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Abstract

LCIS DSS—An Irrigation Supporting System for Efficient Water Use in Precision Agriculture †

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Abstract: The sustainable management of water resources is one of the most important topics to face future climate change and food security. Many countries facing a serious water crisis, due to both natural and artificial causes. The efficient use of water in agriculture is one of the most significant agricultural challenges that modern technologies. These last are considered powerful management instruments able to help farmers achieve the best efficiency in irrigation water use and to increase their incomes by obtaining the highest possible crop yield. In this context, within the project "An advanced low cost system for farm irrigation support—LCIS" (a joint Italian Israeli R&D project), a fully transferable Decision Support Systems (DSS) for irrigation support, based on three different methodologies representative of the state of the art in irrigation management tools (W-Tens, in situ soil sensor; IRRISAT®, remote sensing; W-Mod, simulation modelling of water balance in the soil-plant and atmosphere system), has been developed. These three LCIS-DSS tools have been evaluated, in terms of their ability to support the farmer in irrigation management, in a real applicative case study in Italy and Israel. The main challenge of a new DSS for irrigation is attributed to the uncertain factors during the growing season such as weather uncertainty, and crop monitoring platform. For encounter this challenge, we developed during two years the LCIS, a web-based real-time DSS for irrigation scheduling using low-cost imaging spectroscopy for state estimation of the agriculture system and probabilistic short- and medium-term climate forecasts. While the majority of the existing DSS models are incorporated directly into the optimization framework, we propose to integrate continuous feedback from the field (e.g., soil moisture, crop water-stress, plant stage, LAI, and biomass) estimated based on remote sensing information. These field data will be collected by the point-based spectrometer and hyperspectral imaging system. Then a low-cost camera will be designed for specific spectral/spatial parameters (bound to the required feedbacks). The main objectives were: developing real-time Decision Support System (DSS) for optimal irrigation scheduling at farm scale for crop yield improvement, reducing irrigation cost, and water saving; developing a low-cost imaging spectroscopy framework to support the irrigation scheduling DSS above and facilitates its use in countries/places where expensive imaging spectroscopy is not available; examining the developed framework in real-life application, the framework will be calibrated evaluated using high resolution devices and tested using a low-cost system in Israel and Italy farms.

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