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FONDO EUROPEO AGRICOLO PER LO SVILUPPO RURALE: L'EUROPA INVESTE NELLE ZONE RURALI

Regione del Veneto

PSR VENETO 2014-2020

ROVITIS 4.0 is an Operational Group of the EIP AGRI: the European Innovation Partnership for Agriculture productivity and sustainability

eip-agri

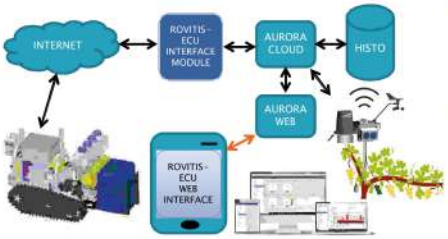
ROVITIS 4.0

Autonomous robot connected to a DSS for a sustainable and efficient management of the vineyard

What is it about?

Rovitis 4.0 proposes a highly innovative system applied to viticulture, based on a robotic management of the vineyard which is characterized by the interaction between: a robot, sensors for data collection from the vineyard and a Decision Support System (DSS):

- The robot, developed in 2 prototypes within the project, should autonomously operate in the vineyards and implement phytosanitary treatments;
- The sensors, both those equipped on the robot and those emplaced in the vineyard, detect climatic and environmental data, including measurements of the canopy growth and the state of health of the vineplants;
- The DSS allows the interaction with the robot and suggests the agronomic interventions, with the human supervision: by processing all the data collected by the sensors, the agronomic activities, such as the plant-health treatments, are planned according to the real needs of the crop.



A connected and self-managed farm

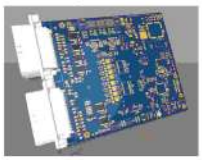
The project goes towards the idea of a self-managed farm, where the connection between sensors, autonomous machines and software, allows to minimize the human-labour intervention and to perform the field activities upon the real risks to which the crop is subjected. Such an idea shall be suitable for small-sized farms, thus adopting affordable technology, as well as for big-sized farms, where an extended network of sensors and robots in cooperation can be used.

The expected benefits

- **Economic:** the use of autonomous machines reduces the need for human-labour, which can be otherwise employed in quality-enhancing activities within the farm; the use of sensors and precision farming devices allows resource optimization and a better quality production.
- **Environmental:** the use of sensors and a DSS, including diseases prediction models, allows the reduction of pesticides use.
- **Social:** the use of autonomous machines replacing human-labour for the most hazardous and repetitive activities, such as tractor driving and pesticides spraying, minimizes the human operator health risks.

What is the technology?

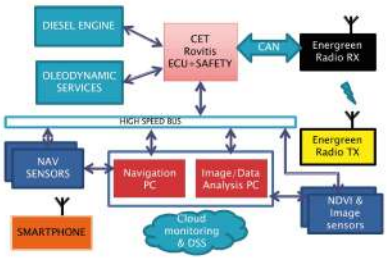
ECU: Engine Control Unit



A new electronic control unit developed by CET Electronics. The system allows the control of all the robot actuators via the communication through the web software interface or directly by the navigation software installed on the board CPU. The ECU has an integrated safety system, which controls the machine stop or shutdown in case of impact on obstacles, accidents, or, in general, whenever a danger condition is detected: automatic recognition of such situations in the field are under study and training.

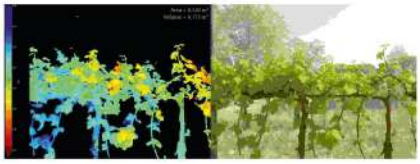
Navigation

The autonomous drive system is based on SLAM (Simultaneous Localization and Mapping), i.e. a set of algorithms which allows the robot, to reconstruct autonomously the map of the environment and to learn the path, after a first inspection of an unknown environment. Navigation relies on sensors as Lidar (3D Laser Scanner) and inertial sensors, combined with GPS for the navigation in open field without obstacles.
The navigation software is mainly developed by the University of Maribor and Az. Agr. Giorgio Pantano.



Canopy inspection on board

Stereo cameras and NDVI sensors will be placed at the head of the robot for canopy inspection on board. Leaf volume and surface shall be computed on line by the robot GPU in order to optimize the doses of plant protection products according to the vegetative development, with a direct control of the spraying section. The sensors are used also to detect plants affected by evident state of bad health and a training is undergoing for the automatic recognition of the specific problem/disease.



What is the project proposal?

ROVITIS 4.0 is an evolution of a first idea and prototype of robot previously developed by the Leader Partner, Az. Agr. Giorgio Pantano. The partnership is composed of:

- A technical team of experts in electronics, mechanics and software engineering for the development of two prototypes of the machine (CET Electronics, Energreen, University Of Maribor).
- Research centers in viticulture (CREA-VE, CIRVE - Unipd) for the evalution of the system from the technical, agronomic and economical point of view.
- Two wine companies hosting the field trials in their vineyard (Az. Agr. Giorgio Pantano and Terre Grosse Soc. Agr. s.s.).
- Confagricoltura Veneto for the divulgation of the results.

The main actions:

- Development of two prototypes of autonomous robot equipped with sensors for self-driving and data collection from the vineyard (2018-2019)
- Adjustment of the autonomous driving system throughout the vineyard rows by continuous field trials (2019)
- Development of the sprying section with doses modulated by a stereo vision system for the on-line detection of the foliage volume (2018-2019)
- Connection to the DSS and elaboration of the data colected from the robot: NDVI index, automatic recogniction of plant diseases (2018-2019)
- Interaction between two robots (2019-2020)
- Final field test of the robot prototypes in normal operating conditions, with periodic suverys in the field about the phytosanitary status (2020)
- Final analysis for evaluting the overall advantages of thetechnology from the environmental, agronomic and economical point of view.

The ROVITS 4.0 partnership:

PANTANO

TERRE GROSSE

cet www.cet-electronics.com

ENERGREEN Macchine Professionali

Univerza v Mariboru

crea

CIRVE

Confagricoltura Veneto

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