ERA-NET COFUND ICT-AGRI-FOOD

2022 Joint Call

STAR

GIVING SMELL SENSE TO AGRICULTURAL ROBOTICS

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Giving Smell sense To Agricultural Robotics

https://www.star-project.eu/

Introduction and goals

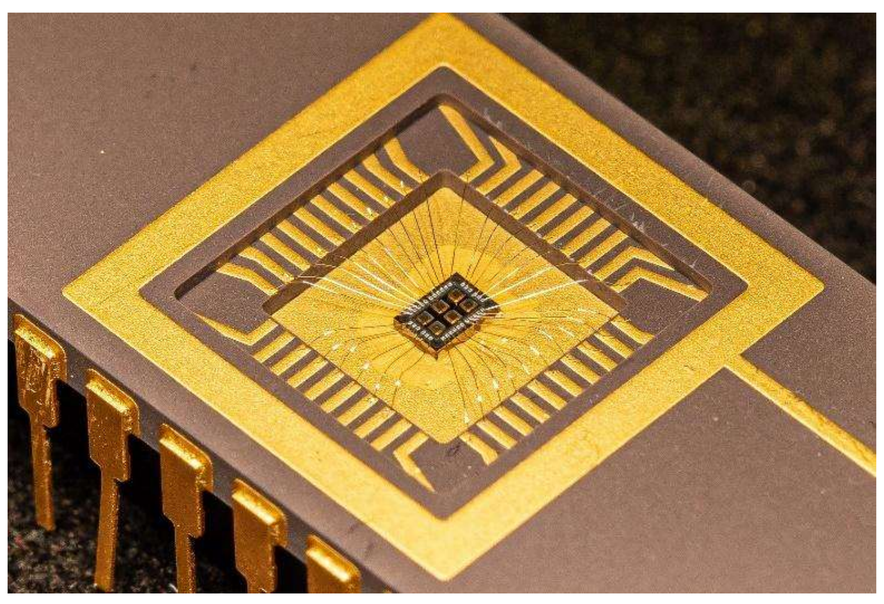
The ability to single out healthy fruits/plants from those with problems and to selectively start the harvesting or apply a remedy without wasting resources or contaminating the environment is critical for precision farming. Project **STAR** develops a unifying framework to combine different sensor modalities that include standard (e.g., RGB-D cameras) with novel sensors (e.g., gas sensors), 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 overall **goal** of STAR project is the development and implementation of multi-sensor systems and sensor processing algorithms to enable agri-robots to perform fruit freshness level monitoring and reduce food waste throughout the supply chain, 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 gas sensors mounted on board of ground robots. Information coming from the fixed sensing devices will flag "attention spots" in the crop for further local investigation by the robotic platform.

Methods

To achieve the objectives of project STAR, the following materials and methods will be implemented:

- an **autonomous farmer robot** that monitors the health status of a vineyard row without any human supervision;
- unique **sensing system**, dubbed GMOS, that selectively detects parts-per-billion concentration of gasses to monitor the freshness level and reduce food waste throughout the supply chain;



- **gas emission analysis** to enable closer monitoring of plant health, as well as, for yield mapping and forecasting;
- **multisensory data** processed to extract relevant agronomic information from the crop;
- **decision support system** for the generation of application maps for plant protection products;
- **AI module** for the decision support system.

Expected results

The proposed 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**. The STAR system will help to 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, through spectral analysis, 3D reconstruction, and gas emission analysis to enable closer monitoring of plant health, as well as for yield mapping and yield forecasting.
- **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." Measuring real-time terrain properties makes it possible for a vehicle to adapt to the site-specific environment by varying its velocity and suspension system configuration or tire pressure and adjusting the parameters of onboard control and stability systems. This would also contribute to increasing the safety of agri-bots during operations.

The implemented system will demonstrate the integration of robotics and sensor technology into the digital agricultural workflow through the use of standardised cloud services. This will allow farmers to share and use the data within the digital systems they have already in use and thus lead to a larger applicability of robotics technology in agriculture.

Partners

Politecnico di Bari
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TODOS Technologies
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Fraunhofer IAIS
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RML Robotic Mobility Lab

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no 862665.