A Supervisory Control And Data Acquisition (SCADA) system in agriculture and related path planning problems.

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1 Introduction

Agriculture has commonly been pioneer in the use of new technologies to improve productivity. This contribution aims at presenting some of the research activities withing the H2020 project PANTHEON. This project is to develop the agricultural equivalent of an industrial Supervisory Control And Data Acquisition (SCADA) system to be used for the precision farming of orchards. By taking advantage of the technological advancements in the fields of control, robotics, remote sensing, and big-data management, our objective is to design an integrated system where a relatively limited number of heterogeneous unmanned robotic components (including terrestrial and aerial robots) move within the orchard to collect data and perform typical farming operations. The information will be collected and stored in a central operative unit that will integrate the data coming from the different robotic (ground and aerial) vehicles to perform automatic feedback actions (e.g. to regulate the irrigation system) and to support the decisions of the agronomists and farmers in charge of the orchard. Figure 1 illustrates the foreseen concept.

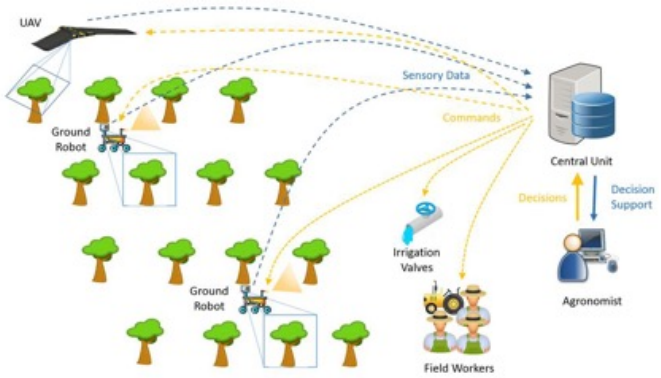

Figure 1: Idea of the SCADA system for agriculture.

We expect that the proposed SCADA system will be able to acquire information at the resolution of the single plant. This will permit to drastically increase the detection of possible limiting factors for each individual plant, such as lack of nutrients or pests and diseases affecting the plant health, and to react accordingly. Compared to the current state of the art in precision farming, we believe that the proposed SCADA infrastructure represents a relevant step ahead in the context of orchards management and maintenance. In fact, the capability of monitoring the state and the evolution of each single tree will be the enabling-technology to allow more focused interventions. This will result in a better average state of health of the orchard and in an increased effectiveness of Integrated Pest Managements . In conclusion, the proposed architecture has the potential to increase the production of the orchard while, at the same time, being more cost-effective and environmentally-friendly.

2 Optimal trajectory planning

Beside the technology to be developed, several research actions are necessary for the development of a working system. In this talk we will overview some of our research activities concerning path and mission planning for the ground and aerial robots. The main challenge is to determine which are the optimal trajectories[1] to be followed to collect a sufficient amount of data to evaluate the state of each plant.

Acknowledgement

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References

[1] Garone, Emanuele, Jean-Franois Determe, and Roberto Naldi. "Generalized traveling salesman problem for carrier-vehicle systems." AIAA Journal of Guidance, Control, and Dynamics 37.3 (2014): 766-774.