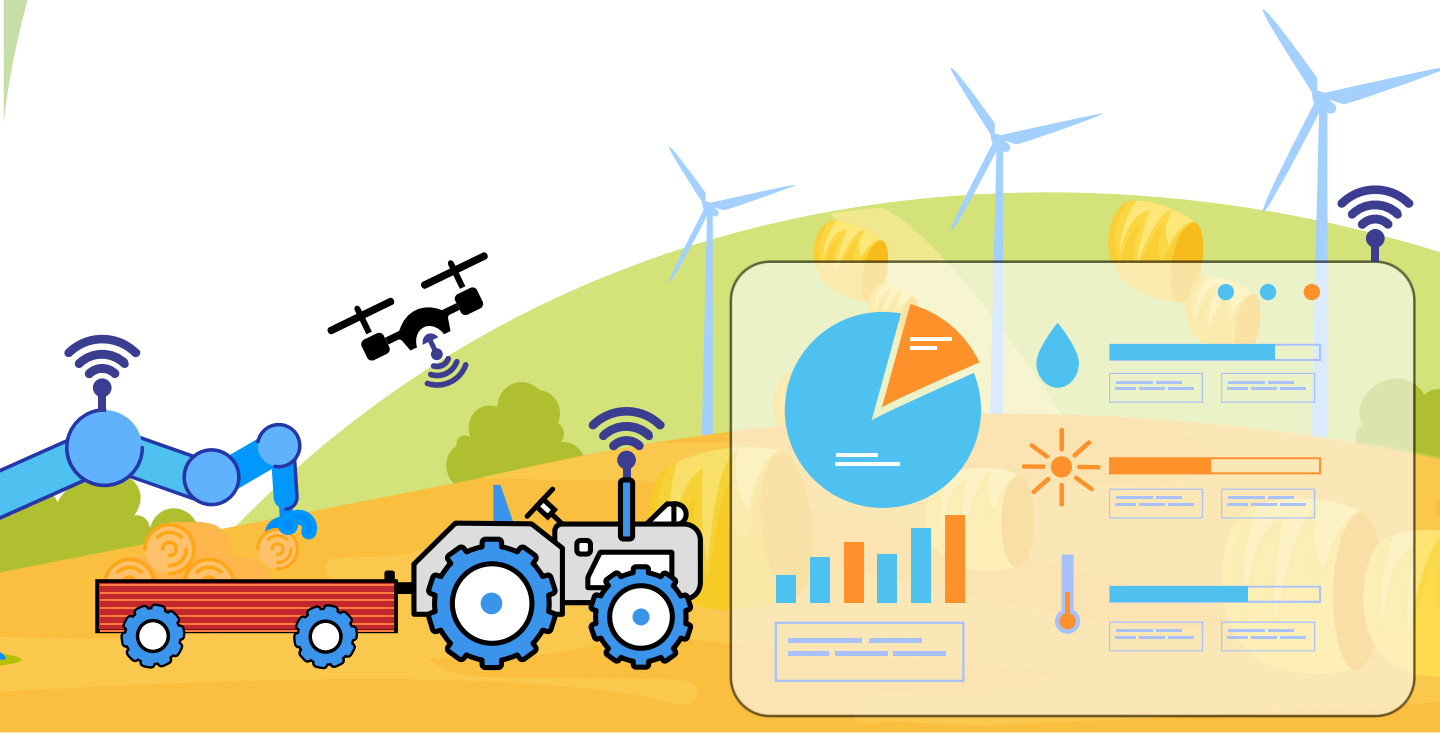
FLEXIGROBOTS

Newsletter #2

January 2022



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101017111

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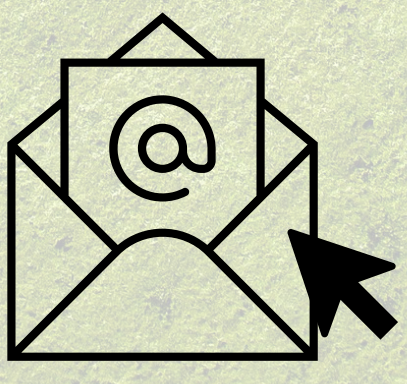

https://flexigrobots-h2020.eu/

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FlexiGroBots – Project Updates

WP2 – Requirements, architecture and standardisation

WP2 focuses on analyzing various aspects related to the design of the FlexiGroBots platform. The goals were:

- To know the opinion and expectations of the **potential stakeholders**.
- To specify **the platform requirements** and provide a description of its architecture.
- To ensure the correct application of available standards **for agricultural safety, agricultural machinery and autonomous machinery**.
- To incorporate **ethical, legal and socio-economic (ELSE) responsibilities**, generating knowledge between AI, robotics and ELSE factors.
- To ensure the development and implementation of **the three pilots**, encouraging the design of experiments, definition of KPIs, and the exchange of ideas and best practices between the teams.

The work done during the last six months can be summarized as follows:

- **Stakeholder feedback has been completed** and the responses have been analyzed. The methodology used, the data analysis as well as the guidelines are included in the deliverable D2.1 submitted in October.
- **Different architectures have been further analyzed** with the aim of defining a robust and complete set of specifications for the FlexiGroBots platform. The methodology, the architectures reviewed, and the results are included in the deliverable D2.2
- **Information has been collected about the type of standards that partners are using** or are planning to use. Participants also gave insights about future strategies to **increase portability and interoperability**.
- **Individual interviews of at least two-days have been carried out** to collect information from the partners on ELSE aspects. The interviews have been conducted with all the teams of the pilots and from different WPs. The data will **provide recommendations** for the design of each groups' technologies.
- **Further progress has been made with the pilots** in order to achieve maximum alignment between them. The main results are included in the deliverable D2.7.

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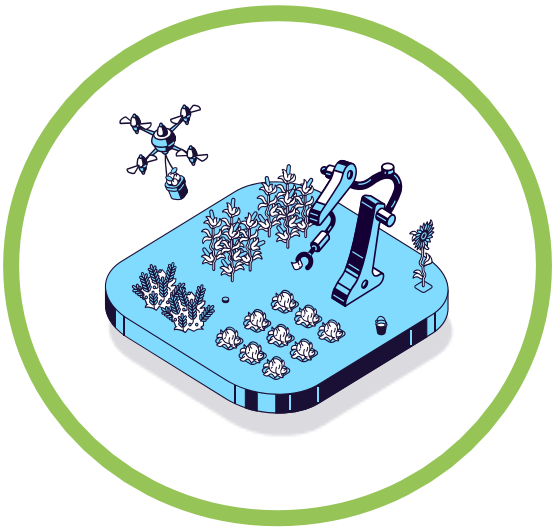
WP3 – Platform development



The aim is to develop the FlexiGroBots **common platform and the building blocks** that support its implementation.

The platform will satisfy the stakeholders' requirements and it will enable the reference architecture for **mission control systems for heterogeneous robots' fleets**.

FlexiGroBots platform will be based on the following elements:

- **An Artificial Intelligence platform** that will support the management of the complete lifecycle of Machine Learning models for robotics systems.
- **An IDSA-compliant agricultural data space** that enables common data repositories and services with spatial and non-spatial information,
- To provide **AI for robotics services** which can be reused across pilots and multirobot solutions, providing AI methods for perception, decision and action in intelligent robotics systems.
- To facilitate **a platform for high-level planning, supervision and control of agricultural heterogeneous multirobot missions**, covering a higher control than conventional robotic platforms.

At the end of the first year , WP3 released deliverable D3.1, which describes the status of the **first version of the FlexiGroBots platform.**

For the Artificial Intelligence functionalities, **Kubeflow** will be the technology for precision agriculture services. It will be part of the embryonic **Agriculture Data Space (ADS)** that leverage the architecture of the **International Data Spaces Association (IDSA).**

At the same time, geospatial data processing is being enabled through **Open Data Cube and OGC standards**.

WP3 has also started to work in a portfolio of **common application services** for detection of diseases, insects and weeds.

Finally, an initial **prototype of the Mission Control Centre** is being implemented through the open-source tool **QGroundControl**.

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FlexiGroBots – Project Updates

WP4 – Pilot 1: Grapevines

Pilot 1 has the global objective of automating and improving the management tasks that are carried out in a vineyard during the season.

The 3 objectives are:

- Early Detection of Botrytis: Anticipating the appearance of visible symptoms in the plant, through the data collected by a fleet of unmanned air vehicles (UAV or drones) and sending Unmanned Ground Vehicles (UGV) for a close inspection.
- Phytosanitary Treatments: Applying the treatments in a localized and accurate way on the bunch of grapes that suffers the disease, by means of UGV.
- Transport of the Grapes: That will be carried out by UGV, which will imply time and cost savings. The aim is to have robots carrying baskets, autonomously following operators and going to the vineyard line when the baskets are fully loaded with grapes.

During this period, the first version of DSS platform have been implemented and integrated with agrometeorological providers to obtain meteorological and satellite data. In addition, IoT sensors have been installed into the vineyard, so the pilot can have more accurate data from the crops.

Ground and aerial inspections were designed during this time.

- For ground inspections, an autonomous platform based on Renault Twizy was developed. The vehicle has been automatized using an on-board computer.
- For aerial inspections, two different DJI drones were provisioned, to capture images from different angles and flight conditions.

Click HERE and read: D4.1 – Pilot 1 objectives, requirements and design

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In-field tests were carried out during September, where aerial drones performed flights and collected images of the crops.

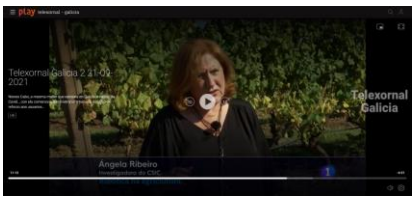
More than **200 sample points** were identified using the images to develop **models** to predict the presence of Botrytis and other diseases.

In addition, the **harvesting assistance robots** were used in this test, which assist the operators in the harvest by transporting the boxes of grapes.

Several **datasets** were also obtained in this period:

- **meteorological data**, from public and private stations and IoT sensors, and synthesized to generate meteorological aggregates
- **botrytis disease** images collected during in field tests
- **UAV image** products like multispectral images, NDVI maps or point maps

Check the TV interviews covering the field tests



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WP5 – Pilot 2: Rapeseeds

The Rapeseed pilot focuses on piloting solutions in pest management , weeding and harvesting of silage.

During the second half of 2021, we continued the development of:

- autonomous weeding robot
- the autonomous tractor
- services and interfaces for automation of processes

Moreover, we defined the demonstration concept, where the farmer does its activities together with robot operation, drone operation, and AI service provider companies using our **embryonic IDSA-based agriculture data space** for exchanging the confidential data.

The main progress in the period has been that **first autonomous driving tests** of both units we conducted.

We executed **drone survey missions** and collected images and data for developing the **AI-services for pest, weed, and object detection**.

We also tested **the first connection between two entities** through data space.

The specification of the pilot was completed and we now ready **to move towards real-life unit tests** to be done next summer.

"Autonomously flying **drones** are already existing technology but having **AI for the detection of very small pests** at the right time of growth period and the execution of precision spraying operations by drone are far from trivial".

Juha-Pekka Soininen, VTT, Pilot leader.

Read 'FlexiGroBots pilot in Finland is ramping up' to know more.

Click HERE and read: D5.1 – Pilot 2 – Rapeseeds: objectives, requirements and design

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FlexiGroBots – Project Updates

WP6 – Pilot 3: Blueberries

The goal is to demonstrate novel robotic solutions for blueberry farming in real (farm) operational environments, supported by **advanced remote sensing, deep learning and decision-support techniques**.

Pilot 3 is structured according to **3 goals** and areas of foreseen **technological development and innovation**:

- **Detection:** Integration of monitoring solutions.
- **Assessment:** Actionable insights for decision making and optimization.
- **Action:** Autonomous robot for operations in blueberry farms.

More specifically, the objectives are as listed:

- To plan the analysis of **the initial business cases** into a set of service demonstrators and their pilot **evaluation with real users**.
- To collect functional and not functional **requirements** and define use cases.
- To **develop the components** involved in the pilot demonstrators to be tested.
- To implement the pilot and run **demonstrators with end-users** (ZEL and AGS) that will represent the communities targeted by the developed applications.
- To collect and **analyse results** to make suggestions on the improvement of the demonstrator **from a technical perspective**.
- To provide ICT solutions with AI-driven robotics state-of-the-art technologies that can be reused beyond the project lifetime.

The WP6 team has successfully carried out **initial experiments on targeted blueberry fields**.

Drone scanning of all Pilot 3 locations resulted in **comprehensive datasets** which will provide valuable insights needed for upcoming in-field experiments.

Furthermore, significant progress was made in **the development of the sprayer and module for soil analysis** which will lead to various prototypes being ready for next year's in-field experiments.

Click HERE and read: D6.1 – Pilot 3 objectives, requirements and design

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WP7 – Dissemination and Exploitation

Within the second half of Y1 of the project – specifically on M06 – under WP7 and under the leading role of AFL, *T7.3 "Business models and ecosystem building"* was initiated and, according to the project's workplan, will cover the rest of the FlexiGroBots duration.

This task encompasses activities regarding the exploration and development of **business models** applicable for **commercial exploitation** of the FlexiGroBots platform, the pilots within the project and their separate hardware and software components.

In more details, the objectives of the above-mentioned activities can be described as follows:

- To **identify the exploitable elements** of the FlexiGroBots platform, the pilots and their separate hardware or software components.
- To **explore** conventional (i.e. direct sales) and alternative (i.e. Haas and SaaS) **business and service delivery models** for exploitation.
- To prepare a **strategy focused on cooperation** with agri-food and/or robotics **Digital Innovation Hubs**.
- To build and maintain an **ecosystem of networked stakeholders** interested in the exploitation of the project.

Towards this end, we have initiated and implemented activities that aim to meet both expectations (business model and ecosystem development).

More specifically, **a questionnaire has been developed and distributed** amongst the consortium's partners which has helped us **identify the exploitable elements of the platform and of the pilots** and has helped us develop a common framework upon which the foreseen business models will be based.

Also, regarding the ecosystem building process, **an initial mapping of the currently existing key partners, groups, networks, initiatives, etc. of the consortium** is under development with the aim of preparing a DIH-focused strategy with targeted approaches for each key stakeholder.

FlexiGroBots – News & Events

Events

Peltoteknolgiapäivä, Field technology day, Proagria

21/06/2021 | Juva, Finland + Virtual

At the event organised by ProAgria, **Jere Kaivosoja** and **Oiva Niemeläinen**, from LUKE, explained new measurement technologies for field management in FlexiGroBots and demonstrated drones' technologies.

On-farm field exhibition, ProAgria

03/08/2021 | Kitee, Finland

The field exhibition covered topics related to agriculture, farming and new technologies to improve operations. **Oiva Niemeläinen** from **LUKE**, introduced new measurement technologies for farms from FlexiGroBots.

InnoPanorama 2021

26/08/2021 | Kaunas, Lithuania

The exhibition invited initiatives for digital technologies for agriculture and forestry, renewable energy and bio-greens and environmental care. Agrosmart and Agrifood Lithuania presented FlexiGroBots at the exhibition booth.

European Regions for Smart Communities Summit

04/10/2021 | Amsterdam, Netherlands

Oskar Marko from **BioSense Institute**, held the presentation **"Optimising Blueberry Production using AI-Driven Aerial and Ground Robots"** based on FlexiGroBots work and achievements within Pilot 3.

Koneagria, Farm Machiney Exhibition

14/10/2021 | Tampere, Finland

Madis Lemsalu from **LUKE** presented the EFDI-controlled UGV platform related to FlexiGroBots. MTECH Digital Solutions (MTE) had a booth during the exhibition where the project was represented and there was engagement with various target audiences and external stakeholders.

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FlexiGroBots – News & Events

SmAgTech EXPO Conference

16/11/2021 | Virtual

Joao Valente, from Wageningen University & Research, participated in the Smart Fruit Growing session with the presentation *"Efficient orchards and vineyards management using AI-driven UAVs"*.

AgriFood Forum 2021

25/11/2021 | Virtual

Daniel Calvo Alonso, FlexiGroBots Project Coordinator, participated on behalf of the project with a 5-mins introductions of the objectives and outcomes within CoRoSect'st panel discussion ***"Working side by side with agrifood robots - opportunities and challenges".***

Virtual Booth at the European Big Data Value Forum

02/12/2021 | Virtual

Ana María Morales, from Atos Research and Innovation, presented the project motivation, expected results and use cases in an hour-long session at the international event.

Blog Posts

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Meet FlexiGroBots Partners

Centre for European Policy Studies

CEPS is a leading think tank and forum for debate on EU affairs, ranking among the top think tanks in Europe. The main assets of CEPS are: **(1) Complete independence** to set its own research priorities and freedom from any outside influence; **(2) Eminently qualified research team** of more than 60 analysts drawn from 23 different countries; **(3) Membership in various research networks** and institutional settings, comprising research institutes and non-for profit organisations from all over Europe and beyond; **(4) An extensive membership base** of some 120 Corporate Members and over 100 Institutional Members, which provide expertise and practical experience and act as a sounding board for CEPS policy proposals.

Regarding **new technologies and AI,** CEPS' researchers have extensive experience both from a policy and a technical point of view.

Prof. Andrea Renda was, for example, a members of the European Commission's High Level Expert Group on AI, regularly advises policy makers on AI ethics and policy, works at the digital policy cluster at European University Institute and is part of the European Parliament's STOA panel.

Moritz Laurer co-authored several studies on the impact of new technologies and specializes in natural language processing and computational social sciences.

The team conducted the cost assessment for the European Commission's AI Act. **Artur Bogucki** holds a PhD in law and economics and contributes legal and economic expertise to the project.

Within FlexiGroBots:

In the FlexiGroBots project, CEPS is responsible for analysing ethical, legal and socio-economic impacts of robotics and AI.

CEPS gathers **experience from practitioners** on the ground, analyses **private and public ethical standards** and develops **tailored recommendations** for the project's pilots and platform.

Moreover, CEPS will share the practical lessons learned from the impact analysis and the implementation of ethical standards with the broader public to bring policy makers and technical developers closer together.

Andrea Renda, Senior Research Fellow and Head of Global Governance, Regulation, Innovation & Digital Economy

Moritz Laurer, Researcher in the Global Governance, Regulation, Innovation, Digital Economy (GRID) unit

Artur Bogucki, Research assistant CEPS | Behavioral Law and Economics

Meet FlexiGroBots Partners

WAGENINGEN UNIVERSITY & RESEARCH

Wageningen University & Research (WUR) is a top-class university**, ranking among the world's leading institutions in the food, agriculture and environmental domains**.

Within WUR, 9 specialised research institutes from the Wageningen Research Foundation and Wageningen University have joined forces to help answer the most important questions in **the domain of healthy food and living environment.** An integrated approach to problems and the cooperation between various disciplines are at the heart of the unique approach of Wageningen.

Within WUR, the Information Technology Group (INF) is doing **research on the topics of smart systems development, and system-of-systems engineering**, which is primarily centred in the life sciences domain. In this context, we focus on software engineering, robotics, data science, and socio-technical systems.

In the last years, the group has rapidly grown and developed a solid research agenda on smart systems engineering.

This research will also be aligned with the **Social Artificial Intelligent Drones (SAID) Lab of INF-WUR**. The SAID Lab aims to develops **Artificial Intelligence (AI)** and drone-based solutions to support agricultural management and decision-making while strengthening the interaction between people and airborne technology.

The SAID lab envision stepping towards the employment of autonomous and more intelligent vehicles for remote sensing the environment.

Within FlexiGroBots:

Wageningen University will **supply drones equipped with multispectral cameras** and execute the multiple UAV aerial surveys for collecting image data over the entire vineyard.

Furthermore, it will generate the **high-resolution orthorectified NDVI-based maps**. WU will also be responsible for the UAV fleet setup, flights and communication to the base station.

Finally, it will contribute to the **UAVs perception and decision support system** developing vision-based artificial intelligence and data-driven approaches for the early detection of Botrytis cinerea.

WUR contributes to T1.3 and T1.5 to project reporting and financial management, likewise data, DPDR, and ethnics. In T2.2 and T2.5 it contributes to **the platform requirements and architecture**, and **Pilots methodology**, alignment and follow-up. WUR contributes to T3.1, T3.3, T3.4 and T3.5 due to previous experience in aerial mission planning, optimal image acquisition with multiple UAVs, image data pre-processing, very high-resolution images generation. WUR mostly contributes to Pilot 1 because it has experience in UAVs fleet and field conditions trials, ground truthing data acquisition and image annotations. Finally, WUR participates in T7.1 and T7.2in the **dissemination and communication**.

Dr. Joao Pereira Valente, Assistant Professor

Mar Ariza Sentis, Research Assistant

Meet FlexiGroBots Partners

INTERNATIONAL DATA SPACES ASSOCIATION

The **International Data Spaces Association (IDSA)** is a coalition of more than **130 member companies** that share a vision of a world where all companies self determine usage rules and realize the full value of their data in **secure**, **trusted**, equal partnerships; and we are making that vision a reality.

Our goal is nothing less than a **global standard for international data spaces (IDS)** and interfaces, as well as fostering the related technologies and business models that will drive the data economy of the future across industries.

Within FlexiGroBots:

IDSA mainly supports the development of common **Agriculture Data Space Services** for FlexiGroBots.

The IDS Reference Architecture Model specifies a **standard that guarantees data sovereignty** for a peer-to-peer network providing usage control of data.

IDSA will **support the three pilots** realize **a data value chain** which maximizes synergies, collaboration and trading around data while ensuring data sovereign, data governance and security in data sharing / exchange across companies, domains and international borders.

The involvement of IDSA in the recently launched **Data Sharing Business Alliance (DSBA)** will allow for the collection of enabling services that be implemented for the Agriculture Data Space of FlexiGroBots to be aligned with commonly agreed Data Spaces Framework that defines a common set of rules and design principles based on existing frameworks.

In this way, **FlexiGroBots will become part of the envisioned Single Market for data**, where data can flow between countries and sectors, and be accessed and used easily, respecting European values and rules.

Markos Matsas, Senior Project Manager

Check the Blog Post: "FlexiGroBots: Smart Farming with AI and Big Data"

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Thanks for your collaboration, for any questions or content recommendation, please contact us:
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