



Innovating Precision Agriculture

A Game-Changing Smart Farming IoT Ecosystem

About us

NITLAB, as an innovative research laboratory, has developed significant know-how and has created partnerships with important academic institutions, research laboratories and companies, in the field of Precision Agriculture from all over Greece and abroad, aiming to develop innovative integrated solutions for all stakeholders engaged into the crop production value chain.

To this end, NITLAB has developed and implemented integrated Precision Agriculture technological solutions supported by IoT technologies, such as Wireless Sensor Networks, Cloud Technologies, Integrated Farm Management Software as well as Decision Making tools Support System.



Analysis – Processing – Management – Intervention

Smart Farming systems initially aim to identify the current state of a crop or a field via the distributed collection of field- and crop-related data, in real-time. The proper analysis, processing and interpretation of the collected data enables the optimal cultivation processes required for each crop or field.

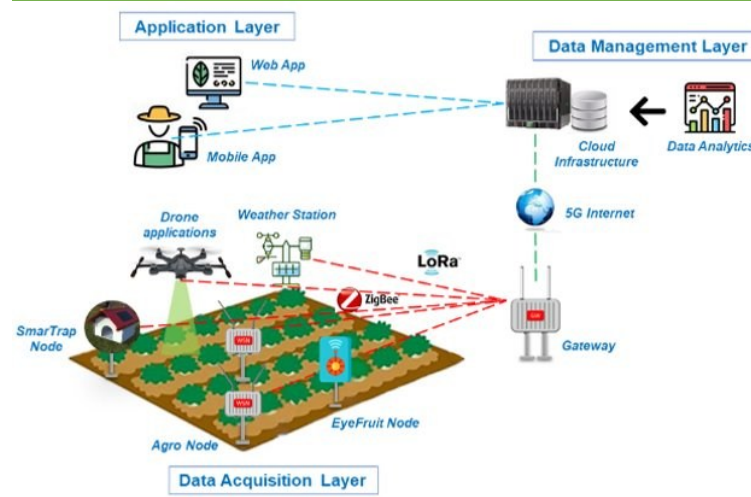
The optimization of cultivation practices provides the possibility for cultivation interventions with variable dosage of inputs (variable-rate application), in order to satisfy the real, site-specific crop requirements in water, nutrients, etc.

This way, a more efficient use of resources is achieved, resulting directly in reducing the cultivation costs and in enhanced environmental protection, with a view to increasing the crops productivity and produced quality.

AGRONIT ARCHITECTURE

3-layered architecture:

- 1. Data acquisition layer
 - a) Wireless Sensor Networks (WSNs)
- 2. Data management layer
 - a) Cloud infrastructure
- 3. Application layer
 - a) AgroNIT app.



WIRELESS SENSOR NETWORK

				
Agro node	Weather station	EyeFruit node	SmarTrap node	Gateway node
<ul style="list-style-type: none">• Monitors crop, soil, environmental conditions• Soil water potential, Air temp. & humidity, Leaf wetness	<ul style="list-style-type: none">• Local climatic conditions• Solar irradiance, Precipitation, Wind speed & direction	<ul style="list-style-type: none">• Fruit or tree growth / phenology monitoring• Raspberry pi camera	<ul style="list-style-type: none">• Monitoring insect capturing on sticky card• Quantification / identification of captured insects	<ul style="list-style-type: none">• Provides access to backbone network• Embeds different communication technologies to interact with the WSN nodes• Connects the WSN with the end-users via the internet

The devices of a WSN are 1) the field-based sensors (agro) node, 2) the EyeFruit node, 3) the weather station, 4) the SmarTrap node, and 5) the gateway node. The agro and camera nodes are installed at crop level, while the weather station together with the gateway node are located at the edge of a field.



The agro node is equipped with low-cost, accurate crop, soil and environmental sensors that allow the seamless monitoring of the most important parameters affecting crop development (air temperature/humidity, soil temperature/water potential, and leaf wetness) (see Table 1 for more information).



The weather (meteo) station, similarly to the agro node, is equipped with low-cost, accurate sensors that measure key climatic parameters, such as wind speed/direction, precipitation, and total solar radiation



The EyeFruit node is installed at the tree level to monitor one (or more) fruit's development rate on a regular basis (a few times per day), by using a Raspberry Pi Camera Module V2 (8MP,1080p) camera sensor to obtain field-based images of the targeted fruit(s). Computer Vision solutions combined with Artificial Intelligence algorithms can achieve significant results in the detection of patterns in images, such as fruit size and fruit color development in time. This pattern recognition can be interpreted to accurately estimate the fruit development degree and rate, contributing to optimized harvesting.



The SmarTrap node is a custom-made node that is composed of a modified delta trap to host a fully autonomous monitoring system on the top of the trap. The monitoring system features a Raspberry Pi Camera Module V2 (8MP,1080p) camera sensor to capture images of the targeted sticky card placed at the bottom of the trap. The system is capable of capturing multiple photos and sorting them based on their definition, on a daily basis. The captured photographs are sent directly to the Cloud, via the node's communication system using a 5G dongle.



The gateway node provides the backbone network/ backhaul and supports the remote configuration of each sensing device. It functions as a sensed data sink, which is transmitted over the 5G network to the proprietary cloud platform, in real time.

Agro – Meteo Node Specifications

Component Category	Component Description
Sensors	Temperature, humidity
	pressure sensor
	Soil/Water Temperature (Pt-1000) Sensor
	Watermark Soil Moisture Sensor 4.5m
	Leaf Wetness Sensor
	Solar radiation sensor
Microcontroller	Meteo, Weather Station (WS-3000)
	Waspote Agriculture Sensor Board Pro
	PCB Waspote V 15 1
Communication	Sub-GHz Modules XBee SX 868, 25mW DigiMesh, U.FL
	Antennas 868 MHz tilt/swivel dipole whip antenna, RP-SMA plug (female socket) connector mount, LPWA applications
Energy	Battery Li >3000mAh
	Battery holder
	Solar Panel >=1W
Mounting	Waterproof case IP65



Gateway Node Specifications

Component Category	Component Description
Single-board Computer	Arduino Pro Mini 328 - 3.3V/8MHz
	Beaglebone Black Hat for hosting low power communication interfaces
Communication	Sub-GHz Modules XBee SX 868, 25mW DigiMesh, U.FL 1
	Antennas 868 MHz tilt/swivel dipole whip antenna, RP-SMA plug (female socket) connector mount, LPWA applications
	Jumper Cable CRC9 Male Right Angle To RG316 SMA Female (20cm) (OEM)
	Antennas LTE Blade Dipole Swivel Antenna SMA
	4G Dongle
	SIM card- LTE 4G
Energy	The 5V 5A Voltage Regulator is a DC-DC converter. input 9 - 35V / output 5V 5A 25W.
	Solar Panel System with battery 12V 40 Ah 1
	Charging controller PWM 24V 10A
	Yusuba Battery UPS Capacity 22Ah Voltage 12V
	Invictus SRM-50P Multi-crystallic Solar panel 50W 12V 680x515x30mm
Mounting	Maxlink Alubox aluminum waterproof universal mounting box



EyeFruit Node Specification		
Component Category	Component Description	
Sensors	Raspberry Pi Camera Module V3 - Standard 11.9MP 120°	
	Antennas LTE Blade Dipole Swivel Antenna SMA	
Communication	Jumper Cable CRC9 Male Right Angle To RG316 SMA Female (20cm) (OEM)	
	HUAWEI 4G Dongle E3372-h153	
	SIM card- IoT sharing (Group1 100MB)	
	Raspberry Pi 4 - Model B - 2GB	
Single-board computer	WaveShare Power Management HAT for Raspberry Pi Embedded RTC and Multiple Protection Circuits	
	Memory Card microSDHC 32GB Class 10 - SanDisk Ultra SDSQUA4-032G-GN6MA	
	Battery Lithium NCR18650B 3350mAh	
Energy	Waveshare Solar Power Manager (C) - 3x 18650	
	Solar Panel 10W 250x250mm, 12V	
	Converter DC-DC Step-Up 5-35V 2A	
Mounting	Waterproof Plastic Case	
	Galvanized Pipe Structural Steel Sections GI Pipe For Construction 3m	

SmarTrap Node Specification		
Component Category	Component Description	
Sensors	Raspberry Pi Camera Module 5MP Fisheye Lens (G)	
	LED Ring - 16 x WS2813 5050 RGB	
	Sonoff Temperature sensor Battery Smart, Humidity Sensor White Colour SNZB-02	
	Antennas LTE Blade Dipole Swivel Antenna SMA	
Communication	Jumper Cable CRC9 Male Right Angle To RG316 SMA Female (20cm) (OEM)	
	HUAWEI 4G Dongle E3372-h153	
	SIM card- IoT sharing (Group1 100MB)	
	Sonoff ZBDongle-P Smart Hub Συμβατό με Alexa / Google Home Μαύρο	
Single-board computer	Antennas LTE Blade Dipole Swivel Antenna SMA	
	Raspberry Pi 4 - Model B - 2GB	
	WaveShare Power Management HAT for Raspberry Pi Embedded RTC and Multiple Protection Circuits	
	Memory Card microSDHC 32GB Class 10 - SanDisk Ultra SDSQUA4-032G-GN6MA	
Energy	Battery Lithium NCR18650B 3350mAh	
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Software's app

1. Display service of field/crop/farmer basic information, such as the properties of the soil, the crop, the irrigation system, the farm equipment/machinery etc.
2. Display service of all field-based sensed data and images captured by the WSN, in real time, which are mainly presented using configurable graphs.
3. Data analytics service aiming to interpret appropriately and extract useful conclusions for the end-user in the form of advice or notifications. it incorporates custom-made A.I. algorithms for 1) the estimation of real crop needs in water (irrigation) and nutrients (fertilization); 2) the assessment of the current crop's phenological status, by monitoring the accumulated chilling hours/portions and growing degree hours; as well as 3) to forecast potential threats from biotic and abiotic factors, such as diseases, pests or adverse weather phenomena, by monitoring local climatic conditions or weather forecasting, respectively.
4. Consulting/alerting service for the timely and accurate execution of the most important cultivation practices aiming to enhance resource efficiency in a sustainable way.
5. 48-hour weather forecast service integrating recommendations on the appropriate farmer's task scheduling based on the forecast.
6. Cultivation calendar service that incorporates a logger for task record-keeping by the farmer or the supervising agriculturist.
7. Auxiliary services encompassing the monitoring and record of crop's health status employing non-destructive methods and tools; such methods are remote sensing by UAVs equipped with RGB or multispectral cameras; the determination of a fruit's maturity using the DA meter, a handheld device that measures its chlorophyll content etc.



USER INTERFACE / DASHBOARD

User-friendly interface

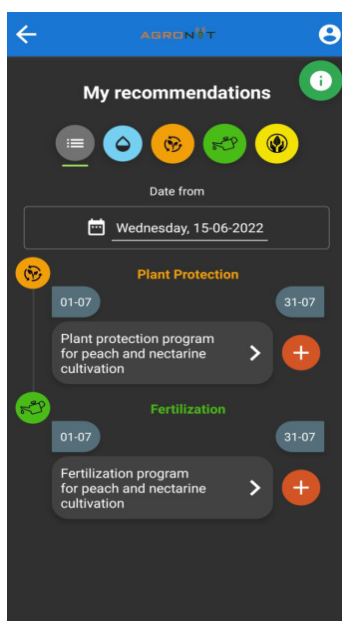
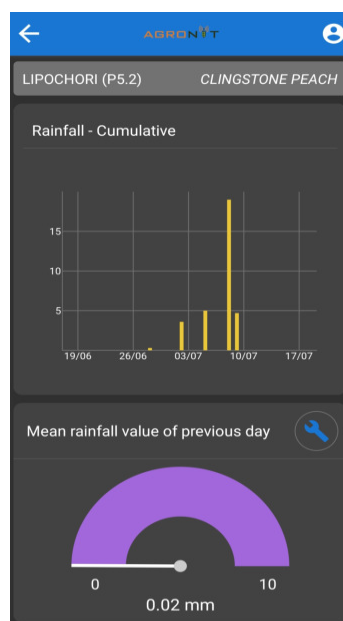
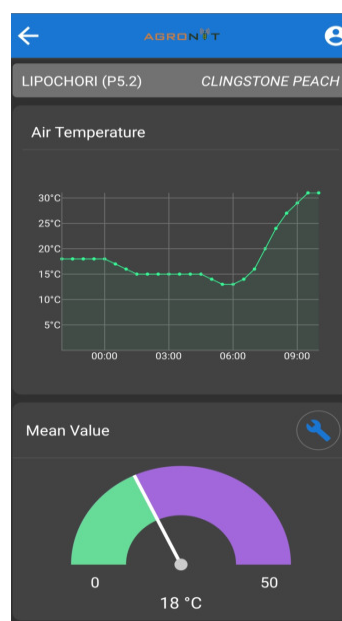
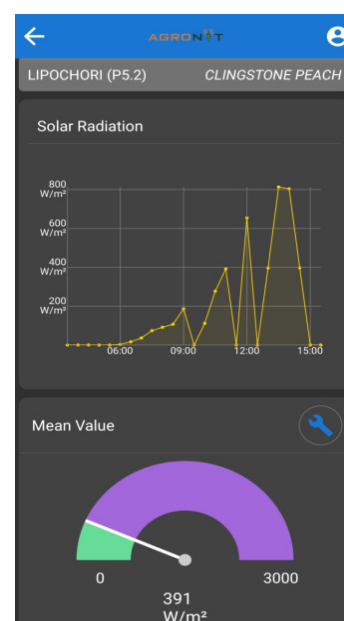
Available for web and mobile applications

Simplifies visual presentation of information

Interactive UI:

Augmented user control with customisable graphs and heatmaps & by enabling user feedback & input

Provides deeper understanding of the crop performance by offering consolidated knowledge through interactive recommendations and alerts



The AgroNIT app is available for Android & iOS smartphones



Username: demo_account

Password: demo1234