



# INTEL-IRRIS

Intelligent Irrigation System for Low-cost Autonomous Water Control  
in Small-scale Agriculture



# Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture



## Training & capacity building with INTEL-IRRIS starter-kit

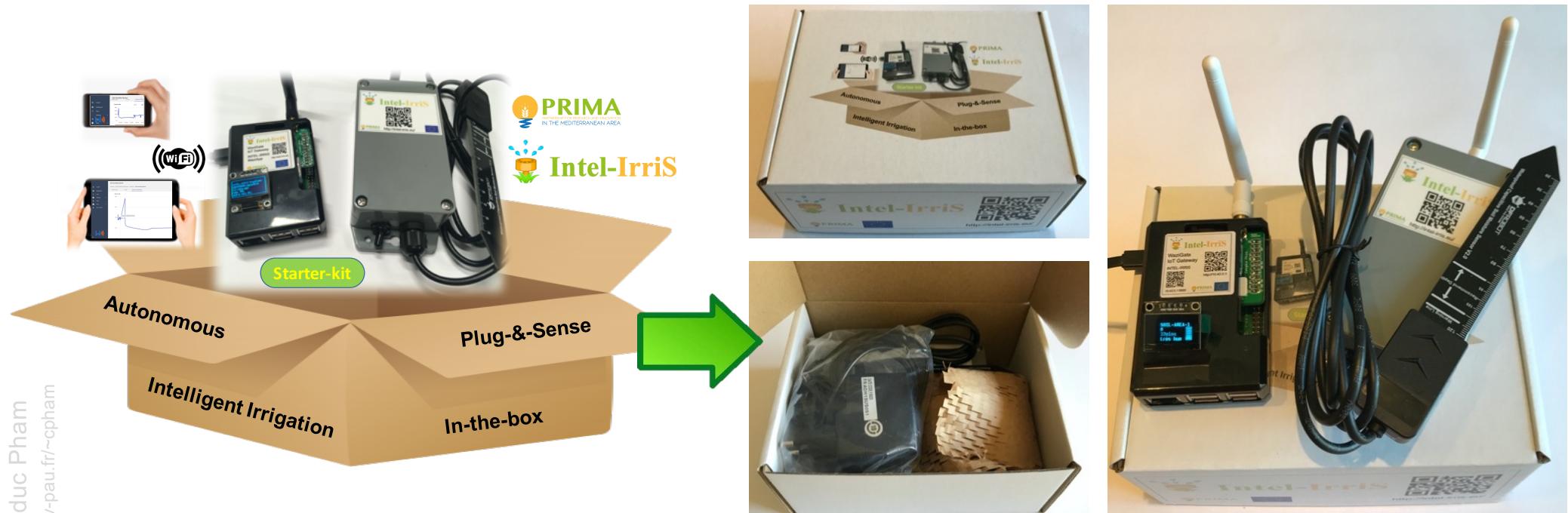


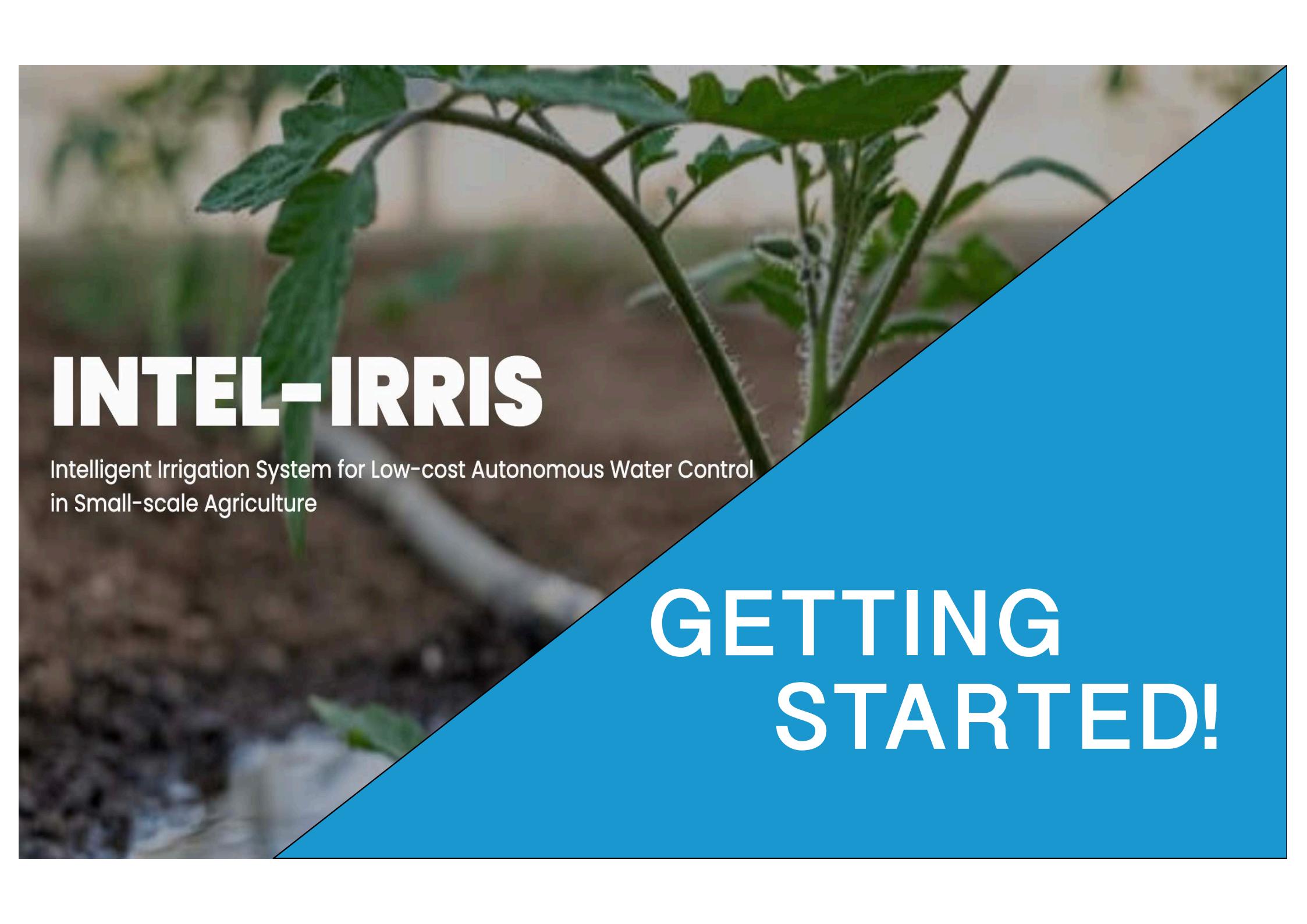
Prof. Congduc Pham  
<http://www.univ-pau.fr/~cpham>  
Université de Pau, France



# INTEL-IRRIS's starter-kit

○ From idea to reality!



A close-up photograph of a young green plant with serrated leaves growing in dark brown soil. The plant has a thin stem and several leaves. The background is slightly blurred.

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# GETTING STARTED!

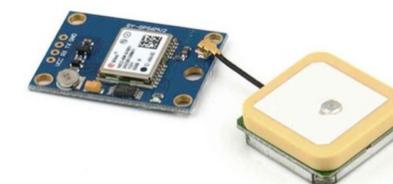
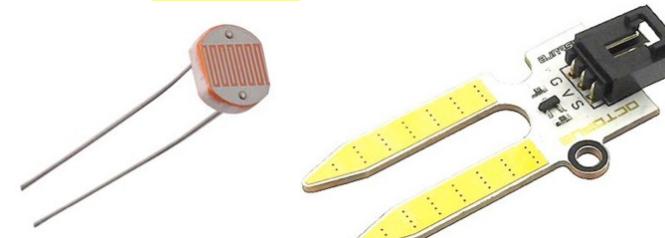
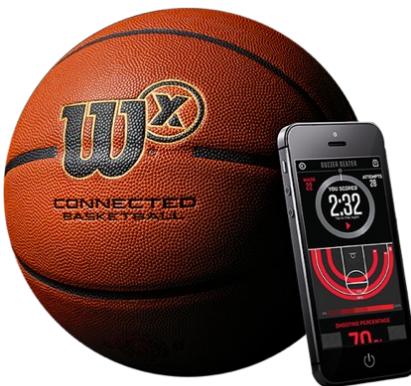
# IoT devices!



# All communicating objects?

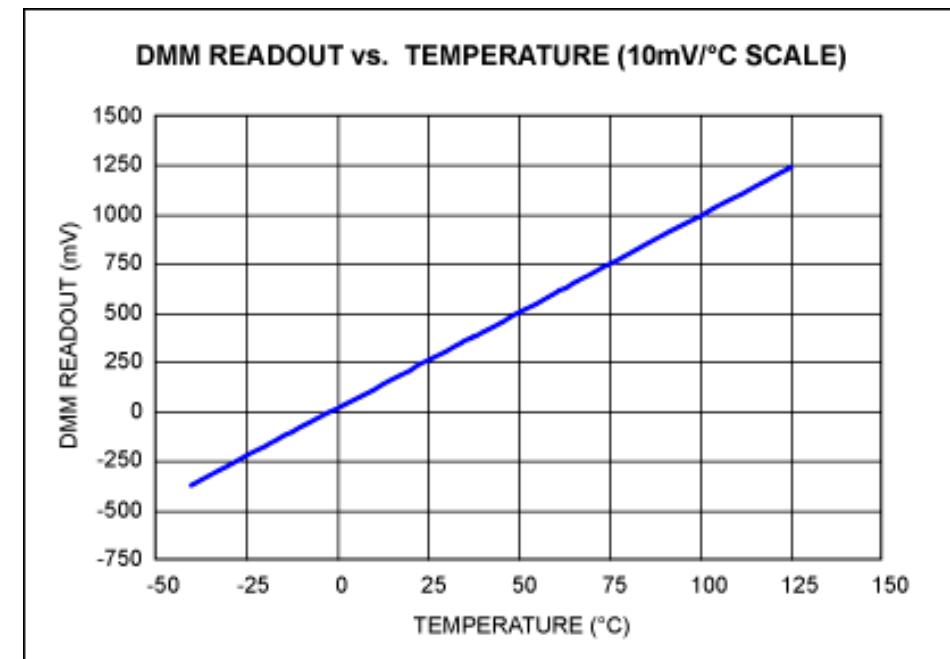


# Interaction: Sensors



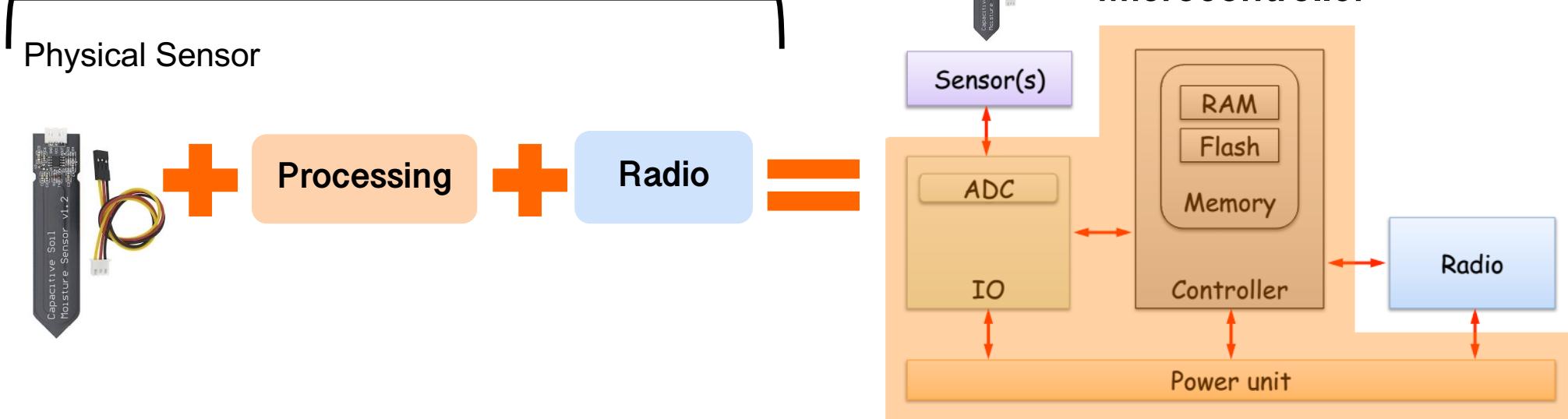
# Interacting with the real world?

- Taking the simple analog sensors example
- Analog sensors provides a voltage output that varies according to a physical parameter, e.g. temperature, humidity, luminosity,...



# Typical IoT device

- IoT device can be viewed as a simple Embedded System

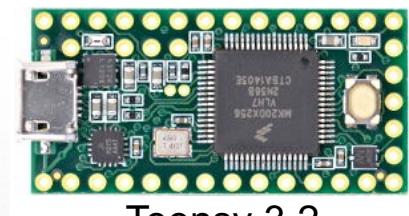
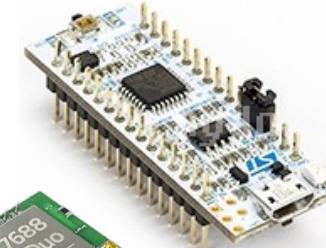


**Q: uprocessor vs ucontroller?**

# the incredibly large microcontroller board ecosystem!



STM32 Nucleo-32



Teensy 3.2



LinkIt  
Smart7688 duo



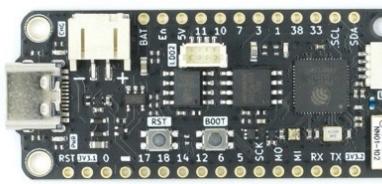
Adafruit Feather



uPesy ESP32



ePulse Feather Low Power ESP32



FeatherS3 – ESP32-S3



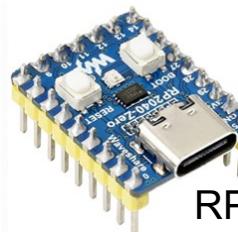
Heltec WiFi LoRa 32



XIAO SAMD21



Arduino Nicla  
Sense ME



RP2040  
zero



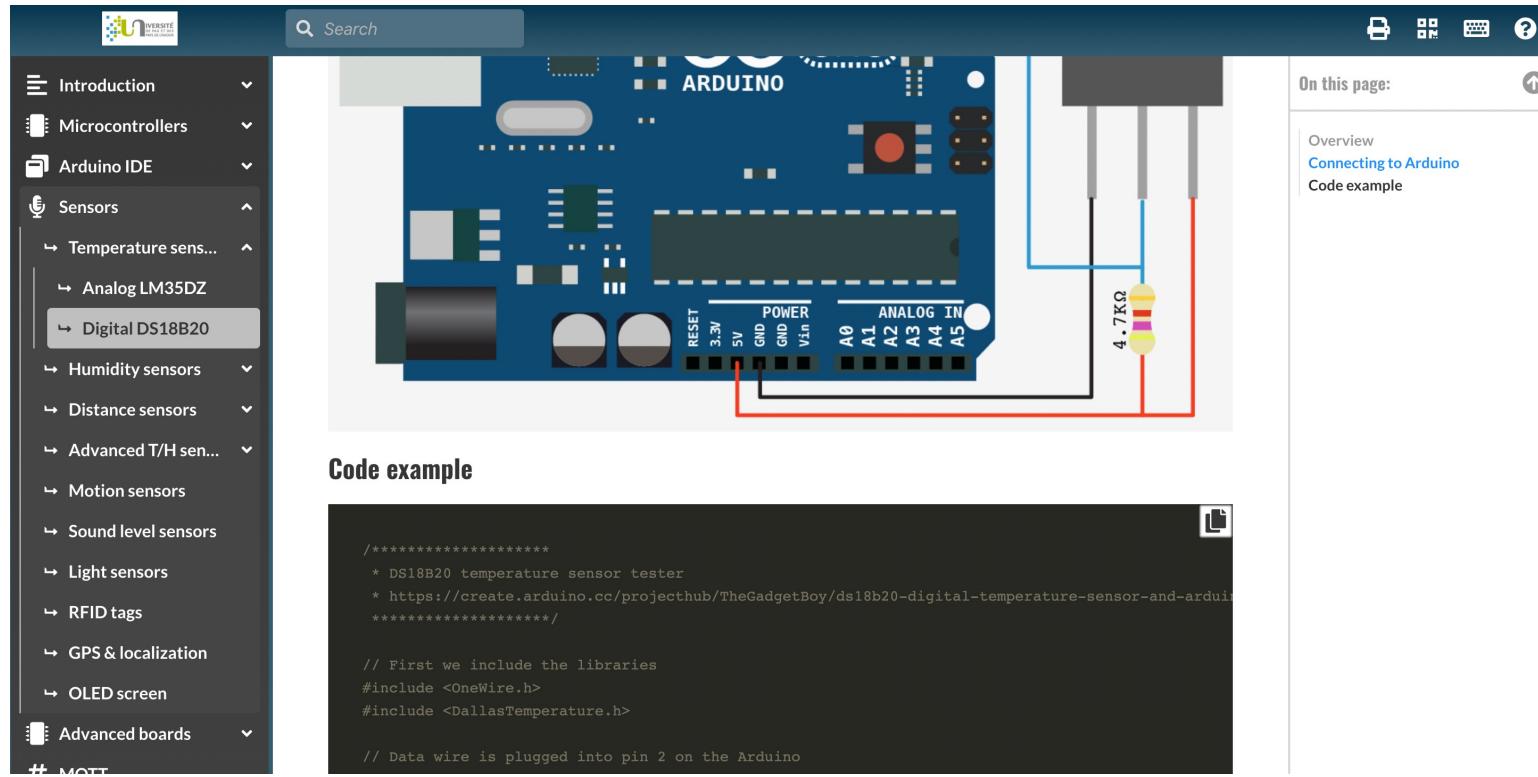
DFRobot  
Beetle



QT Py ESP32-C3

# Online Arduino & Sensor tutorial

- <https://cpham.perso.univ-pau.fr/LORA/HUBIQUITOUS/solution-lab/arduino-lora-tutorial>



**Code example**

```

/*
 * DS18B20 temperature sensor tester
 * https://create.arduino.cc/projecthub/TheGadgetBoy/ds18b20-digital-temperature-sensor-and-arduino
 */

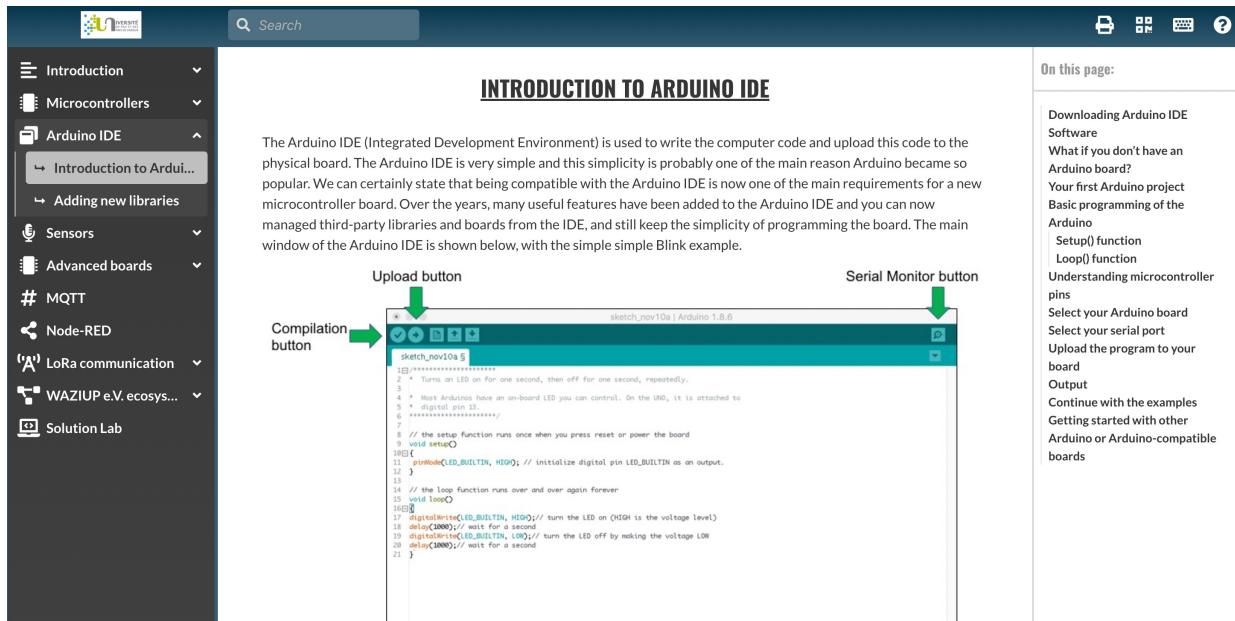
// First we include the libraries
#include <OneWire.h>
#include <DallasTemperature.h>

// Data wire is plugged into pin 2 on the Arduino

```

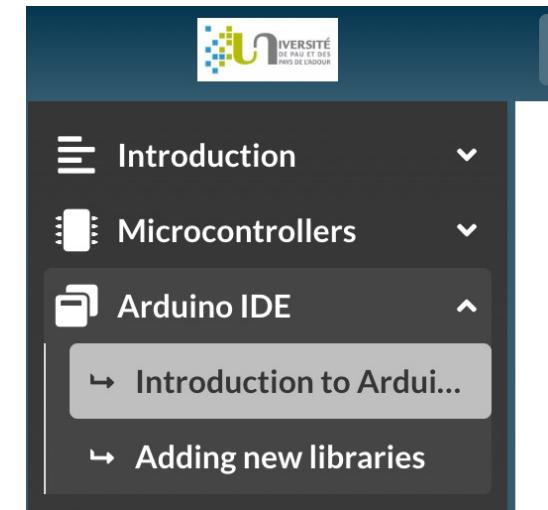
# Discover the Arduino ecosystem

- Understand microcontrollers & their architecture
- Discover the most advanced boards with WiFi capabilities
- Get to know how to program microcontrollers with Arduino IDE
- Then step-by-step tutorial on connecting various sensors



The screenshot shows the PRIMA website's navigation menu on the left, which includes sections like Introduction, Microcontrollers, Arduino IDE (selected), Sensors, Advanced boards, MQTT, Node-RED, LoRa communication, WAZIUP e.V. ecosys..., and Solution Lab. The main content area displays a "INTRODUCTION TO ARDUINO IDE" page. It features a screenshot of the Arduino IDE interface with a sketch titled "sketch\_nov10a.ino" and code for a simple blink example. Annotations with arrows point to the "Upload button" (top right), "Serial Monitor button" (top right), and "Compilation button" (bottom left). To the right of the IDE screenshot is a sidebar titled "On this page:" containing links to various Arduino-related topics.

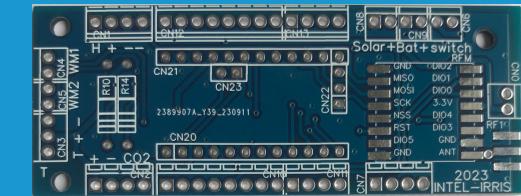
**Navigate and read:**



This screenshot shows a different view of the PRIMA website's Arduino IDE section. The navigation menu on the left is identical. The main content area now displays a list of sub-sections under "Arduino IDE": "Introduction to Ardu..." and "Adding new libraries". A vertical bar on the left is colored orange at the top and green at the bottom.

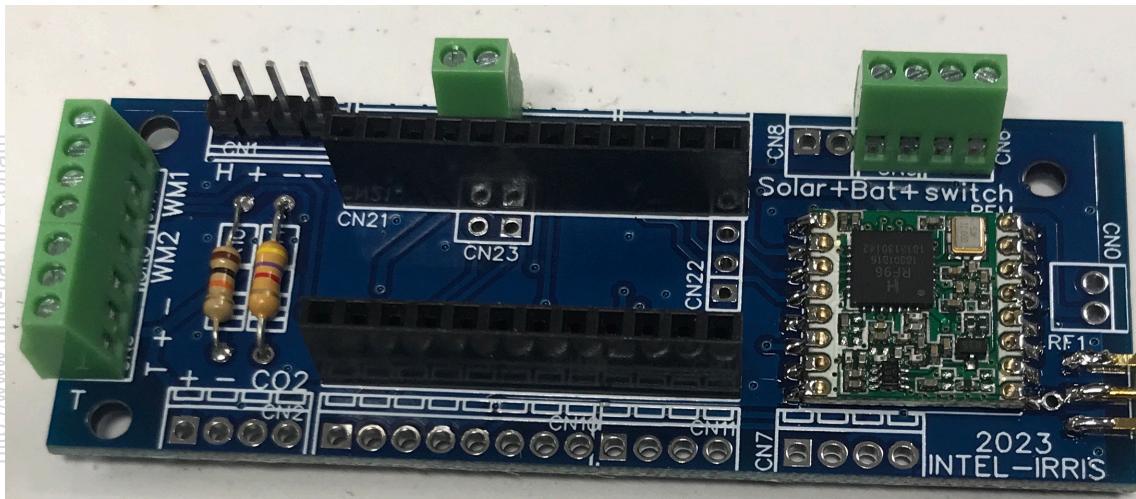
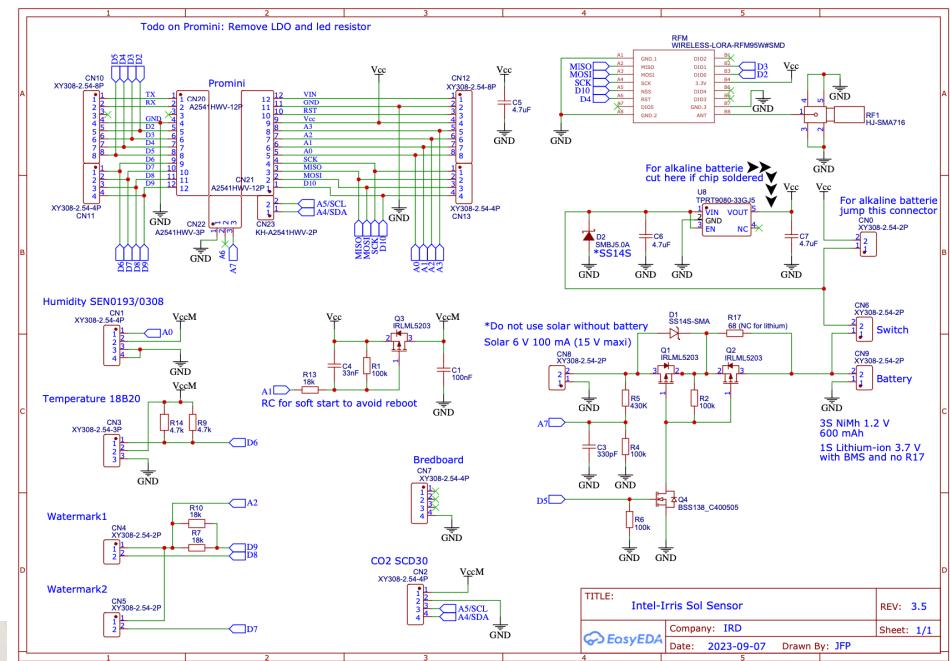
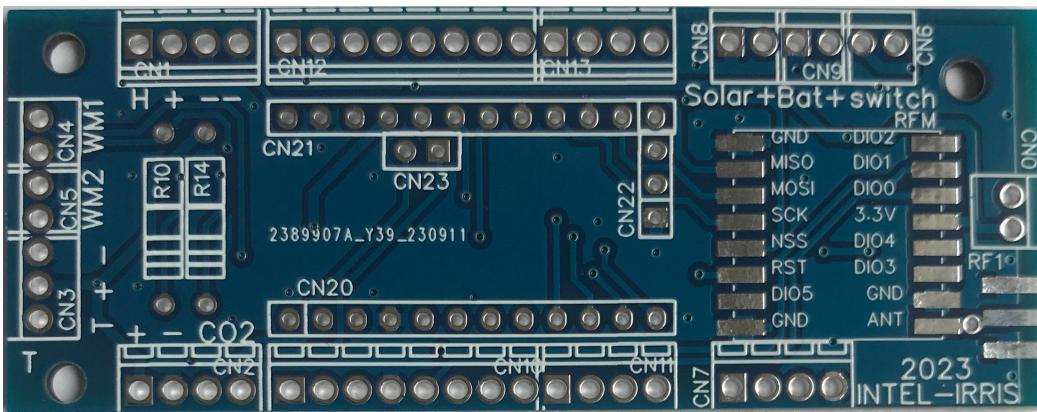
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in Small-scale Agriculture



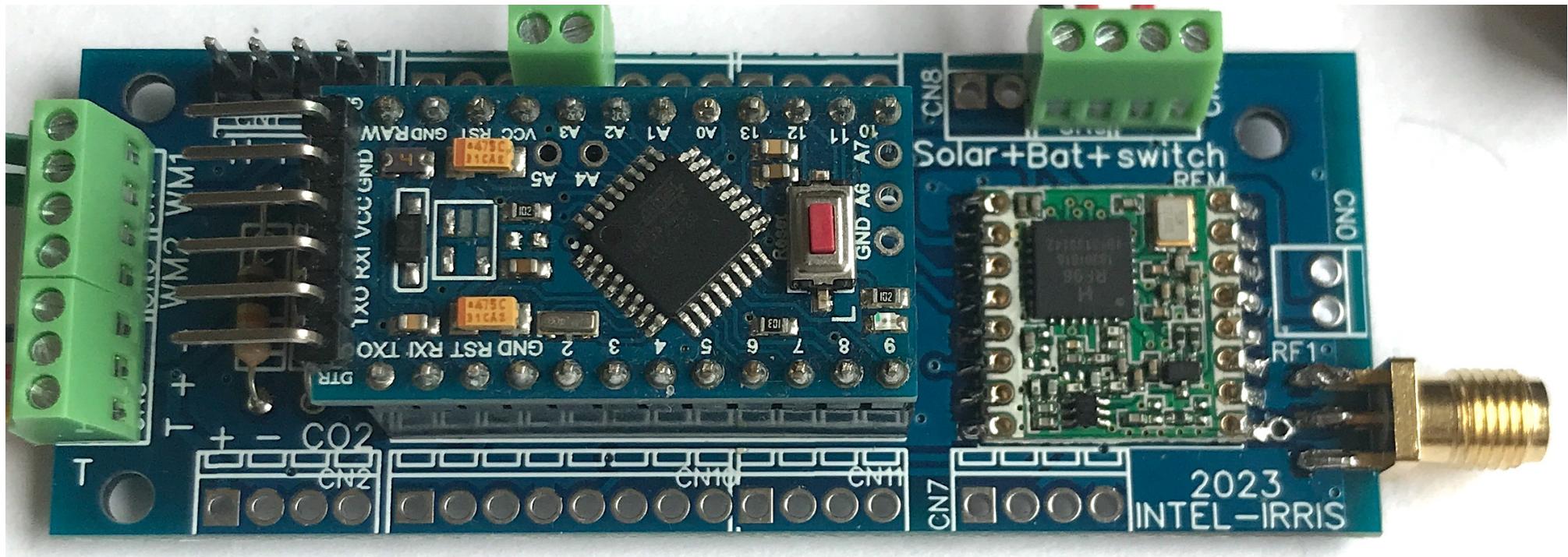
# HANDS-ON

# The new IRD PCB (raw version)

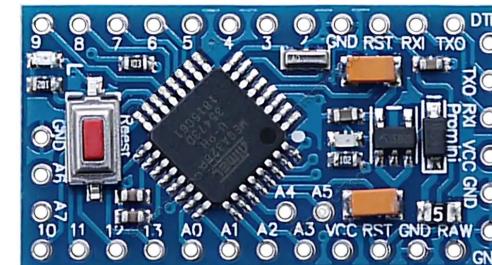


Arduino Pro Mini

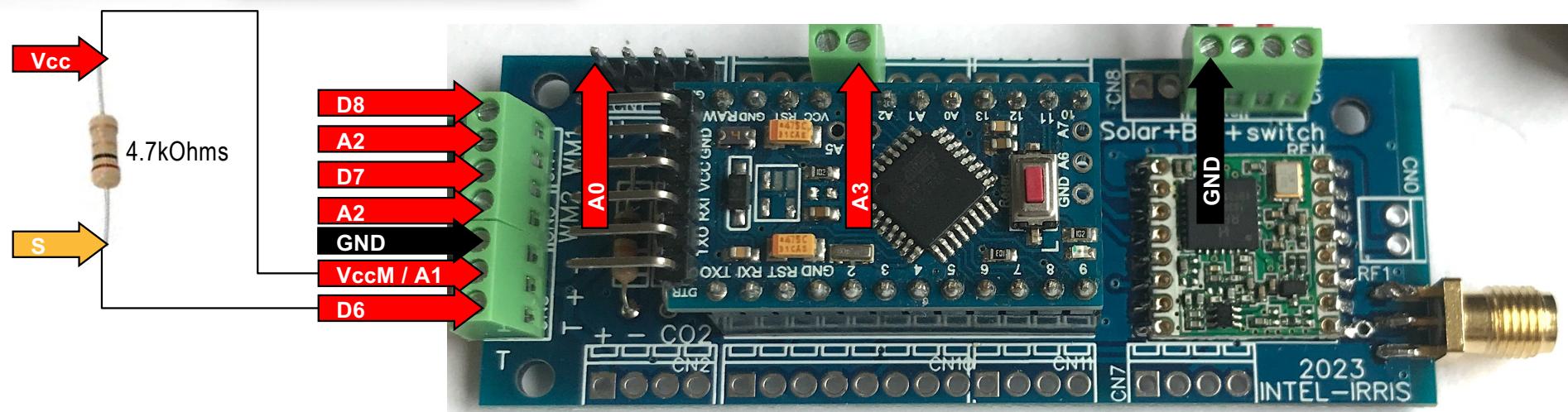
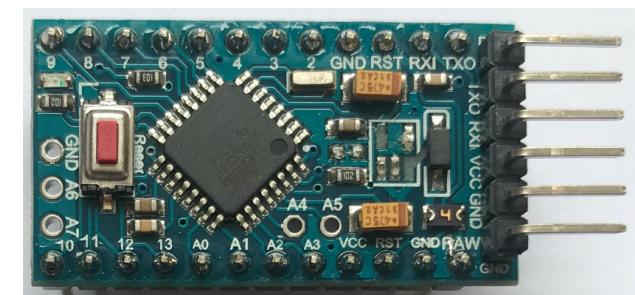
# The new IRD PCB: close-up view



# Arduino pins exposed on the PCB

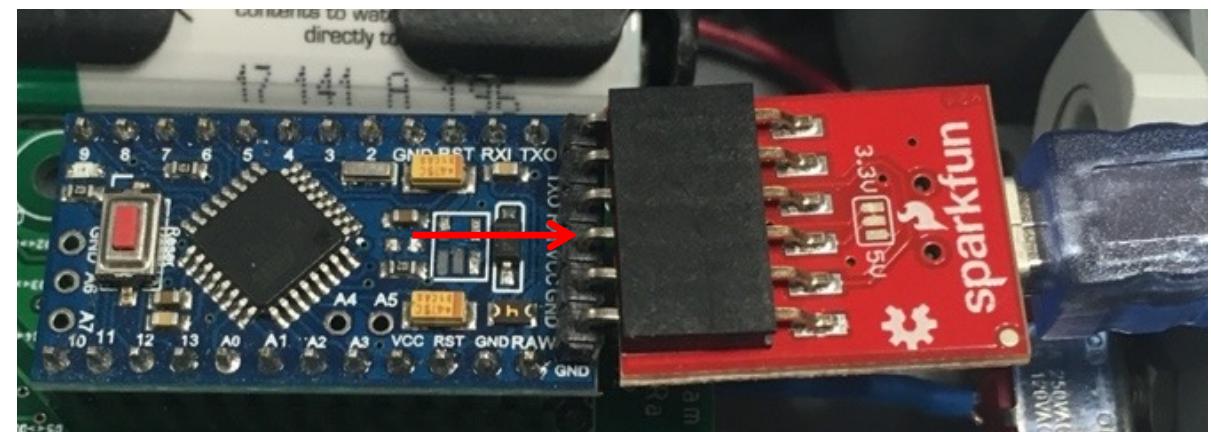
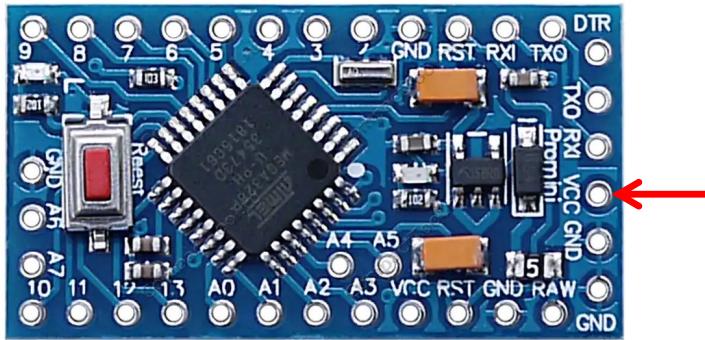


The compact Arduino  
Pro Mini



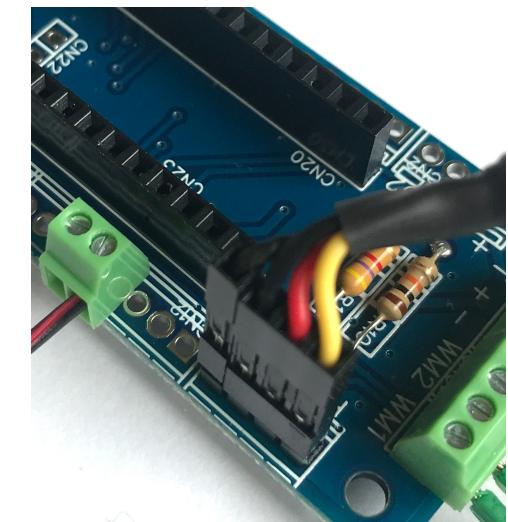
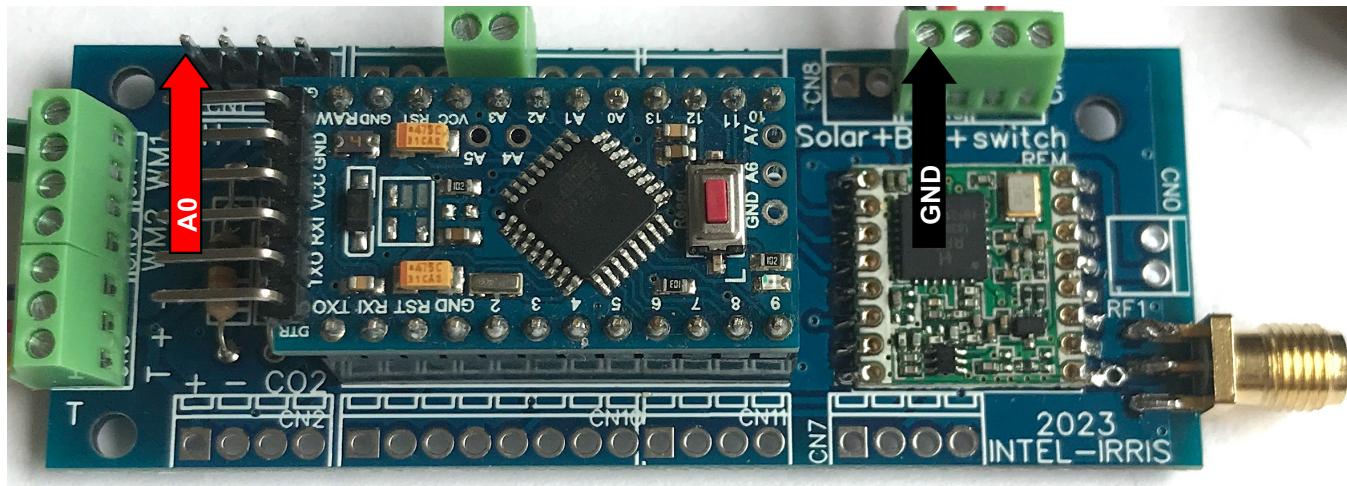
# Programming the microcontroller

Most Chinese clone version,  
check the VCC pin

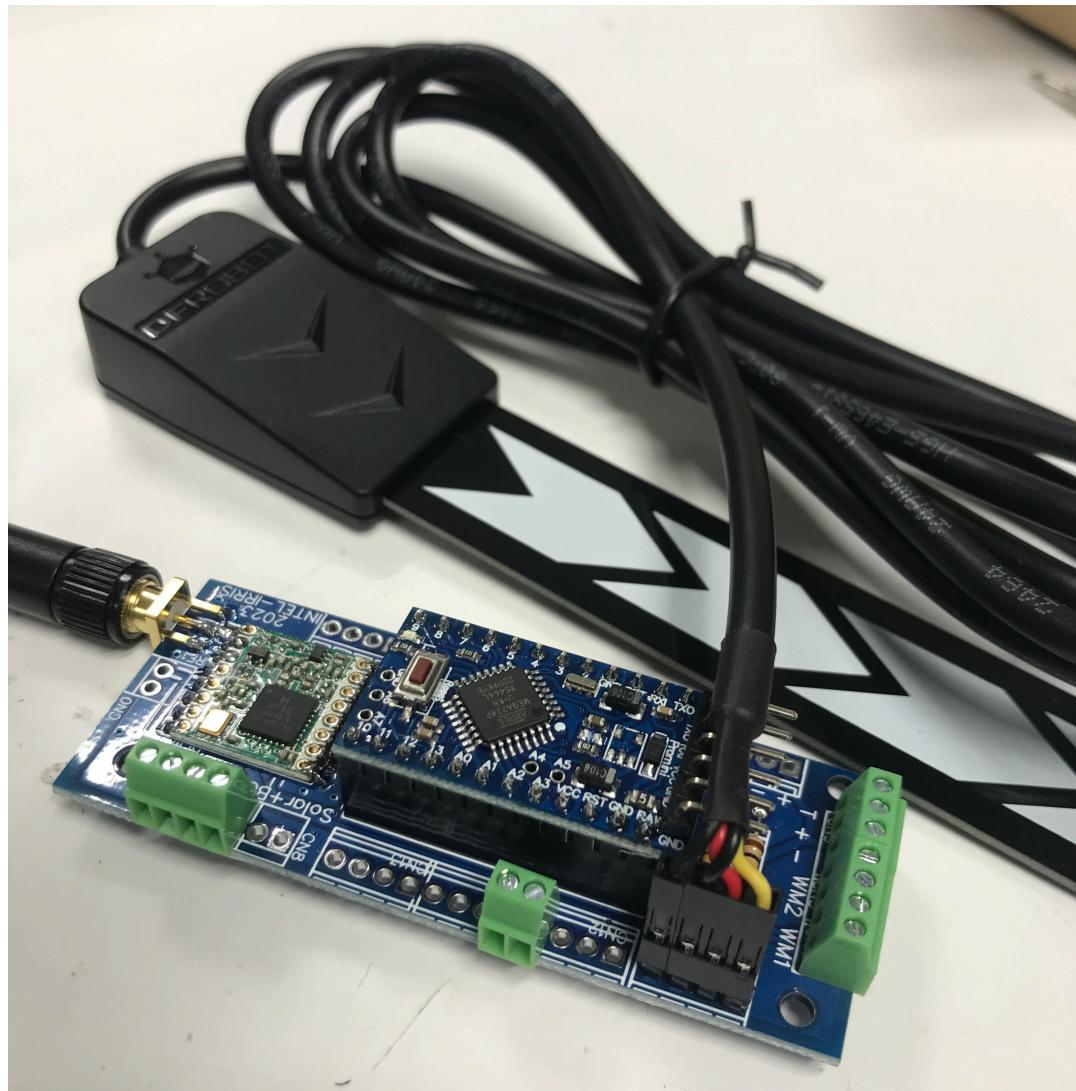


# 1<sup>st</sup> example: read from analog

- <https://cpham.perso.univ-pau.fr/LORA/HUBIQUITOUS/solution-lab/arduino-lora-tutorial/sensors/humidity/soil-humidity/>

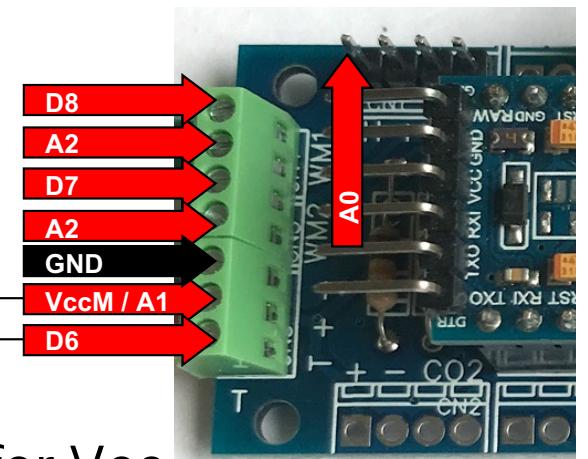
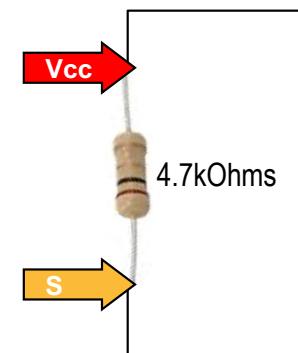
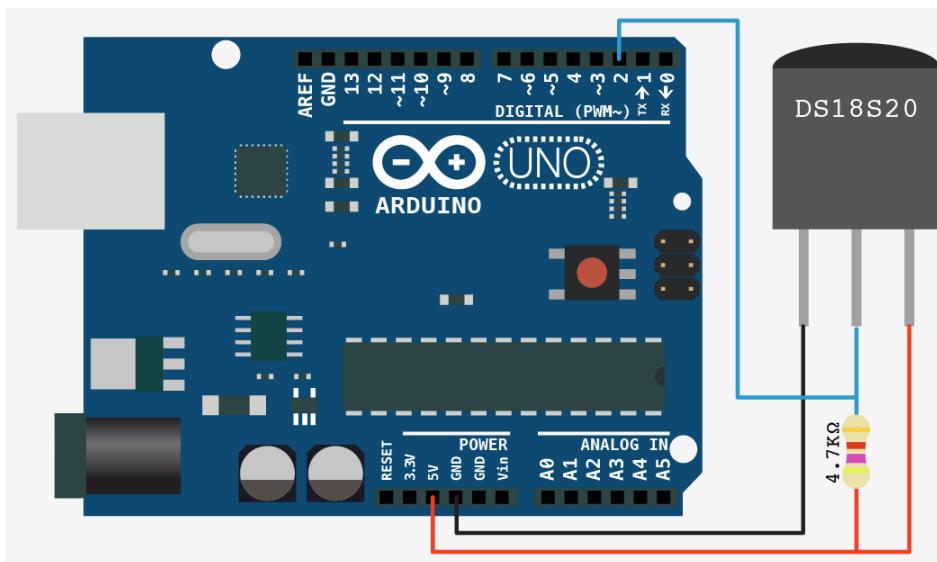


# Connecting SEN0308 in image



# 2<sup>nd</sup> example: read from digital, 1-wire

- <https://cpham.perso.univ-pau.fr/LORA/HUBIQUITOUS/solution-lab/arduino-lora-tutorial/sensors/temperature/ds18b20/>
- Use a digital temperature sensor DS18B20



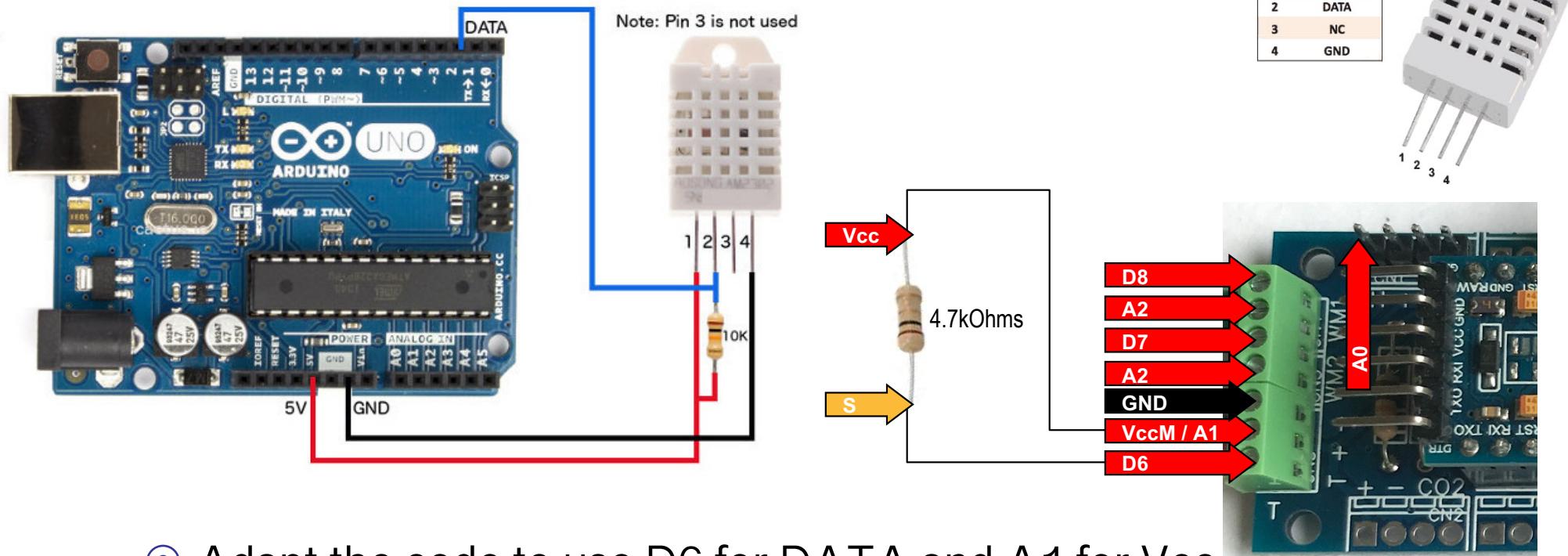
- Adapt the code to use D6 for DATA and A1 for Vcc

# Connecting DS18B20 in image



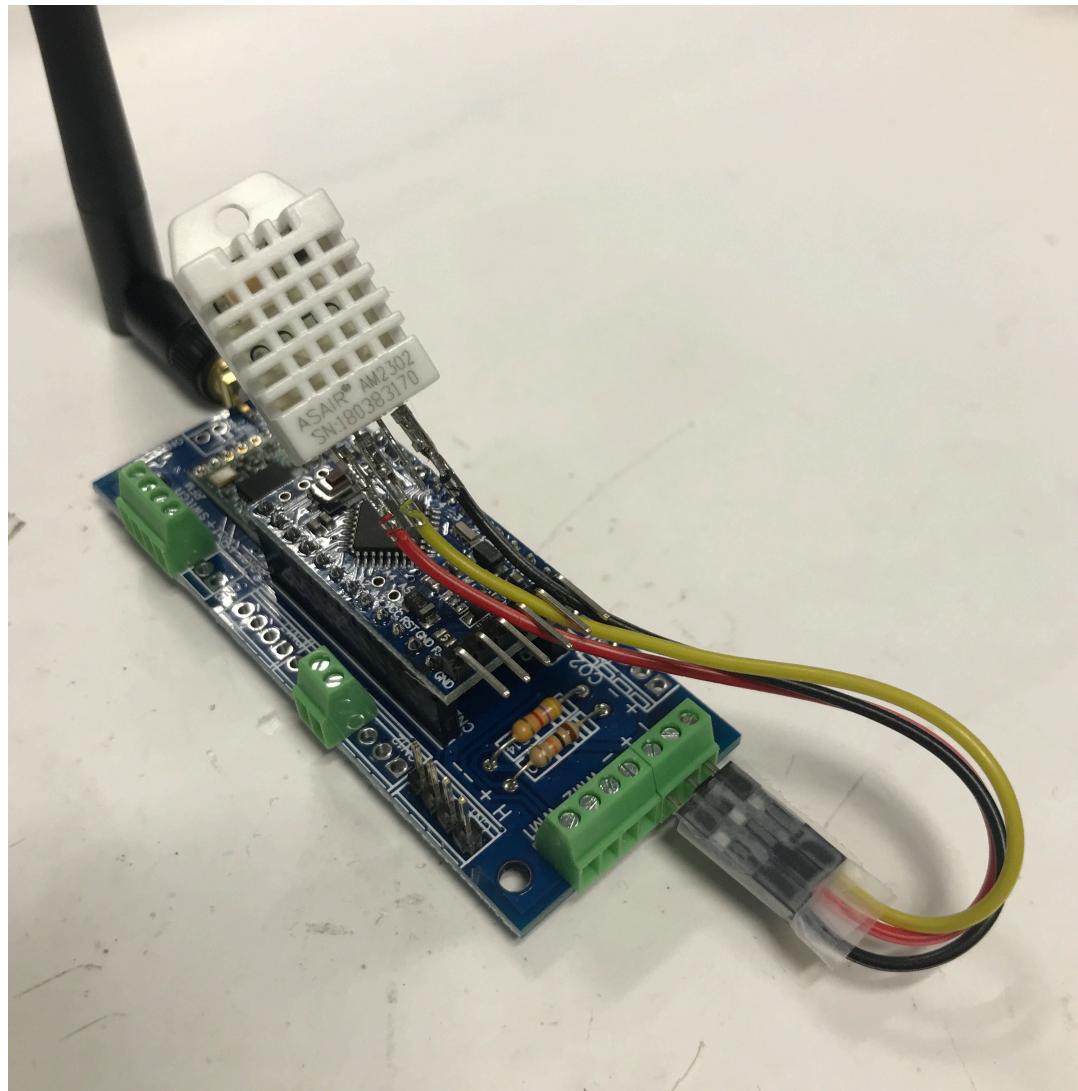
# 3rd example: read from digital DHT22

- DHT22: combined temperature & humidity sensor
- [https://cpham.perso.univ-pau.fr/LORA/HUBIQUITOUS/solution-lab/arduino-lora-tutorial/sensors/temp\\_hum/dht22/](https://cpham.perso.univ-pau.fr/LORA/HUBIQUITOUS/solution-lab/arduino-lora-tutorial/sensors/temp_hum/dht22/)



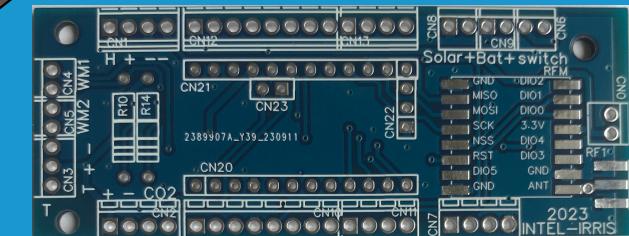
- Adapt the code to use D6 for DATA and A1 for Vcc

# Connecting DHT22 in image



# INTEL-IRRIS

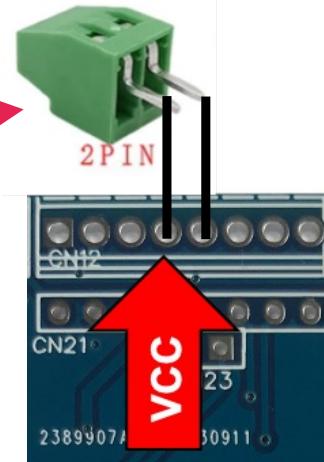
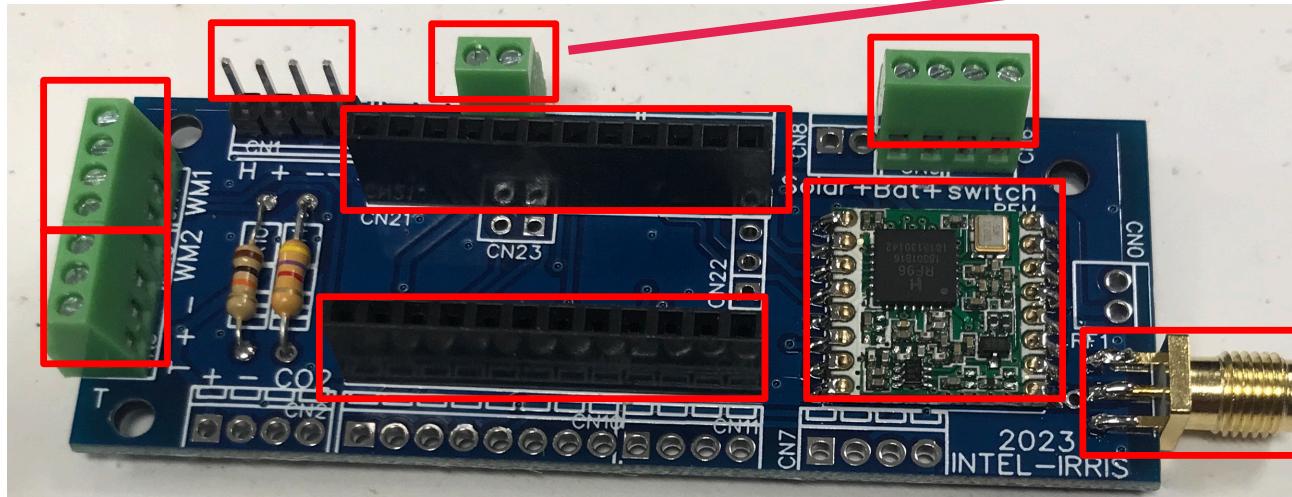
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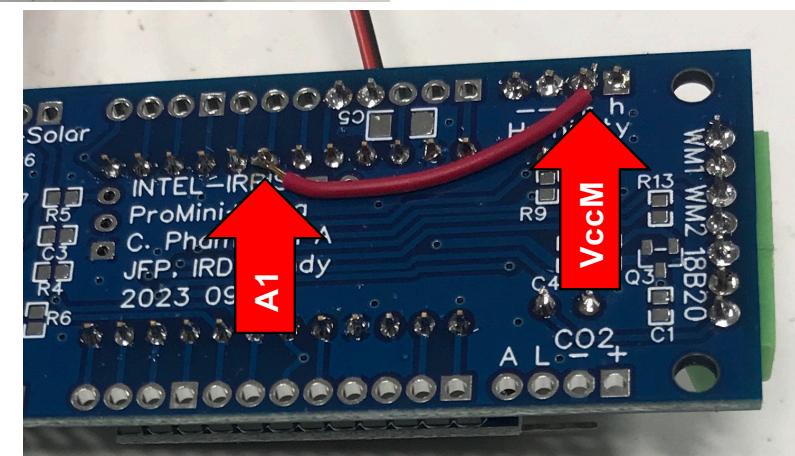
# BUILDING STARTER-KIT

# Wiring with new IRD PCB (raw version)

- First, solder the various components

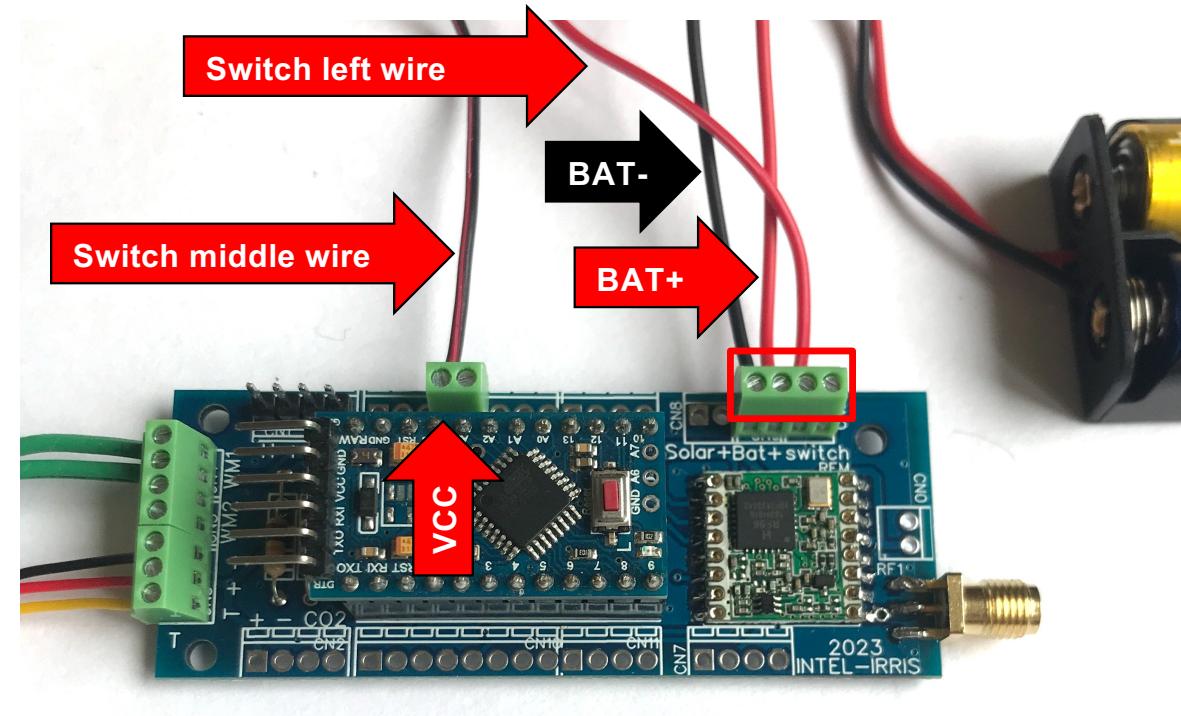
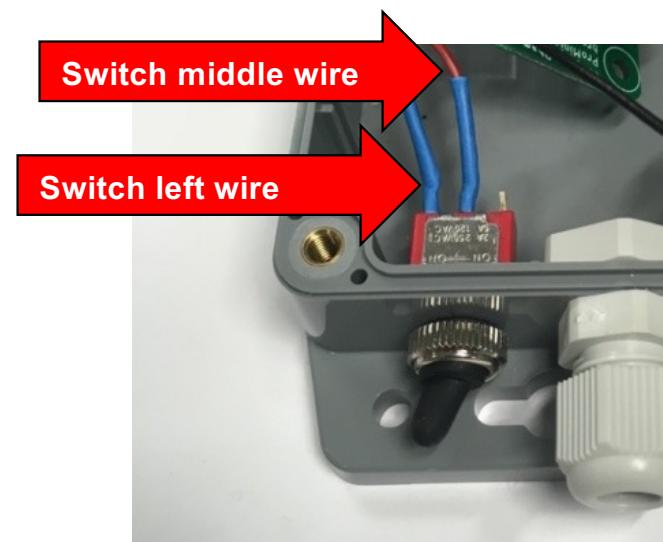
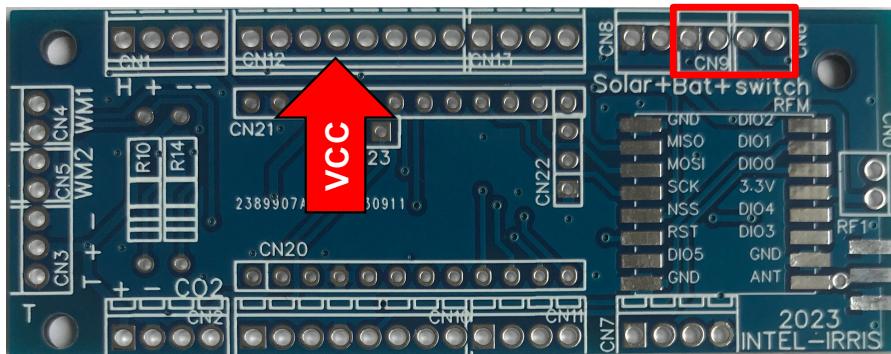


- For the raw PCB (no circuit for solar), need to link A1 to VccM on the back side of the PCB
  - VccM can be taken on the + of the soil humidity sensor



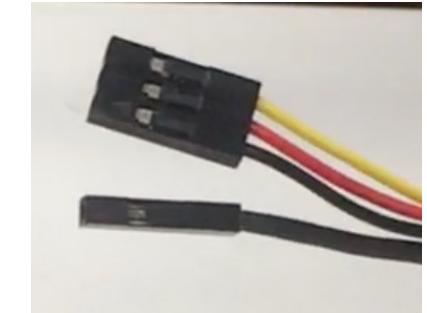
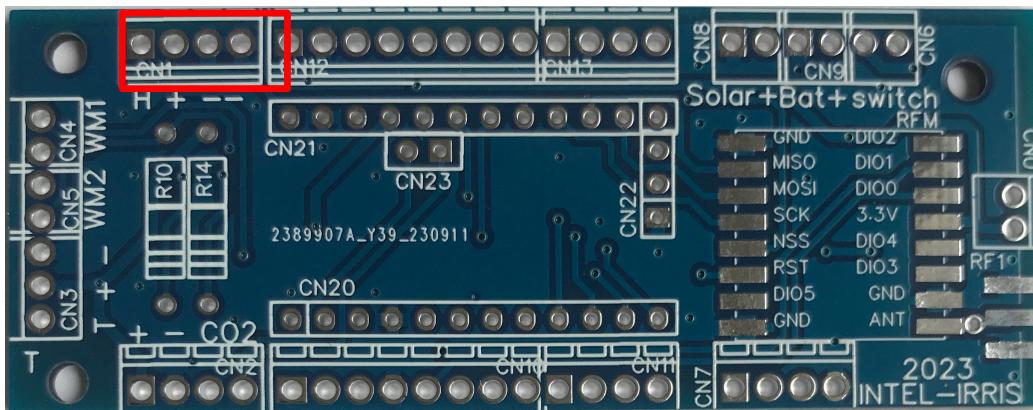
# Wiring with new IRD PCB (raw version)

## ○ Power wires

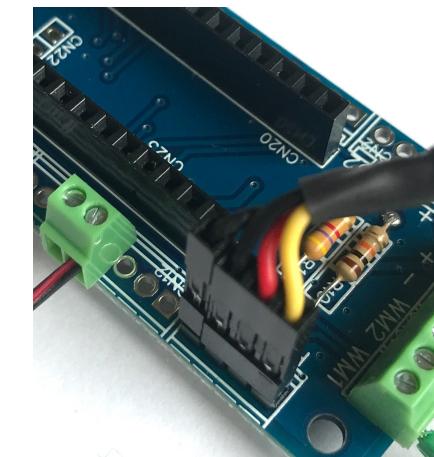
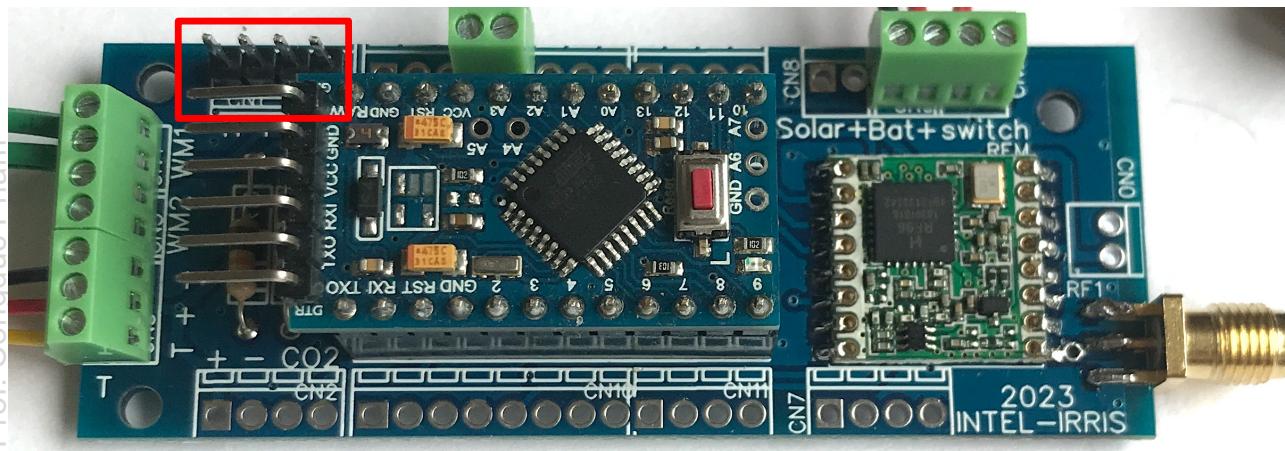


# Wiring with new IRD PCB (raw version)

- SEN0308 capacitive

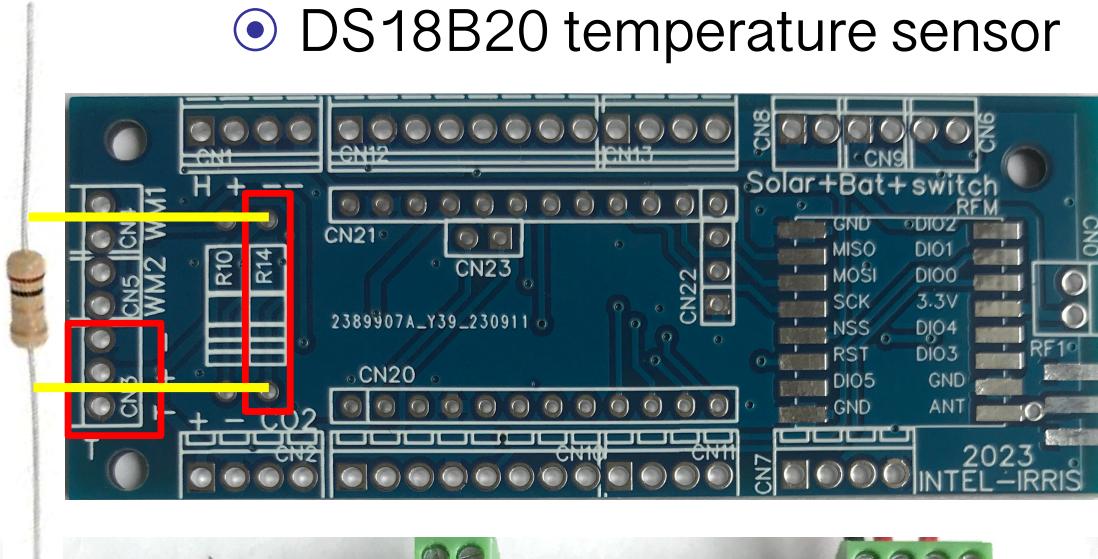


Just connect the sensor in the dedicated header  
 -- are the 2 black wires  
 + is red and H is yellow

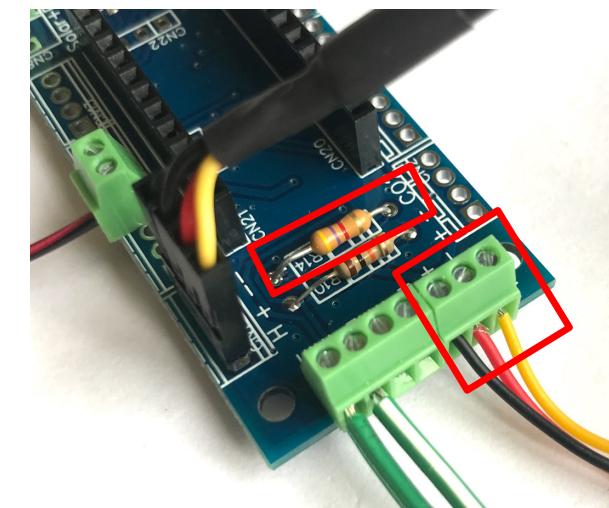
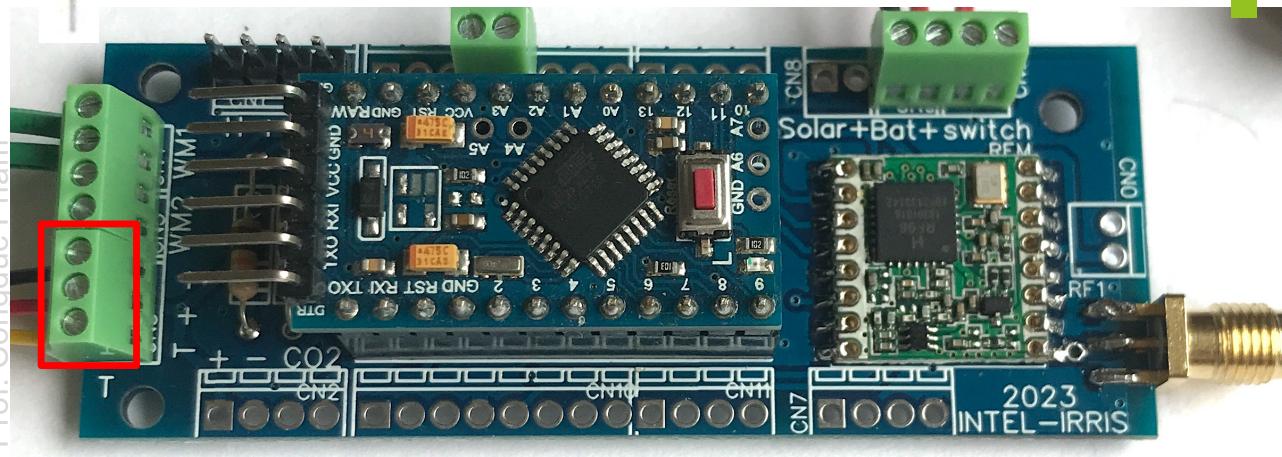


# Wiring with new IRD PCB (raw version)

- DS18B20 temperature sensor

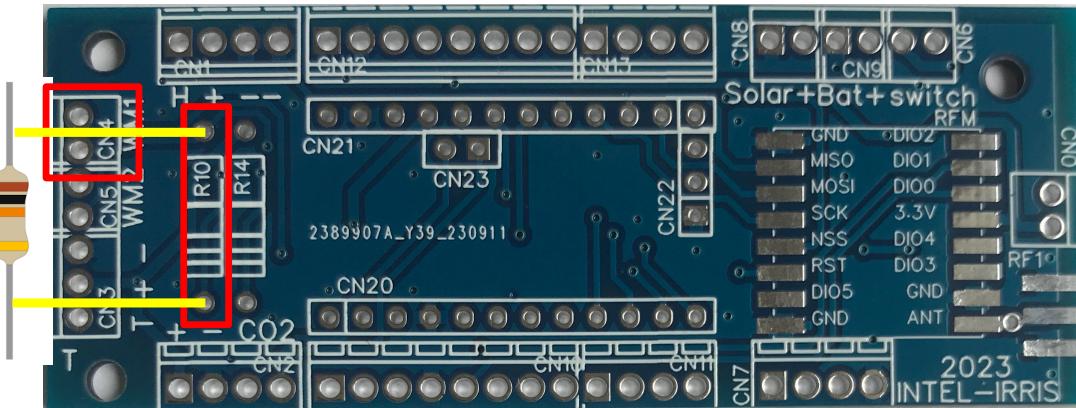


Solder a 4.7kOhms resistor  
then wire in the dedicated  
terminal block  
T+ - : Yellow, Red, Black wires

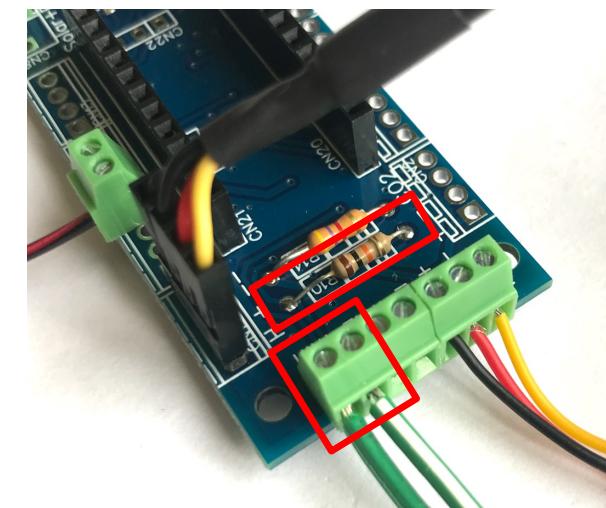
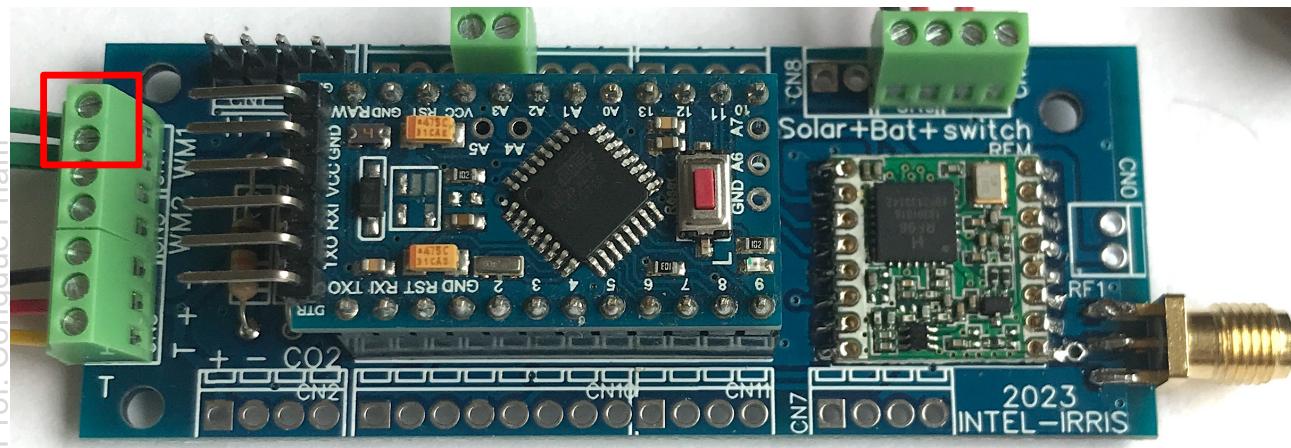


# Wiring with new IRD PCB (raw version)

## ○ First Watermark

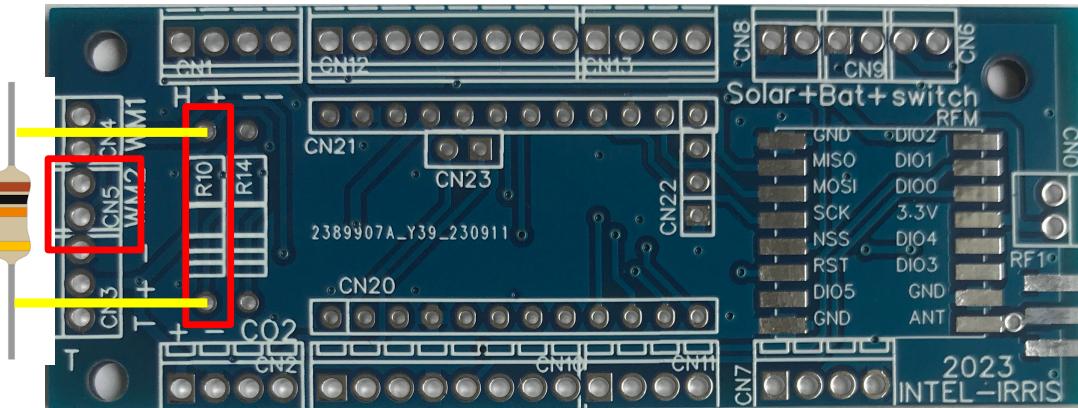


  Solder a 10kOhms resistor  
then wire in the dedicated  
WM1 terminal block

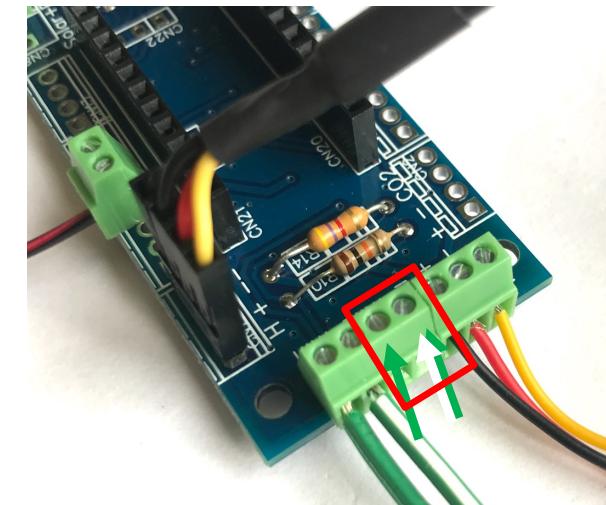
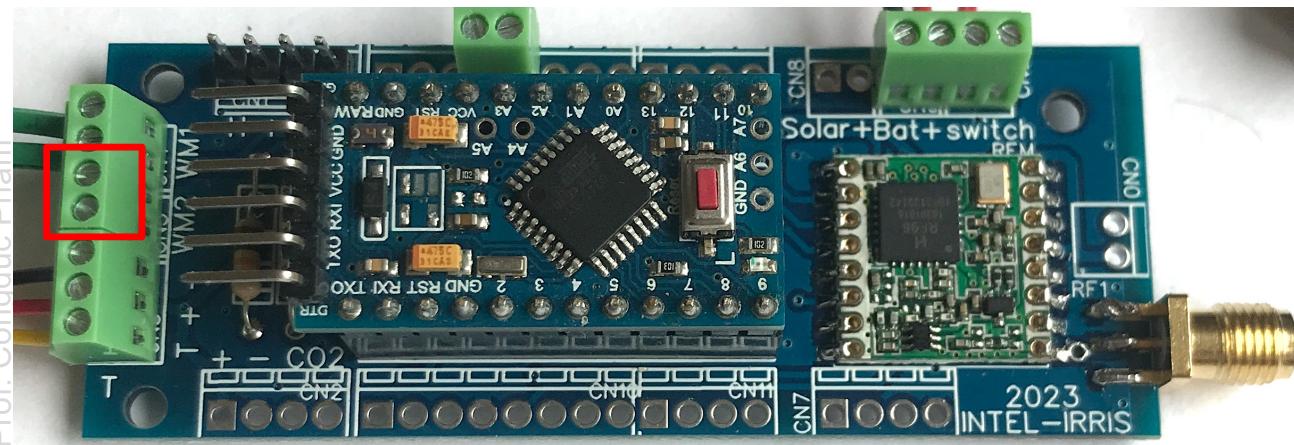


# Wiring with new IRD PCB (raw version)

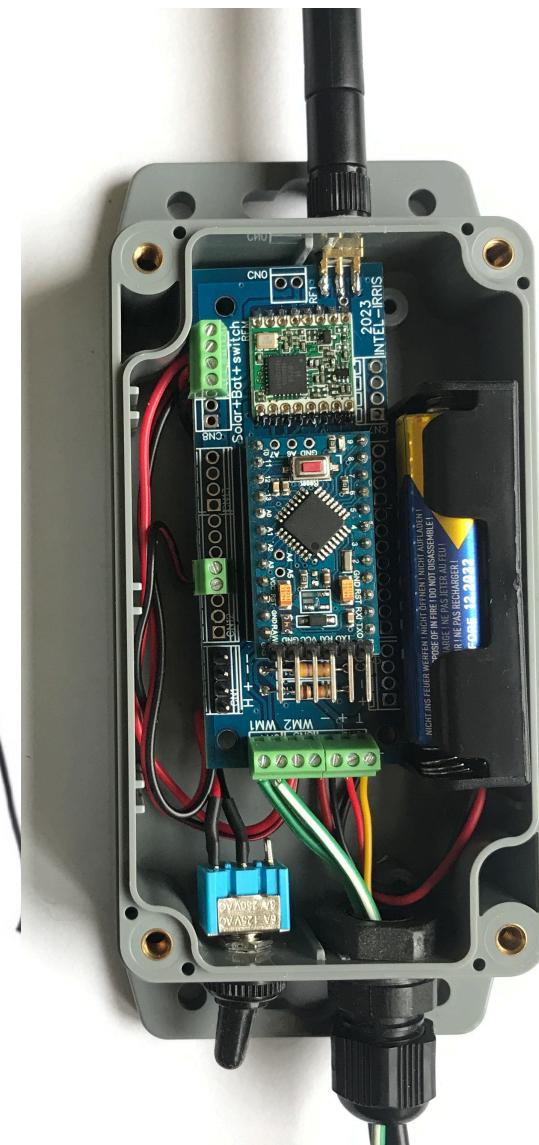
○ Second Watermark

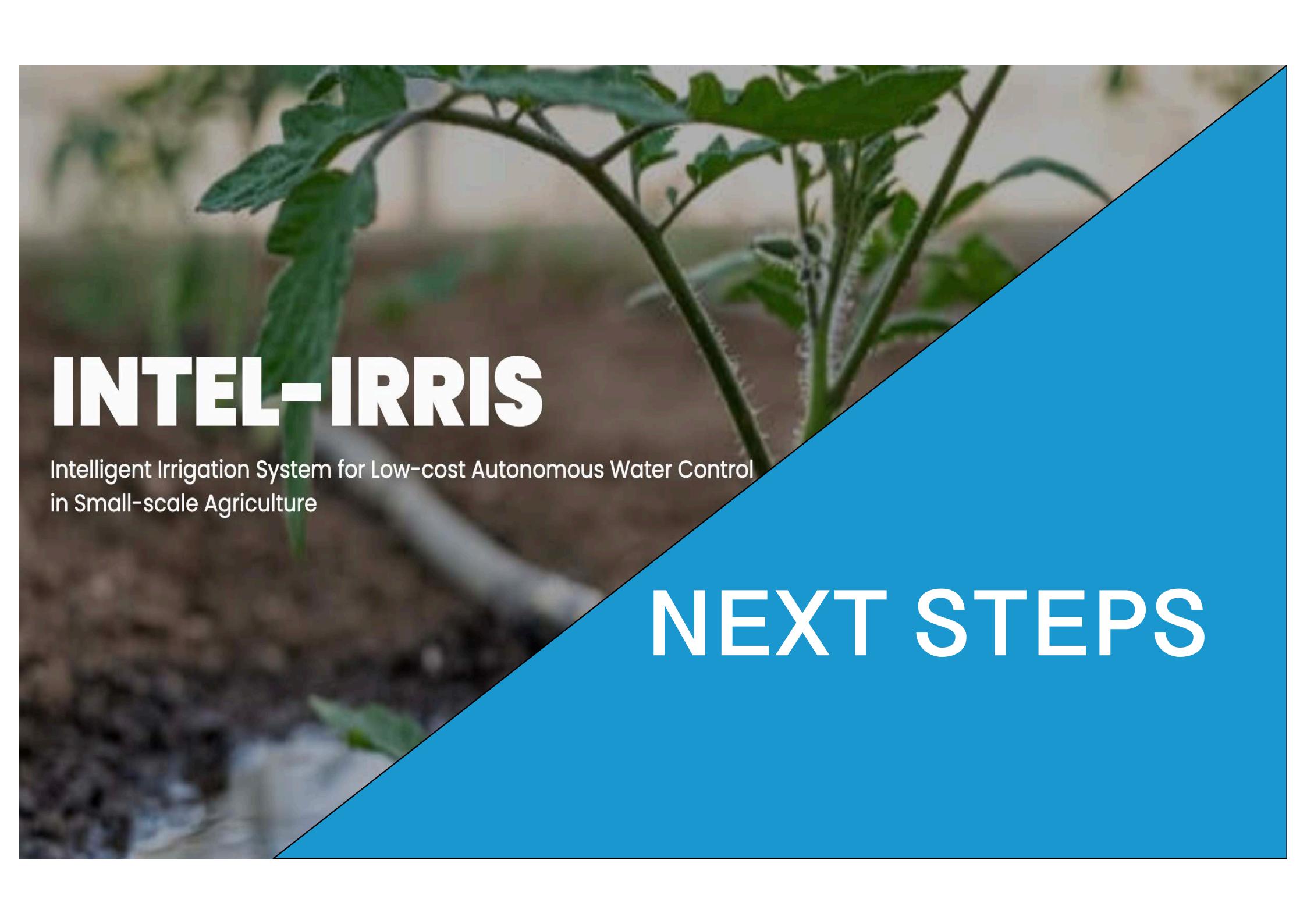


No additional resistor  
just wire in the dedicated WM2  
terminal block



# Final result with casing & sensors



A close-up photograph of a young green plant with large, serrated leaves growing in dark brown soil. The plant has several thin stems and small leaves. The background is slightly blurred.

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## NEXT STEPS

# Transmission to gateway



Parameters for  
INTEL-IRRIS gateway



SF12BW125  
868.1MHz | 433.175MHz  
Node id is 26011DAA  
1 msg/60mins  
1 sensor  
XLPP data



This dedicated video will show all these steps, from connecting the SEN0308 to testing transmission to the gateway  
Video n°4: <https://youtu.be/j-1Nk0tv0xM>



# Live demo

Dashboard

- Logout
- Intel-Irris WaziApp
- Dashboard
- Sync
- Settings
- Apps
- Help
- User Profile

Home Assistant

- Overview
- Energy
- Map
- Logbook
- History
- Configurator
- Media

Farm

SOIL-AREA-1 ID 644

SOIL-AREA-1/centibars from WM200 24 cbar

SOIL-AREA-1/resistance value from WM200 4,287 Ohms

SOIL-AREA-1/Soil Temperature Sensor 17.9 °C

SOIL-AREA-1/Battery voltage 2.77 Volts

Capacitive Sensor

SOIL-AREA-1/Raw value from SEN0308 164.5

SOIL-AREA-1/Soil Temperature Sensor -99 °C

SOIL-AREA-1/Battery voltage 3.46 Volts

SOIL-AREA-1/soil cond... 17.9 °C

Tensiometer Sensor

SOIL-AREA-2/centibars from WM200 24 cbar

SOIL-AREA-2/resistance value from WM200 4,287 Ohms

SOIL-AREA-2/Soil Temperature Sensor 17.9 °C

SOIL-AREA-2/Battery voltage 2.77 Volts

SOIL-AREA-2/Soil Temp... 17.9 °C

SOIL-AREA-2/soil cond... 4

SOIL-AREA-2/soil value index 4

