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

Système intelligent, autonome et à faible coût pour optimiser l'irrigation dans les petites exploitations agricoles

Intel-IrriS

The INTEL-IRRIS starter-kit targeting smallholder farmers

Prof. Congduc Pham

http://www.univ-pau.fr/~cpham

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

LIUPPA

European Commission | Horizon 2020 European Union funding for Research & Innovation

WAZIUP

IoT – from idea to reality

WAZIHUB

HUBiquitous

Paving for the next 10 years of innovation in IoT and AI

PRIMA PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

Intel-IrriS RESILINK

Advanced and disruptive IoT/AI technologies targeting the smallholder community for increased resilience

PRIMA S2 2020 INTEL-IRRIS

https://prima-med.org/

- **P**artnership for **R**esearch and **I**nnovation in the **M**editerranean **A**rea
- R&I approaches to improve water availability and sustainable agriculture distressed by climate change, urbanisation and population growth
- **Appel à projet: Section 2 Multitopic 2020**
- Thematic Area 1-Water management
  - Low cost, lean solutions for enhancing irrigation efficiency of small-scale farms

AUA: Agricultural University of Athens — Greece

ENSA-Safi: National School of Applied Sciences – Safi — Morocco

INRA: National Institute of Agronomic Research — Morocco

IRD: Institute for Research & Development — France

UMAB: University A. Benbadis — Algeria

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UPPA: University of Pau & Adour Country — coordinator — France

WAZIUP eV: WAZIUP association — Germany

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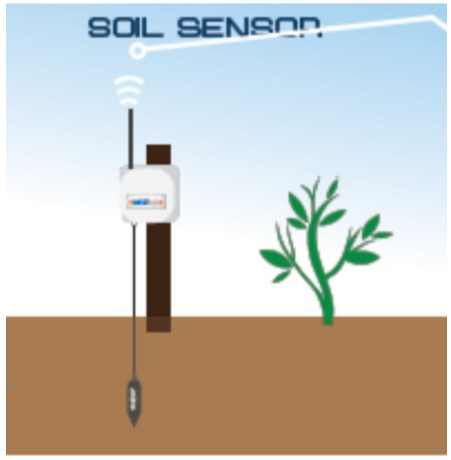
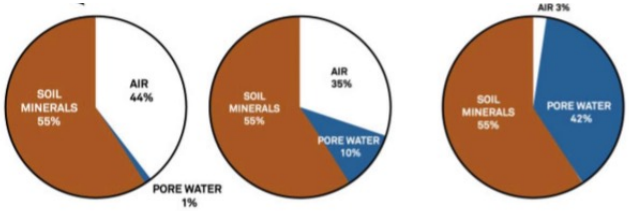
Irrigation with soil moisture sensing





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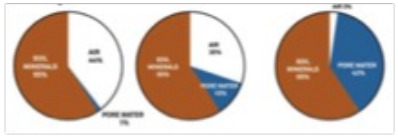
Not as simple as it seems ☹



Volumetric Water Content, Water Potential, Water Tension,…

TDR, FDR, capacitance, resistance, ….

Soil characteristics: bulk density, soil salinity, soil texture & soil type

Evapotranspiration, soil-plant-atmosphere continuum,…

Irrigation type: drip, furrow, sprinkler,…

Plant/Crop varieties

Relationship with other agriculture inputs

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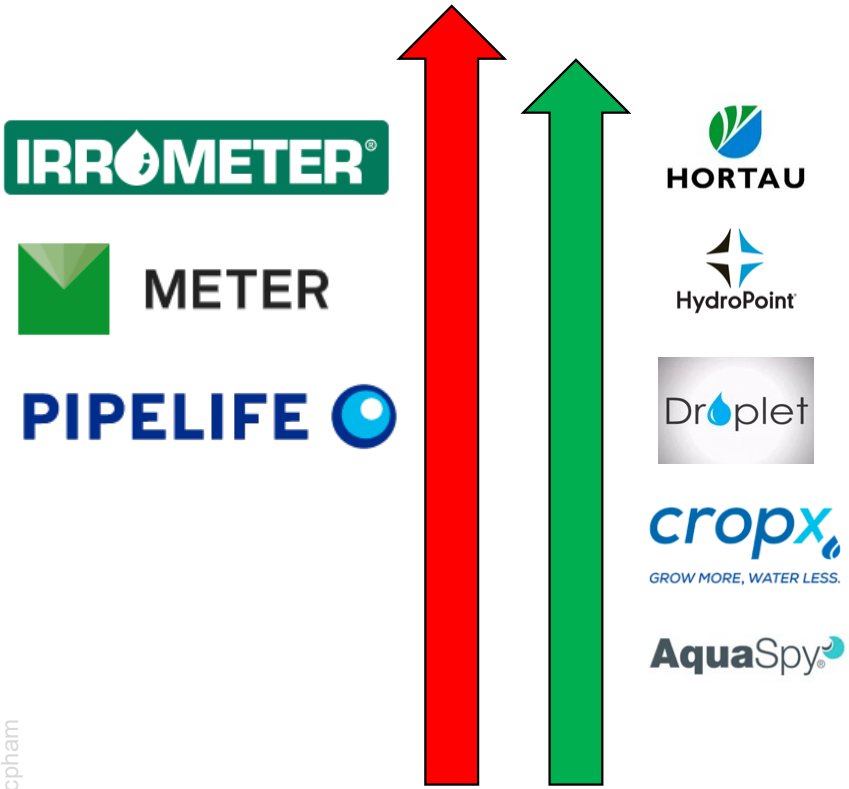
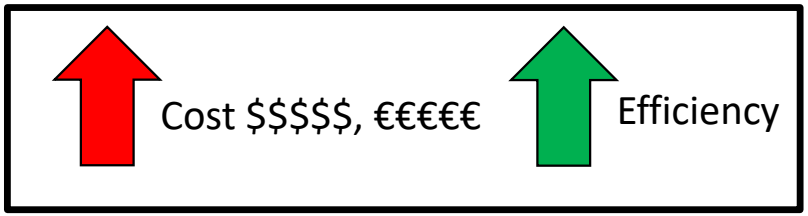
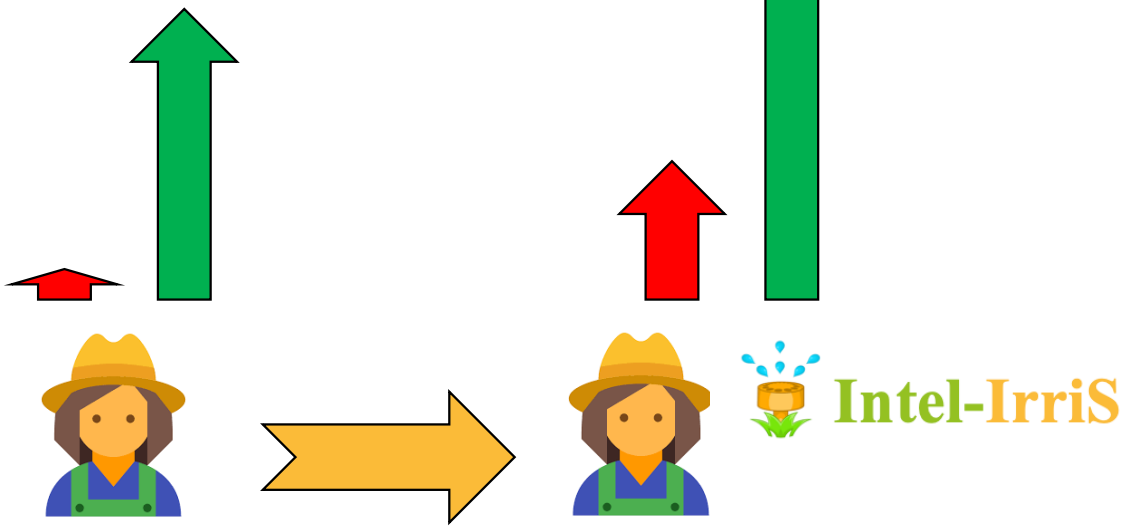
It is always a tradeoff…



High-end systems, dedicated hardware,…

Big companies with high expertise, targeting large-scale farms





Smallholder Farmers

Smallholder Farmers

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INTEL-IRRIS starter-kit

- At the beginning: an idea…
- "Intelligent Irrigation in-the-box", "plug-&-sense"

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INTEL-IRRIS starter-kit

- "Intelligent Irrigation in-the-box", "plug-&-sense"
- From idea to reality!

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2 versions of the soil device

A soil temperature sensor can be added

~ 30€

SEN0308
capacitive sensor

~ 60€

Watermark WM200
Water tension sensor

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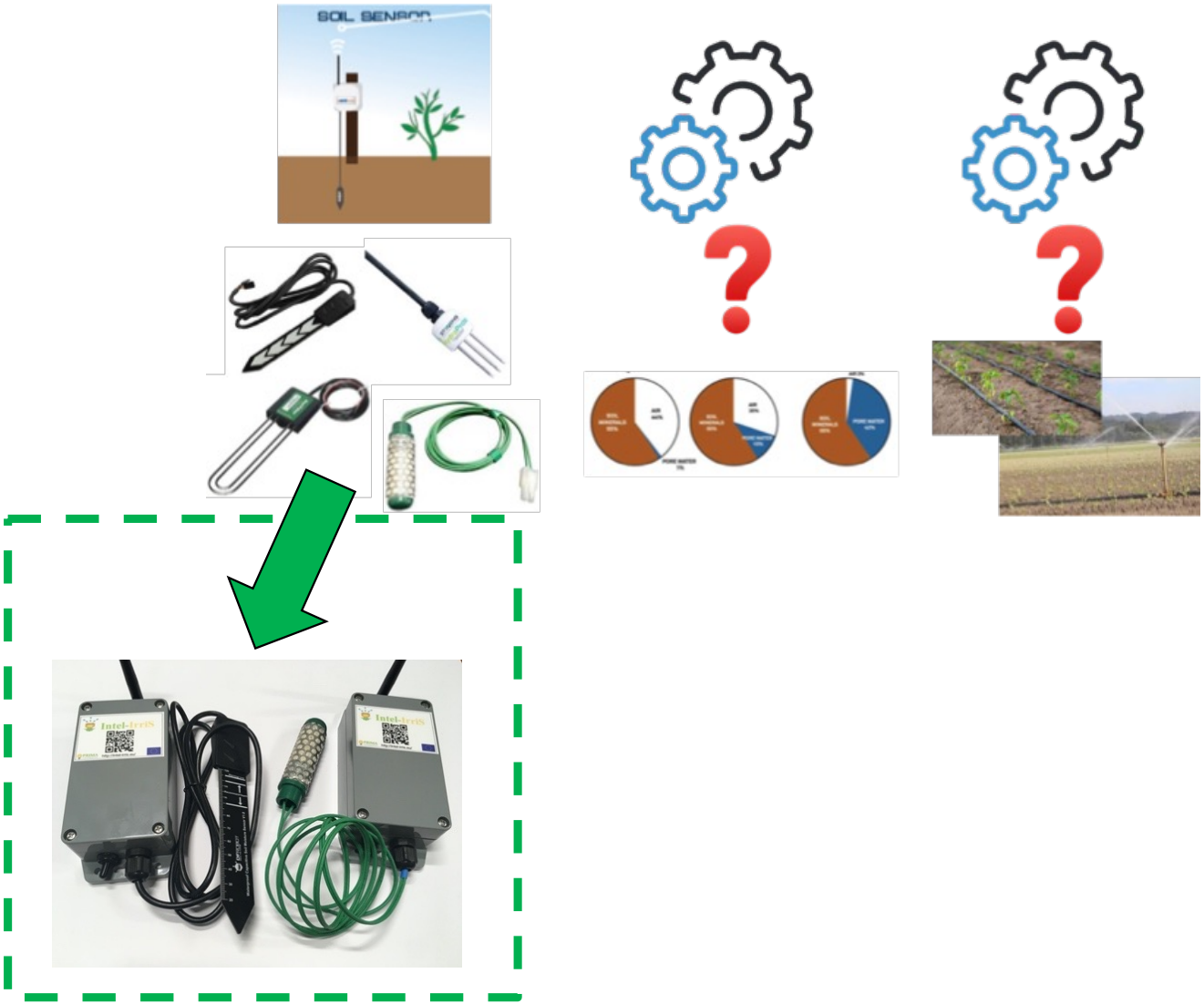
INTEL-IRRIS: sensing node part



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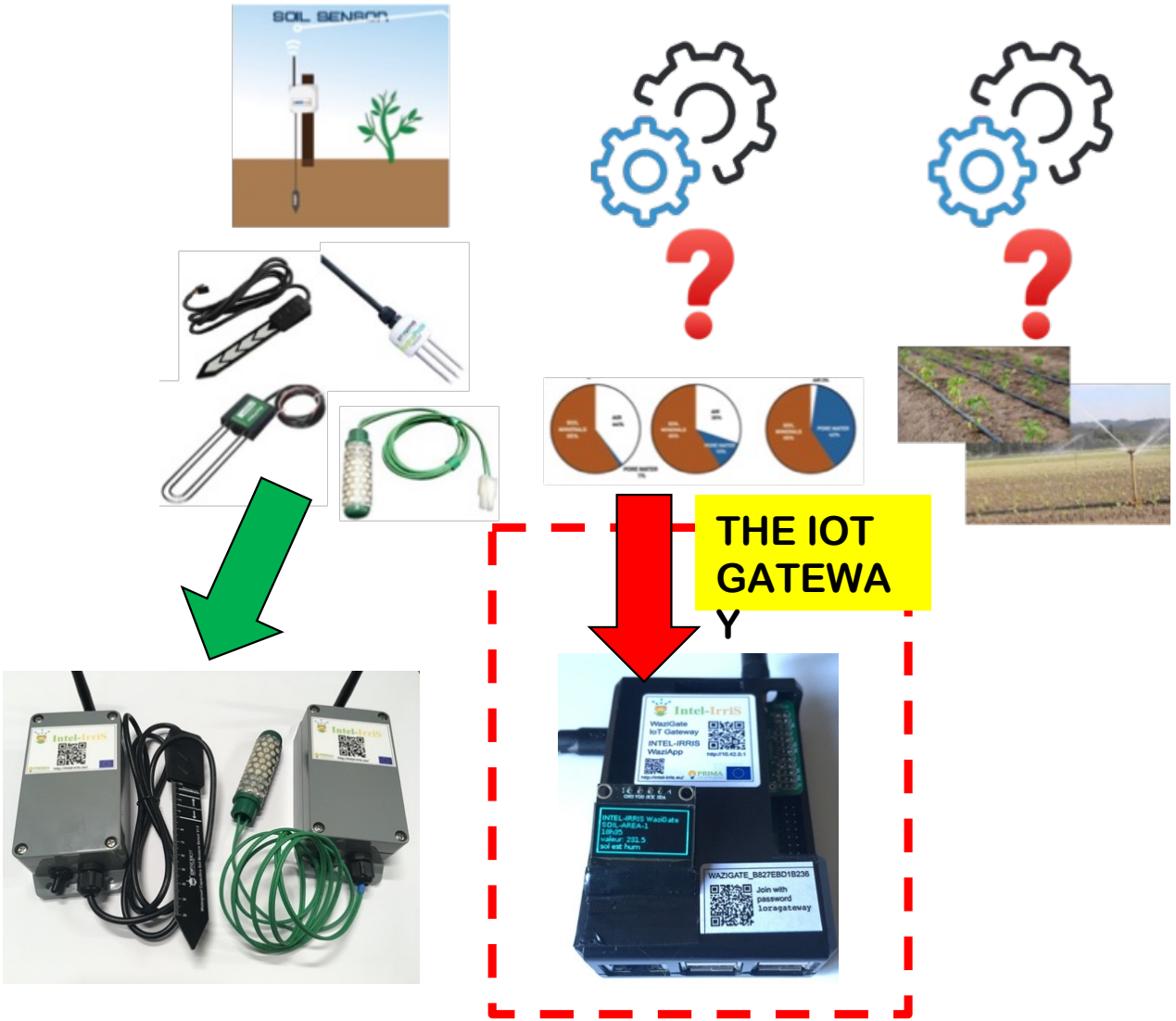
INTEL-IRRIS: gateway part



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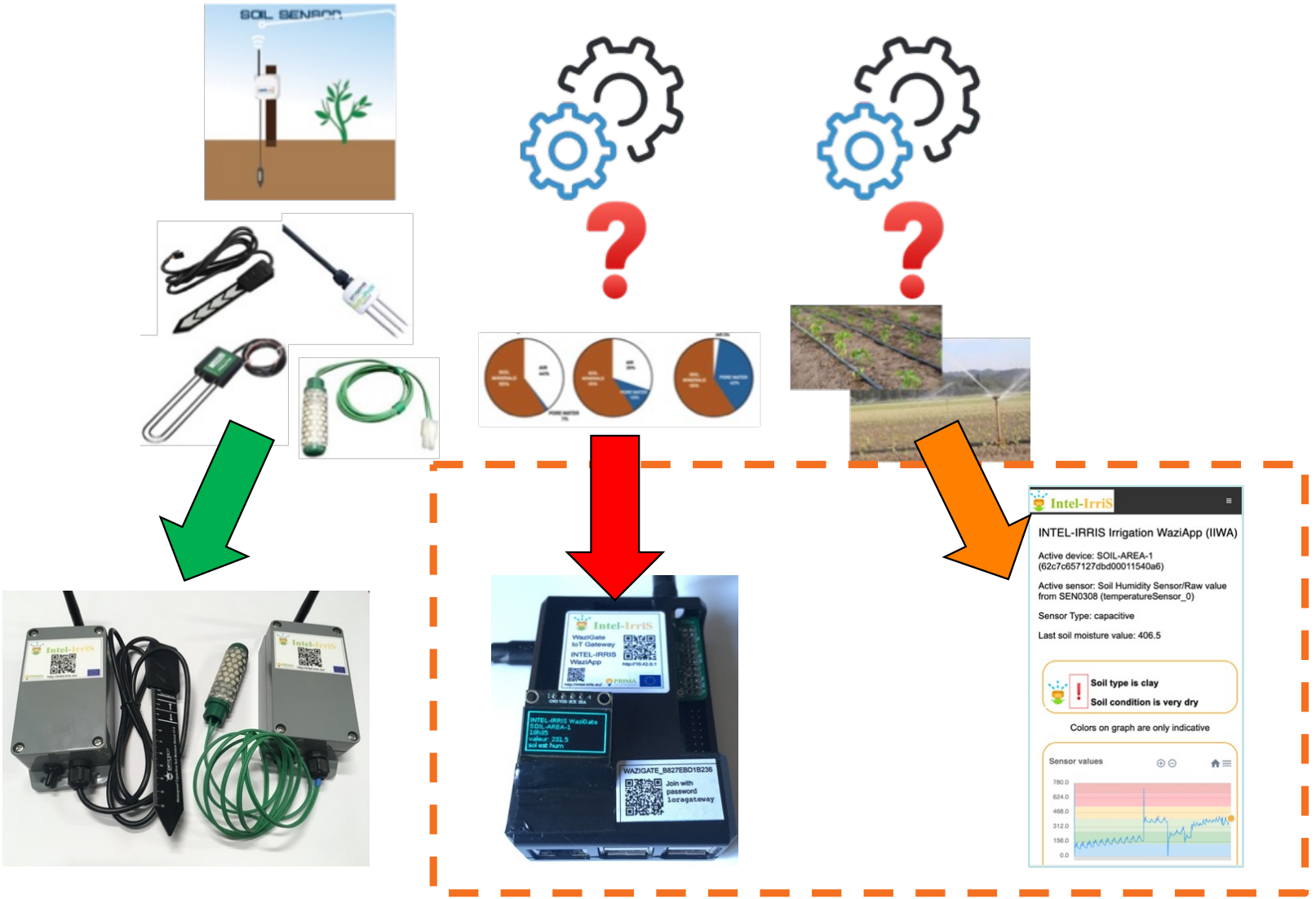
INTEL-IRRIS: add intelligence



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Deployment

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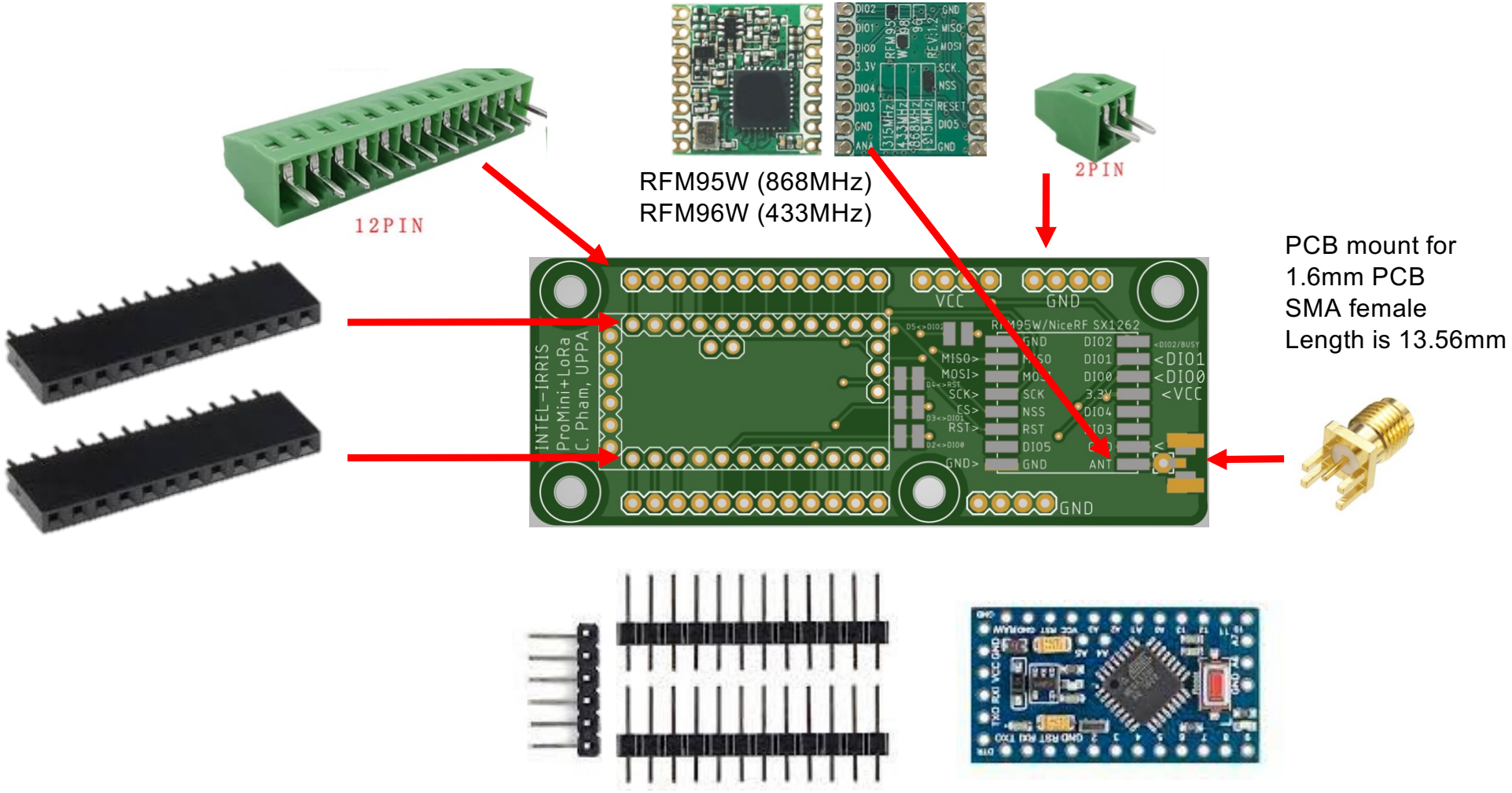
Soil sensor: electronic parts



Arduino ProMini 3.3V 8MHz

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Soil sensor: integration

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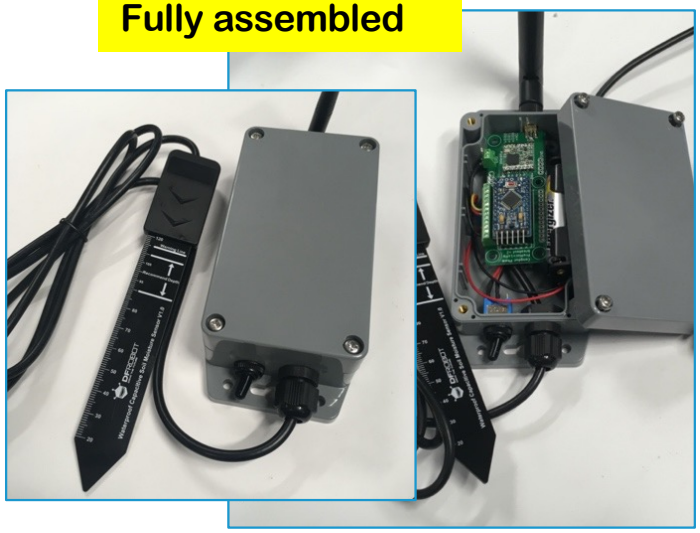
Soil sensor…in kit!

Fully assembled



Packaging in enclosure

To be assembled

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A generic plateform

- Low-cost: < 20€
- Off-the-shelves composants
- Easily duplicated
- Assembling by local partners
- Can connect several sensors
- Can be adapted by local partners

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Available tutorials

- Instructional videos provide technical information for local partners to build locally the soil sensor devices

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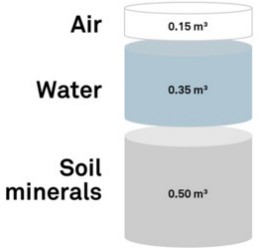
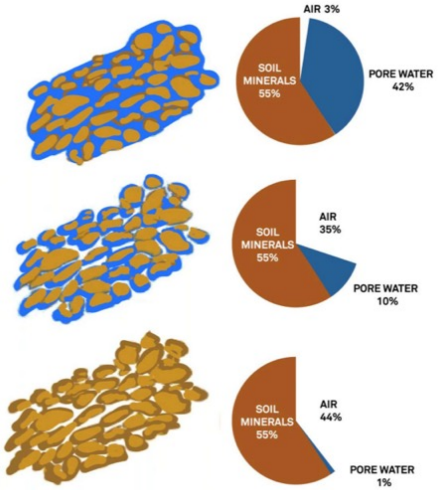
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture

ACCURACY?

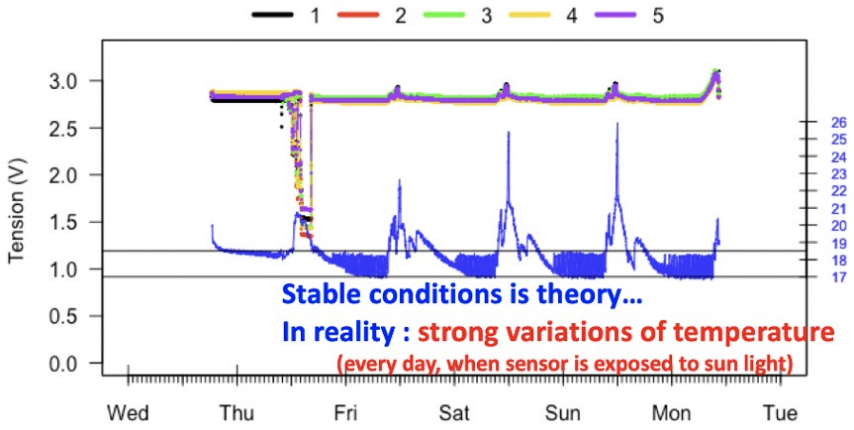
Capacitive sensor





From METER group

- Capacitive soil moisture sensors usually measure volumetric water content
- Soil density & soil texture are important parameters



Impact of temperature ?

IRD in conducting extentise test on the accucary and the stability of the low-cost SEN0308 capacitive sensor

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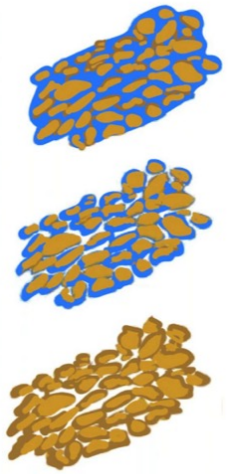
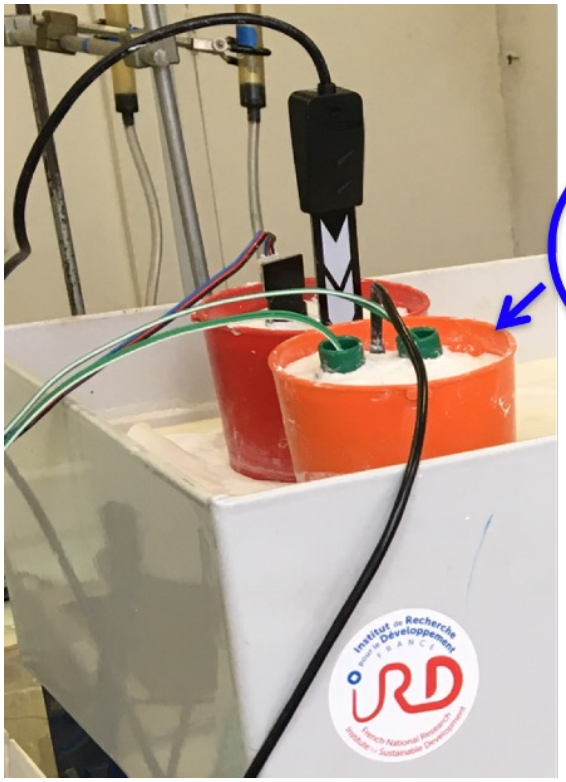
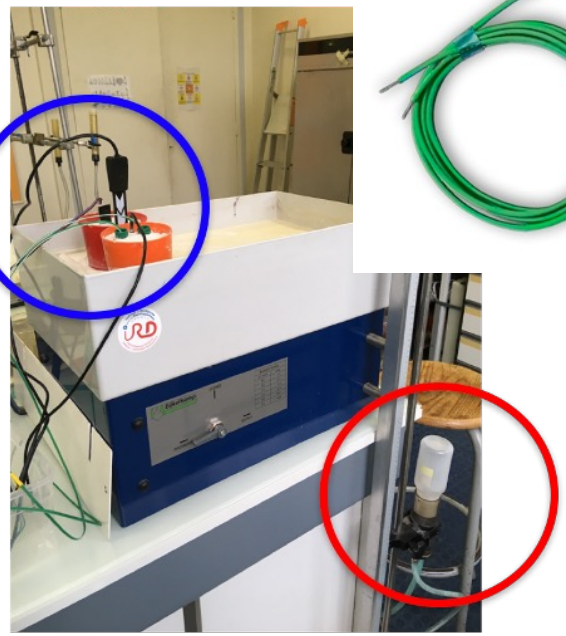
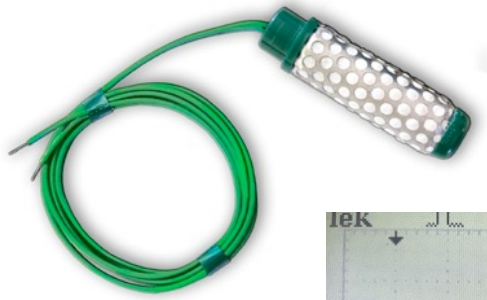
Water tension sensor

- Water tension sensor measures the amount of force required to extract water from soil's pores

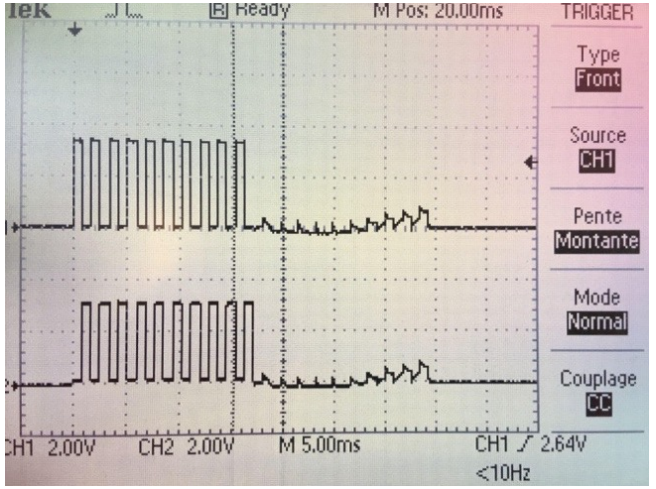








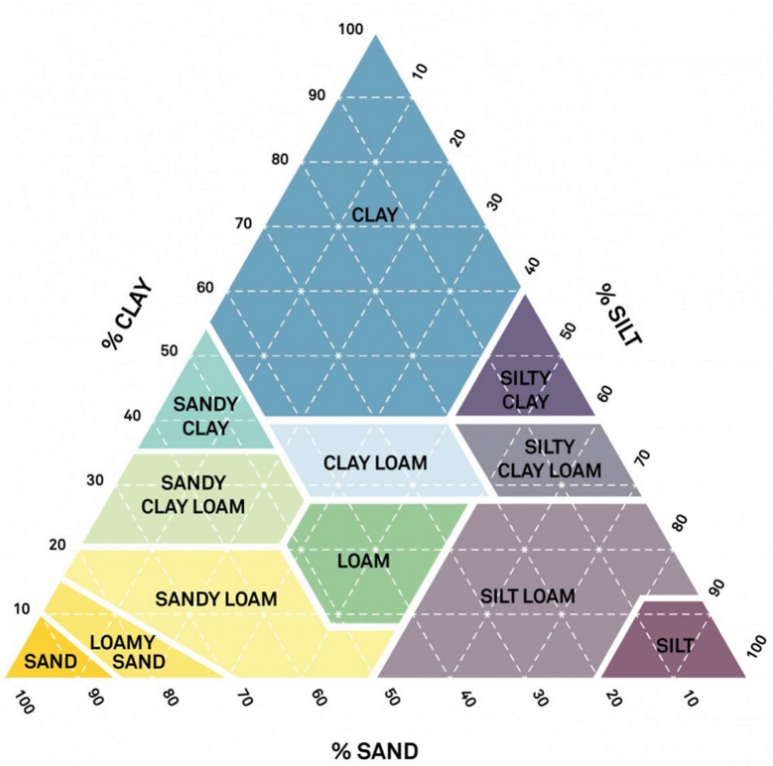
From METER group

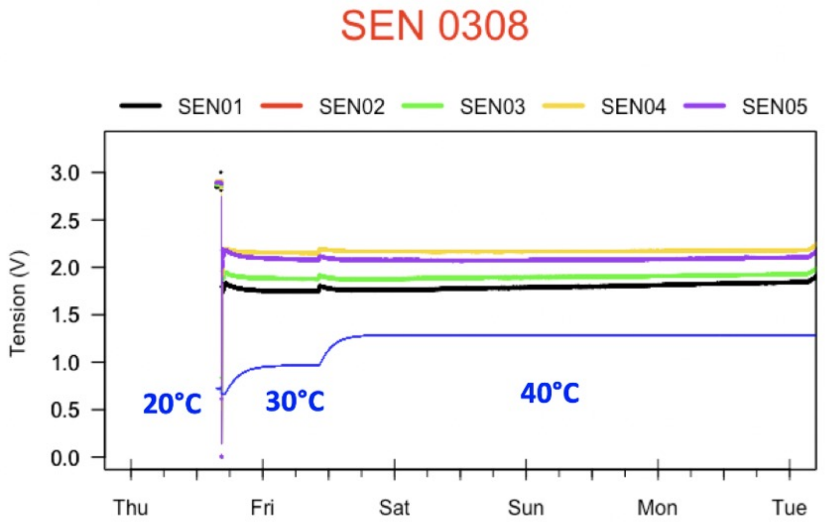


IRD in conducting extensive tests on the stability & suitability of microcontroller-based usage of the Watermark water tension sensor

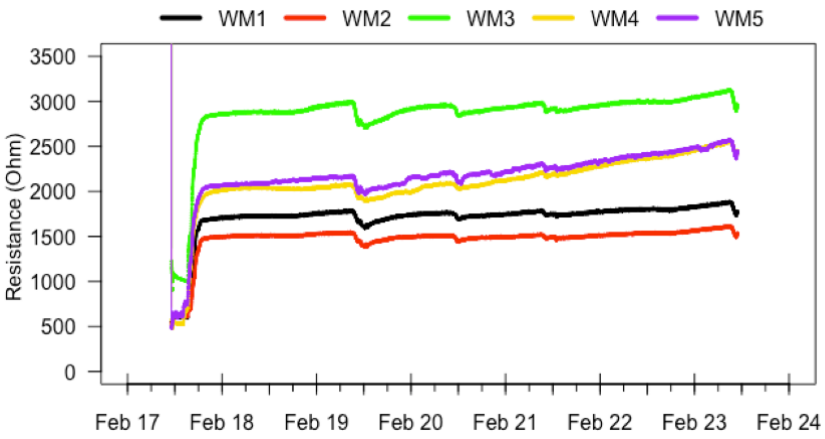
Calibration

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





Ambient air emperature has low impact, except...



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INTEL-IRRIS

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

AUTONOMOUS?

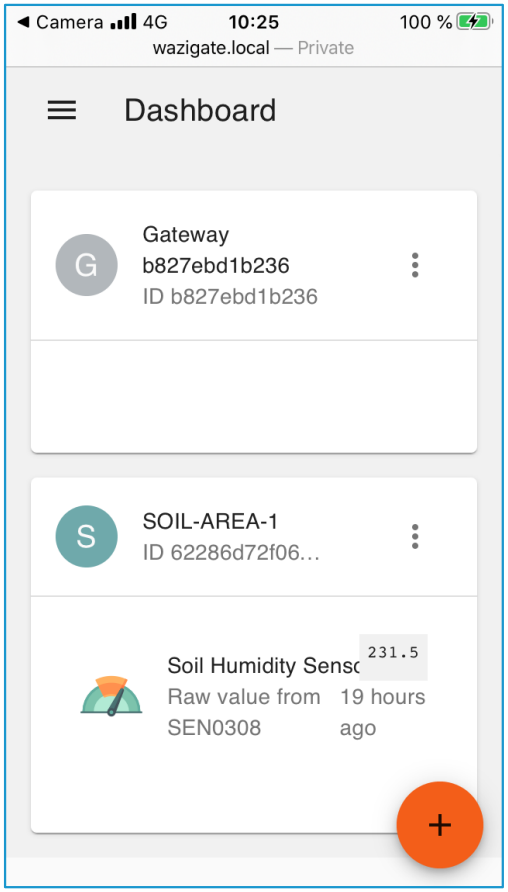
Gateway: collect sensor data

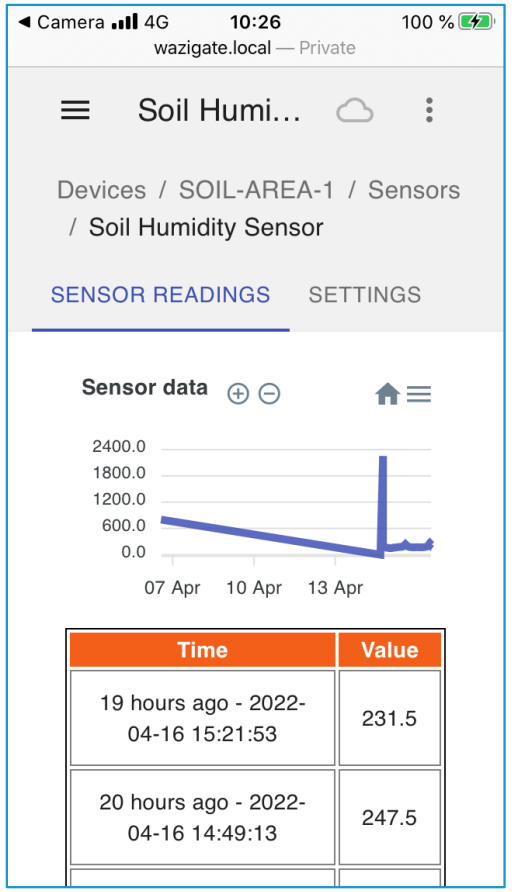
WAZIGATE GATEWAY

FULL EDGE-COMPUTING (NO INTERNET)

ALL DATA PROCESSING CAN BE DONE LOCALLY

EMBEDDED WEB INTERFACE





1 GATEWAY HANDLES SEVERAL DEVICES

< 50€

ACCESSED FROM A SMARTPHONE

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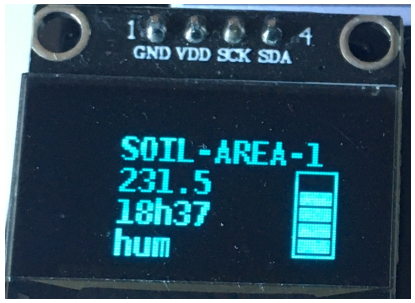
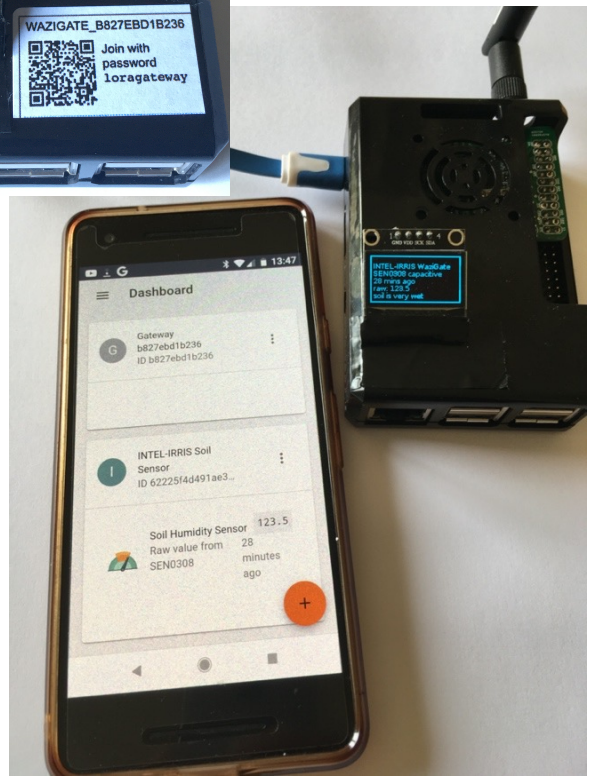
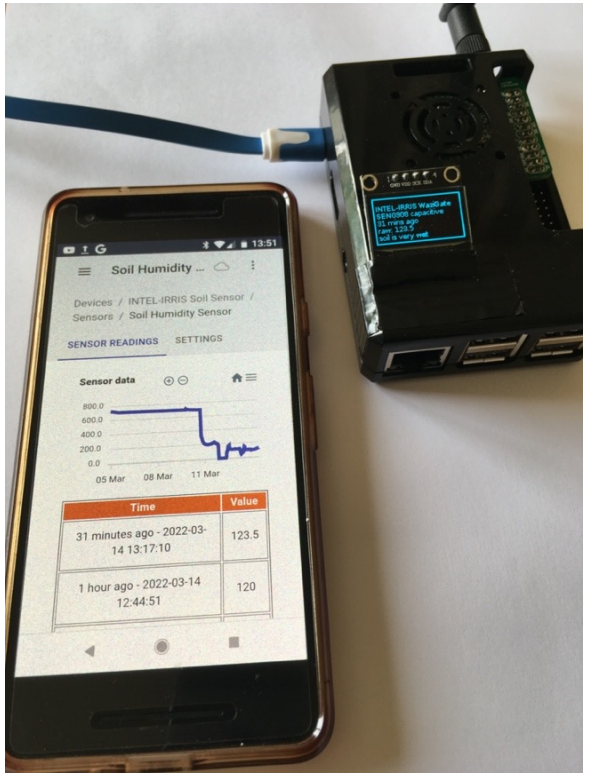
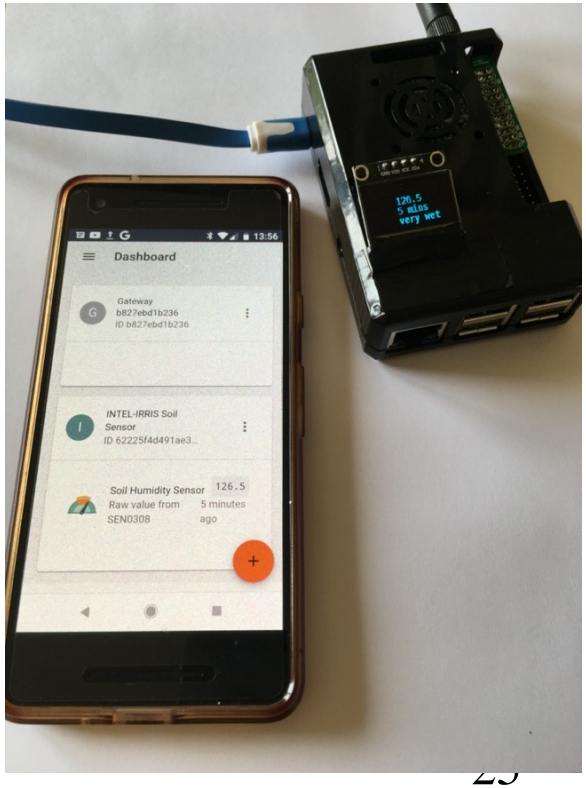
User interfaces









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INTEL-IRRIS starter-kit

- "Intelligent Irrigation in-the-box", "plug-&-sense"
- From idea to reality!

< 90€

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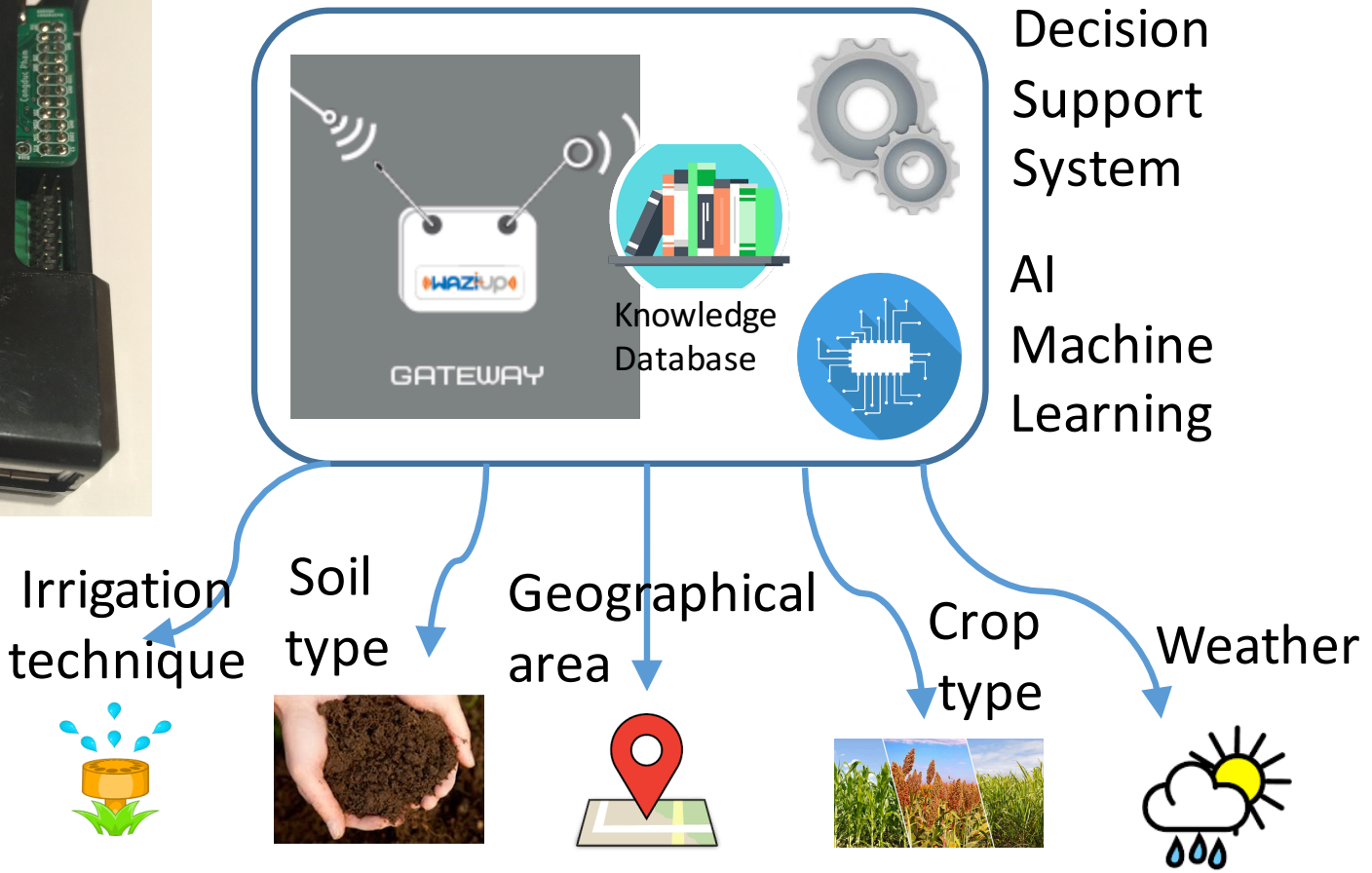
INTEL-IRRIS

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

SMARTER?

Embedded intelligence



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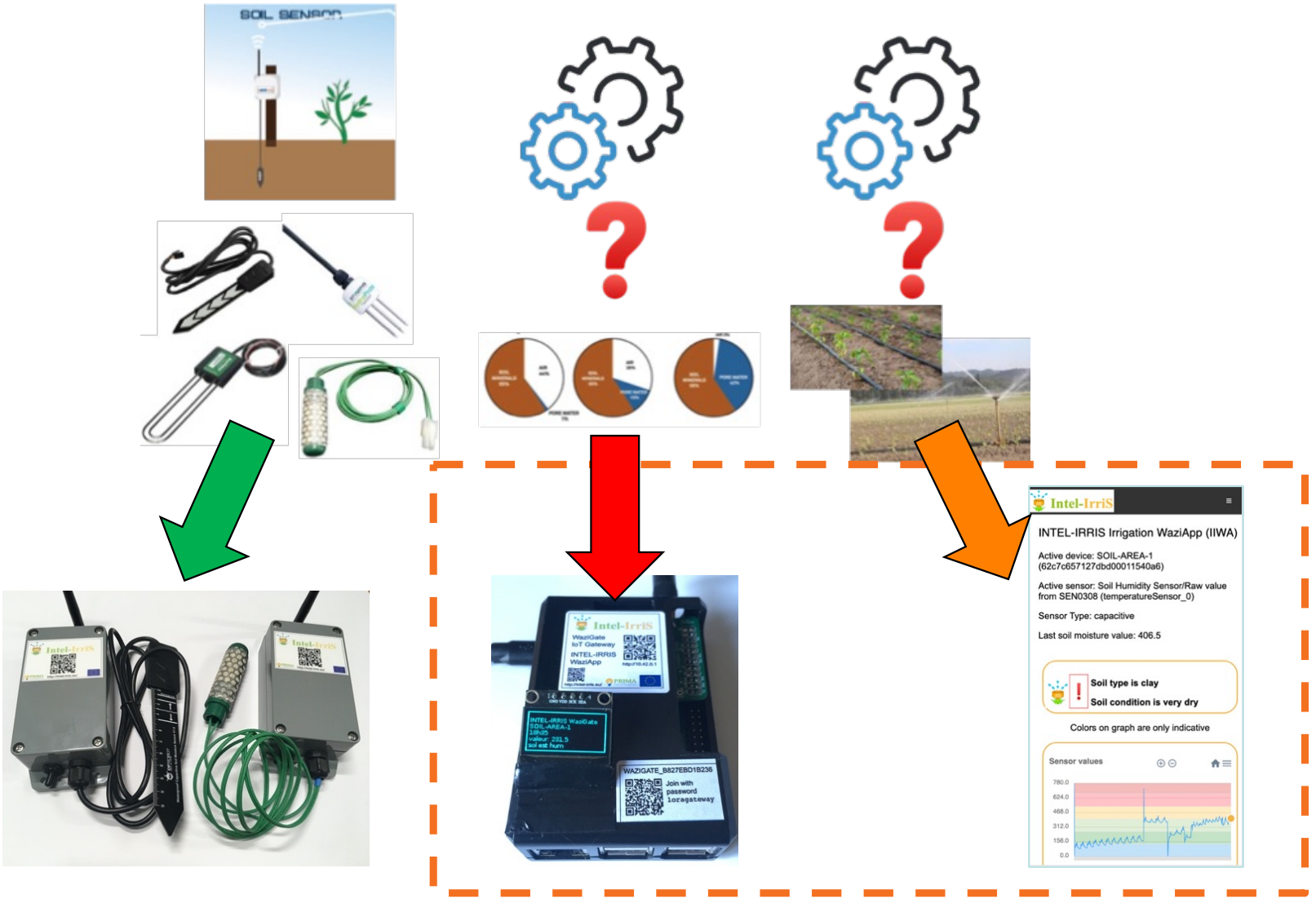
INTEL-IRRIS: add intelligence



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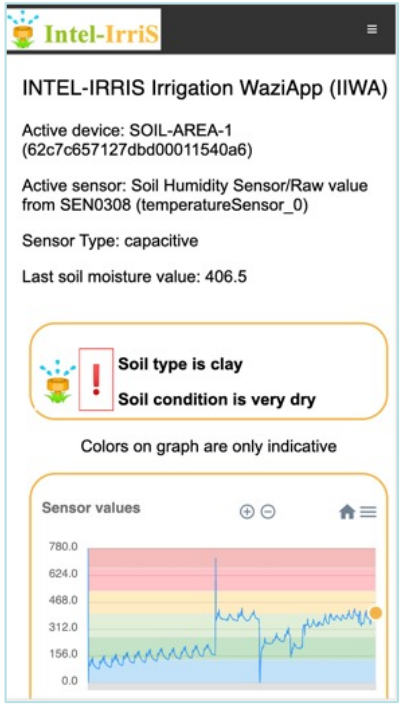
INTEL-IRRIS Irrigation WaziApp

- Embedded application running on the INTEL-IRRIS WaziGate
- Included in the starter-kit to implement the "intelligent Irrigation in-the-box" & "plug-&-sense" approach
- Enhances the irrigation indication by applying sensor calibration models with soil/plant/weather parameters



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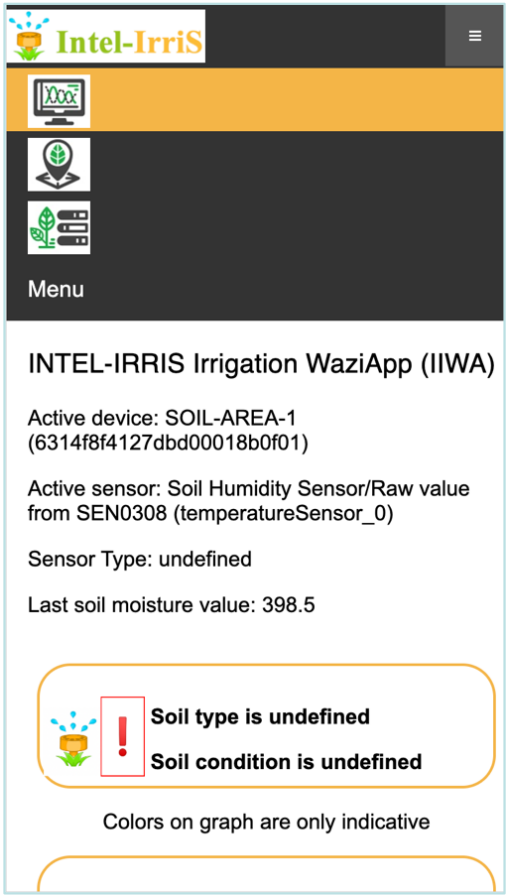
IIWA main screens

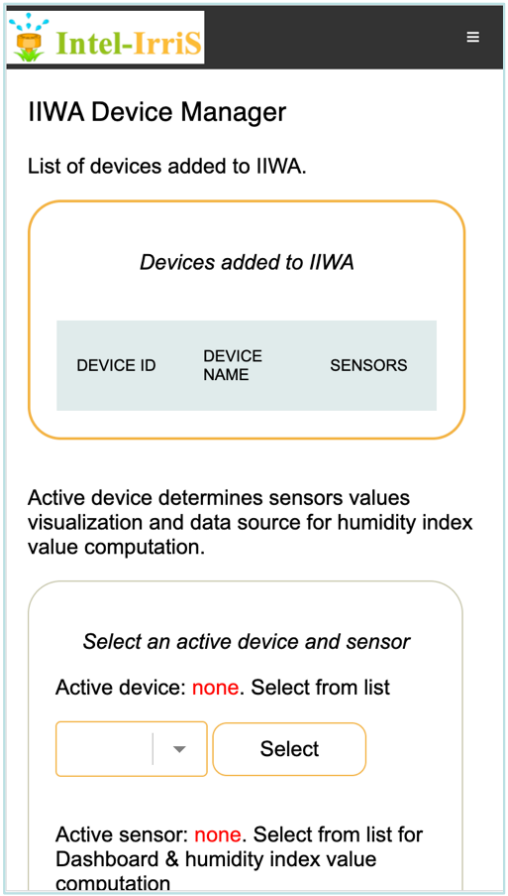
- Dashboard, Device Manager and Sensor Configuration

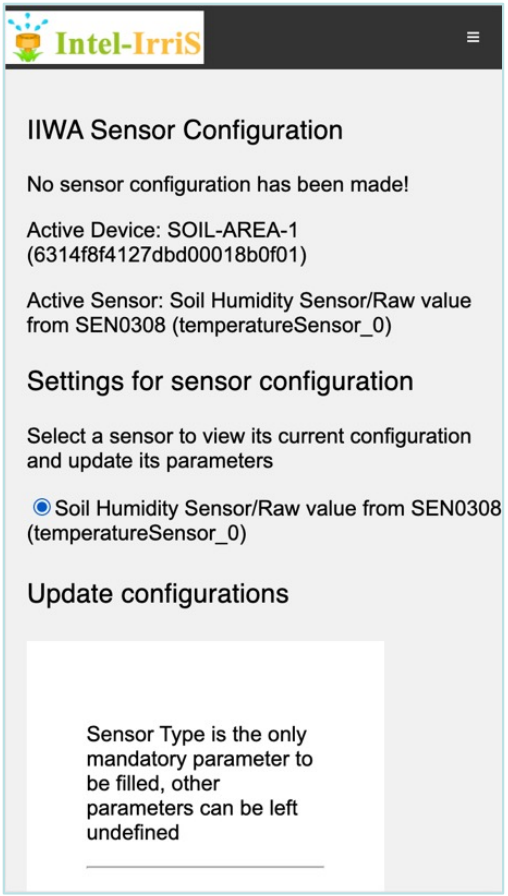
Dashboard →

Device Manager →

Sensor Configuration →







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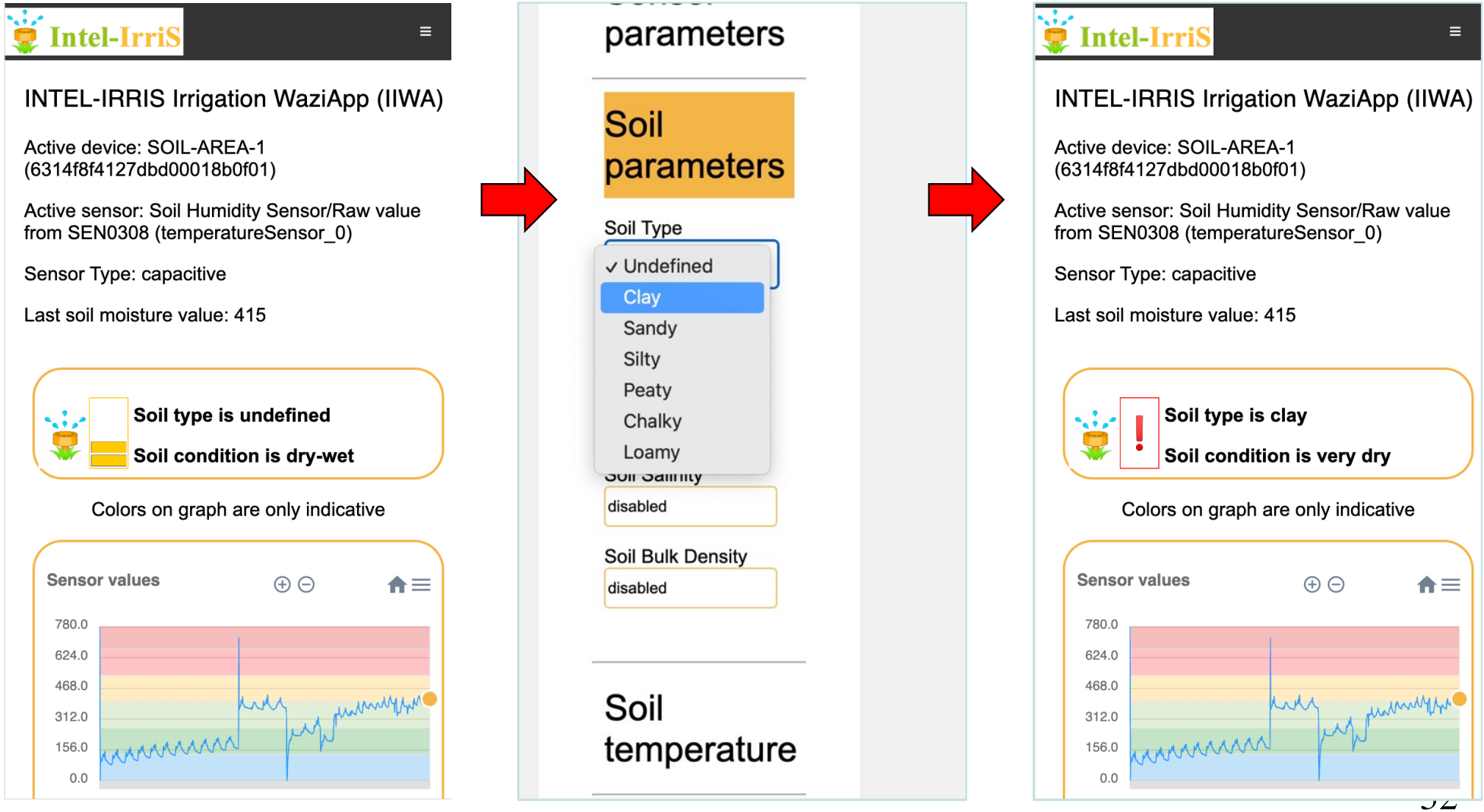
Example



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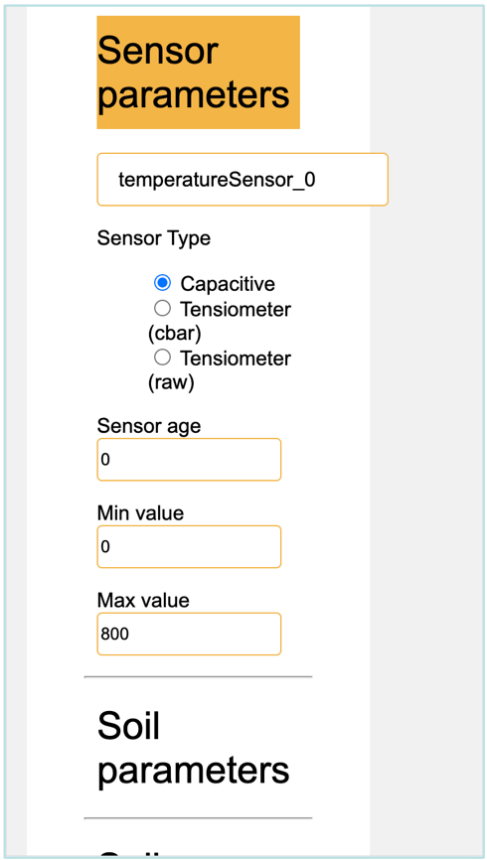
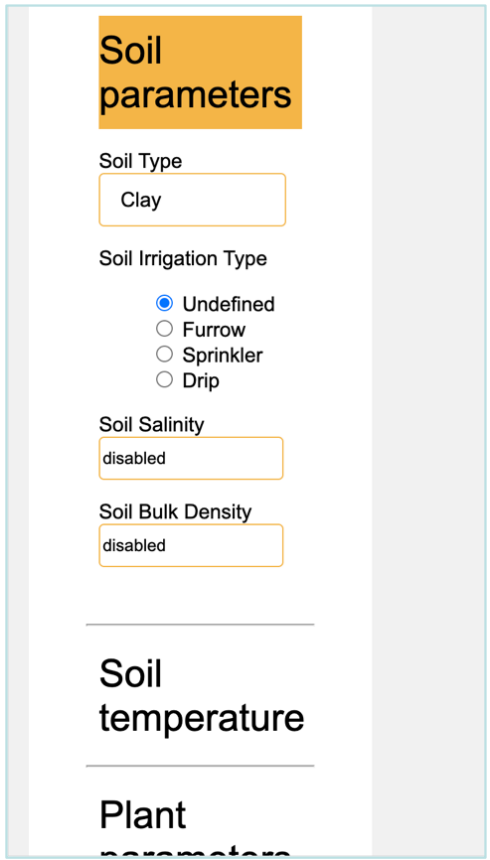
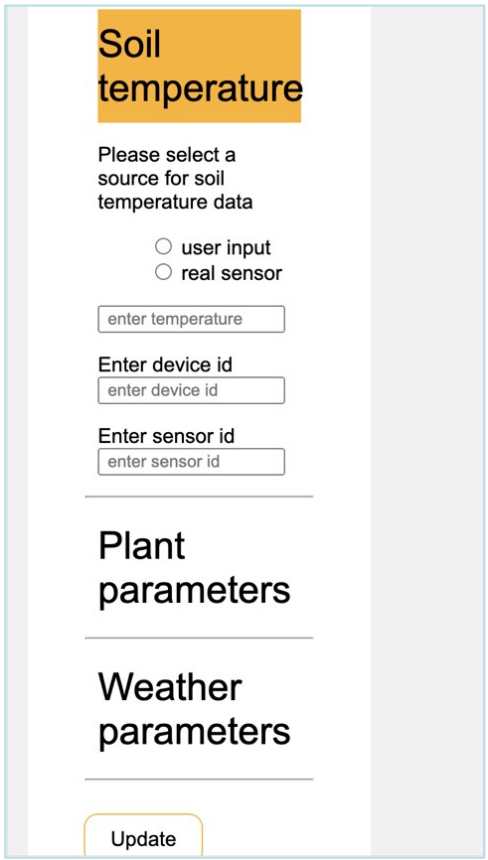
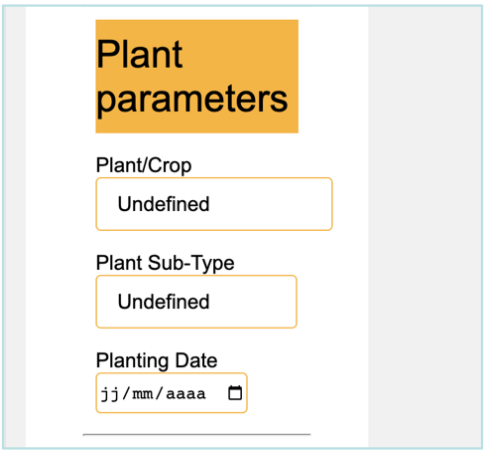
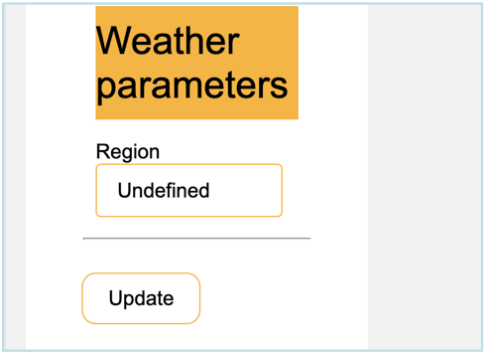
List of advanced parameters











More parameters will be integrated in IIWA during the INTEL-IRRIS project

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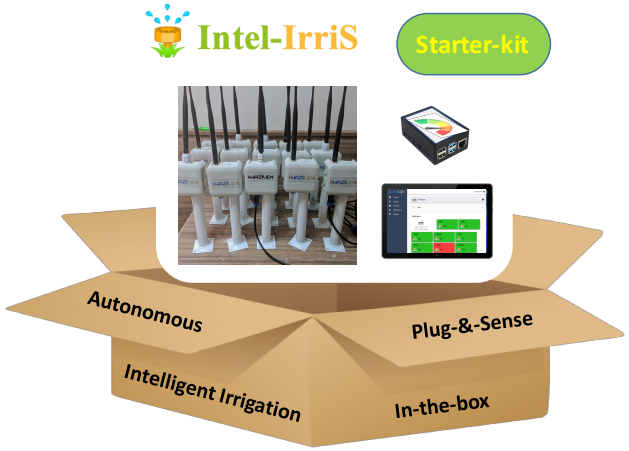
INTEL-IRRIS

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

PILOTING

Smallholder Piloting Program

- Participatory approach to co-design & test the innovative solutions in fields
- Take into account region-dependent technical, agricultural, social, climatic and environmental aspects
- Will run for 30 months to ensure that the proposed irrigation systems are well tailored for the specificities of the regional context
- 9 farms already enrolled to participate in the Piloting Program
- Scale-up to involve at least 20 small-scale farms



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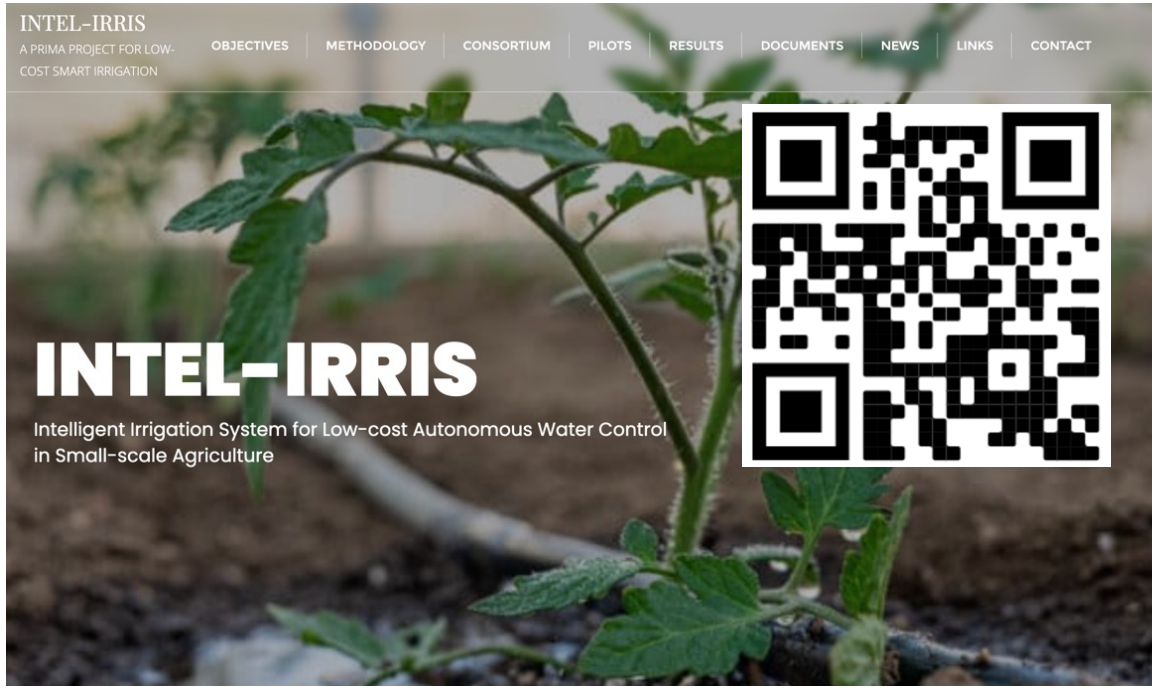
More information

- Web site: http://intel-irris.eu



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Demonstration video

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