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Executive Summary

This deliverable showcases the entire final demonstration of the CANOPIES project within the experimental site in Aprilia. It consists of a video showing the results of the quality mapping, navigation, human-robot-interaction, harvesting, box exchange, learning from demonstration (in virtual reality) and pruning. The video is available at the following link:

CANOPIES D9.4 video (https://tinyurl.com/canopies-D-9-4)

Please reproduce the video with audio.

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1. Introduction

This report is a support document for Deliverable 9.4. This deliverable presents the final field validation of CANOPIES methodologies. The accompanying video demonstrates the functioning robotic platforms, showcasing their ability to perform autonomous operations and in collaboration with human operators.

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2. Video Overview

This video deliverable was developed to communicate the capabilities of the CANOPIES robotic platforms in real-world conditions. In detail, the robotic prototypes are shown to successfully realize the following demos:

- Quality Mapping Demo, in which the human, using a graphical user interface, asks the farming robot for mapping the quality of the bunches in a certain area of the vineyard. Then, the robot navigates through the selected part and the human visualizes the quality map in the graphical user interface.

- Navigation Demo, in which the human, using voice commands, asks the farming robot to reach a certain area or pose in the vineyard in a safe manner.

- Human-robot-interaction and harvesting demo, in which the human communicates with the farming robot to have information about the bunches around (e.g., the human might ask “How many grapes can you see?”, “Check the quality of the grapes”, etc.) and can ask the robot to perform harvesting operations. In case of failure, the human can help the robot (e.g., by manually guiding the end effector).

- Box-exchange demo, in which, when the farming robot requests to exchange the box, the logistic robot autonomously navigates the field to reach it and executes the coordinated maneuver for the box exchange. In the event of failures, the system initiates multiple autonomous retries. If all attempts are unsuccessful, human intervention is required.

Additionally, the video shows the capabilities of the virtual reality for learning from demonstration tasks as well as it shows the successful human-robot interaction for pruning operations. All experiments were carried out in September and October 2024 except for the pruning one, which was recorded in January 2024 due to the seasonality of the agronomic operation.