Alliance for AI, IoT and Edge Continuum Innovation

Webinar • 19 June 2025

AI and Robotics in Agriculture

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Context: future of EU agriculture

SEPTEMBER 2024

Strategic Dialogue on the Future of EU **Agriculture**

A shared prospect for farming and food in Europe

- *"Agrifood systems that are more resilient, sustainable, competitive, profitable, and just"*

- Produce **more food of high quality with less resources** and carbon footprint, protecting nature and biodiversity while fostering a globally sustainable and resilient farming sector.
  - *"the sector operates within planetary boundaries and contributes to the protection and restoration of the climate, ecosystems, and natural resources, including water, soil, air, biodiversity, and landscapes*

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AIOTI active role in the process
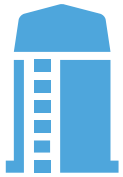
White paper: the role of 6G in agriculture (May 2024)

https://aioti.eu/wp-content/uploads/6GIA-AIOTI-White-Paper-Agriculture-Final.pdf
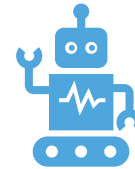
AIOTI input to the Strategic Dialogue on the Future of EU Agriculture

https://aioti.eu/wp-content/uploads/AIOTI-paper-for-strategic-dialogue-on-the-future-of-EU-agriculture-Final-240731.pdf

AIOTI input to the Vision for EU Agriculture and Food (Feb'2025)

https://aioti.eu/wp-content/uploads/AIOTI-input-to-the-EU-agriculture-vision-Final.pdf

White paper: use of robots and AI in agriculture

(in preparation)

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Role of digital technologies

From traditional agriculture to **precision agriculture**

- Integration of data-driven solutions, such as **sensors**, **autonomous robots**, **data analytics**, **AI**,… to optimize agricultural practices.

- Increase of **productivity** and **food quality**

- Reduction of **environmental impact**

Enabling novel farming techniques: **vertical farming**

- Fine control of **growth and health parameters**

- **Smart lighting**

- Maximisation of **productivity** and **food quality**

- Minimisation of **waste and environmental impact**

Environmental and biodiversity monitoring

- **Preservation** of landscapes and biodiversity (CAP)

- **Control** of biodiversity (species), soil health, pollutants, ilegal activities, forests…

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Main technology drivers

	Precision agriculture	Vertical farming	Environmental and biodiversity monitoring
Smart sensing and monitoring	XX	XXX	XX
Farm management systems	XXX	XXX	
Digital twins	XX	XXX	XX
AI for pattern identification, decision making, prediction, recommendation/advising, interfacing… (GenAI)	XXX	XXX	XX
Autonomous and cooperative machines/robots	XX	XXX	X
Surveillance			XXX

Data gathering, management, visualization, dashboard…

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Robotics in agriculture

Evolution of "big" ag machinery

- Intelligent systems
- Automation of agricultural operations (plants, animals)
- "Harversters"
- Monitors

already here

Autonomous tractors/appliances

Robotic milking machines

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Robotics in agriculture

Small-scale UxVs for automation of operations

- Lightweight platforms
- Low impact (e.g. soil compaction)
- Cost effective
- Energy efficient
- High granularity/precision

- Sensor-equipped
- Actuators embedded
- Autonomous operation

Prototypes, first deployments

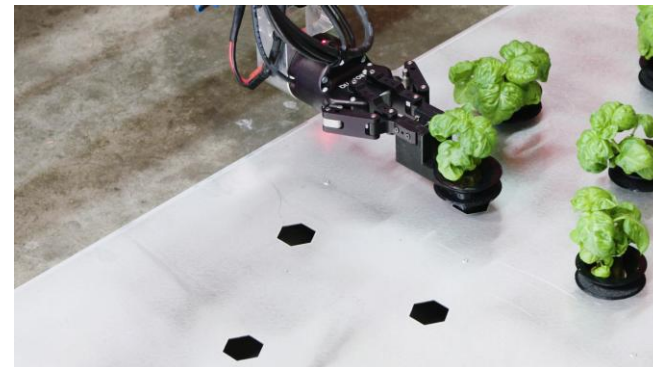UAV - Spraying of fertilisers

UGV - Crop monitoring

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Robotics in agriculture

Precision robotics

- High-precision, delicate handling
- Selective harvesting
- Prunning
- Grafting
- Seeding
- …

Prototypes, coming soon

Selective picking

Seeding (hydroponic farming)

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Robotics in agriculture

Cooperative robots

- Coop with humans: augmenting workers instead of replacing
- Coop with other robots (swarm robotics)
    - Higher efficiency
    - Larger coverage

Research in progress...

Harvesting and prunning cobot for grapes

Fleet of weed removers

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Requirements in agriculture robotics relevant to 6G networks

◎ Accurate geo-location (indoor and outdoor)

👤 Autonomous decision making – sensing and computing

👥 Safe operation in collaborative environment (esp. with human workers)

🖧 Inter-machines communication (incl. sensors) to enable cooperation

🤖 Reliable communications for remote control of autonomous robots and actuators

🖥 High-throughput communications for multisensorial data (including image/video)

🔒 Cybersecurity

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Relevant 6G enablers

Global coverage

Remote areas

Terrestrial and NTN networks

Low-latency and reliable (machine-type) communication

Dense networks

Safety

Edge computing

Faster response for decision making

Scalability

AI as a service

Offer native AI solutions taking into consideration reliability, trust, energy-efficiency, etc.

Integrated sensing and communications

Communications, sensing, positioning

Sustainability

- Energy efficiency:
  - Comms networks
  - Computation (ML and AI)
  - Sensors and actuators
- Environmentally friendly electronics

Thank you for listening