Construction of the Robo-Farmer autonomous robotic platform

Digitalisation of organic fruit production improved by new robotics precision technology in Romania.

EAFRD-funded projects

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Summary

The Robo-Farmer project was an EIP Operational Group (OG) project that developed an efficient solution addressing labour shortages in Romania's organic fruit growing sector. The project sought to test a precision agriculture approach using an autonomous robotic solution for tasks like weed control, pest monitoring, and spraying. Related software and a database were also developed to detect and inform farmers about diseases and pests in organic fruit farming.

Robo-Farmer project achievements included: a modular autonomous robotic platform for maintaining organic orchards, a study on the main characteristics of fruit orchards established by modern cultivation systems, a database with information on diseases and pests, a mobile application for monitoring the robotic platform, and dissemination materials.

Project results

- The modular autonomous robotic platform enhances operational efficiency in orchards, leading to increased productivity and reduced labour costs.
- Integration with existing databases and AI algorithms helps early detection of disease and pest management, minimising crop losses and enhancing overall farm profitability.
- It is estimated that Robo-Farmer can reduce pest and disease control substances by at least 60%.
- Robo-Farmer is an electric autonomous technology which can significantly reduce the need for machinery used by manual labour, thus lowering greenhouse gas emissions and creating energy savings.

Key lessons and recommendations

- Networking and cooperation within an OG can create synergies from different skillsets and allows partners to achieve more by working together than could be possible by working alone.
- Demonstrations, conferences, and publications effectively engaged stakeholders and promoted innovative best practices in fruit cultivation.

*The project promoter/beneficiary is an EIP-AGRI Operational Group. (https://eu-cap-network.ec.europa.eu/operational-groups_en)

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Context

Significant labour challenges can be faced by organic fruit farms in Romania. An EIP Operational Group (OG) was formed to seek possible automated digitalisation solutions to address this problem. It brought together stakeholders from farmers, agricultural research, robotics, and the mechanics sectors. OG members were tasked to ensure effective project management, coordination, and dissemination of results.

Universities and academic institutions were also involved, such as for studies on fruit plantations and economic efficiency impact assessments. Fruit growers, farmer cooperatives, and agricultural organisations were the primary beneficiaries of this project's knowledge and tools.

Objectives

Overall aims for the OG were enhancing agricultural practices and productivity by:

- Improving economic efficiency, addressing obstacles in organic fruit cultivation, and demonstrating sustainability and resilience for fruit industry stakeholders.
- Increasing awareness and implementing smart farm management systems for intelligent precision horticulture through the integration of agri-robotic technology.
- Monitoring and improving orchard health, implementing management by automating tasks such as weed control, pest monitoring, and treatment applications, thereby bringing innovation to organic agriculture.
- Enhancing work conditions to make agriculture more appealing to young farmers.
- Reducing fossil fuel consumption, resulting in a direct reduction of greenhouse gas emissions.

Activities

Robo-Farmer project activities involved:

- Establishing the OG with its project management and coordination - this activity ensured effective management of the OG throughout the project, facilitating communication and coordination among stakeholders.
- Conducting a study on the main characteristics of fruit plantations applying modern cultivation systems to identify key factors for informing the development of the robotic platform.
- Design and testing Robo-Farmer by creating an initial prototype of the platform, and, based on received feedback, developing a functional prototype. Throughout the testing phase, data and information were collected to help modify and adapt the solutions with the goal of identifying an optimal technology. With the completion of this activity, the Robo-Farmer platform was successfully designed, implemented, and tested, ready for deployment in organic fruit farms.
- Creating a database with the main diseases and pests on organic fruit farms, developing and testing the software for disease and pest recognition, as well as the farmers' information mode regarding diseases and pests. This action identified diseases and pests in organic fruit farms, providing valuable support for the development of the specific AI algorithm for disease and pest recognition.
- Developing a mechanised harvesting solution for fruit bushes by creating a prototype with the minimum necessary characteristics for conducting harvesting activities.
- Demonstrating the functionality of innovative technology through testing the robotic platform's functionality, promoting project results, and collecting stakeholder feedback.
- Conducting a study on the economic efficiency of using the platform in fruit orchards.
- Wide-scale dissemination of results by all OG members via the EU EIP-AGRI network and National Rural Network, creating informational and promotional materials, and organising events to showcase project achievements. Efforts were made to ensure the rapid uptake and application of new knowledge generated by the project in practical settings.

Main results

A variety of sustainable development benefits were forecast following the OG results, notably:

- The modular autonomous robotic platform enhances operational efficiency in orchards, leading to increased productivity from reduced labour-related costs.
- Integration with existing databases and AI algorithms helps improve early disease detection and pest management, minimising crop losses and enhancing overall farm profitability.
- The OG estimates that pest and disease control substances can be reduced by at least 60% by using Robo-Farmer, as the implementation of precision agriculture and robotics in pomology (fruit growing) contributes to reducing the environmental impact by optimising resource use and minimising chemical inputs.
- Robo-Farmer is an electric autonomous technology which can significantly reduce the need for machinery used by manual labour, thus lowering greenhouse gas emissions and creating energy savings.
- The mobile application for monitoring and controlling the robotic platform promotes accessibility and ease of use, empowering farmers to manage their orchards more effectively.
- Participation in events and promotional activities fosters knowledge sharing and collaboration among stakeholders, including women in agriculture, agricultural schools, and local government authorities.

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Key lessons and recommendations

- Networking and cooperation within an OG can create synergies from different skillsets and allows partners to achieve more by working together than could be possible by working alone.
- Through activities such as demonstrations, conferences, and publications, the project effectively engaged stakeholders and disseminated its results, promoting innovation and best practices in fruit cultivation.
- By providing valuable tools and solutions for organic fruit farmers, the project has contributed to advancing agricultural practices, promoting sustainability, and enhancing economic efficiency in fruit orchards.

Additional information:

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