Intel-IrriS

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION
IN THE MEDITERRANEAN AREA

Deploying low-cost and full edge-IoT/AI system for optimizing irrigation in smallholder farmers communities

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UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

LIUPPA

It is a collaborative work

Deploying low-cost and full edge-IoT/AI system for optimizing irrigation in smallholder farmers communities

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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

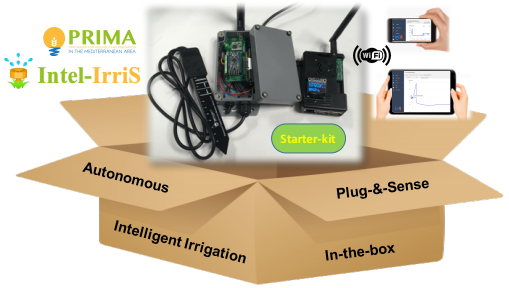
WAZIUP eV: WAZIUP association — Germany

PRIMA programme

- **Partnership for Research and Innovation in the Mediterranean Area** "will devise new R&I approaches to improve water availability and sustainable agriculture production in a region heavily distressed by climate change, urbanisation and population growth"
- **Call: Section 2 Multitopic 2020**
- Thematic Area 1-Water management
  - Low cost, lean solutions for enhancing irrigation efficiency of small-scale farms
- Thematic Area 2-Farming systems
  - Re-design the agro-livelihood systems to ensure resilience.
- Thematic Area 3-Agrofood chain
  - New optimization models of the agro food supply chain system to fair price for consumers and reasonable profit share for farmers

Optimize irrigation

- 35% of the world's food are produced in small-scale farms while only occupating about 12% of all agricultural land [FAO]
- A smart irrigation process can adapt water usage (i) for a particular crop, (ii) at a particular moment and (iii) for a given soil type and condition
- BUT, low adoption by smallholders, primarily due to the high initial cost and high skills requested to master the technology
- Intel-IrriS **will reduce the cost of smart technologies for smallholders, increase adoption and long-term smallholders' sustained production and income**
- Target: smallholders, small-scale farms
- "Intelligent Irrigation in-the-box" !



Technology components

Sensor part

Intel-IrriS

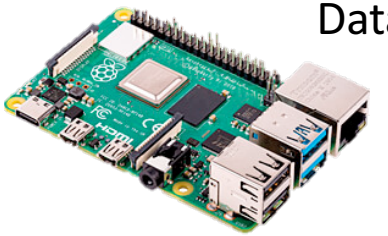
SEN0308 capacitive sensor cost<25€

Irrometer WM200 Water tension sensor Cost < 55€

LPWAN

Control part

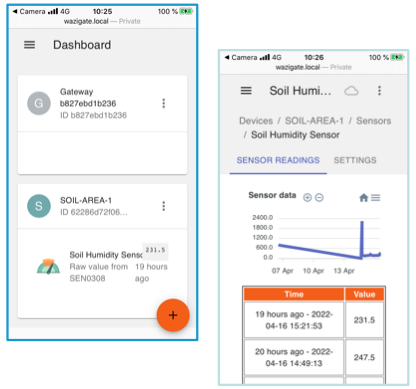
Embedded Database



Software updates

Wifi

Embedded User Interface



Low-cost sensors

Sensor part

Intel-IrriS

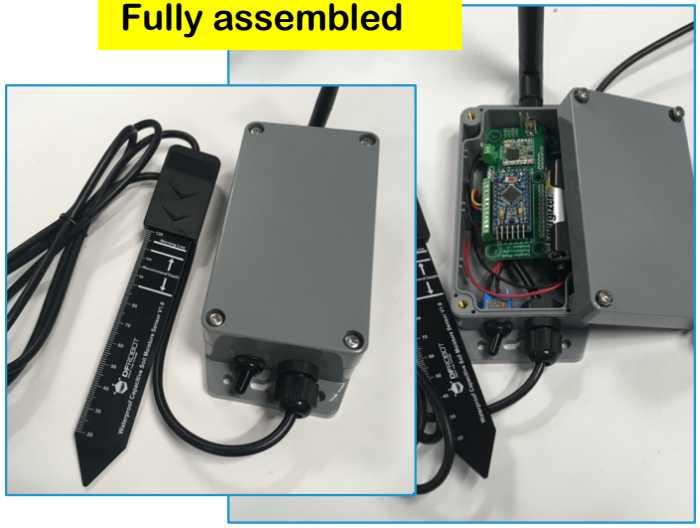
SEN0308 capacitive sensor cost<25€

Irrometer WM200 Water tension sensor Cost < 55€

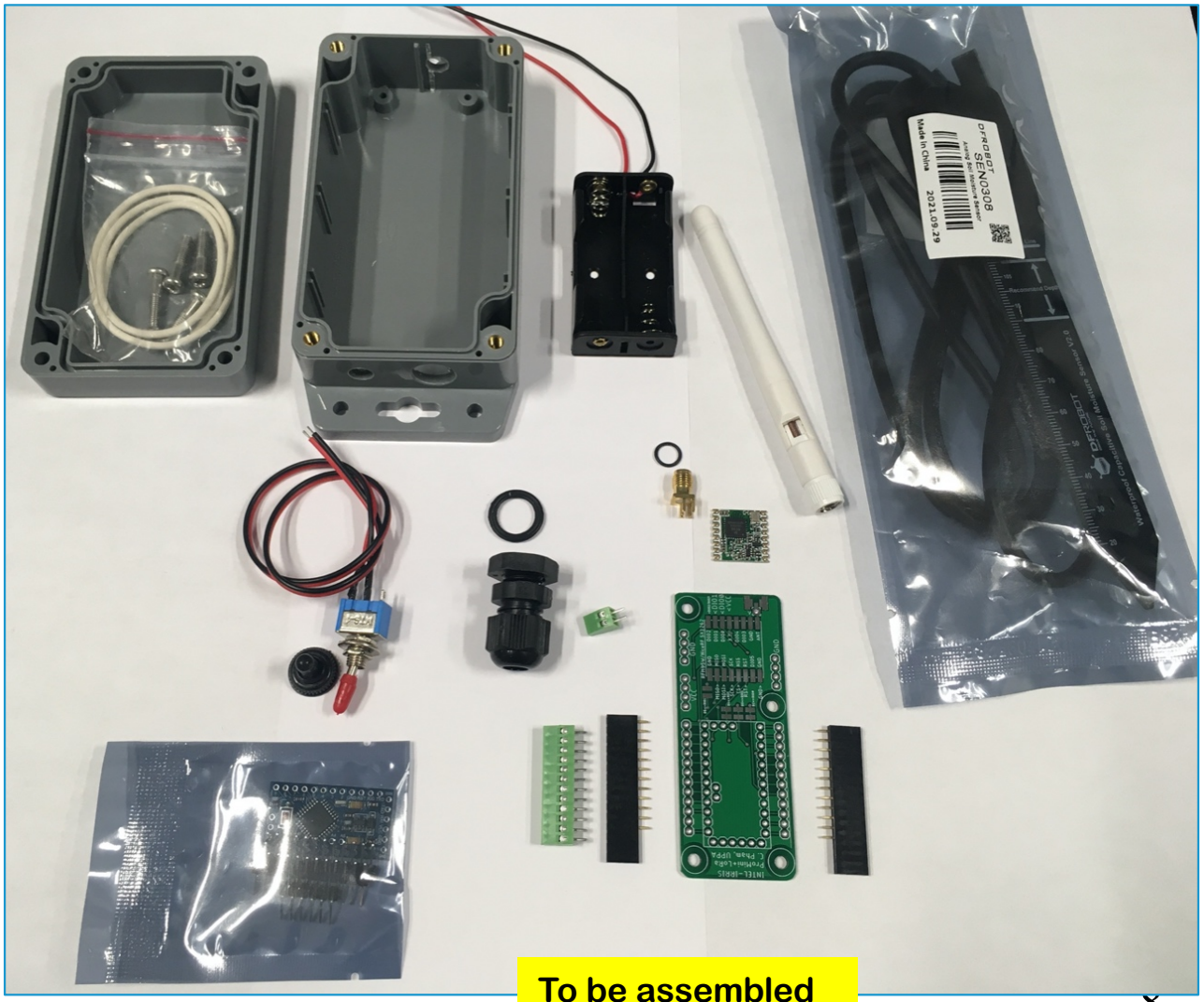
- Build on low-cost, low-power IoT expertise
- Enable deployment of several complementary low-cost sensors
- Several versions can be designed to meet cost constraints
- **Increase accuracy of low-cost sensors by advanced calibration procedures**

Low-cost approach: <25€

Fully assembled



Packaging in enclosure



To be assembled

Smart embedded control

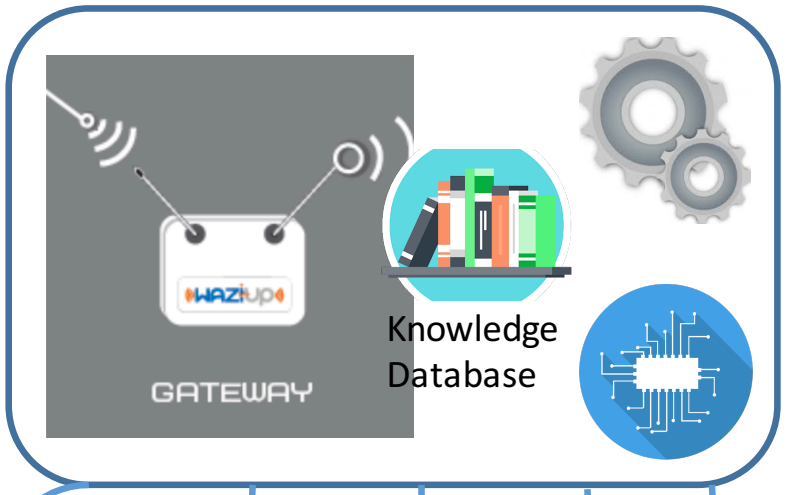
- Build on low-cost embedded & open IoT gateway expertise
- Fully autonomous, no Internet
- Implement the “Intelligent Irrigation in-the-box” with "plug-&-sense" approach
- Embed dedicated irrigation-oriented application
- Model complex water-soil-plant-weather interaction
- Integration of various knowledge streams

INTEL-IRRIS starter-kit

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

Prof. Congduc Pham
http://www.univ-pau.fr/~cpham

Embedded intelligence



Irrigation technique

Soil type

Geographical area

Crop type

Weather

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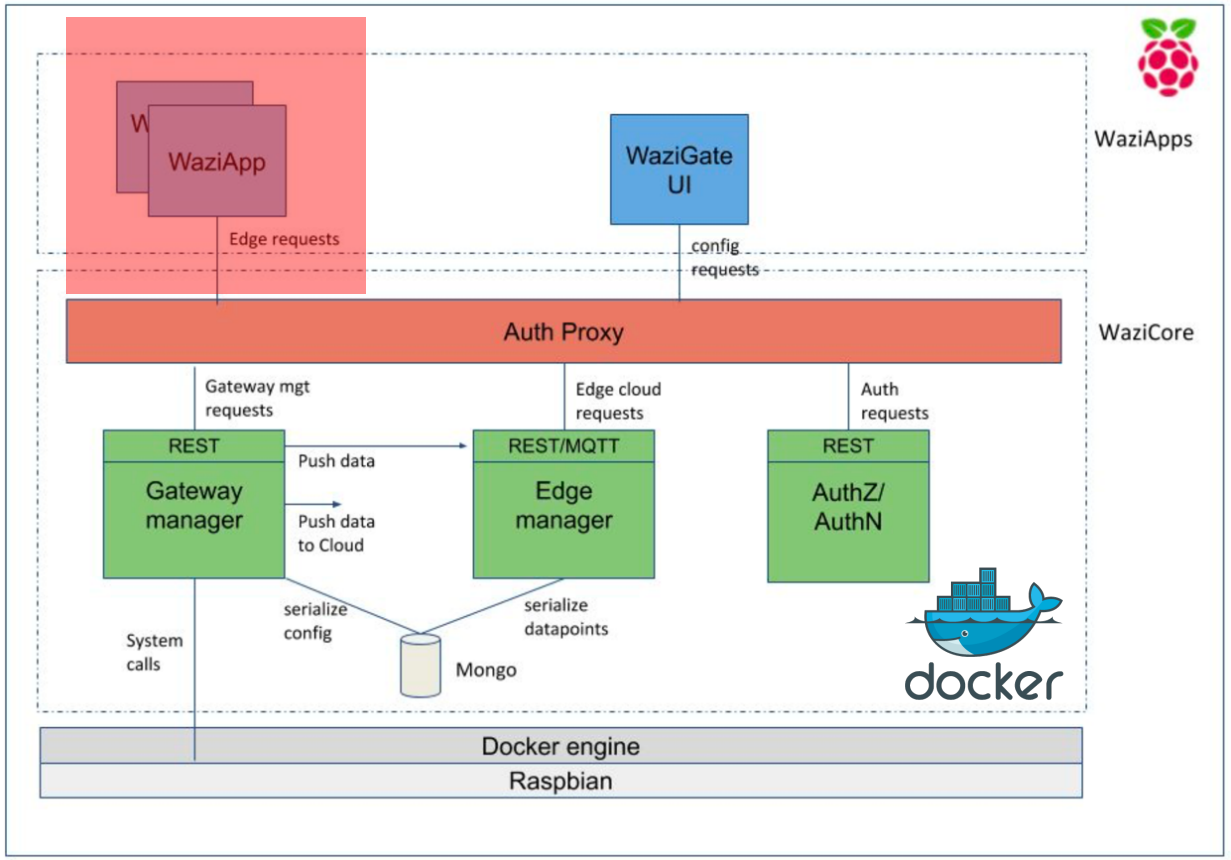
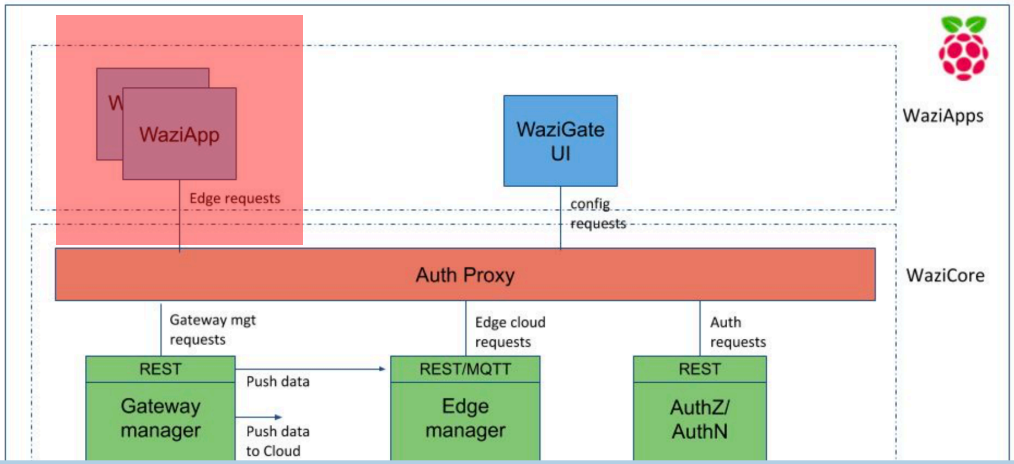
WaziGate: the versatile IoT gateway

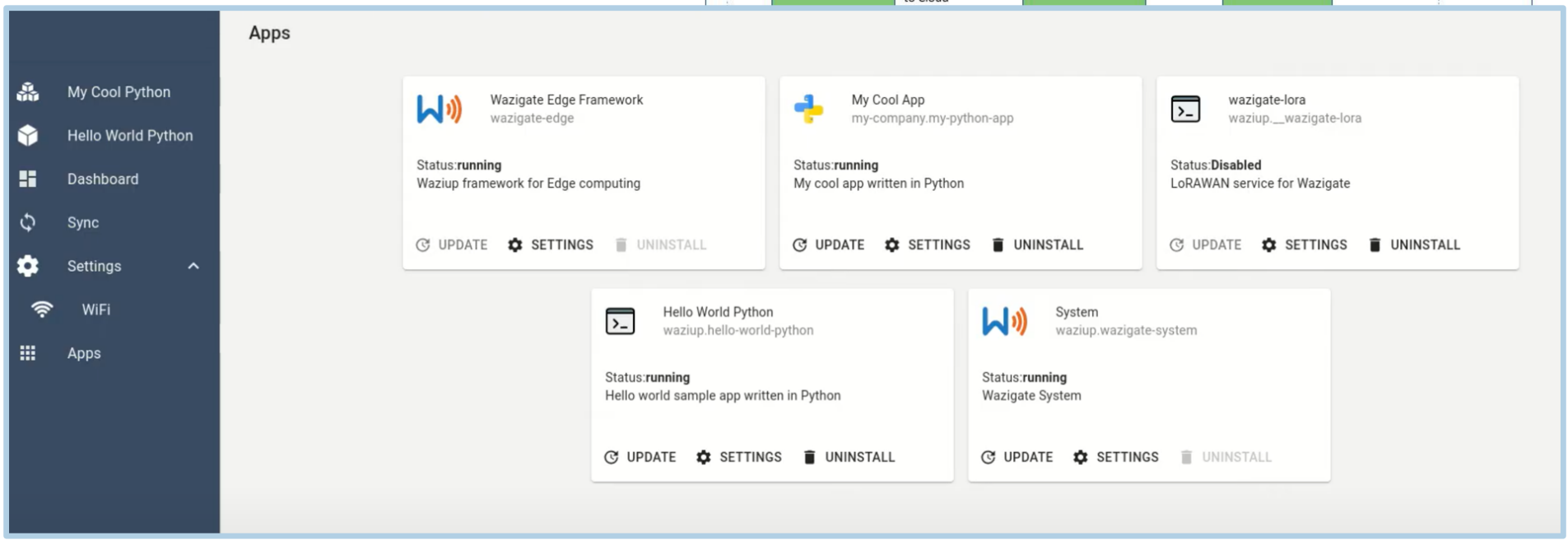
- Micro-service architecture
- System & User APIs
- Docker-based user apps
- LoRa & LoRaWAN



WaziApps

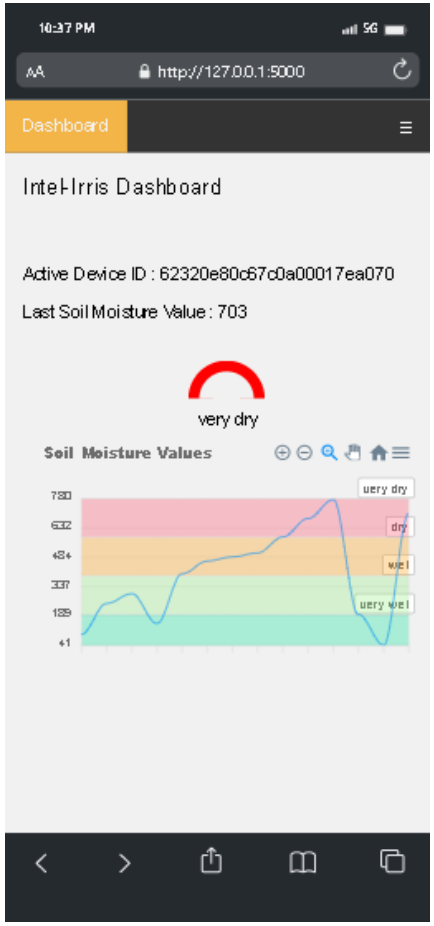
- WaziGate supports user-developed applications

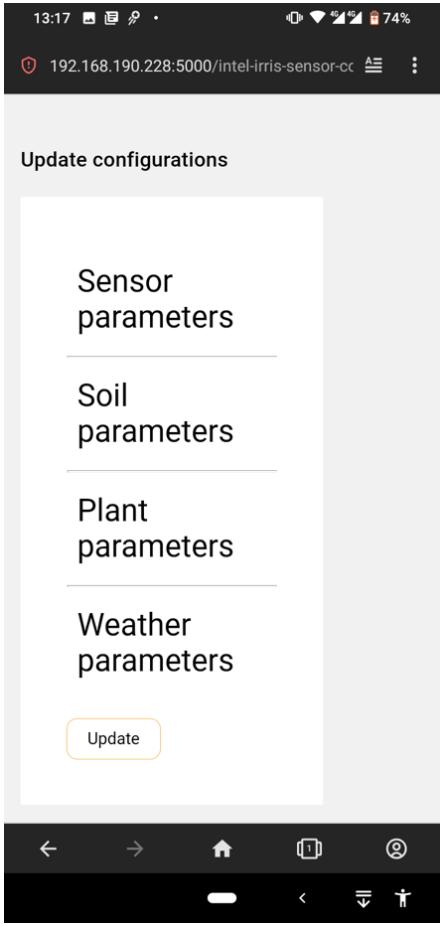




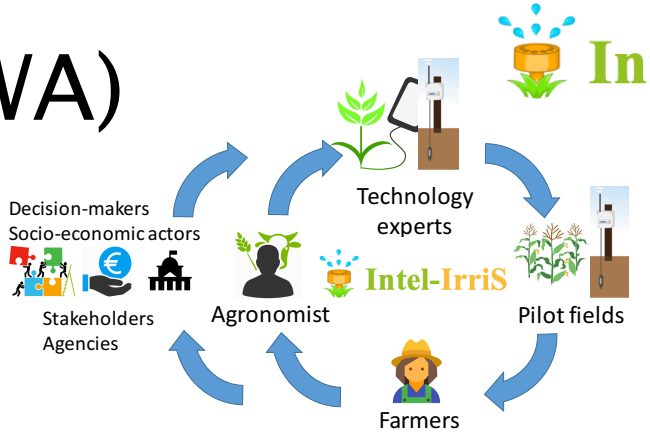
Advanced calibration

- **Intel-Irris WaziApp (IIWA)**
- smart irrigation application that focuses on processing of soil parameters from a sensor
- sensor type & characteristics, soil type & characteristics, irrigation techniques, plant variety and weather data are also taken into consideration during the processing

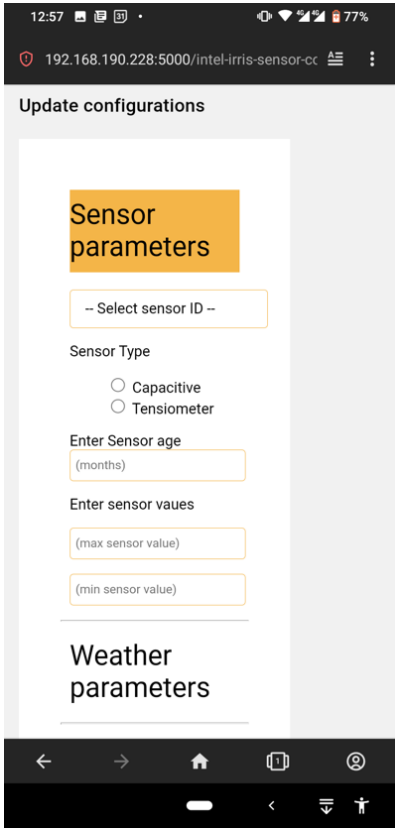


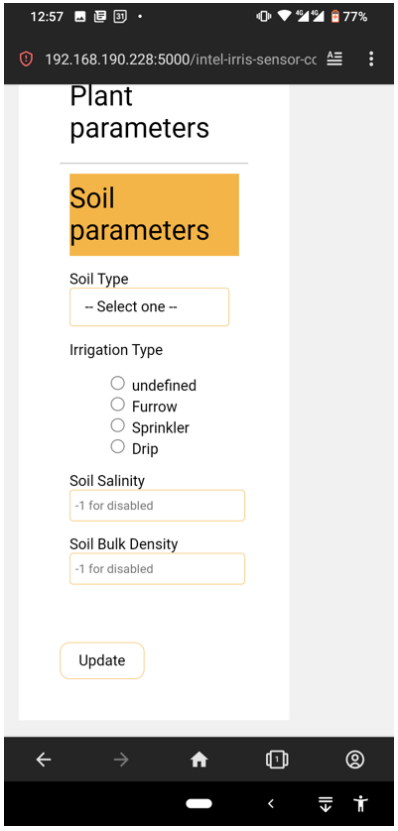


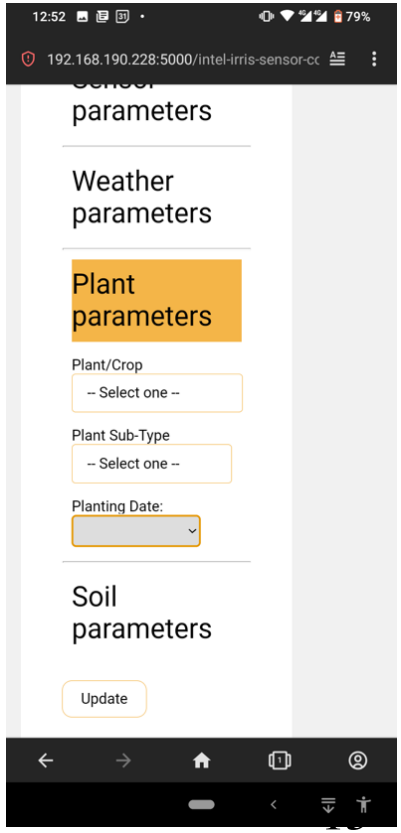
Intel-Irris WaziApp (IIWA)



- Parameters such as that can be adjusted:
  - sensor id
  - sensor type
  - sensor age
  - region
  - soil type
  - irrigation type
  - plant/crop type
  - planting date
  - soil salinity
  - bulk density
  - ...

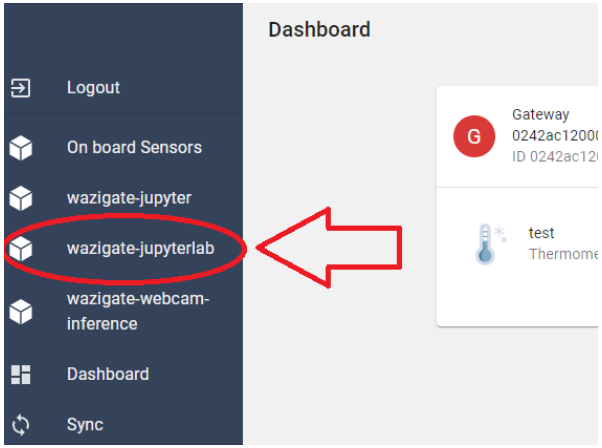


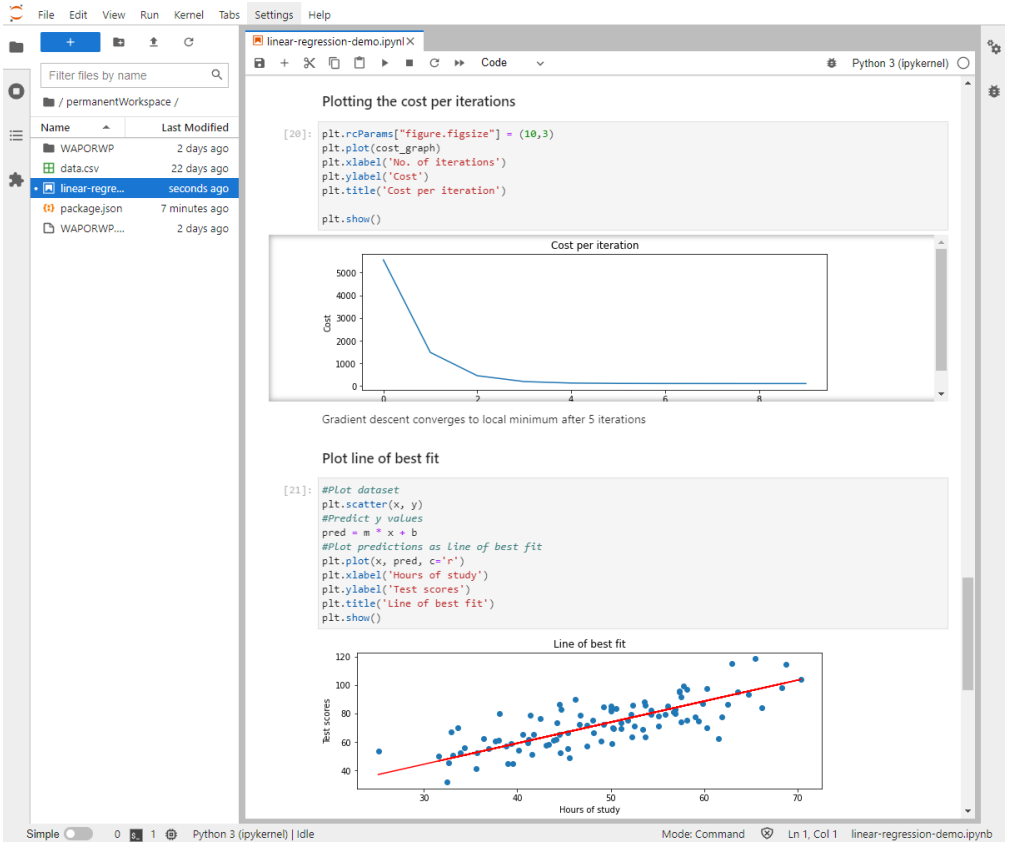




AI, Machine Learning

- WaziApps – Jupyterlab
- Available languages: Markdown, Python, R, LaTeX, ...



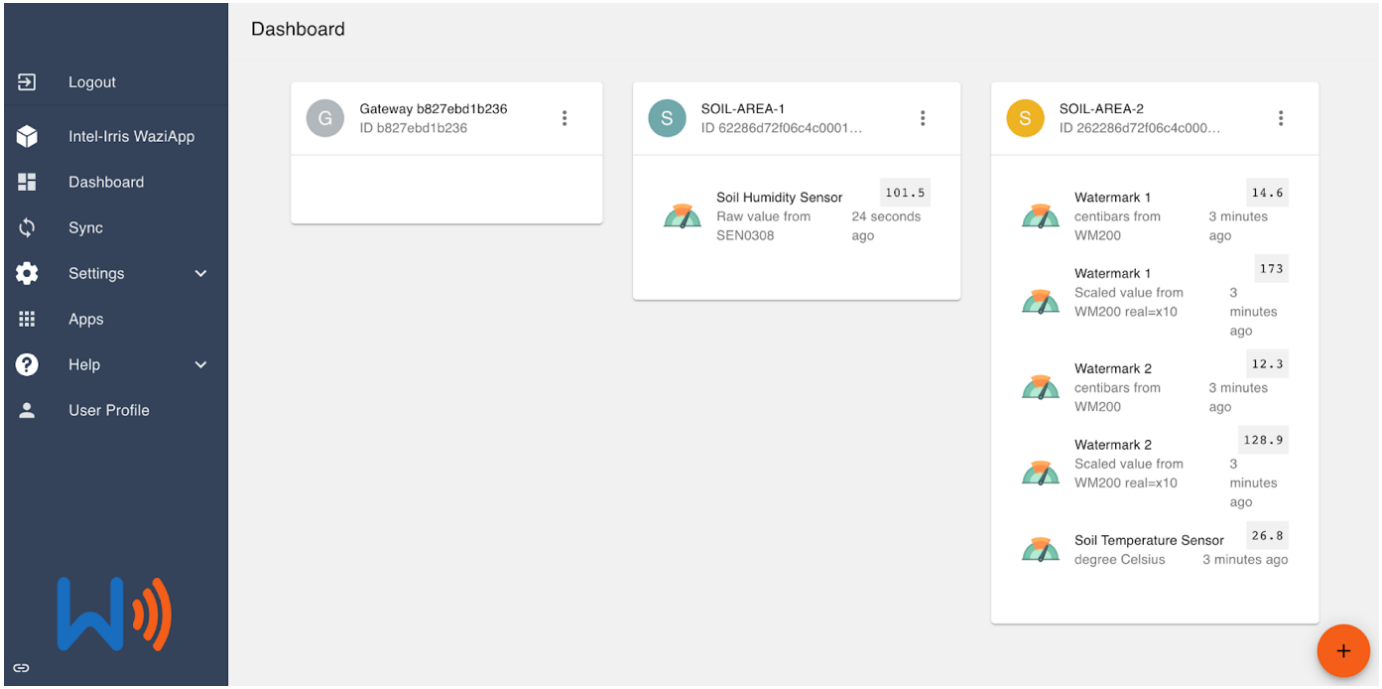


And dataset?

- AI and Machine Learning need datasets!
- The INTEL-IRRIS starter-kit will be installed in "promiscuous" mode to build datasets
- Controled environments
  - tests campaign with INTEL-IRRIS agricultural partners
  - AUA, INRA, IRD, UMAB
- Smallholder Piloting Program
  - Test campaign with pilot farms & smallholders
  - Participatory approach to co-design & test the innovative solutions in fields
  - Take into account region-dependent technical, agricultural, social, climatic and environmental aspects

Experimental devices for datasets

- The datasets campaign will use 2 soil devices
  - A soil device with 1 capacitive sensor
  - A soil device with 2 watermark sensors + 1 temperature sensor



Going farther with AI?

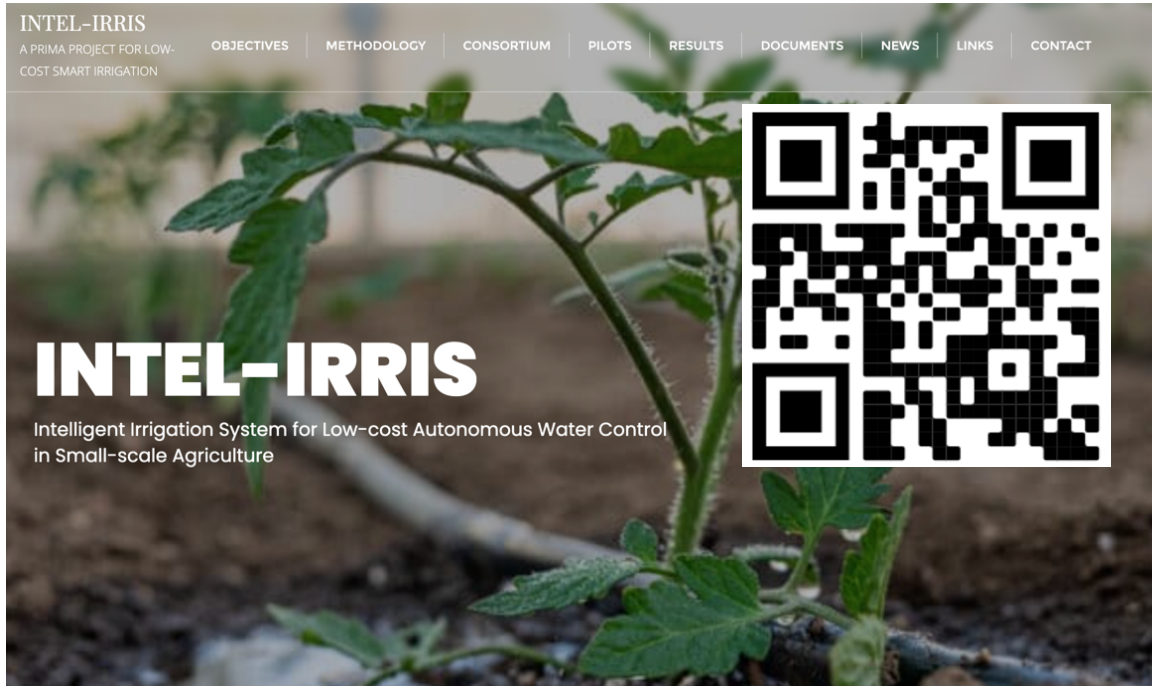
- Digital platforms & AI for smart agriculture from AUA
  - SHERPA repository. SHERPA repository is a compilation of research outputs and findings from past and on- going projects related to rural areas. https://sherpa-repository.eu/home
  - FAIRshare. Digital Tools for Farm Advisors. Browse through the collection of Digital Advisory Tools and Services. https://www.h2020fairshare.eu/
  - EU FarmBook. A collection of vetted best practices for farmers & foresters. https://www.eufarmbook.eu/
  - Eden Library. Enabling AI in agrifood. https://edenlibrary.ai/

Eden Library

- Spin-off company of the Agricultural University of Athens
  - Over 100K photos on the edenlibrary.ai platform with different infestation scenarios
  - Team of expert agronomists, engineers and developers
  - Specialized knowledge in precision agriculture and artificial intelligence applications
- Eden Library – datasets
  - An industry-leading platform, which hosts thousands of expert-annotated datasets for smart agriculture tasks
  - Collected under real field conditions
  - Annotated images with metadata about **diseases, weeds, pests** or **nutrition deficiencies**

More information

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



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- Twitter: https://twitter.com/Intel_IrriS

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

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