



**Aerial Data Collection and Analysis
and Automated Ground Intervention
for Precision Farming**

<https://flourish-project.eu/>



FLOURISH is an **Horizon 2020** project aiming to develop an **autonomously operating precision farming robotic system** easily **adaptable** to a wide range of farm management activities and different crops



Sustainable farming

- Increases yield while minimizing chemical inputs
- Precision agricultural techniques monitor crop health and target treatments only to plants or infested areas that need them



Crops health monitoring is time consuming and expensive. There has been great progress on **automating** this activity using robots, but most existing systems have been developed to solve only specialized tasks



This **lack of flexibility** poses a high risk of no return on investment for farmers

ADAPTABILITY

is the key feature to make a robotic system deployable in agricultural practice



FLOURISH develops a flexible robotic system

performing a continuous survey, ground intervention and data analysis that can be tailored to a **wide variety of agricultural situations** simply by varying the sensors, the treatment method and the data analytics and interpretation.

APPROACH

Flourish develops a **robotic system** combining aerial survey capabilities of a small autonomous multi-copter **Unmanned Aerial Vehicle (UAV)** with a multi-purpose agricultural **Unmanned Ground Vehicle (UGV)**

The system is able to:

- *survey a field from the air*
- *perform targeted intervention on the ground*
- *provide detailed information for decision support*

Minimal User Intervention Required

COLLABORATIVE ROBOTIC SYSTEM



*UGV acts as a **mobile docking and charging station** for UAV. During the missions, the UAV automatically lands and starts from the UGV to recharge its batteries. UAV can upload data on the UGV data analysis module*



SUGAR BEET has been defined as the primary use case for FLOURISH system development, while **SUNFLOWER** is an additional use case



MISSION SCENARIOS

UAV and **UGV** evaluate the **crop growth performance**, nutritional condition, weed infestation and health status non-destructively.

UAV and UGV continuously collect a rich set of data (position, temperature, 3D-information, as well as visual and spectral imagery) over the field

Detected problem areas are communicated to the UGV analysis module, high resolution imagery of problem areas is taken

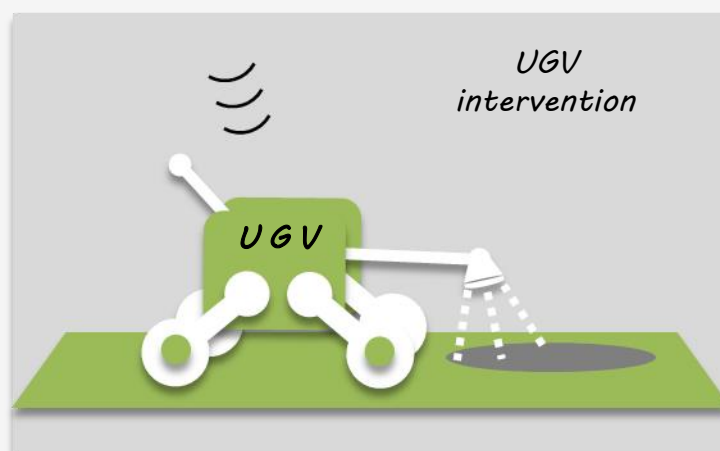
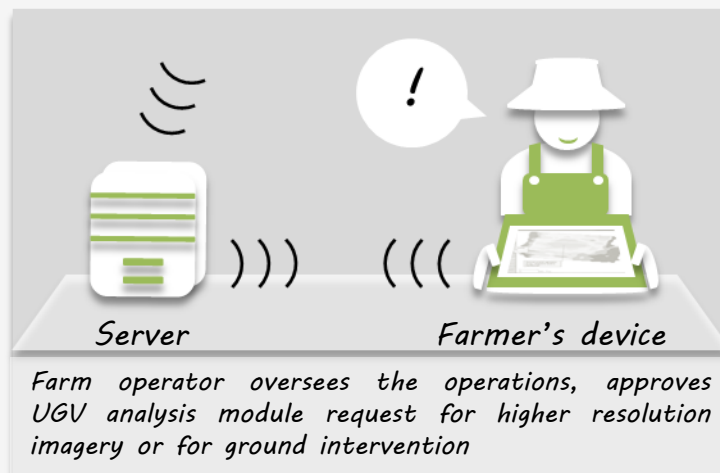


Collected data can be sent to a **server** (data storage, handling and processing and map building) and to the **farmer device** (i.e. Mission Control Interface).

Management recommendations are derived on the basis of agricultural maps, the need for ground intervention by the UGV is prioritized and UGV missions are scheduled

Management recommendations are sent back to the UGV, so that it can **autonomously** fertilize or control weeds with its ground intervention tools.

UGV intervention, in collaboration with UAV, can be commanded by farm operator or directly by its data analysis module



SYSTEM FEATURES

UAV

Autonomous flying

UAV determines the optimal path of the flight mission based on the field boundaries, it can start the flight mission autonomously, avoid non-fly-zones, return to the landing position upon completing the mission

Data Capture

UAV captures RGB, NIR image data and eventually 3D data and other data useful for health and infestation estimation

Map generation

The UAV generates a map of the field from the acquired data

Hot Spot Detection

The UAV system identifies field areas with high probability of weed or infested areas that need ground intervention

Battery Monitoring

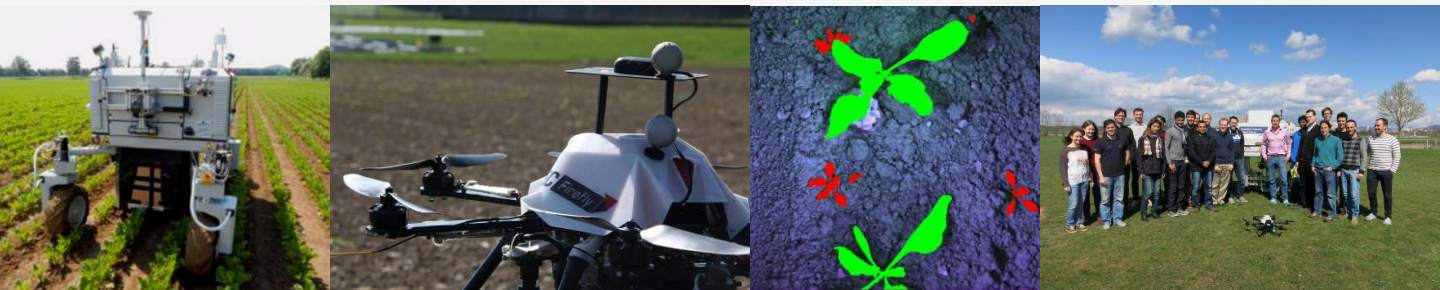
The UAV monitors its battery status to ensure a safe state at any time. If it detects a critically low battery status, it flies to the landing position for charging, then it continues its interrupted flight mission. If the UGV is not located at the field, the UAV flies back to the starting position for manual charging by the operator

Data Transfer to UGV

After the UAV has landed on the UGV landing base it transfers the collected flight data to the UGV data storage

Operation Speed

The UAV is able to survey at least 10 ha per hour



UGV

System Concept

The UAV system uses the UGV as platform vehicle

UGV Autonomous Driving

UGV determines the optimal path for field treatment, it drives autonomously the mission defined by the system, it analyses the "hot spots" identified by the UAV, it adapts the maximum driving speed depending on the presence of hot spots. UGV does not damage the crops, detects and avoids obstacles in its path. UGV returns to the starting position upon finishing the mission

Processing features

(sugar beet)

UGV speed is comparable to manual weeding. The goal is to achieve at least 0.25 ha per hour (research prototype speed). The UGV can process at least one row of the target crops and

plants up to a height of 5 cm. UGV can drive along slopes of 10 % inclination

Map Generation

UGV generates a map of the captured data

UGV Weeds & Crop Detection

UGV can distinguish between weeds and crop plants (labeling)

Weeds Treatment

The system supports selective mechanical (stamping) as well as selective chemical inter-and intra-row weed treatments

Operating Time

UGV operates for at least 4 hours before it needs to be re-charged/re-fueled

HOW TO GET INVOLVED

SUBSCRIBE TO OUR NEWSLETTER

The FLOURISH project publishes a biannual newsletter to announce events and report on progress.

Subscribe here to stay informed!

<http://flourish-project.eu/pressmaterial/>

CONTACT US

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<https://www.facebook.com/flourishproject/>



<https://twitter.com/flourishrobots/>

The FLOURISH project brings together seven highly qualified partners with know-how from robot design to crop management and involves four European countries: Switzerland, Germany, France and Italy.

Coordinated by



Partners involved



BOSCH

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