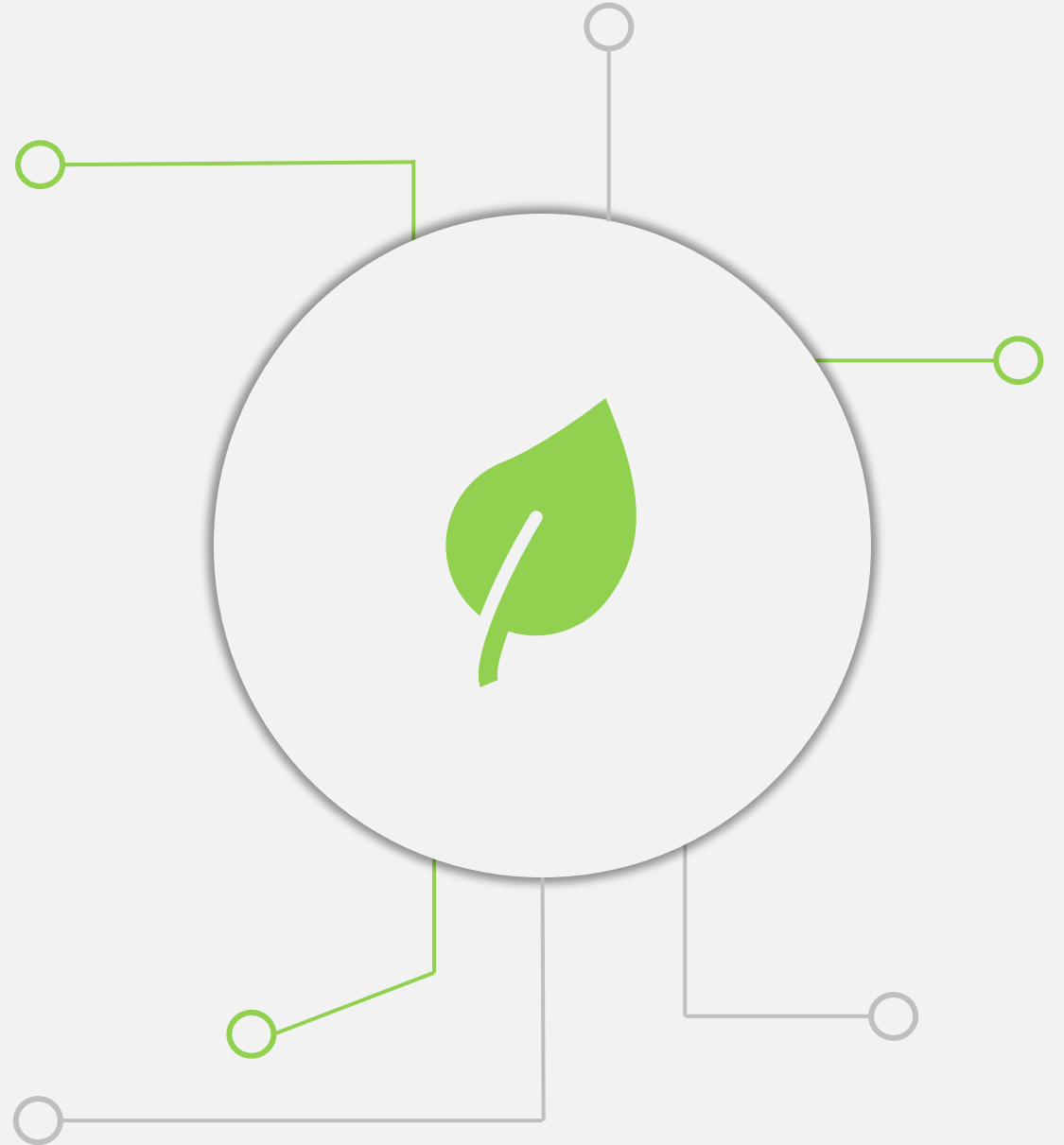


IoT in Agriculture

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Why IoT?

IoT technology integrates **sensors**, **data analytics**, and **automation** in agricultural practices. It enables farmers to:

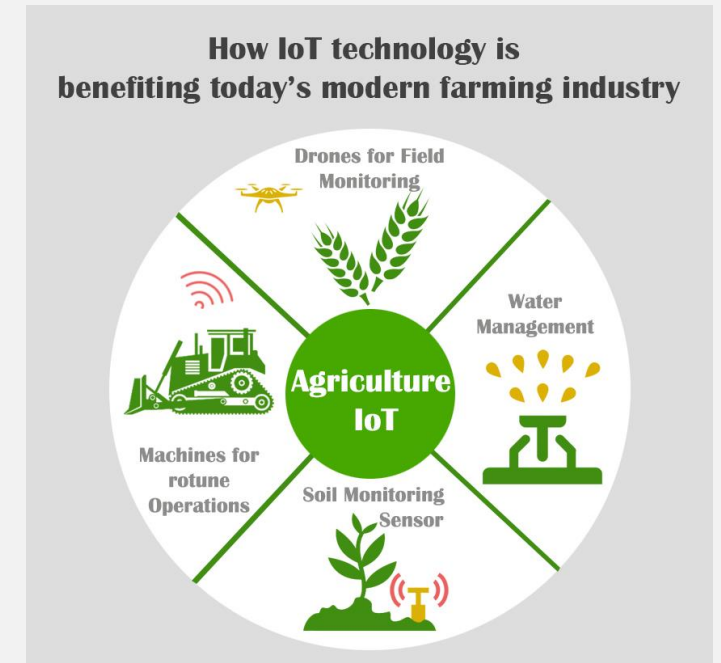
- monitor environmental conditions
- optimize resource usage
- make data-driven decisions, for example re-organize the water or other resources distribution

Nowadays the biggest **obstacle** that prevents farmers to use those technologies are the **costs** (of sensors) and problems linked to the **infrastructure** that would not allow to have a fast and functional transmission of the data



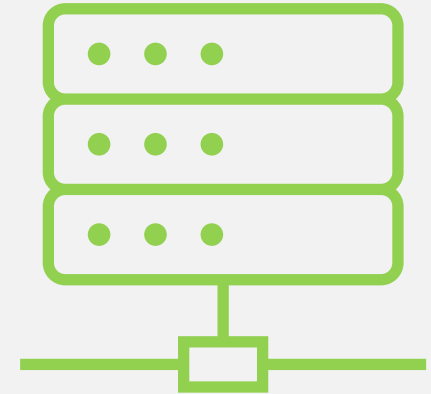
Sensor networks

- Consist of various sensors deployed in fields to monitor **soil moisture, temperature, humidity**, and other parameters. These sensors provide real-time data on **crop health** and environmental conditions
- Sensors can also be **attached to machinery** or integrated into agricultural equipment
- Sensor data helps farmers **make informed decisions** about irrigation, fertilization, and pest management, leading to higher crop yields and reduced resource wastage.
- Examples: sensors commonly used in agriculture include soil moisture sensors, weather stations, and drones equipped with multispectral cameras.



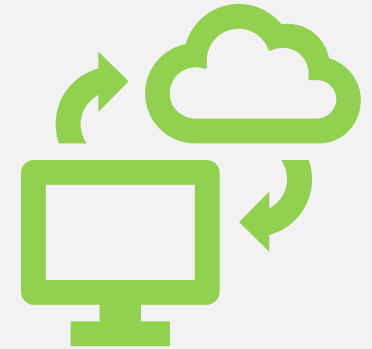
Data collection

- Sensor data is collected by sensors deployed in the field and transmitted wirelessly to a **central hub** or **cloud-based** platform for storage and analysis.
- Since those data can be taken **real-time**, their transmission enables farmers to monitor and respond to changing conditions **promptly**
- Examples of wireless communication technologies applied are **Wi-Fi**, **LoRaWAN**, and **cellular networks** are used for data transmission in agricultural IoT systems.



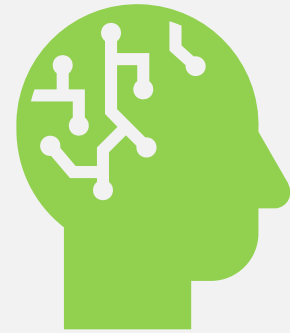
Cloud-based platforms

- Cloud-based platforms provide (de-)centralized **data storage, analysis, and visualization** tools (for example, through dashboards) for agricultural IoT applications. They enable farmers to access and manage sensor data from anywhere using web-based interfaces
- Cloud platforms facilitate data-driven decision-making, collaboration, and scalability in agricultural operations, even for non-experts in IT



Decision Support Systems

- Decision support systems (DSS) analyze sensor data using advanced analytics and machine learning algorithms to provide **actionable insights** and **recommendations** to farmers
- DSS help farmers optimize **irrigation schedules**, **predict crop diseases**, and improve **resource allocation** based on real-time data, leading to higher productivity and profitability, also for the ecosystem



Automation systems

- The results of the analysis seen before can be **implemented in practice** by automation and control systems, such as irrigation, fertilization, and pest control, **based on sensor data** and predefined rules
- Automation improves **efficiency**, reduces **labor costs**, and ensures timely and precise execution of tasks, leading to better crop health and higher yields
- Examples: automated irrigation systems and robotic harvesters



IoT Challenge: Data Analysis

- Data analysis is challenging due to the volume, variety, and velocity of sensor data generated in agricultural IoT systems.
- Effective data analysis enables farmers to identify **trends**, **patterns**, and **anomalies** in sensor data, leading to better decision-making and improved agricultural practices
- Also, research can apply in this area: it explores techniques for predictive modeling, anomaly detection, and optimization of agricultural processes based on sensor data.



IoT Challenge: Security

- Security is a major concern due to the risk of data breaches, cyber-attacks, and **unauthorized access to farm equipment** and infrastructure
- Ensuring data privacy and cybersecurity is essential to protect sensitive information and maintain the integrity and reliability of agricultural operations
- Researchers in this area focus on developing robust authentication, encryption, and intrusion detection mechanisms specifically for agricultural IoT systems



Thanks for your attention

Link and sources used for this presentation:

- <https://external-content.duckduckgo.com/iu/?u=http%3A%2F%2Finfiniteinformationtechnology.com%2Fwp-content%2Fuploads%2F2017%2F06%2FP061a.-IoT-Agriculture.jpg&f=1&nofb=1&ipt=736d088bcf5a948470b535618084cffbcafc49a88028bd129829d3c7f6cb4e18&iipo=images>
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