SCORPION project: cost effective robots for smart precision spraying

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The SCORPION project

The SCORPION project, supported by the European Union's Horizon 2020 program (EUSPA) and concluded in 2023 after three years of research and development, focused on creating a secure, adaptable, and self-sufficient precision spraying robot. This cutting-edge robotic platform is engineered to execute vital functions like phytosanitary treatments in vineyards with demanding rough and steep slope conditions. For navigation, it integrates advanced SLAM (Simultaneous Localization and Mapping) techniques, leveraging the latest GNSS signals from Galileo constellations.

The project prototype: WETA robot

WETA robot consists in an autonomous fully electric platform (powered with a 48VDC battery) with an airblast sprayer with **100 L tank** and **two recovery panels** (1) each equipped with 4 **nozzles** (2) supplied with the Pulse-Width Modulation (**PWM**) spraying system and a variable-rate application technology (**VRT**) for precision spraying. The spraying system is exchangeable with specific **UVC light panels** (3) consisted of two series of 32 UVC lamps for alternative treatments.

Exchangeable recovery panels

Panels with UVC lamps

Panels with nozzles and PWM system

Control devices and sensors installed:

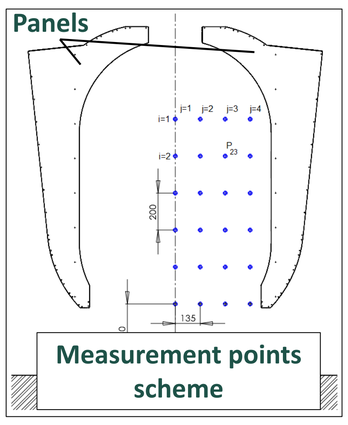
- **Navigation system** with a *GNSS receiver* (Galileo triple frequency - E1, E5 and E6).
- **Position** and **proximity detectors**.
- **3D LIDAR**.
- **Camera connection to DSS**.
- **Crop perception system**.

POWER CONSUMPTION:
Spraying panels: 1.05 Kw/h; UVC panels: 1.2 kw/h

Tests carried out

Laboratory tests on the functionality of the **UVC devices:**

1. Evaluation of the **optimal parameters of use: *exposition time, distance from lights source, irradiance (dose), electrical consumption.***

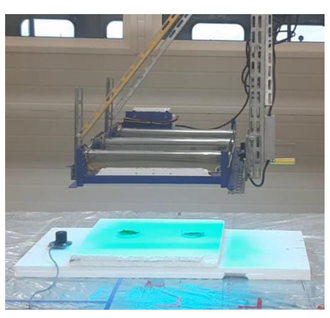


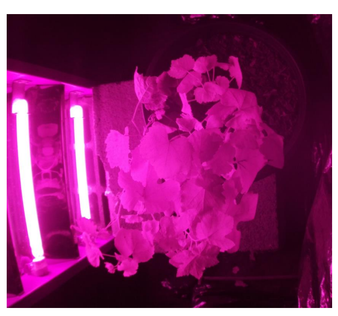
Measurements for testing the UVC devices on the two sides panels

2. Tests on ***biological samples inoculated with pathogens*** (Grey mould, *Botrytis cinerea*; Powdery mildew, *Oidium neolycopersici*).

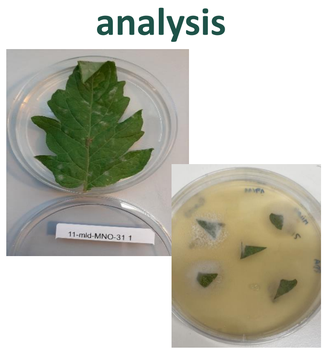
Sample of inoculated plant

Samples UVC treatments: dark vs daylight measurements.



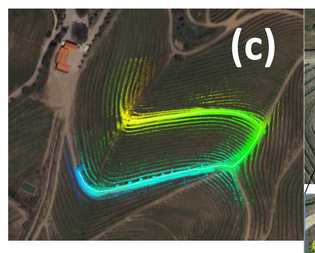


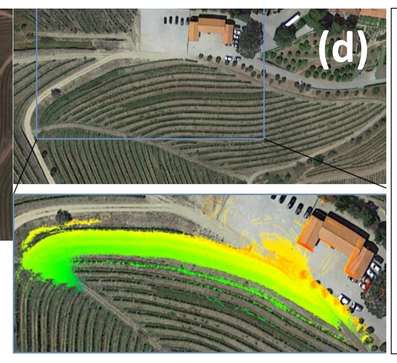
Samples collection and analysis



Field tests on the **navigation system**, the **set of multiple detection sensors** (3D LIDAR, camera connection to DSS, proximity and position detectors) and the **crop perception system**.

Some of the field tests carried out in vineyard (a, b)





Examples of the results obtained with: (c) the **multi-sensory based 3D SLAM** and (d) the **Redundant Localization and Mapping System** (RLMS).

The project's partners:

INESCTEC — Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência

STEMS Istituto di Scienze e Tecnologie per l'Energia e la Mobilità Sostenibili — Consiglio Nazionale delle Ricerche - Istituto di Scienze e Tecnologie per l'Energia e la Mobilità Sostenibili

IPN Instituto Pedro Nunes — Instituto Pedro Nunes Associação para a Inovação e Desenvolvimento em Ciência e Tecnologia

Viticoltura Eroica CERVIM — Centro Di Ricerche, Studi, Salvaguardia Rappresentanza e Valorizzazione per la Viticoltura Di Montagna

spi Sociedade Portuguesa de Inovação — Sociedade Portuguesa de Inovação Consultadoria Empresarial e Formento da Inovação SA

INNOVI Clúster Vitivinícola Català — Associacio Aei Innovi (Agrupacio Empresarial Innovadora)

eurecat Centre Tecnològic de Catalunya — Fundacio Eurecat

WAGENINGEN UNIVERSITY & RESEARCH — Stichting Wageningen Research

TEYME Smart Spraying — Teyme Technologie Agricola SL

deimos grupo elecnor — Deimos Space Sociedad Ltd. Uni

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