

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



Investigating collaboration among PRIMA projects

April 12<sup>th</sup>, 2024

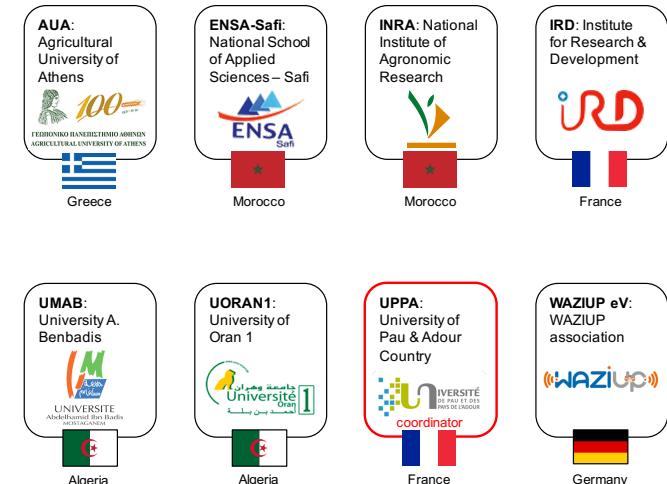
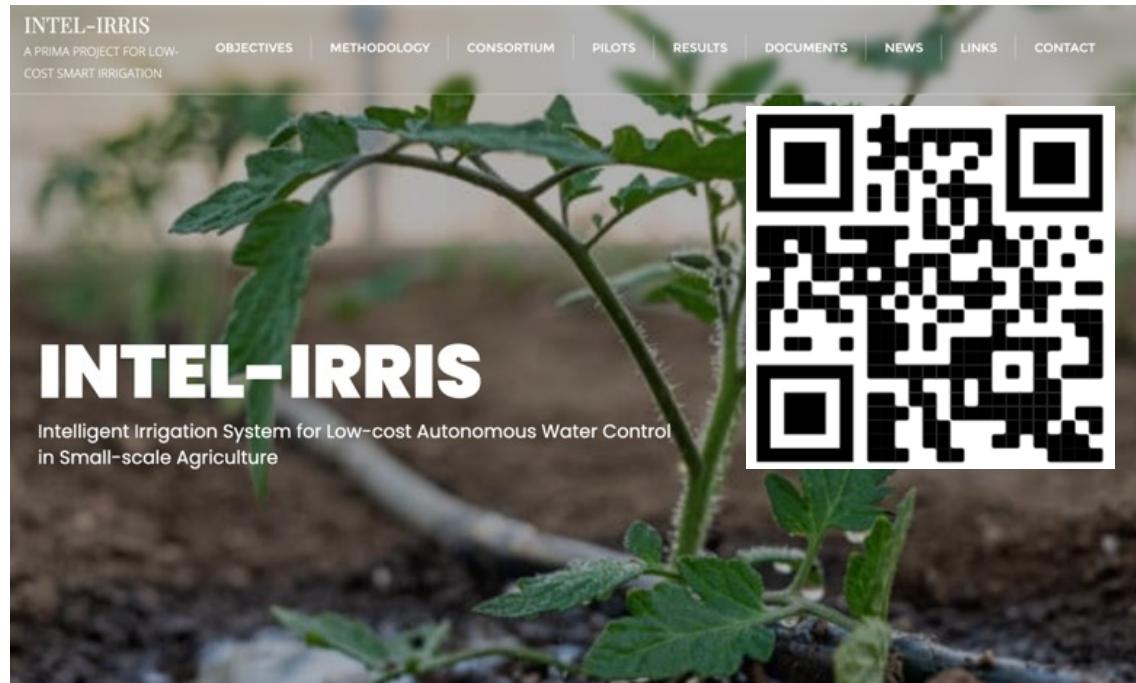
Prof. Congduc Pham  
<http://www.univ-pau.fr/~cpham>  
Université de Pau, France



# More information on INTEL-IRRIS



- Web site: <https://intel-irris.eu>



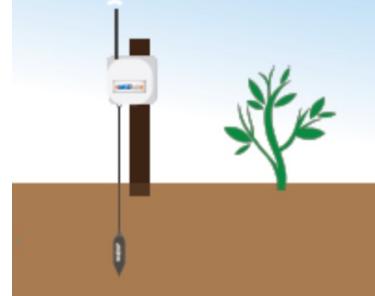
- Twitter: [https://twitter.com/Intel\\_IrriS](https://twitter.com/Intel_IrriS)



Intel\_Irris  
@Intel\_IrriS

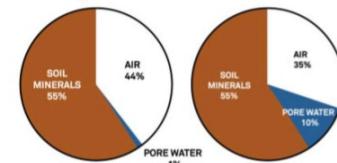
# Low-cost

## 1 Propose low cost but highly efficient water control systems for irrigation optimization



# Advanced technologies

**2** Use cutting-edge technologies to propose highly innovative systems yet simple to deploy and adapted to smallholders



# Autonomous Plug-&-Sense

**Seamless integration into existing irrigation system and/or local customs and practices**



# INTEL-IRRIS's starter-kit

○ From idea to reality!



# 2 versions of the soil device

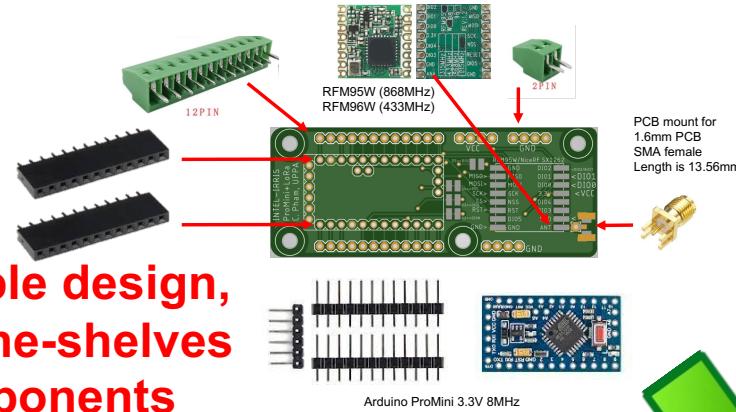


A soil temperature sensor can be added

Especially for tensiometer

# Key to low-cost design

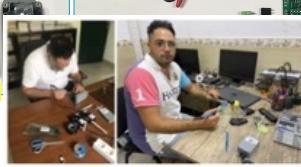
Simple design,  
off-the-shelves  
components



Easy integration



Low-cost  
approach



Technology transfer,  
Capacity building

Generic  
platform,  
easy  
adaptation



# Soil sensor: integration

~ 12€

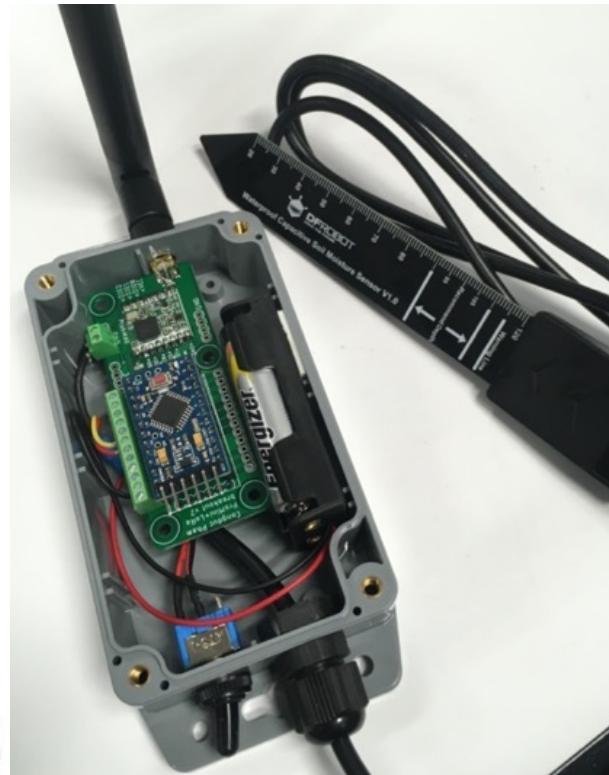
~ 38€



~ 10€

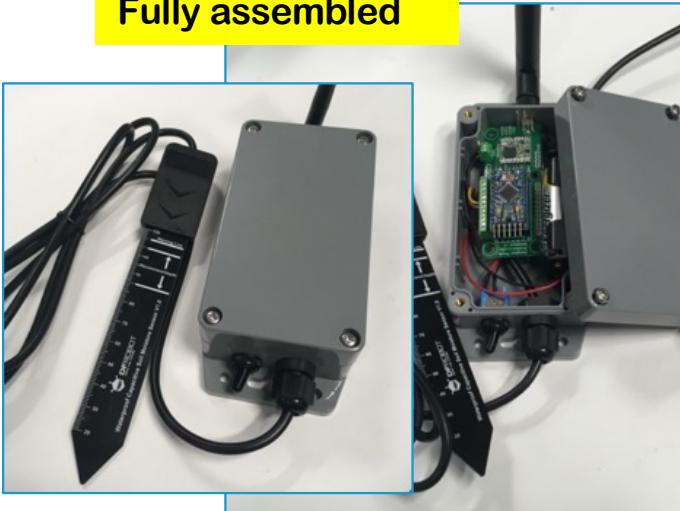


~ 2€



# Starter-kit...in kit!

Fully assembled



Packaging in enclosure



To be assembled

# Tutorial materials



Building the Intel-Irris LoRa IoT platform  
Part 1: soil sensor device



Building the Intel-Irris LoRa IoT platform  
Part 2: edge-enabled gateway (WaziGate)



Technologies de capteurs de mesure de l'humidité du sol pour le pilotage de l'irrigation:

Principe de fonctionnement, Calibrations et Performances

EL Aissaoui Abdellah (Ing. PhD)  
Institut National de La Recherche Agronomique  
Centre Régional de La Recherche Agronomique de Settat  
Laboratoire des Agroéquipements et Energie

30 Mars 2022



Building the Intel-Irris IoT platform  
Annex-1: ordering PCBs



Building the Intel-Irris LoRa IoT platform  
Part 3: the INTEL-IRRIS starter-kit



LES CAPTEURS FAIBLE COÛT POUR MESURER L'EAU DANS LE SOL:  
CONTRAINTE, LIMITATIONS ET PERSPECTIVES



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

INTEL-IRRIS – PRIMA 52 2020 – PROJECT ID 1960

Dr. Christian Hartmann  
M. Jean-François Printanier  
M. Mamadou Gueye  
M. Lotfi Smaili



Institut de Recherche pour le Développement  
christian.hartmann@ird.fr  
jean-francois.printanier@ird.fr



Irrigation : concepts et état des lieux



Présenté par : Dr. BOUAZZAMA Bassou  
Chercheur et Ingénieur en Génie Rural  
Bassou.bouazzama@ova.ma



L'eau dans le sol et les contraintes de l'irrigation

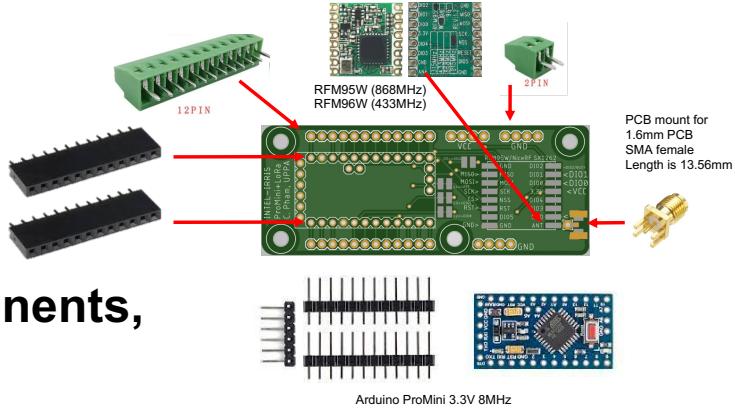
Pr BENKHELIFA Mohammed (UMAB)



# Low-cost design space

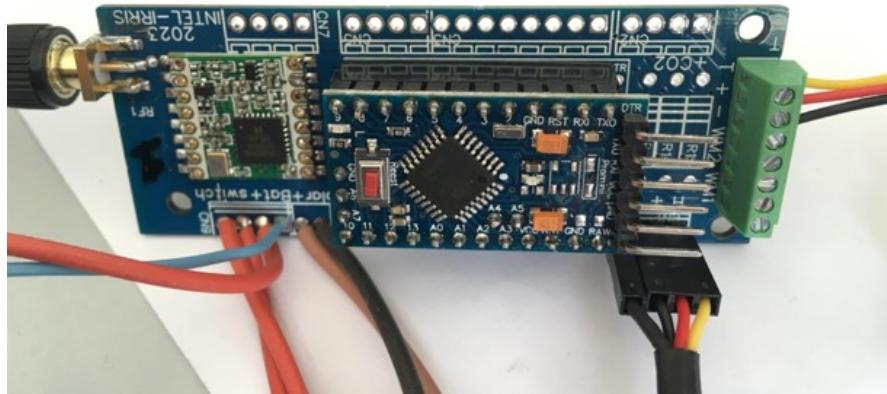
1

**Simple design, off-the-shelves components, 100% DIY**



**Simple design, off-the-shelves components, low-cost support for solar panel, some components already soldered, mixed-DIY**

2

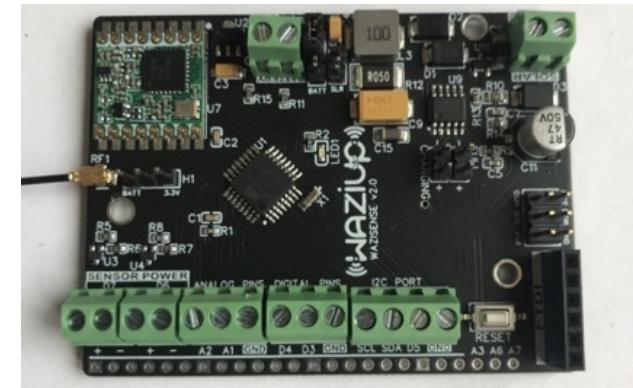
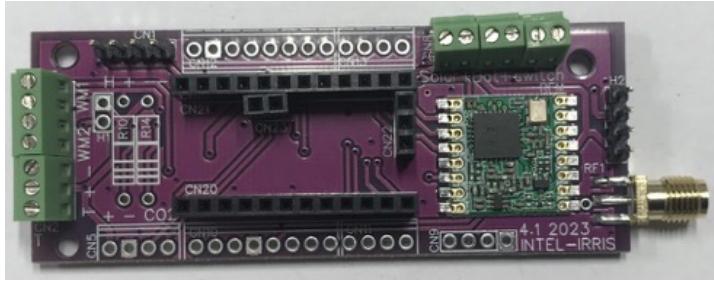


3

**Integrated design, off-the-shelves components, full support for solar panel, all components already soldered**



# Starter-kit v3



# Transmission to gateway

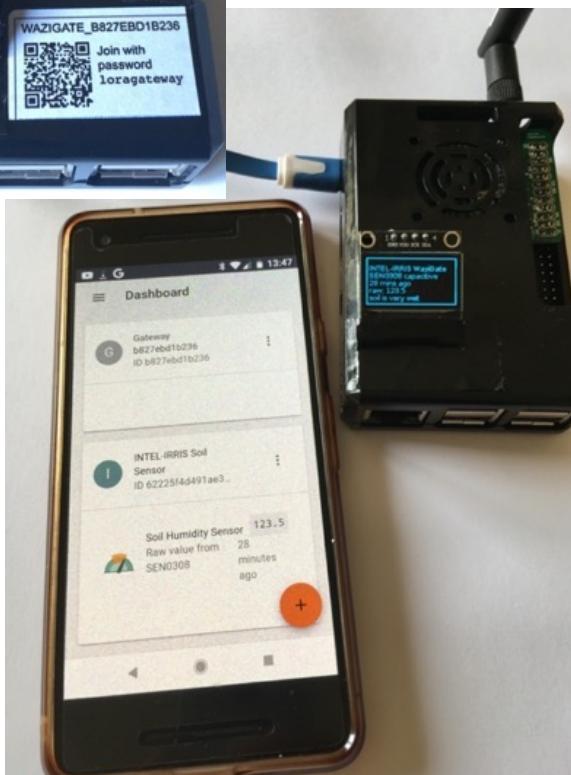
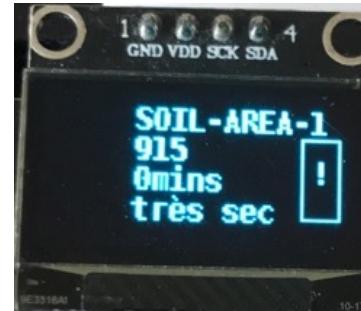
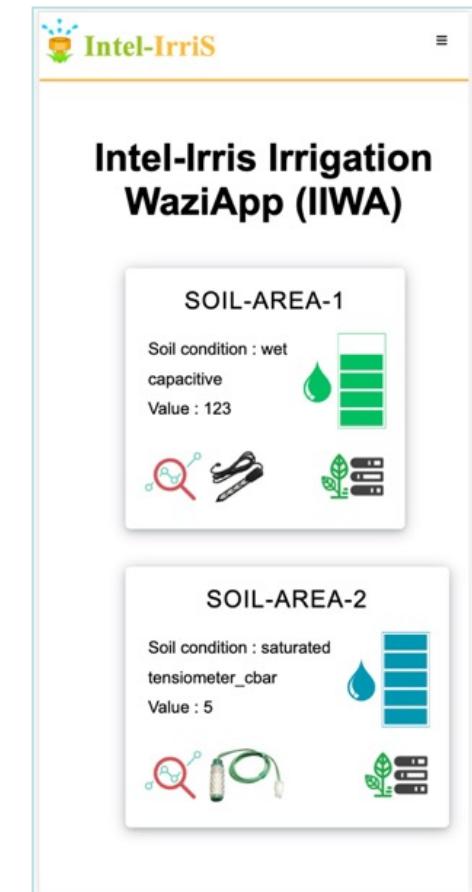


Parameters for  
INTEL-IRRIS gateway  
(default in red)

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



# INTEL-IRRIS gateway various User Interfaces

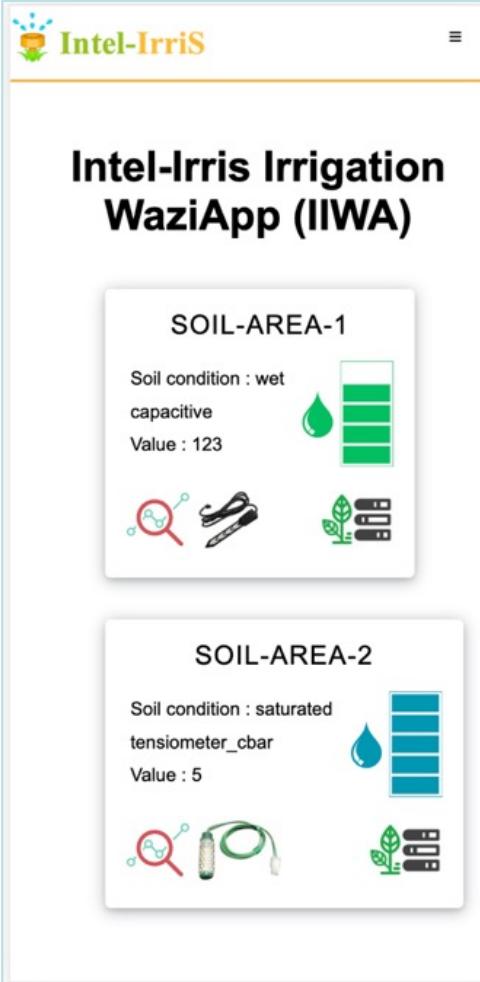



**Intel-Irris Irrigation WaziApp (IIWA)**

**SOIL-AREA-1**  
Soil condition : wet capacitive  
Value : 123

**SOIL-AREA-2**  
Soil condition : saturated tensiometer\_cbar  
Value : 5

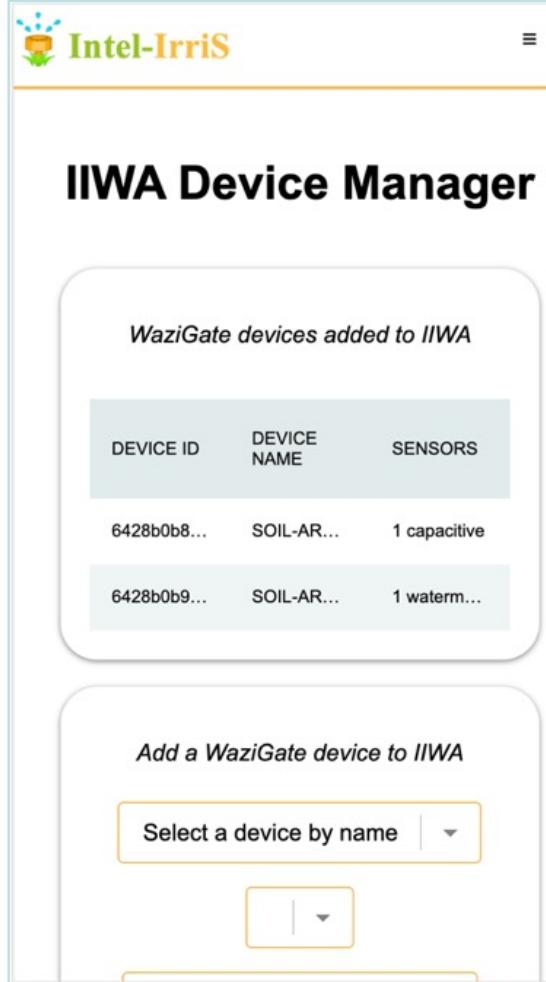
# IIWA screens & configuration



**Intel-Irris Irrigation WaziApp (IIWA)**

**SOIL-AREA-1**  
 Soil condition : wet capacitive  
 Value : 123

**SOIL-AREA-2**  
 Soil condition : saturated tensiometer\_cbar  
 Value : 5



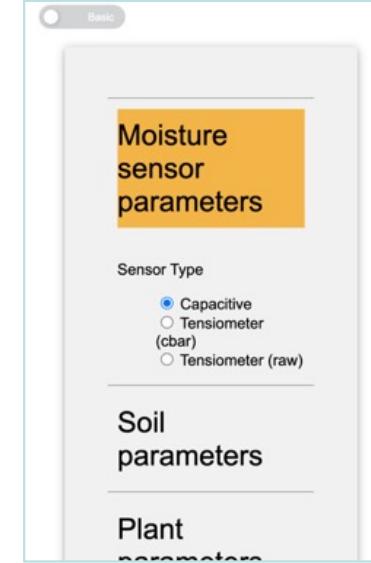
**IIWA Device Manager**

*WaziGate devices added to IIWA*

DEVICE ID	DEVICE NAME	SENSORS
6428b0b8...	SOIL-AR...	1 capacitive
6428b0b9...	SOIL-AR...	1 waterm...

*Add a WaziGate device to IIWA*

Select a device by name



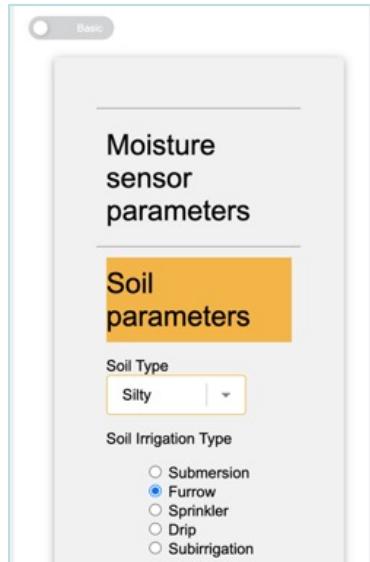
**Moisture sensor parameters**

Sensor Type

- Capacitive
- Tensiometer (cbar)
- Tensiometer (raw)

**Soil parameters**

**Plant parameters**



**Moisture sensor parameters**

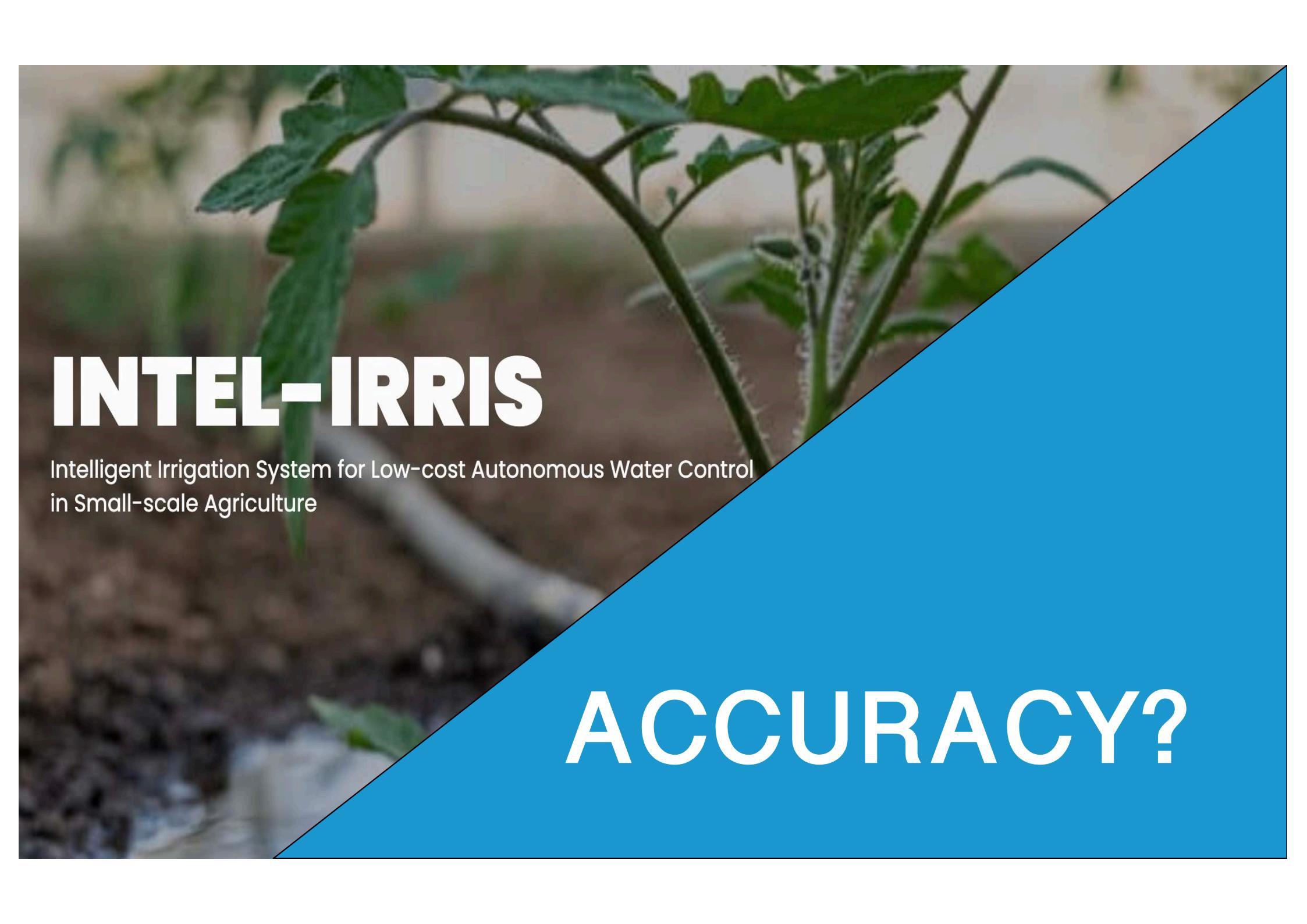
**Soil parameters**

Soil Type

Silty

Soil Irrigation Type

- Submersion
- Furrow
- Sprinkler
- Drip
- Subirrigation

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

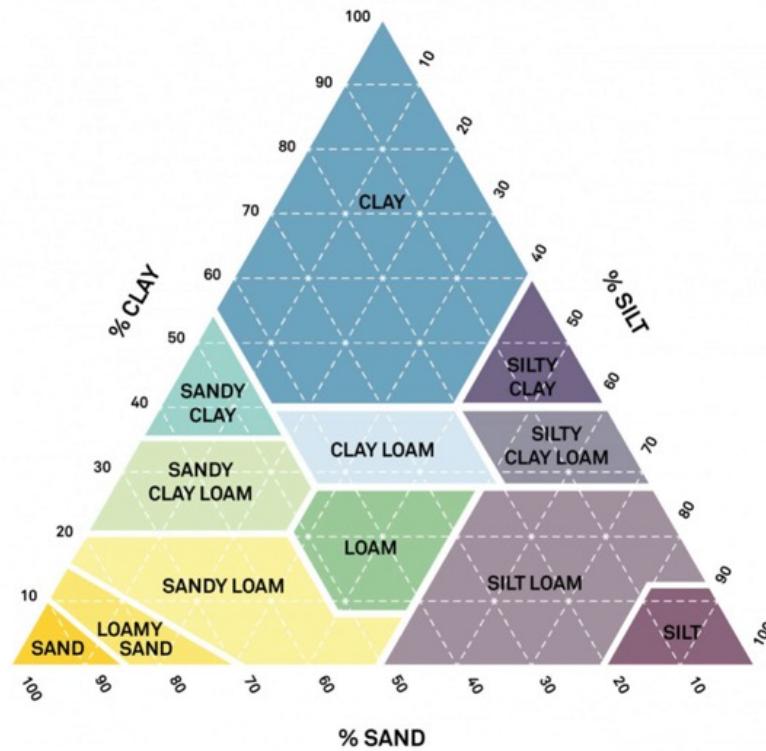
# INTEL-IRRIS

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

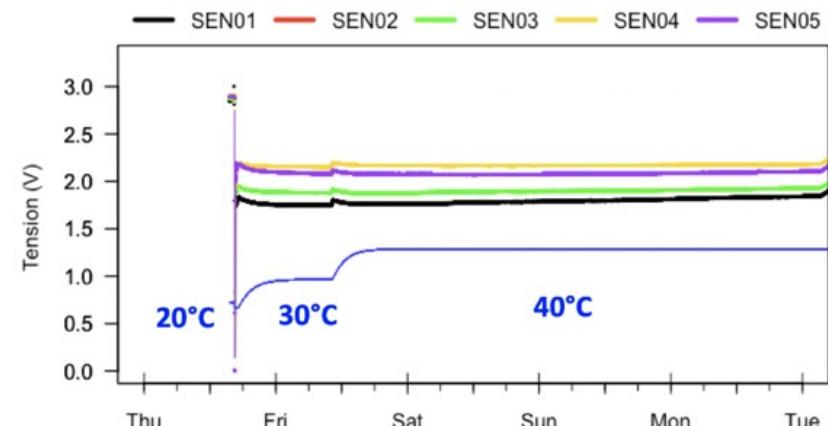
# ACCURACY?

# Calibration

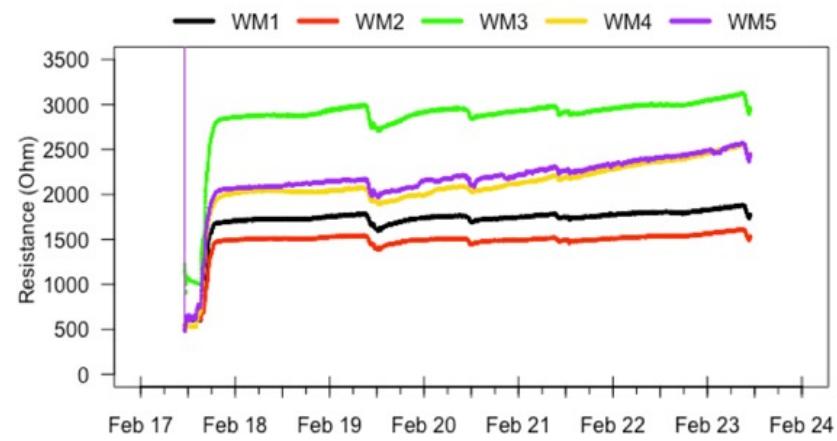
- Soil-specific calibration
- Impact of external "noise"



**SEN 0308**



Ambient air emperature has low impact, except...



# Piloting farms, visits, deployment,...



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

