

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: Approche Mono-ferme

Project PNR S2IEA

Smart and sustainable irrigation system for agricultural farms
Système d'Irrigation Intelligent et Durable pour Exploitations Agricoles : Approche Multi-fermes



DSA-Oran



SMART FARMING III
28 February, 2024



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University of Oran1 Ahmed Ben-bella





Objectives



Intel-Irris project:

- Propose Low cost and efficient water control system for irrigation optimization for **Mono-farm approach using advanced technologies**



PNR-S2IEA project:

- Propose Low cost and efficient water control system for irrigation optimization for **Multi-farm approach using advanced technologies**
- Study of water quality dedicated to irrigation
- Early detection of plant diseases

INTEL-IRRIS

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

**INTEL-IRRIS
PROJECT**



Project Background

Code : 1560



❖ Call: Section 2 Multitopic 2020

❖ 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




France

WAZIUP eV:
WAZIUP
association




Germany

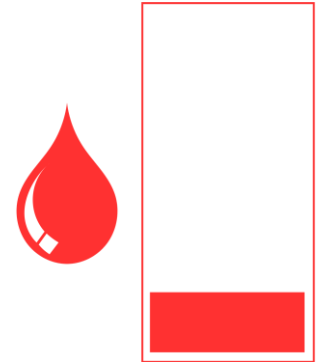
❖ 36 months – start date June 1st, 2021 - 31 May 2024

❖ Funding: Local agencies (Algeria: DGRSDT/MESRS)

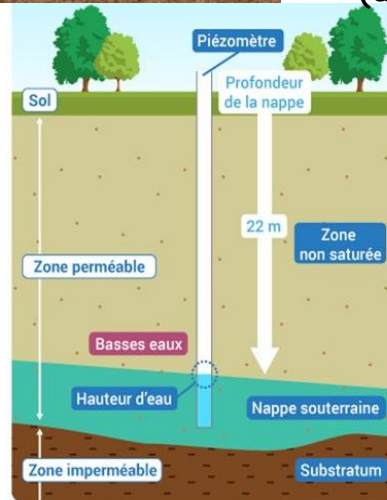
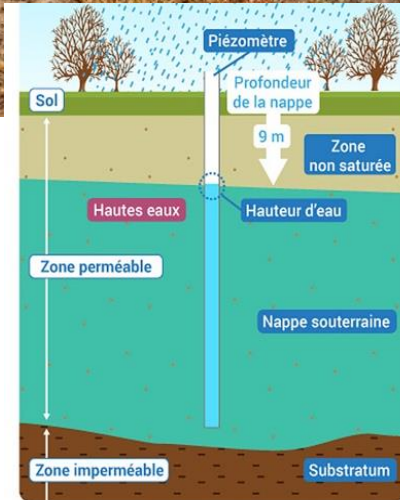
Water resource is precious!



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).



- ✓ 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



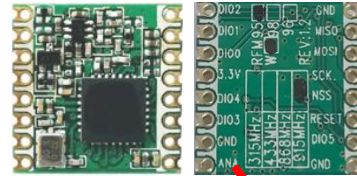
Out of reach for smallholders !!

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

**LOW COST &
LOCAL
ASSEMBLY**

Soil sensor



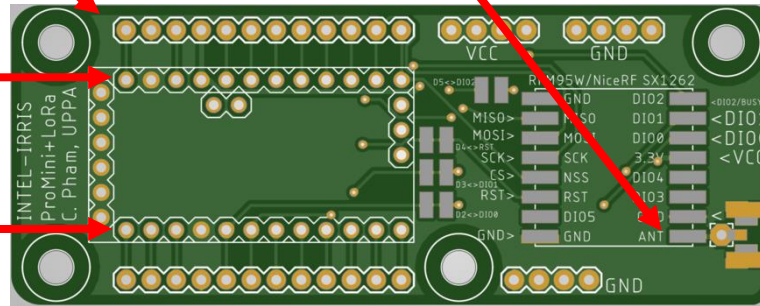
RFM95W (868MHz)
RFM96W (433MHz)



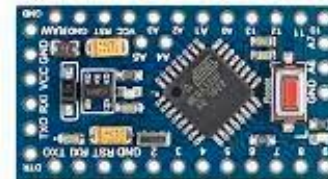
2PIN



12PIN

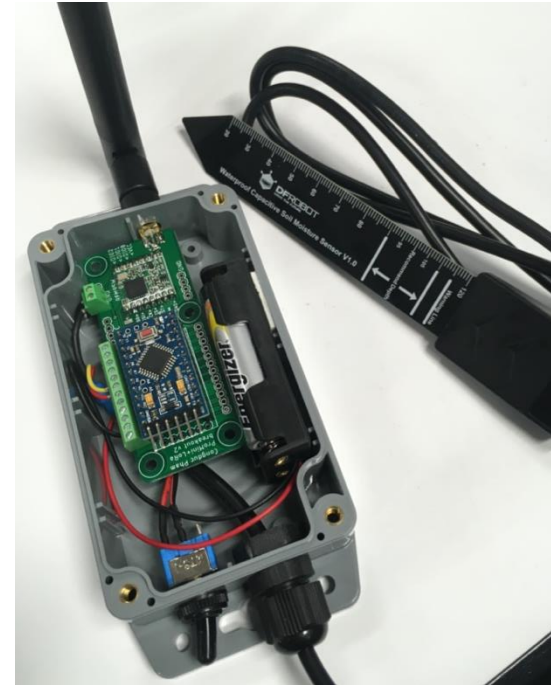


PCB mount for
1.6mm PCB
SMA female
Length is 13.56mm



Arduino ProMini 3.3V 8MHz

Soil sensor: easy integration





Starter-Kit Local assembly



During GM June 2023 ORAN1



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

In RIIR Laboratory

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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 Watermark

~ 60€

Watermark
WM200



2 Watermark

Energy Harvesting
(solar panel)

Starter-kit V3



Embedded AI

DataSet, ML
Algorithms

WaziAct



Electrovanne



Fully automated irrigation

**Not yet
developed**

Gateway: collect sensor data

WAZIGATE GATEWAY

**FULL EDGE-COMPUTING
(NO INTERNET)**

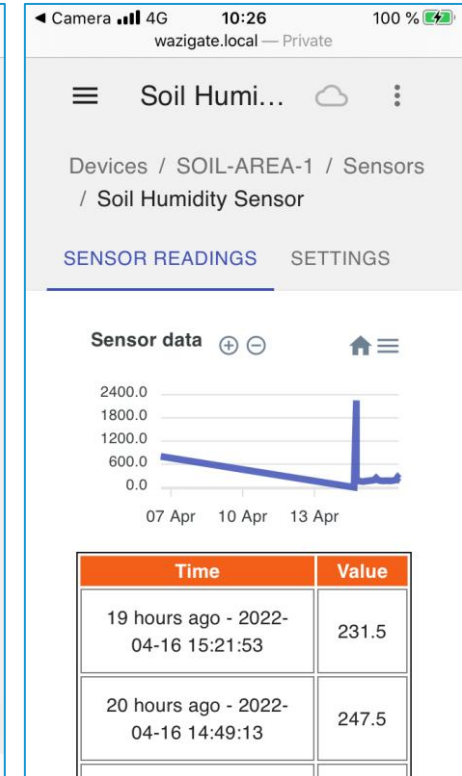
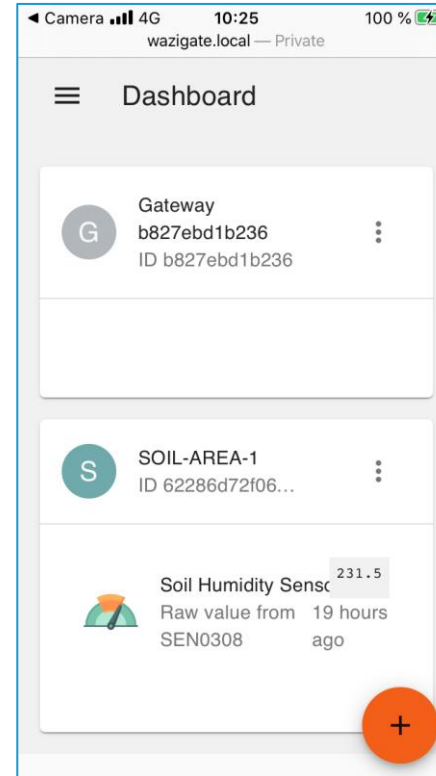
**ALL DATA PROCESSING
CAN BE DONE LOCALLY**



**1 GATEWAY HANDLES
SEVERAL DEVICES**

< 50€

EMBEDDED WEB INTERFACE



ACCESSED FROM A SMARTPHONE

INTEL-IRRIS

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

**STARTER-KIT
DEPLOYMENT**

Visit of farms to deploy Startet-kits (Oct-Nov 2023)

Plan – Phase 1 - Deployment

- Deployment of Starter-kits in two partner farms to make 'Open field' tests during a period of 15-30 days in the presence of farmers.
- Helping farmers to use the starter-kit (switching on the sensors and the Gateway, reading results via the Gateway's integrated OLED display, reacting to Gateway decisions,).
- Farmers contact the team in the event of a breakdown or technical problem for urgent intervention (particularly in the event of a power failure).
- Data collection and storage in the gateway ----> UORAN1-Data set
(From Watermark sensor and capacitive sensor + soil temperature sensor)



نظام ري ذكي -النموذج الإبتدائي-

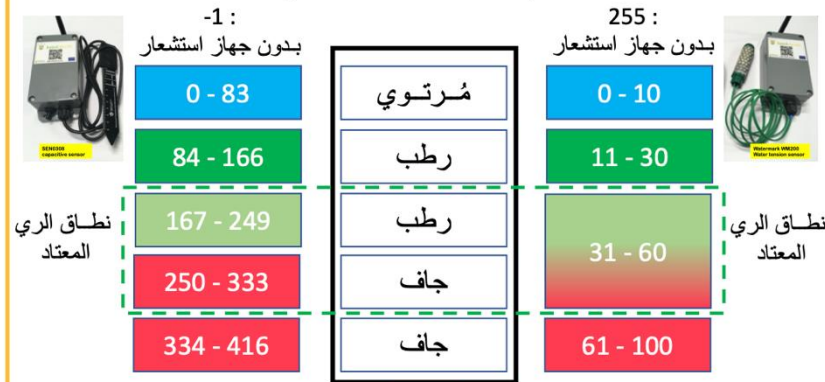


عرض آخر قيمة تم
الحصول عليها وحالة
رطوبة التربة



يتم تسليمها مع بوابة واحدة ومستشعر سعوي أو مقياس رطوبة التربة

تفسير القيم المقاسة وعرض أوضاع التربة



> 416



جاف جدا

> 100

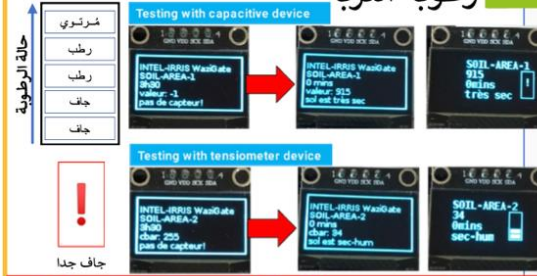
النموذج الإبتدائي لا يزال في مرحلة التطوير والاختبار والتعديل القيم المبيّنة هي إرشادية لمرحلة الاختبار.

<https://www.irrometer.com/basics.html#using>

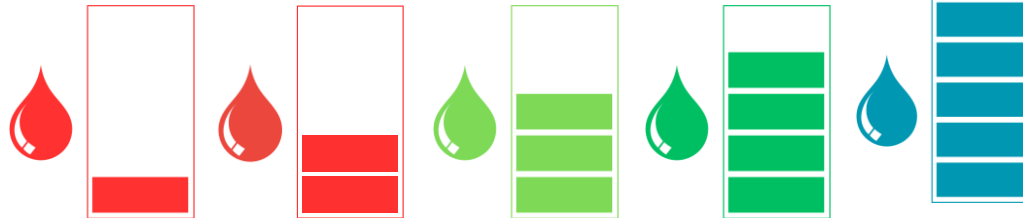
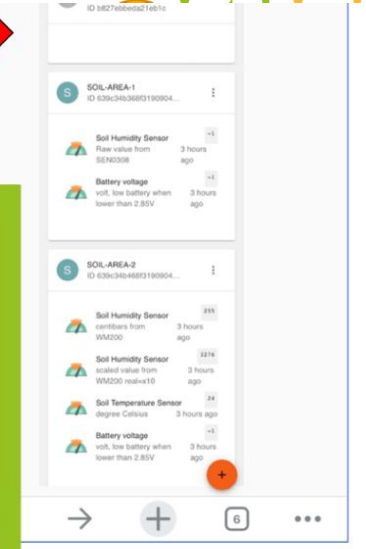


لوحة الفياده التي تعرض
بيانات المصنع الأصلية
لأجهزة الاستشعار

عرض آخر قيمة مستلمة وحالة رطوبة التربة



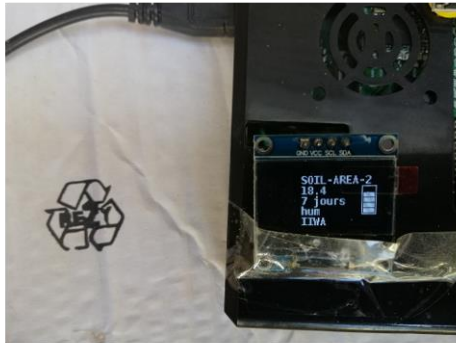
اختبر المزيد من الميزات مع تطبيق
INTEL-IRRIS IRRIGATION
الذي تم تثبيته على WAZIGATE!



Complex technologies
made simpler!
Local adaptation

Visit of farms to deploy Startet-kits (Oct-Nov 2023)

Farm 1 : Region of Aint-Turk (≈ 15 Km from Oran1)



Gateway with LORA Connectivity (868 Mhz-New)



tomato crop

Watermark and capacitive sensors V2 with LORA Connectivity (868 Mhz-New)

Visit of farms to deploy Startet-kits (Oct-Nov 2023)

Farm 2 : region of Misserghin (≈ 20 Km from Oran1)



Citrus
(Fr: agrumes –
les oranges)

Visit of farms to deploy Starter-kits (Oct-Nov 2023)

Plan – Phase 2 - Feedback

- Does the starter-kit work as intended ?
- Is this irrigation system easy to use (user interface)?
- Did the system help you save water after this test ?
- Did you notice any technical problems using the starter-kit ?
- Did the technical team quickly solve these problems ?
- Are you satisfied with this system in your daily irrigation?
-etc.

So far, farmers are generally very satisfied with the starter-kit.

➔ **Need to design a questionnaire to get this feedback (in progress)**

Also organize with farmers practical sessions or meeting to discuss with them the use of the starter kit, especially the user interface

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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 webinar 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 contexte méditerranéen présentera les contraintes et les avancées de la gestion de l'eau d'irrigation à l'échelle parcelaire. Elle offrira aussi l'opportunité d'échanger et de partager 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 webinar 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/>

Horaires	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. Mohamed Benkhefella (UMAB)
12h00-12h30	Débat et clôture



March 30th, 2022

SEMINAIRE 2022
L'AGRICULTURE CONNECTÉE À BAS COUTS

30 MARS 2022 À PARTIR DE 10H
à l'ENSA de ORAN (AMPHI A)

Pr. BENKHOJA Khalil
Directeur de l'IMAS
Mot d'ouverture

Pr. Congduc PHAM
Université de Pau
Nécessaire un projet d'irrigation précis pour développer des technologies d'irrigation pour les petits exploitants agricoles

Pr. EL ISSAOUI Abdellah
INRA-CIRIA SETIF
Technologies des coproducts pour l'irrigation de précision: performances techniques et économiques

Pr. MADIAFI Mohammed
MISA Sfax
Intelligence Artificielle au Service de l'Agriculture

Coordonnateur du séminaire
Pr. BARAKA Kamal

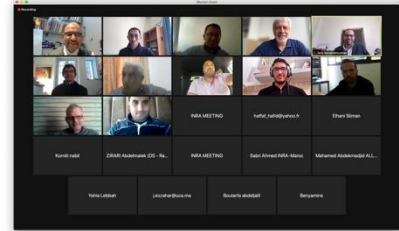
Site: <http://intel-irris.eu>



Apr 1st, 2022

WEBINAR
2ème édition
Irrigation 4.0

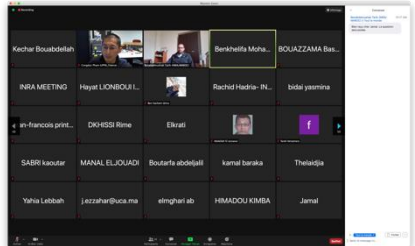
Vendredi 1 Avril 2022
09h00 (GMT)
<http://intel-irris.eu/>
sur Zoom



June 8th, 2022

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

Scientific day of PRIMA INTEL-IRRIS project and the challenges of Irrigation 4.0



WORKSHOP SMART FARMING II (2ème édition)
Date : 13 Novembre 2022
Lieu : Amphithéâtre Talahit du Campus Taleb. Mourad Salim

SMART FARMING II

THEMATIQUES

- TIC et Consommation d'énergie
- Agriculture de précision et Sécurité alimentaire
- Economie de l'eau et sa Gestion durable

Site: smartfarming.ora2022@gmail.com
Site web: https://www.intel-irris.eu/Smart_Farming_2ndedition.html





Smallholder dissemination events

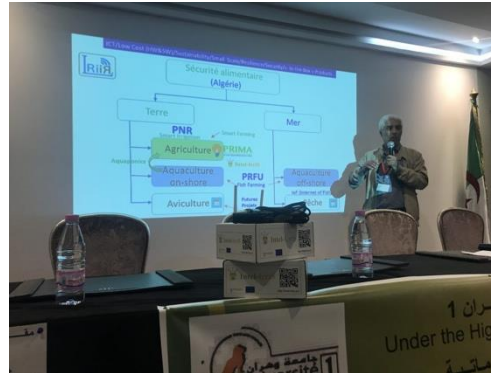
June 9th, 2022



June 13th, 2022

Dec 14th, 2022

تحت الرعاية المشرفة لمدير جامعة وهران 1
Under the High Patronage of the Rector of the University Oran 1
مدير الحوسبة الشبكية والشبكات المعلوماتية
Laboratory of Industrial Computing and Networks (RIIR)
Do it Yourself
نظم
الجزء الثاني
يوم إعلامي وتوعوي في الزراعة الدقيقة
Information and Sensibilisation Day in Precision Agriculture
December 14, 2022
At The PACHA hotel



الورشة الأولى Intel-IrriS Prima2 جامعة مستغانم 07 مارس 2023
1st Intel-IrriS Prima2 Workshop UMAB Mostaganem March 07, 2023
المزارع الصغيرة بين نقص الموارد المائية والتسيير الذكي للمري
Small-Scale Agriculture Irrigation between Water Resource Deficit and Smart Management



March 7th, 2023



Social media: INTEL-IRRIS Twitter

Intel_Irris
 53 Tweets

Home
 Explore
 Notifications
 Messages
 Bookmarks
 Lists
 Profile
 More

Intel_Irris
 @Intel_Irris

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

intel-irris.eu · Joined September 2021

16 Following · 34 Followers

Tweets · Tweets & replies · Media · Likes

Intel_Irris @Intel_Irris · 34m
 Happy to announce the INTEL-IRRIS NEWSLETTER #2: the INTEL-IRRIS Smallholder Piloting Program, improving the accuracy of low-cost sensors, WaziGate v2 ... intel-irris.eu/intel-irris-ns...
 #iot #irrigation #waziup #wazigate #waziapp

TEL-IRRIS



Intel_Irris
 @Intel_Irris

Waziup IoT Retweeted
 Intel_Irris @Intel_Irris · Apr 15

More than 30 starter-kits have already been assembled, ready to be deployed in piloting program with smallholders! With the WaziGate IoT gateway, the starter-kit can be deployed out-of-the-box! #iot #WaziGate #irrigation #smallholders.

Autonomous
 Intelligent Irrigation
 Plug-&Sense
 In-the-box

PRIMA
 Intel-Irris

1 retweet · 6 likes

Intel_Irris @Intel_Irris · May 16

The INTEL-IRRIS starter-kit is here! From idea to reality, with the @waziupIoT WaziGate IoT gateway for embedded intelligence in irrigation optimization for smallholders! #irrigation #iot #smallholders

0:04 27 views

2 likes

Intel_Irris @Intel_Irris · Nov 22, 2022

The INTEL-IRRIS IoT Gateway moved to WaziGate v2 for increased robustness and better edge deployment support in small scale agriculture! @waziupIoT #EdgeComputing #agriculture #farmer. Check-out on our Results section intel-irris.eu/results.

WAZIGATE v2
 Join with
 password
 Lowcost Gateway

3 likes

Social media: INTEL-IRRIS Facebook

Dec 14th, 2022

March 7th, 2023

Oran1 Ahmed Ben Bella University
mercredi

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

الجمهورية الجزائرية الديمقراطية الشعبية
République Algérienne Démocratique et Populaire
Ministère de l'Enseignement Supérieur et de la Recherche Scientifique
الوزارة العليا للتعليم والبحث العلمي
الجامعة الجزائرية للعلوم الدقيقة والتكنولوجيا
Faculté des sciences exactes et appl.

Laboratoire : Laboratoire de Recherche en Informatique Industrielle et en Réseaux
laboratoire : Pr KECHAR Bouabdellah
et PNR « SZIEA » : Pr KECHAR Bouabdellah
Projet : Système d'irrigation intelligent et durable pour exploitations agricoles – SZIEA
Organisation d'une manifestation scientifique

يوم إعلامي وتوعوي في الزراعة الدقيقة
Information and Sensibilisation Day in Precision Agriculture
Journée d'Information et de Sensibilisation dans l'Agriculture de Précision

Le Mercredi 14 Décembre 2022 à LE PACHA HOTEL
Organisée par le laboratoire RiiR (Université ORAN1) et son partenaire Socio-économique DSA Oran

تقديمات مبتكرة منخفضة التكلفة من أجل زراعة حديثة ومستدامة في الجزائر
أنجزه بنفسك
Innovative low cost technologies for a modern and sustainable agriculture in Algeria
Do-it-Yourself
Les technologies low cost pour une agriculture moderne et durable en Algérie
Faites-le-Vous-même

Page - 1

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 منخفضة للمزارع الصغيرة في إطار مشروع بحث intel-irris prime 2 تحت عنوان المزارع الصغيرة بين نقص الموارد المائية والتسيير الذكي الري تحت اشراف الأستاذ الباحث بن خليفة محمد وبحضور خبراء أجانب في المجال بالتنسيق مع مديرية المصالح الفلاحية و الفرقة 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

PNR-S2IEA

Smart and sustainable irrigation system for agricultural farms

PNR PROJECT

3 Enseignants Chercheurs + 3 cadres de DSA Oran



Une équipe-Projet PNR

Durée: 3 ans

Starting from March 2022



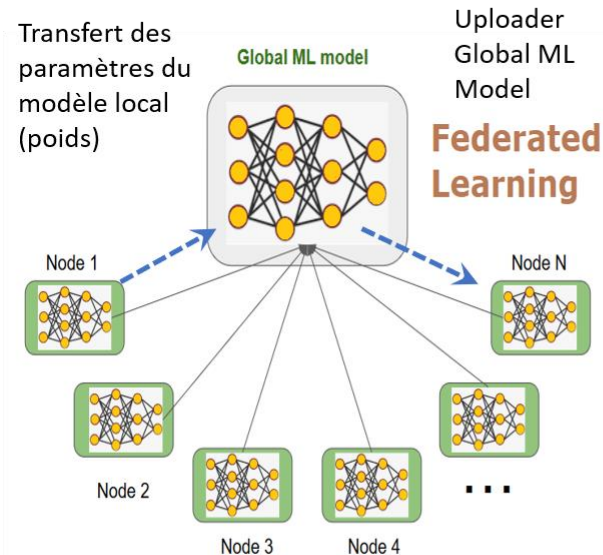
Thématiques de recherche du projet S2IEA

Point de départ: démarrer avec la solution générique INTEL-IRRIS (PRIMA)
Solution Mono-ferme et l'adapter (Hardware + Software)

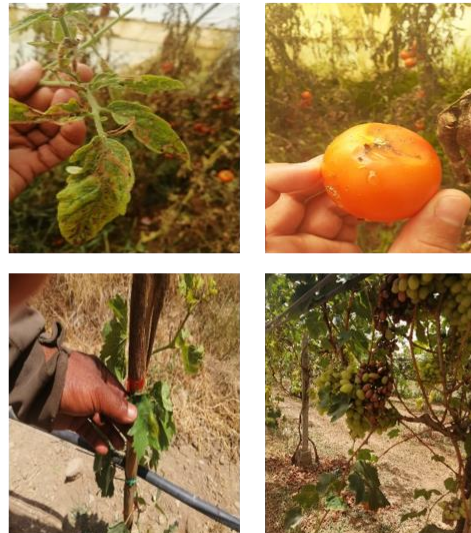
Approche d'irrigation multi-fermes

Détection des maladies des plantes

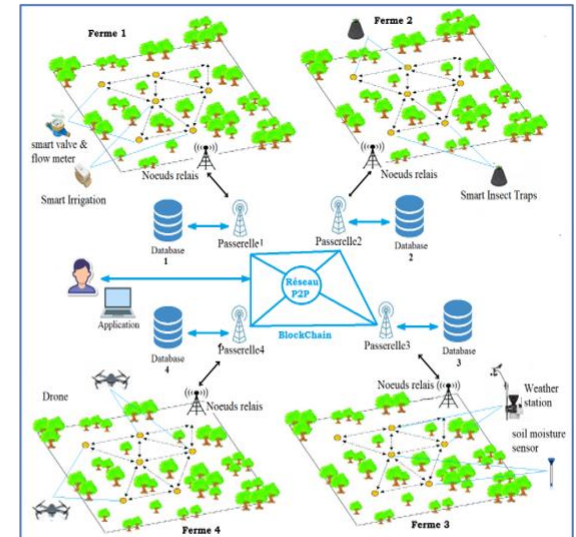
Cyber-sécurité (Data)



Avec Analyse de la qualité de l'eau dédié à l'irrigation



IoT/ML/Analyse d'images



Blockchain

Intelligent irrigation system using advanced technologies



LORA technology

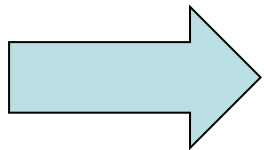


Data Collection

Soil sensor-5 in 1 integrated soil sensor
+ Data from weather station

Data storage and analysis

NVIDIA Jetson Nano
With **GPU** (128 NVIDIA CUDA cores)



Comparative Study with Intel-IrriS solution



Results

Publications:

- Several publications in indexed journals (e.g. Sensors)
- International communications (e.g. IEEE)

Doctoral Thesis defenses:

- 2 phd students (2024)

Master's thesis defenses (several)

Work in progress:

- 1 PhD thesis (PNR)
- 4 Master projects (PNR)

Patents and startups

Thank you for your attention

شكرا

Contact

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ORCID: orcid.org/0000-0001-8635-4667

Researchgate: <https://www.researchgate.net/profile/Kechar-Bouabdellah>

Google Scholar : <https://scholar.google.be/citations?user=nqTTv1cAAAAJ&hl=fr>