Autonomous RTUs
IoT for Precision Agriculture

Precision Agriculture

Agriculture related weather measurements:

- Solar radiation
- Air temperature and relative humidity
- Wind speed and direction
- Rainfall
- Soil temperature and moisture
- All in one weather stations

Irrigation

Water resources management

- River level & flow gauging
- Groundwater monitoring
- Lake and reservoir level monitoring
- Leak detection in distribution pipelines
- Water quality monitoring

Design Principles

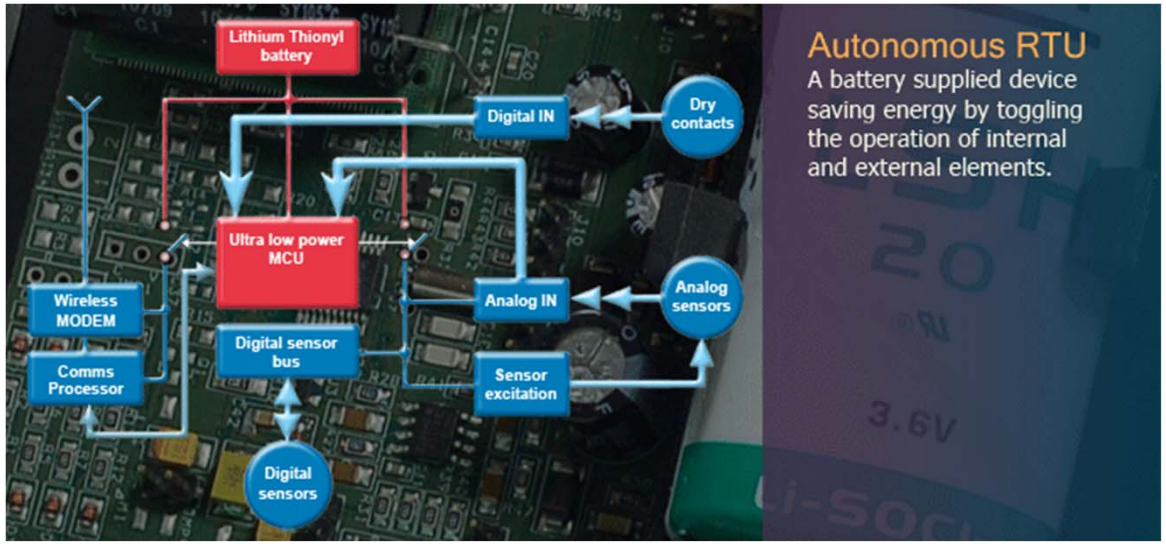
Autonomous RTUs are flexible devices allowing any modern power source scheme.

They are designed to operate autonomously using single lithium battery cells achieving maximum reliability, and long term solution robustness with operational lifetime >10 years.

They can work on mains or photovoltaic power with automatic failover to internal lithium battery on power shortage.

They can be used in hybrid power solutions combining lithium battery for telecommunications with rechargable power sources for sensor excitation allowing mixed power media applications seamlessly.

Operating principle



An ultra low power MCU is in continuous operation with two main tasks:

- Performing measurement, data recording and detecting an alarm condition.
- Controlling power of internal and external functional elements in order to extend battery lifetime. The principle is to power functional sections, according to user defined time schedules.

Autonomous RTUs utilize an ultra low power dual processor architecture in order to combine low power consumption with advanced processing and communication characteristics.

Functions:

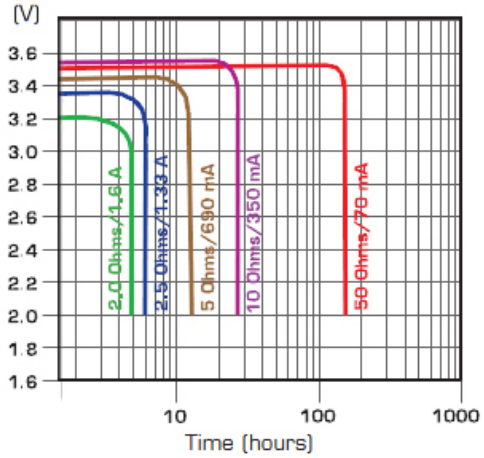
- Measurement
- Transducer excitation
- Data recording
- Data & alarm transmission

D-size,
Primary lithium-thionyl chloride battery
Nominal voltage: 3.6V,
Capacity: 13.0Ah

System comparison

Subject	Solar powered	Autonomous
Daily energy consumption	2 mAh (An average 2 mA current draw is assumed).	0.03 mAh (2 mA during sampling, 40 µA in idle state, sampling period at 1 minute).
Maintenance free operation	2-3 years. The rechargeable cell's capacity diminishes over time. Current delivery is reduced due to increase in internal resistance over time.	Up to 15 years. The Lithium Thionyl battery features undiminished voltage level and current delivery during almost 98% of its lifetime.
System power supply	Complex, costly.	Simple, low cost.
Ambient temperature	Frost protection for the solar cell is required at lower temperatures. Solar cell efficiency is lowered and rechargeable battery life is shortened at temperatures over 40°C.	Infinite's autonomous devices operate at temperatures between −20°C and +65°C.
Weather conditions	Smooth operation depends on sufficient sunlight.	Weather independent.
Overall system size	Massive, provoking vandalism.	Minimum sized, compact, unnoticeable.
Minimum sampling period	Down to a few seconds, according to the availability of the renewable energy source.	1 minute (5...15 minutes, typ) for preserving a reasonable battery lifetime.

Lithium Thionyl Battery



Typical discharge profiles at + 20°C

Internet of Things Networks & Technologies

2G/3G/4G

NB-IoT

LTE-M

sigfox

LoRa™

Itron

Silver Spring NETWORKS

ADU-500 Autonomous RTU

The ADU-500 is an ultra low power, wireless RTU with data logging and alarming capabilities.

The battery powered RTU supports acquisition from multiple sensors and it incorporates three digital inputs, two analog inputs, two pulse counter inputs, SDI-12 bus, RS485 Modbus and multiple excitation options for powering measuring transducers.

The ADU-500 uses an internal cellular modem to automatically send data and alarms.

A D-size Lithium Thionyl battery can provide autonomous operation for over 10 years.

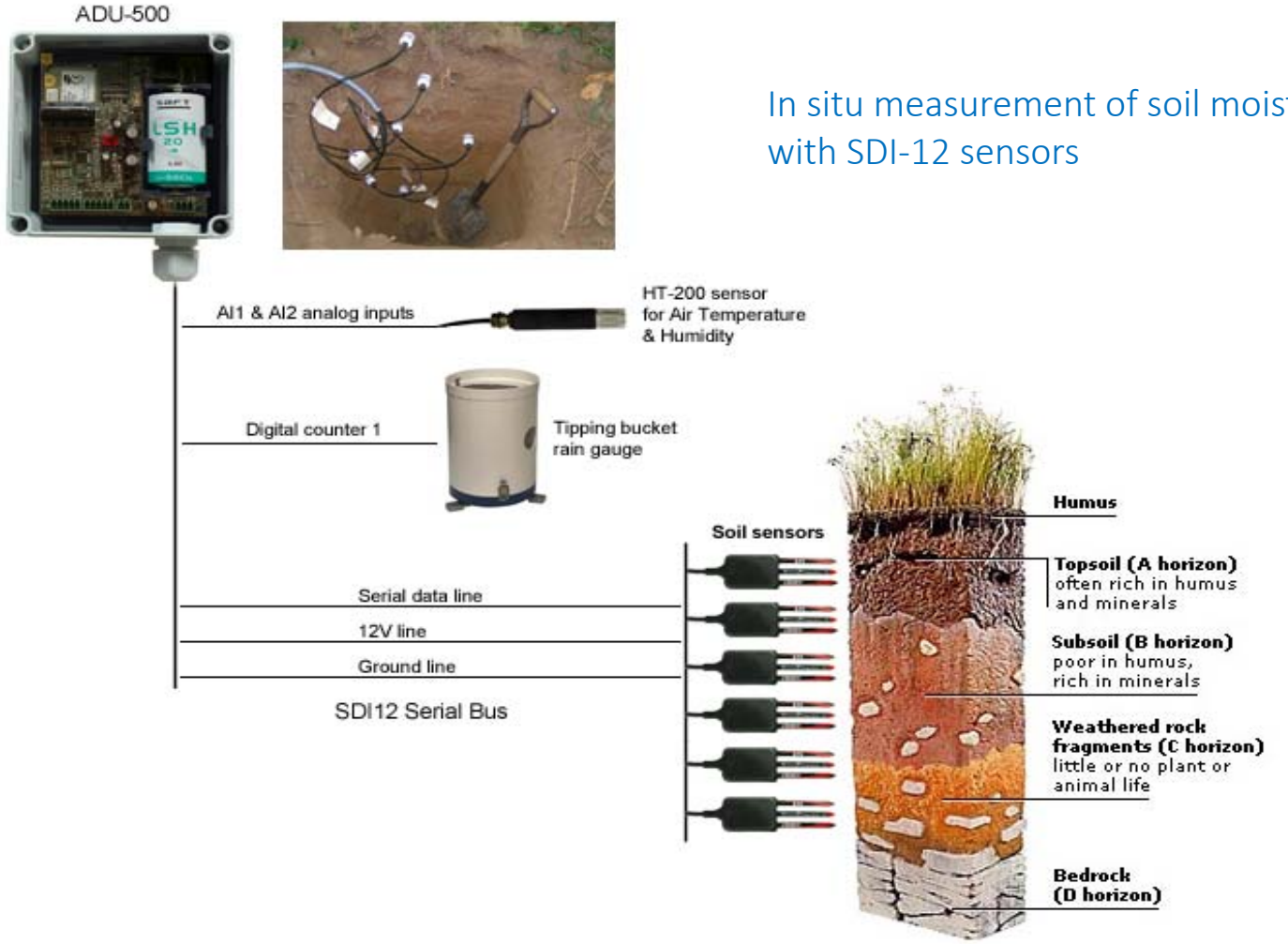
IoT Autonomous devices

NB-IoT
LTE-M
2G/3G/4G

ADU-500, RTU/Data Logger

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	12VDC mains or photovoltaic power
Consumption :	Continuous 18µA
SDI12:	up to 16 SDI-12 sensors with up to 48 channels
RS485:	up to 10 Modbus ASCII/RTU up to 10 channels
Digital inputs:	3, 0-30VDC
Pulse counters:	2, 2KHz, common with DI 2&3
Analog inputs:	2, 12 bit resolution, differential, 1-200 programmable gain
Transducer Excitation:	12VDC/400mA, or 9V/500mA or 5VDC/200mA, 3.3V/1A
Battery monitoring:	built in battery gauge continous consumption monitoring
Wireless modem:	Sierra Wireless HL series 2G, 3G or 4G
Messages:	Alarm, Status, Data
Temperature:	-40°...+65°C, operating
Dimensions:	130 x 130 x 75 mm
Housing:	IP66, IP68 Nema 4x

ADU-500 Autonomous RTU



In situ measurement of soil moisture with SDI-12 sensors

ADU-700 Profisens

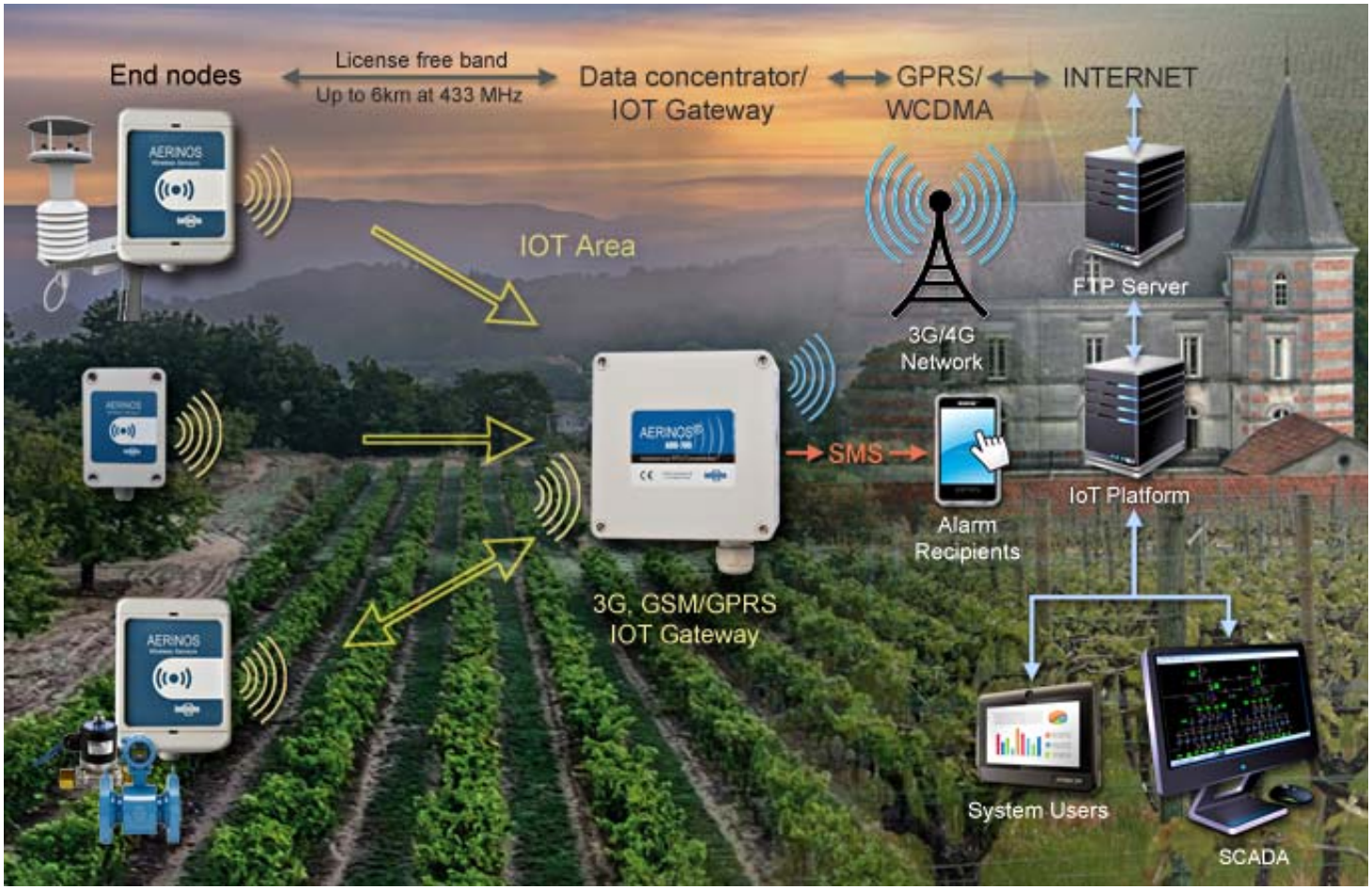
The ADU-700 is a local area wireless IOT platform for data logging, alarming and remote control.

It comprises of wireless sensor nodes and a 3G cellular Data Concentrator/ Gateway.

The coverage of the wireless network can reach a radius of 1-6 km (Line of sight). The platform is available for the 433 MHz license free band and optional for the 868 MHz and 915 MHz bands.

The battery powered system supports acquisition from multiple sensors and up to 32 wireless slaves. It incorporates digital inputs, analog inputs, pulse counter inputs, SDI-12 sensors, RS485 Modbus sensors, Valve and relay actuation and multiple excitation options for powering measuring transducers and actuators.

ADU-700 Profisens



IoT Autonomous devices

ADU-700, Wireless Gateway RTU/Data Logger

NB-IoT
LTE-M
2G/3G/4G

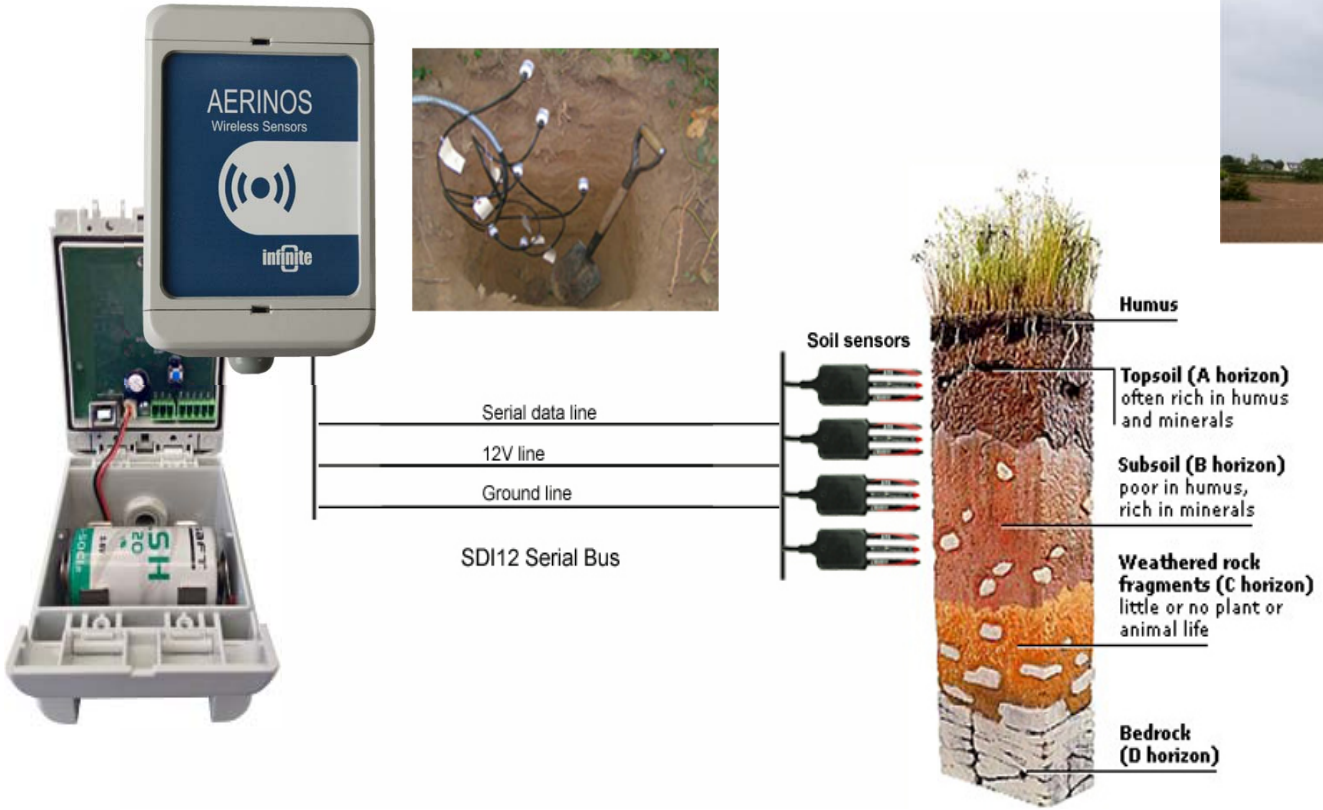
Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	12VDC mains or photovoltaic power
Consumption :	Continuous 18µA
RS485:	For future use
Digital inputs:	3, 0-30VDC
Wireless RF:	Radiocrafts 433.05-433.79 4+Km line of sight
Wireless modem:	Sierra Wireless HL series 3G or 4G
Messages:	Alarm, Status, Data
Temperature:	-40°...+65°C, operating
Dimensions:	130 x 130 x 75 mm
Housing:	IP66, IP68 Nema 4x

IoT Autonomous devices

ADS-200, IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	IN1, configurable as:
	Digital input, 0-30VDC
	Analog input, 0-1VDC, 12 bit resolution
	Digital counter, 1 KHz
SDI-12 Bus:	8 Channels, up to 3 sensor support.
RS-485, MODBUS:	8 Channels, up to 3 sensor support, ASCII/RTU.
Transducer excitation	12V/250mA, 5V/200mA
Wireless tranceiver:	Radiocrafts 433.05-433.79 Mhz
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

ADS-200


AERINOS
Wireless Sensors
infinite
Serial data line
12V line
Ground line
SDI12 Serial Bus
Soil sensors
Humus
Topsoil (A horizon)
often rich in humus
and minerals
Subsoil (B horizon)
poor in humus,
rich in minerals
Weathered rock
fragments (C horizon)
little or no plant or
animal life
Bedrock
(D horizon)

IoT Autonomous devices

ADS-210, IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	1 Digital input, 0-30VDC
	1 Digital counter, 1 KHz
	1 Analog input, 0-1VDC, 12 bit resolution
Outputs :	1 Valve Channels
Transducer excitation	12V/250mA, 5V/200mA
Wireless tranceiver:	Radiocrafts 433.05-433.79 Mhz
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

IoT Autonomous devices

ADS-102, IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	1 Digital input, 0-30VDC
	1 Digital counter, 1 KHz
	2 Analog input, 0-1VDC, 12 bit resolution
Transducer excitation	3.6V/120mA
Wireless RF :	Radiocrafts 433.05-433.79 Mhz
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

ADS-260 SIGFOX

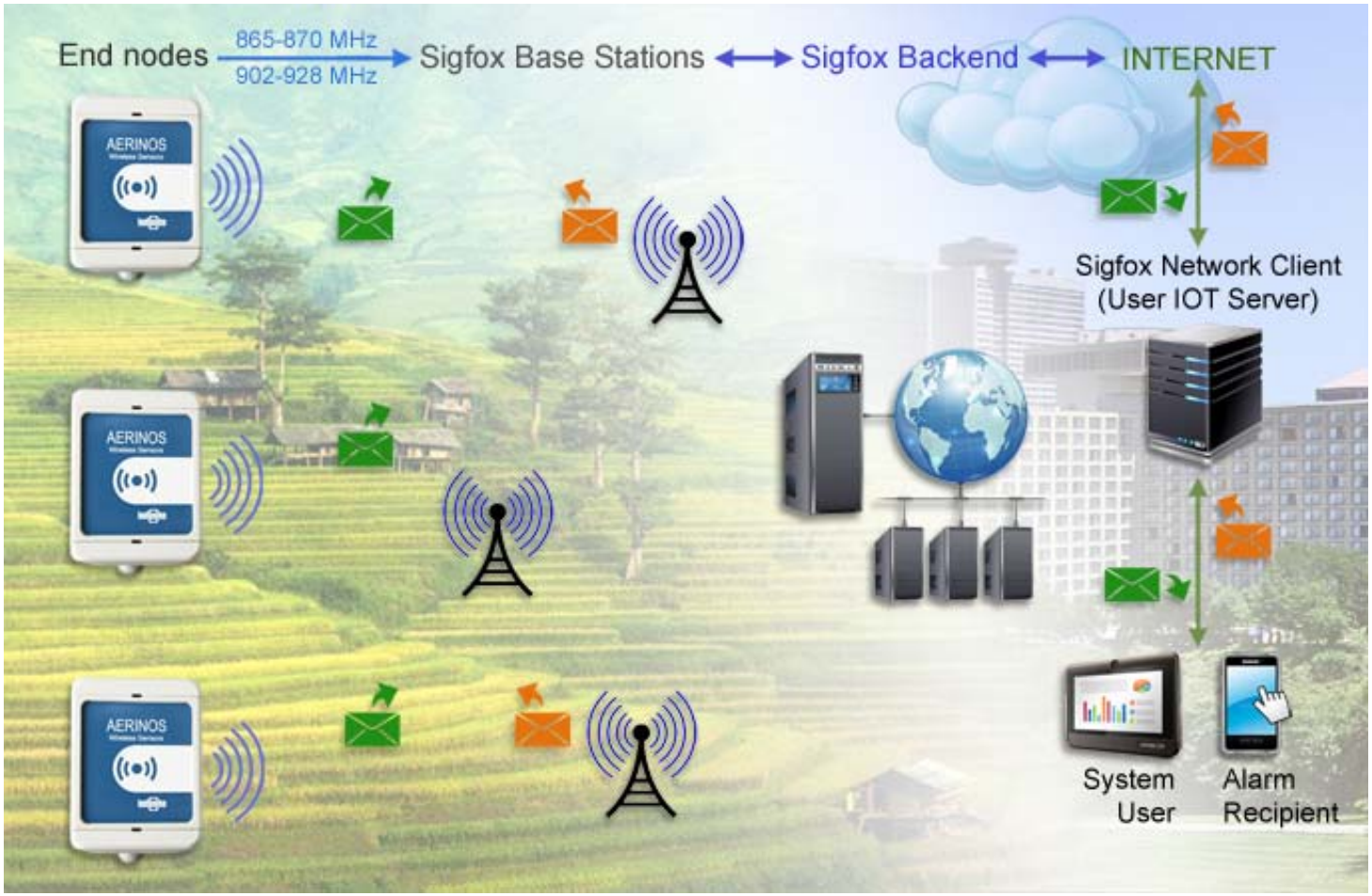
The ADS-260 is an ultra low power, wireless smart end node for the Sigfox network.

It is available for the SIGFOX network for Europe, USA, Latin America, Singapore, Taiwan, Hong Kong, Australia, New Zealand, South Africa, Oman, RC1, RC2, RC4.

The battery powered RTU supports acquisition from multiple sensors and it incorporates one digital/analogue/pulse input, SDI-12 bus with up to 3 sensors supported, an RS485 Modbus bus with up to 3 sensors supported and multiple excitation options for powering measuring transducers.

A D-size Lithium Thionyl battery can provide autonomous operation for over 10 years.

ADS-260 SIGFOX

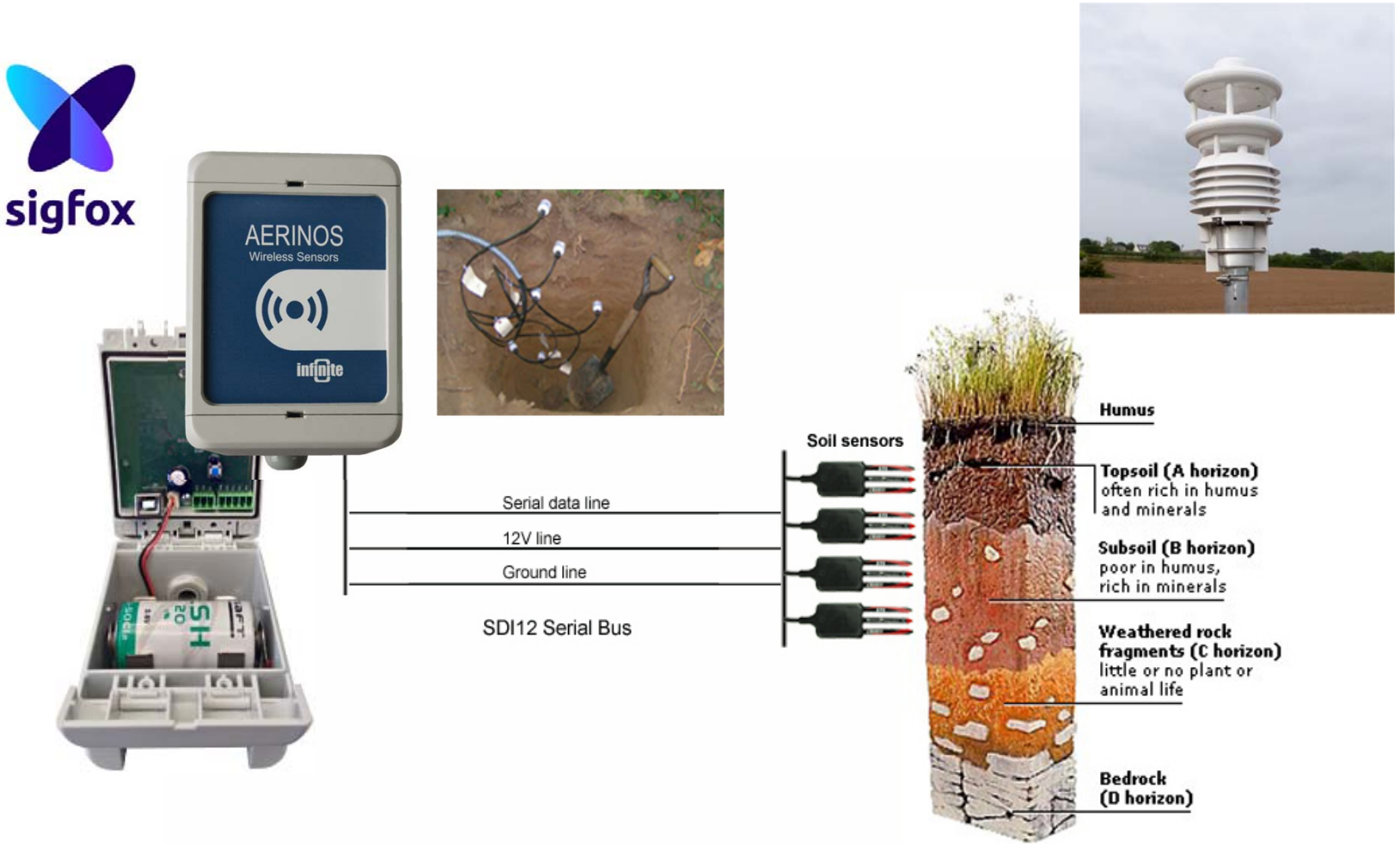


IoT Autonomous devices

ADS-26x, Sigfox IoT wireless end nodes

Power supply:	3.6V, 13-18 Ah Lithium Thionyl battery, D-size
	5VDC mains or photovoltaic power
Consumption :	Continuous 18µA
Discrete inputs:	IN1, configurable as:
	Digital input, 0-30VDC
	Analog input, 0-1VDC, 12 bit resolution
	Digital counter, 1 KHz
SDI-12 Bus:	8 Channels, up to 3 sensor support.
RS-485, MODBUS:	8 Channels, up to 3 sensor support, ASCII/RTU.
Transducer excitation	12V/250mA, 5V/200mA
Wireless modem:	Radiocrafts Sigfox RC1,2,4
Antenna	internal or external
Messages:	Data, Alarm
Temperature:	-20°...+65°C, operating
Dimensions:	79.5 x 125 x 61 mm (with cable gland)
Housing:	IP66, IP68 Nema 4x

ADS-260 SIGFOX




Silos & Level
Weather
AERINOS
Wireless Sensors
infinite
Herds
Soil
sigfox

Sensors

All in one weather

Soil Moisture, Conductivity, Temperature

Valve

Sensors

Leaf Wetnets

Soil Moisture

Ambient Humidity & Temperature

Soil Temperature

Sensors

Wind Speed

Sun Radiation

Wind Direction

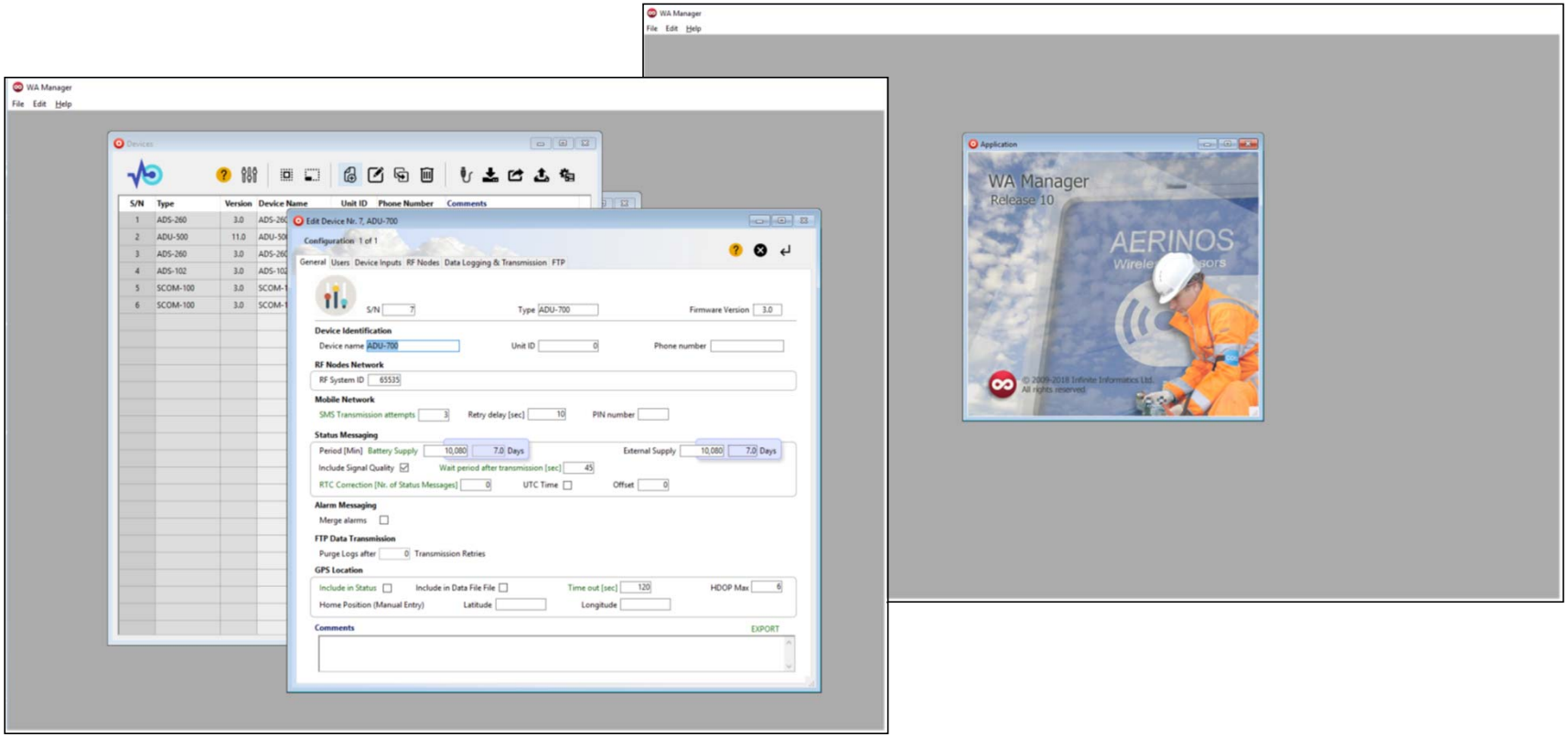
Sensors

Water Level Ultrasonic

PH

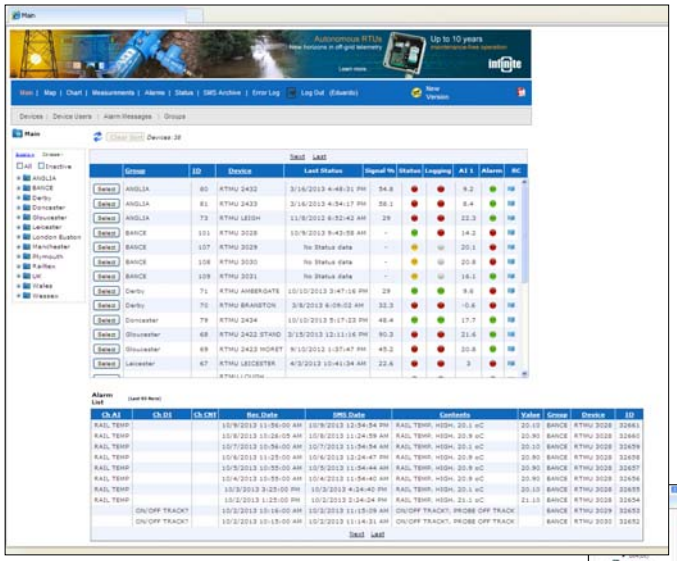
Water Quality

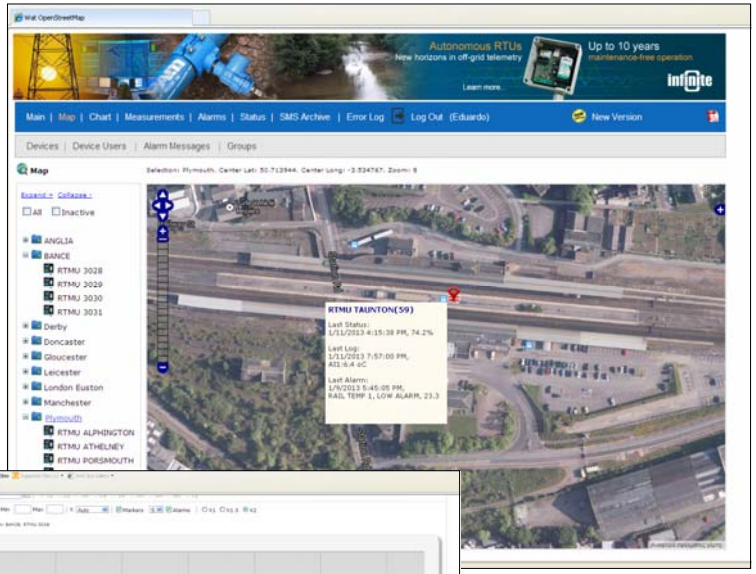
WA Manager configuration tool

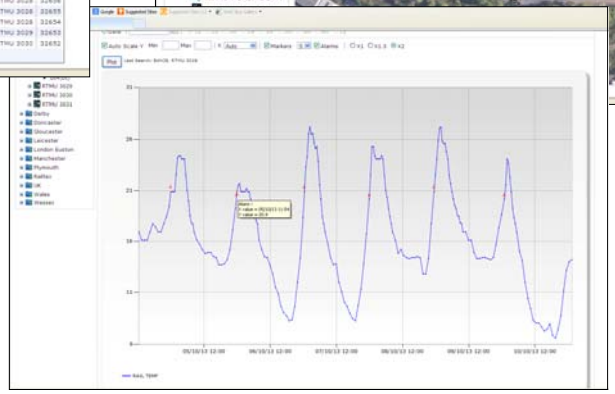


WaT - Web aided Telemetry

Cloud telemetry platform with GIS information







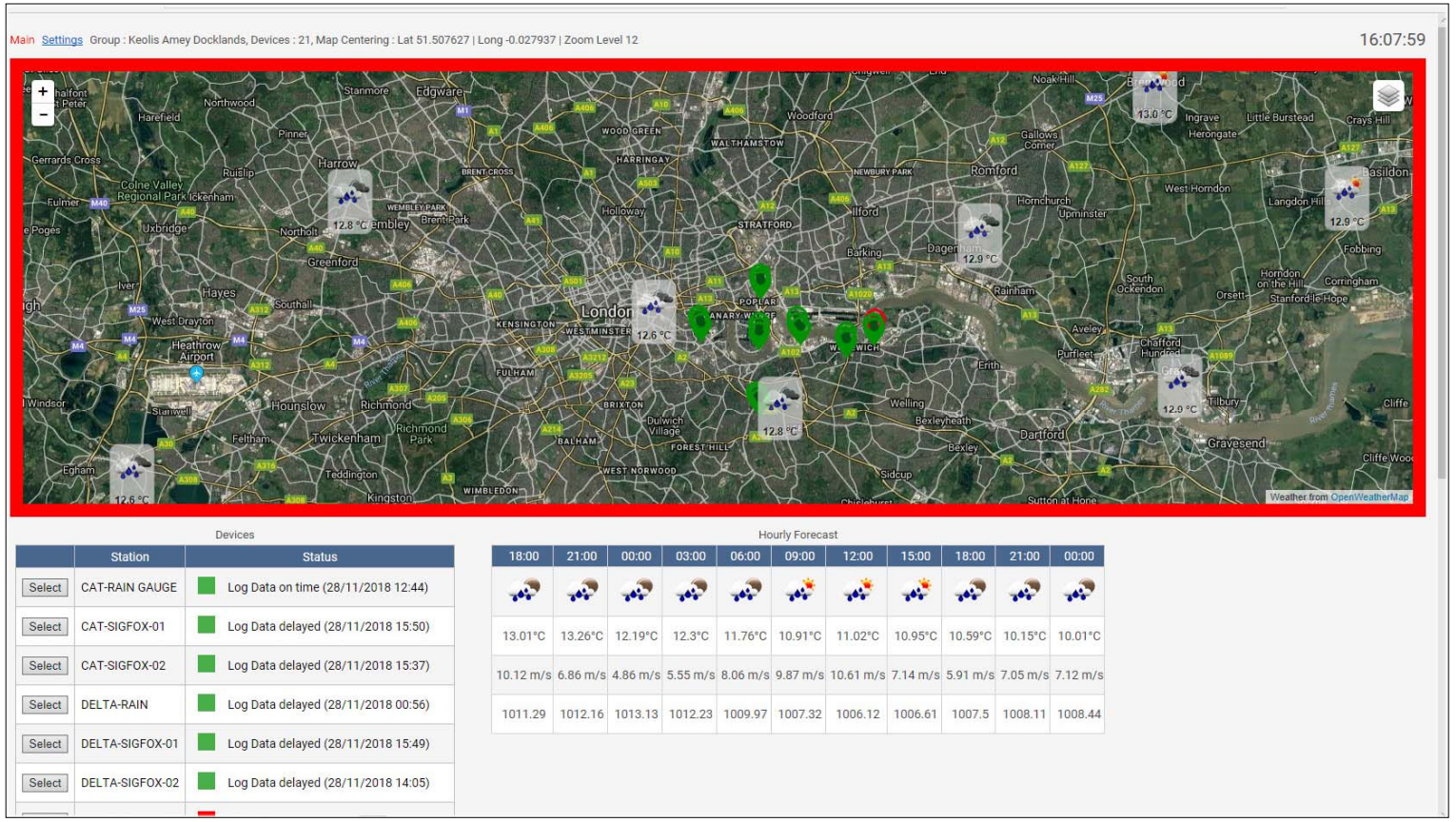
ANDROID APP ON Google play

Download on the App Store

infinite

WaTEye - Web aided Telemetry Eye dashboard

Online dashboard with live weather and telemetry data

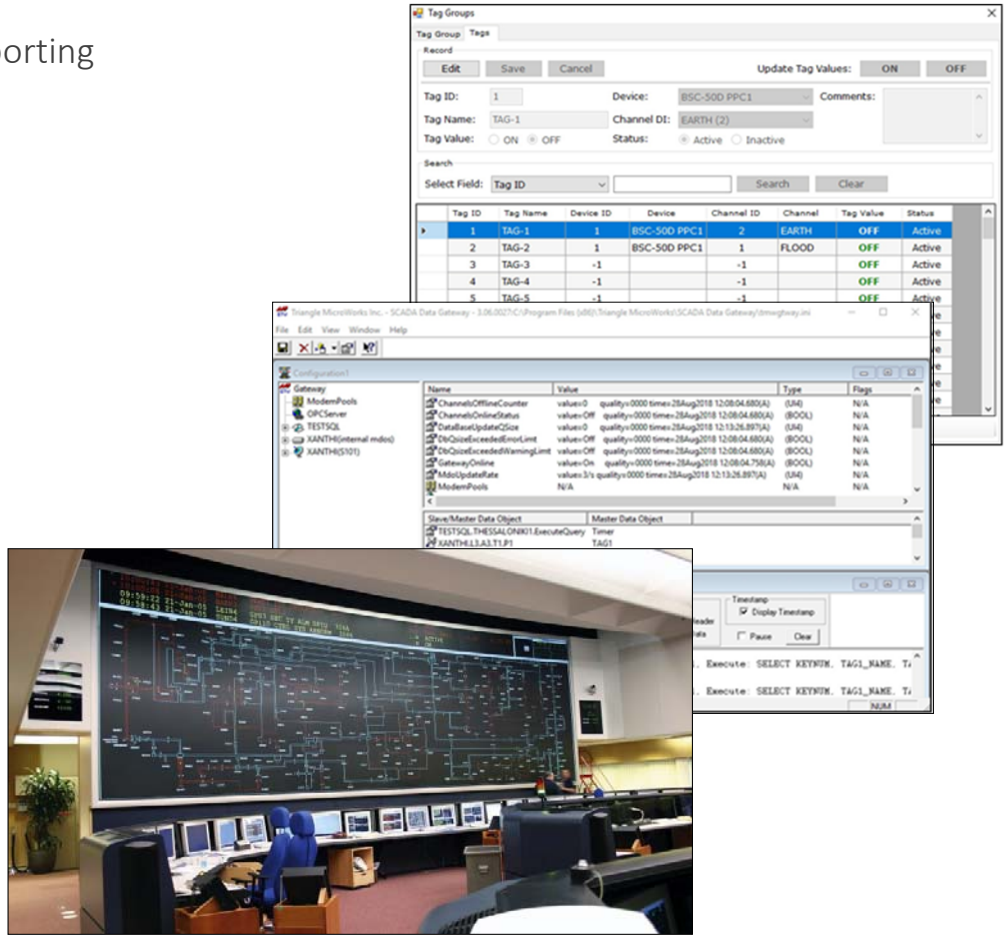


MsG – Multiprotocol Scada Gateway

The MSG is a modern SCADA communication gateway, supporting multiple protocols,

- DNP3 Secure Authentication v5 (SAv5)
- IEC 60870-5-101, 102,103
- IEC 60870-5-104
- IEC 60870-5 Secure Authentication for -101 and -104
- OPC Data Access
- OPC XML Data Access
- OPC Alarms & Events
- IEC 61850
- IEC 60870-6
- Modbus

MS SQL server database backend for
Historical data storage and management.



Case Study Olive Trees

ADU-700
Gateway 3G with GPS

Slave 1: ADS-200
3x SDI12 Soil Moisture,
Conductivity

Slave 2: ADS-210
Irrigation, 1 counter for flow

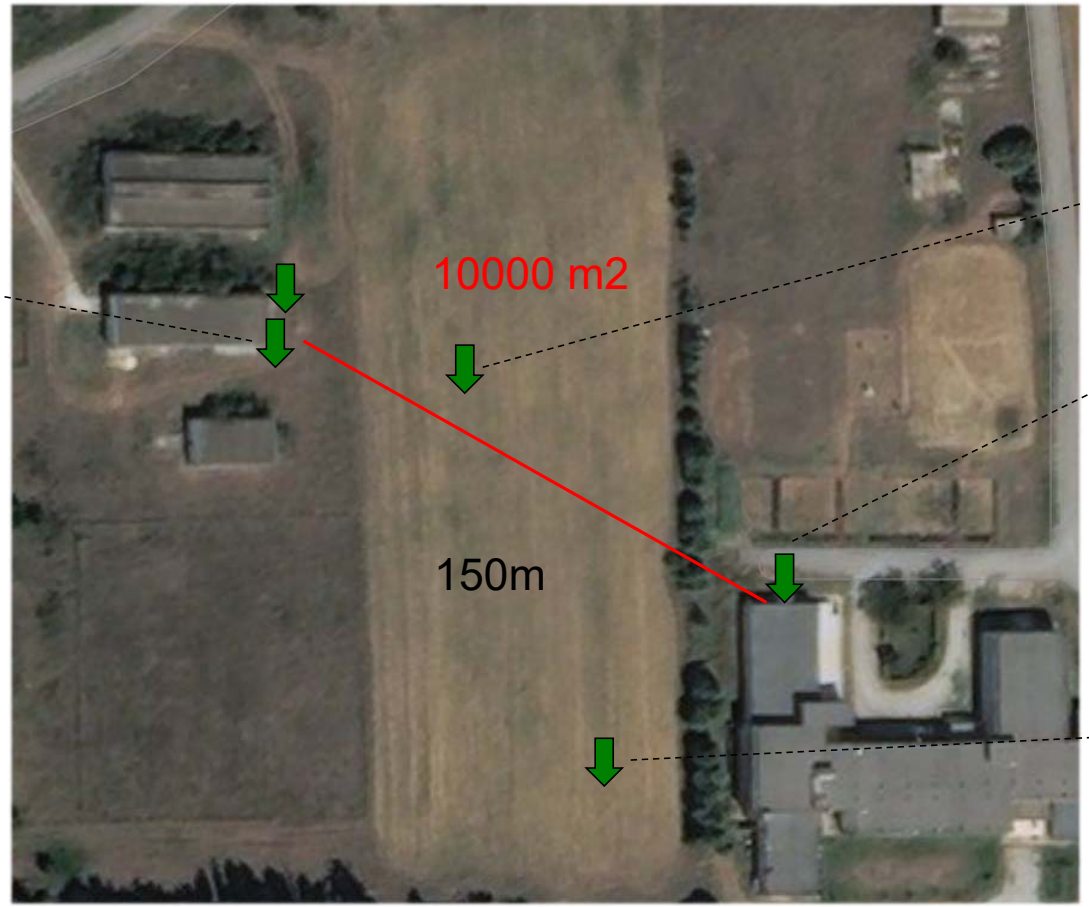
Slave 3: ADS-102
1x analogue Air Temperature
1x analogue Air Humidity

Slave 4: ADS-200
3x SDI12 Soil Moisture,
Conductivity

Pilot Vital

Sensors

Case Study Olive Trees



Slave 3
Air temperature
Air Humidity

Slave 1
3x SDI12 Soil Moisture,
Conductivity

Slave 2
Irrigation + Flow

Slave 4
3x SDI12 Soil Moisture,
Conductivity

Test Case

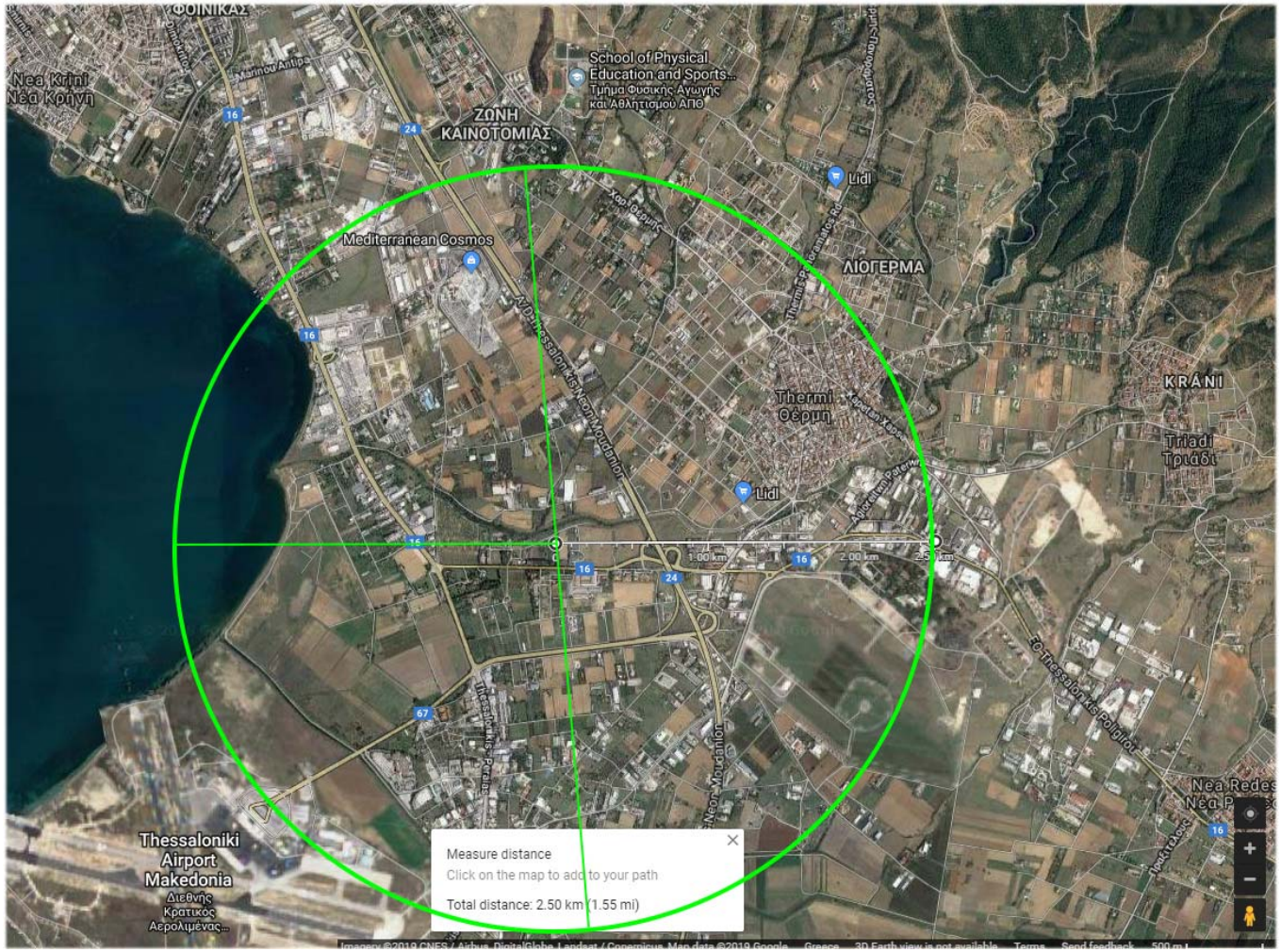
RF Transceiver Radiocrafts RC1740HP_RC232

- Ultra narrowband, high-performance radio
- High sensitivity and high selectivity
- High blocking properties
- High RF Power, long range (up to 10 km Line-Of-Sight)
- Completely shielded module
- 12.7 x 25.4 x 3.3 mm compact module for SMD mounting
- 2.8 – 3.6 V supply voltage
- Ultra low power modes
- Conforms with EU R&TTE directive (EN 300 220, EN 301 489, EN 60950)

Parameter	RC1740HP-RC232	Unit
Frequency band	433/444	MHz
Data rate	1.2 -100	kbps
Max output power	+ 27	dBm
Sensitivity, (1.2 kbps)	-118	dBm
Supply voltage VCC	2.8 – 3.8	Volt
Current consumption, RX /IDLE	31,7	mA
Current consumption, TX (+24 dBm)	318	mA
Current consumption, SLEEP	Max 0.6	uA
Temperature range	-40 to +85	°C

Operational line of sight 10 Kms reduced power to 5+Kms

Case Study Olive Trees



Pilot Vital

Main Settings Group : Diavalkaniko, Devices : 1, Map Centering : Lat 40.538155 | Long 22.993739 | Zoom Level 12 18:08:27

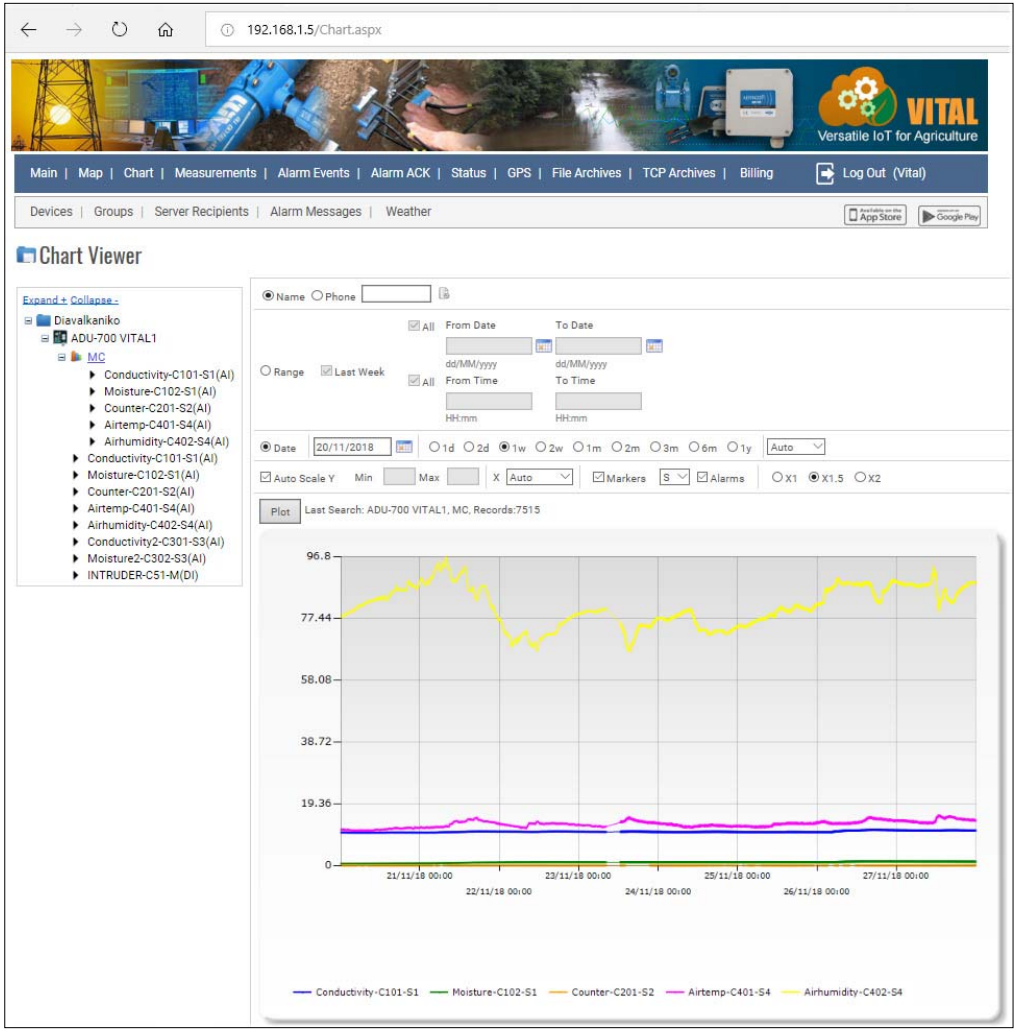
Devices

	Station	Status
Select	ADU-700 VITAL1	Log Data delayed (29/09/2018 10:50)

Data

Channel	Last Value	Unit	Last Date	AVG	MIN	MAX
Airhumidity-C402-S4	72.4	%	22/11/2018 14:15:16	74.8	67.3	87.6
Airtemp-C401-S4	13.2	°C	22/11/2018 14:15:16	13.0	11.7	14.3
Conductivity-C101-S1	9.3	dS/m	22/11/2018 14:15:16	10.6	10.5	10.7
Counter-C201-S2	.0	lt	22/11/2018 14:15:16	0.0	0.0	0.0
Moisture-C102-S1	.4	%	22/11/2018 14:15:16	1.0	0.9	1.0

WaT


192.168.1.5/Chart.aspx
VITAL
Versatile IoT for Agriculture
Main | Map | Chart | Measurements | Alarm Events | Alarm ACK | Status | GPS | File Archives | TCP Archives | Billing
Log Out (Vital)
Devices | Groups | Server Recipients | Alarm Messages | Weather
Chart Viewer
Expand + Collapse -
Diavalkaniko
ADU-700 VITAL1
MC
Conductivity-C101-S1(AI)
Moisture-C102-S1(AI)
Counter-C201-S2(AI)
Airtemp-C401-S4(AI)
Airhumidity-C402-S4(AI)
Conductivity-C101-S1(AI)
Moisture-C102-S1(AI)
Counter-C201-S2(AI)
Airtemp-C401-S4(AI)
Airhumidity-C402-S4(AI)
Conductivity2-C301-S3(AI)
Moisture2-C302-S3(AI)
INTRUDER-C51-M(DI)
Name Phone
From Date
To Date
Range
Last Week
From Time
To Time
Date
20/11/2018
Auto Scale Y
Min
Max
Markers
Alarms
Plot
Last Search: ADU-700 VITAL1, MC, Records:7515
96.8
77.44
58.08
38.72
19.36
0
Conductivity-C101-S1
Moisture-C102-S1
Counter-C201-S2
Airtemp-C401-S4
Airhumidity-C402-S4

Case Study Olive Trees

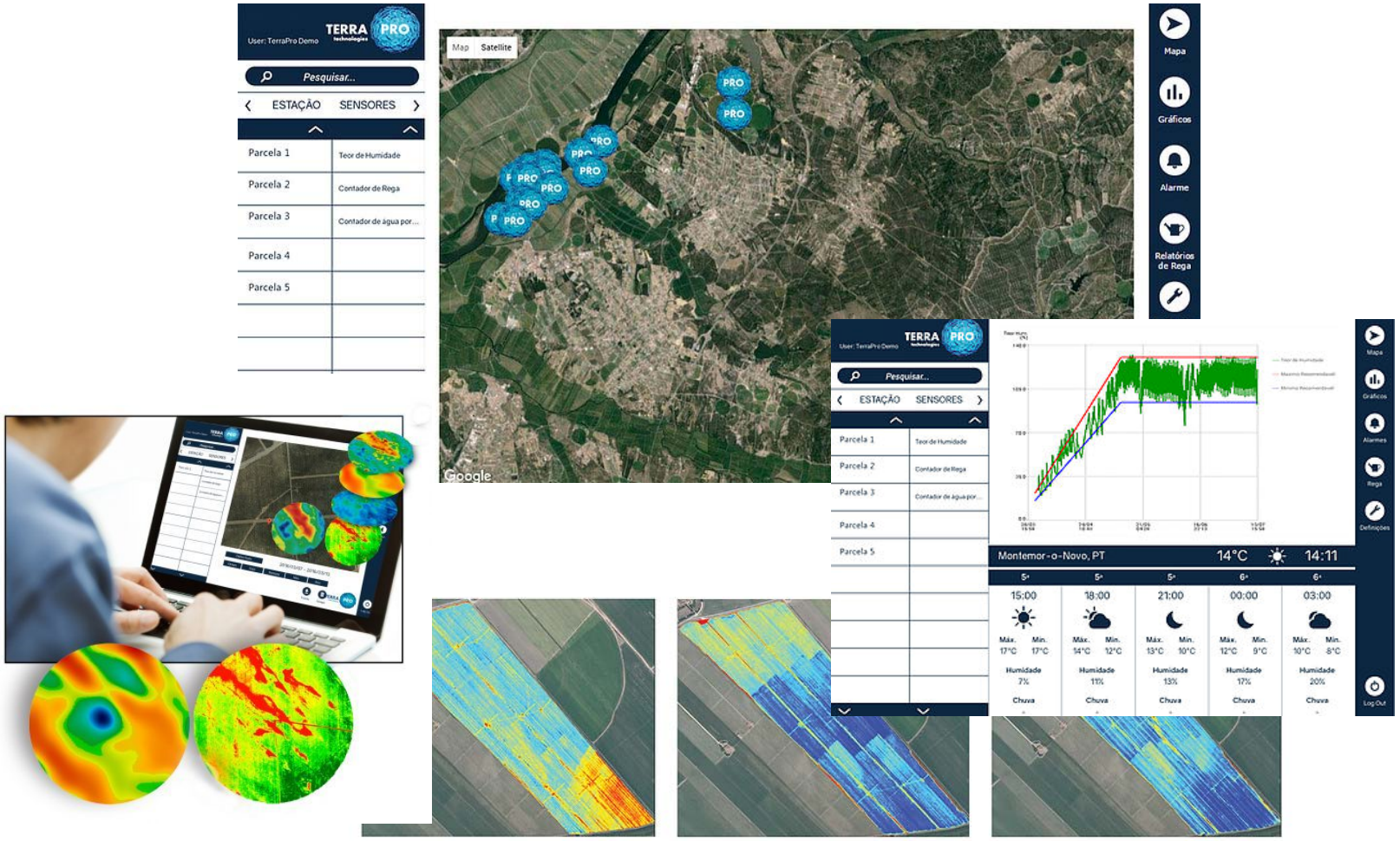
Partners

Partners


Pluviómetro
Temperatura
Humidade do ar
Velocidade e direção do vento
Radiação Solar
Estação uMeteo
TERRA PRO
agricultura de precisão
precision agriculture

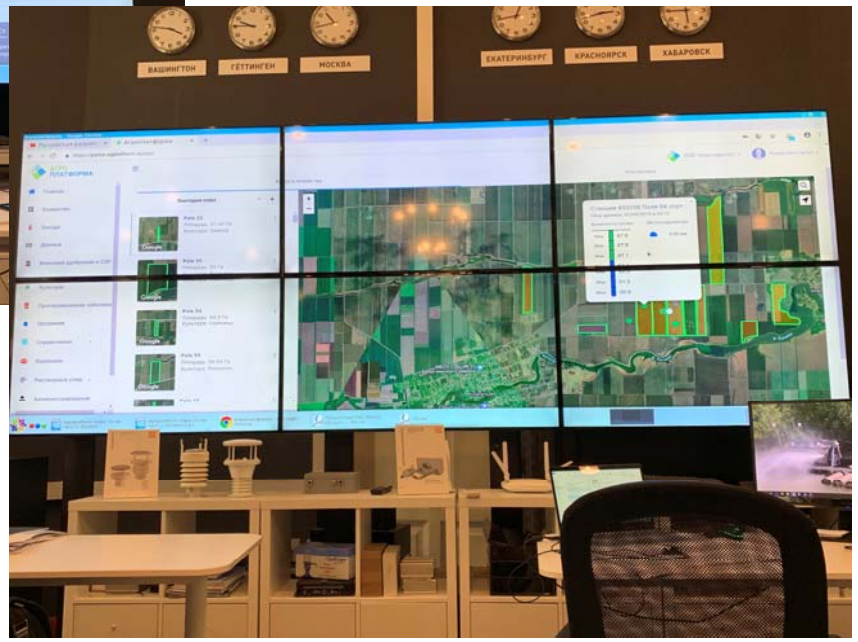

TERRA PRO
agricultura de precisão
precision agriculture
TERRA
technologies
PRO

Partners


User: TerraPro Demo
TERRA PRO
Pesquisar...
ESTAÇÃO
SENSORES
Parcela 1
Teor de Humidade
Parcela 2
Contador de Rega
Parcela 3
Contador de água por...
Parcela 4
Parcela 5
Map
Satellite
Google
Mapa
Gráficos
Alarme
Relatórios de Rega
Montemor-o-Novo, PT
14°C
14:11
15:00
18:00
21:00
00:00
03:00
Humidade
Chuva
Log Out

Partners

АГРОПЛАТФОРМА



Partners


ВАШИНГТОН
ГЁТТИНГЕН
МОСКВА
ЕКАТЕРИНБУРГ
КРАСНОЯРСК
ХАБАРОВСК
Журнал обработки поля «Козловка правое 3»
Станция Крёкшино - морковь
Суммарный влагозапас почвы

Partners

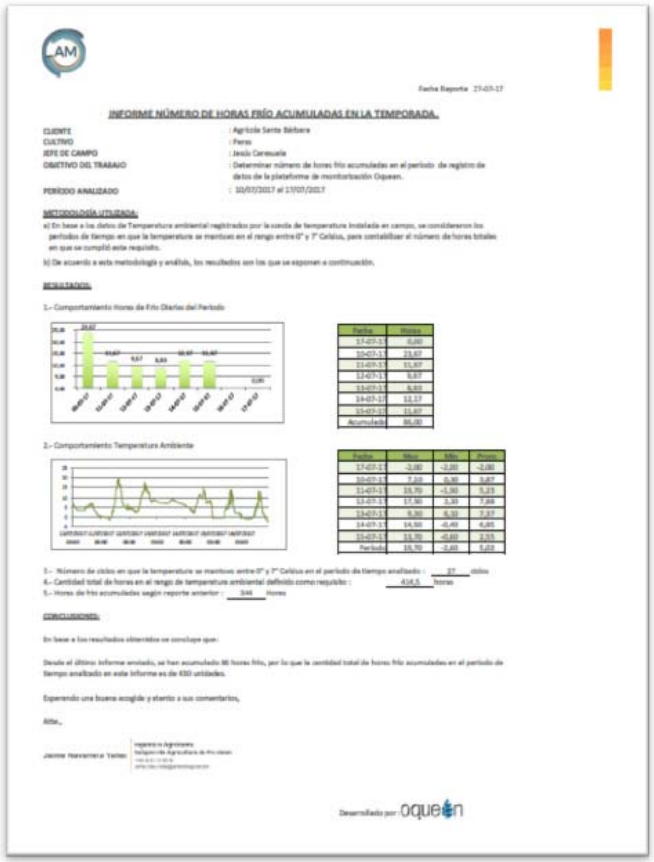
AM ecological

oqueen

BAYER

Partners


oqueon
SERVICIOS
INGENIERIA
EMPRESAS RELACIONADAS
CONTACTO
Usuario:
RUT:
Dirección:
Rango de fechas:
22/01/2017 - 16/02/2017
Actualizar Datos
Reporte
Guardar Grafico
Ver Mapa
MODIFICAR DATOS DE CONTACTO
Sondas
Cuartel 10
01
Criterios de Selección
Humedad
Cuartel 10
Humedad de suelo
Cuartel 10
Salinidad
Cuartel 10
[%VWC]
[dS/m]
Cuartel 25
Humedad de suelo acumulada
Cuartel 25
Estanque de Agua de la Planta
[mm]
503.1
15-Feb-2017
15:33:24
Humedad de suelo acumulada
[10+20+30+40+50+60+70+80] cm
INFORMACIÓN DEL SERVICIO
ALARMAS
SERVICIOS HIDROGEOLÓGICOS
Telemetría Oqueon - Monitoreo agrícola v1.2


INFORME NÚMERO DE HORAS FRÍO ACUMULADAS EN LA TEMPORADA.
CLIENTE
CULTIVO
JEFE DE CAMPO
OBJETIVO DEL TRABAJO
PERÍODO ANALIZADO
METODOLOGÍA UTILIZADA:
RESULTADOS:
1.- Comportamiento Horas de Frío Diarias del Periodo
2.- Comportamiento Temperatura Ambiente
CONCLUSIONES:
Desarrollado por: oqueon