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

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

Intel-IrriS

Les objectifs et les défis du projet INTEL-IRRIS pour l'optimisation de l'irrigation pour les petits exploitants agricoles

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
- Accent mis sur l'utilisation optimale des ressources naturelles en agriculture/élevage

- **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	**ENSA-Safi**: National School of Applied Sciences – Safi	**INRA**: National Institute of Agronomic Research	**IRD**: Institute for Research & Development	**UMAB**: University A. Benbadis	**UORAN1**: University of Oran 1	**UPPA**: University of Pau & Adour Country	**WAZIUP eV**: WAZIUP association
Greece	Morocco	Morocco	France	Algeria	Algeria	France (coordinator)	Germany

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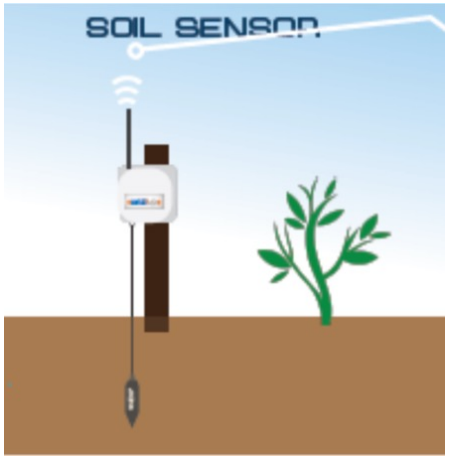
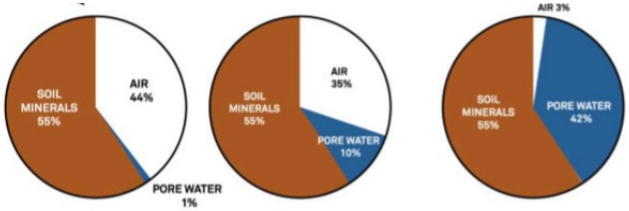
Irrigation avec capteur d'humidité





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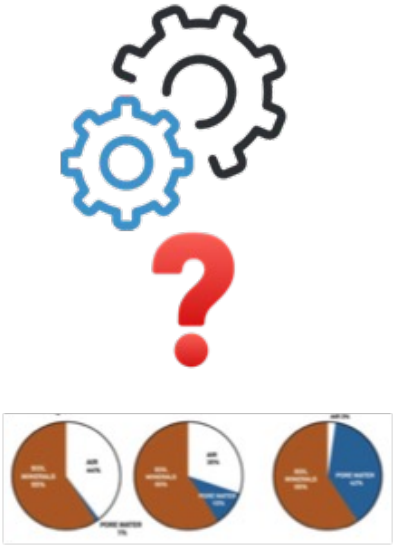
Pas aussi simple qu'on le croit ☹



Volumetric Water Content, Water Potential, Water Tension,…

TDR, FDR, capacitance, resistance, ….

Caractéristique du sol: densité apparente, taux de salinité, texture & type de sol

Evapotranspiration, sol-plante-atmosphère continuum,…

Type d'irrigation: goutte-à-goutte, gravitaire, aspersion/sprinkler,…

Plante/Céréale

Corrélation avec d'autres types d'entrants

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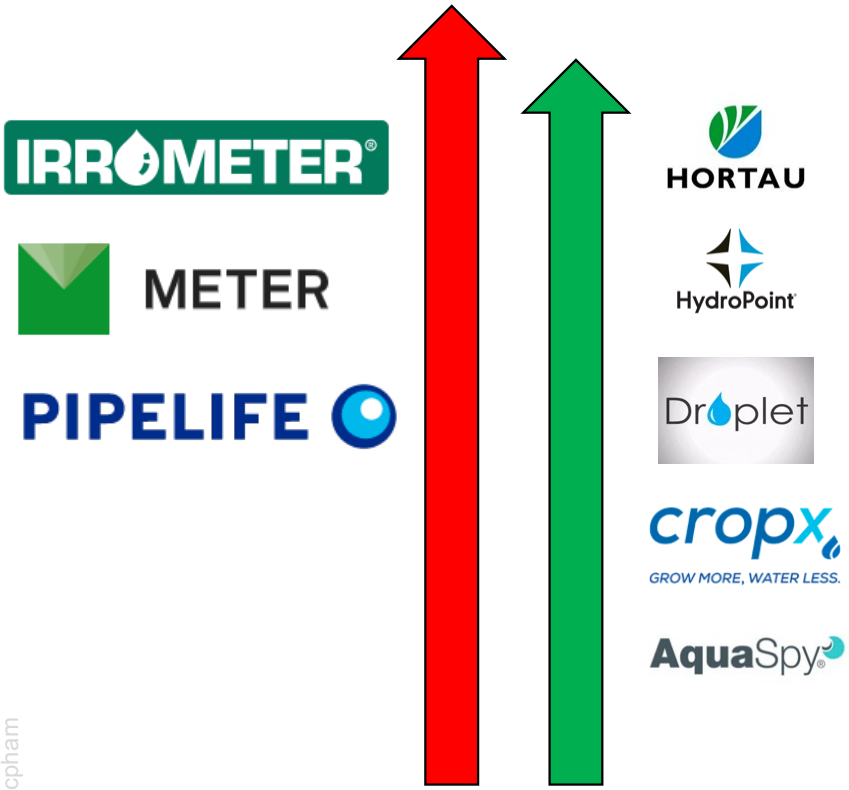
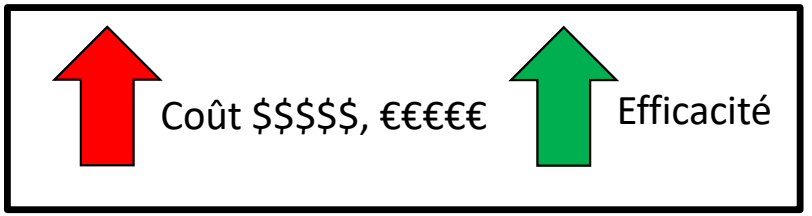
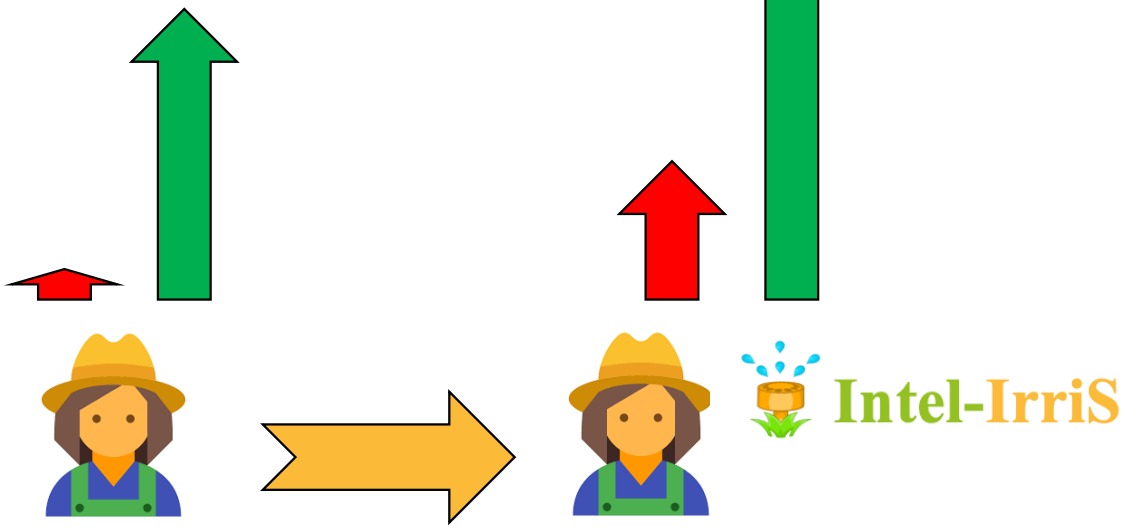
C'est toujours un compromis…





Systèmes très intégrés, capteurs très chers…

Grandes entreprises avec grande expertise, visant le marché des très grandes exploitations



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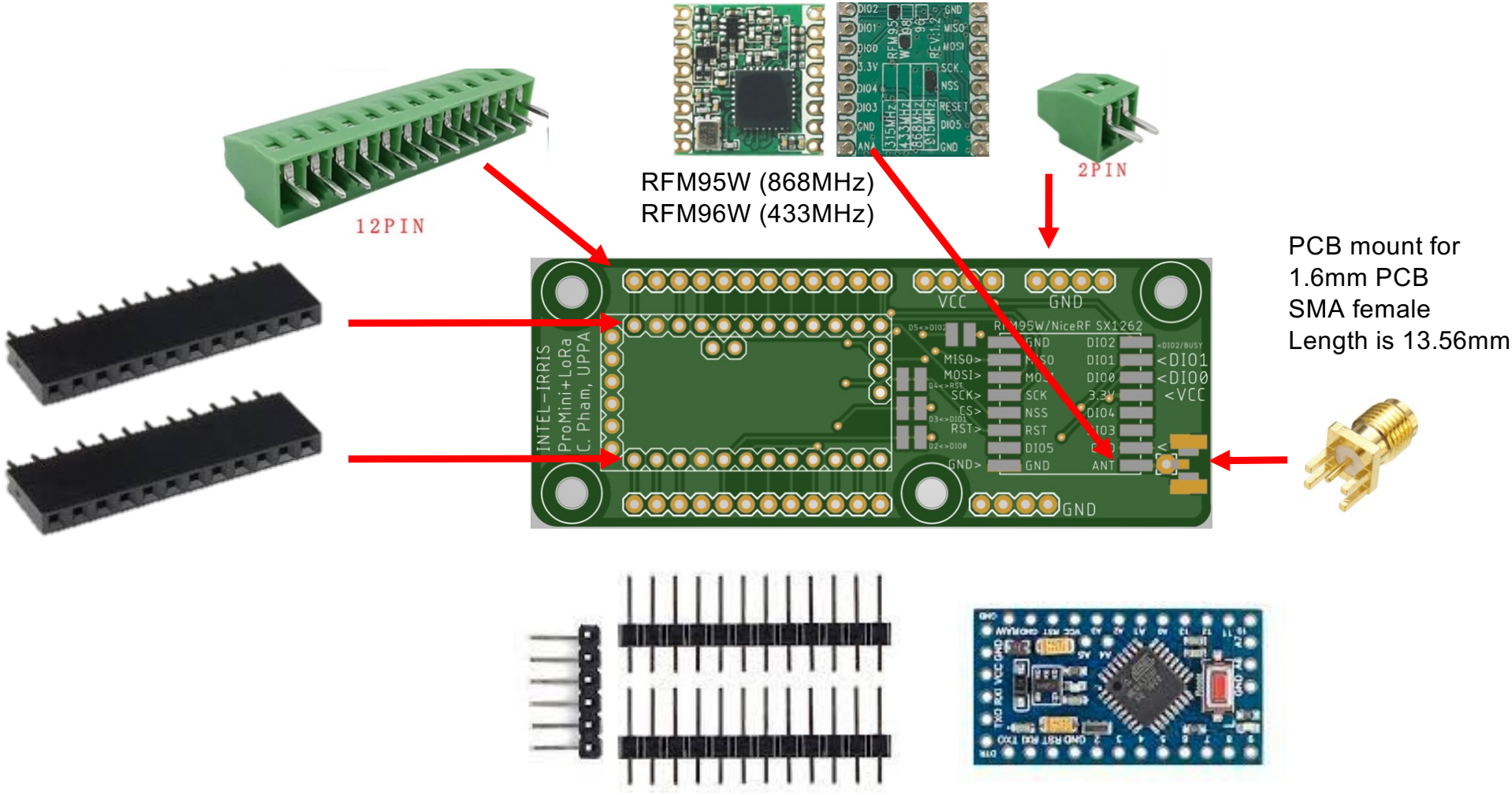
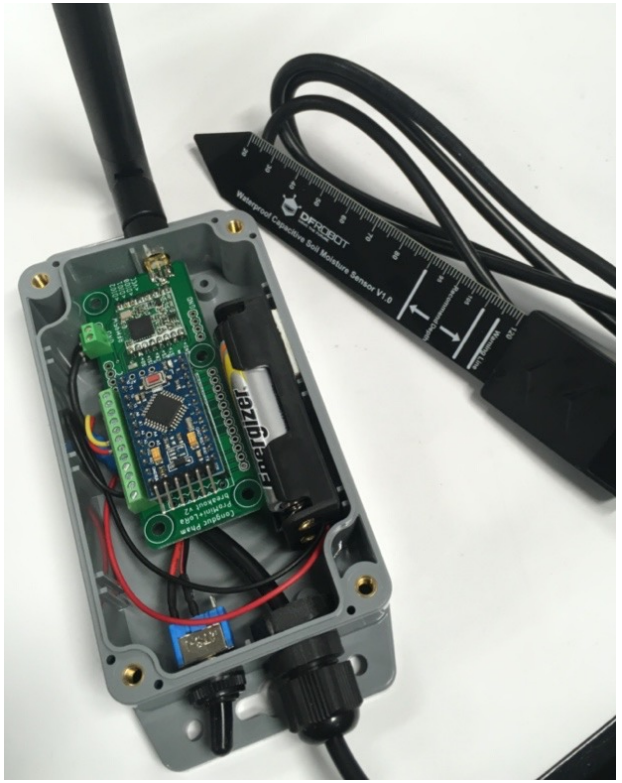
FAIBLE COUT?

Partie électronique
starter-kit version



Intégration



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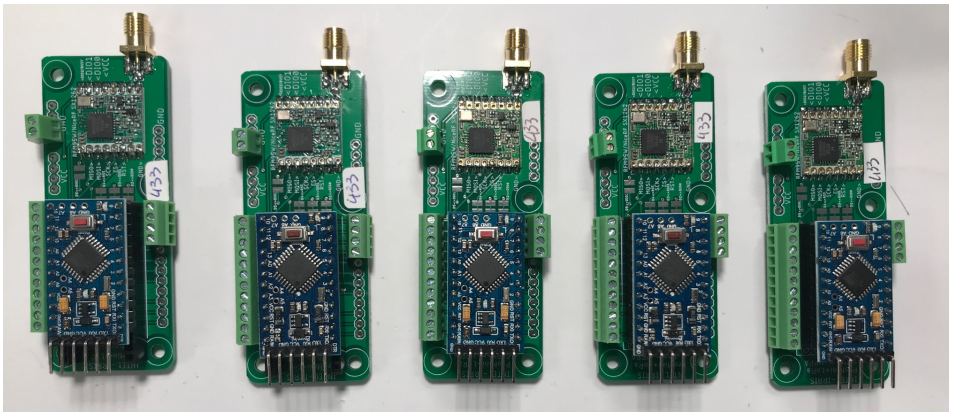
Une plateforme générique

- Faible-coût: < 20€
- Composants standards
- Facilement reproductible
- Montage & assemblage par partenaires locaux
- Permettant de connecter plusieurs types de capteurs
- Possibilités d'adaptation supplémentaire par partenaires locaux



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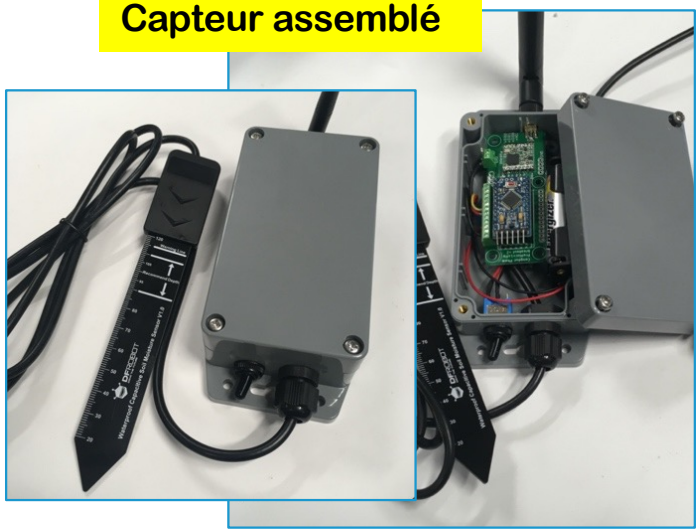
Starter-kit…en kit!

Capteur assemblé



Capteurs en kit pour les partenaires technologiques

2 versions du nœud capteur

~ 30€

SEN0308
capacitive sensor

~ 60€

Watermark WM200
Water tension sensor

Un capteur pour la température du sol peut être rajouté

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Déploiement typique

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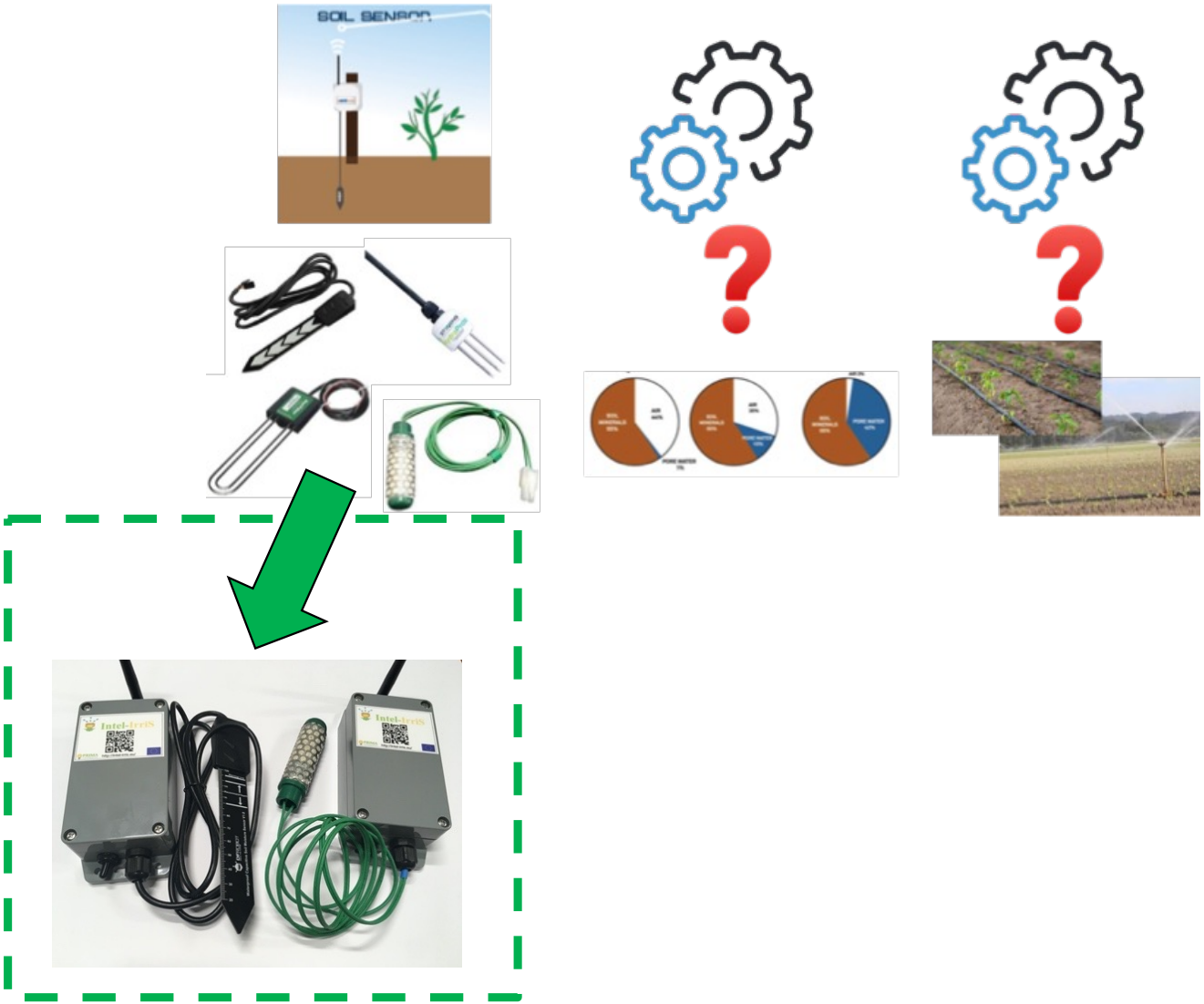
INTEL-IRRIS: nœud capteur



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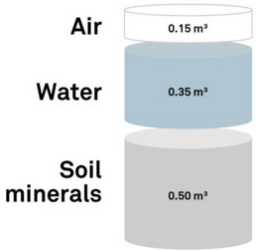
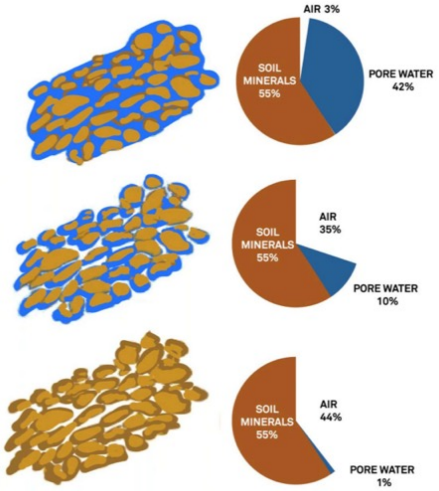
PRECISION?

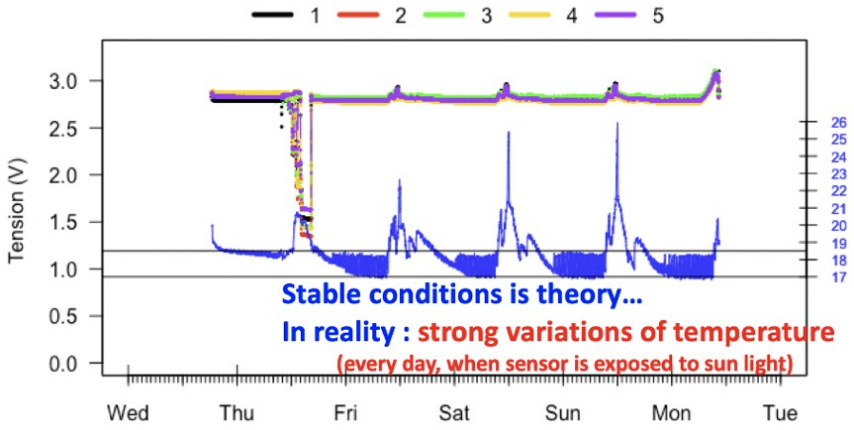
Capteur capacitif





From METER group

- Les capteurs capacitif mesurent le "volumetric water content"
- Densité & texture sont des paramètres importants



Impact of temperature ?

Tests par l'IRD pour qualifier & quantifier la précision et la stabilité du capteur capacitif SEN0308

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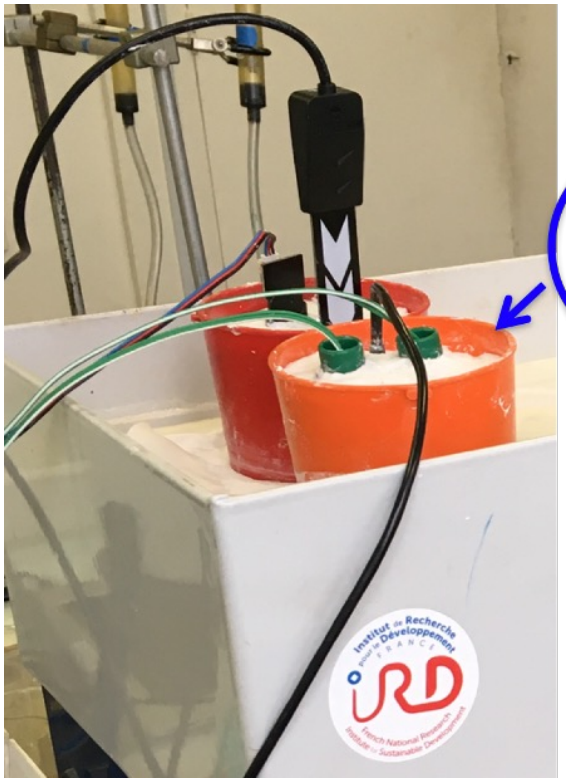
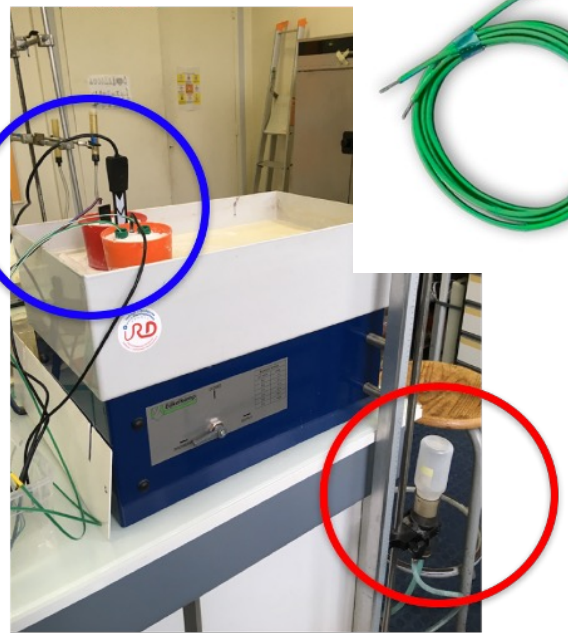
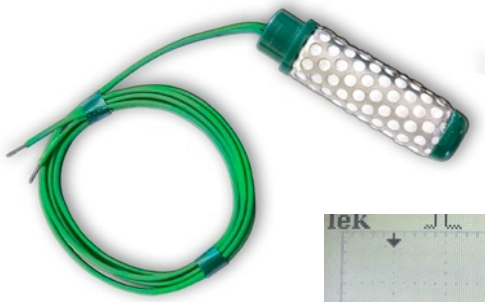
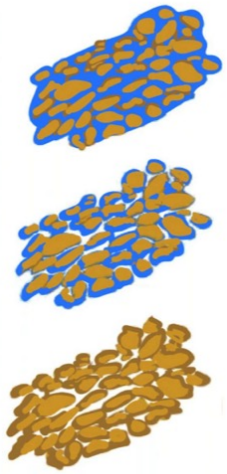
Capteur de type tensiomètre

- Un tensiomètre mesure la force nécessaire à extraire l'eau des pores/cavités du sol

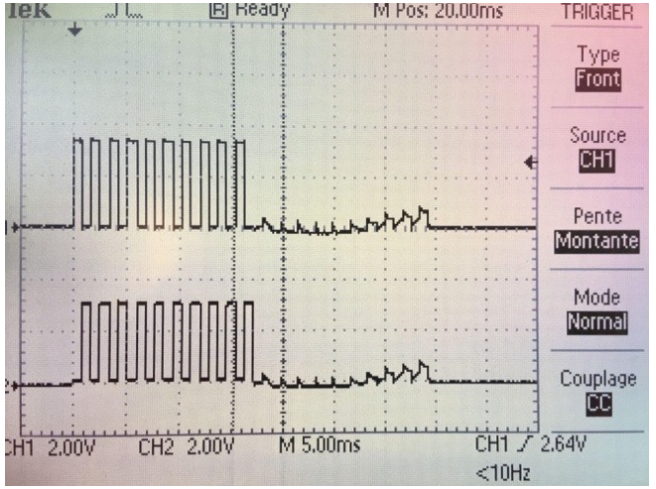








From METER group



Tests par l'IRD pour qualifier & quantifier la stabilité et la faisabilité de l'usage de microcontroleur pour piloter le capteur Watermark WM200

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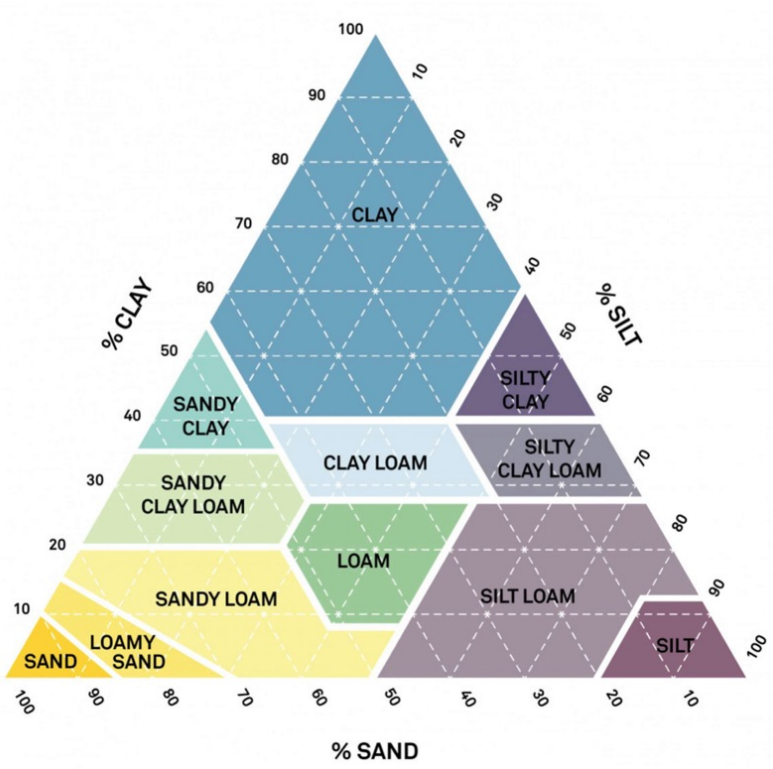
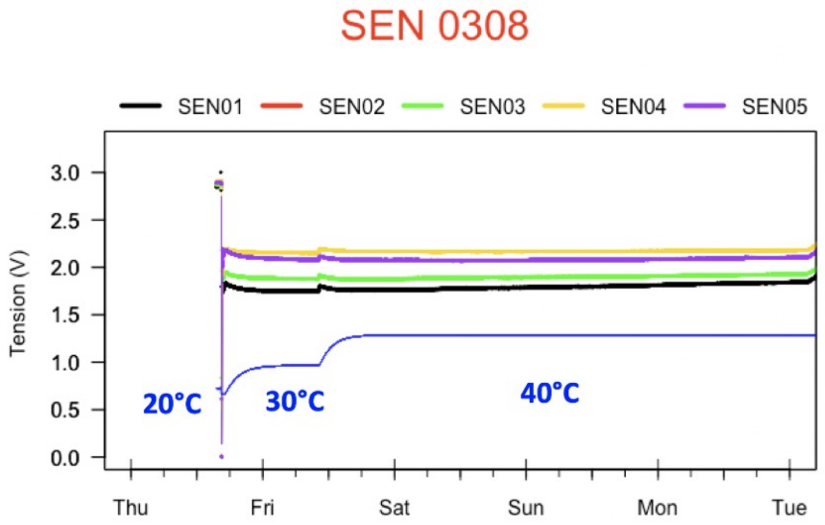
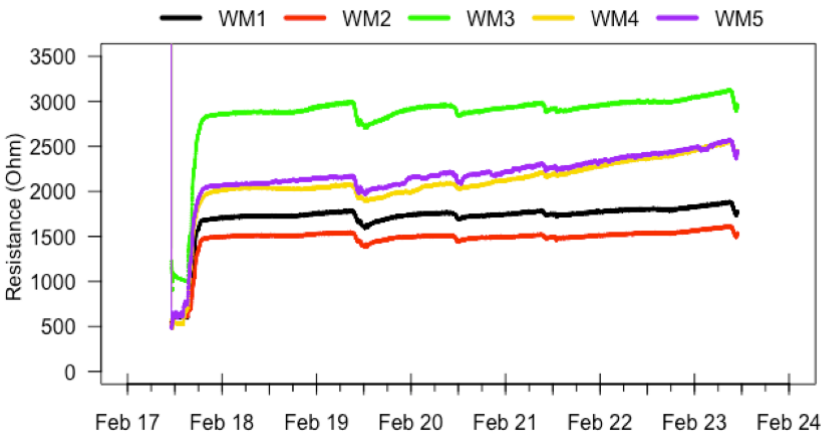
Calibration

- Spécifique à un type de sol
- Impact des "bruits" externes





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

AUTONOME?

INTEL-IRRIS starter-kit

- Au début: une idée…
- "Intelligent Irrigation in-the-box", "plug-&-sense"
- Starter-kit=1 nœud capteur + 1 nœud passerelle

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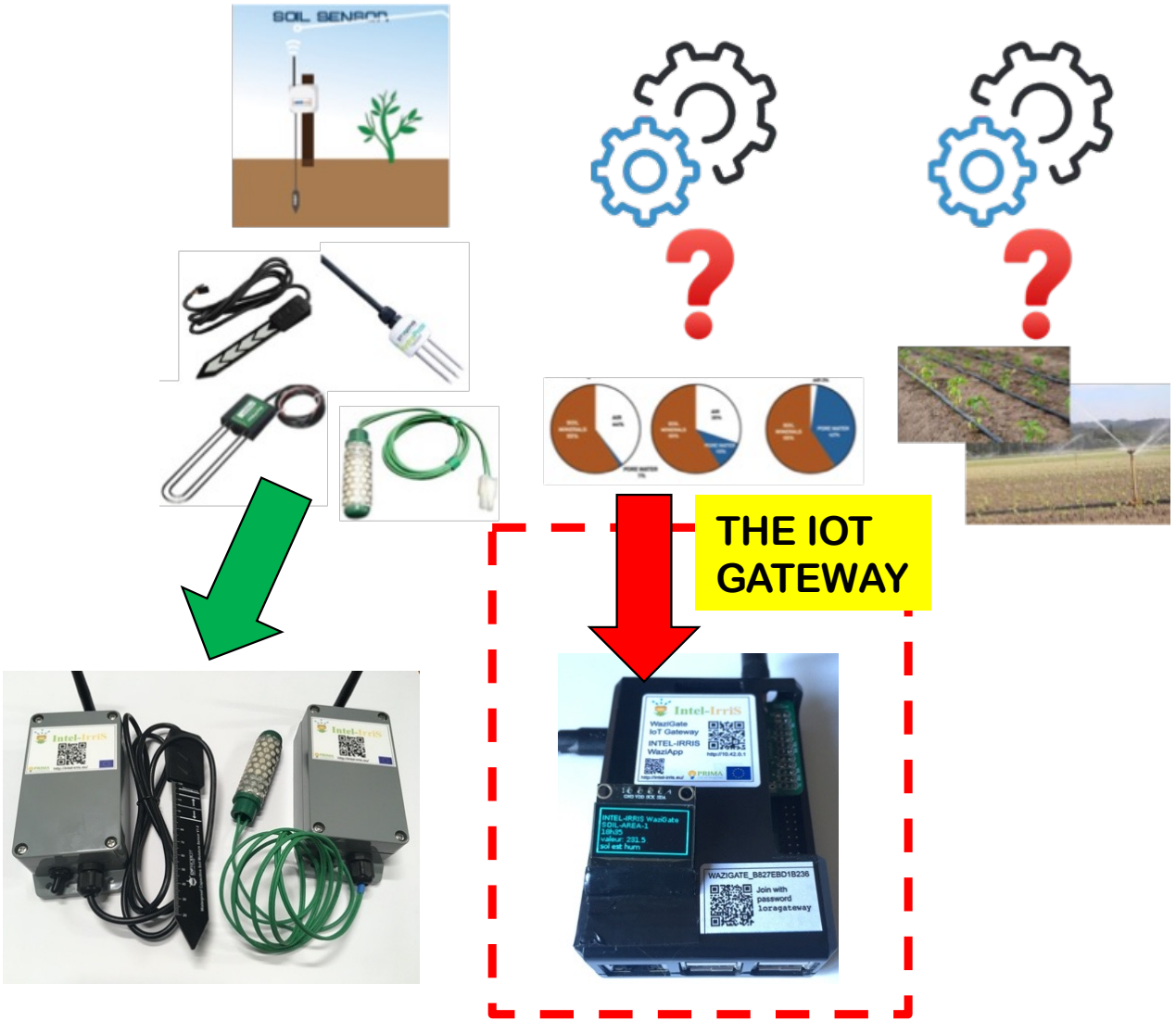
INTEL-IRRIS: nœud passerelle



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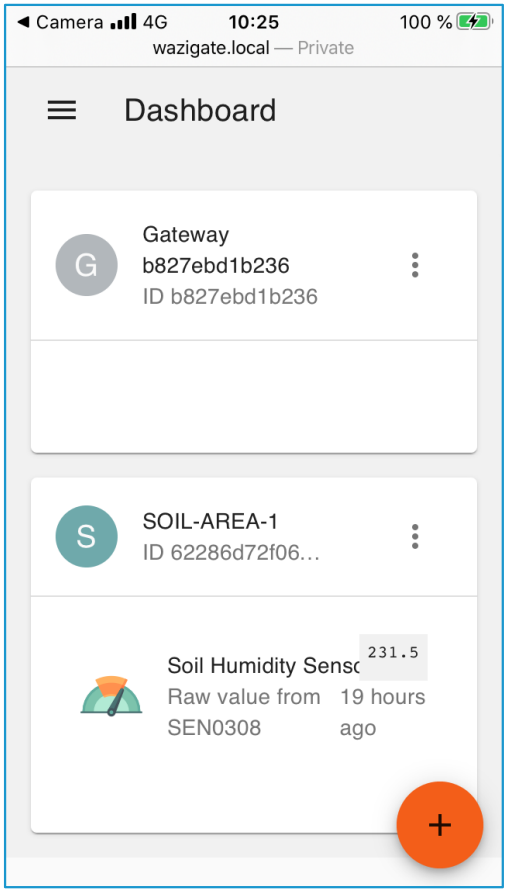
Passerelle: collecte des données

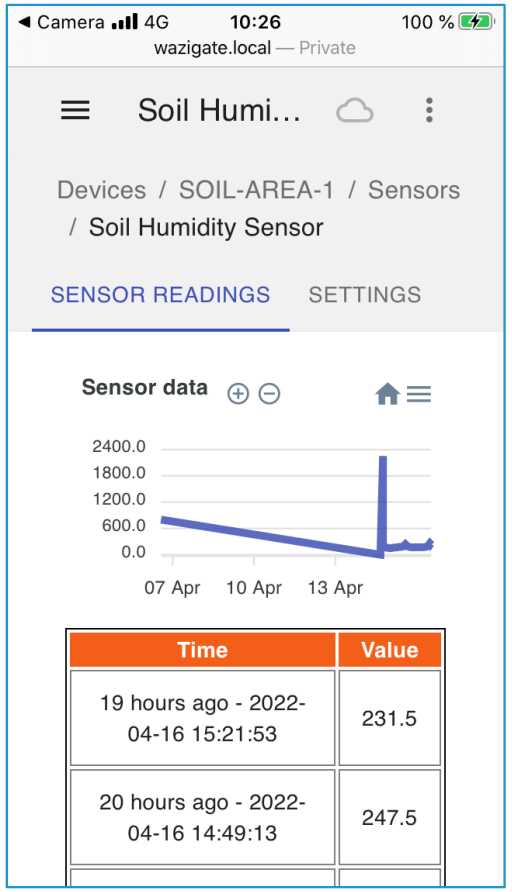
PASSERELLE WAZIGATE

PAS BESOIN D'INTERNET

TOUS LES TRAITEMENTS SONT LOCAUX

INTERFACE WEB EMBARQUÉE





1 PASSERELLE POUR PLUSIEURS CAPTEURS

< 50€

ACCESSIBLE AVEC UN SMARTPHONE

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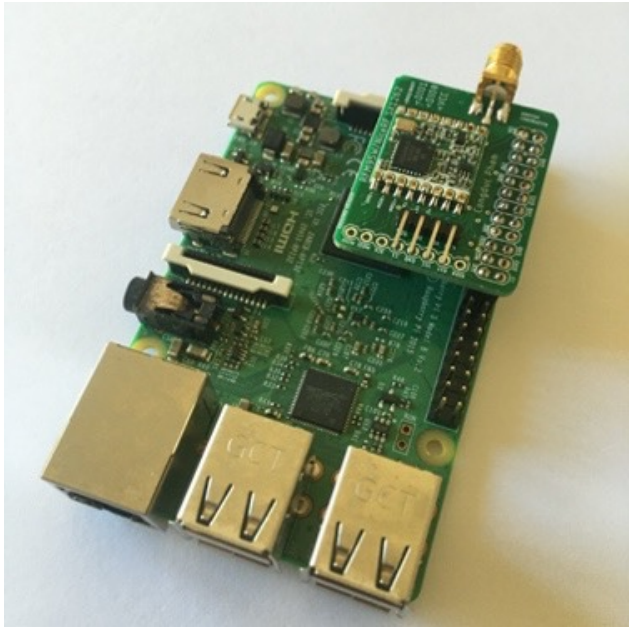
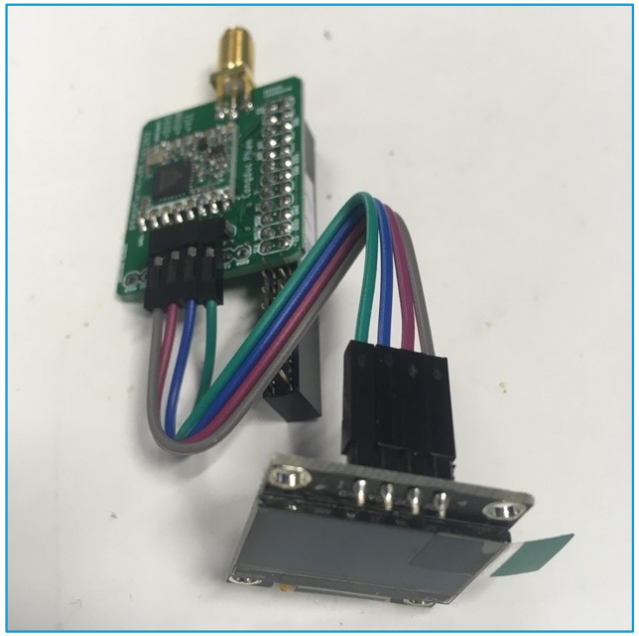
Architecture ouverte

- Un Raspberry Pi sert de passerelle IoT pour la collecte/contrôle
- Système WaziGate, open-source et très ouvert pour l'adaptation





< 50€

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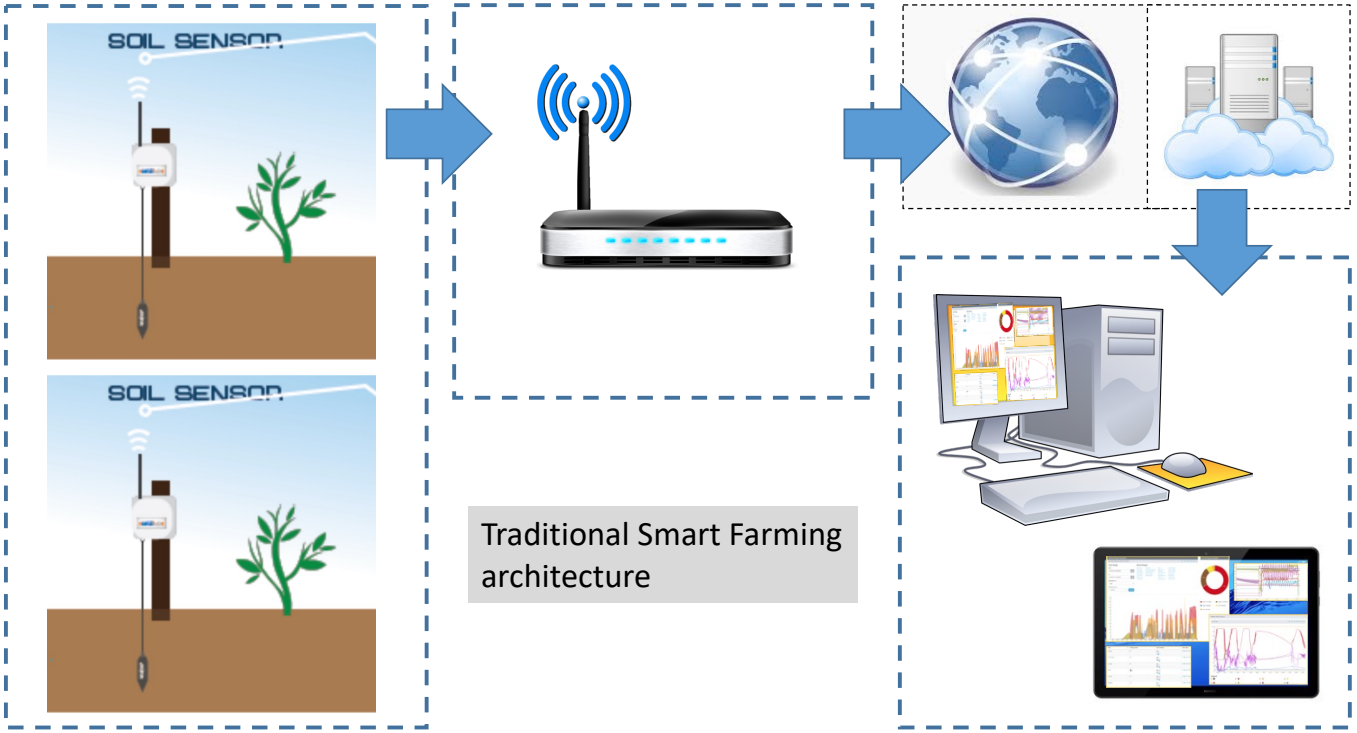
Travailler sans Internet?

- Les systèmes traditionnel pour l'agriculture connecté utilisent des serveurs sur Internet et, le plus souvent, nécessite du logiciel dédié
- Les utilisateurs deviennent dépendant du fournisseur ☹



Traditional Smart Farming architecture

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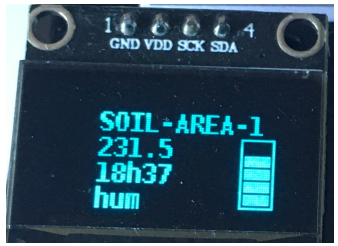
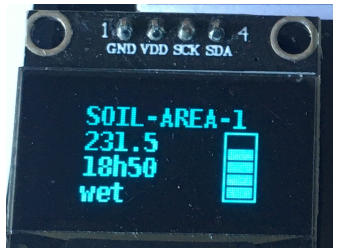
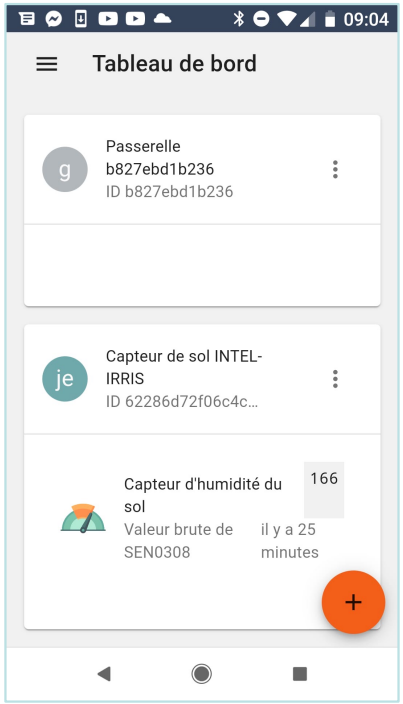
Adapter la solution au public visé

- "Intelligent Irrigation in-the-box"
- L'interface utilisateur est critique pour un public qui peut être très peu habitué aux nouvelles technologies
- Utilisation de composants visuels
- Texte en français quand c'est possible







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INTEL-IRRIS starter-kit

- "Intelligent Irrigation in-the-box", "plug-&-sense"
- d'une idée vers une implémentation réelle!

< 90€

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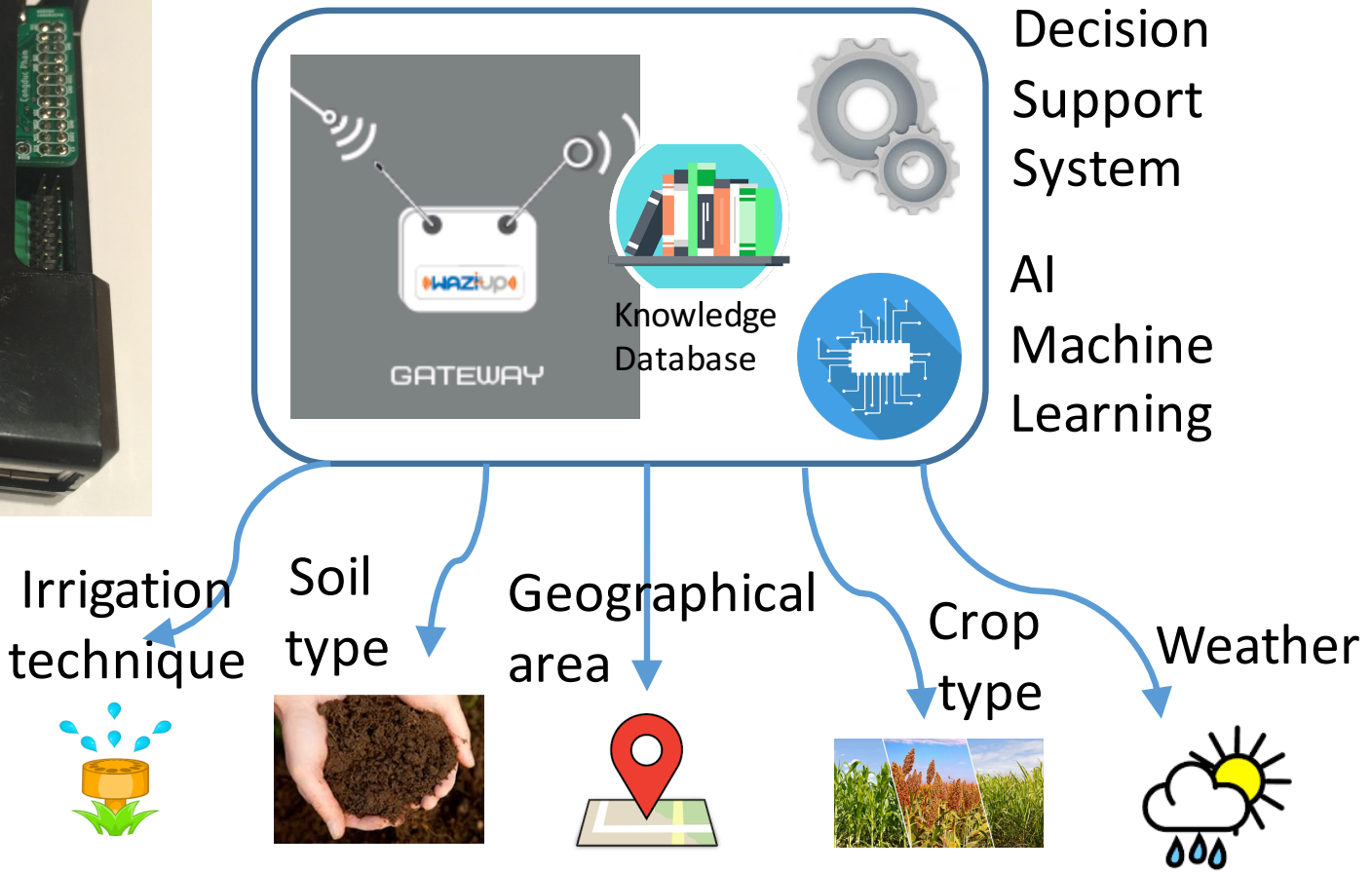
+intelligent?

Intelligence embarquée



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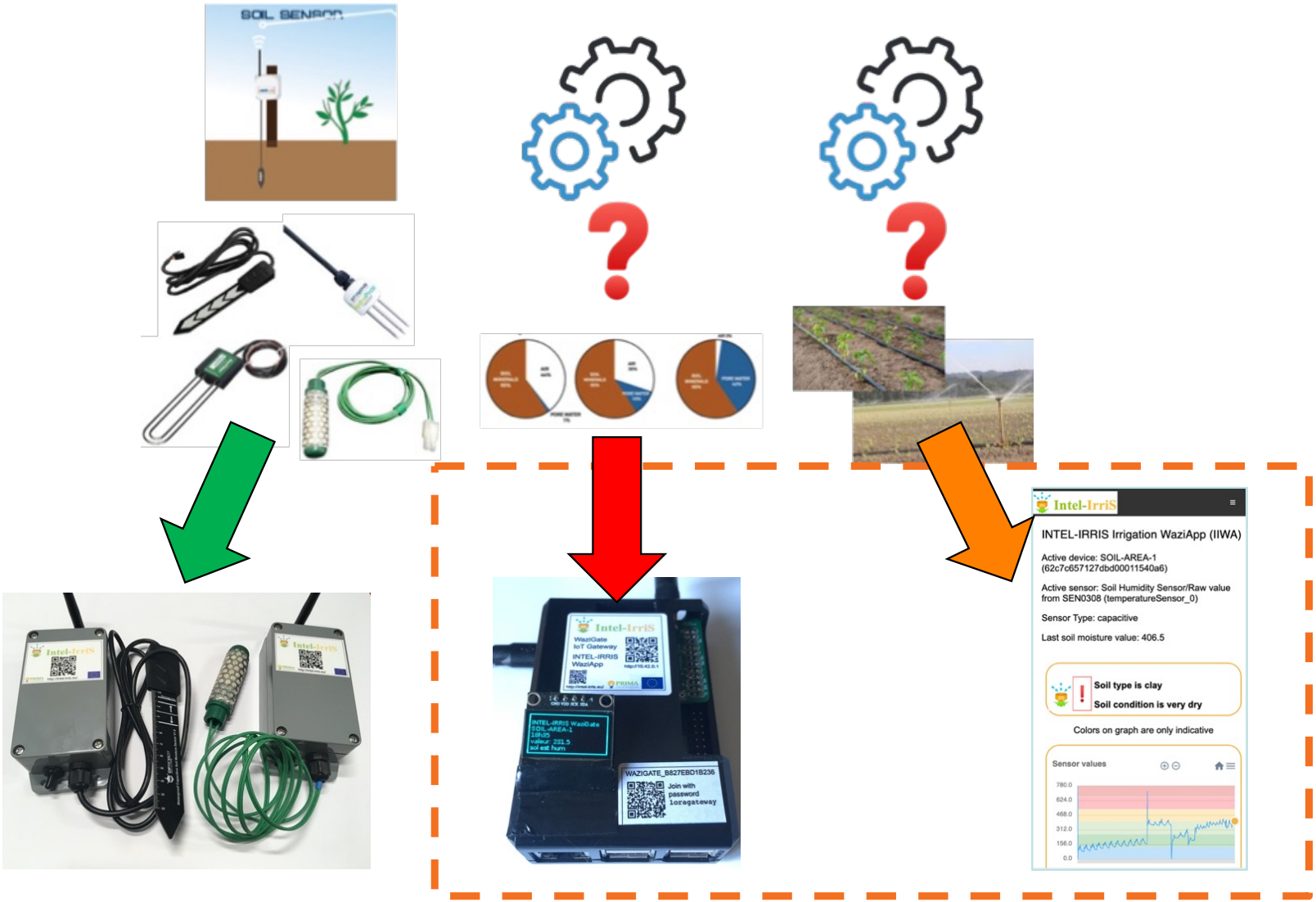
INTEL-IRRIS: rajouter de l'intelligence



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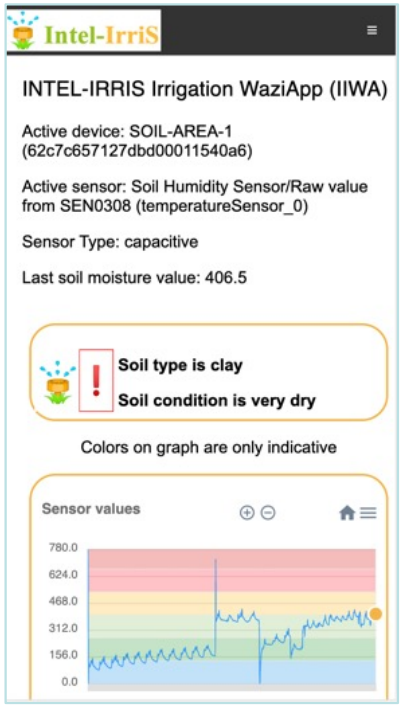
INTEL-IRRIS Irrigation WaziApp

- 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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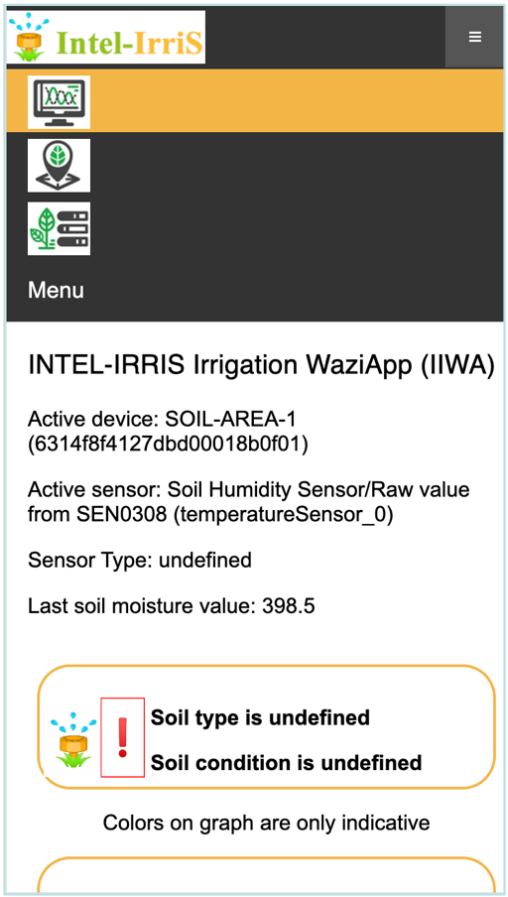
IIWA main screens

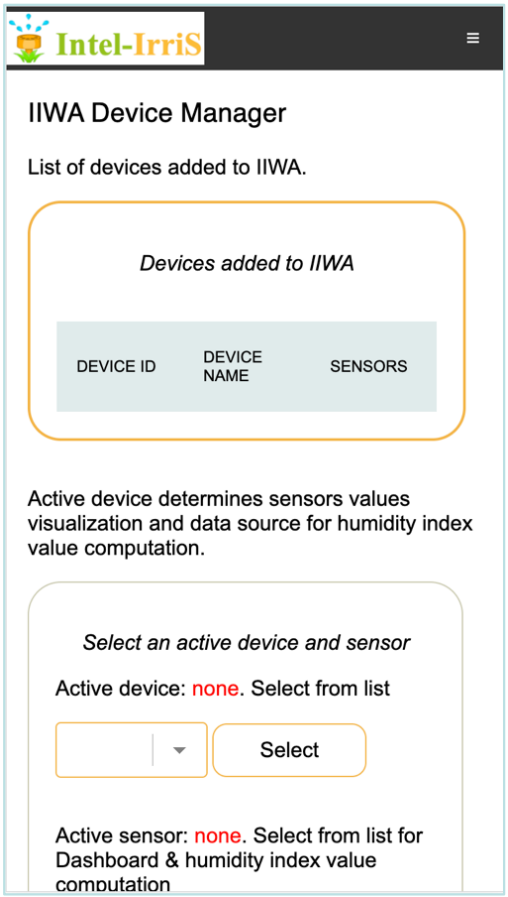
- Dashboard, Device Manager and Sensor Configuration

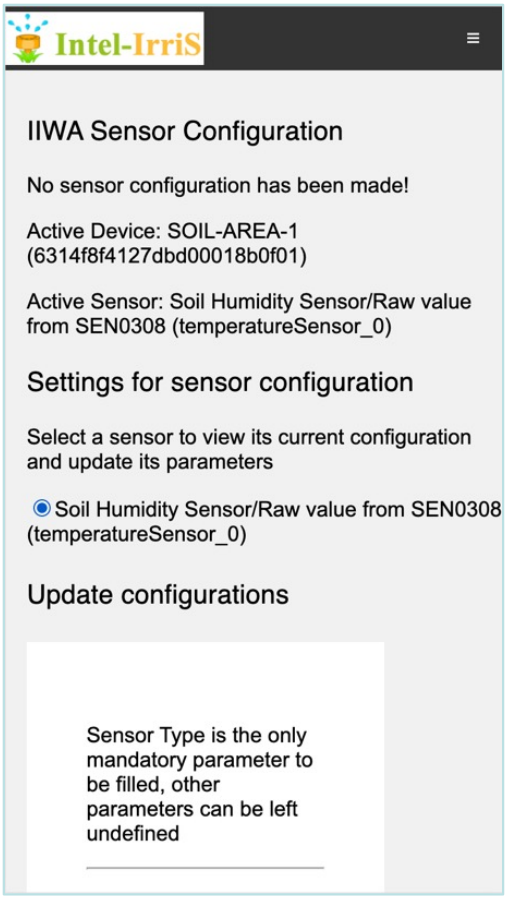
Dashboard →

Device Manager →

Sensor Configuration →







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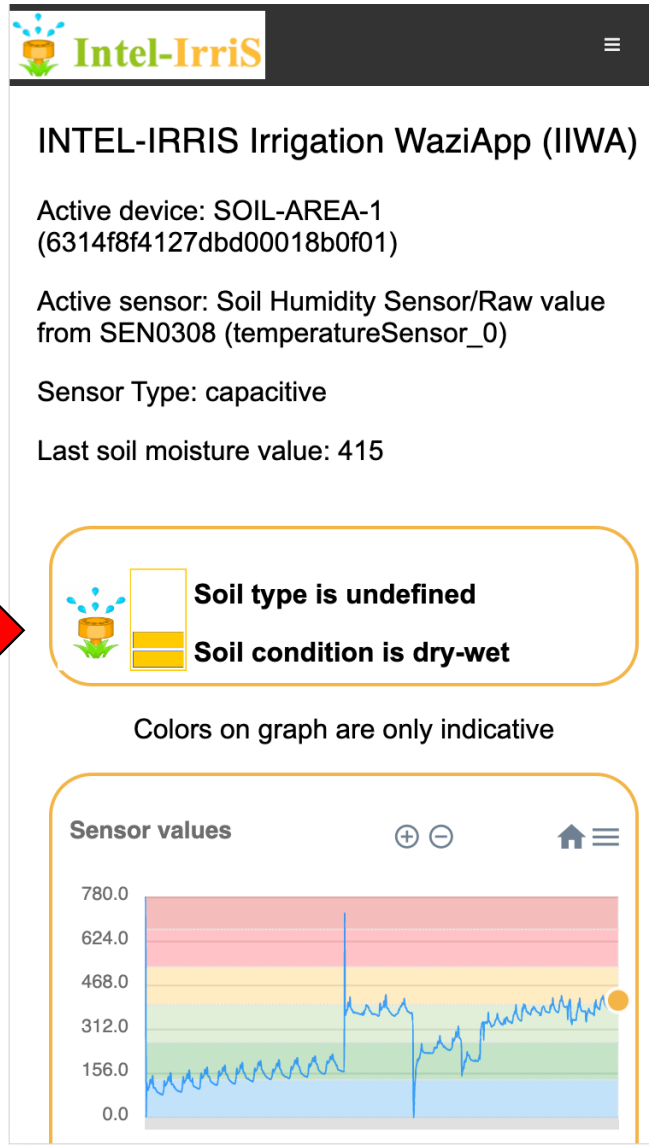
IIWA dashboard

- When a device/sensor pair has been defined, IIWA dashboard can display information for the active sensor
- The soil type, and other parameters, are still undefined therefore IIWA takes the default value to determine irrigation conditions
- The "dry-wet" indication in this example is not correct!



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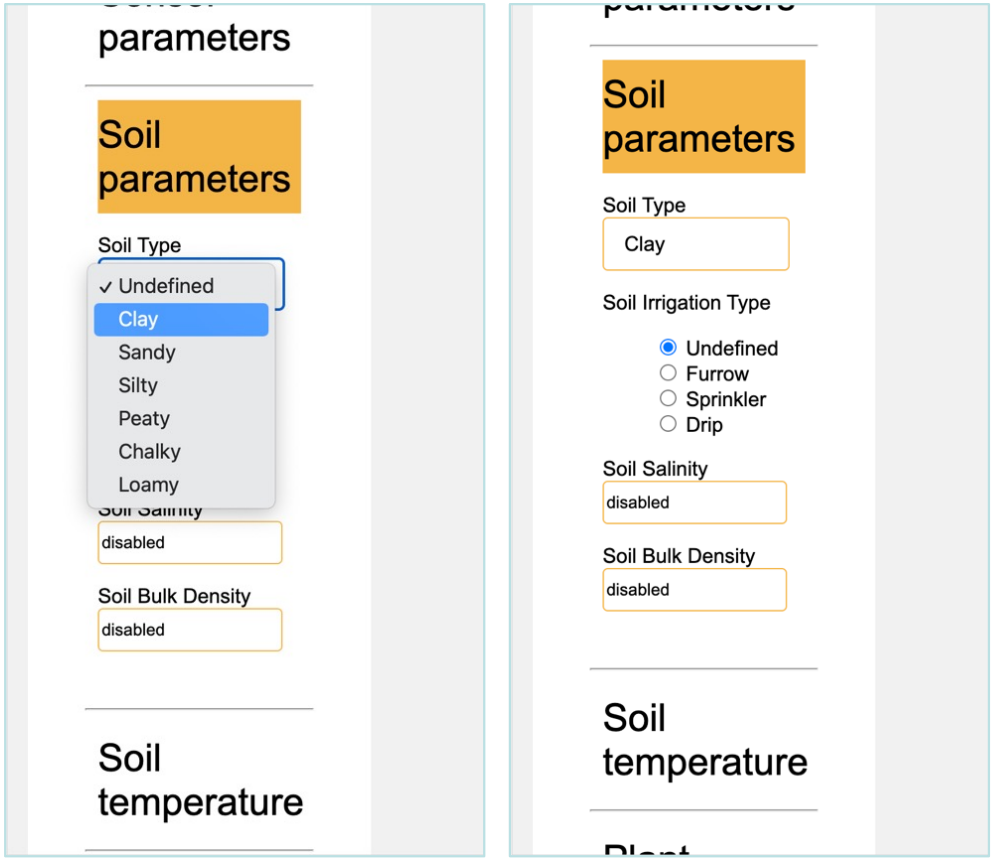
Advanced configuration…

- We will configure soil type to better reflect the reality
- Here, we go to "Soil Parameter" tab and select "Clay" as soil type
- This is the soil type where the sensor is installed for this example
- Click on "Update"



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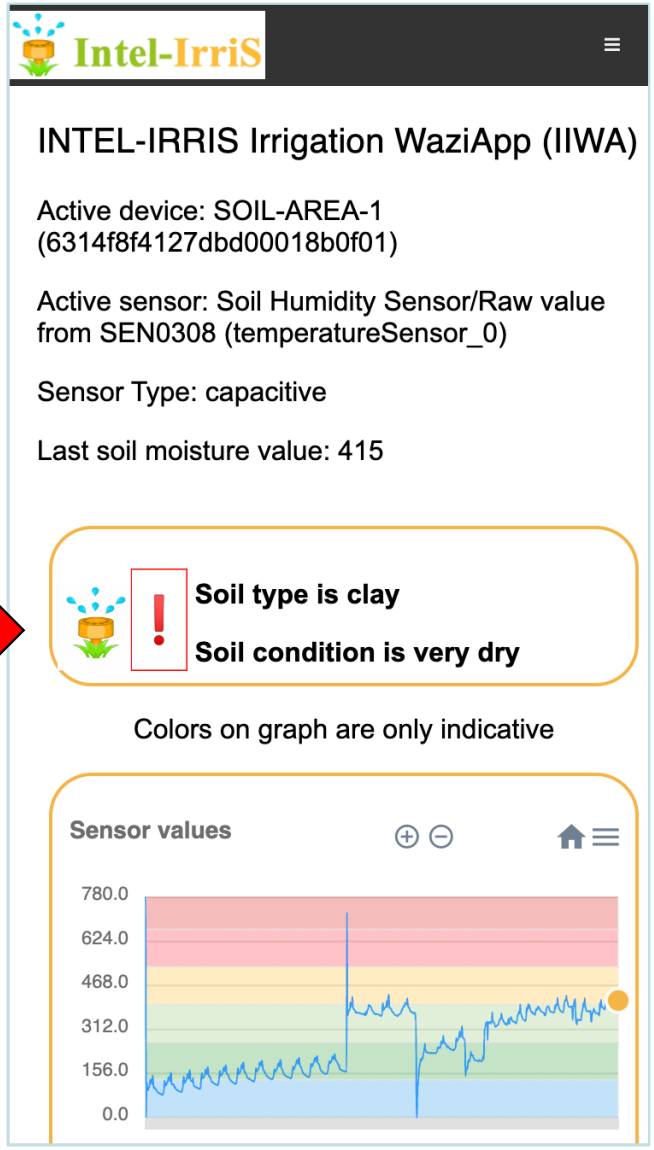
…to further calibrate the sensor

- When getting back to the dashboard, the irrigation indication has been corrected by taking into account the soil type
- Now, the soil condition is reported to be "very dry" which is the case in the deployment example used for this presentation
- Values were obtained on July 2022, during the heat wave!



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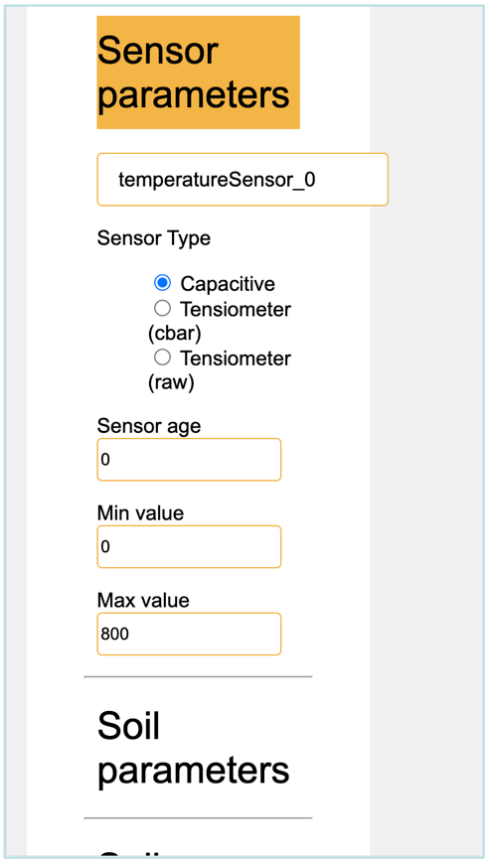
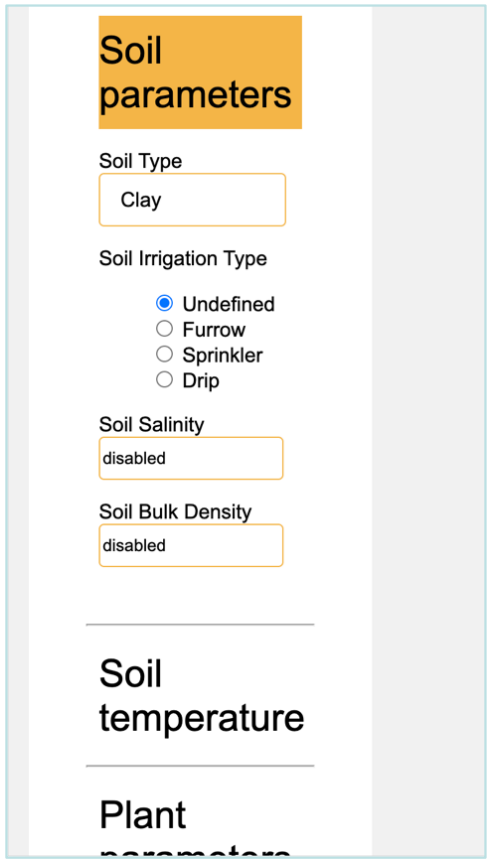
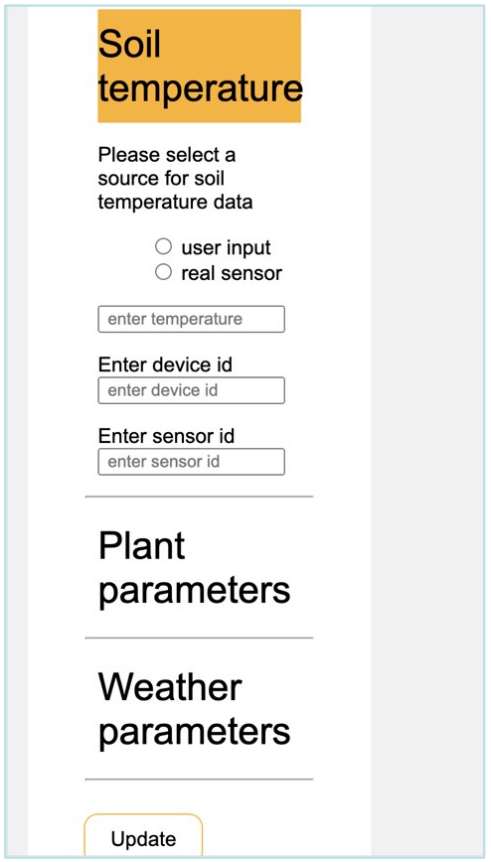
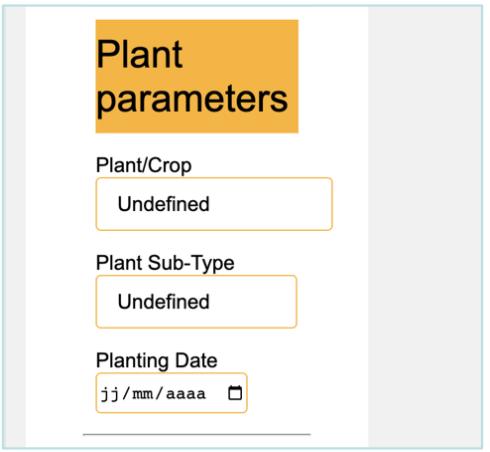
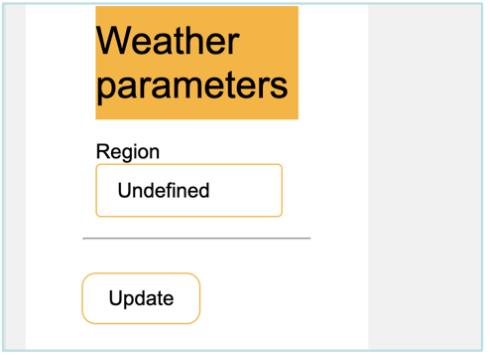
List of advanced parameters











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

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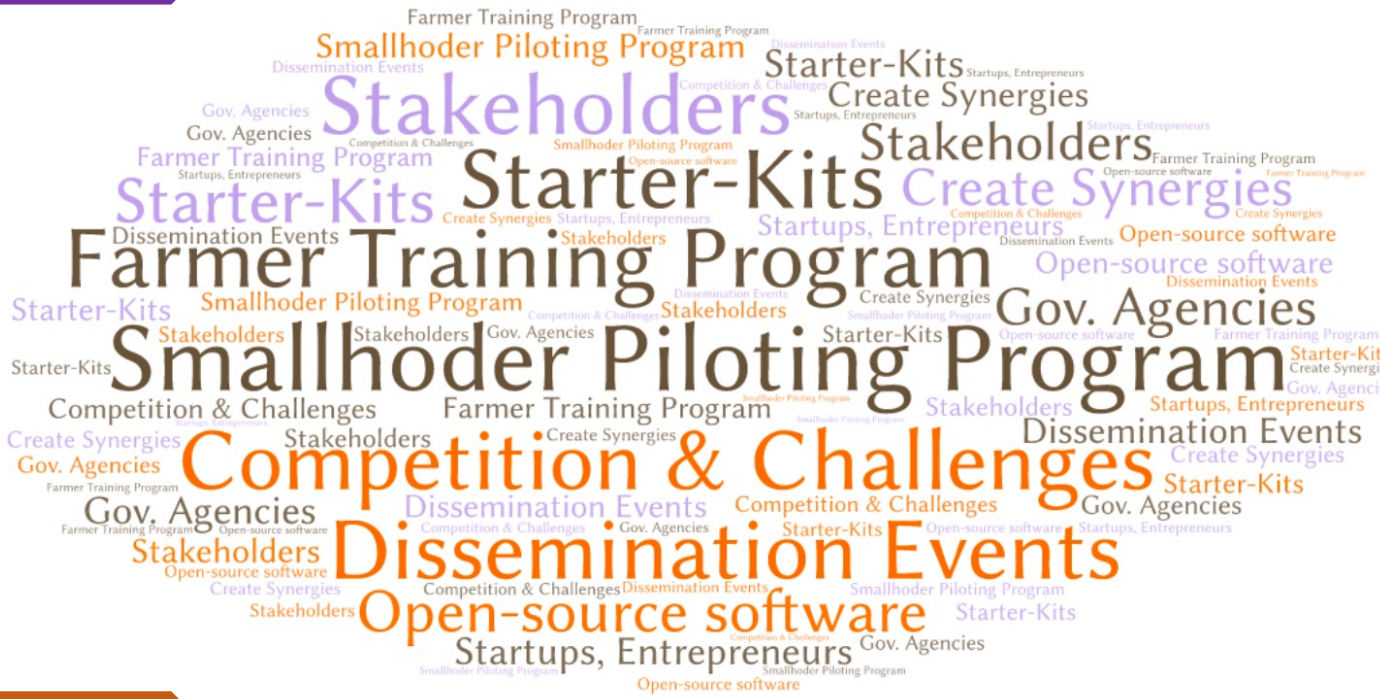
INTEL-IRRIS

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

DEPLOIEMENT

Au delà de la technologie…

4 **Développer des solutions open-source pour favoriser l'innovation et l'appropriation des technologies par les acteurs locaux**



5 **Créer de la synergies et des collaborations avec les acteurs locaux pour favoriser l'adoption à large échelle**

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Smallholder Piloting Program

- Programme collaboratif pour interagir avec les utilisateurs finaux
- Plusieurs types de fermes, de techniques d'irrigation et prises en compte de la diversité des sols
- Profitez de l'expérience des agriculteurs pour améliorer la qualité et l'efficacité du système
- 24 mois pour tester, récolter les retours et améliorer les fonctionalités

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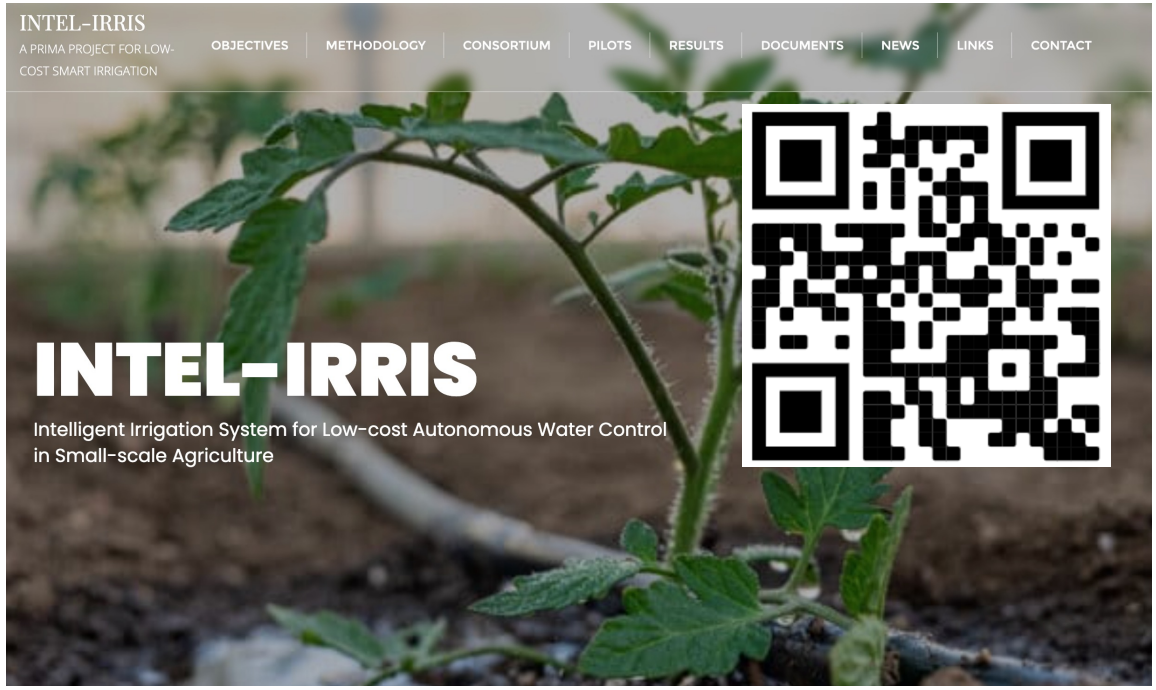
Pour en savoir plus

- Site web: http://intel-irris.eu



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

UORAN1: University of Oran 1 — Algeria

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

WAZIUP eV: WAZIUP association — Germany

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