Agricultural service unit motion planning under harvesting scheduling and terrain constraints

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Abstract

Most of the existing harvesting strategies rely on traditional path planners that only minimize the length of the path or energy consumption, ignoring the state of the crops and production process. Furthermore, the existing approaches use simplified kinematic models that neglect the robots' dynamics and their interaction with the terrain. To address these limitations, we propose and test in the field a harvesting and motion-planning strategy that explicitly considers the expected plant yield and the terrain's traversability. The latter has direct impact in the energy management of the agricultural service unit. A map with the predicted yield of each plant is employed to determine a priority queue of harvesting points. The priority queue, together with the harvesting rate and the robot's payload capacity, are used to generate a harvesting schedule for the different locations in the grove. The joint harvesting and motion-planning strategy applied is evaluated using field data from a Chilean avocado grove during the harvesting season. The results show that the proposed strategy provides a useful approach to automate the harvest points scheduling and motion planning while saving machinery resources.

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