ANTONIO



MULTIMODAL SENSING FOR INDIVIDUAL PLANT PHENOTYPING IN AGRICULTURE ROBOTICS

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.

BACKGROUND

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 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, 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, reusing many sensors and much experience from the Ambient Awareness for Autonomous Agricultural Vehicles (QUAD-AV) project, funded by ERA-NET ICT-AGRI-Call 1, and the Simultaneous Safety and Surveying for Collaborative Vehicles (S3-CAV) project, funded by ERA-NET ICT-AGRI-Call 2. Synergies will be also developed with the Agricultural Interoperability and Analysis System (ATLAS) project, funded by H2020 DT-ICT-08-2019 - Agricultural digital integration platforms.

MAIN PROJECT ACTIVITIES

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 that rely on accurate high-resolution local maps, i.e.:

- Variable-rate applications, apply pesticides or fertilizers where it can be seen to be needed, that is treat the specific site instead of the entire crop or field.
- Crop monitoring and yield estimation. Sensing technologies will be applied to monitor qualitative and morphometric parameters related to crop composition and development.
- 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.





EXPECTED SOCIAL IMPACT

Residues of pesticides and herbicides are considered to have a significant impact on food and feed safety. Securing clean of pesticides and herbicides will reduce the risk to human health, and lead to improving food safety.

Keywords

- Precision agriculture
- Field robotics
- Crop sensing
- Sensors fusion
- UAV
- Situation awareness
- Deep learning
- Decision support system (DSS)

Duration

01/03/2021 - 28/02/2023

TRL

Technology Readiness Level 6

Consortium

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