



FLEXIGROBOTS

WP6 - Pilot 3 Setup and Assessment

Blueberries in Lithuania and Serbia

Oskar Marko

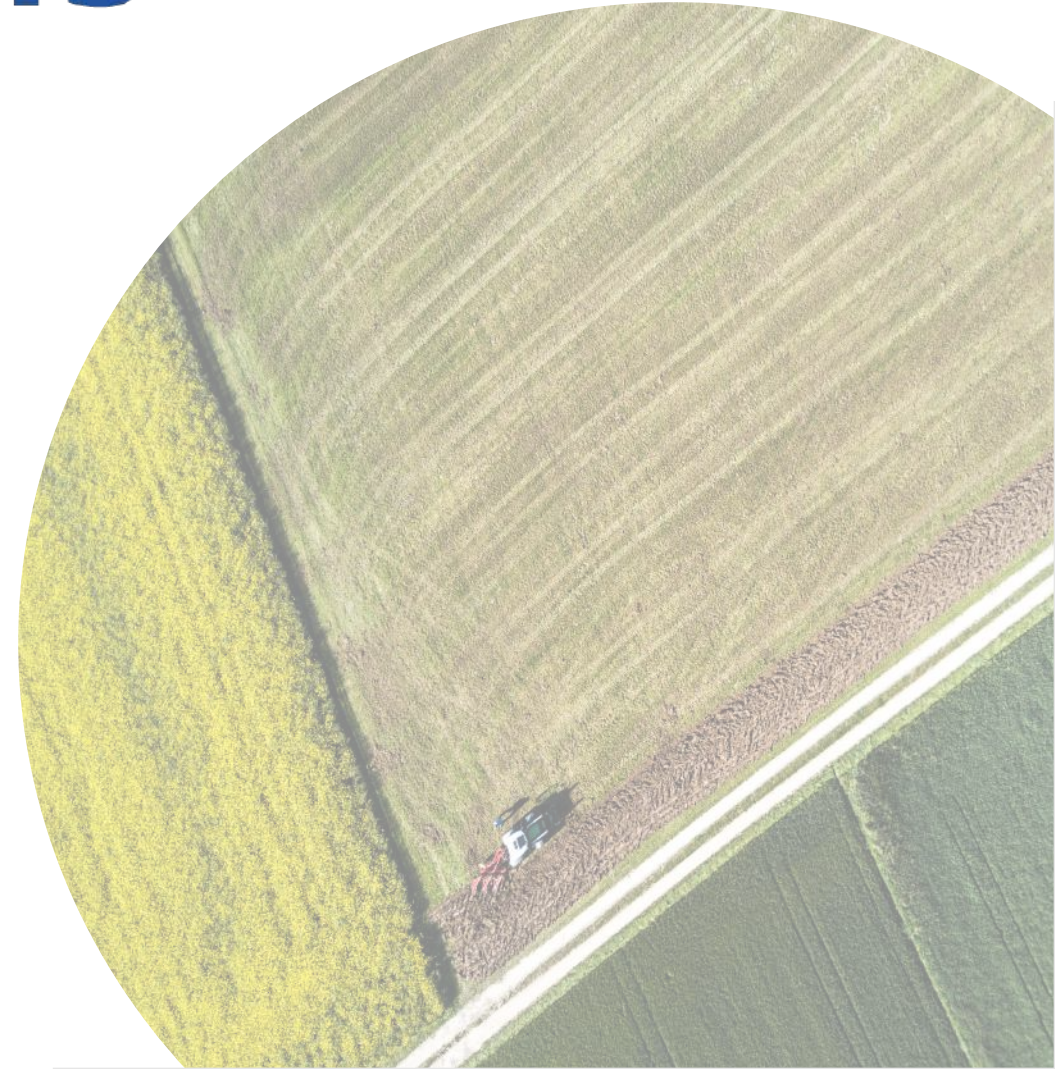
WP6 coordinator



Online, 28th January 2021



This project has received funding from the European Union's H2020 research and innovation programme under the grant agreement No. 101017111



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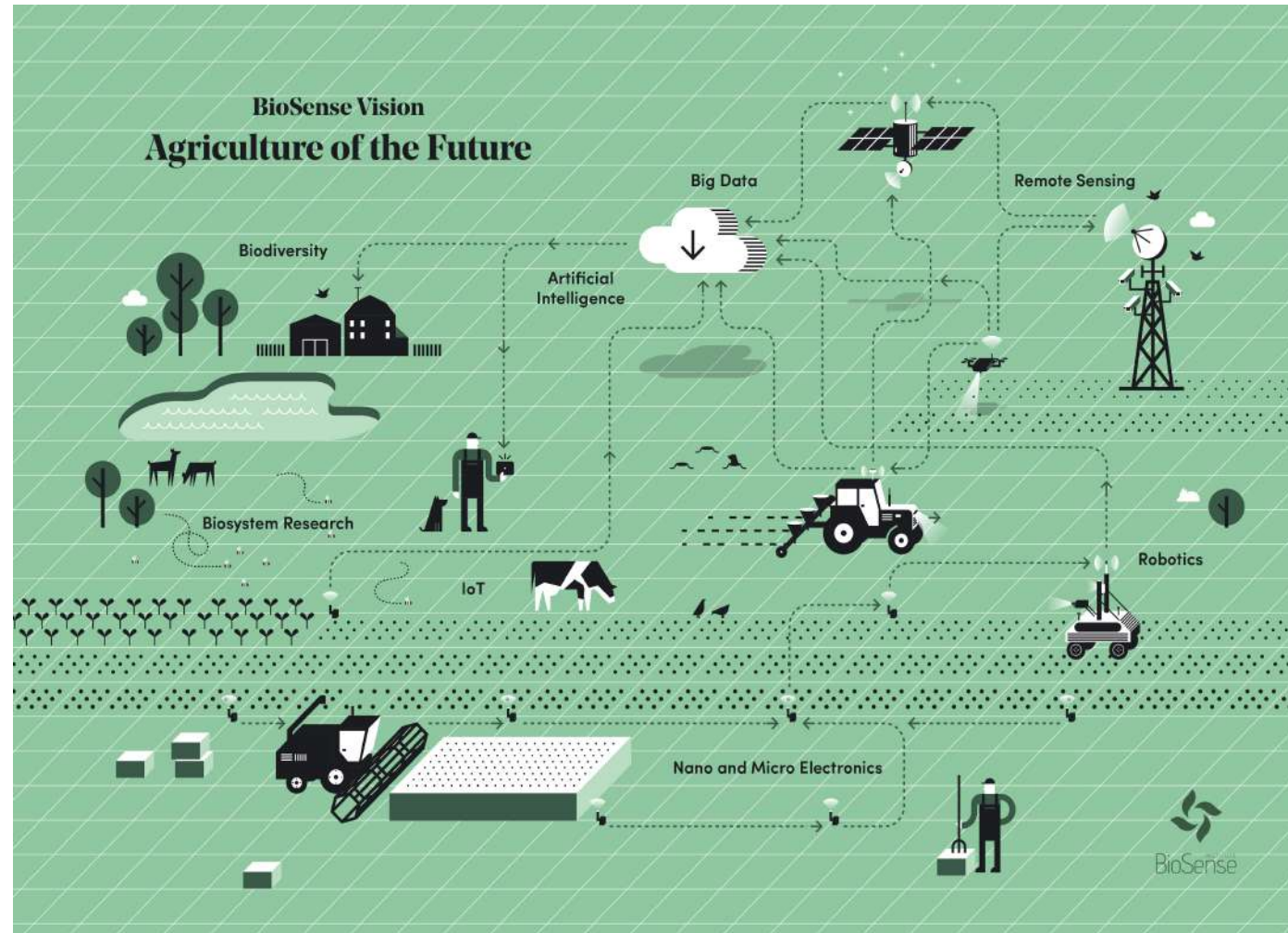




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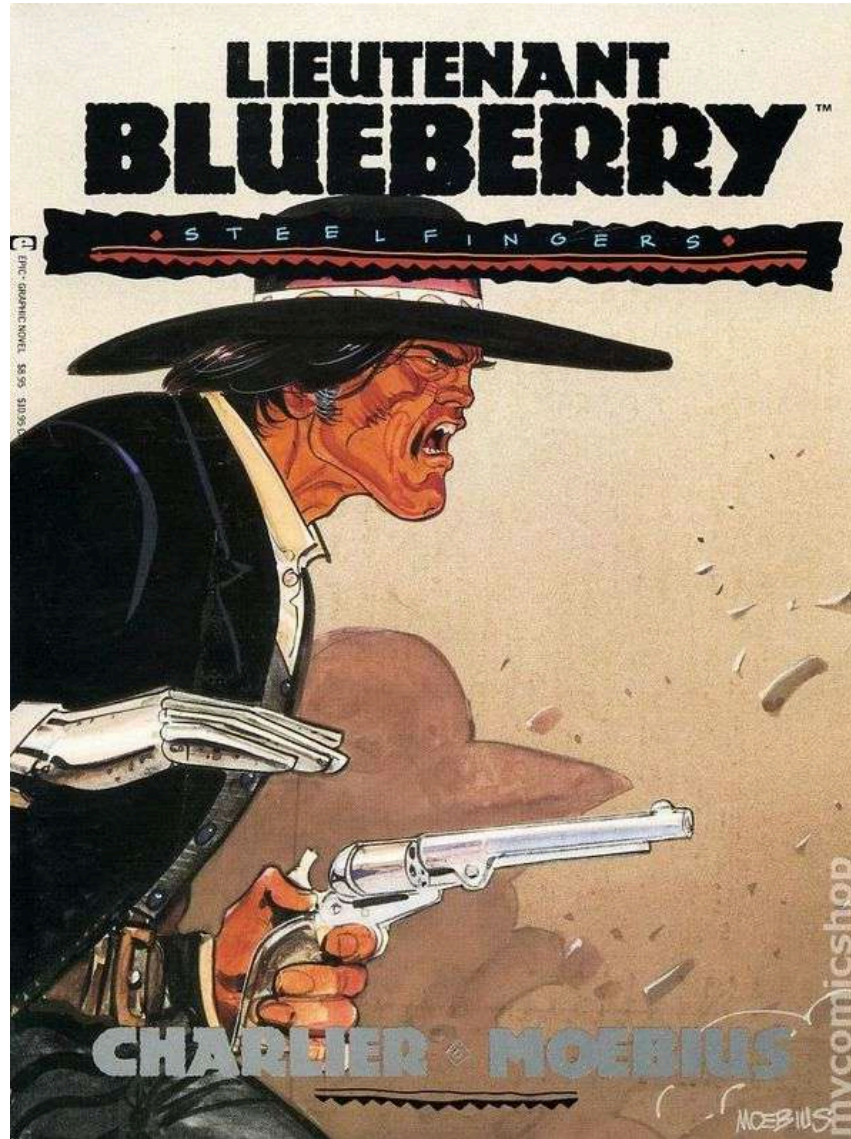


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Blueberry

- Geeks vs. farmers



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1

Partners

- Flexible robots for intelligent automation of precision agriculture operations -

Partners

- BioSense (R&D Institute)
- Art21 (AgTech SME)
- AgriFood Lithuania (DIH)
- AgroSmart SIA (AgTech SME)
- Zeleni Hit (Farming SME)



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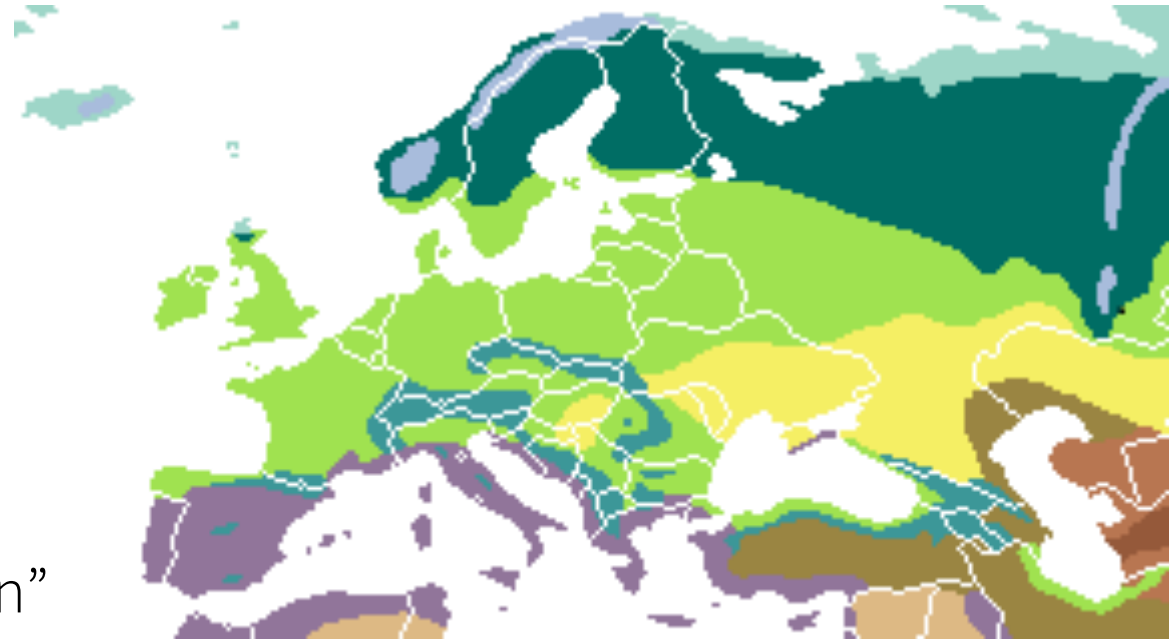
Blueberries

Blueberries



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- Northern America
- Northern/southern variety
- High-value crop (€40k/ha)
- Grows for 50 years



“something to leave for your grandchildren”

Pilots

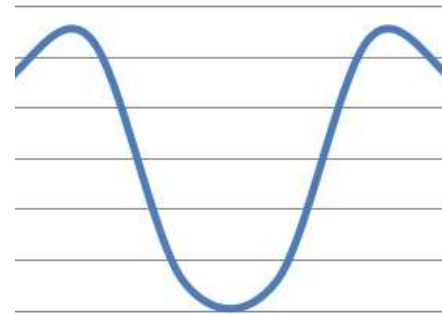


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- Northern and southern edges
- Slightly hilly terrain, lowlands



Outskirts of Belgrade, Serbia



Kaunas region, Lithuania

Blueberries



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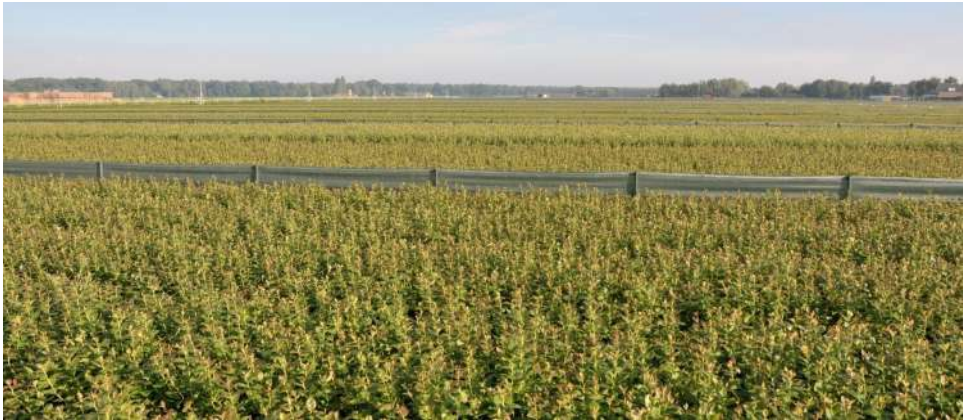
- 80% exports to NL and RUS
- Jam, juice, cakes...
- Health benefits (anti-aging, sight...)
- Area in RS and LT x2 from 2018
- 1000 -> 2000 ha in RS
- €80M



Growing



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Growing



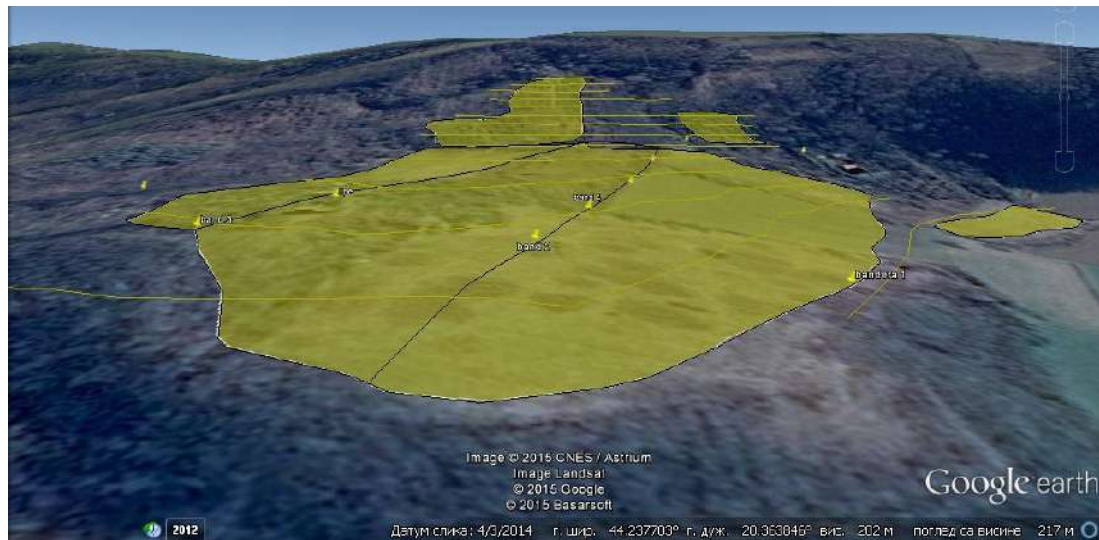
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- Pots vs. ridge planting

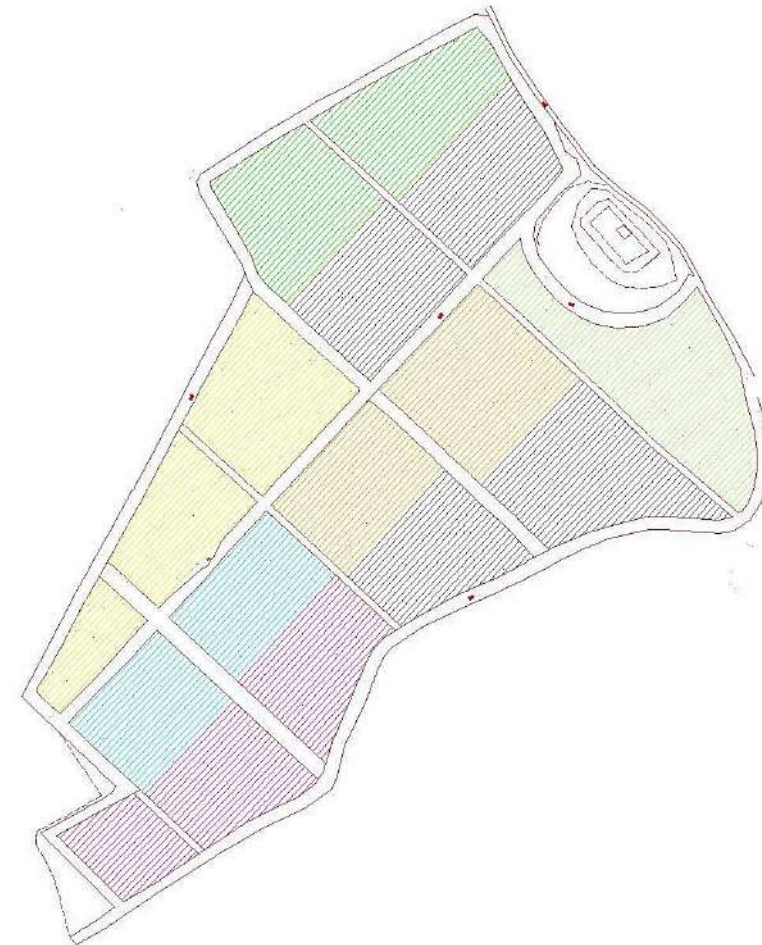


Planning

- Project preparation
- Analysis of soil, slope, terrain



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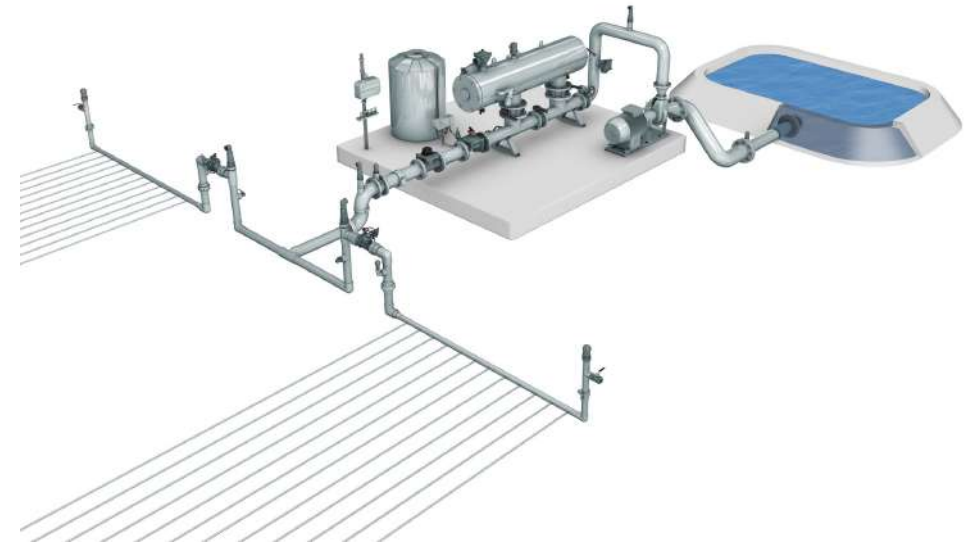


Irrigation



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- "Drop by drop" irrigation
- Optimal amount and timing
- Fertigation



Soil



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- 12 soil samplings per season
- 1 day per sampling at 10ha
- NPK
- Granules/fertigation
- Amount ~ **predicted yield**



Weeds and diseases



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- Manual weed control:
expensive human labour
soil, munch and microbiome destabilised
lower yield
- Targeted pesticide application:
less pesticide used
lower costs
healthier produce





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Objectives

- Flexible robots for intelligent automation of precision agriculture operations -

Business Problems



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Planning

Yield prediction



Sampling

Automated field soil sampling and analysis



Diseases

Early-stage blueberry disease detection



Spraying

Targeted and autonomous agricultural spraying

General Objectives



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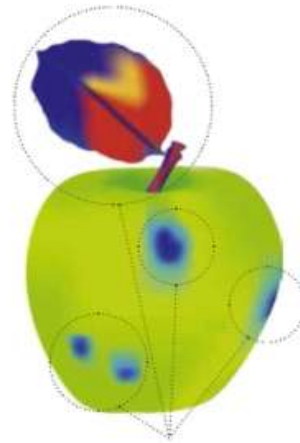
Detection

Integration of current and novel monitoring solutions



Assessment

Providing actionable insights for decision making and optimization



Action

Autonomous robot for operations in blueberry farms





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Detection

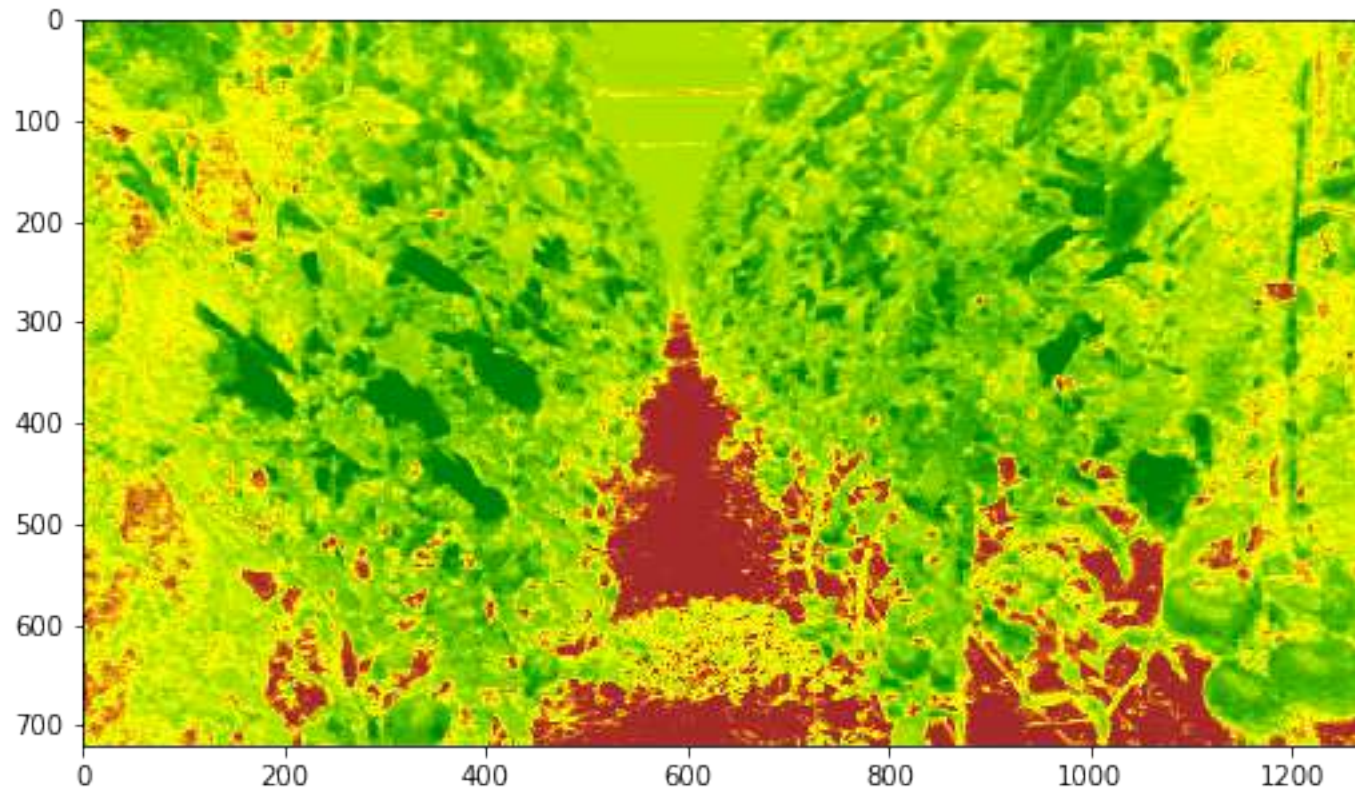
- Flexible robots for intelligent automation of precision agriculture operations -

UGV Sensors



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- Supporting UAV imagery

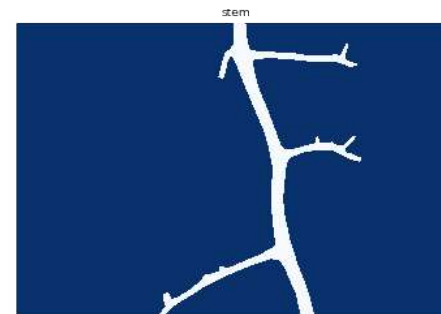
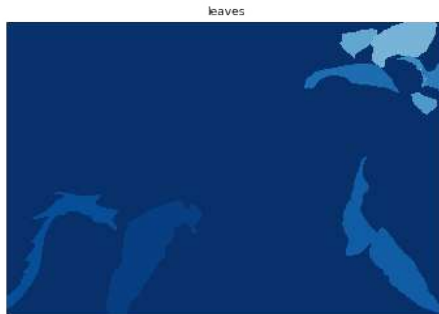


Deep Learning



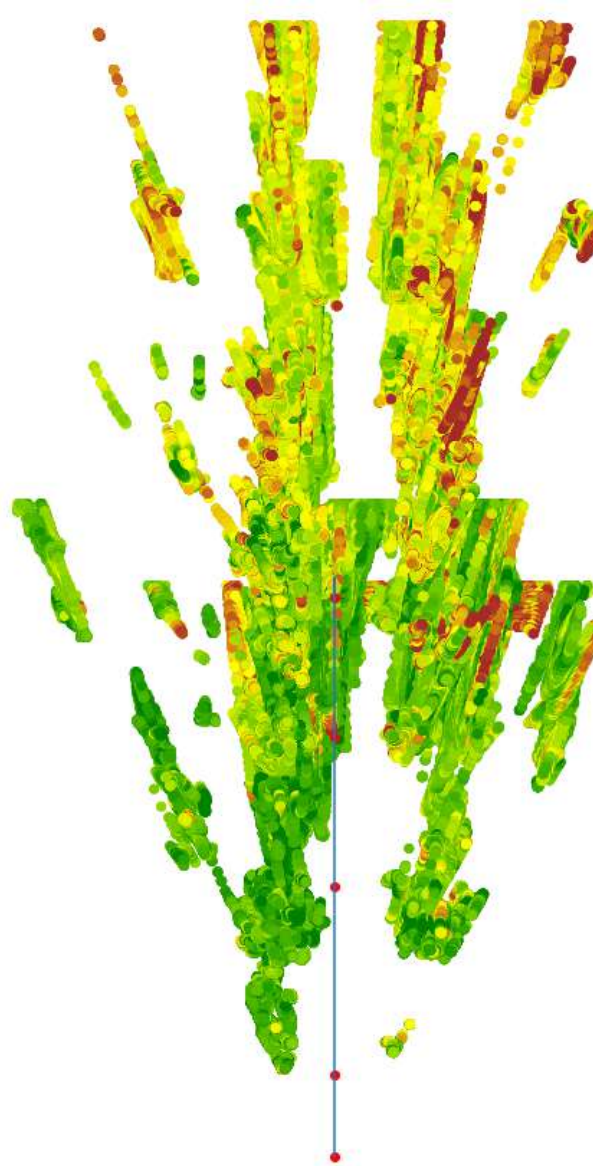
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- Image segmentation and pattern recognition



UGV Sensors

- Lidar
- Autonomous navigation
- Point-clouds



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UGV Sensors



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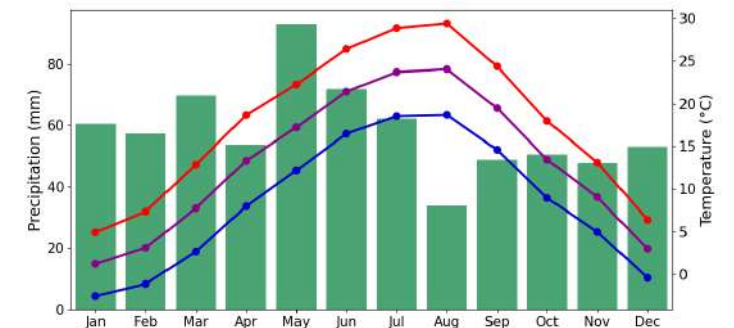
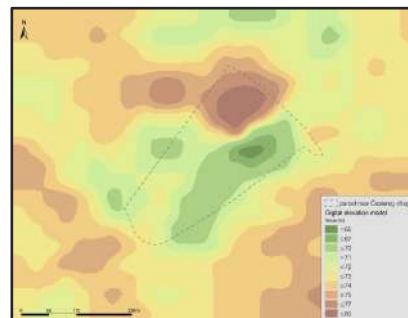
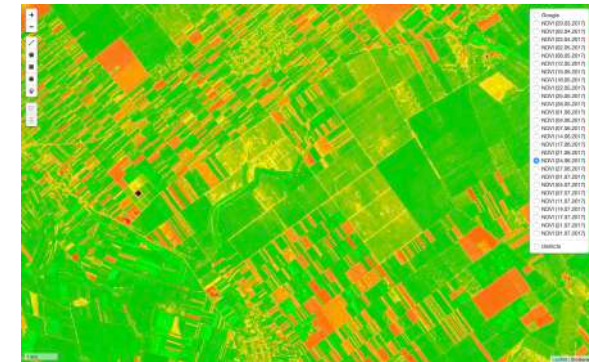
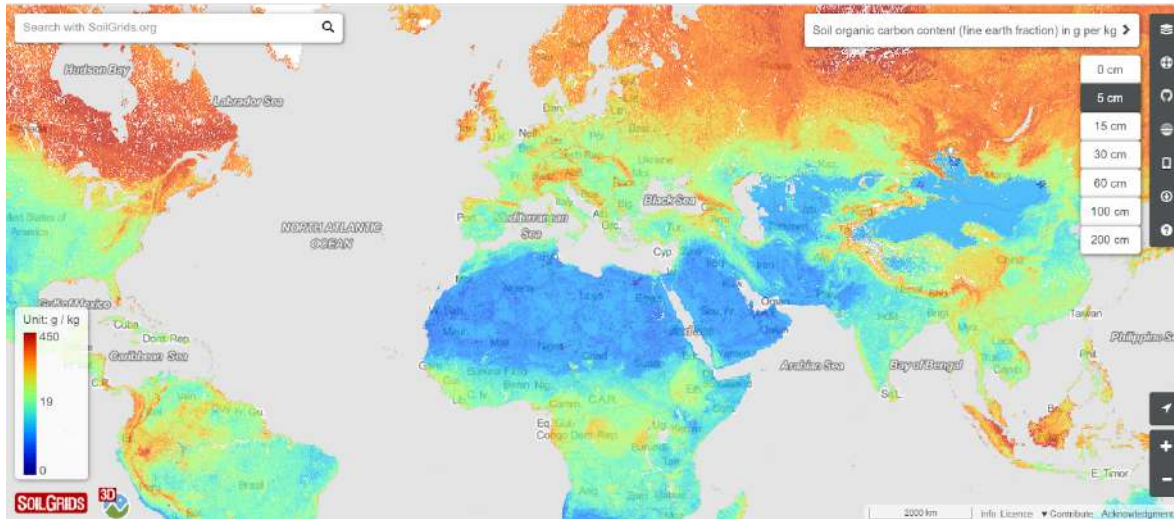
- Plant-O-Meter



Open-Access Data



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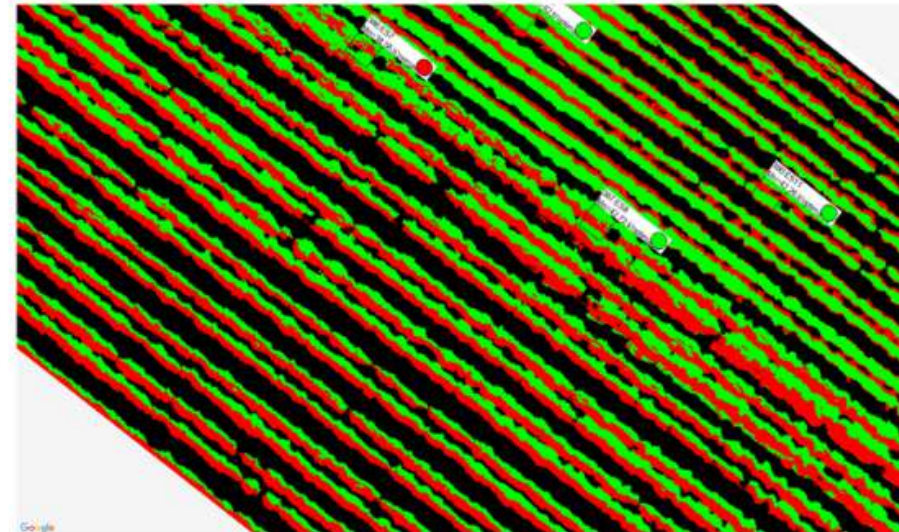
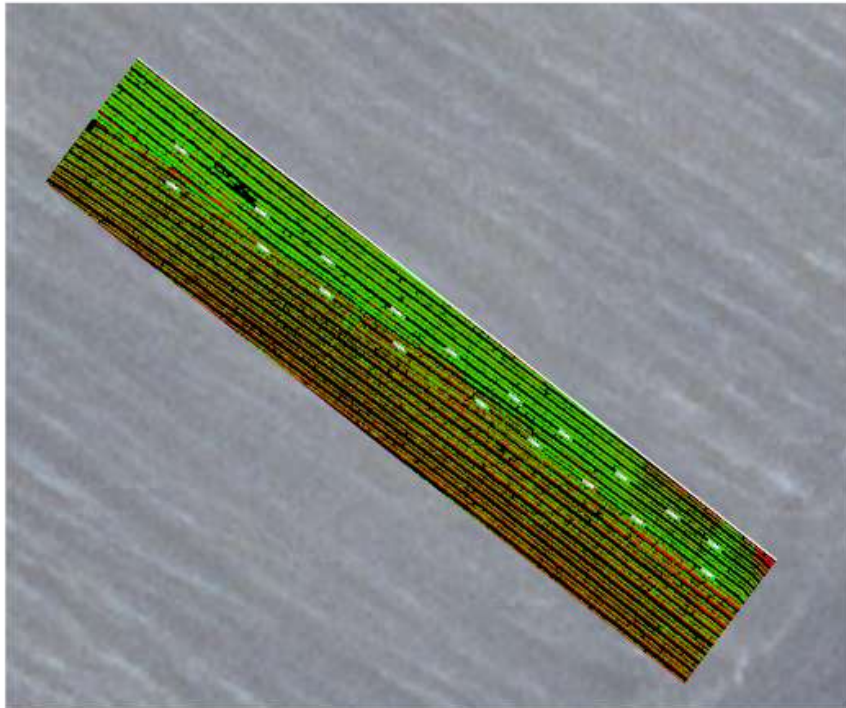


Drones



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- Hyperspectral image analysis

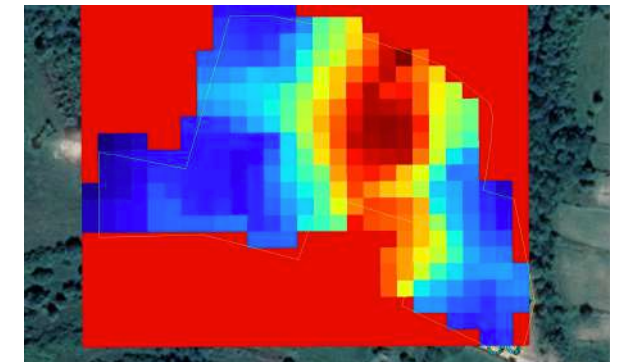
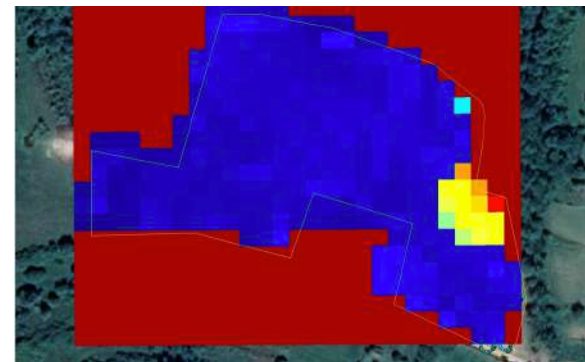
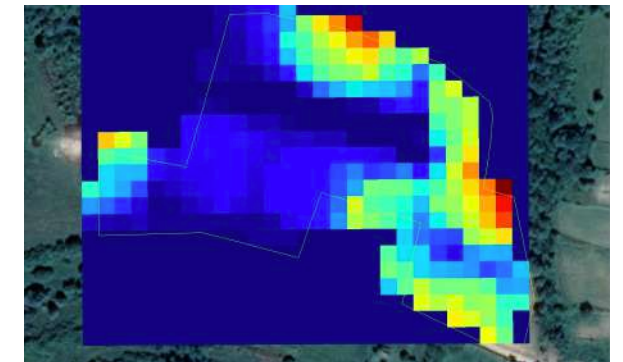
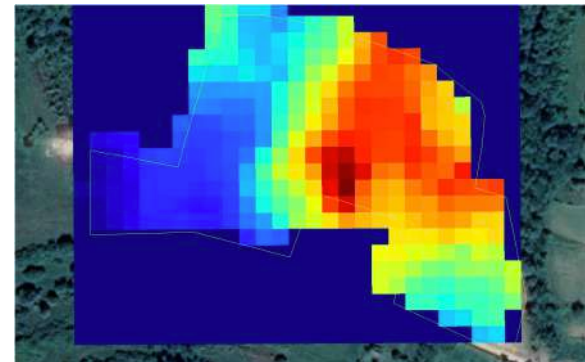


EM38 Probe



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- Electrical Conductivity

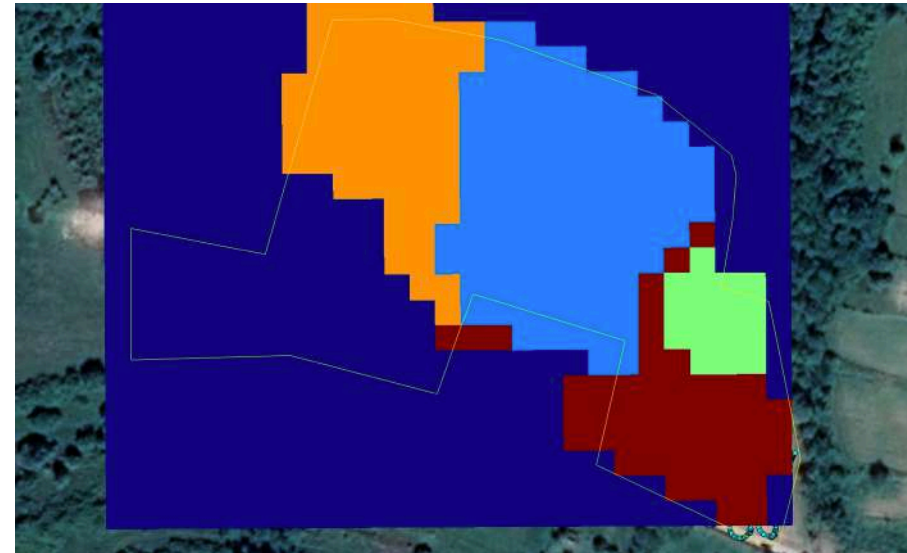
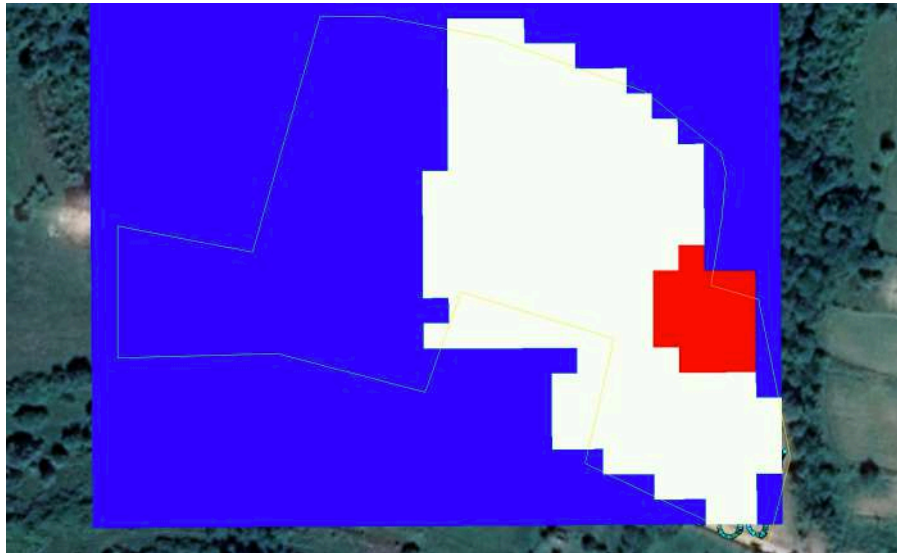


EM38 Zone Delineation



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- Choosing the optimal number of zones





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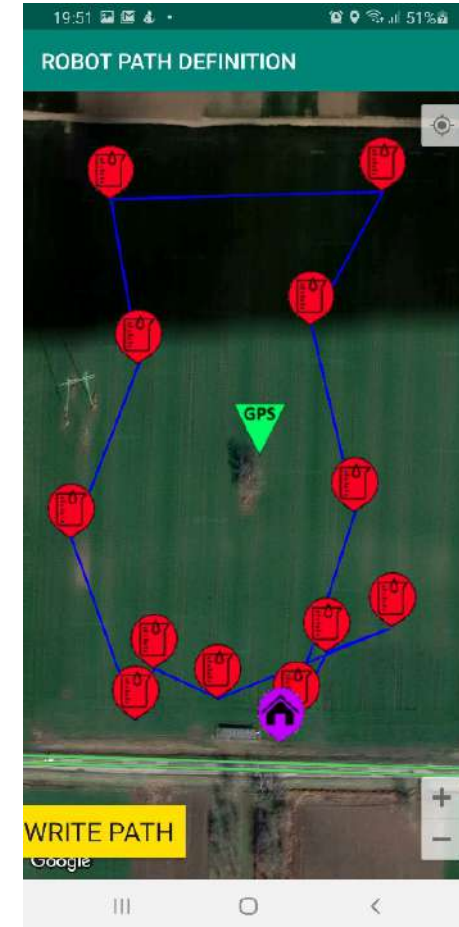
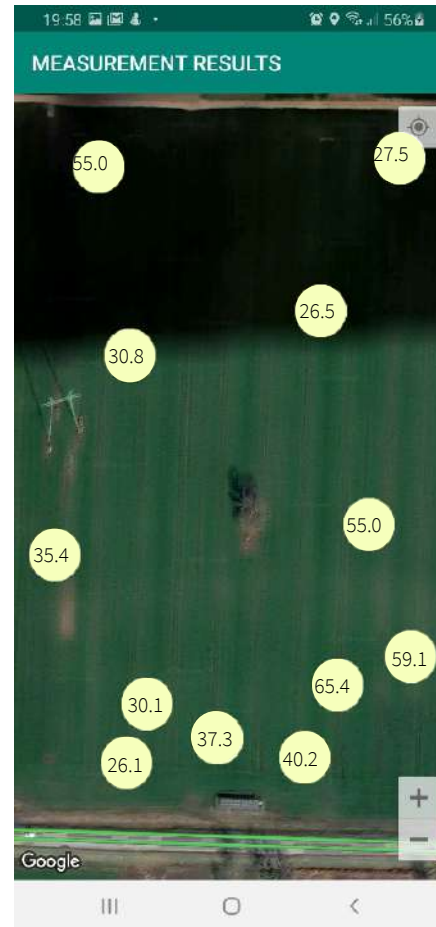
Assessment

Operation management tools



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- Smart scheduling
- Path optimization
- Planning of operations

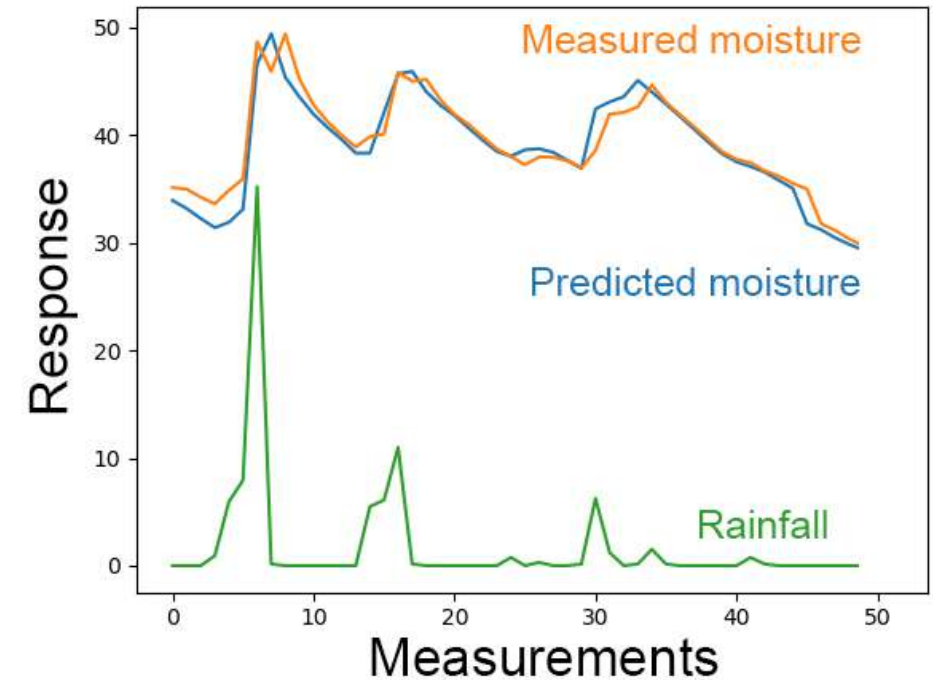


Decision-Support Systems



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- Plant irrigation needs assessment
- Sustainable fertilization planning
- Optimal pesticide application
- Expert knowledge and best practices





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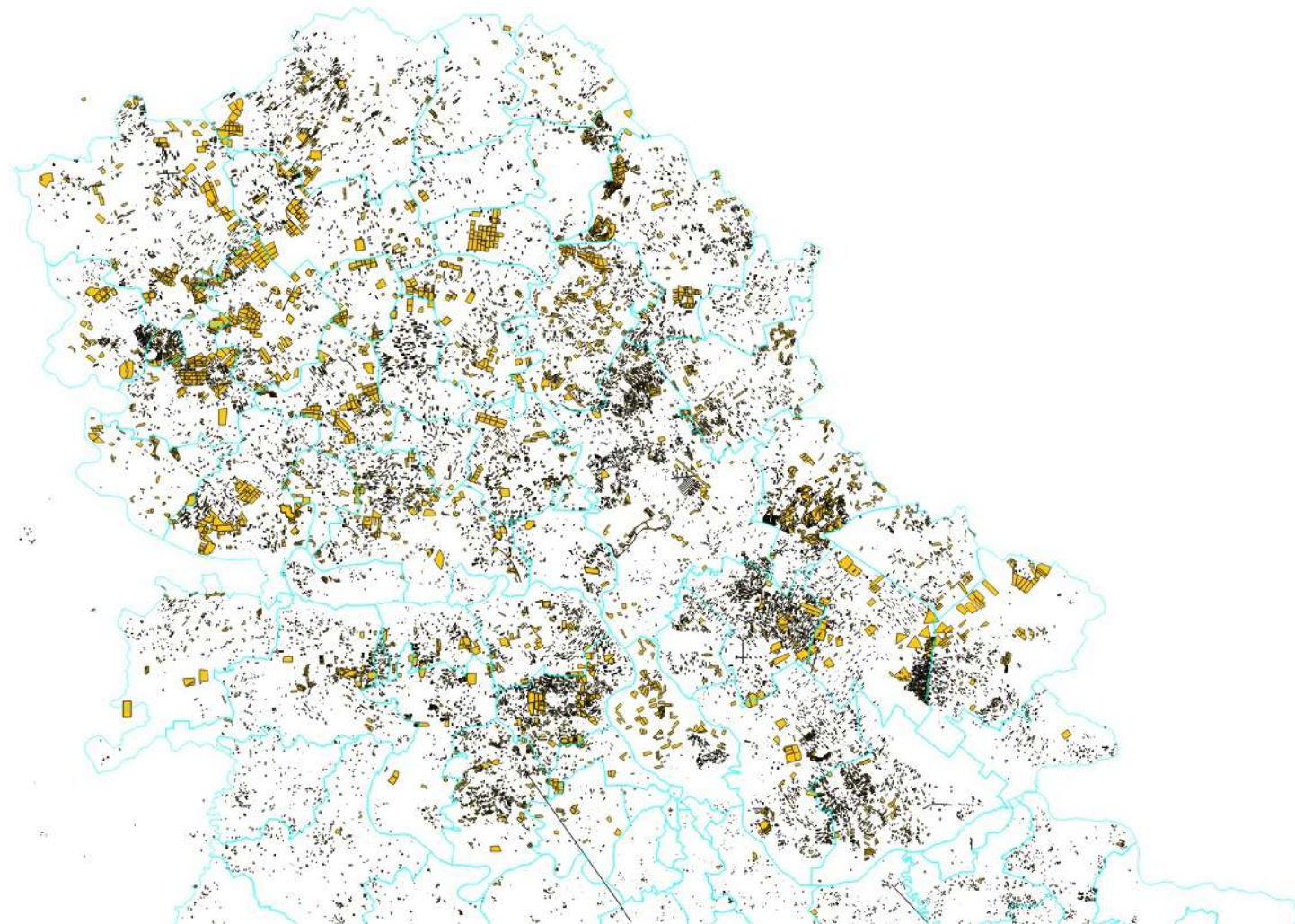
Action

- Flexible robots for intelligent automation of precision agriculture operations -

AgroSense



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AgroSense



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The screenshot shows the AgroSense web application interface. At the top, there is a dark blue navigation bar with the following items: a logo, 'Board', 'Parcels', 'Meteo', 'Costs', 'PIS', 'Technologies', 'FAQ', and 'About'. On the right side of the navigation bar, it says 'BioSens Institut | Premium' and a 'Log out' button.

On the left side, there is a 'Map operations' sidebar with the following options: 'Create parcel', 'Region' (with a dropdown menu showing 'NOVI SAD'), 'Catastar region' (with a dropdown menu showing 'FUTOG'), 'Parcel number' (with an input field containing '8711' and a search icon), and a link 'Don't know parcel number? Draw it!'. Below these are 'Find my parcel' and 'Pictures' options.

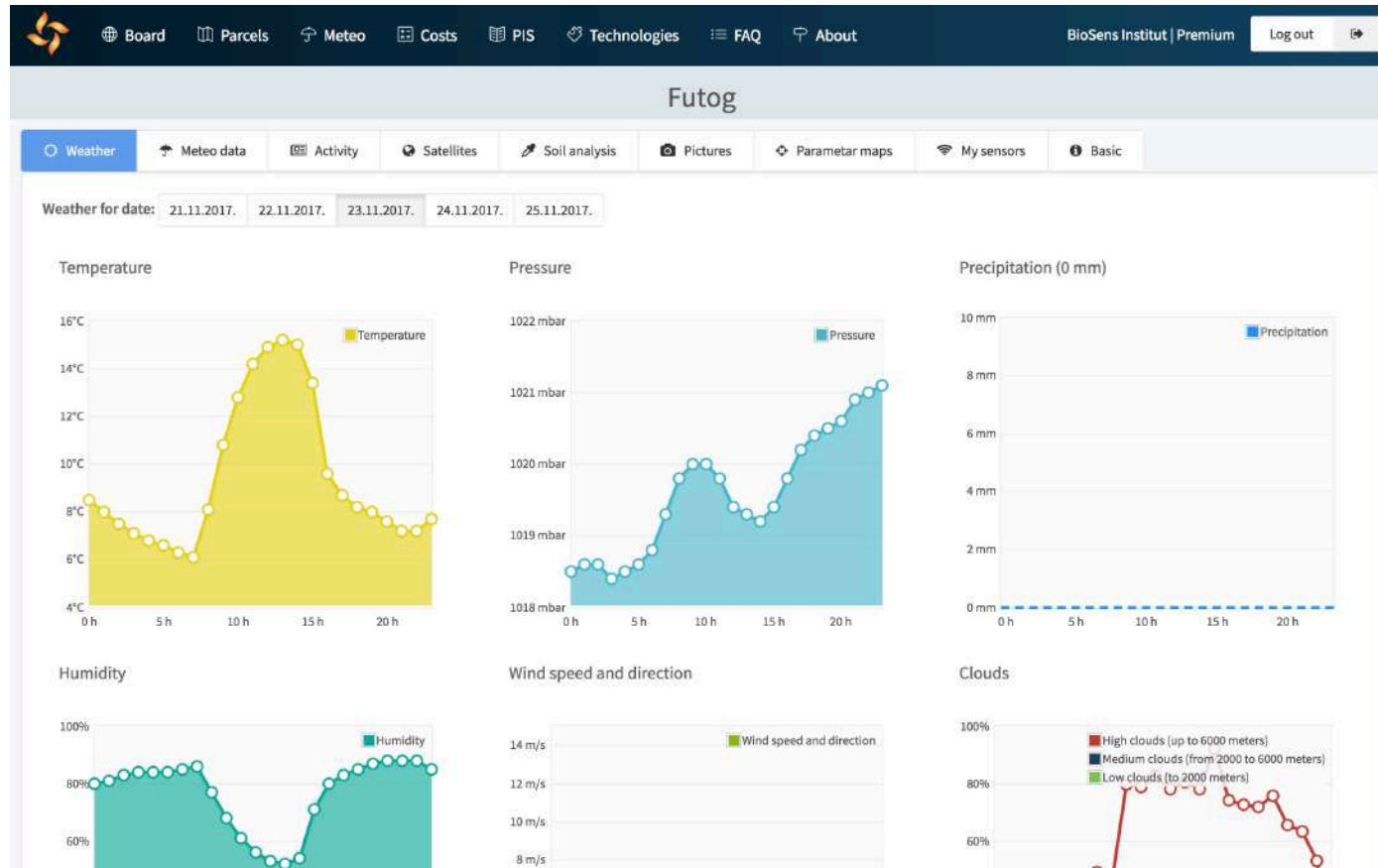
The main area is a satellite map showing a grid of parcels. One parcel is highlighted with a green border. A 'Selected parcel' popup is visible, listing the following parcel numbers: Parcel 8711, Parcel 8708, Parcel 8709, Parcel 8707, Parcel 8710, and Parcel 8681. At the bottom of the popup are 'Save parcel' and 'Cancel' buttons.

At the bottom of the page, there is a footer with '© 2017 - BioSens Institut - AgroSens v2.1.0' on the left and 'Terms and Conditions' on the right.

AgroSense



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Monitoring



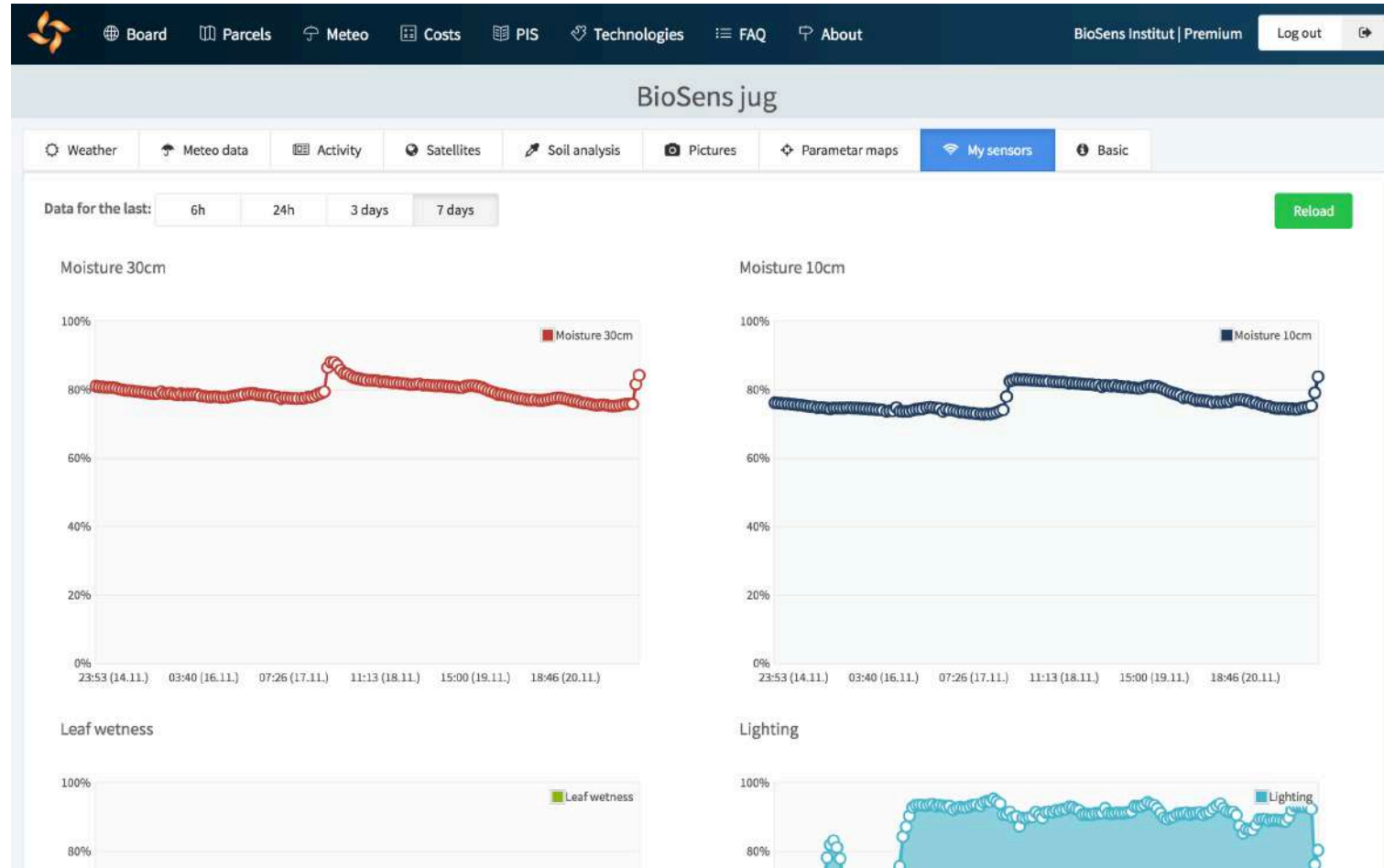
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AgroSense



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AgroSense



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AgroSense



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The screenshot displays the AgroSense web interface. At the top, a dark blue navigation bar contains icons for Board, Parcels, Meteo, Costs, Services, PIS, Technologies, and Tools, along with the text 'BioSens Institut' and notification icons. Below this is a secondary menu with tabs for Weather, Meteo data, Activity, Satellites (selected), Soil analysis, Pictures, Parametar maps, My sensors, and Basic. The main content area features a gallery of satellite images with dates from 04.06.2017 to 01.11.2017. Two large panels show detailed maps for 14.07.2017 and 03.08.2017. Each panel includes a zoom control (+/-), a legend checkbox, and a list of vegetation indices: RGB, NDVI, NDMI, EVI (30%), SR, NDWI, SAVI, and BURN. The 14.07.2017 map shows a field with a mix of green and orange, while the 03.08.2017 map shows a more uniform yellow-green field.

AgroSense



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Mapa Parcele Troškovi Usluge PIS Tehnologije Alati BioSens Institut

Ravno selo - pšenica

Vremenska prognoza Meteo podaci Aktivnosti Mape Zoniranje Analiza zemljišta Fotografije 0 parceli

Naziv
Zoniranje - test

Svrha zoniranja
Ljud u stanje useva

Osnova za zoniranje
Mapa parametara Vrsta
14.05.2020. RAVNOSELO_25M_1

Broj zona
2 zone 3 zone 4 zone

Sačuvaj Odustani

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Mapa Parcele Troškovi Usluge PIS Tehnologije Alati BioSens Institut

Ravno selo - pšenica

Vremenska prognoza Meteo podaci Aktivnosti Mape Zoniranje Analiza zemljišta Fotografije 0 parceli

Uvid u stanje useva - 3 zone

Uvid u stanje useva
Kreirano: 22.09.2020.
Broj zona: 3
Izvor: Dron snimak od 14.05.2020.
(RavnoSelo_25m_14052020)
Opis:
Unesite opis...

Grupa/zona br. 1
Zona: 20.38%
Površina: 0.14 ha

Grupa/zona br. 2
Zona: 49.35%
Površina: 0.35 ha

Grupa/zona br. 3
Zona: 30.26%
Površina: 0.21 ha

Preuzmi SHP

Izmeni Obrisi

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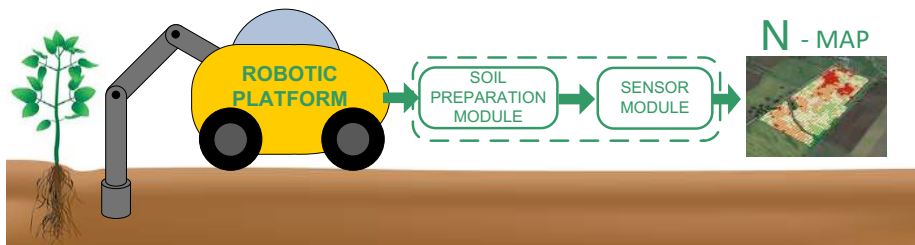
The screenshot displays the AgroSense web application interface. At the top, there is a dark blue navigation bar with icons for Board, Parcels, Costs, Services, PIS, Technologies, and Tools. Below this is a secondary navigation bar with icons for Weather, Meteo data, Activity, Maps, Parcel zoning (highlighted), Soil analysis, Pictures, and Basic. The main content area is divided into three sections: a left sidebar, a central map, and a right sidebar. The left sidebar, titled 'zoniranje', contains a 'Soil sampling plan' section with details like 'Created: 29.10.2020.' and 'Number of zones: 4'. Below this is a 'Description' field and a 'Show recommended sampling points' checkbox. A list of four zones is shown with their respective areas: Group/zone no. 1 (26.48 ha), Group/zone no. 2 (3.30 ha), Group/zone no. 3 (11.04 ha), and Group/zone no. 4 (23.16 ha). At the bottom of the sidebar are 'Download SHP', 'Edit', and 'Delete' buttons. The central map shows an aerial view of a field with a color-coded zoning overlay and numerous yellow sampling points. Labels on the map include 'Krivaja bungalov', 'СВЕТИ ВМЧ. Пантелејмон', and 'Vrhulje'. The right sidebar, titled 'Creating sampling tasks', lists several tasks with dates: 'Task for soil sampling 21-09-2020' (13.11.2020.), 'uzorkovanje' (29.10.2020.), 'uzorci' (29.10.2020.), 'uzorkovanje' (29.10.2020.) with a 'Show task points' checkbox, 'tacke_uroci' (29.10.2020.), 'Task for sampling 21-09-2020' (21.09.2020.), 'Sampling task 14-09-2020' (14.09.2020.), 'Sampling task 09-09-2020' (09.09.2020.), 'Sampling task 07-09-2020' (07.09.2020.), and 'Sampling task 21-08-2020'.

Soil Sampling



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- Drone + EM38
- Zone delineation (ML clustering)
- Optimal sampling points
- Field sampling
- Map generation

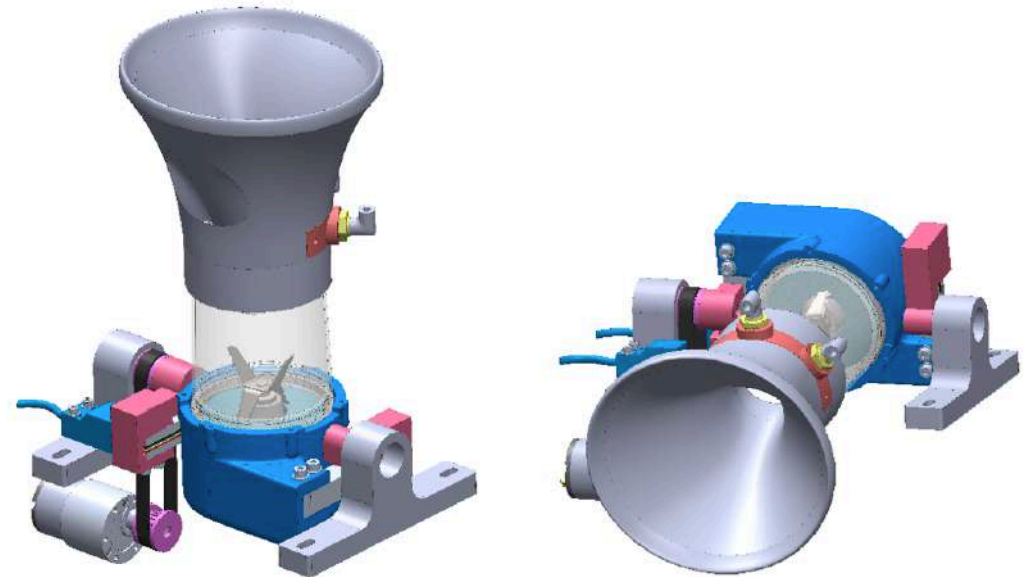


UGV Spraying

- Mixing with water
- Disposal

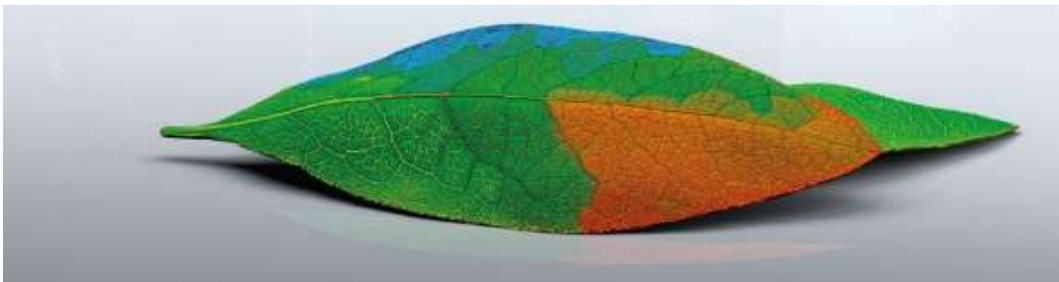


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UGV

- Precision spraying
- Operation management tools
- FMIS
- DSS
- Demonstration on the field



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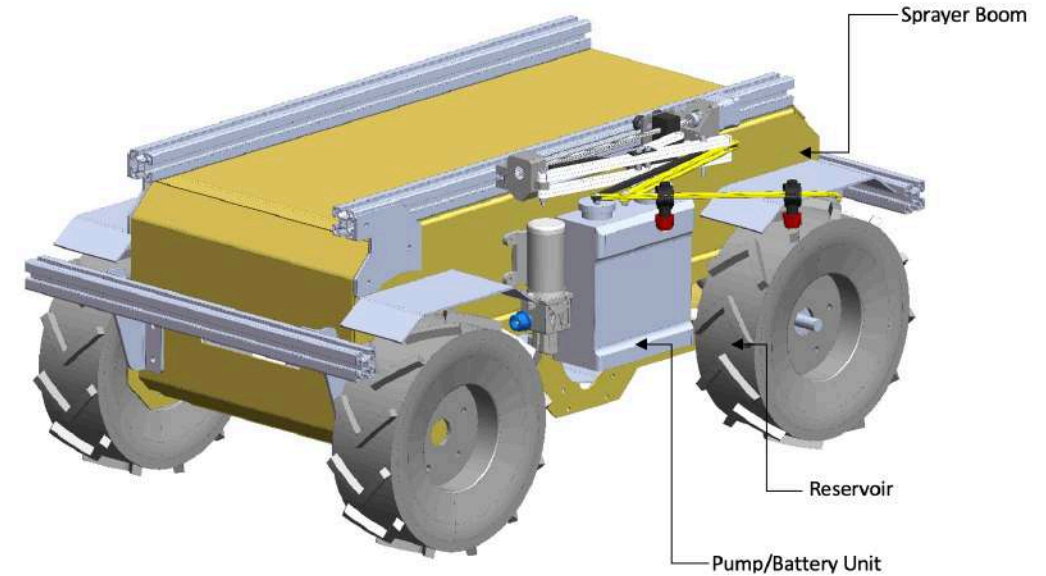
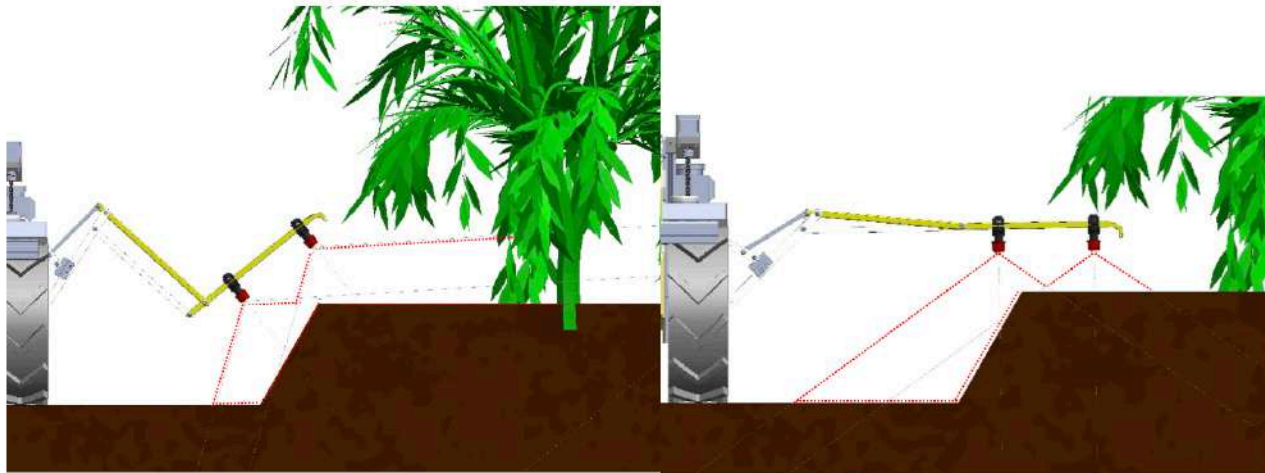


UGV Spraying

- Overview of the components
- Adjustable spraying angle



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