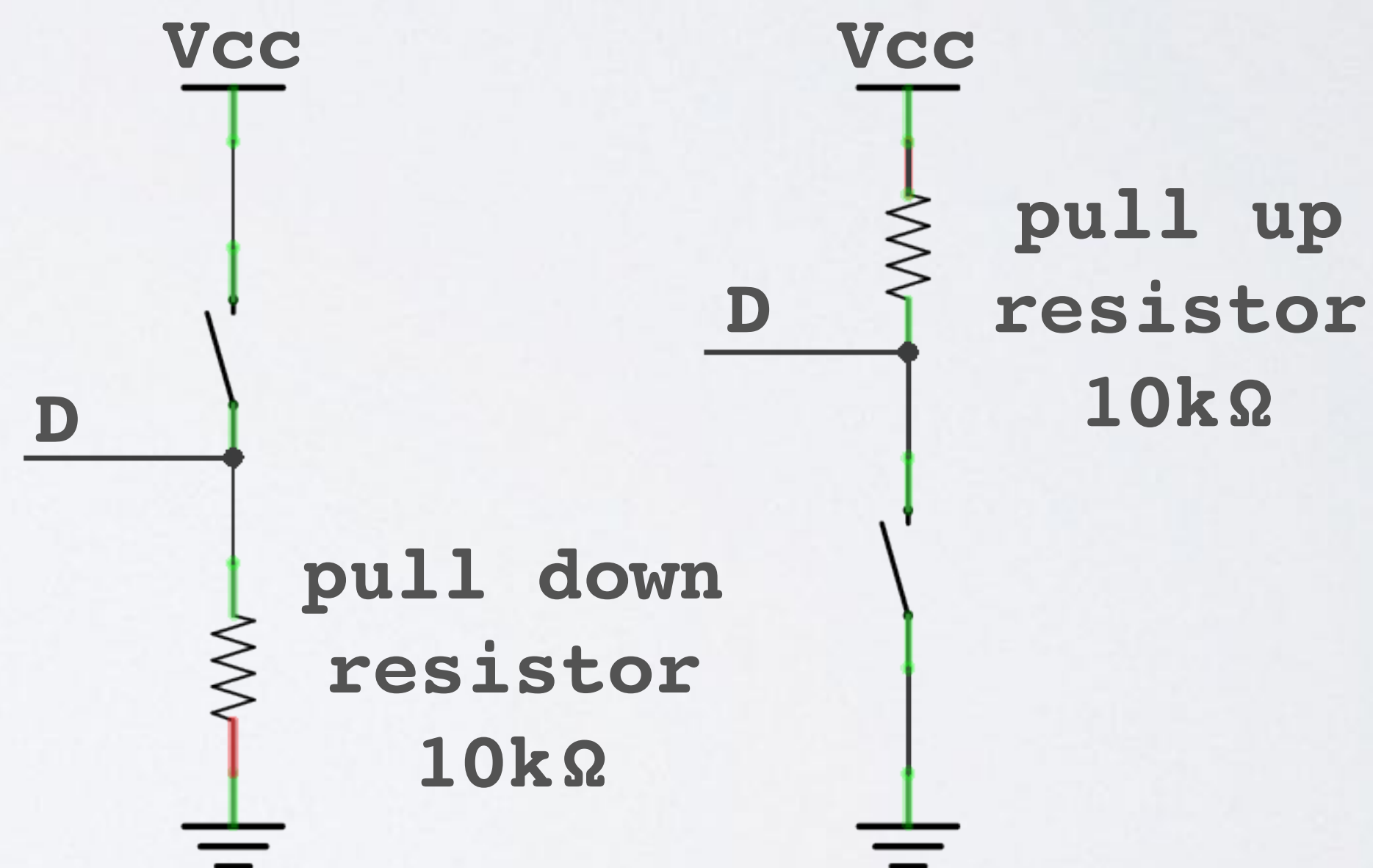
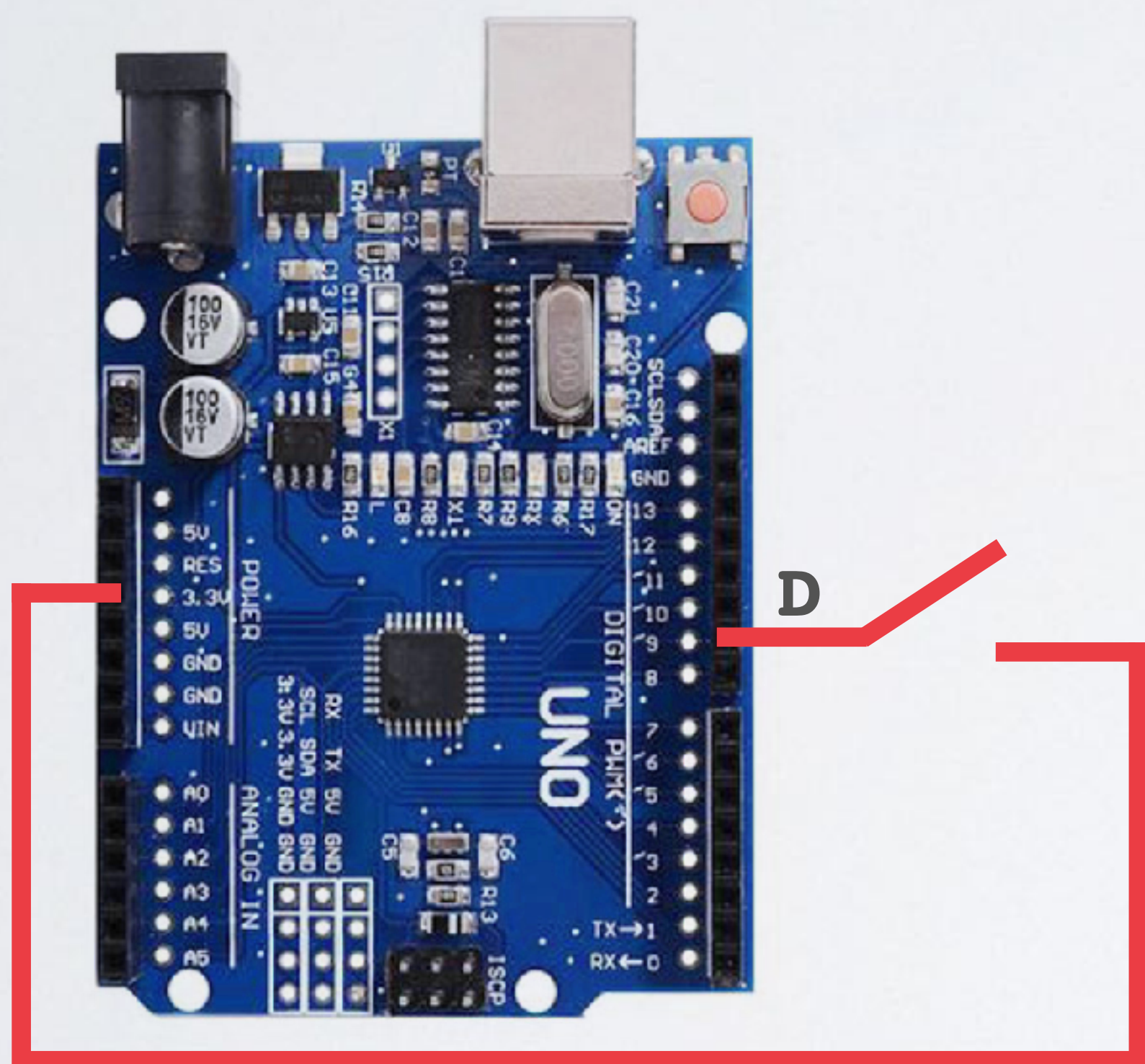
- a button switch
- and a DHT11 sensor module

Do not forget the resistors!



# PULL DOWN & PULL UP RESISTORS

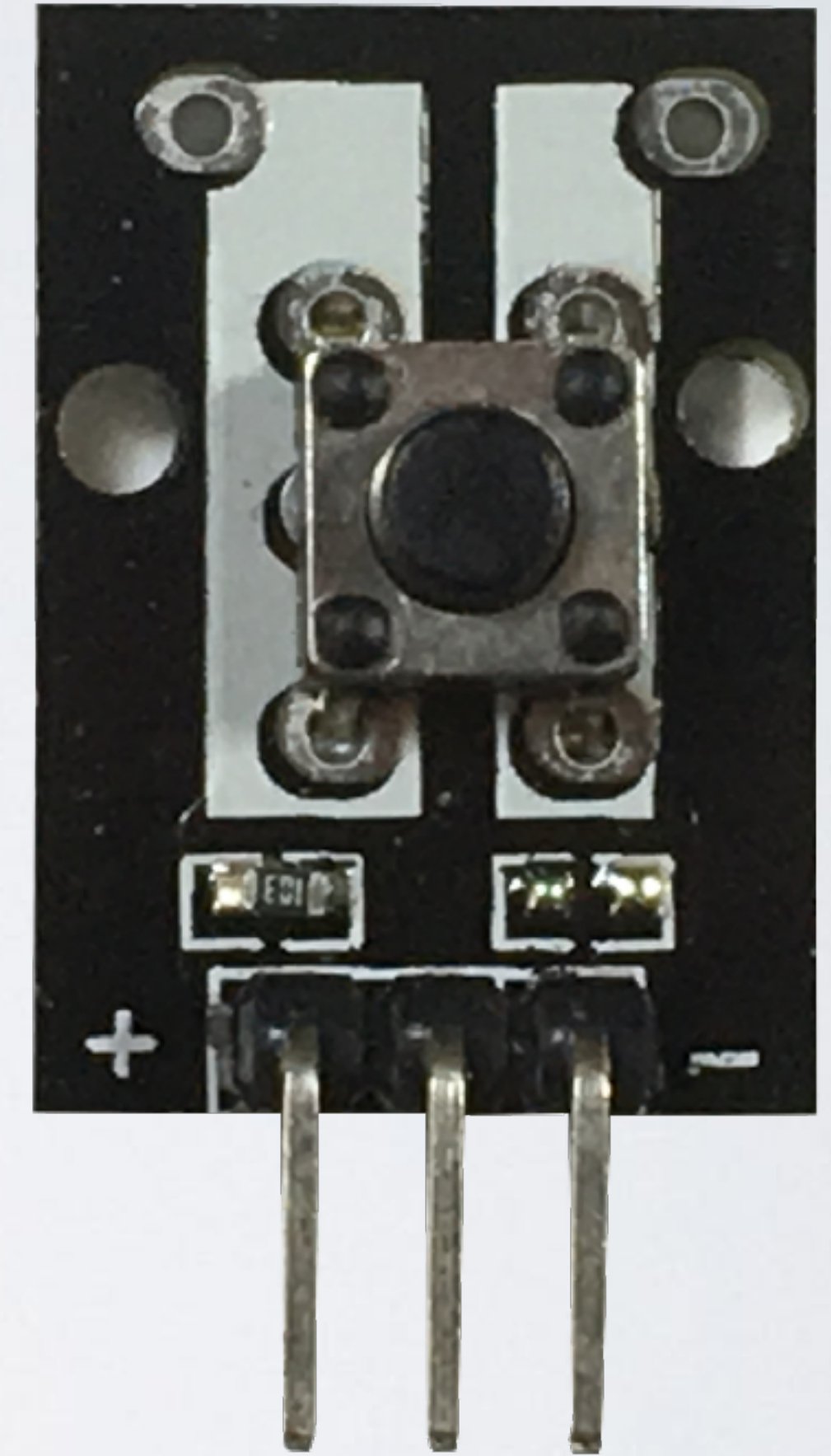
- If the state of a pin is unknown, meaning nothing is connected to the pin, the pin is referred to as floating. To prevent floating pins, the pin is pulled to Vcc (pin is high) or the pin is pulled to ground (pin is low). The  $10\text{ k}\Omega$  resistor is to prevent a short circuit.





# BUTTON SWITCH

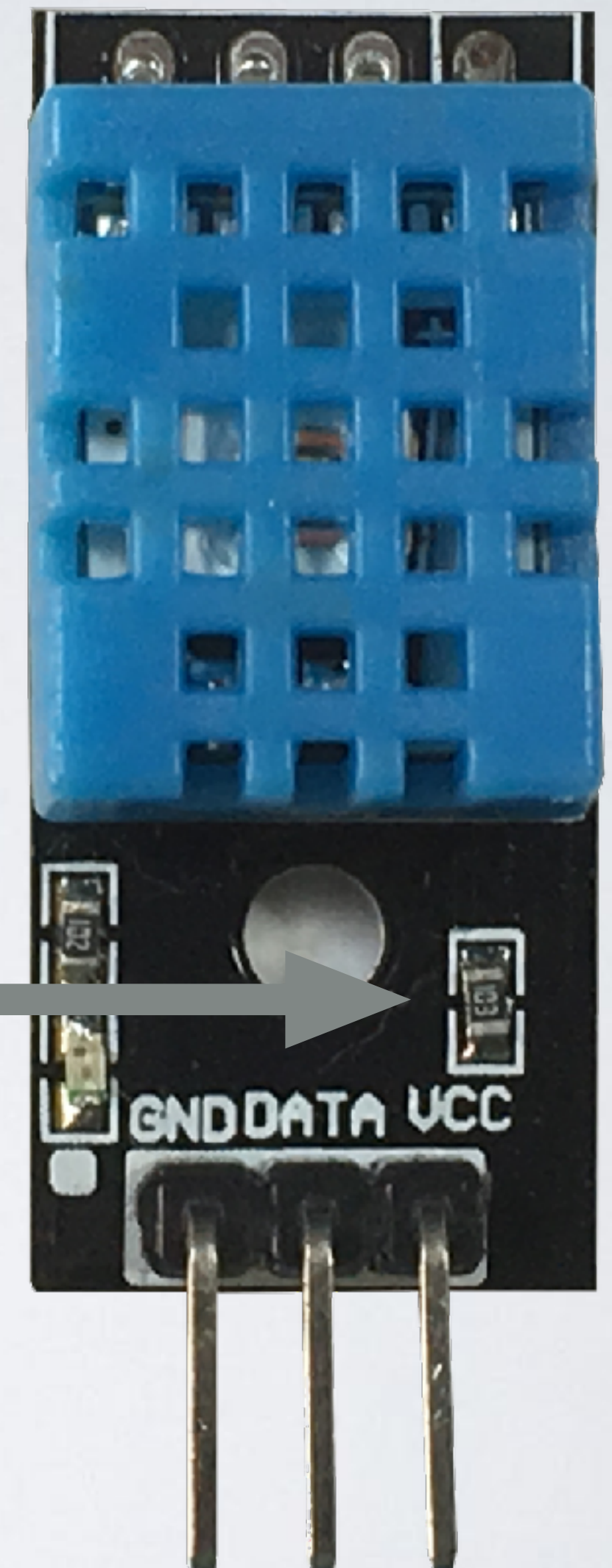
- Key switch module aka button switch
- Pin + connected to Arduino 3.3V  
Pin middle not used  
Pin - connected to Arduino GND
- Price ~€ 0.25
- Do not forget the  $10\text{ k}\Omega$  resistor (pull down resistor).



# DHT11 SENSOR

- Digital Humidity & Temperature (DHT11) module aka DHT11 sensor.
- This particular DHT11 sensor comes with a  $10\text{ k}\Omega$  pull up resistor from the data pin to Vcc.
- Pin VCC connected to Arduino 3.3V  
Pin DATA connected to Arduino pin 7  
Pin GND connected to Arduino GND
- Price ~€ 0.75
- A DHT11 sensor is cheap, less precise and less accurate. For better accuracy and precision use a DHT22.

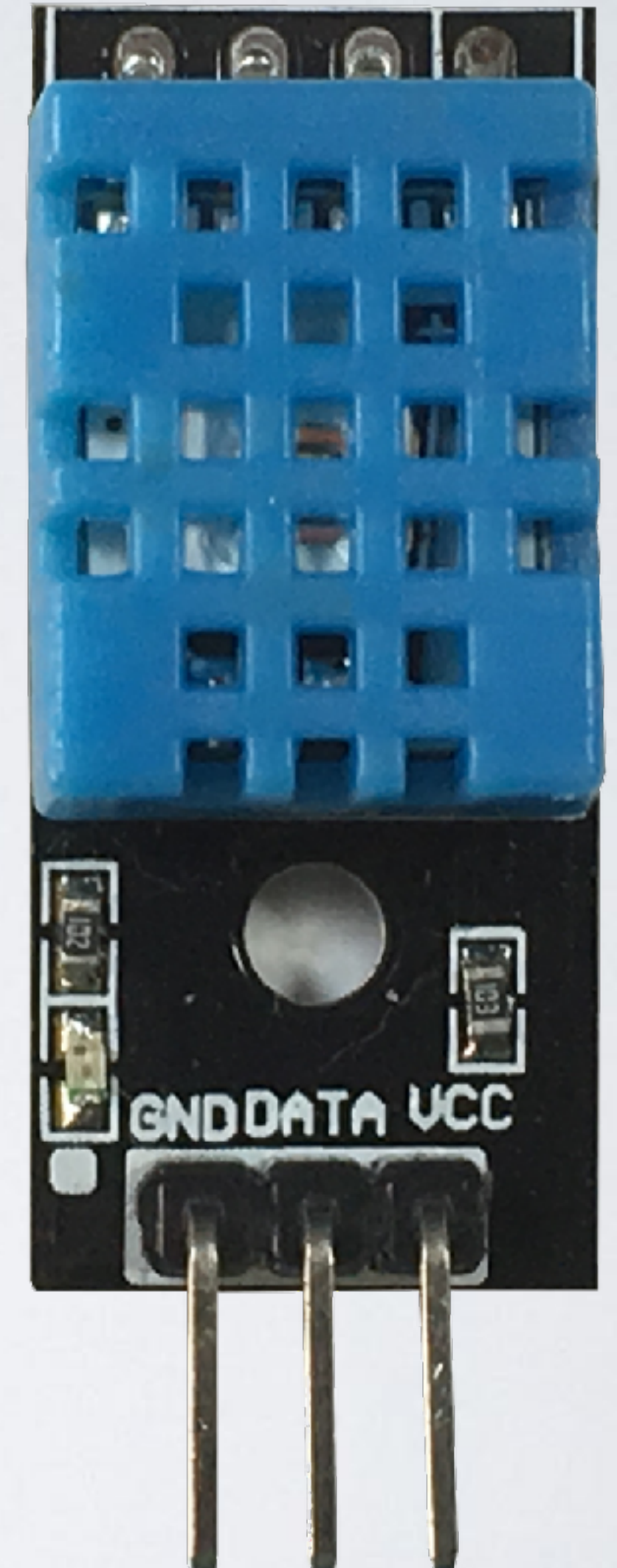
**SMD 103  
10 k $\Omega$  pull up  
resistor**





# DHT11 SPECIFICATION

- Supply voltage: 3 to 5.5V DC
- Output: single-bus digital signal
- Measuring range: humidity 20 to 90% RH, temperature 0 to 50°C
- Accuracy: humidity  $\pm 5\%$  RH, temperature  $\pm 2^\circ\text{C}$
- Resolution: Humidity 1% RH, temperature 1°C
- Long-term stability:  $< \pm 1\%$  RH / Year





# THE THINGS NETWORK CONSOLE

- Goto The Things Network console:
  - Select the app: youtube\_demo\_app
  - Select the registered device: youtube\_demo\_device
  - Select reset frame counters. Do this each time your end device is powered up.
- The selected device “youtube\_demo\_device” uses the OTAA method.
- The DevEUI, Application EUI and AppKey are needed in the sketch, which will be explained later.
- If you copy these values watch out for big-endian and little-endian notation.



# THE THINGS NETWORK CONSOLE

- When the sketch is uploaded, every 60 seconds the temperature and humidity data is displayed in The Things Network console.
- To make the payload data more human readable, select tab “Payload Formats”, select decode and copy and paste the decoder function from this link [https://www.mobilefish.com/download/lora/tutorial\\_26\\_decoder.txt](https://www.mobilefish.com/download/lora/tutorial_26_decoder.txt) and paste it in this field.



# DEMONSTRATION

```
function Decoder(bytes, port) {
  if(bytes.length == 1) {
    if(bytes[0] == 1) {
      return {
        'button': 'activated'
      }
    } else {
      return {
        'error': 'button action unknown'
      }
    }
  } else if(bytes.length == 4) {
    var humidity = (bytes[0]<<8) | bytes[1];
    var temperature = (bytes[2]<<8) | bytes[3];
    return {
      'humidity': humidity/ 100,
      'temperature': temperature/100
    }
  } else {
    return {
      'error': 'payload unknown'
    }
  }
}
```

## Decoder function



# ARDUINO IDE

- Install the following libraries in the Arduino IDE (menu: Tools | Manage Libraries)
  - MCCI LoRaWAN LMIC library (<https://github.com/mcci-catena/arduino-lmic>)


Type  Topic

**MCCI Arduino LoRaWAN Library** by Terry Moore, ChaeHee Won  
**High-level library for LoRaWAN-based Arduino end-devices.** Implements many of the details of network interfacing and deployment, so that you can focus on your application rather than worrying about the network. Requires the arduino-lmic library from <https://github.com/mcci-catena/> or The Things Network NY.  
[More info](#)

**MCCI Catena Arduino Platform** by Terry Moore, ChaeHee Won, Sungjoon Park  
**Arduino library for MCCI Catena 44xx, 45xx, 46xx and 48xx systems.** This library provides platform support for the MCCI Catena family of IoT systems, based on the Adafruit Feather M0 LoRa, or on the Murata LoRaWAN module. FRAM system configuration, generalized polling, and a number of low-level drivers are included for the peripherals that are included with the system. A non-blocking event-driven USB-serial command interface is also provided, along with a generalized command parsing framework.  
[More info](#)

**MCCI LoRaWAN LMIC library** by IBM, Matthis Kooljman, Terry Moore, ChaeHee Won, Frank Rose Version 2.3.1 **INSTALLED**  
**Arduino port of the LMIC (LoRaWAN-MAC-in-C) framework provided by IBM.** Supports SX1272/SX1276 and HopeRF RFM92/RFM95 transceivers. Refactored to support multiple bandplans beyond the original two supported by the IBM LMIC code. Various enhancements and bug fixes from MCCI and The Things Network New York. Original IBM URL <http://www.research.ibm.com/labs/zurich/ics/lrsc/lmic.html>.  
[More info](#)

This was already installed from previous tutorials



# ARDUINO IDE

- DHT sensor library (<https://github.com/adafruit/DHT-sensor-library>)

Type  Topic

**DHT sensor library** by Adafruit Version 1.3.0 **INSTALLED**  
**Arduino library for DHT11, DHT22, etc Temp & Humidity Sensors** Arduino library for DHT11, DHT22, etc Temp & Humidity Sensors  
[More info](#)

**DHT sensor library for ESPx** by beegee\_tokyo  
**Arduino ESP library for DHT11, DHT22, etc Temp & Humidity Sensors** Optimized libray to match ESP32 requirements. Last changes: Use correct field separator in keywords.txt.  
[More info](#)

**Grove Temperature And Humidity Sensor** by Seeed Studio  
**Arduino library to control Grove Temperature And Humidity Sensor, it contains chip DHT11 AM2302.** This temperature & humidity sensor provides a pre-calibrated digital output. A unique capacitive sensor element measures relative humidity and the temperature is measured by a negative temperature coefficient (NTC) thermistor. It has excellent reliability and long term stability.  
[More info](#)

**SimpleDHT** by Winlin  
**Arduino Temp & Humidity Sensors for DHT11 and DHT22.** Simple C++ code with lots of comments, strictly follow the standard DHT protocol, supports 0.5HZ(DHT22) or 1HZ(DHT11) sampling rate.  
[More info](#)

← install



# ARDUINO IDE

- Adafruit Unified Sensor ([https://github.com/adafruit/Adafruit\\_Sensor](https://github.com/adafruit/Adafruit_Sensor))  
This library is needed by the DHT sensor library.

Type  Topic

[More info](#)

**Adafruit LSM303DLHC** by Adafruit  
**Unified sensor driver for Adafruit's LSM303 Breakout (Accelerometer + Magnetometer)** Unified sensor driver for Adafruit's LSM303 Breakout (Accelerometer + Magnetometer)  
[More info](#)

**Adafruit TSL2561** by Adafruit  
**Unified sensor driver for Adafruit's TSL2561 breakouts** Unified sensor driver for Adafruit's TSL2561 breakouts  
[More info](#)

**Adafruit Unified Sensor** by Adafruit Version **1.0.2** **INSTALLED**  
**Required for all Adafruit Unified Sensor based libraries.** A unified sensor abstraction layer used by many Adafruit sensor libraries.  
[More info](#)

← install

# ARDUINO IDE

- Open the Arduino IDE and copy the sketch from this link <https://www.mobilefish.com/download/lora/ttn-otaa-sensors.ino.txt> and call the sketch ttn-otaa-sensors.ino
- Change the DevEUI, Application EUI and AppKey.  
This sketch uses the Over-The-Air-Activation (OTAA) method.
- The sketch transmits a byte value 0x01, each time the button is pressed. It also transmits the temperature and humidity data from the DHT11 sensor, every 60 seconds
- The two leds can be switch On or Off, by sending a downlink message.  
This is already demonstrated in Tutorial 25 and will not be demonstrated in this video.



# ARDUINO IDE

- Connect the self build LoRa development board to your computer using the USB cable.
- In the Arduino IDE, select menu Tools | Board and select: *Arduino/Genuino Uno*  
In the Arduino IDE, select menu Tools | Port and select: *your\_port*
- Compile and upload the ttn-otaa-sensors sketch.  
You should not see any errors.
- In the Arduino IDE, select menu Tools | Serial Monitor  
Select baud rate: 9600

# DEMONSTRATION

- Make sure a LoRa gateway is in your area and your LoRa end device can send messages to that gateway.
- Go to The Things Console and see if the end device is registering.
- Check if the temperature and humidity data is received every 60 seconds.
- Press the switch button, in the Things Console you will see the message:  
“button: activated”



# TTN FAIR ACCESS POLICY

- When you use this sketch please watch out for The TTN Fair Access Policy. More information about TTN Fair Access Policy can be found at: <https://www.thethingsnetwork.org/docs/lorawan/duty-cycle.html>