



Lesson 1:

Introduction to Smart Farming and Drones in Agriculture

Smart Farming with Drones

Drones4STEM © 2023 by Drones4STEM is licensed under CC BY-NC-SA 4.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc-sa/4.0/>



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Lesson Objectives

Understand the basics of smart farming



Introduction to drone technology and its applications
in agriculture.

Hands on activity

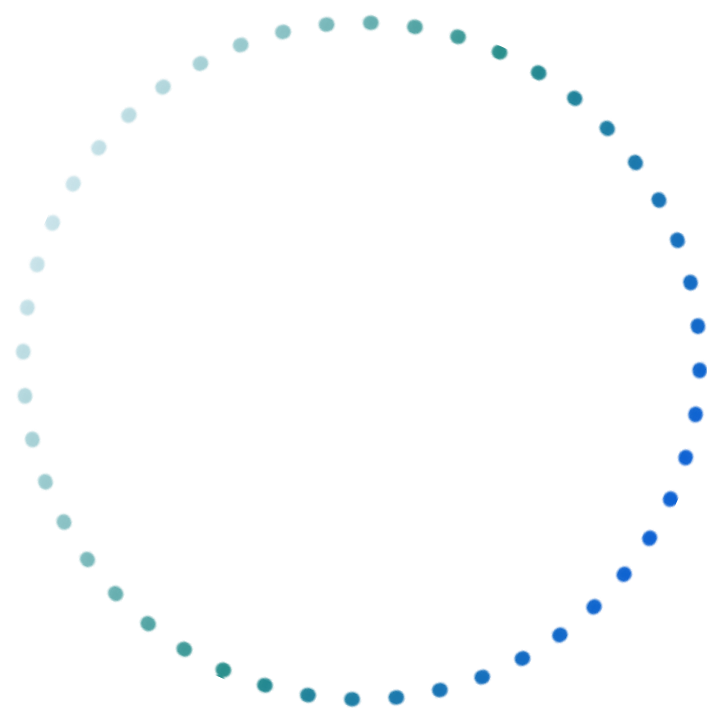


TOPICS

- Introduction to smart farming
- How drones are used to agriculture
- Benefits of using drones in agriculture
- Future of drones in agriculture
- Use cases

What is smart farming

Smart farming, also known as precision agriculture, leverages advanced technology to improve the efficiency and effectiveness of agricultural practices



Examples of Smart Farming Technology

- Sensors : Soil moisture sensors, weather stations.
- IoT Devices: Connected devices for real time monitoring
- Drones: Used for aerial imaging and monitoring.
- Data Analytics: Software tools to analyze and interpret data.

How drones are used in agriculture

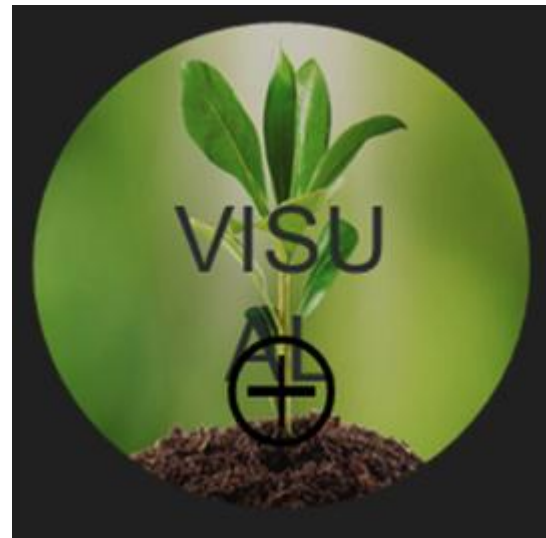
- Crop Monitoring:
 - Identify issues such as pest infestations, diseases, and nutrient deficiencies early.
 - Use multispectral and thermal cameras to gather detailed information.
- Health Assessment:
 - Assess plant health by analyzing color and heat patterns.
- Use NDVI (Normalized Difference Vegetation Index) to measure vegetation health.
- Soil and Field Analysis:
 - Create detailed maps of soil properties and field variations.
- Plan and manage irrigation systems based on soil moisture data.



Sensors Used In Agricultural Drones

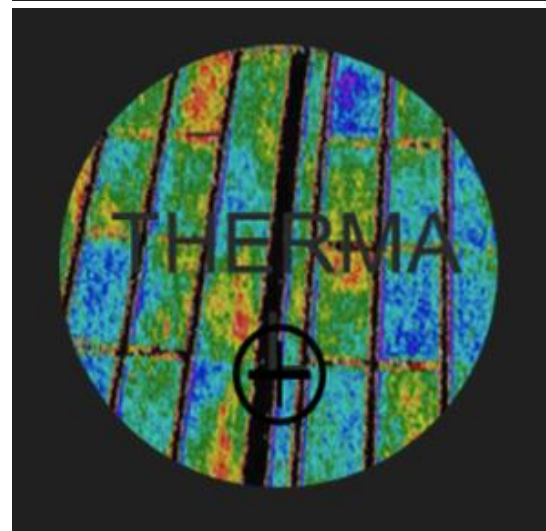
- Visual:

- Aerial mapping
- Imaging
- Plant counting
- Surveying



- Thermal:

- Heat signature detection
- Livestock detection
- Surveillance
- Water source detection
- Emergency response



- Hyperspectral:

- Plant health measurement
- Water quality assessment
- Vegetation index calculation
- Full spectral sensing
- Spectral research and development



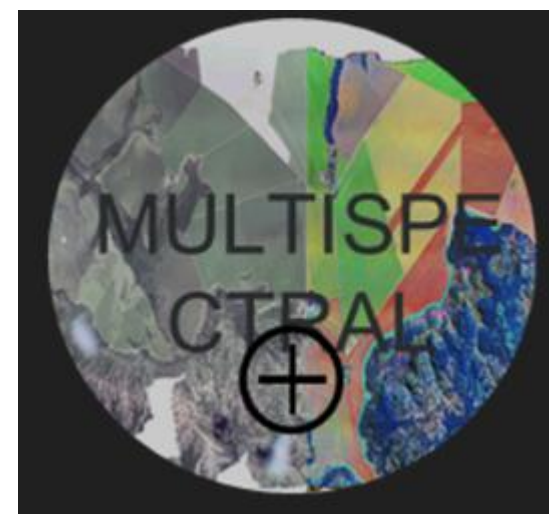
- LiDAR:

- Useful in 3D digital surface modelling
- Surface variation detection
- Flood mapping
- Short range



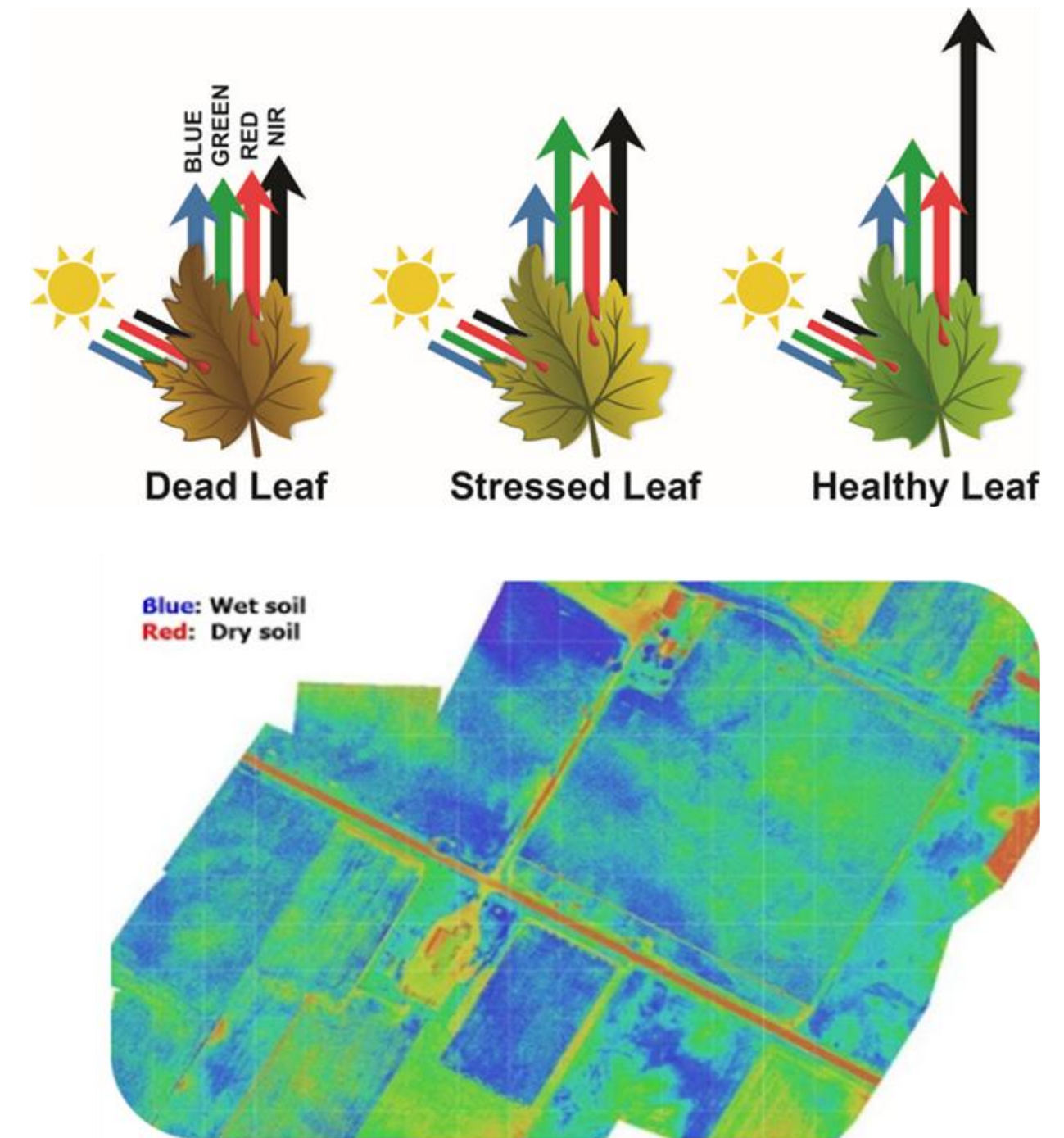
- Multispectral:

- Plant health measurement
- Water quality assessment
- Vegetation index
- Plant counting



Sensors Used In Smart Farming

- Drones equipped with special imaging equipment called Normalized Difference Vegetation Index (NDVI).
- Software analysis can be used to change values to reflect the crop type and even its growth stage.
- Drones provide accurate field mapping.
- Field elevation data helps identify drainage patterns and wet/dry spots for better watering strategies.



Sensors Used In Smart Farming

Planting and Seeding:

- Automated drone seeders are used in forestry industries.
- Drones can replant hard-to-reach areas without endangering workers.



Spray Application:

- Crop spraying drones carry large liquid storage reservoirs and can be operated more safely.
- Operated and maintained at a fraction of the cost compared to crop dusters.



Sensors Used In Smart Farming

Security:

- Drones monitor far reaches of farms, allowing more frequent checks in hard-to-reach areas.
- Monitoring remote areas that took hours can now be done in minutes.



Drone Pollination:

- Researchers in the Netherlands and Japan are developing drones for plant pollination without damage.
- Goal: Autonomous drones that monitor crop health and pollinate without operator input.

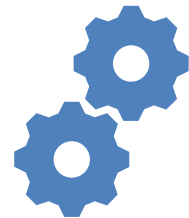


Sensors Used In Smart Farming

- Using microwave sensing, drones capture highly accurate soil health information.
- Water can be distributed efficiently across a field to conserve resources.
- Commonly used sensors in drone irrigation:
 - Multispectral Sensor
 - Lidar Sensor
 - Thermal Sensor
 - Hyperspectral Sensor



Benefits of using drone in agriculture



Increased Efficiency:
Optimizes use of resources.



Higher Yields: Improves
crop production.



Sustainability: Reduces
environmental impact.



Cost Savings: Lowers
operational costs.

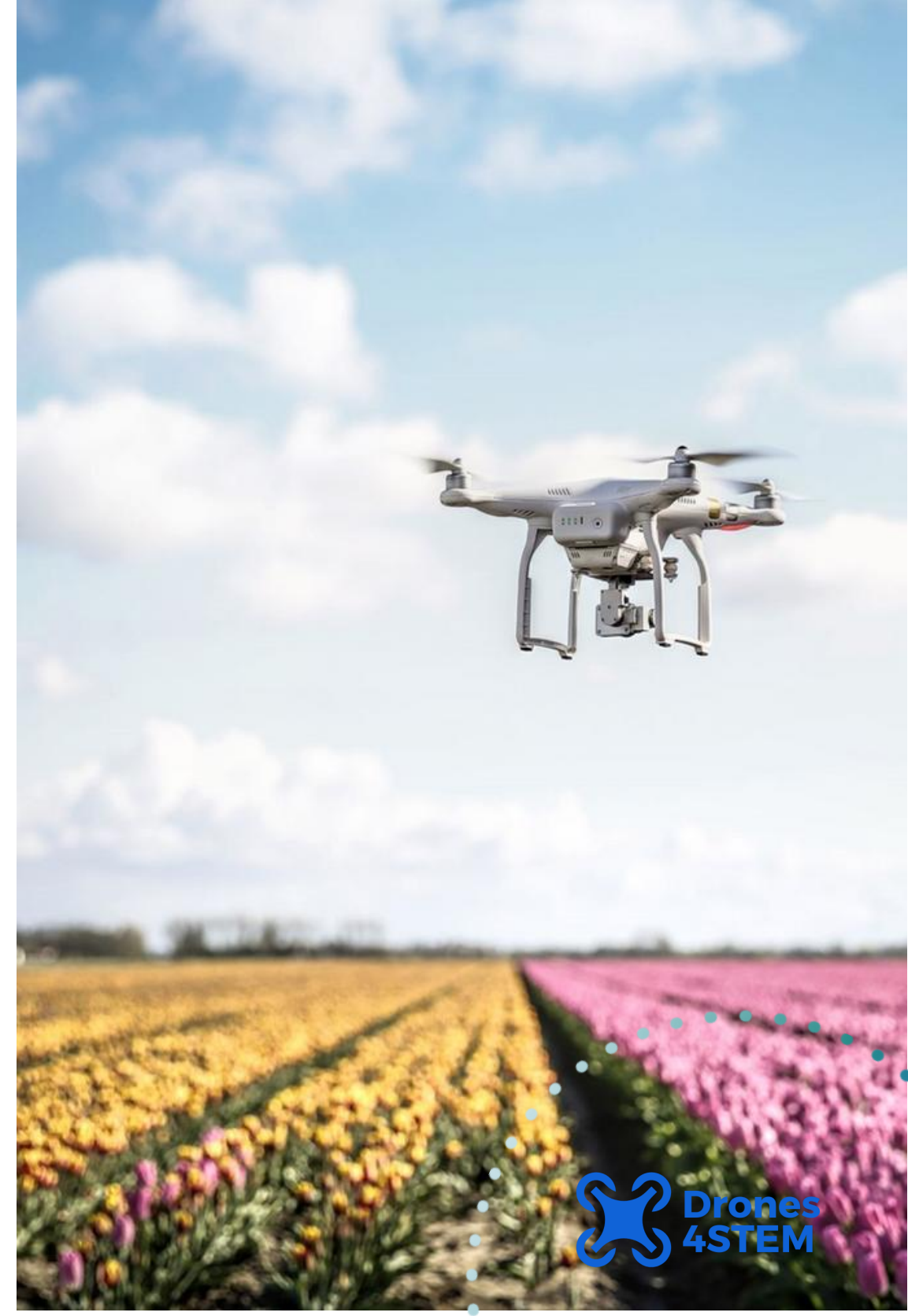
Benefits of using drone in agriculture

- Time-Saving: Cover large areas quickly.
- High Precision: Provide accurate data.
- Cost-Effective: Reduce manual labor.
- Enhanced Data Collection: Gather difficult-to-access data.



Future Of Drone In Agriculture

- AI-driven drones can interpret environmental data, allowing them to make independent decisions about crop spraying, irrigation, and health monitoring.
- Automation for tasks like planting and harvesting.
- Improvements in battery technology are extending drones' endurance, allowing for longer flight times and greater range.



Use cases

Efficiency in Water Usage in Avocado Orchards:

Through thermal imaging and **NDVI** analysis, an avocado orchard was able to optimize its irrigation schedules and reduce water usage while maintaining, and in some areas improving, fruit yield and quality. This was particularly crucial during a drought, helping the orchard maintain sustainability and profitability.



USE CASES

A new vineyard project aims to create an open-source initiative for data integration which could potentially revolutionise wine production in the UK and globally.



Real World Applications

- Precision farming: Identifying and addressing problem areas in crops.
- Automating data collection to save time and resources.
- Leveraging drones to improve agricultural efficiency and sustainability.

What are your questions?



Additional Resources

Further Reading

<https://www.croptracker.com/blog/drone-technology-in-agriculture.html>

Videos

<https://www.youtube.com/watch?v=263dJ7Fm>



Thank you for your
attention !



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.