

# INTEL-IRRIS

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



This project is part of the PRIMA  
Programme supported by the  
European Union



Intel-IrriS



**PRIMA**  
PARTNERSHIP FOR RESEARCH AND INNOVATION  
IN THE MEDITERRANEAN AREA

# 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!



# INTEL-IRRIS

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

## GETTING STARTED!

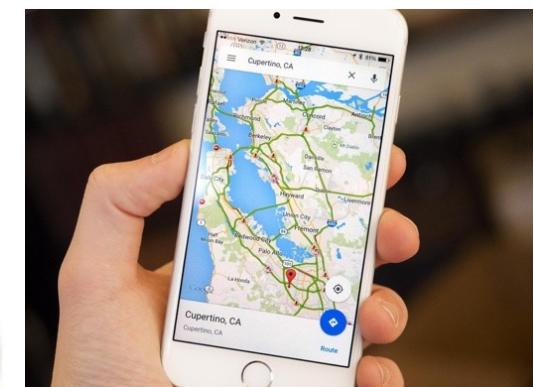
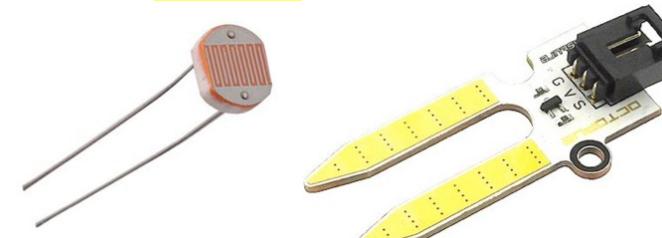
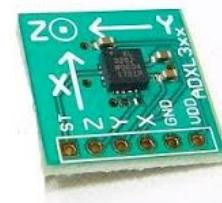
# IoT devices!



# All communicating objects?

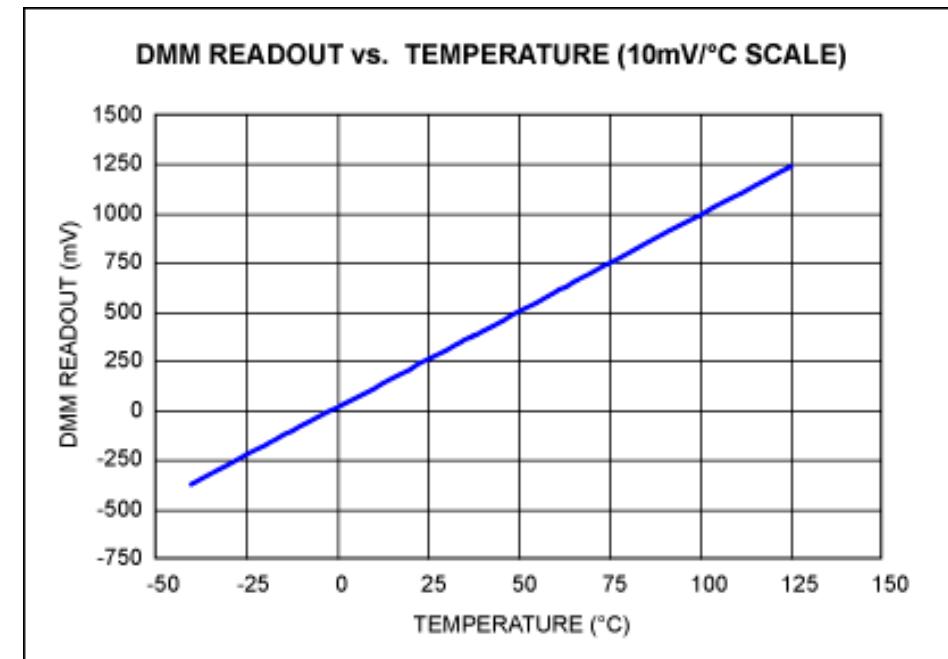


# Interaction: Sensors



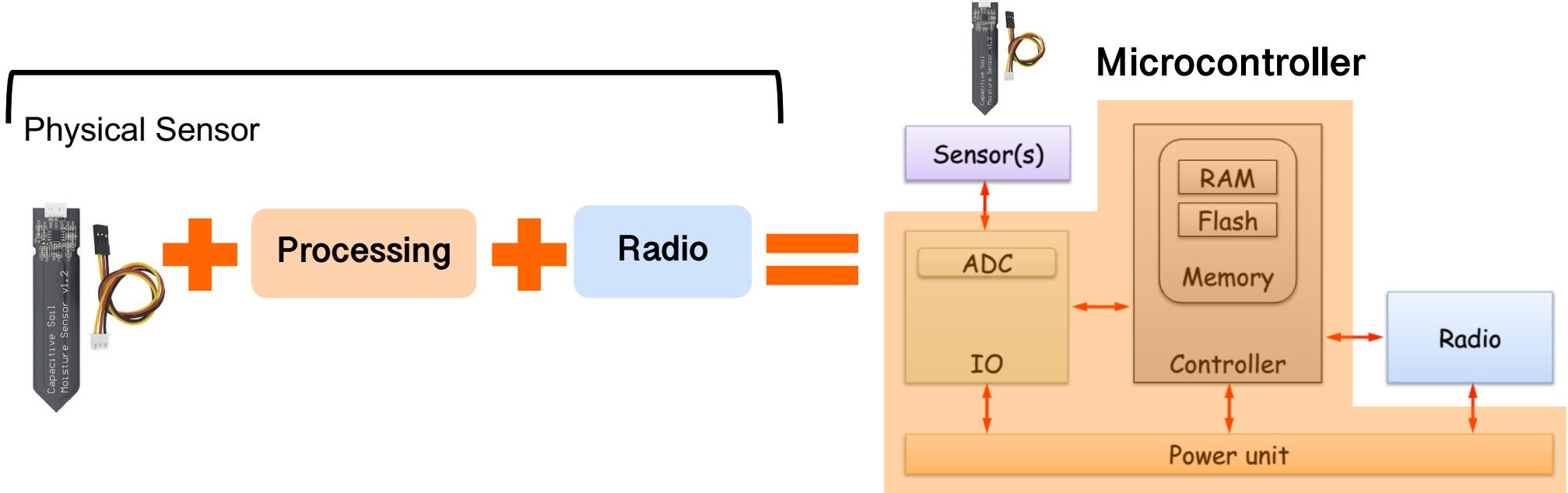
# Interacting with the real world?

- 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

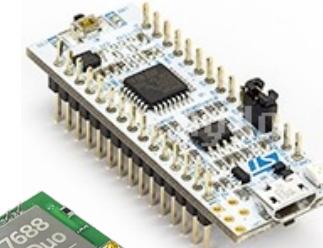


**Q: uprocessor vs ucontroller?**

# the incredibly large microcontroller board ecosystem!



STM32 Nucleo-32



Teensy 3.2



LinkIt  
Smart7688 duo



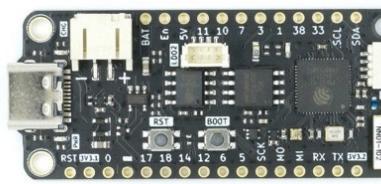
Adafruit Feather



uPesy ESP32



ePulse Feather Low Power ESP32



FeatherS3 – ESP32-S3



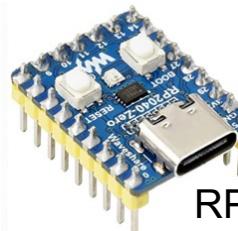
Heltec WiFi LoRa 32



XIAO SAMD21



Arduino Nicla  
Sense ME



RP2040  
zero



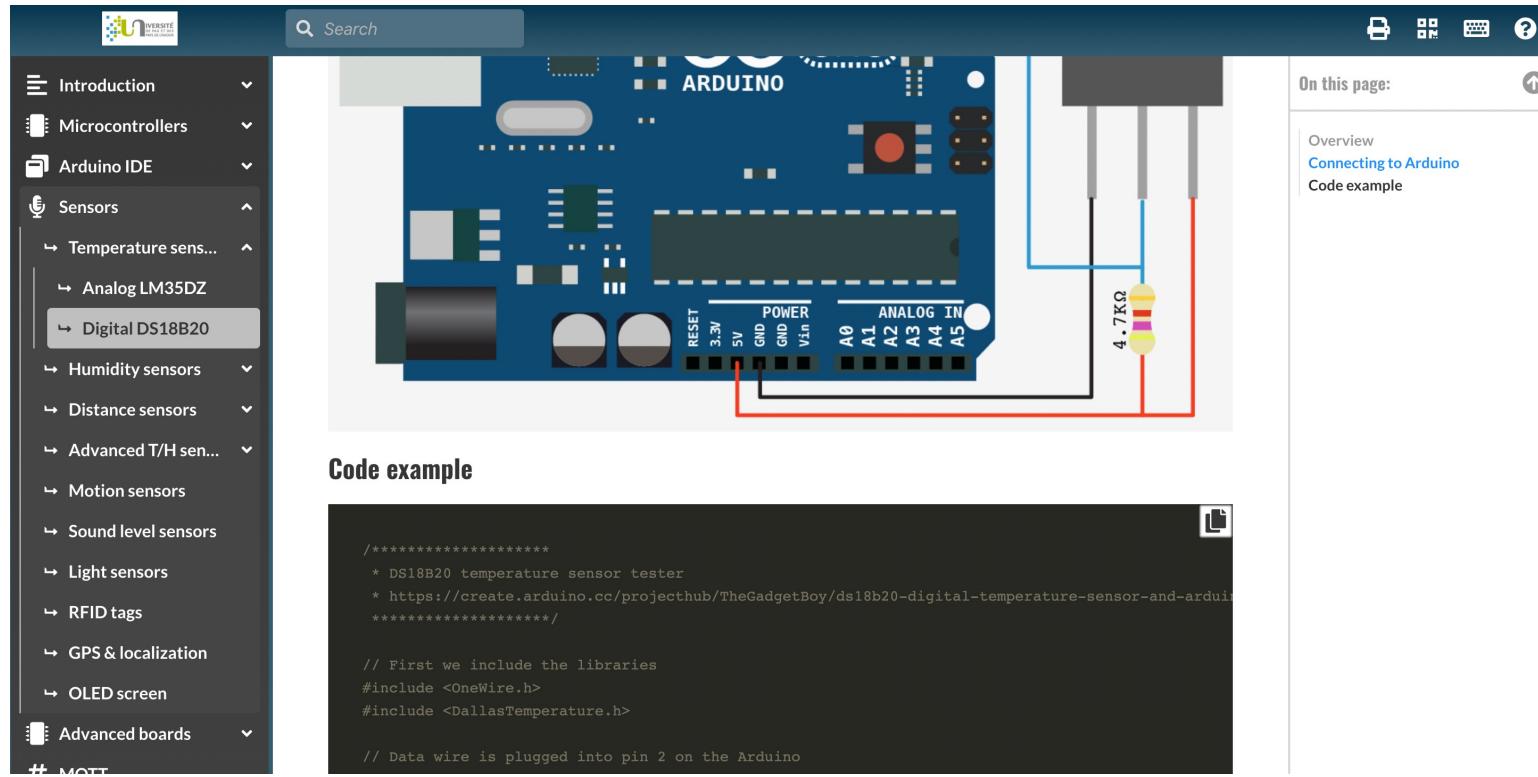
DFRobot  
Beetle



QT Py ESP32-C3

# Online Arduino & Sensor tutorial

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



The screenshot shows a web-based tutorial for an Arduino Uno. On the left, a sidebar menu lists various sensor categories: Introduction, Microcontrollers, Arduino IDE, Sensors (with sub-options: Temperature sensors, Analog LM35DZ, Digital DS18B20, Humidity sensors, Distance sensors, Advanced T/H sen..., Motion sensors, Sound level sensors, Light sensors, RFID tags, GPS & localization, OLED screen), and Advanced boards. The main content area features an image of an Arduino Uno with a DS18B20 temperature sensor connected via a breadboard. A detailed circuit diagram shows the sensor's pins connected to digital pins A0, A1, A2, A3, A4, and A5, with a 4.7KΩ pull-up resistor. Below the image is a "Code example" section containing the following Arduino code:

```

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

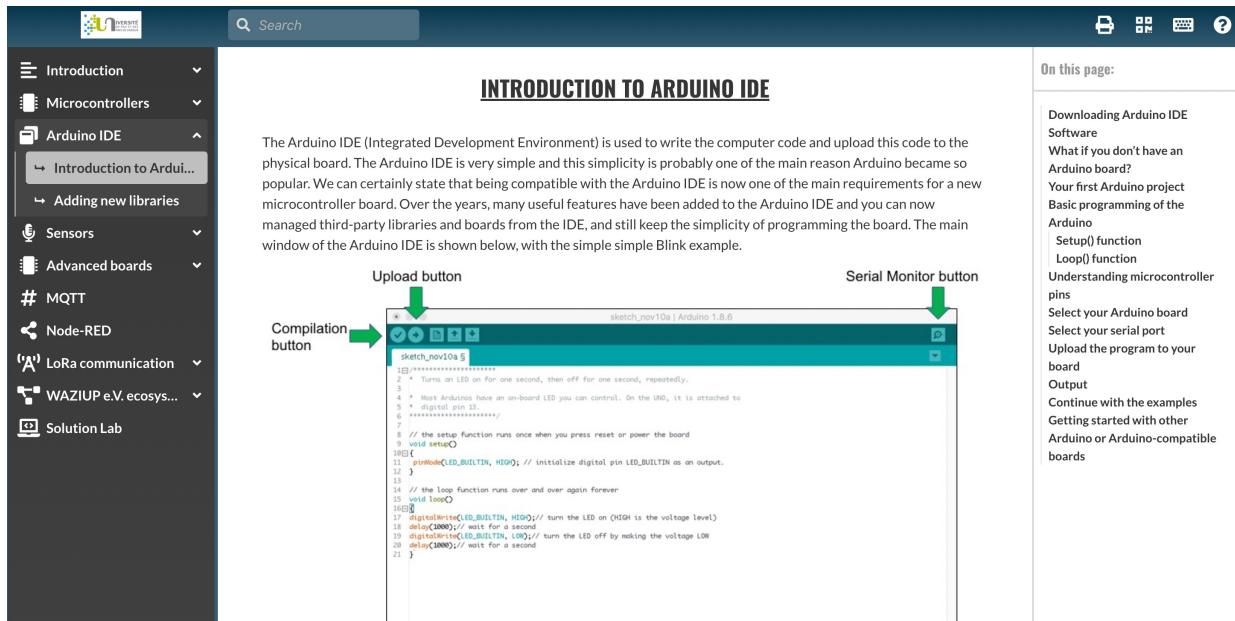
// First we include the libraries
#include <OneWire.h>
#include <DallasTemperature.h>

// 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, with "Arduino IDE" selected. The main content area displays a "INTRODUCTION TO ARDUINO IDE" page. It features a screenshot of the Arduino IDE interface with annotations: a green arrow points to the "Upload button" at the top, another green arrow points to the "Compilation button" on the left, and a third green arrow points to the "Serial Monitor button" on the right. Below the screenshot is a code snippet for the "Blink" example:

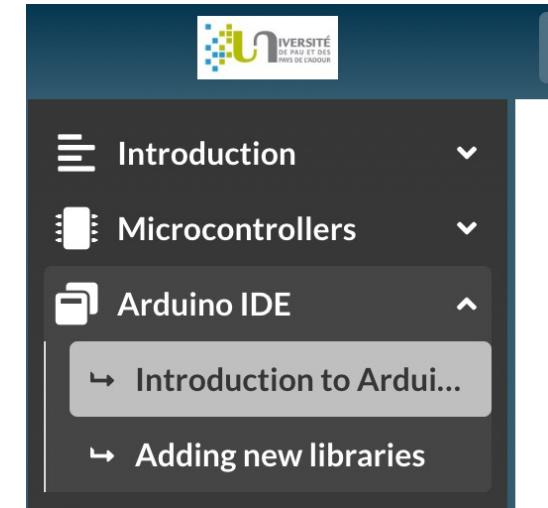
```

 1 // This sketch demonstrates how to use the built-in LED on the Uno.
 2 // Turn an LED on for one second, then off for one second, repeatedly.
 3
 4 * Most Arduinos have an on-board LED you can control. On the Uno, it is attached to
 5 * digital pin 13.
 6 /**
 7 */
 8 // the setup function runs once when you press reset or power the board
 9 void setup()
10 {
11   // initialize digital pin LED_BUILTIN as an output:
12   pinMode(LED_BUILTIN, HIGH);
13 }
14 // the loop function runs over and over again forever
15 void loop()
16 {
17   digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
18   delay(1000); // wait for a second
19   digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
20   delay(1000); // wait for a second
21 }

```

The page also includes a sidebar with links related to the Arduino IDE.

**Navigate and read:**

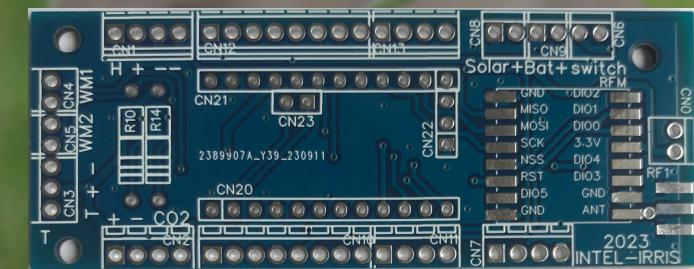


This screenshot shows the same PRIMA website layout, but with a vertical navigation bar on the left side. The vertical bar has a yellow top section and a green bottom section. It contains the same navigation items as the horizontal menu, including "Introduction", "Microcontrollers", and "Arduino IDE". The "Arduino IDE" item is expanded, showing "Introduction to Ardu..." and "Adding new libraries" under its sub-menu.

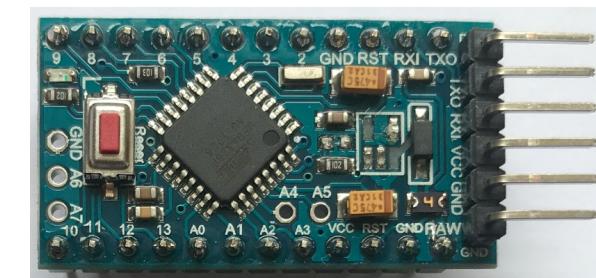
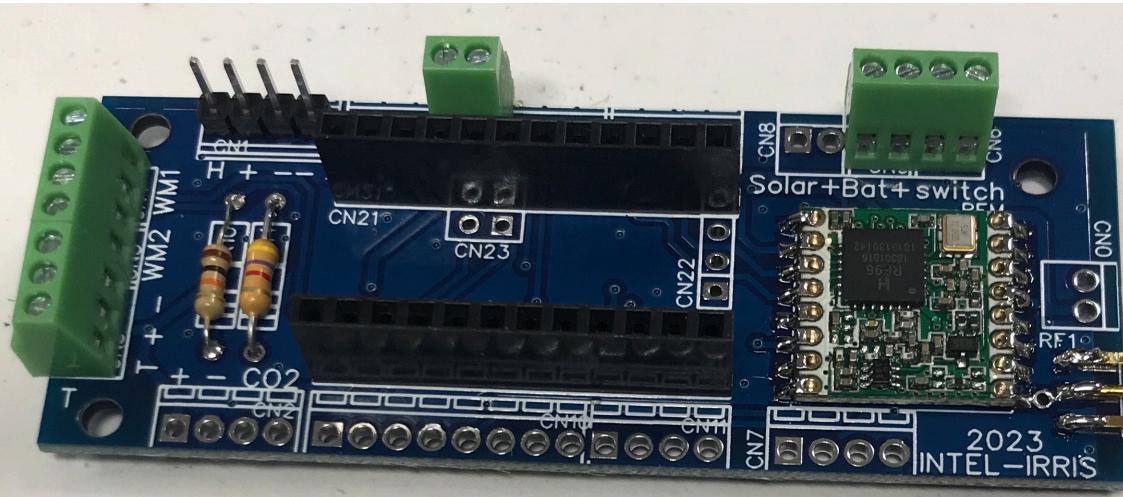
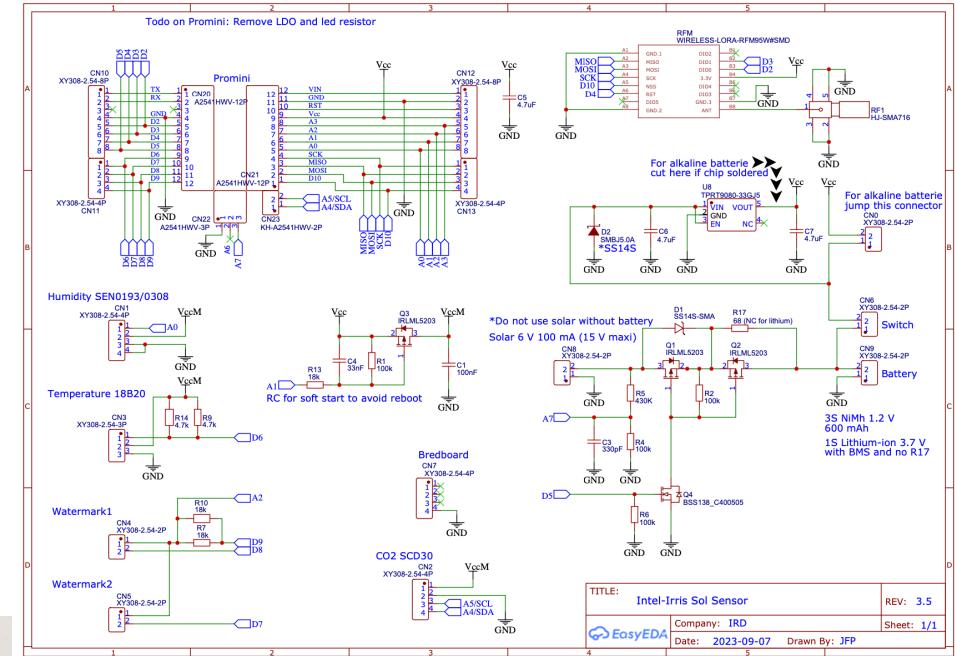
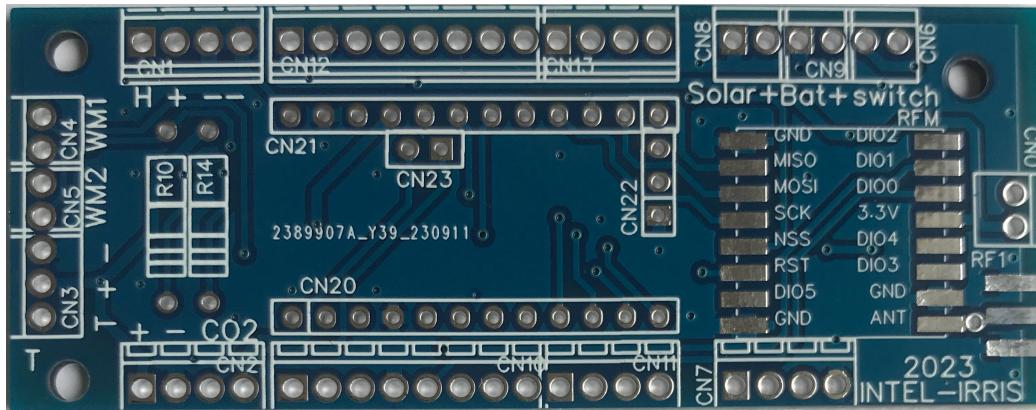
# INTEL-IRRIS

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

## HANDS-ON

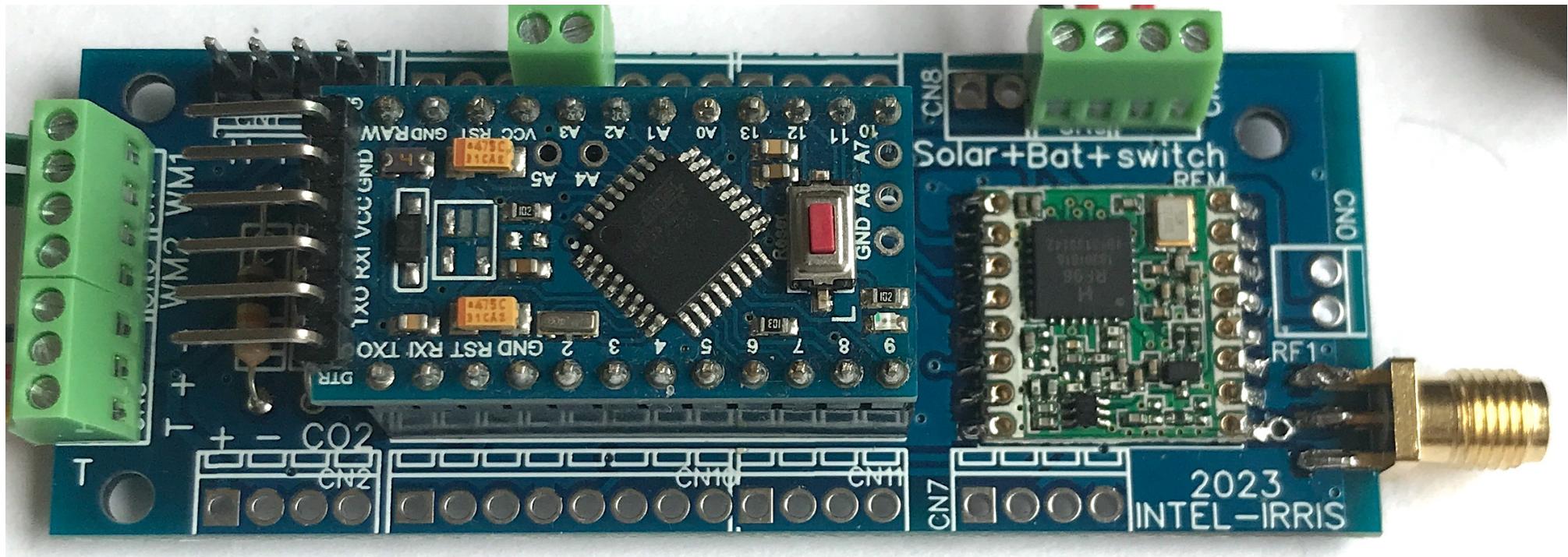


# The new IRD PCB (raw version)

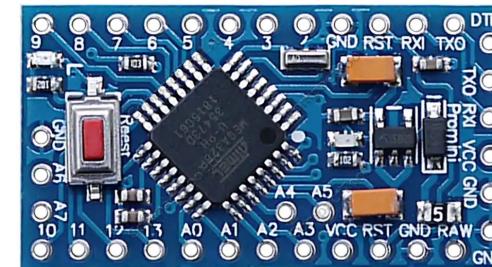


Arduino Pro Mini

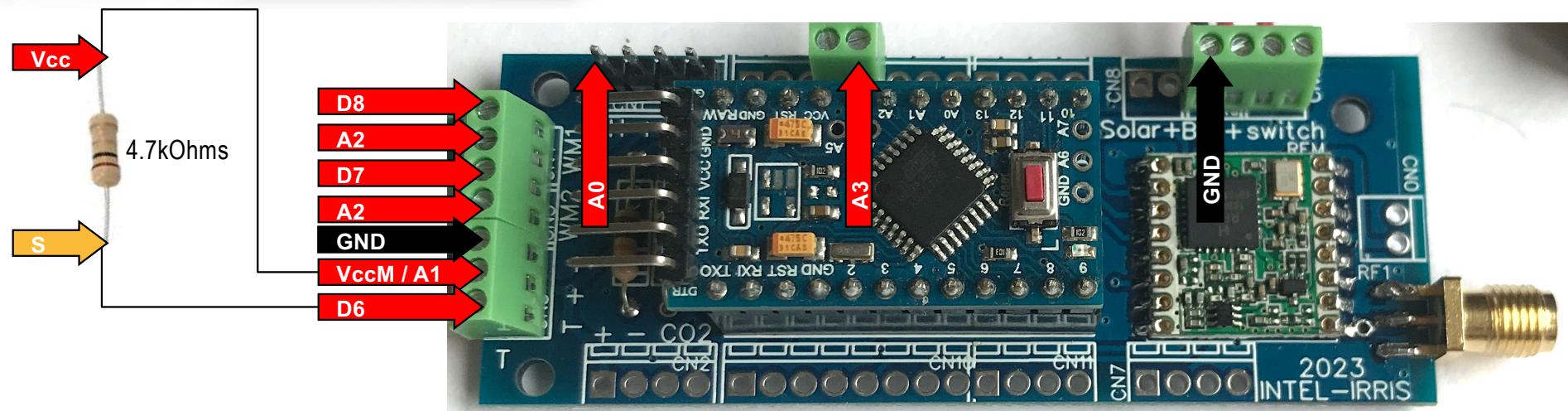
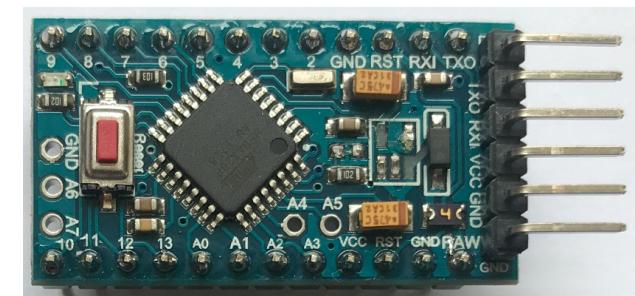
# The new IRD PCB: close-up view



# Arduino pins exposed on the PCB

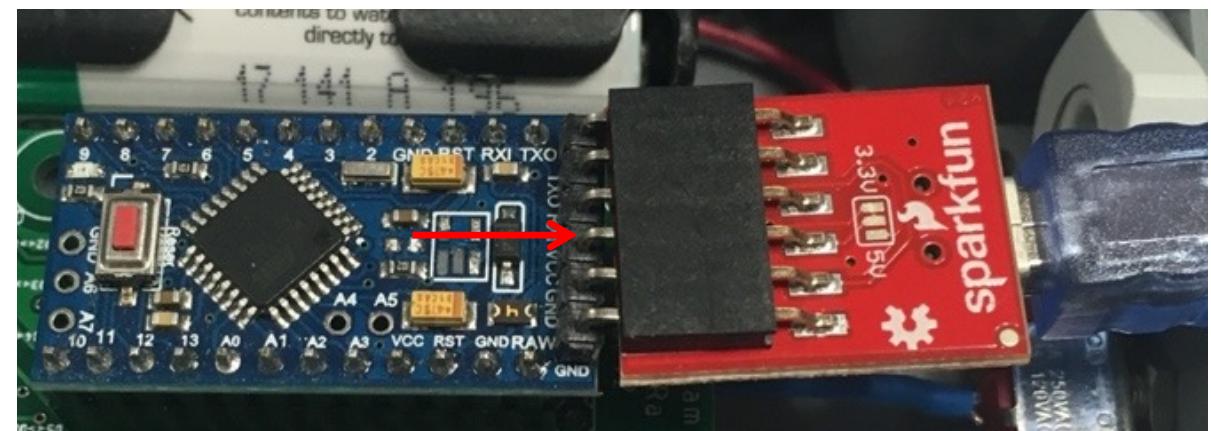
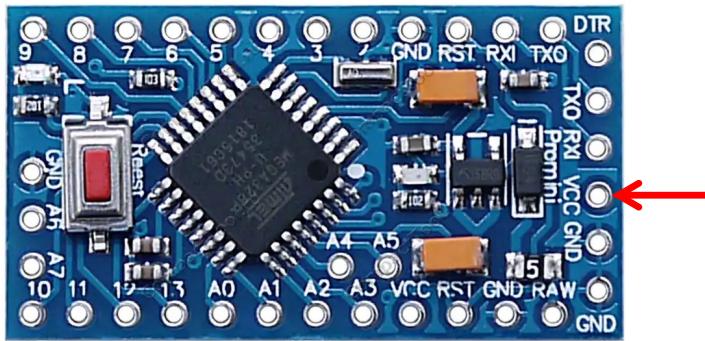


The compact Arduino  
Pro Mini



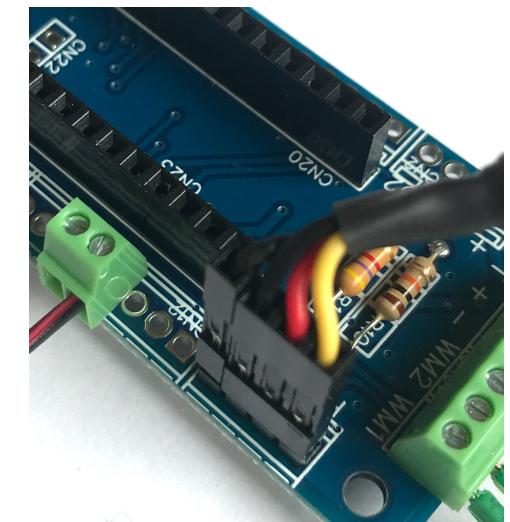
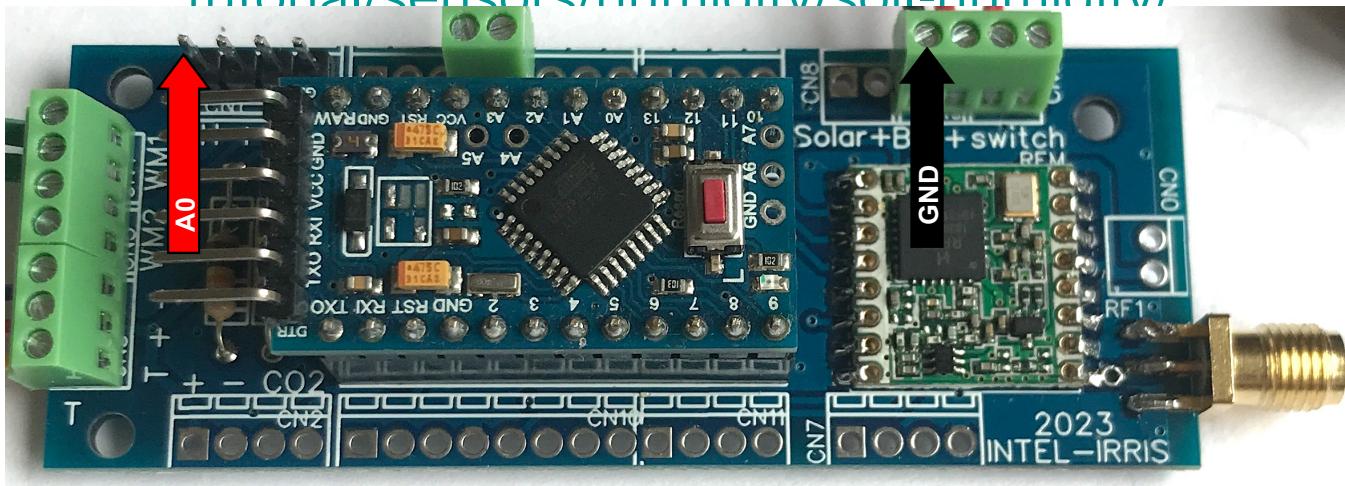
# Programming the microcontroller

Most Chinese clone version,  
check the VCC pin

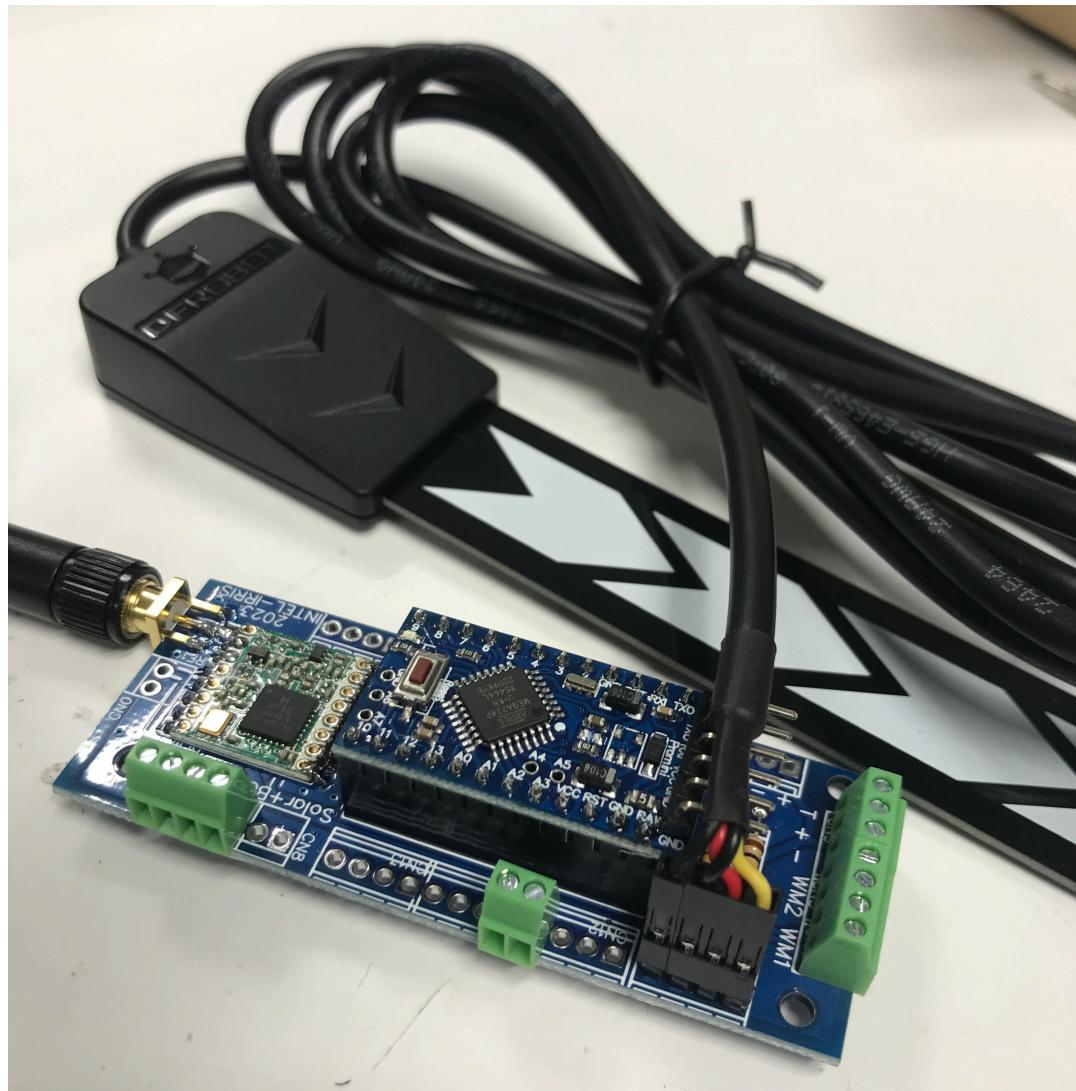


# 1<sup>st</sup> example: read from analog

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

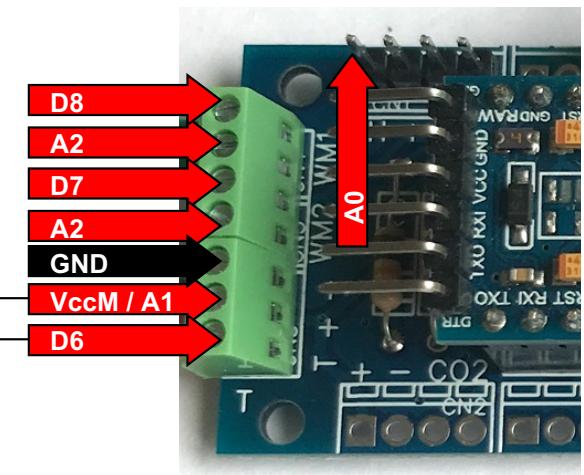
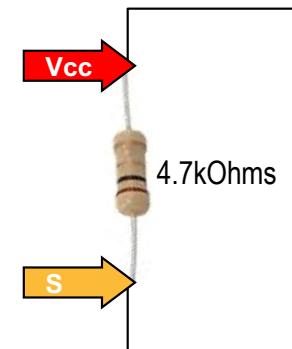
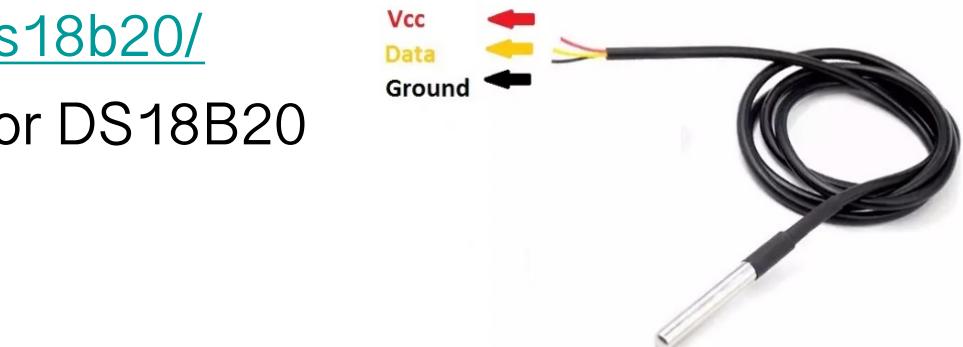
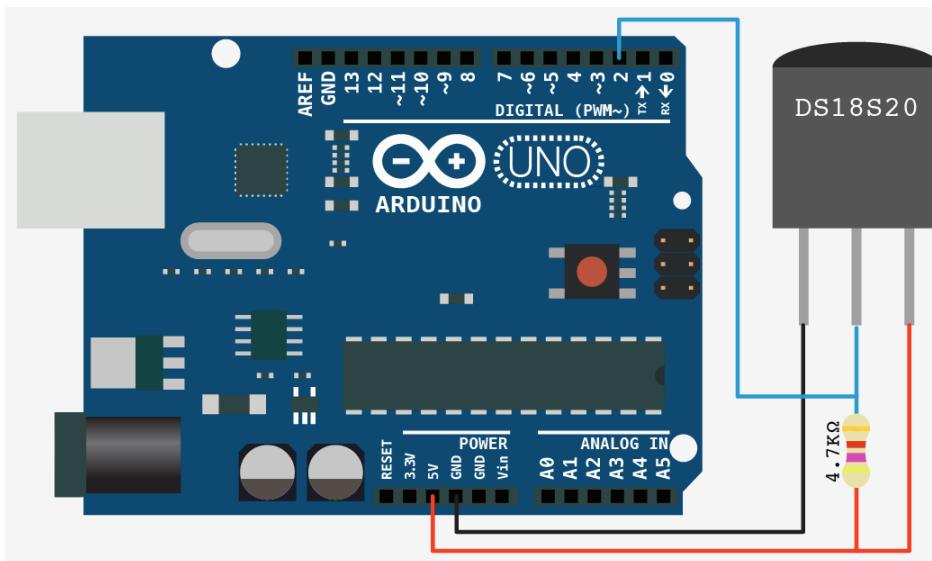


# Connecting SEN0308 in image



# 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



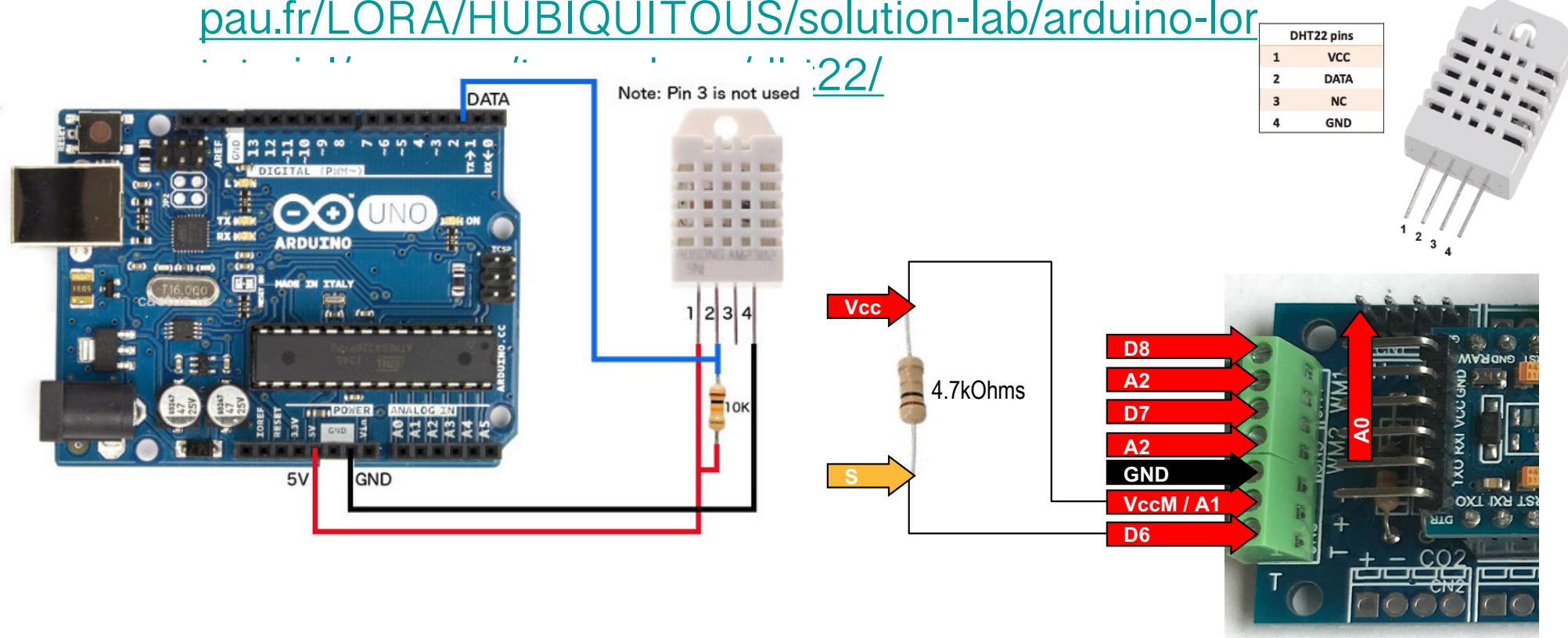
- Adapt the code to use D6 for DATA and A1 for Vcc

# Connecting DS18B20 in image



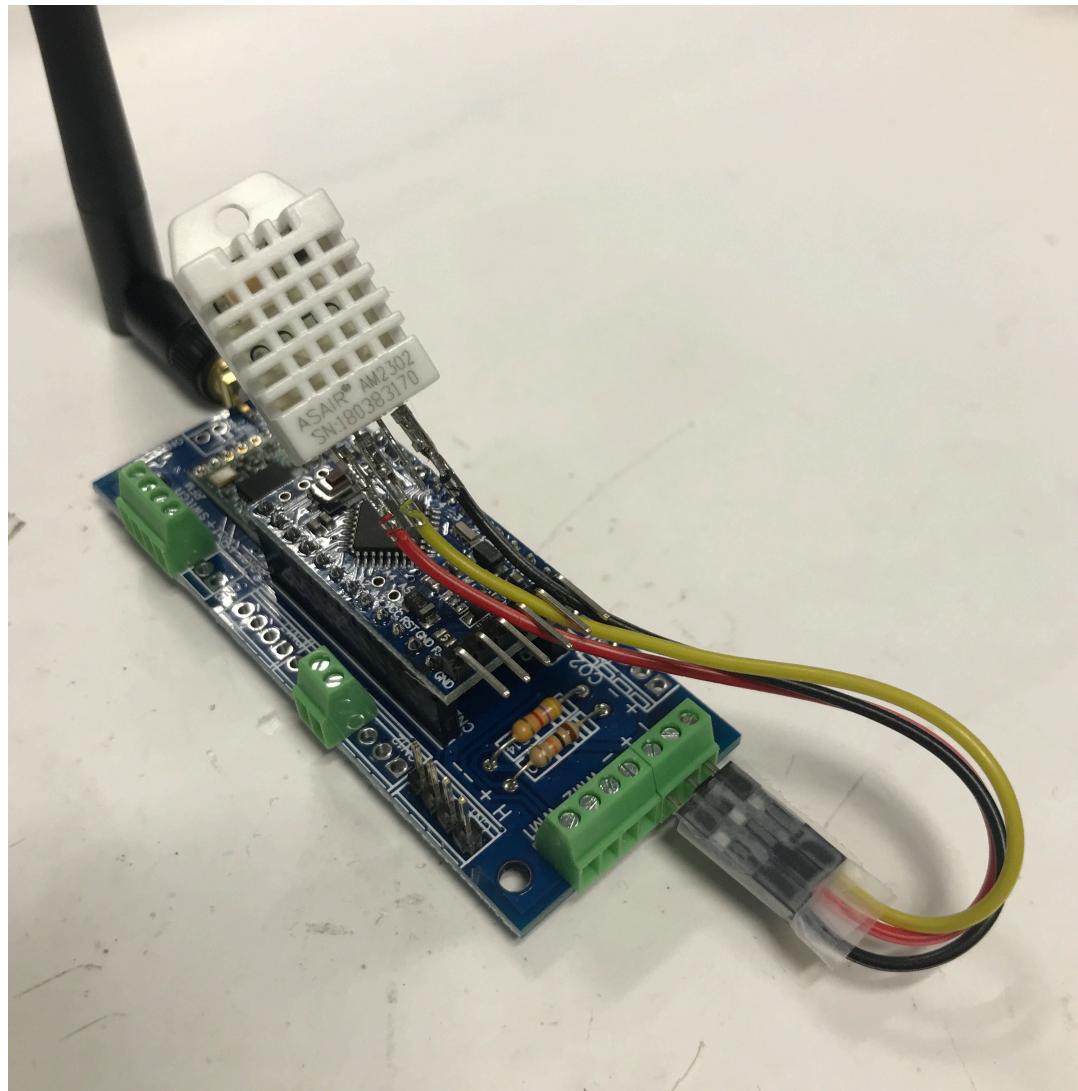
# 3rd example: read from digital DHT22

- DHT22: combined temperature & humidity sensor
- <https://cpham.perso.univ-pau.fr/LORA/HUBIQUITOUS/solution-lab/arduino-lora-dht22/>



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

# Connecting DHT22 in image



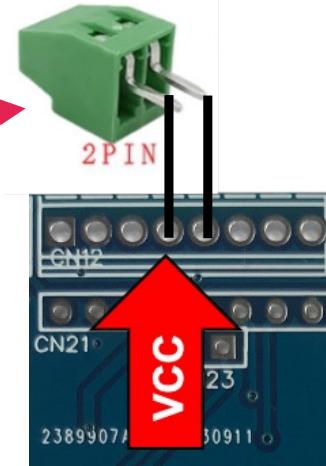
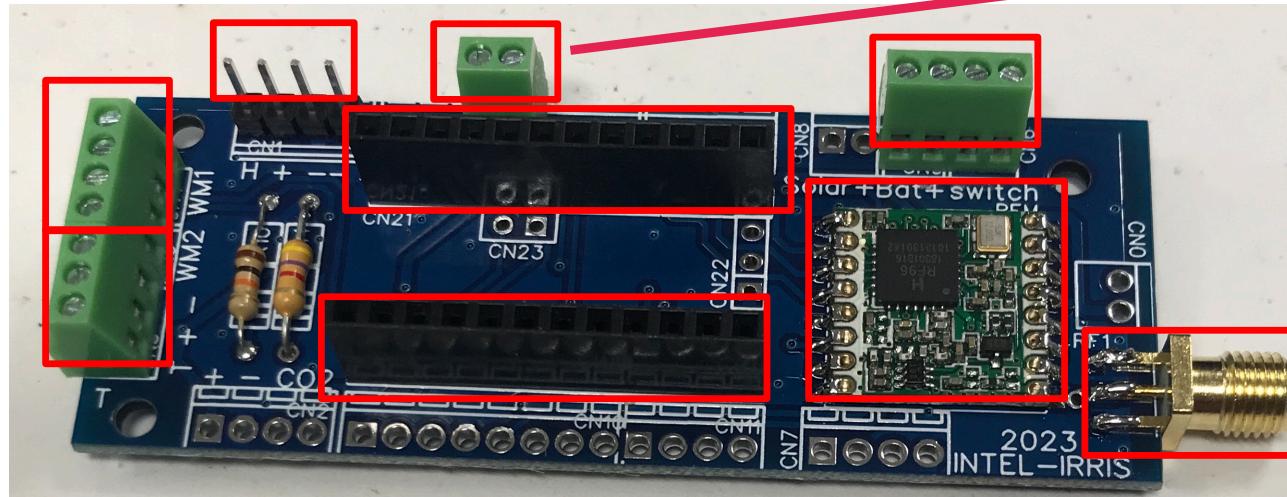
# **INTEL-IRRIS**

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

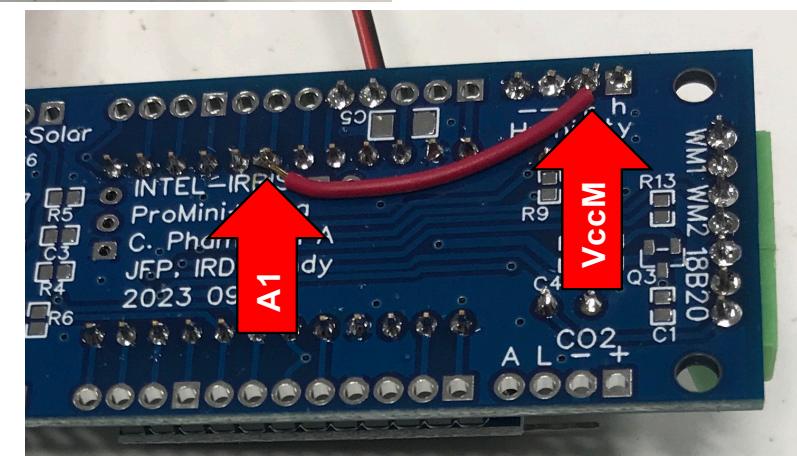
## **BUILDING THE STARTER-KIT**

# Wiring with new IRD PCB (raw version)

- First, solder the various components



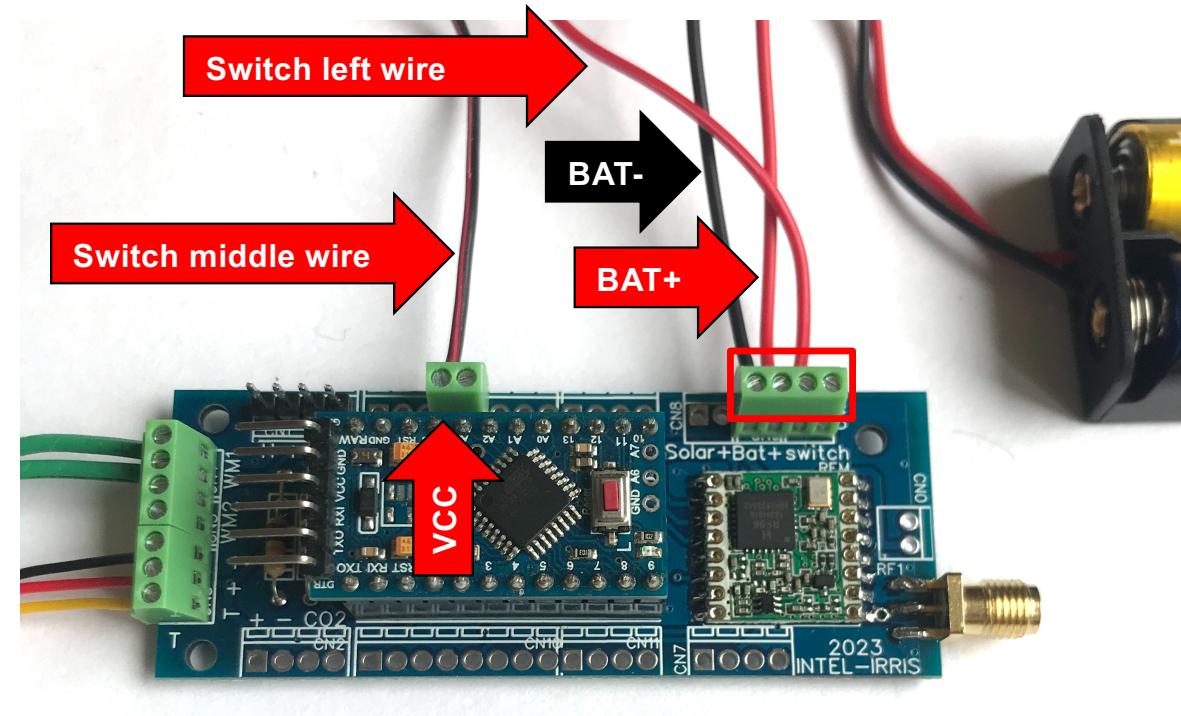
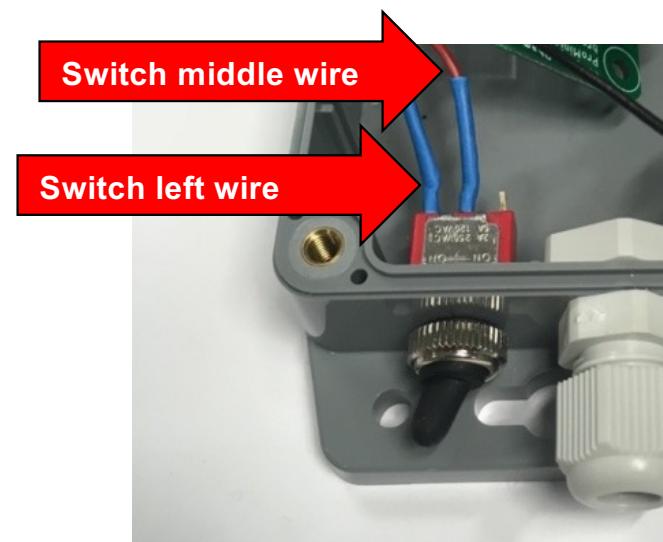
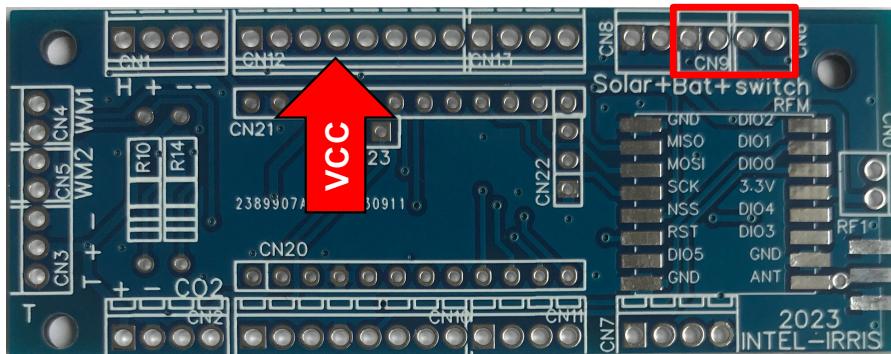
- For the raw PCB (no circuit for solar), need to link A1 to VccM on the back side of the PCB
- VccM can be taken on the + of the soil humidity sensor



# Wiring with new IRD PCB (raw version)

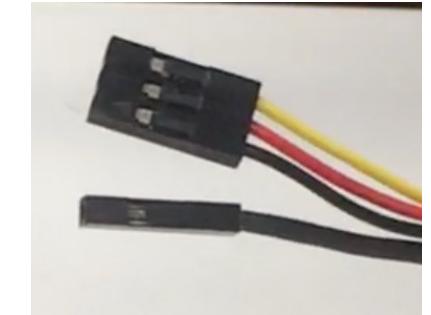
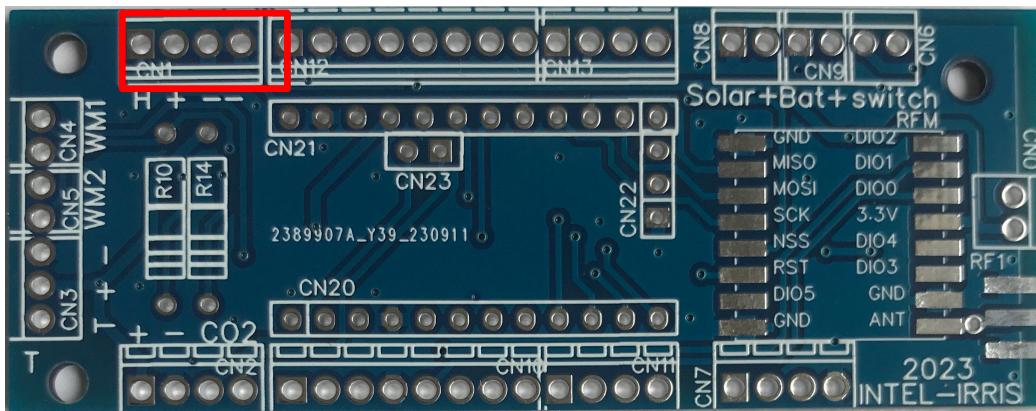


## ○ Power wires

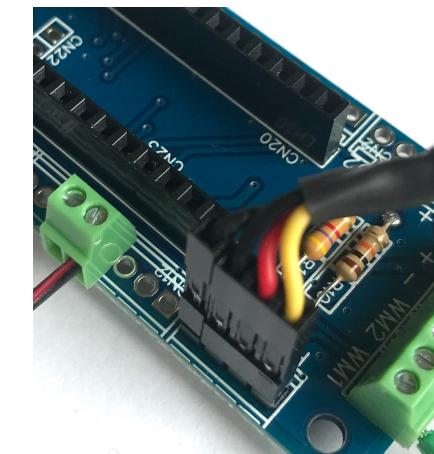
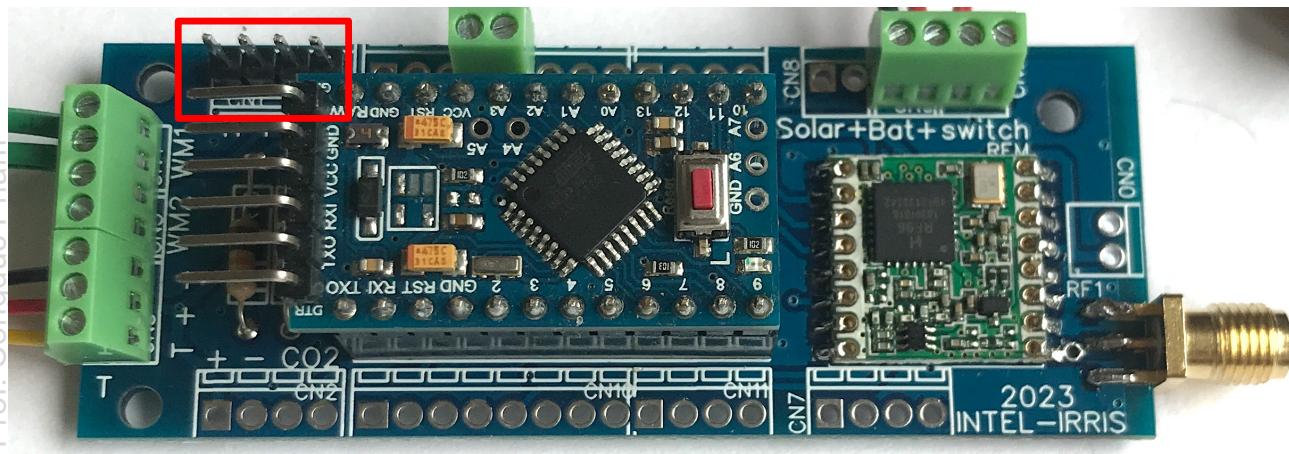


# Wiring with new IRD PCB (raw version)

- SEN0308 capacitive

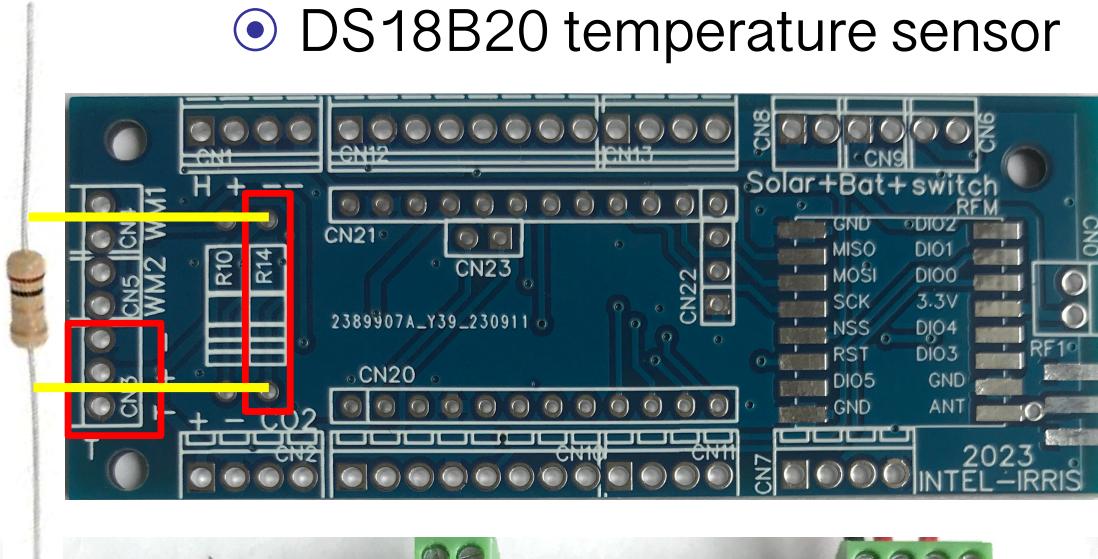


Just connect the sensor in the dedicated header  
 -- are the 2 black wires  
 + is red and H is yellow

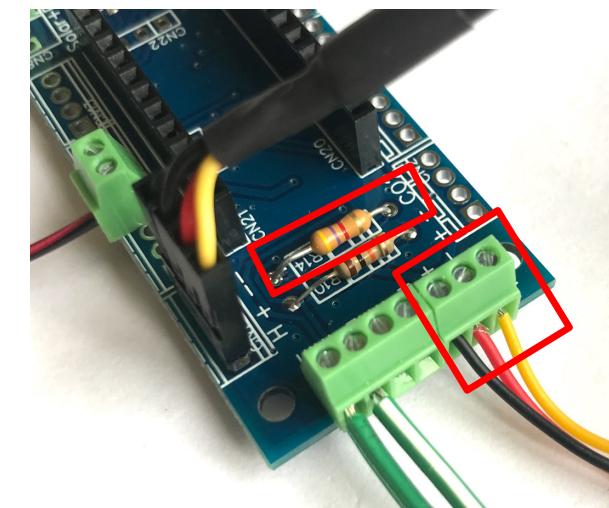
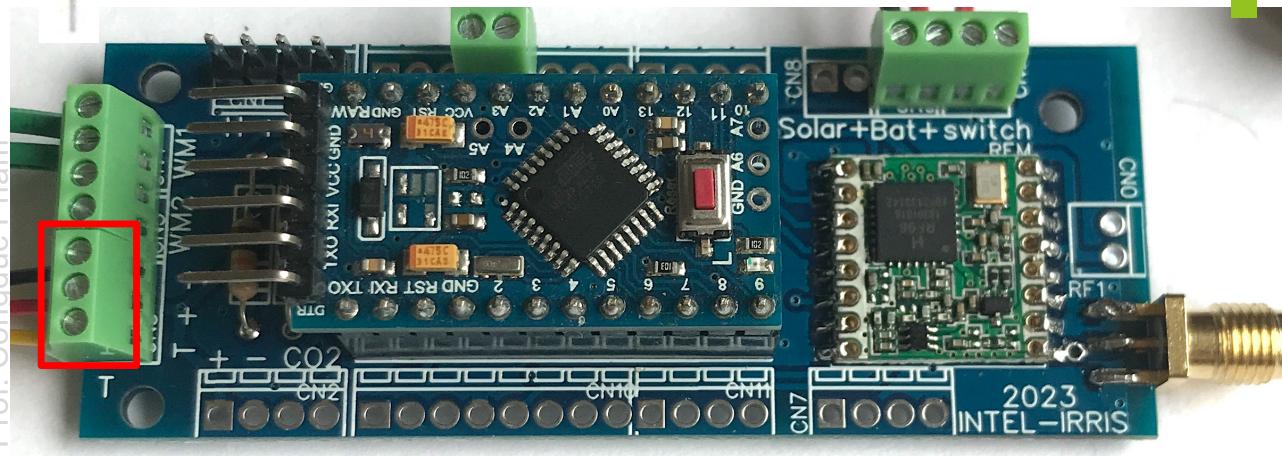


# Wiring with new IRD PCB (raw version)

- DS18B20 temperature sensor

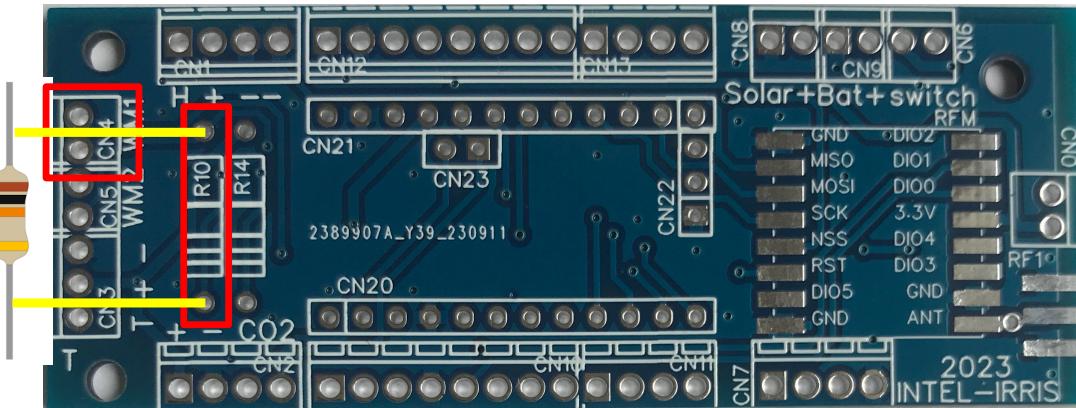


Solder a 4.7kOhms resistor  
 then wire in the dedicated  
 terminal block  
**T+ - : Yellow, Red, Black wires**

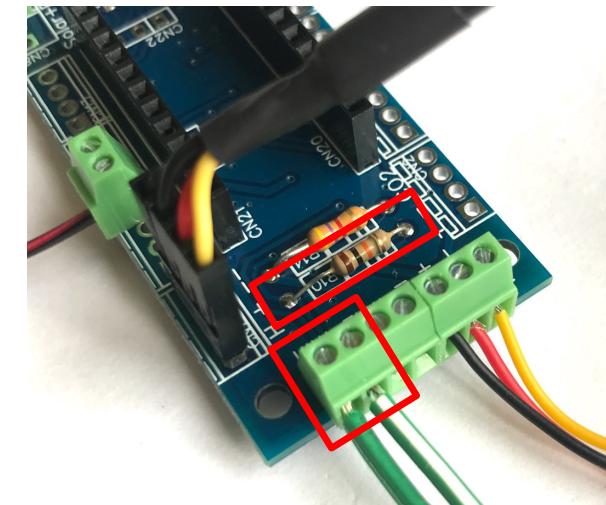
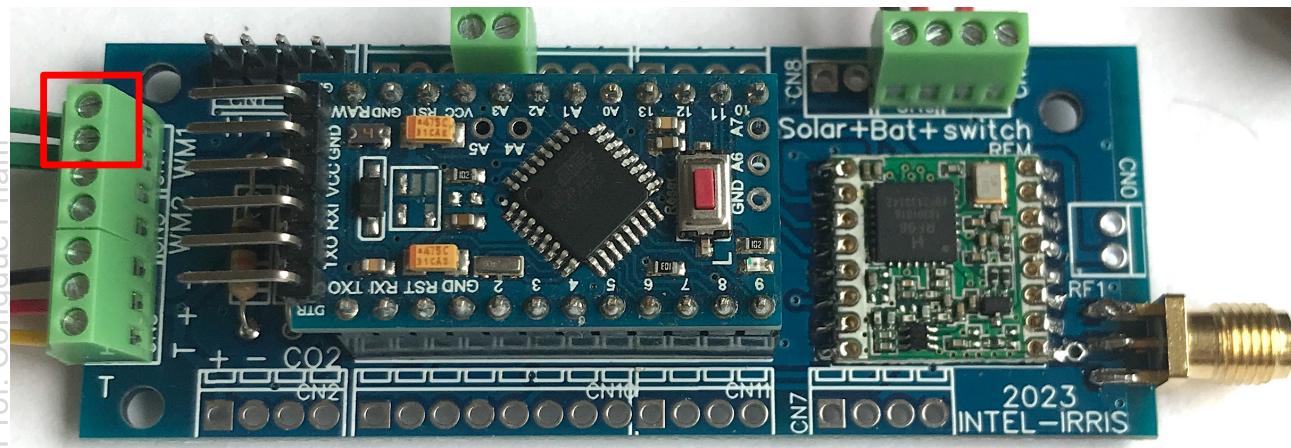


# Wiring with new IRD PCB (raw version)

## ○ First Watermark

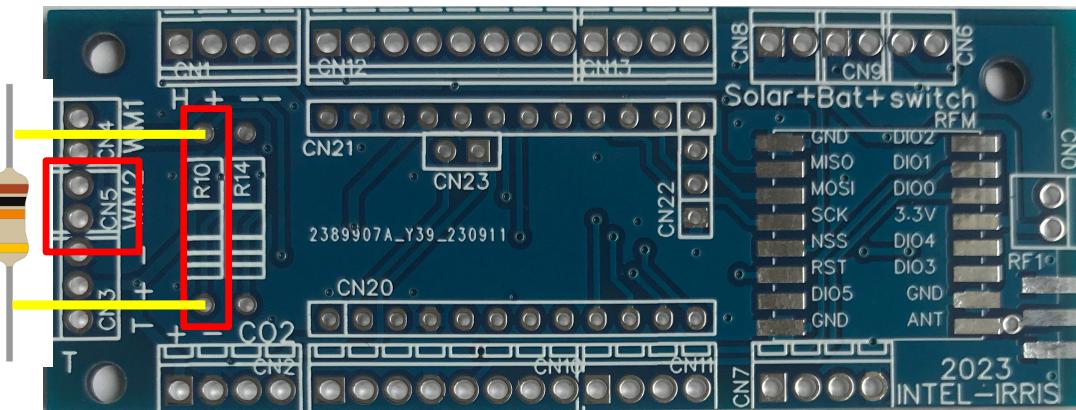


  Solder a 10kOhms resistor  
then wire in the dedicated  
WM1 terminal block

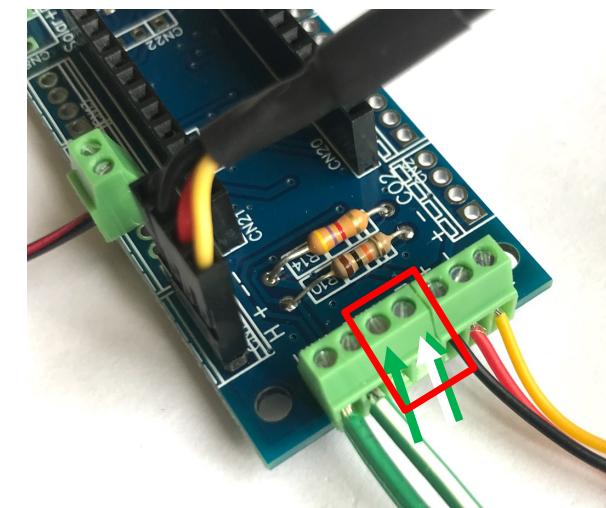
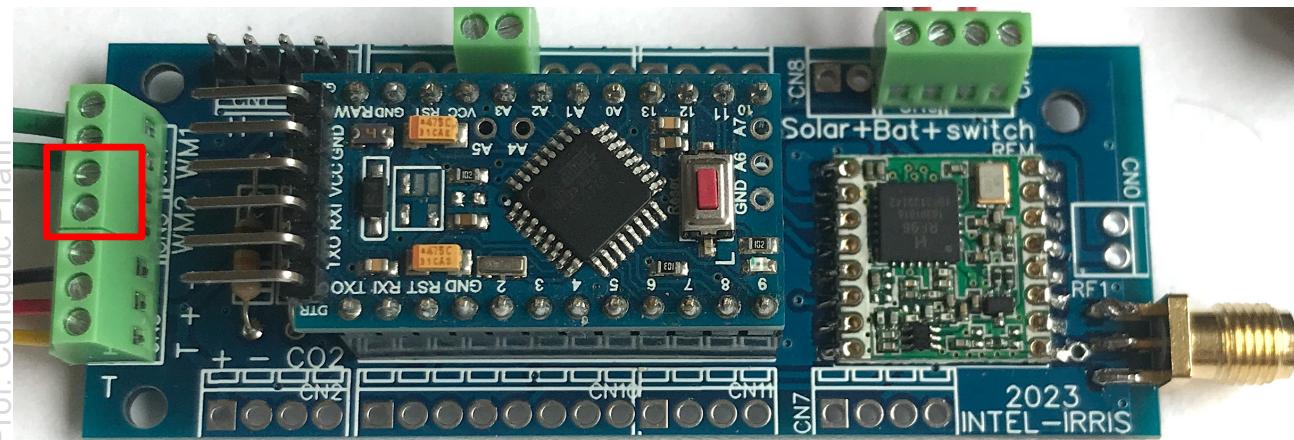


# Wiring with new IRD PCB (raw version)

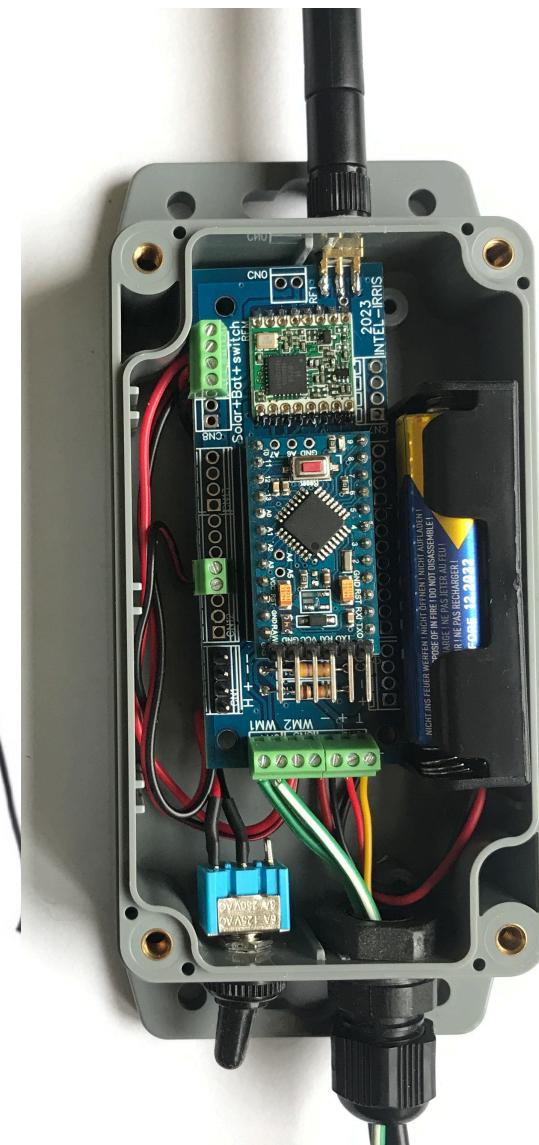
⌚ Second Watermark



No additional resistor  
just wire in the dedicated WM2  
terminal block



# Final result with casing & sensors



# INTEL-IRRIS

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

## NEXT STEPS

# Transmission to gateway



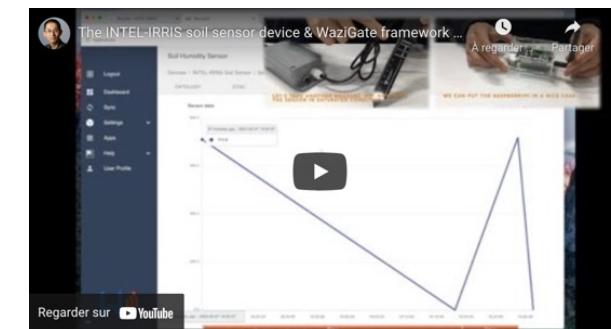
Parameters for  
INTEL-IRRIS gateway



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

