Project Intel-IrriS

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

Système Intelligent d'Irrigation à Bas-Coût pour un Contrôle Autonome de l'Eau dans les Petites Exploitations Agricoles

Workshop on Earth Observation and Geospatial Information: Education and Research Perspectives

27 - 29 May, 2023

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

RSDT
البحث العلمي في خدمة المواطن

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

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University of Oran1 Ahmed Benbella


INTEL-IRRIS
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
IDEA OF THE PROJECT

New research strategy

- ✓ Current trend of the RIIR laboratory - “Network and QoS” team
  The Use of WSN/IoT technologies for societal and industrial Smart applications
- ✓ The laboratory promote useful and impactful research, Lab & Open Field Experimentation/validation
- ✓ Compliance with the national research plan: National Priority of MESRS/DGRSDT (Food, Energy, Health)
- ✓ Choice of Strategic Axis: Food Security
- ✓ Project development / National partnership (PNR, impact and mixed projects, PRFU) and International cooperation (PRIMA)

Project Background

Code : 1560

- **Call: Section 2 Multitopic 2020**

https://prima-med.org/

- **Thematic Area** 1-Water management

Low cost, lean solutions for enhancing irrigation efficiency of small-scale farms

Fr: Solutions peu coûteuses et légères pour améliorer l'efficacité de l'irrigation des petites exploitations agricoles

- **8 partners**: Algeria (2), France (2), Germany (1), Morocco (2), Greece (1)

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

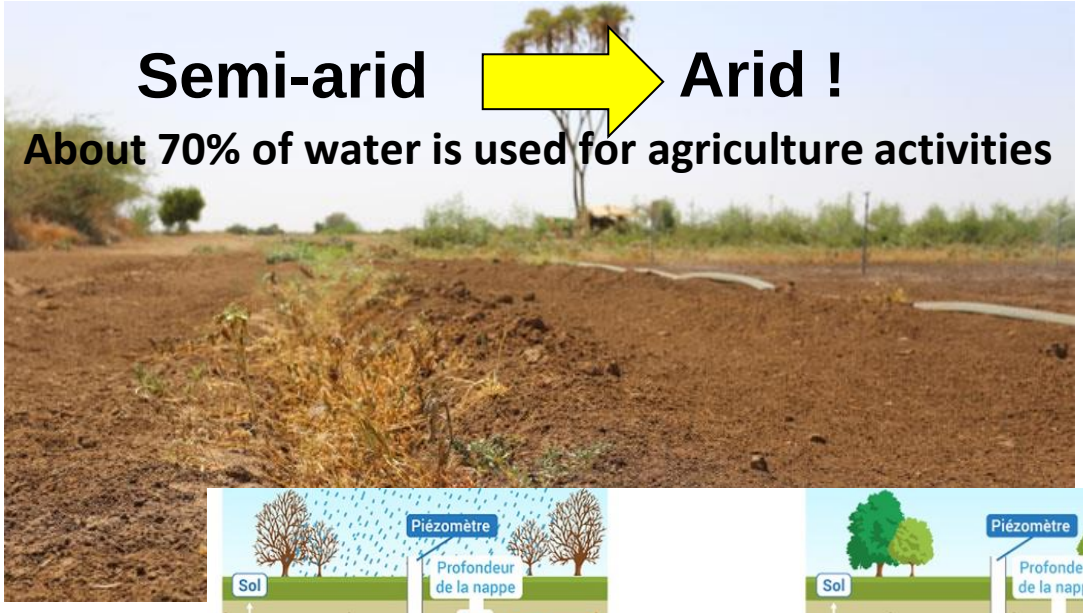
UORAN1: University of Oran 1 — Algeria

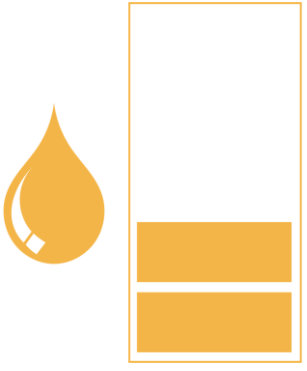
UPPA: University of Pau & Adour Country — coordinator — France

WAZIUP eV: WAZIUP association — Germany

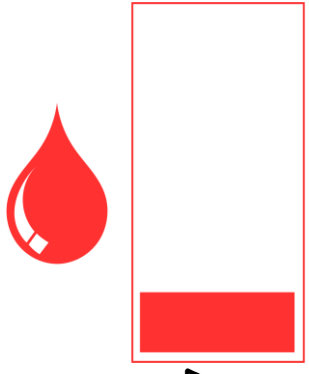
- **36 months** – start date June 1st, 2021 - 31 May 2024
- **Funding**: Local agencies (Algeria: DGRSDT/MESRS)

Water resource is precious!

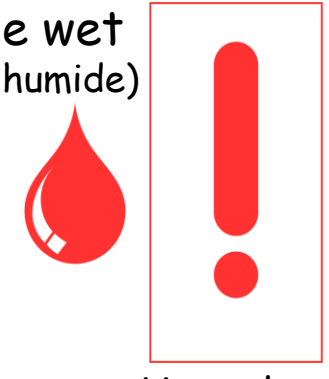




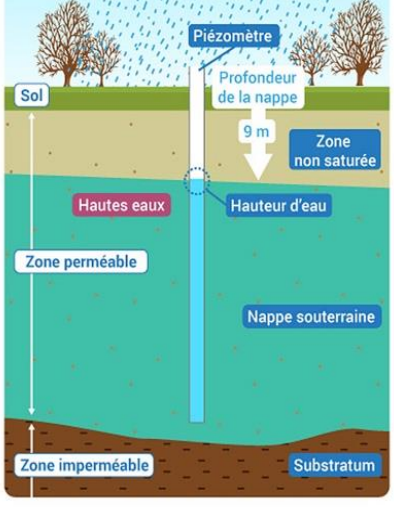
A little wet
(un peu humide)

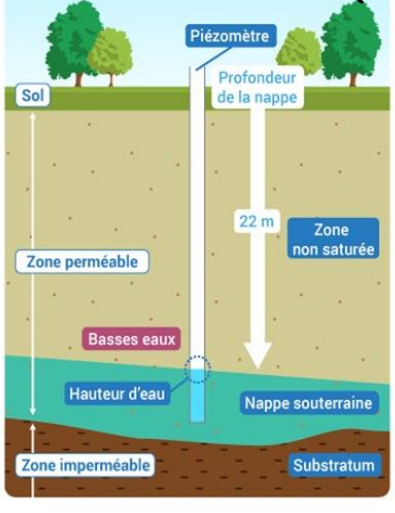


Dry
(sec)



Very dry
(Très sec)





Smallholders – up to 2ha

- Most (84%) of the world's 570 million farms are smallholdings.
- Provide about 32% of world food supply, on about 24% of agriculture land.
- In Algeria, most farms are privately-owned, averaging between 2 and 20 hectares (smallholdings). Financial resources are limited, and sometimes catastrophic in the event of disaster (drying).

Digital Technologies

- ✓ Too expensive
- ✓ Too integrated
- ✓ Highly specialized
- ✓ Difficult to customize
- ✓ Difficult to upgrade

Technologies in agriculture

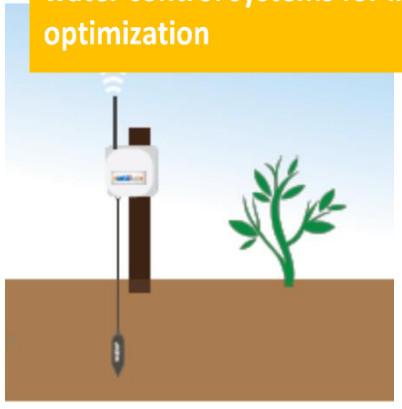
- Digital technologies can help reducing and optimizing usage of water and improve crop quality and quantity, **but…**

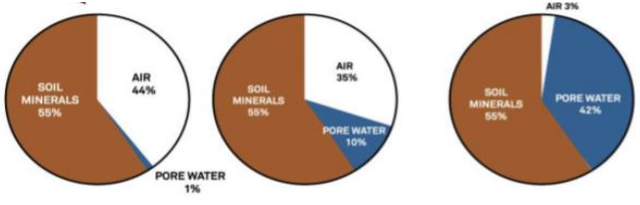
Possible for large farms

Out of reach for smallholders !!

Project INTEL-IRRIS : Objectives

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

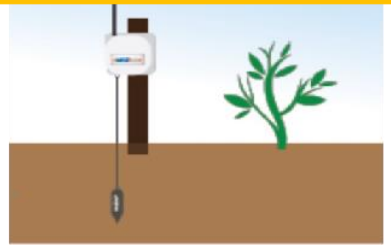




Irrigation with soil moisture sensing

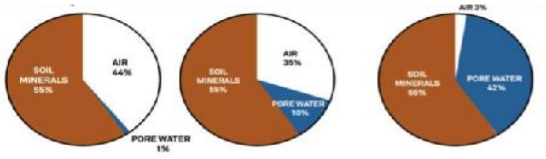
Project INTEL-IRRIS : Objectives

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



Volumetric Water Content, Water Potential, Water Tension,…

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



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

Evapotranspiration, soil-plant-atmosphere continuum,…

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

Irrigation type: drip, furrow, sprinkler,…

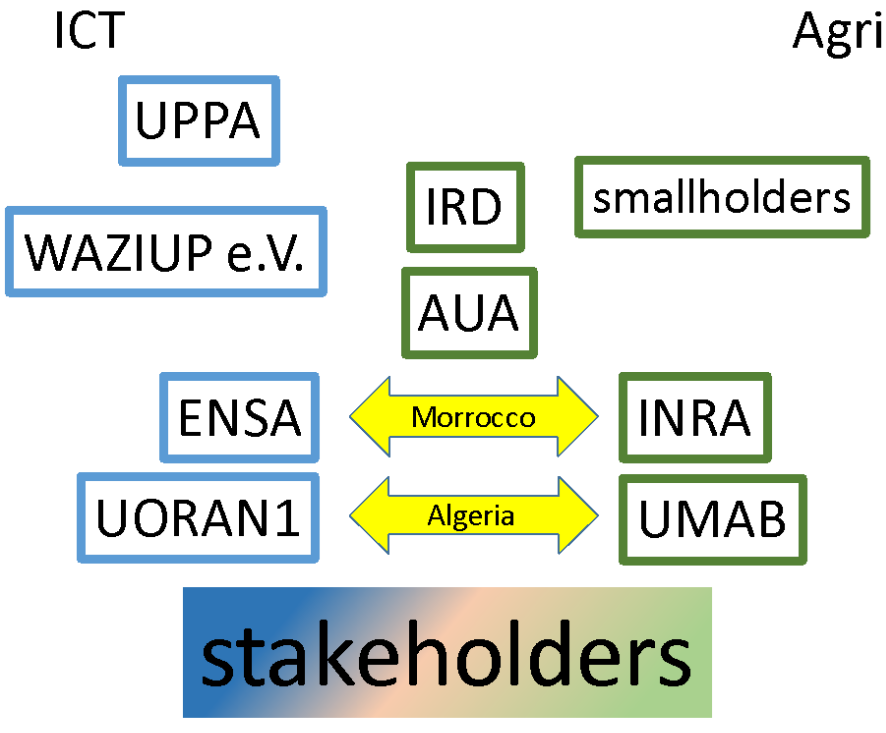
Plant/Crop varieties

Relationship with other agriculture inputs

Project INTEL-IRRIS : Objectives


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

Synergy between ICT & Agri communities



Other domains: regulatory, financial, business, innovation, …

List of WPs (Work Pakckages)

WP #	WP Title	Lead Participant No	Lead Participant Short Name	Person-Months	Start Month	End Month
WP1	Low-cost sensor platform for connected irrigation system	1	UPPA	64PM	M01	M30
WP2	Plug-&-Sense smart irrigation system in-the-box	3	WAZIUP e.V.	59PM	M01	M30
WP3	Smallholders Piloting Program, demonstrator and evaluation	7	UORAN1	53PM	M01	M36
WP4	Community engagement, communication and dissemination activities	5	ENSA	42PM	M01	M36
WP5	Cooperations, synergies and long-term sustainability for smallholders	6	INRA	47PM	M01	M36
WP6	Project management	1	UPPA	26PM	M01	M36
				291PM		

INTEL-IRRIS Gantt diagram – M18

Technology

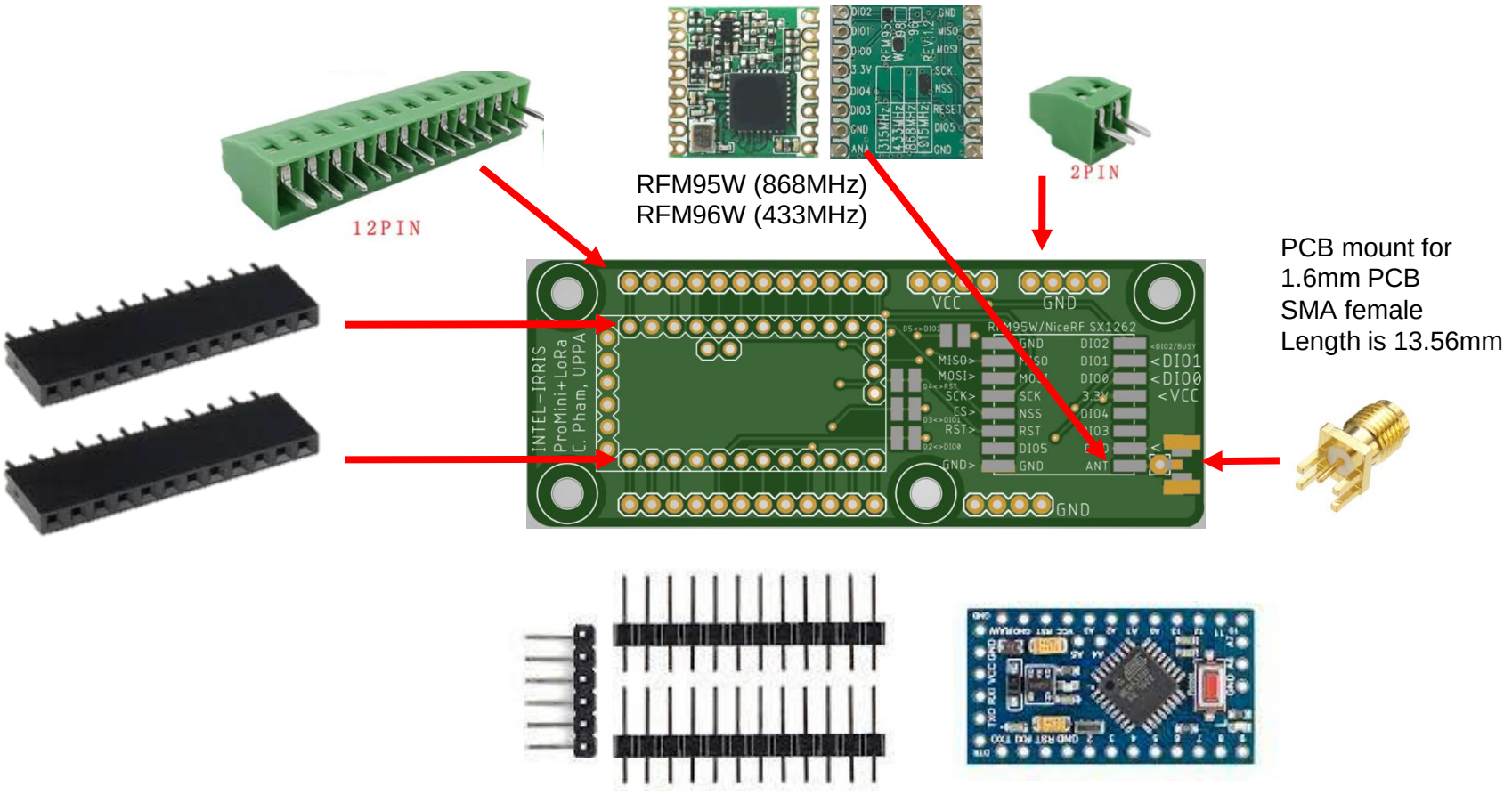
Piloting, Evaluation

Dissemination, Innovation, Sustainability

WP/Task	Title	M01	M02	M03	M04	M05	M06	M07	M08	M09	M10	M11	M12	M13	M14	M15	M16	M17	M18
WP1	Low-cost sensor platform for connecte	M1					M4		M5							M9			
T1.1	Multi-actors technology adaptation, c						D1.1												
T1.2	Design and development of low-cost s								D1.2a				D1.2b						
T1.3	Development of advanced soil-water-p												D1.3a						
T1.4	Test and validation in controlled agricu												D1.4a						
WP2	Plug-&-Sense smart irrigation system i	M1											M7			M10			
T2.1	Design of an edge-enabled sensor-gat								D2.1a										
T2.2	Development of multi-level & multi-st																		D2.3a
T2.3	Development of advanced AI edge-pro																		
T2.4	Training procedures for AI processing																		
T2.5	Datasets for smart agriculture																		
T2.6	Integrating the irrigation "in-the-box"												D2.2a						
WP3	Smallholder piloting program, demons	M1					M4						M8						M11
T3.1	Status on smallholders common irriga						D3.1a				D3.1b								D3.1c
T3.2	Smallholders Piloting Program & test p										D3.3								D3.4a
T3.3	Farmer Training Program																		D3.5a
T3.4	Evaluation and KPI assessment for the																		D3.6a
WP4	Community engagement, communicat	M1			M2						M6								
T4.1	Communication and dissemination ma				D4.1		D4.2						D4.3a						
T4.2	Organization of dissemination events																		
T4.3	Competitions and Challenges for Tech																		
T4.4	Starter-kit program																		
WP5	Cooperations, synergies and long-term	M1			M3														
T5.1	Partnership programs with local stake						D5.1						D5.2a						
T5.2	Mediterranean Partnership programs																		
T5.3	From piloting to long-term exploitatio																		
T5.4	Documentation and training materials																		D5.3a
WP6	Project management	M1																	
T6.1	Project coordination/administration			D6.1									D6.2						
T6.2	Technical management																		
T6.3	Quality and risk management																		


INTEL-IRRIS
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
LOW COST &
LOCAL
ASSEMBLY

Soil sensor


12PIN
RFM95W (868MHz)
RFM96W (433MHz)
2PIN
PCB mount for
1.6mm PCB
SMA female
Length is 13.56mm
INTEL-IRRIS
ProMini+LoRa
C. Pham, UPPA
VCC
GND
RFM95W/NiceRF SX1262
MISO>
MOSI>
SCK>
NSS>
RST>
GND>
DIO5
ANT
DIO2
DIO1
DIO0
3.3V
DIO4
DIO3
<DIO1
<DIO0
<VCC
Arduino ProMini 3.3V 8MHz

Soil sensor: easy integration

Local assembly


2 pictures above: Building starter-kits by ENSA in Morocco




4 pictures above: Building starter-kits by UORAN1 in Algeria


January 2023

UPPA helping INRA SETTAT to build soil sensors

Capacity building of agri partners


INTEL-IRRIS
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
STARTER-KIT
3 VARIANTS

Type of Starter-kit for INTEL-IRRIS Project

An incremental design approach: From idea to reality

	capacitive SEN0308	tensiometer WM200	Base WaziGate	"+IIWA"	"+embedded AI"	"+WaziAct"
starter-kit v1 – M12	x		x			
starter-kit v2 – M24	x	x	x	x		
starter-kit v3 – M30	x	x	x	x	x	x

Starter-kit V1

SEN0308 capacitive sensor

~ 30€

Already developed

+

Starter-kit V2

1 Watermatrk

IIWA

~ 60€

Watermark WM200

2 Watermatrk

+

Starter-kit V3

Embedded AI

DataSet, ML Algorithms

+

WaziAct

Electrovanne

Not yet developped

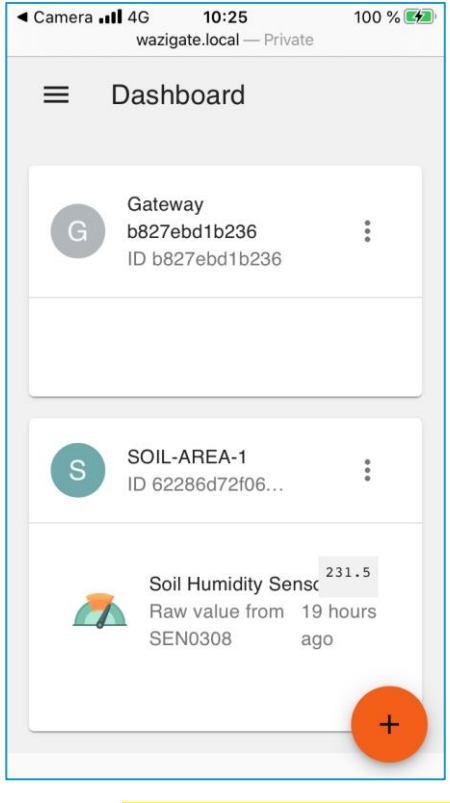
Gateway: collect sensor data

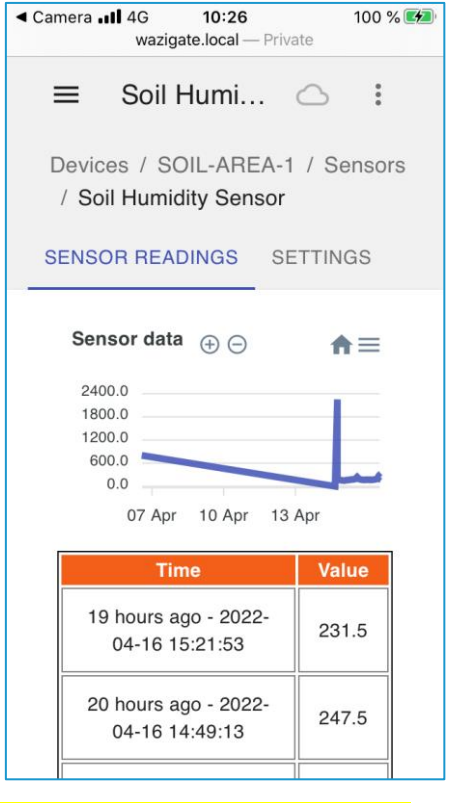
WAZIGATE GATEWAY

FULL EDGE-COMPUTING (NO INTERNET)

ALL DATA PROCESSING CAN BE DONE LOCALLY

EMBEDDED WEB INTERFACE





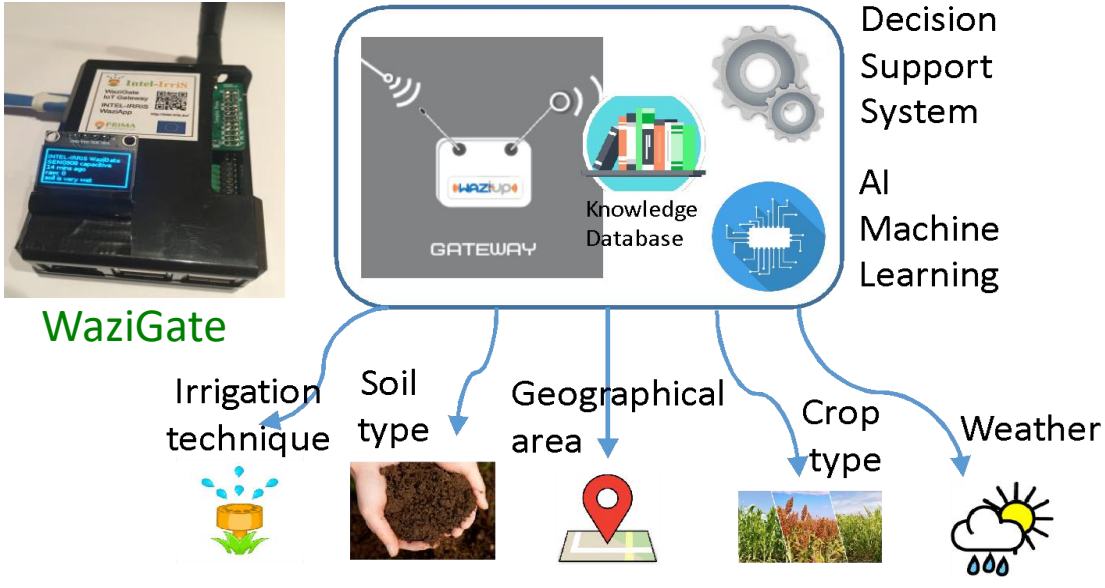
1 GATEWAY HANDLES SEVERAL DEVICES

< 50€

ACCESSED FROM A SMARTPHONE


INTEL-IRRIS
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
STARTER-KIT
INTELLIGENT

Embedded intelligence: INTEL-IRRIS Irrigation WaziApp (IIWA)



- IIWA: Embedded application running on INTEL-IRRIS WaziGate to implement the "intelligent Irrigation in-the-box" & "plug-&-sense" approach


INTEL-IRRIS
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
STARTER-KIT
DISSEMINATION

Seminars, scientific days, webinars, …

March 11th, 2022

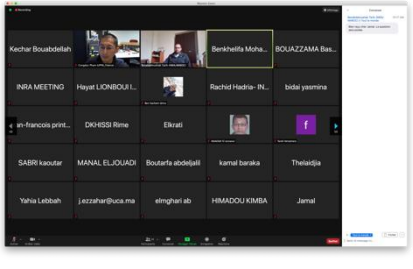
Irrigation : concepts et état des lieux

Résumé:

Le projet INTEL-IRRIS organise un webinaire sur « Irrigation : concepts et état des lieux » le 11 Mars 2022. Cette manifestation qui ambitionne d'apporter les éléments conceptuels nécessaires sur l'utilisation de la ressource hydrique dans le pourtour méditerranéen présentera les contraintes et les avancées de la gestion de l'eau d'irrigation à l'échelle parcellaire. Elle offrira aussi l'opportunité d'échange et de partage d'expérience en vue d'une gestion efficiente de l'eau d'irrigation et dans l'optique d'atténuer les effets du changement climatique. Outre les trois présentations introductives sur les concepts d'irrigation et la vision future en matière de recherche en irrigation assurées par des chercheurs et experts renommés, le webinaire couvrira divers aspects de la problématique de qualité et de gestion de l'eau d'irrigation.

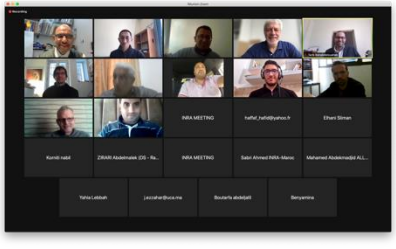
Vendredi 11/03/2022 | 09h30 (GMT+1) | http://intel-irris.eu/

Horaire	Programmation
09h30-10h00	Ouverture : **Présentation du projet** Pr. Congduc Pham (UPPA)
10h00-11h00	« **L'irrigation au Maroc face aux changements climatiques : les nouveaux défis** » Dr. Bassou Bouazzama (INRA)
11h00-12h00	« **L'eau dans le sol et contraintes de l'irrigation** » Pr. Mohammed Benkhelifa (UMAB)
12h00-12h30	Débat et clôture



March 30th, 2022

Apr 1st, 2022



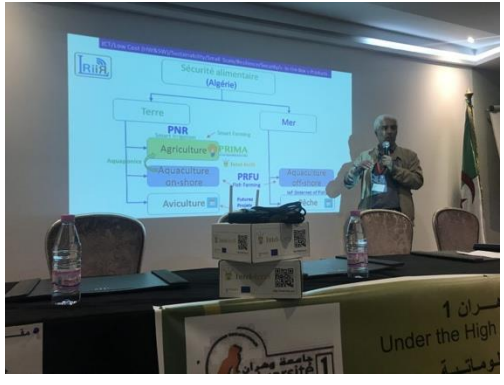
June 8th, 2022

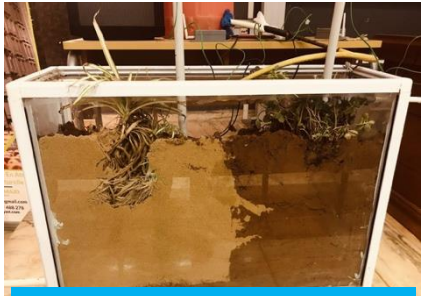
Smallholder dissemination events

June 9th, 2022

June 13th, 2022

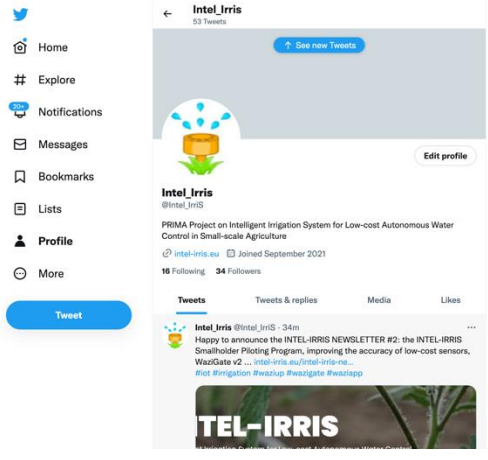
Dec 14th, 2022





March 7th, 2023

Social media: INTEL-IRRIS Twitter



Social media: INTEL-IRRIS Facebook

Dec 14th, 2022

جامعة وهران1 أحمد بن بلة Oran1 Ahmed Ben Bella University
mercredi

Lancement de la Journée d'Information et de Sensibilisation dans l'Agriculture de Précision

March 7th, 2023

Chambre De L'agriculture Mostaganem
il y a environ 2 semaines

احتضنت جامعة مستغانم بالقسم علوم طبيعة والحياة يوم تقني حول نظام ري ذكي للتحكم الذاتي في الماء بتكلفة منخفظة للمزارع الصغيرة
في إطار مشروع بحث intel-irris prime 2 تحت عنوان المزارع الصغيرة بين نقص الموارد المائية و التسير الذكي الري
تحت اشراف الاستاذ الباحث بن خليفة محمد و بحضور خبراء أجانب في المجال بالتنسيق مع مديرية المصالح الفلاحية و الغرفة الفلاحية لولاية مستغانم
حيث يعد هذا اللقاء الورشة الأولى للمشروع الذي حضره شركاء القطاع وبعض فلاحي الولاية

Others

- Press releases, interviews, local radio & TV
- Tutorial materials
- Cooperation with WaterMed 4.0 – https://www.watermed-project.eu/

  PRIMA S1 N°1821 – Coordinator A. Skarmeta (ES)

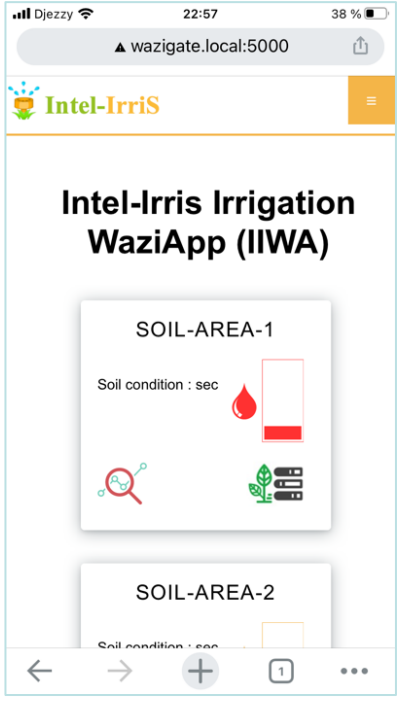
  Algeria coordinator: Benyamina Abou El Hassan

  Some INTEL-IRRIS piloting farms will be registered on the WaterMed platform
- Publications : 03 conference papers + 1 journal paper

Competition Challenges

- We launched the INTEL-IRRIS Competition Challenges
  https://intel-irris.eu/intel-irris-challenge

- Competitors will propose improvements on the IIWA application
- Several contribution categories are defined
  - User Graphical Interface
  - Calibration of sensor data
  - Processing & transformation of sensor data
  - Integration of agriculture data & knowledge



GitHub Intel-IrriS


INTEL-IRRIS
Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture
STARTER-KIT
SMALLHOLDER
PILOTING PROGRAM

Smallholder Piloting Program (SPP)

- Very important step in the project
- 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 24 months to ensure that the proposed irrigation systems are well tailored for the specificities of the regional context
- 13 farms already enrolled to participate in the Piloting Program
- Scale-up to involve at least 20 small-scale farms

Preparation of the SPP

- First contact, logistics, databases, questionnaires, deployment, validation, feedback

PRIMA IN THE MEDITERRANEAN AREA

Intel-IrriS

Questionnaire pour les petits agriculteurs

Enquête sur la pratique actuelle de l'irrigation et la perception des petits exploitants et des acteurs de la région dans le domaine agricole sur l'utilisation de la technologie et des pratiques d'irrigation innovantes.

* 1. **Politique de confidentialité :**

☐ Autoriser l'utilisation de mes données personnelles conformément à la législation actuellement en vigueur, au service du projet INTEL-IRRIS.

* 2. **Informations de contact :**

Nom : .....

Prénom : .....

Age : .....

Tél: .....

E-mail : .....

* 3. **Informations sur la ferme :**

Nom de l'exploitation : .....

Nom du propriétaire : .....

Localisation (site, lieu ou coordonnées) : .....

Région (Pays) : .....

Type de culture (variété) : .....

1

PRIMA IN THE MEDITERRANEAN AREA

Intel-IrriS

إستبيان للمزارعين الصّغار

إستبيان لطرق ممارسات الري الحالية وتصور أصحاب المزارع الصغيرة والفاعلين في الميدان الفلاحي حول مسألة استخدام التكنولوجيا وممارسات الري المبتكرة

*1. مسألة إستخدام المعلومات الشخصية:

☐ التصريح باستخدام المعلومات الخاصة بي وفقًا للتشريعات المعمول بها حاليًا، في خدمة مشروع INTEL-IRRIS

*2. معلومات الإتصال

الاسم: .....

اسم العائلة: .....

السّن: .....

الهاتف: .....

البريد إلكتروني: .....

*3 . معلومات عن المزرعة

اسم المزرعة.....

اسم صاحب المزرعة.....

الموقع (المكان او العنوان) .....

بلد (المدينة).....

نوع الزراعة (الصنف) .....

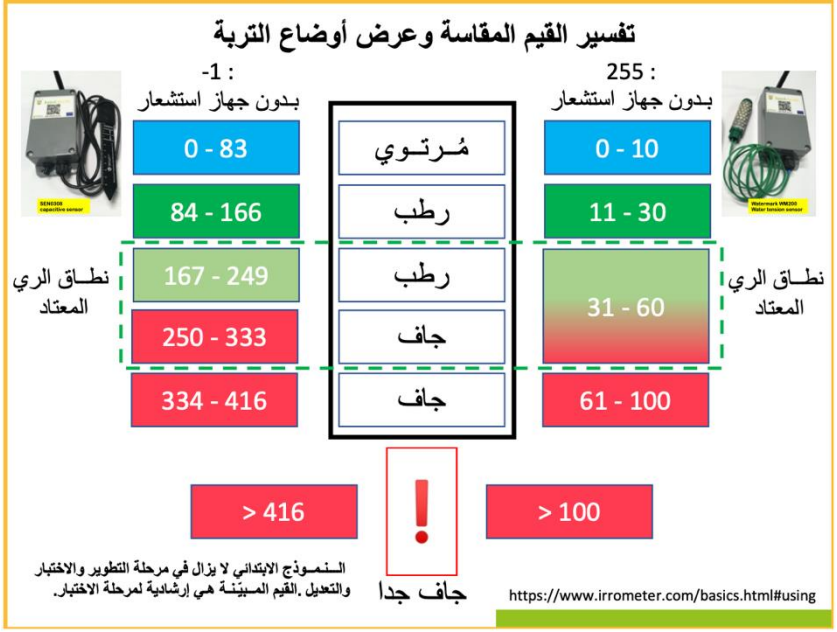
*4. مساحة الارض المستغلة

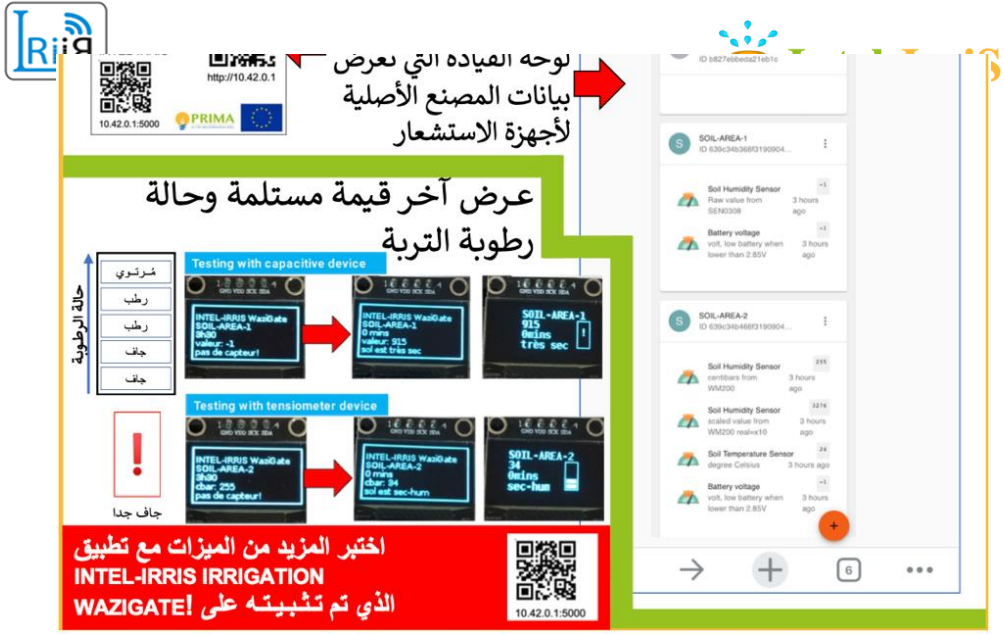
☐ >10 ha ☐ 2-10 ha ☐ 0-2 ha

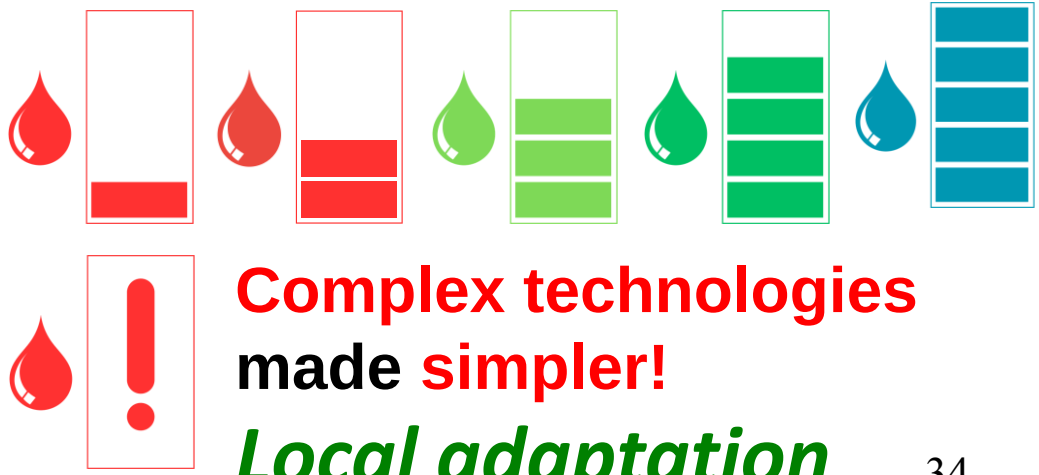
1


نـظـام ري ذكـي
-الـنـمـوذج الإبـتـدائي-
PRIMA
Intel-IrriS


INTEL-IRRIS WaziGate
SOIL-AREA-1
0 mins
valeur: 915
sol est très sec
عرض آخر قيمة تمّ الحصول عليها وحالة رطـوبـة التربة
SEN0308
capacitive sensor
Watermark WM200
Water tension sensor
يتم تسليمها مع بوابة واحدة ومستشعر سعوي أو مقياس رطوبة التربة


تفسير القيم المقاسة وعرض أوضاع التربة
-1 :
بـدون جهاز استشعار
255 :
بـدون جهاز استشعار
0 - 83
84 - 166
167 - 249
250 - 333
334 - 416
0 - 10
11 - 30
31 - 60
61 - 100
مُـرتـوي
رطب
رطب
جاف
جاف
نطـاق الري المعتاد
نطـاق الري المعتاد
> 416
> 100
جاف جدا
الـنـمـوذج الابتدائي لا يزال في مرحلة التطوير والاختبار والتعديل. القيم المـبيّنـة هي إرشادية لمرحلة الاختبار.
https://www.irrometer.com/basics.html#using


لوحة القيادة التي تعرض بيانات المصنع الأصلية لأجهزة الاستشعار
http://10.42.0.1
10.42.0.1:5000
PRIMA
عـرض آخر قيمة مستلمة وحالة رطوبة التربة
حالة الرطوبة
مُـرتـوي
رطب
رطب
جاف
جاف
Testing with capacitive device
Testing with tensiometer device
جاف جدا
اختبر المزيد من الميزات مع تطبيق
INTEL-IRRIS IRRIGATION
WAZIGATE! الذي تم تـثـبـيـتـه على
10.42.0.1:5000


Complex technologies
made simpler!
Local adaptation

Thank you for your attention

شكرا

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