

ANTONIO – Multimodal sensing for individual pLANT phenOtyping iN agriculture robOtics



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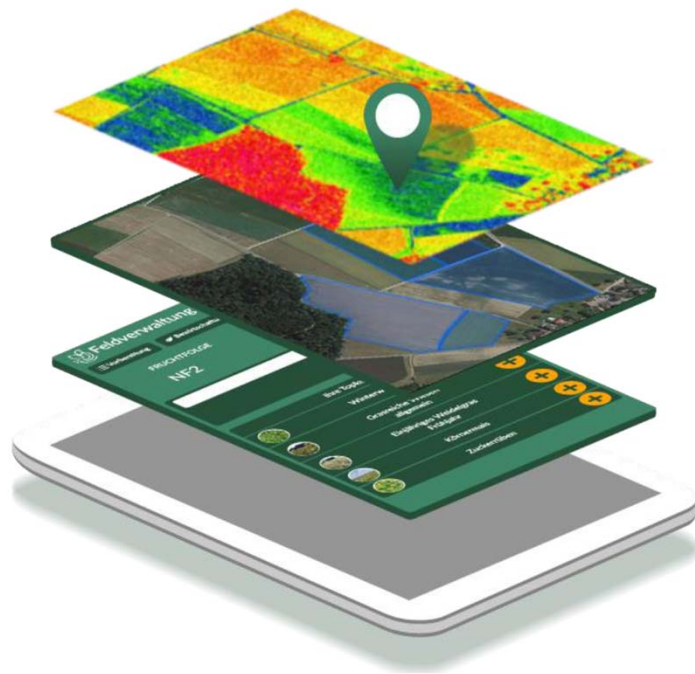
Goal and context

- The overall goal of ANTONIO project is the development and implementation of **multi-sensor** systems and **sensor processing algorithms** to enable agri-robots to perform plant phenotyping and precision agriculture tasks, such as precise local application of pesticides/fertilizers and yield estimation.
- The envisaged idea is based on an integrated sensor network, including mobile sensors mounted on board of ground robots and drones.
- Information coming from the fixed sensing devices will flag “attention spots” in the crop for further local investigation by the robotic platforms.
- This approach will lead to in-field high-throughput crop assessment, and this narrow temporal and spatial scale of detection ability can enable precision farming applications

Main project activities / challenges (1/2)

- The ability to single out the plants or leaves with problems and to selectively apply a remedy without wasting resources or contaminating the environment is critical for precision farming.
- This project develops a unifying framework to combine
 - different sensor modalities, methods for creating accurate maps to facilitate operations on a narrow scale with a smaller environment footprint,
 - artificial intelligence by deep learning algorithms for data processing and decision support, and
 - applications to make relevant information easily visible to the farmer.
- The framework is demonstrated in the field through the integration onboard of unmanned ground and aerial robots and it is implemented to be compatible with AgriCircle's farm management information system (FMIS), which enables map-based control of many application devices, and displayed via standard tablet PCs.
- We demonstrate the use of this framework by building a physical system for closely monitoring crop plants including commercial vineyards in Greece, Italy, and Switzerland

Main project activities / challenges (2/2)



ANTONIO project

- data from **heterogeneous sensors**
- **fused** into higher-level maps,
- available to the **user** and presented
- multimodal **interactive** map,
- standard **tablets/smartphones**.

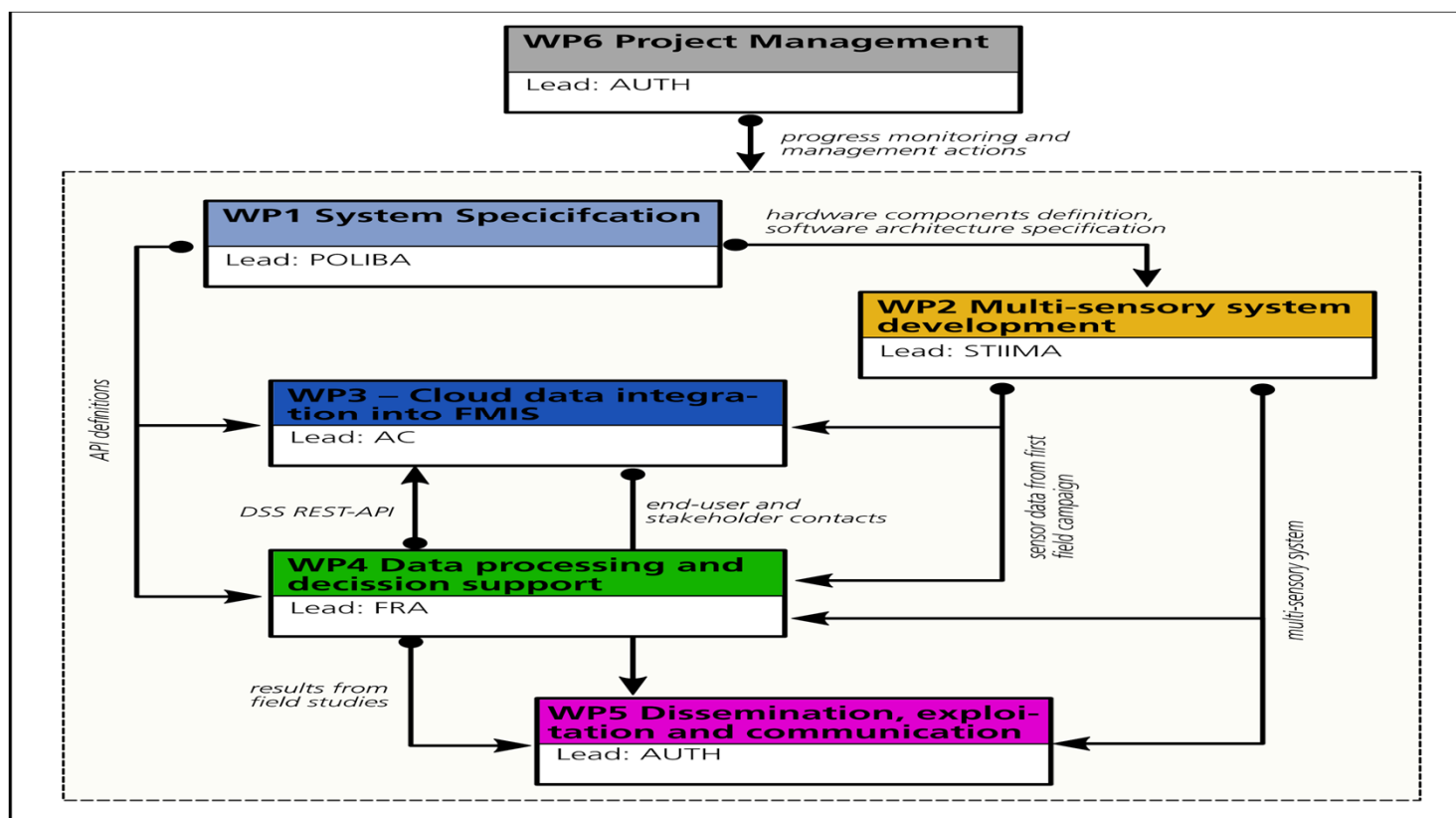
What will your project do?/ Objective and Hypothesis

- **Variable rate applications.** The ANTONIO system will help to apply pesticides or fertilizers where it can be seen to be needed.
- **Crop monitoring and yield estimation.** Sensing technologies will be applied to monitor qualitative and morphometric parameters related to crop composition and development, through spectral analysis and 3D reconstruction to enable closer monitoring of plant health, as well as for yield mapping and yield forecasting.
- **Using a flying vehicle (UAV)** to inspect more remote parts of the field enables closer monitoring of plant health while minimising track use.
- **Controlled traffic farming.** Automated online estimation of key parameters of the terrain that affect its ability to support vehicular traffic (e.g., soil compaction, friction, longitudinal and lateral grade, etc.). Such properties are collectively called “trafficability.”

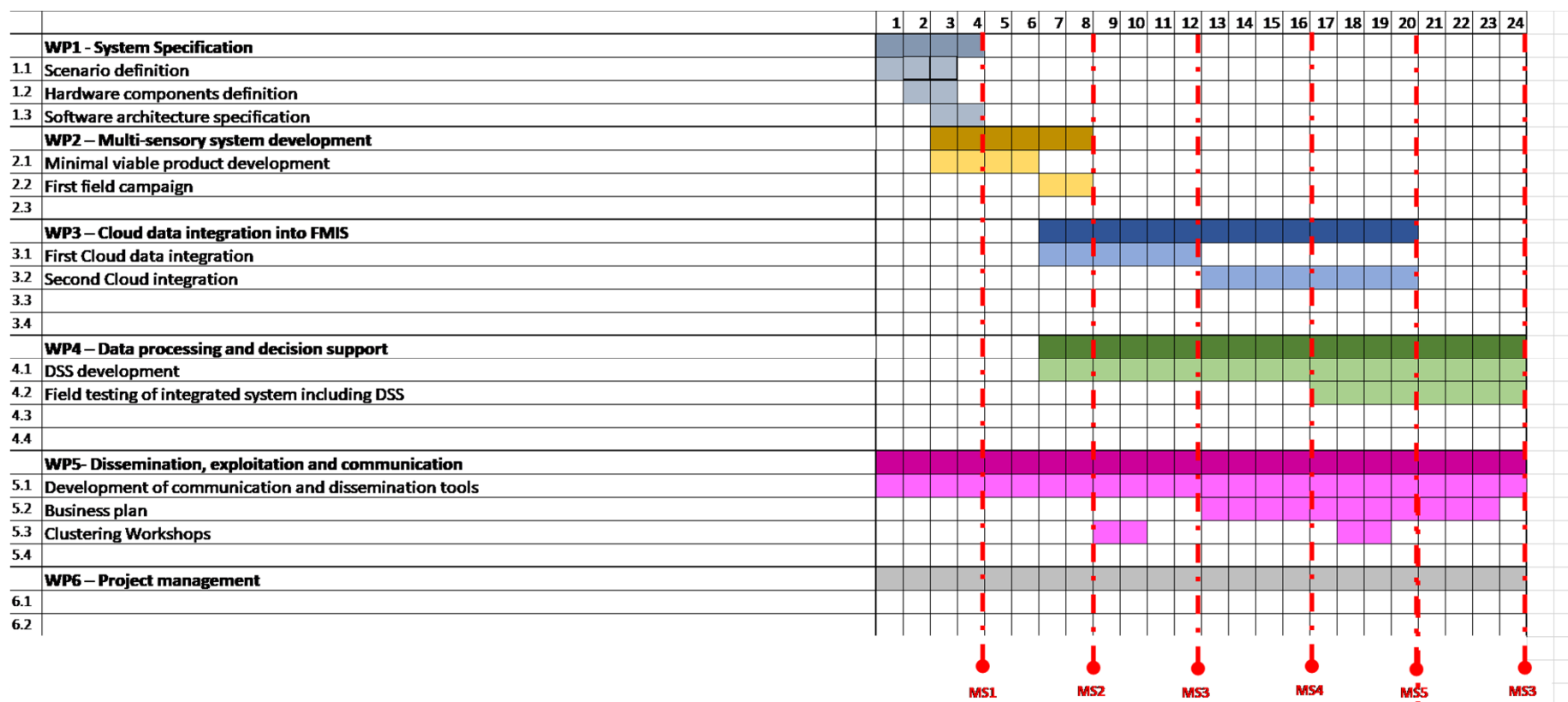
What is your project contributing to? Potential impact

- The ANTONIO project will contribute to reach the United Nations Sustainable Development Goals **SDG 3**: Good Health and Well Being, **SDG 8**: Decent Work and Economic Growth, **SDG 13**: Climate Action.
- **Economic aspects**: The application of fertilizers, pesticides and herbicides where and when needed will result in optimal amounts of inputs, applied, without losses.
- **Environmental aspects**: The precise application of pesticides and herbicides during the cropping season is expected to reduce the amount of agrochemicals applied into the soil and ground and surface water resources, EU framework directive for “A thematic strategy on the sustainable use of pesticides” (COM(2006)372, COM(2006)778).
- **Societal aspects**: Securing clean of pesticides and herbicides will reduce the risk to human health, and lead to improving food safety.
- **Relation to COVID-19**: Promoting remote monitoring and operations (e.g., automatic in-field phenotyping), the ANTONIO framework may help to keep safe interpersonal distances and provide effective solutions to overcome the economic and social disruption that the pandemic has brought to the agricultural domain.

The selected approach / Research approach & activities (1/2)



The selected approach / Research approach & activities (2/2)



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Cooperation with Stakeholders / value chain

- ANTONIO project stakeholders consist of farmers, policy makers, contractors, service providers, farming organisations, agricultural machinery manufacturers, environmentalists, ecologists and ICT industry.
- Several stakeholders expressed interest in ANTONIO, who committed to support the project.

Dissemination and outreach

In addition to a general dissemination approach, more focused communication activities for specific audiences will be framed around two central objectives:

- (1) development of incentives to help engage specific stakeholders (relevant to the agriFood challenge being explored) in the test sites to participate in the experimentation (development and testing) of new solutions,
- (2) creation of the ANTONIO Business Case based upon the field results and use to attract new users/adopters.

Partners / funders (who are they?)

Partners

AESA, GR



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