

INTEL-IRRIS

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



This project is part of the PRIMA
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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



The INTEL-IRRIS starter-kit installation guide



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INTEL-IRRIS starter-kit

- "Intelligent Irrigation in-the-box", "plug-&-sense"
 - 1 starter-kit = 1 soil sensor device + 1 INTEL-IRRIS gateway
 - device can be either with capacitive sensor or tensiometer sensor
 - The INTEL-IRRIS gateway is **pre-configured to be ready for**
 - 1 capacitive sensor & 1 tensiometer sensor (but only 1 device in starter-kit)



2 versions of the soil device



A soil temperature sensor can be added

SEN0308
capacitive sensor

Watermark WM200
Water tension sensor

Installation steps for the starter-kit

- Install the INTEL-IRRIS gateway in farm office/home
 - Just power the gateway, no Internet is required
 - Test access to gateway's dashboard with smartphone
- Prepare the soil sensor device
- Test transmission from device to INTEL-IRRIS gateway
 - NEVER TRANSMIT WITHOUT AN ANTENNA!
 - Switch ON the soil sensor device to get data transmission
 - Check reception of data on gateway's dashboard or OLED screen
- Deploy the soil device in field
 - Beware that a distance of more than 2km between device and gateway can make reception of data very unstable
- All tutorials & videos: <https://intel-irris.eu/tutorials-slides>
- All links to relevant resources: <https://intel-irris.eu/links>

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POWERING THE GATEWAY

Booting the gateway

Normally, no Internet connection scenario

- Power the gateway with the micro-USB power adaptor
- If the micro-USB power adaptor is not provided, use at least a 2A power adaptor
- You should see the first [Internet NO] screen. Wait 3-4mins for the main INTEL-IRRIS OLED screen to appear



- The RTC module of the gateway is normally already configured with correct time & date

QR code for connecting to WiFi

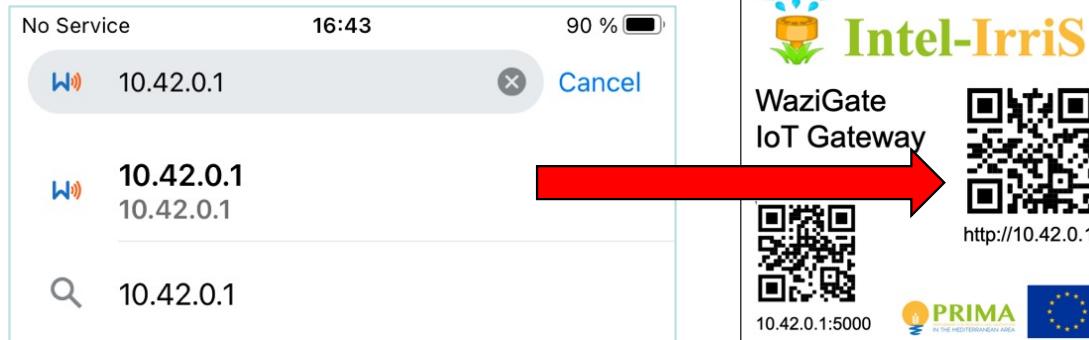
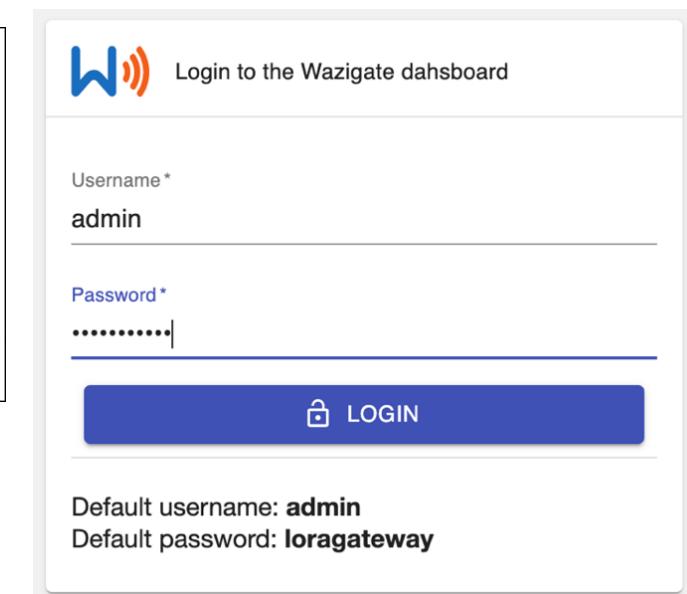
- The gateway WiFi is WAZIGATE_XXXXXXXXXXXX where XXXXXXXXXXXX is the MAC address of the RPI
- For instance WAZIGATE_B827EBD1B236
- With the OLED, a QR code for joining the WiFi network is dynamically generated at boot time and displayed for 10s before the main screen so that users can automatically join with a smartphone
- Once connected to WiFi, users can scan the static QR code on the gateway sticker to connect to the gateway's dashboard or the INTEL-IRRIS IIWA App



Checking the gateway

Using gateway's WiFi

- Use a smartphone/laptop to access WaziGate through WiFi
- Connect to **WAZIGATE_XXXXXXXXXXXXXX** WiFi network
 - default WiFi password is loragateway
- Open web navigator. Go to <http://wazigate.local> or <http://10.42.0.1> or flash QR code

Login to the Wazigate dashboard

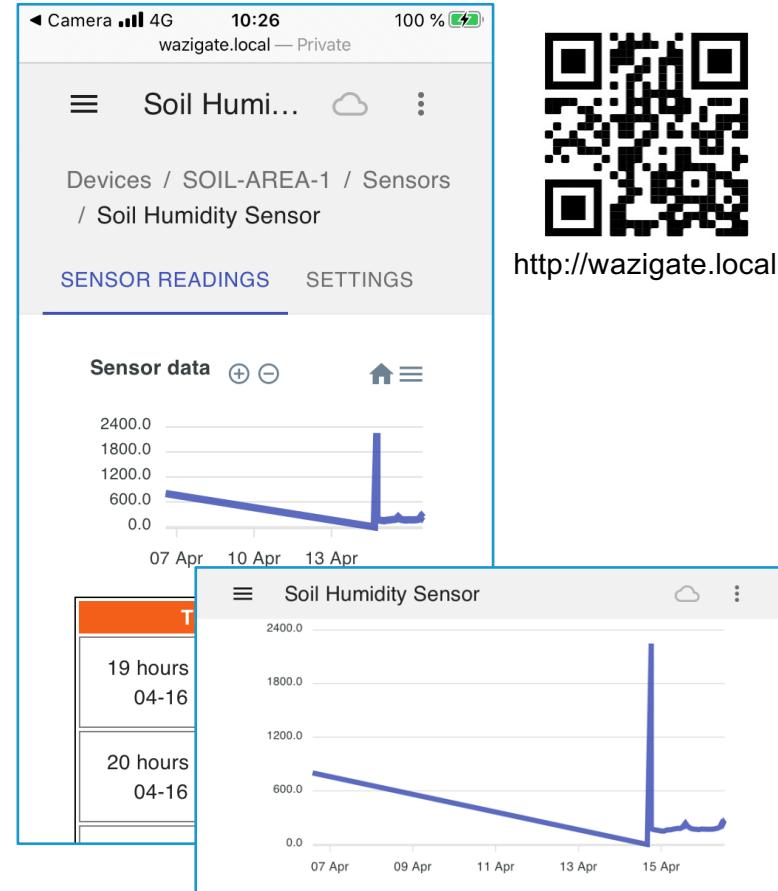
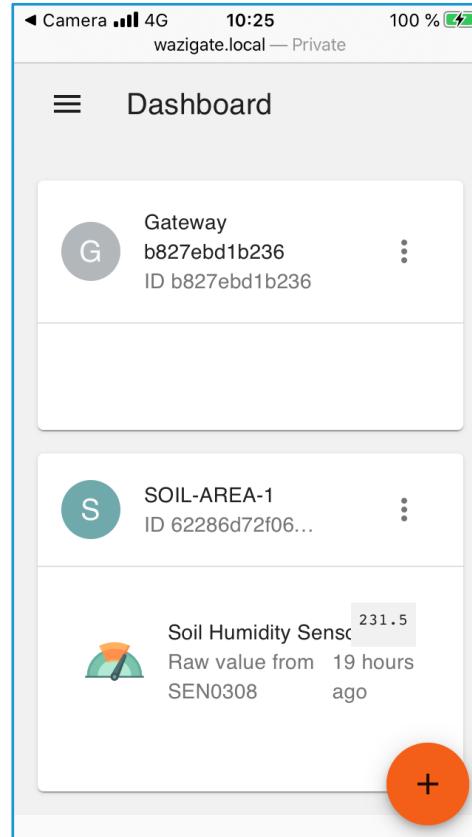
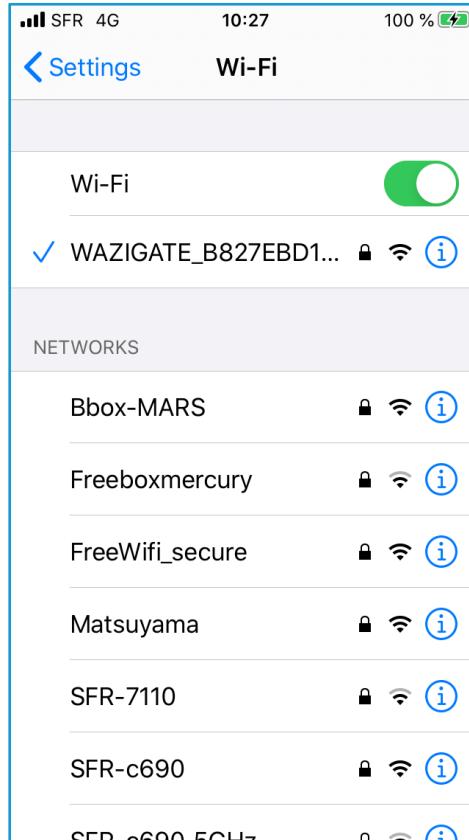
Username *
admin

Password *
.....

Default username: **admin**
Default password: **loragateway**

- Use default login to connect
 - User: admin
 - Password: loragateway

View dashboard on a smartphone

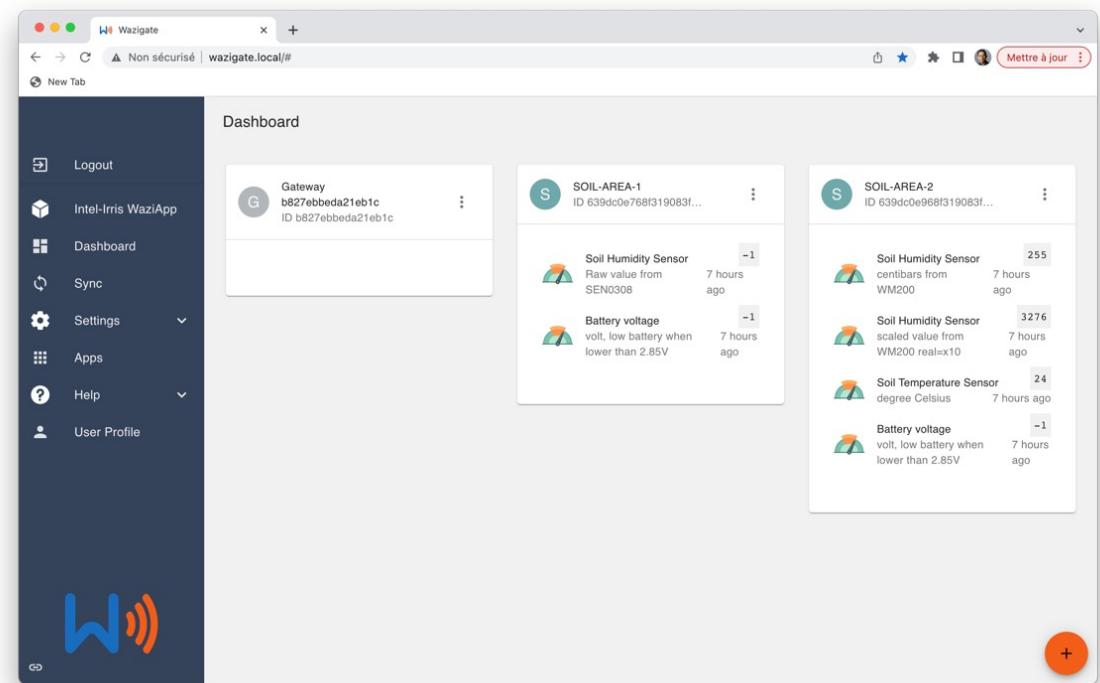


Look at [Video n°4 at t=239s](#)

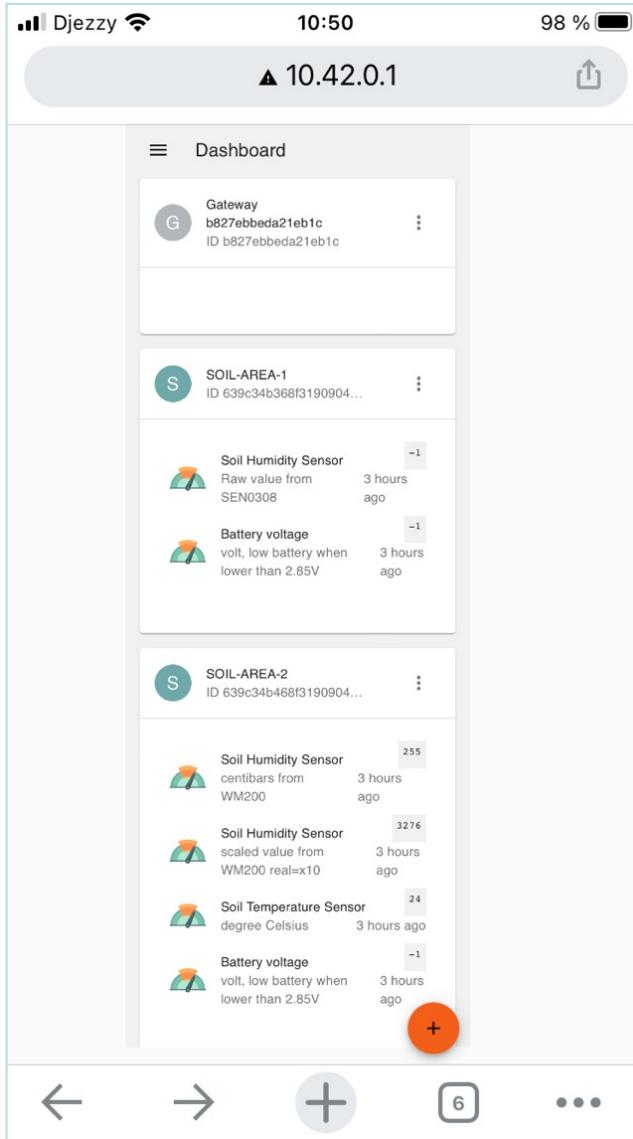
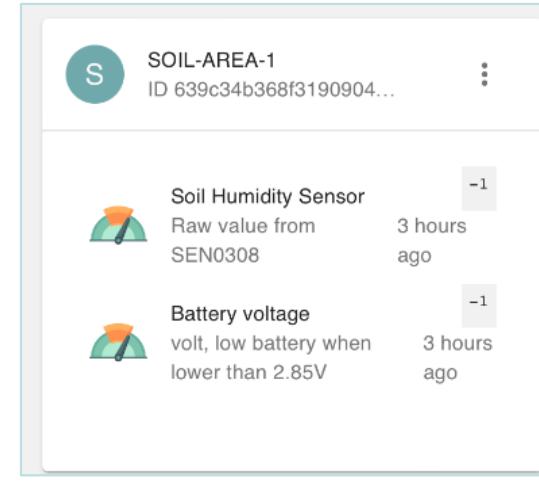
<https://youtu.be/j-1Nk0tv0xM?t=239>

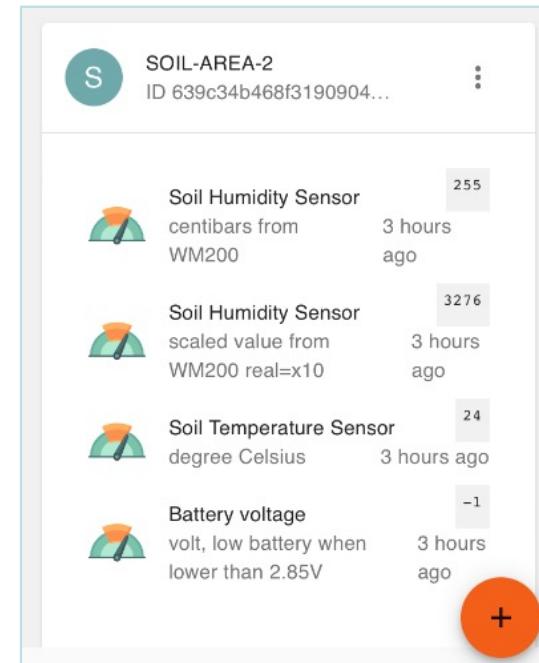
Default gateway configuration (1)

- For the starter-kit, the INTEL-IRRIS gateway will be ready for
 - **1 capacitive sensor named SOIL-AREA-1 with address 26011DAA**
 - **1 tensiometer sensor named SOIL-AREA-2 with address 26011DB1**
- Capacitive device will show humidity and battery values
- Tensiometer device will show centibar, raw resistance, soil temperature and battery values



Default gateway configuration (2)



Default values for the SEN0308 capacitive sensor



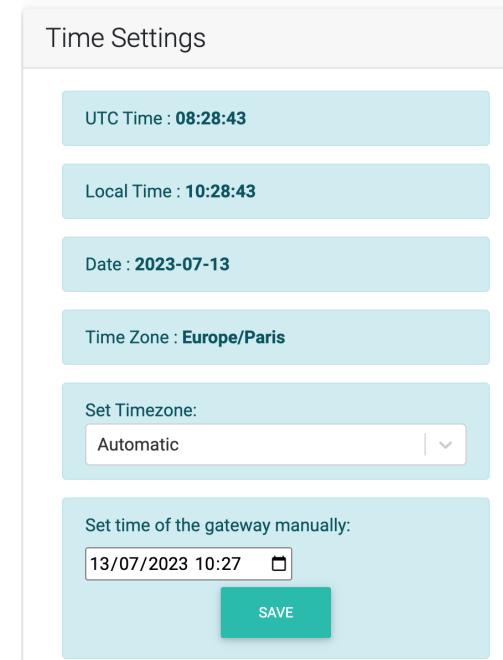
Default values for the WM200 tensiometer sensor



Synching the RTC module

in case date & time are not correct

- It is possible to sync the RTC manually, after boot
- First, power then connect to gateway's WiFi
- Go to Settings then Configuration in Configurations top menu. Set time & date manually. Click on SAVE
- Then use the embedded SSH functionalities (in Settings/Maintenance) to log in the gateway (user pi/ pwd loragateway)
- Then type "date" to check if the previously date & time has been saved
- Then "sudo hwclock -w"
- Check with "sudo hwclock -r"



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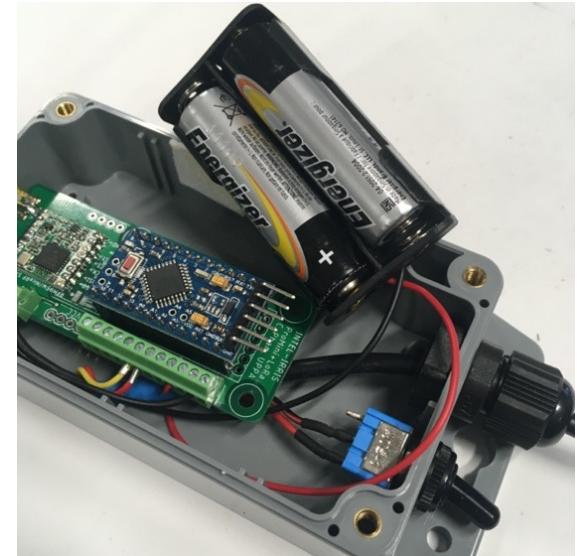
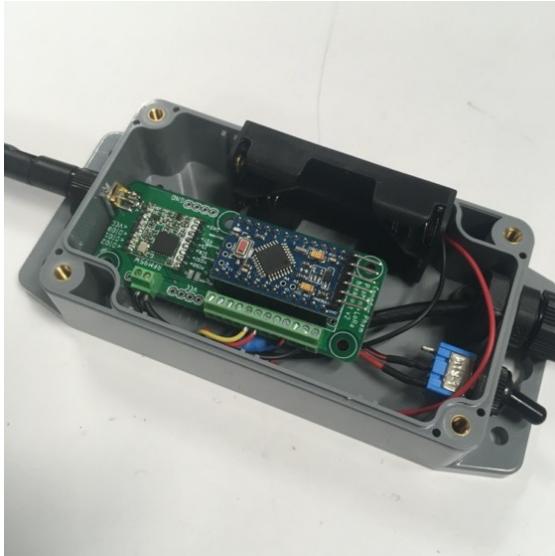
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PREPARING THE SOIL DEVICE

Preparing soil sensor device

install batteries

- Remove cover & install 2-AA batteries in battery holder
- Best way is to pull out the battery holder



- Put back cover and be sure to tighten the cover
- Procedure is the same if you need to replace the batteries
- Screw in the antenna, do not forget the flat rubber seal



Take good AA batteries

- Install new & high-grade alkaline AA batteries to allow for at least 2 years of autonomy
- Take a well-known brand and "heavy-duty" or "long-life" or "max" models



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TESTING TRANSMISSION



Never transmit without antenna

- NEVER, NEVER transmit without an antenna
- Doing so can damage the radio module
- If you deploy a device, make sure that the antenna is correctly connected before powering on the device and realizing any transmission test
- Keep correct polarization of device and gateway antennas: both antennas should be in vertical position

Testing transmission to gateway

- Test with the fully assembled & configured soil sensor device
 - Check that antenna is connected
 - Switch ON the soil sensor device to get data transmission
 - Wait for about 10s, then switch OFF the soil sensor device
 - Check reception of data on gateway's dashboard
 - You need to refresh the web page on the web navigator



Look at [Video n°4 at t=331s](#)
<https://youtu.be/j-1Nk0tv0xM?t=331>

Transmission to gateway



Parameters for
INTEL-IRRIS gateway
(default in red)

LoRaWAN™
SF12BW125
868.1MHz | **433.175MHz**
Node id is **26011DAA**
1 msg/60mins
1 sensor
XLPP data



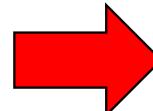
This dedicated video will show all these steps, from connecting the SEN0308 to testing transmission to the gateway
 Video n°4: <https://youtu.be/j-1Nk0tv0xM>

Check data reception on OLED

YOU CAN ALSO VIEW ON DASHBOARD

Default values for the
SEN0308 capacitive sensor

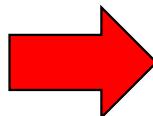
Testing with
capacitive device



Default values for the WM200
tensiometer sensor

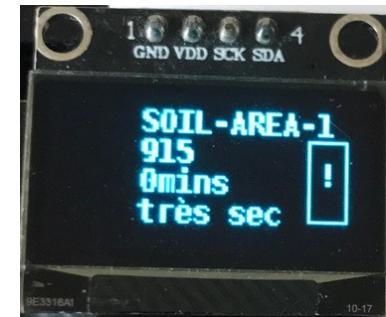
VALUES ARE ONLY INDICATIVE

Testing with
tensiometer device



Soil sensor information on OLED

- The OLED displays the latest received sensor data for the end-user: the device name, the time of last received data, the sensor raw value and the soil condition
- The main screen is displayed for 6s every 30s. Then a screen saver display will show a shorter version of these information with a 5-bar visual
- 5 bars: saturated | 4 bars: wet
- 3 bars: wet | 2 bars: dry
- 1 bar: dry | 0 bar: very dry



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DEPLOYING THE SOIL DEVICE

Typical deployment



Deploying soil device

capacitive sensor

- Use a stick to fix the soil device
- Beware that a distance of more than 2km between device and gateway can make reception of data very unstable
- The capacitive sensor can be inserted carefully in the soil until the recommended depth limit



Deploying soil device

tensiometer (Watermark) sensor

- The tensiometer Watermark sensor needs some preparation, look at installation video from Challenge Agriculture & Irrometer



<https://youtu.be/506ktNp7hhQ>



<https://youtu.be/sIS6Ptyf8xA>



<https://youtu.be/uZw-cKPhemk>



<https://youtu.be/a6Lxhd8PD2A>

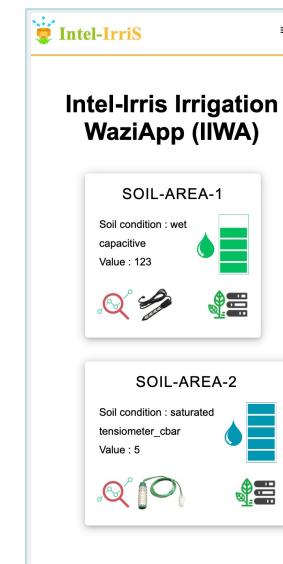
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IIWA APPLICATION

INTEL-IRRIS Irrigation WaziApp

- The INTEL-IRRIS Irrigation WaziApp (IIWA) is an embedded application running on the INTEL-IRRIS gateway itself
- It is included in the starter-kit to implement the "**intelligent Irrigation in-the-box**" & "**plug-&-sense**" approach
- Its objective is to enhance the irrigation indication by applying sensor calibration models with soil/plant/weather parameters



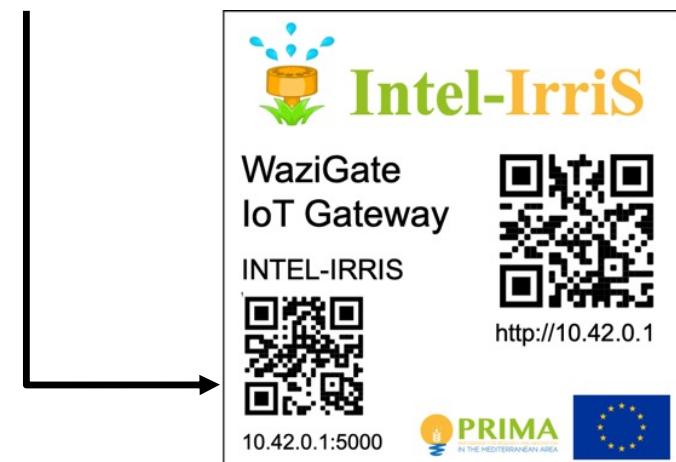
Connect to IIWA

- First, connect to INTEL-IRRIS gateway WiFi which should look like WAZIGATE_XXXXXXXXXXXX
 - Password is loragateway
- Otherwise, with the OLED screen, a QR code for automatically joining the WiFi network is periodically displayed for 10s
 - scan the displayed QR code with a smartphone to connect to gateway's WiFi
- Then, scan the static QR code on the gateway sticker to connect to the INTEL-IRRIS Irrigation WaziApp on : <http://10.42.0.1:5000>



EXAMPLE:

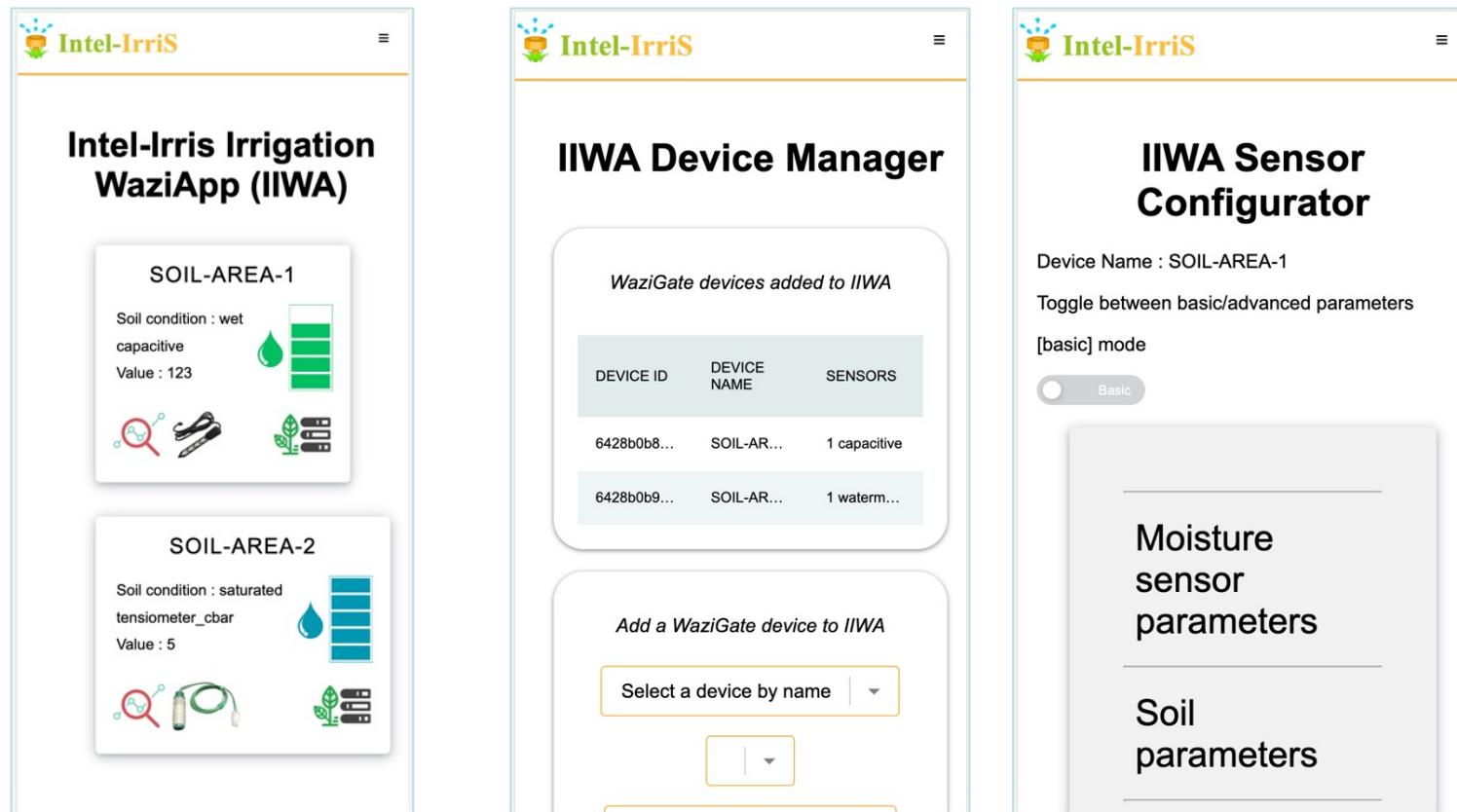
WAZIGATE_DCA6325C2A7A



Get the IIWA presentation slides

- Part 4: the INTEL-IRRIS Irrigation WaziApp

- Tutorial slides on the INTEL-IRRIS Irrigation WaziApp



The image displays three screenshots of the Intel-Irris Irrigation WaziApp (IIWA) interface, showing different features of the system:

- Intel-Irris Irrigation WaziApp (IIWA)**: This screen shows two soil monitoring areas.
 - SOIL-AREA-1**: Soil condition: wet, capacitive; Value: 123. It includes icons for a magnifying glass, a pair of shears, and a plant.
 - SOIL-AREA-2**: Soil condition: saturated, tensiometer_cbar; Value: 5. It includes icons for a magnifying glass, a tensiometer probe, and a plant.
- IIWA Device Manager**: This screen lists WaziGate devices added to IIWA.

DEVICE ID	DEVICE NAME	SENSORS
6428b0b8...	SOIL-AR...	1 capacitive
6428b0b9...	SOIL-AR...	1 waterm...

Below this, there is a section to "Add a WaziGate device to IIWA" with a dropdown menu labeled "Select a device by name".
- IIWA Sensor Configurator**: This screen is for configuring sensors.

Device Name : SOIL-AREA-1
 Toggle between basic/advanced parameters
 [basic] mode

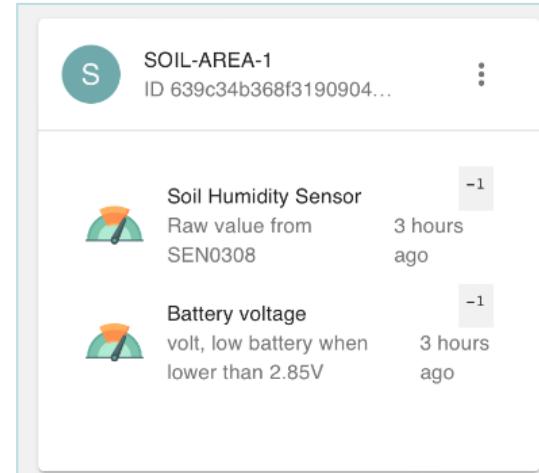
Basic

Moisture sensor parameters

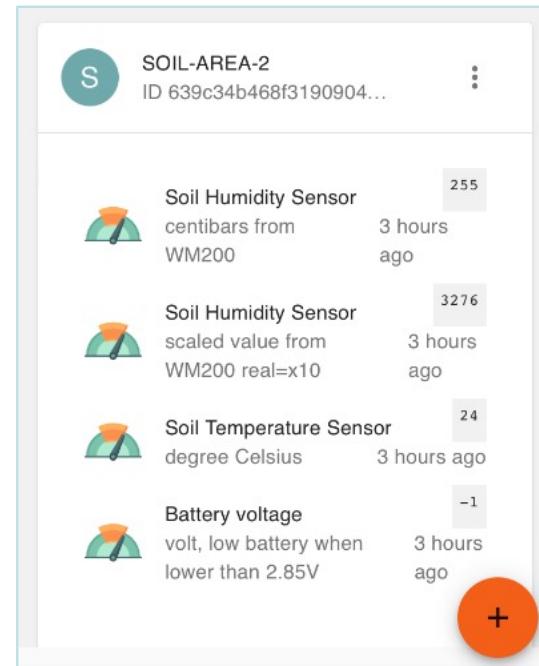
Soil parameters

Default gateway configuration & IIWA

- For the starter-kit, the INTEL-IRRIS gateway will be ready for
 - 1 capacitive sensor named SOIL-AREA-1 with address 26011DAA
 - 1 tensiometer sensor named SOIL-AREA-2 with address 26011DB1
- IIWA default configuration
 - Both SOIL-AREA-1 & SOIL-AREA-2 are added to IIWA
 - Soil condition will be determined for both devices, if relevant data are received



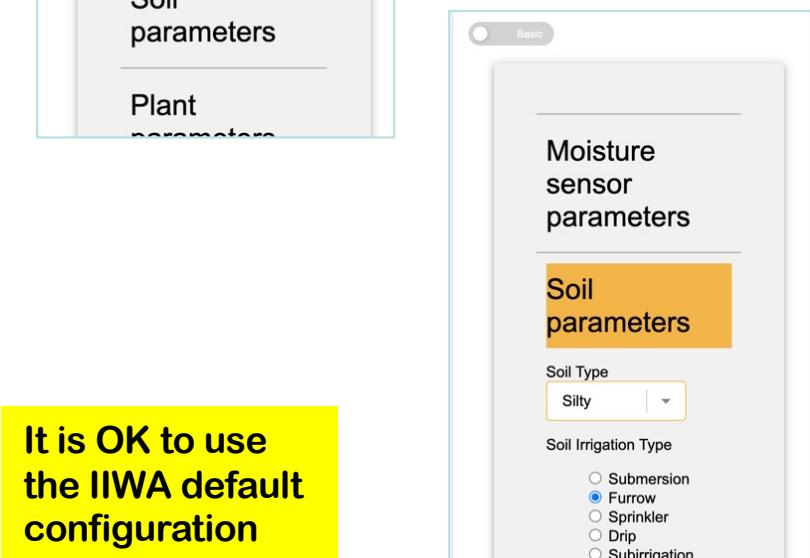
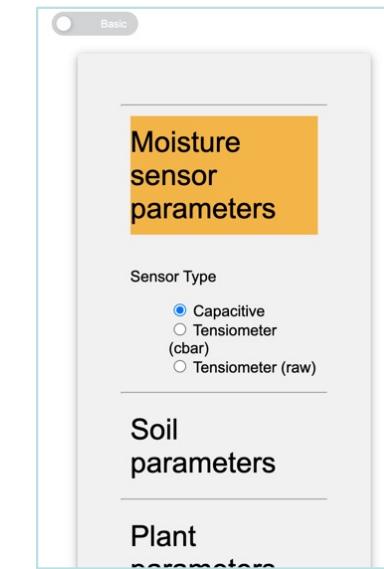
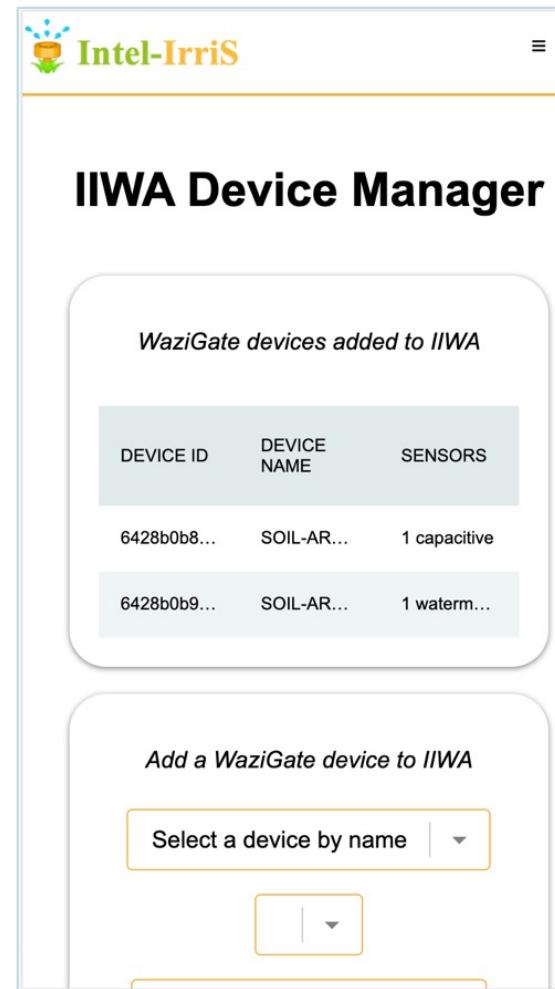
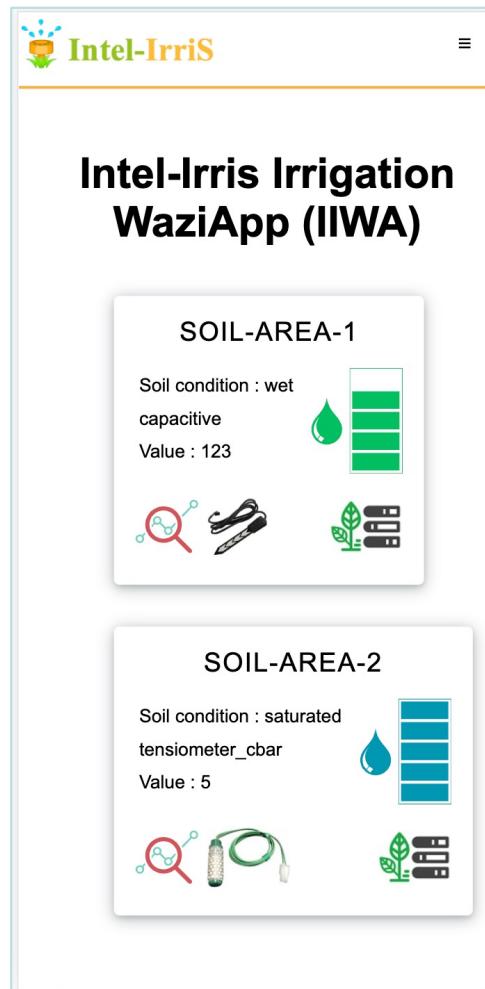
Default values for the SEN0308 capacitive sensor



Default values for the WM200 tensiometer sensor



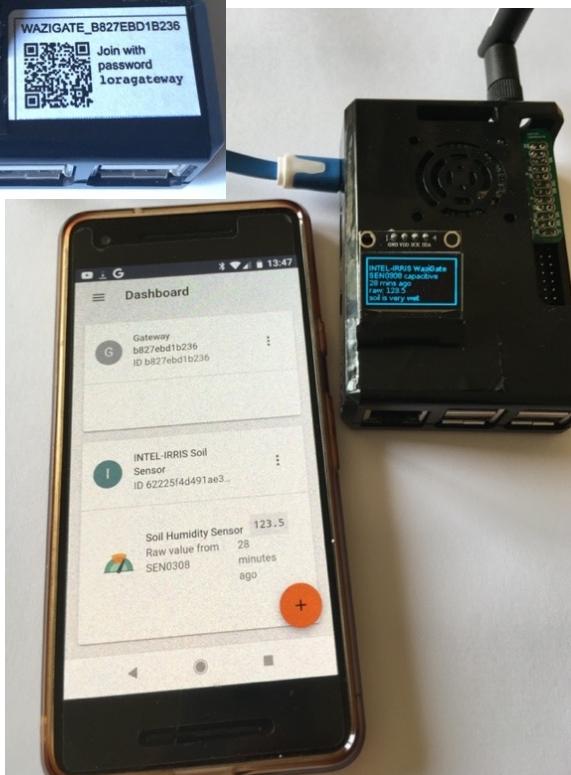
Default IIWA screens & configuration



It is OK to use
the IIWA default
configuration



Summary of INTEL-IRRIS gateway various User Interfaces



 Intel-Irris

Intel-Irris Irrigation WaziApp (IIWA)

SOIL-AREA-1

Soil condition : wet capacitive

Value : 123








SOIL-AREA-2

Soil condition : saturated tensiometer_cbar

Value : 5







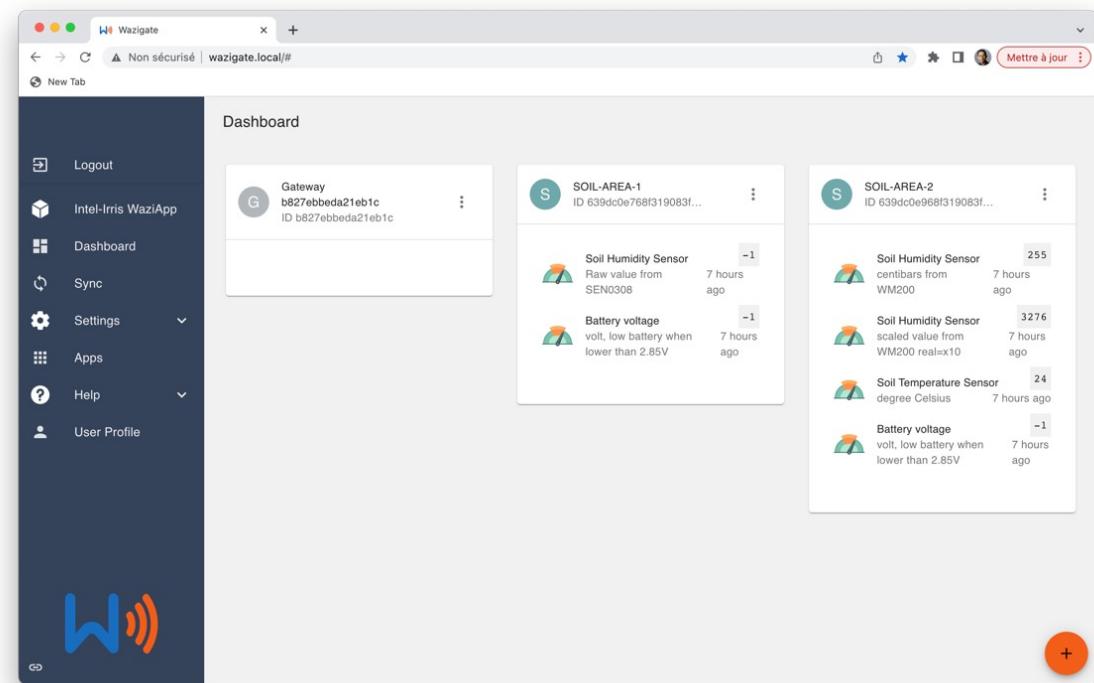

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DEFAULT CONFIGURATION

Default gateway configuration

- For the starter-kit, the INTEL-IRRIS gateway will be ready for
 - **1 capacitive sensor named SOIL-AREA-1 with address 26011DAA**
 - **1 tensiometer sensor named SOIL-AREA-2 with address 26011DB1**
- Capacitive device will show humidity and battery values
- Tensiometer device will show centibar, raw resistance, soil temperature and battery values



Other configuration

- Your iNTEL-IRRIS gateway may be already pre-configured for a specific setting
 - A number C of capacitives devices
 - A number T of tensiometer devices
- The general rule is as follows
 - Name of devices are SOIL-AREA-X
 - X increasing from 1 to C+T
 - Capacitive devices are listed first, then tensiometer devices
 - SOIL-AREA-1, ..., SOIL-AREA-C: for the C capacitive sensors
 - SOIL-AREA-[C+1], ..., SOIL-AREA-[C+T]: for the T tensiometer sensors
 - Capacitive devices have addresses in the form
 - 26011D**AA**, 26011D**AB**, 26011D**AC**, ...
 - Tensiometer devices have addresses in the form
 - 26011D**B1**, 26011D**B2**, 26011D**B3**, ...

Ex: 1 capacitive & 3 tensiometer

- SOIL-AREA-1
 - Capacitive, address is 26011D**AA**
- SOIL-AREA-2
 - Tensiometer, address is 26011D**B1**
- SOIL-AREA-3
 - Tensiometer, address is 26011D**B2**
- SOIL-AREA-4
 - Tensiometer, address is 26011D**B3**

NOTICE ON THE STARTER-KIT



- NEVER TRANSMIT WITHOUT AN ANTENNA
- 1 FULLY ASSEMBLED & CONFIGURED SOIL SENSOR
 - NEED TO INSTALL 2-AA BATTERIES
 - TAKE HIGH-GRADE BATTERIES
 - DO NOT SWITCH ON WITHOUT ANTENNA ATTACHED
 - ALREADY CONFIGURED FOR WAZIGATE
- STARTER-KIT= 1 SOIL SENSOR + 1 GATEWAY
- INTEL-IRRIS GATEWAY IMAGE CAN BE DOWNLOADED FROM <https://intel-iris.eu/results>
- FLASH IMAGE ON 8GB SD CARD (OR 16GB OR 32GB)
- THE GATEWAY IS ONLY PRE-CONFIGURED FOR 1 SOIL SENSOR PER FARM
- STARTER-KIT TUTORIAL : <https://intel-iris.eu/tutorials-slides>

