FLEXIGROBOTS

Flexible robots for intelligent automation of precision agriculture operations

Introduction

FlexiGroBots aims to unleash the power of Artificial Intelligence and Robotics for developing flexible heterogeneous multi-robot systems that cooperate to accomplish complex tasks in an orchestrated way in various types of fields. The EU-funded project boosts the intelligent automation of precision agriculture operations benefiting farmers around the world!

FlexiGroBots provides a robust platform for the creation of a European Common Agricultural Data Space, leveraging the principles and existing building blocks proposed by the International Data Spaces Association (IDSA), which will break the data silos and will enable the secure and sovereign exchange of information between multiple farmers and stakeholders. Thus, FlexiGroBots platform will allow gathering and processing high volumes of data coming from various sources such as sensors, drones, ground robots, Earth Observation, among others.

Moreover, FlexiGroBots has dedicated components to support building, sharing and deploying AI services in the context of the Agriculture Data Space and to process geospatial information relying on Open Geospatial Consortium (OGC) standards. Exploiting these services, a catalogue of highly reusable common AI-powered applications are being developed so that they can be applied to a wide range of agricultural scenarios beyond the project's pilots.

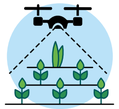
Project Information

Funding programme	H2020-EU.2.1.1.
Grant agreement	No 101017111
Duration	36 months
Start date	January 1st 2021
Overall budget	8,154,443.75 €
Coordinator	Atos IT

Objectives and benefits

To overcome the barriers limiting the adoption of unmanned vehicles and robotics technologies in the agriculture domain, FlexiGroBots envisions a future where fleets of small/medium-size robots work along with drones in a flexible way to serve various needs of farmers regarding real-time decision making and monitoring of field's status.

To accomplish this, the project will meet a series of objectives

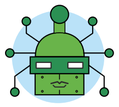


Define a reference architecture and enablers for building mission control of heterogeneous multi-robot systems

Allow the secure and sovereign data exchange across companies and other actors in the agriculture sector

Develop AI-driven robotics methods and services for advanced near-real-time analytics, automated decisions, and decision support for precision agriculture operations

Contribute to the analysis of trustworthy AI for multi-robot systems in terms of transparency, human oversight, privacy and data governance, among others



Demonstrate FlexiGroBots approach through large-scale industry validation in real-world scenarios with various levels of complexity regarding crops, types of robots, geographical and weather conditions, etc

Investigate, develop, and demonstrate new solutions and services that arise from the use of ML and AI-driven robotic systems

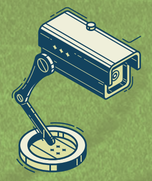
Reinforce AI4EU on-demand platform by reusing and extending the assets and know-how with a marketplace for AI-driven robotics components

Develop guidelines for the usage of robotics in agriculture considering ethics, national regulations and trust requirements

Enable the network of robotics and agriculture Digital Innovation Hubs (DIHs) with the demonstration and piloting of solutions based on heterogeneous multi-robot systems

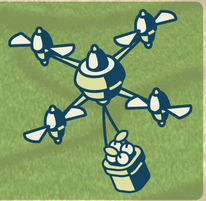
Key Outcomes

FlexiGroBots works in the implementation of AI, Machine Learning and robotics systems to reduce costs and optimize crops performance with 6 key outcomes



To enable multifunctional robots that centralize observation and intervention tasks

To facilitate multi-robot for ground and aerial monitoring



To boost real-time adaptation to the environmental conditions

To provide actionable data for AI-driven design of plans

To guarantee security in the exchange of crucial data

To accelerate precision agricultural operations

The platform services

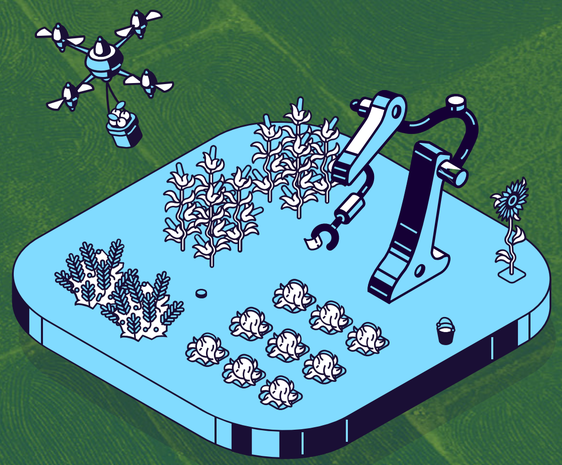
The current landscape of Agriculture 4.0 is not dominated by a single company or by a small group of them. Although some big providers have a very relevant part, especially in the case of heavy machinery, it is quite common that farmers must rely on multiple systems provided by different entities. In most cases, all these systems are completely isolated between them and possible integration is required to reach bilateral agreements and the implementation of ad-hoc connectors, which strongly limits the complete potential of the resulting systems and at the same time, hinders some of the benefits that farmers could have.

FlexiGroBots envisions the creation of a robust platform and data space focused on the enablement of missions of fleets of heterogeneous robots for precision agricultural tasks, where any technology provider that implements an International Data Spaces Association (IDSA) compliant connector could participate and where farmers will have full control of the data collected from their fields.

FlexiGroBots platform is composed by:

- Artificial Intelligence platform providing the technology required by data scientists and Machine Learning engineers to produce innovative ML models and AI-powered applications
- Common data enablers and services creating standard, secure and sovereign data sharing capabilities for the FlexiGroBots platform based on European values, which ensure equal opportunities and trust among data sharing entities through a federated design
- Geospatial enablers and services offering a set of features to facilitate the access, visualization and processing of geospatial datasets collected from satellite imagery and/or UAV's contributing to the efficiency of daily activities on farms and fields
- Common application services providing several software modules designed to be shared and used between the project's pilots and other robotic agricultural solutions classified into three categories: situation awareness, utility and generalization
- Mission Control Centre for designing, planning and supervising heterogeneous multi-robot operations and keeping the human operator in the loop during precision agriculture tasks

The source code of the FlexiGroBots platform components is mostly available in the project's GitHub repository, which is accessible to the whole European robotics community.



Pilots

FlexiGroBots demonstrates its utility to provide efficiency and versatility to farm and agricultural activities with 3 real-life pilots:

Gravepines (Spain)

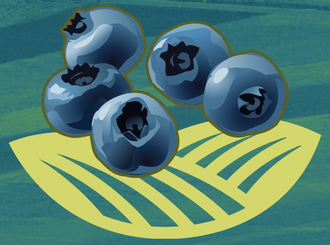
Aims to demonstrate the high capacity and versatility of robots to carry out different tasks in vineyards, as well as their economic profitability. The aerial vehicles are dedicated to the inspection for the early detection of for early detection of Botrytis cinerea, a necrotrophic fungus that affects many plant species, most notably wine grapes, and for obtaining data such as water stress, degree of maturation, etc.

The ground robots oversee close observation of grapes on the ground, to complement the initial data captured from the air and thus complete a more accurate diagnosis of the grapevine condition including the application of phytosanitary treatment only on affected plants. Moreover, a collaborative working environment between robot basket carriers and operators during manual grape harvesting is foreseen.

Rapeseeds (Finland)

Validates FlexiGroBots solutions in pest management of oil crops and harvesting of silage by integration of unmanned ground and aerial vehicles to daily farm activities to reduce the working payload and perform tasks with higher accuracy, reducing time and resources spent.

Various use cases based on automated robots' collaboration are being implemented: robotised tractor in silage fleet, pest detection and pesticide spraying, situation awareness of tractor fleets, grass and rapeseed status mapping, rumex weeding, and silage harvesting plan.



Blueberries (Serbia and Lithuania)

Showcase the use of aerial and ground robots in fruit production which usually require a lot of manual labour and frequent visits to the fields to evaluate the status of the produce. The aerial robots are used as primary tool for data acquisition and field monitoring, mapping weeds and areas affected by diseases. Based on the information collected by the UAV, ground robots execute soil sampling and target-spraying of pesticides.

The pilot includes three use cases: monitoring and detection of weeds and diseases in blueberries, smart soil sampling, and precision spraying.

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