Smart precision treatments by SCORPION robotic solution

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Abstract:

Work safety is certainly a very current issue in contemporary society which in recent years has attributed ever greater importance to this fundamental aspect of production activity. Even in agriculture, as already happened in other production sectors, the study of technological and innovative automated solutions and detection systems equipped with increasingly precise and efficient sensors make it possible to reduce risks and costs for users, while at the same time guaranteeing both a good level of productivity and the protection of workers and the environment.

Scorpion project had as its main objective to study and develop a safe and autonomous precision spraying tool integrated into a modular unmanned tractor (robotics platform) capable of carrying out the treatments plant protection products in vineyards and on other high-value permanent crops characterized by difficult environmental conditions (as steep slopes and rough terrain).

The project consortium consisted of 10 partners from 4 European countries (Portugal, Spain, Netherlands, Italy), and included steep slope vineyard associations, robotics and agricultural machinery RTD institutions, SMEs and large companies and an institution dedicated to innovation.

The project was carried out in different phases which concerned the study and development of all the automatic control systems and the various sensors (driving systems, position and proximity detectors, GNSS receiver, crop perception system) necessary to allow movement and the operation of the equipment in complete autonomy. In parallel with the study of the movement and the detection systems, the component (the module) of the equipment used for phytosanitary treatments on crops was developed and was equipped with various devices (3D LIDAR, VRT, PWM, camera connection to DSS) to optimize the quality and effectiveness of the treatment.

During the experimentation, two different types of prototypes capable of moving and functioning autonomously were created. The first one (AGROB V18) is powered by a diesel engine and consists of a traditional carried airblast sprayer normally used in vineyards and orchards. The second one (WETA robot), the ultimate prototype, is a fully electric version equipped with a spraying system for pesticides consisting of two recovery panels with nozzles equipped with a PWM (pulse-width modulation) system, and also supplied with a variable-rate application technology (VRT).

In addition to the spraying and distribution system for chemicals, an alternative crop treatment system was tested and adopted for the final prototype (WETA robot), which involves the use of ultraviolet rays instead of mixtures of pesticides. Specific UV-C Light panels consisted of two series of 32 UVC lamps were then made, and can be mounted instead of recovery panels with nozzles.

A series of field tests were conducted with the two prototypes to test the behavior of the equipment in different operating conditions and environments. The tests were carried out in Spain, Portugal and Italy in vineyards characterized by different levels of slope, following the laboratory tests carried out on biological samples inoculated with pathogens, to verify the most suitable operating parameters (exposure time, distance from the light source, frequency of treatments) with which to use UVC lamps and carry out an initial evaluation of the effectiveness of this type of treatment.

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