

Seminario | Digitalizzazione e agricoltura biologica: il caso delle colture orticole industriali

*Nuove tecnologie digitali per l'agricoltura di
precisione*

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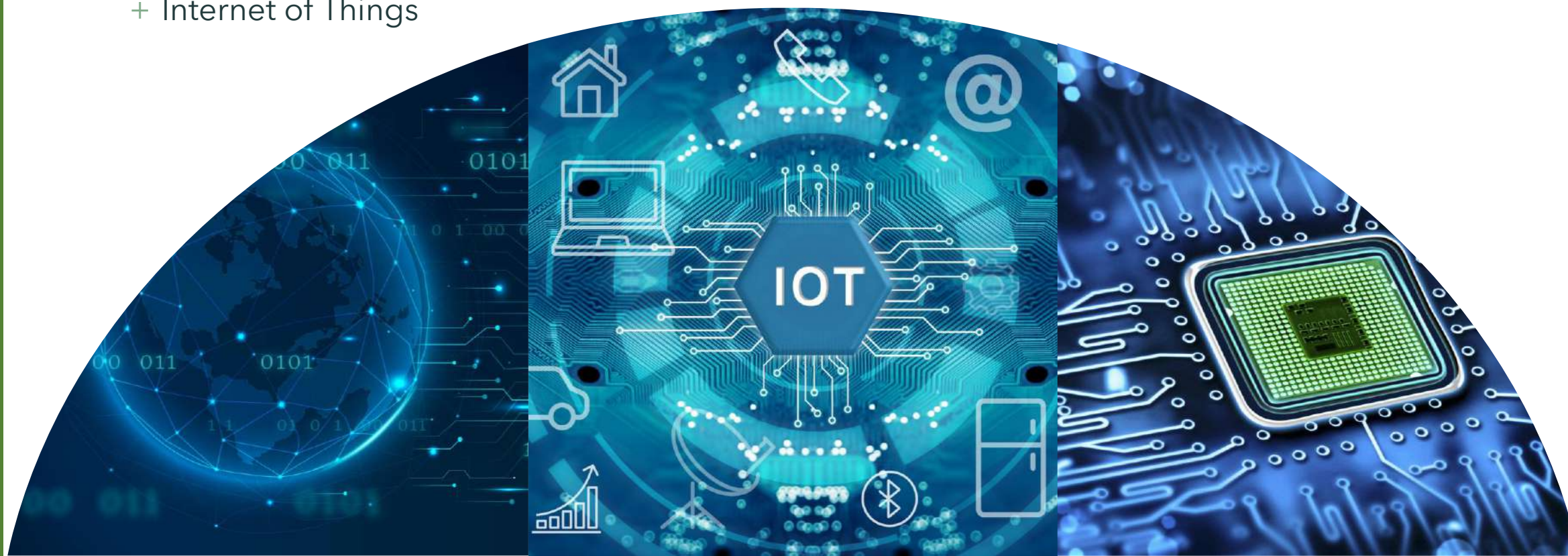
Azienda Agraria Sperimentale STUARD

**From Industry 4.0
to Nature 4.0**

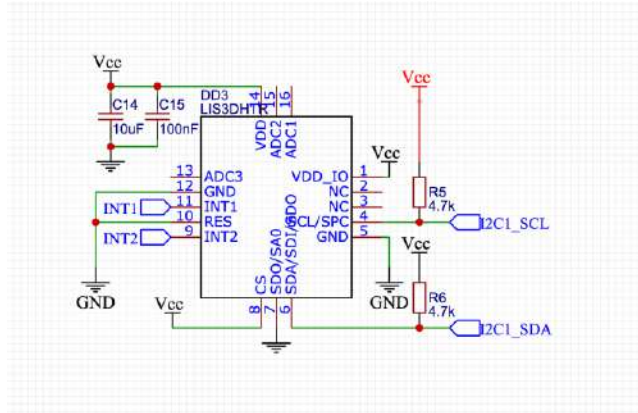
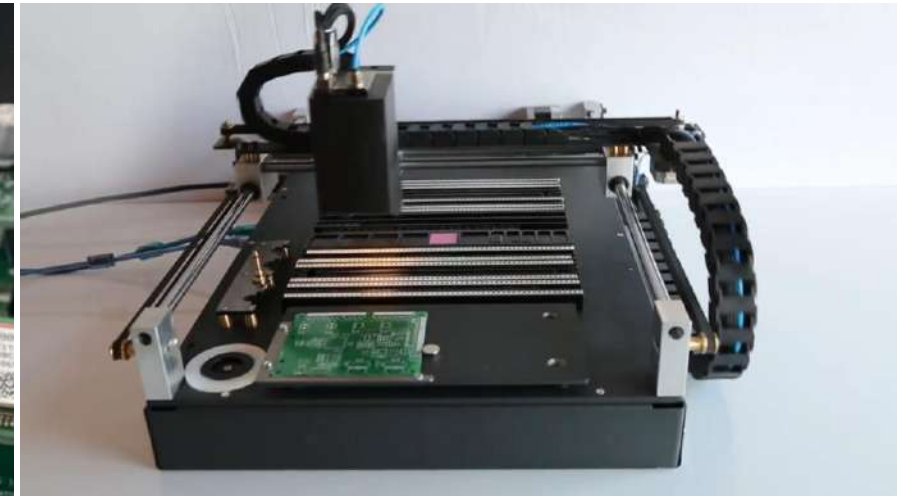
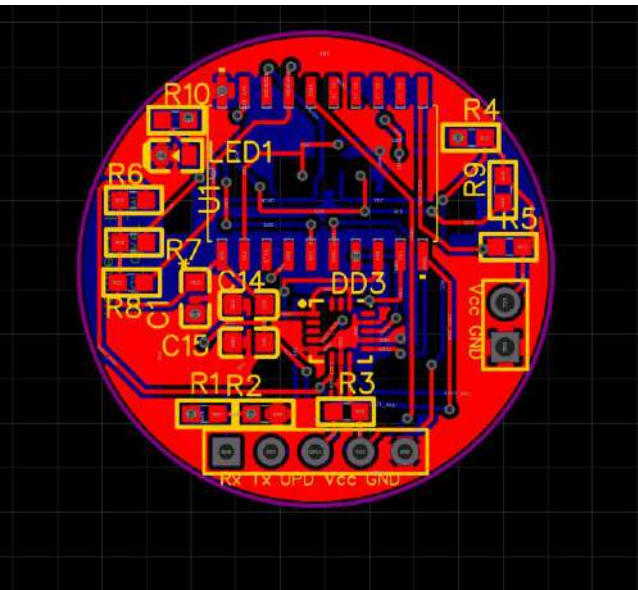
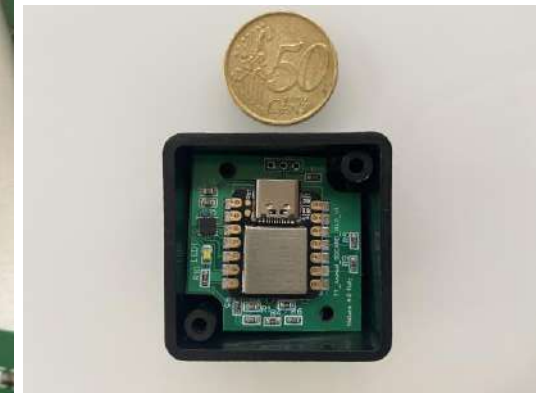
Real Time Data

- + Microprocessing
- + Microcomputing
- + Internet of Things

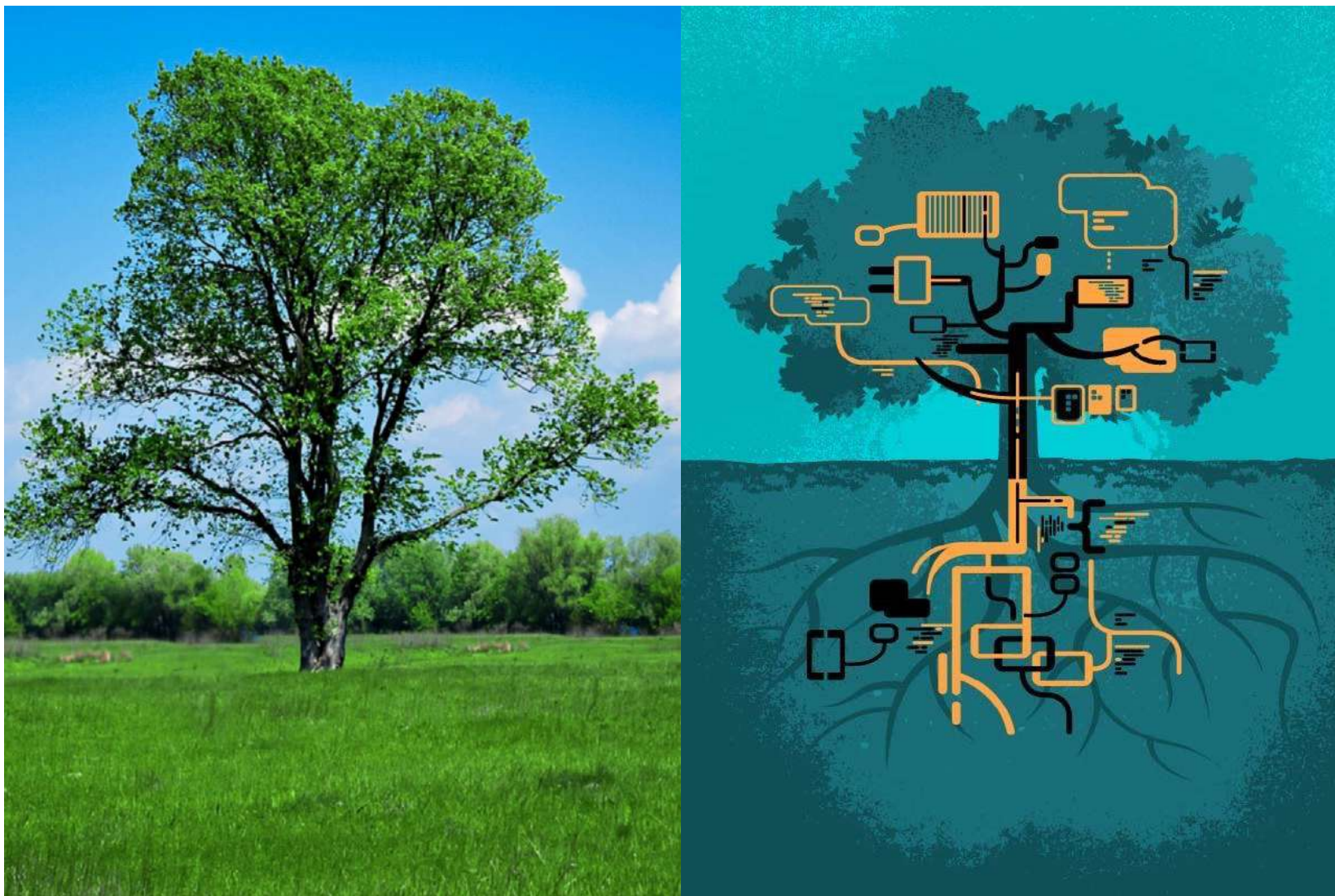
Climate and Environmental
Solutions and Sustainability



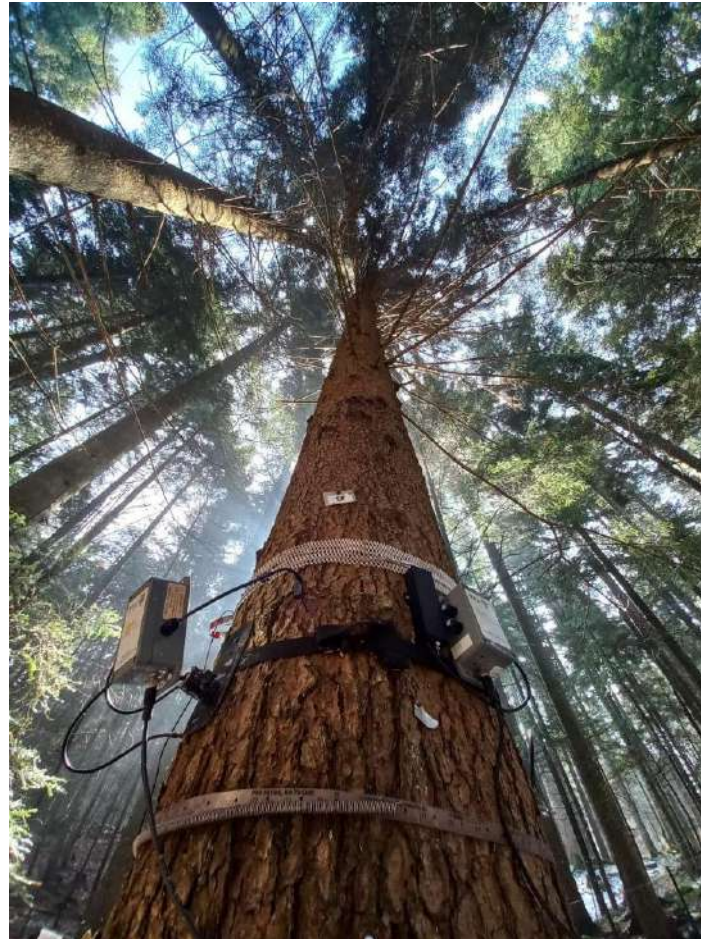
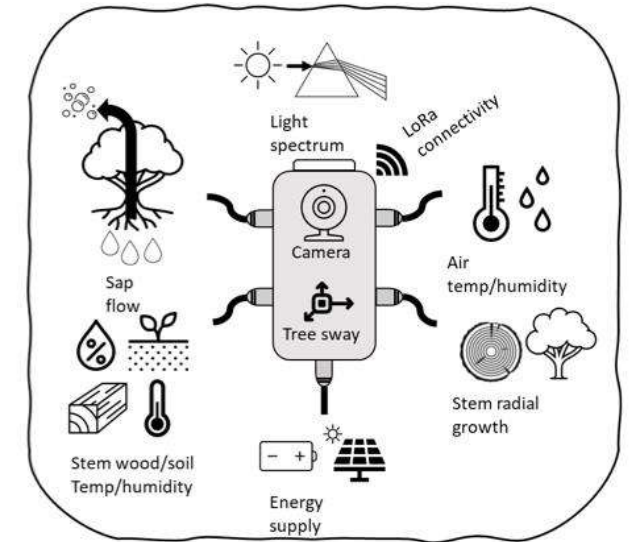
Nature 4.0 capabilities



The forest Digital Twin



The TreeTalker Cyber



- Water consumption
- Leaves spectral components
- Stem moisture
- Diameter Growth
- Tree stability

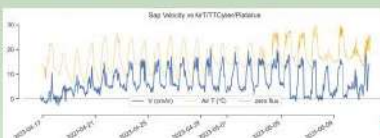


TT-Cyber



Specs:

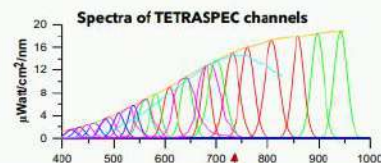
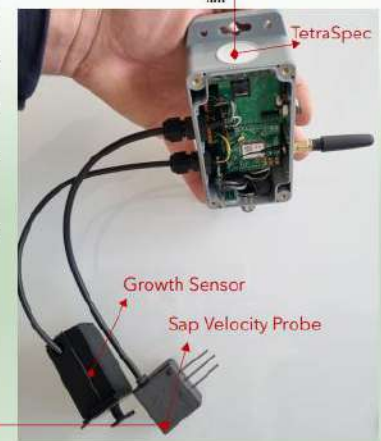
- Monitoring Tree functions (1hour sampling rate)
- Transpiration (sap velocity): reverse, zero and positive flux
- Sapwood Moisture Content, capacitance-based sensors for volume sensing of moisture
- Canopy light transmission in 26 operational spectral bands (410-940 nm), and CLEAR, Flicker
- Radial daily growth (linear magnetic encoder, accuracy: 10 μm -resolution 0.5 μm)
- Stem 3D position (for tree stability studies) $\pm 0.05^\circ$
- Air Temperature (-10 to +85°C $\pm 1^\circ\text{C}$ max) and Humidity (0 to 100 % $\pm 5\%$ Typ.)
- Flash Memory for data storage 16Mbyte



Function and Capabilities

Multifunctional IOT driven device providing tree eco-physiological measurements.

1. Sap Velocity
2. Radial Growth Rate
3. Sapwood Moisture Content
4. Spectrometer-28 bands
5. Tree stability-accelerometer
6. Onboard air temp and humidity sensors
7. LoRa Wan/NB-IoT connection



TT-Air

Function and Capabilities

A real time air quality measurement station that can measure up to 13 air parameters.

1. 6 gas concentrations to choose from CO, O₂, NH₃, H₂S, NO₂, HCl, H₂, PH₃, SO₂, O₃, Cl₂, HF
2. Always measure CH₄, temperature, relative humidity, CO₂, PM1, PM2.5, PM10, VoC
3. GPS position
4. Speed
5. 4G connectivity
6. Possibility to add more sensors



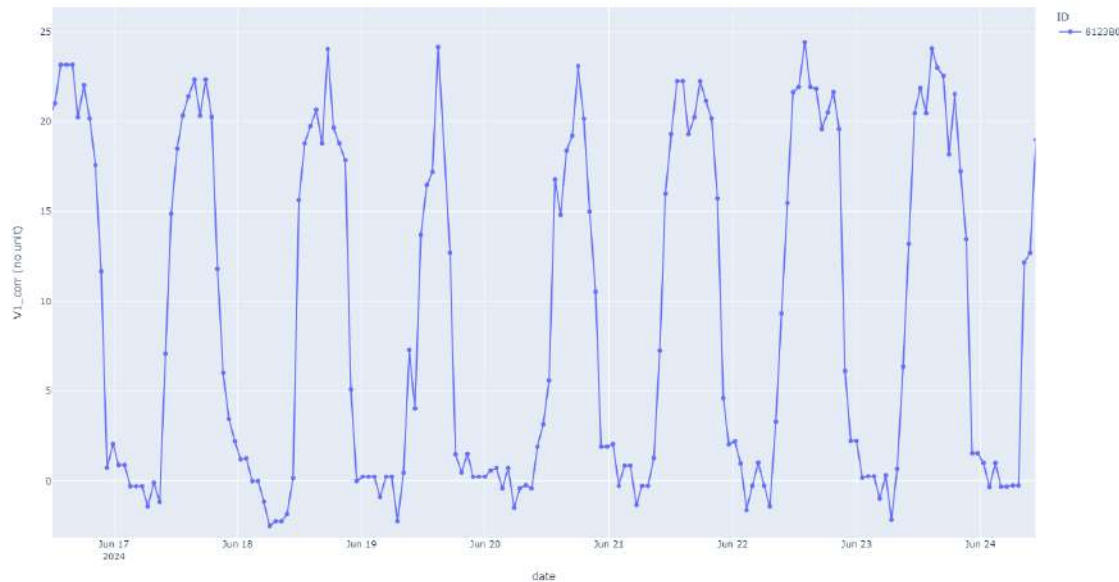
Specs:

- Can be used in stationary or mobile applications (such as drones or cars)
- Accepts real time commands using MQTT communication and can send data to a remote server
- Can be adapted to use other sensor having I2C, analog and digital lines available
- Can be powered from main or battery power supply depending on the application

Sap Flow probe

Radial Growth probe

Figure 13. Schematic graph of TTCarbon dipole/polepair behaviour where every polepair is equal to 2mm and 0-4096 digital number



The below graph is a demonstration of the Sensor in function from an Oak tree in Spain. Here we see approximately 0.5 mm of absolute radial growth between July and September.

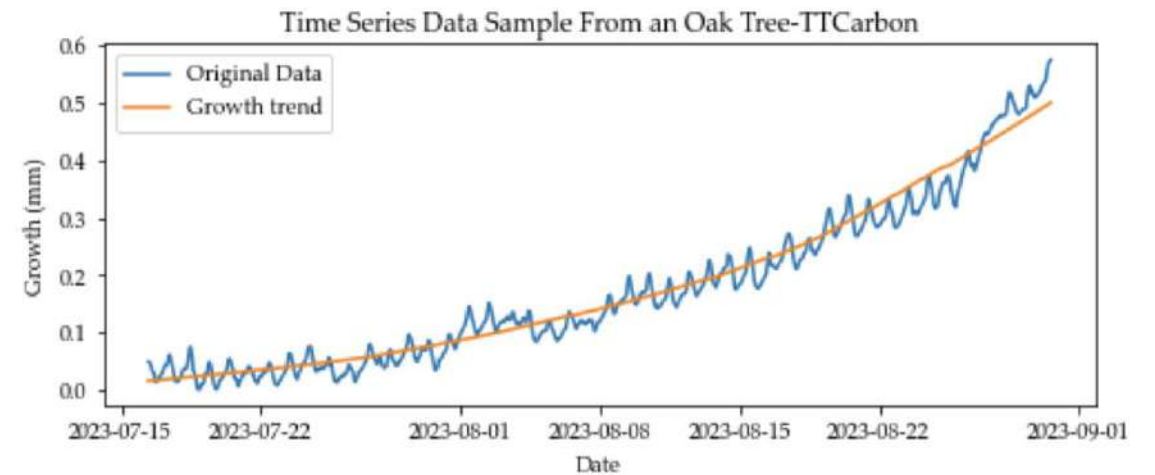
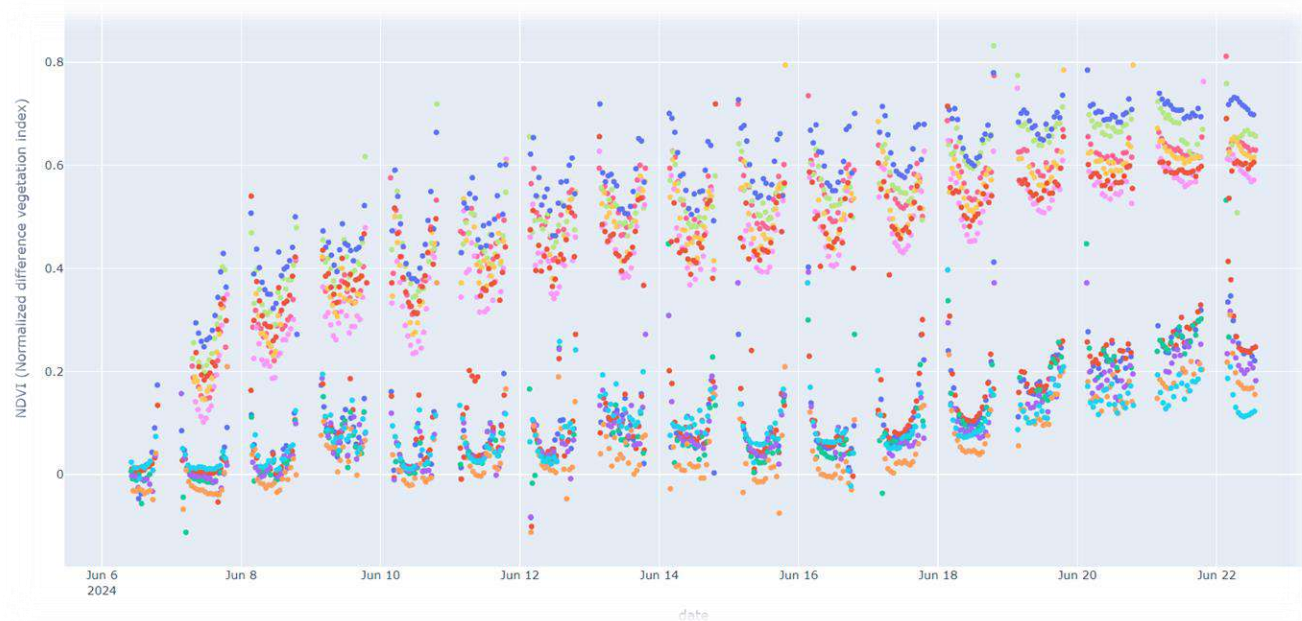
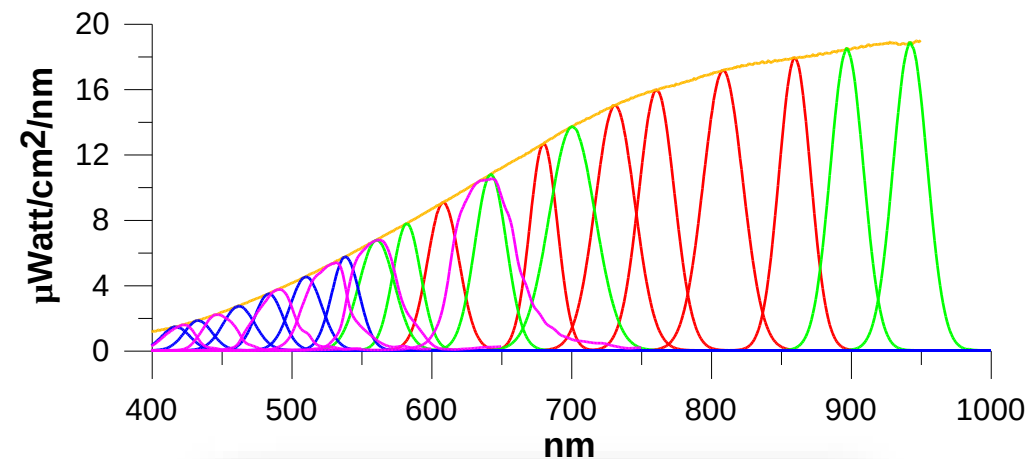
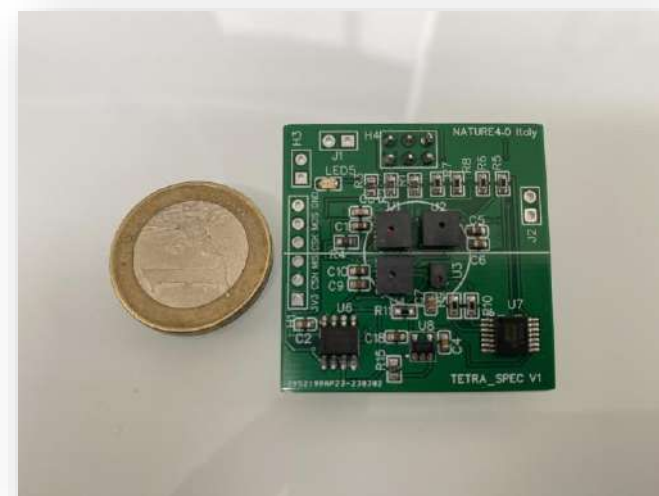


Figure 14 Estimated Radial Growth rate in mm using TTCyber's Growth sensor data on an oak tree located in an experimental site in Spain.

TetraSpec



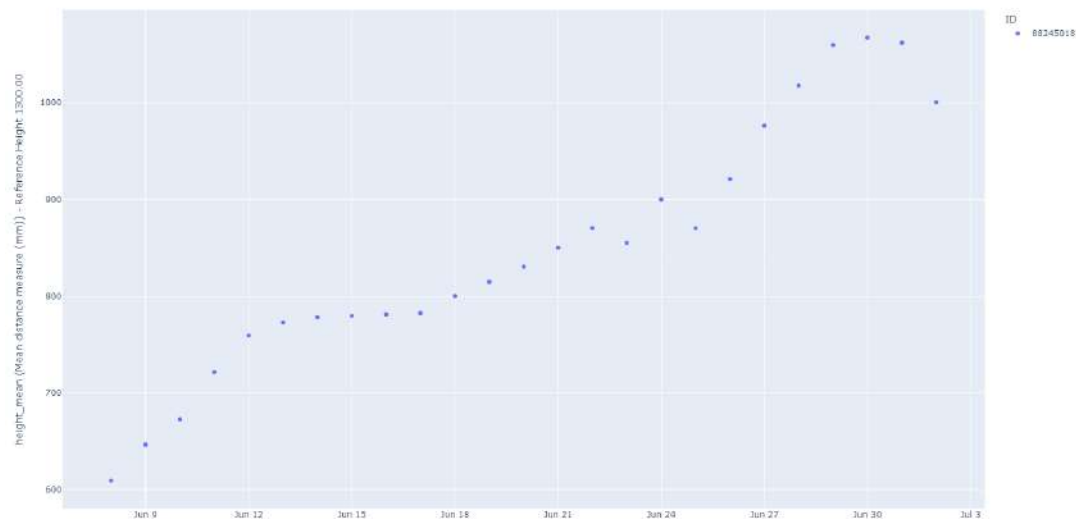
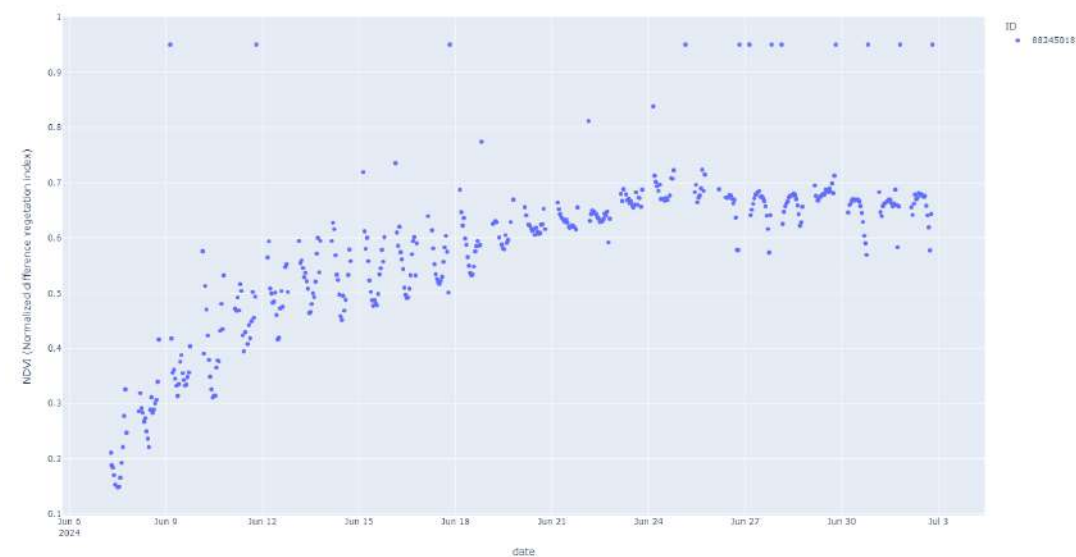
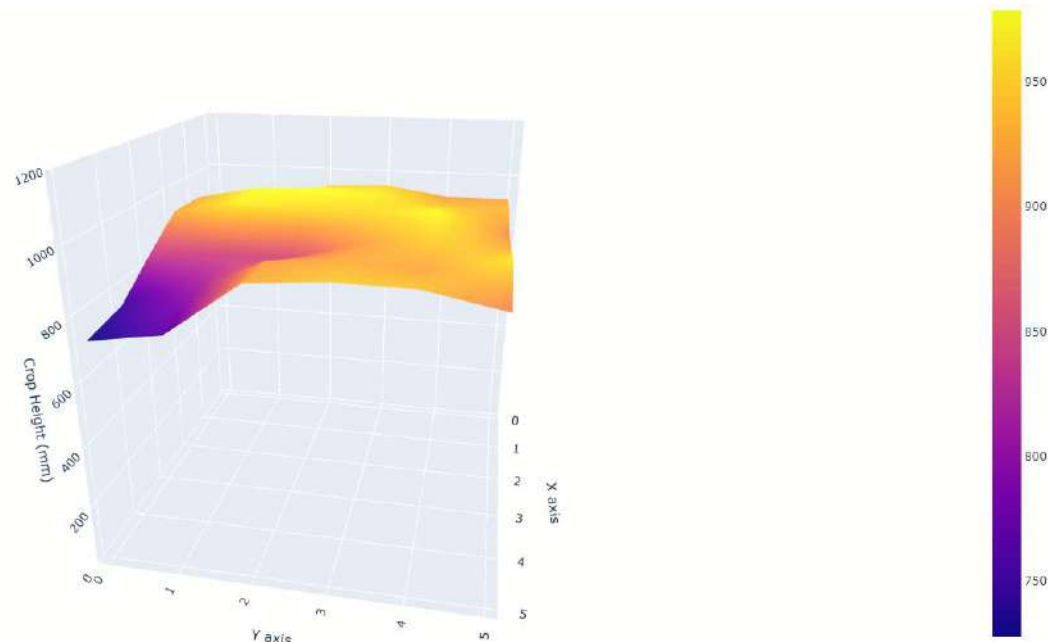
TT Cyber Crop Talker



Function and Capabilities

Multifunctional IOT driven device providing ecophysiological parameters of crops.

1. Continuous crop height by Lidar ToF sensor with a depth image of 8x8 pixels
2. 28 bands spectrometer for leaf physiological conditions (i.e nitrogen content, chlorophyll, nutrients deficiency etc.)
3. 2Mpxl camera for RGB image acquisition
4. Onboard air temp and humidity sensors
5. 4G NB-IoT connection for data stream connection



GRAZIE PER L'ATTENZIONE!

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Progetto PNABio - «Piattaforma nazionale di attività e servizi per il biologico italiano in movimento» -

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