Doctoral Dissertation
Doctoral Program in Mechanical Engineering (34thcycle)

Agri.Q
Sustainable Rover for Precision Agriculture

By

Andrea Botta
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Supervisor(s):
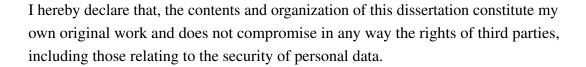Prof. Giuseppe Quaglia, Supervisor

Doctoral Examination Committee:
Prof. Giuseppe Carbone , Referee, Università della Calabria
Prof. Giulio Reina, Referee, Politecnico di Bari

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Declaration

I hereby declare that, the contents and organization of this dissertation constitute my own original work and does not compromise in any way the rights of third parties, including those relating to the security of personal data.

Andrea Botta
2022

Agri.Q

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The thesis reports on the design, development, and integration of the articulated mobile robot for precision agriculture and its control architecture. Starting from bibliographic research on precision agriculture with a particular focus on terrestrial robotic platforms (UGVs), the Agri.Q project was then developed with the aim of creating an articulated robot for agriculture in vineyards, or on fields with large slopes, with particular attention to the issue of sustainability and the integration of the robotic platform with monitoring drones and a redundant robotic arm dedicated to collect field samples or to interact with the environment. The thesis therefore reports the mechanical and electronic design process of the robot, focusing on the peculiarities and salient features. The thesis also gives wide space to the study and analysis of the kinematic and dynamic behavior of the robot navigation through models, simulations, and experimentation on the prototype itself. These results become functional for the implementation of appropriate control strategies to overcome some problems related to the robot architecture and to make it a robust and functional platform. The thesis is accompanied by further phases of experimentation on more specific topics, such as the evaluation of power flows and the effectiveness of solar charging, an initial integration of a redundant robotic arm, and the beginning of preparatory activities for the implementation of an autonomous driving.