smart skills
smart sustainable agriculture

Course 6: Bringing Innovation to Farms

M1: Introduction to Control Systems

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What will you learn?

This module aims to provide you with a comprehensive **introduction to control systems in agriculture**. It will explore the essential components of **automated systems**, such as sensors, controllers, and actuators, and how they work together to optimise farming operations. You will gain a clear understanding of SCADA and PLC systems, discovering their roles in enhancing efficiency, precision, and productivity across various agricultural tasks, from irrigation to crop monitoring. By the end, you will be able to **appreciate the impact of automation on modern farming practices** and its potential to revolutionise the industry.

Understand…

…the role and importance of control systems in modern agriculture.

Identify…

…key components of control systems, including sensors, controllers, and actuators.

Explain…

…the basic functions of SCADA and PLC systems in farm automation.

contents

This module is about how SCADA and PLCs automate agriculture, optimising irrigation, climate control, and livestock management. By integrating sensors, controllers, and actuators, these technologies enhance efficiency, reduce labour, and improve sustainability.

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01

CONTROL SYSTEMS

What are Control Systems?

Control systems in agriculture use **automated technologies** to manage farming operations without direct human intervention. These include:

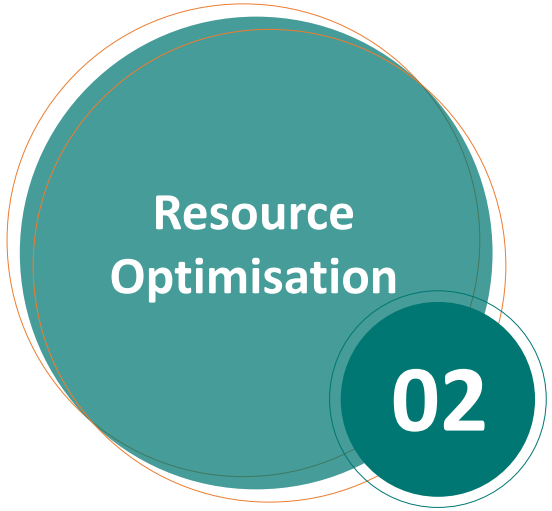
- **Supervisory Control and Data Acquisition (SCADA),**
- **Programmable Logic Controllers (PLCs),**
- **Automation technologies,**

which integrate sensors, controllers, and actuators to optimise processes. They are widely used in irrigation, livestock management, greenhouse control, and precision farming.

How does automation improve farming efficiency?

Automation enhances efficiency by reducing labour demands, improving precision, and optimising resource use, resulting in higher productivity and sustainability. By streamlining operations and minimising waste, farms can lower costs while ensuring more resilient and environmentally friendly agricultural production.

Smart irrigation and automated feeding systems help conserve water and energy, reducing environmental impact.



Precision farming techniques ensure efficient use of inputs, maximising yields while minimising waste.

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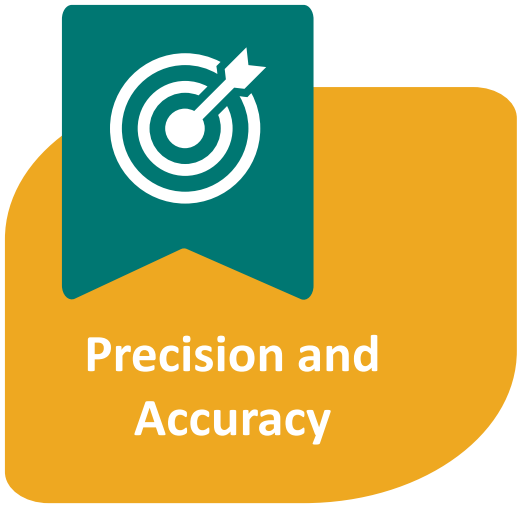
How does automation improve farming efficiency?

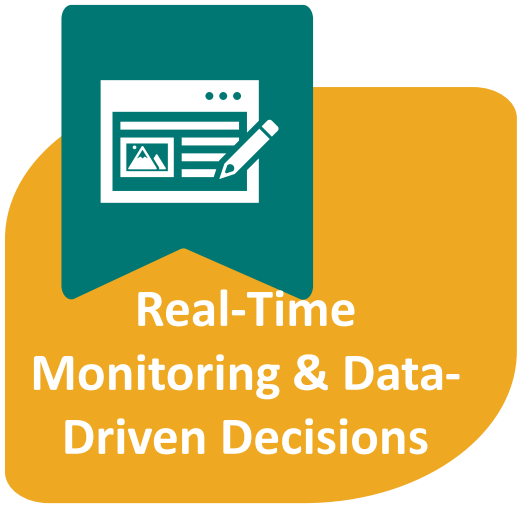


Precision and Accuracy

Automated systems, such as drones and robotic machinery, ensure precise application of inputs like water, fertilisers, and pesticides, minimising waste and environmental impact.

Labour Efficiency

Automation reduces the need for manual labour in repetitive and physically demanding tasks, allowing farmers to focus on strategic decision-making.



Real-Time Monitoring & Data-Driven Decisions

IoT sensors and SCADA systems provide real-time data on soil conditions, crop health, and livestock well-being, enabling timely interventions and better resource management.

Increased Safety

Technologies like unmanned aerial vehicles (UAVs) and autonomous sprayers help reduce human exposure to hazardous chemicals and unsafe working conditions.

02

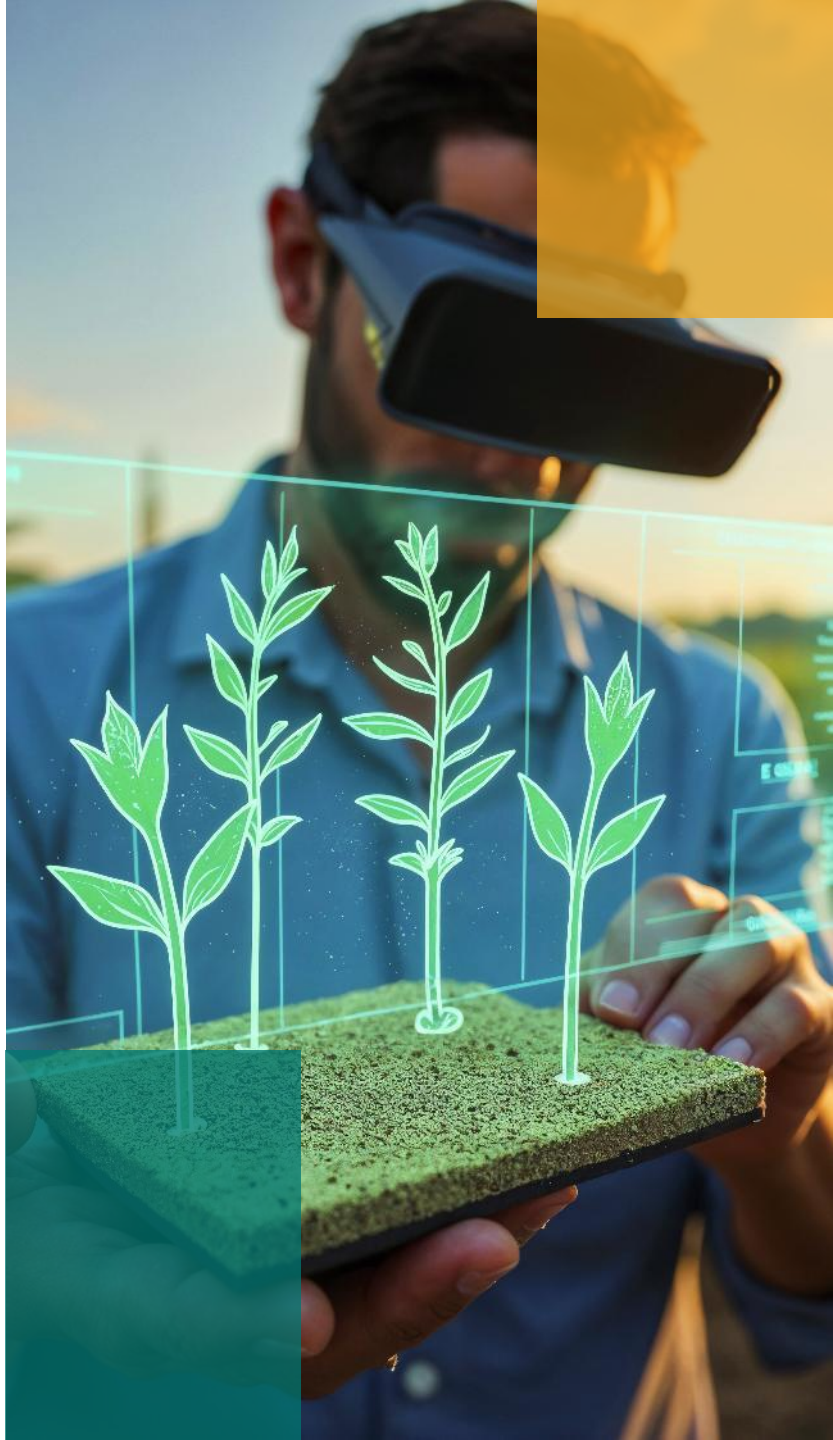
SCADA & PLC SYSTEMS

SCADA Control Systems

SCADA (Supervisory Control and Data Acquisition) is a centralised system that monitors and controls farming operations like irrigation, greenhouse climate, and livestock management in real time.

- **Enhanced Efficiency and Automation:** SCADA automates irrigation, climate control, and feeding, reducing labour, optimising resources and boosting productivity.
- **Remote Monitoring and Decision-Making:** Farmers can remotely monitor farm conditions via SCADA's interface, accessing real-time data on soil, temperature, and equipment for precision management. This enables timely interventions, reduces costs, and ensures precision in farm management.

➔ More information on SCADA

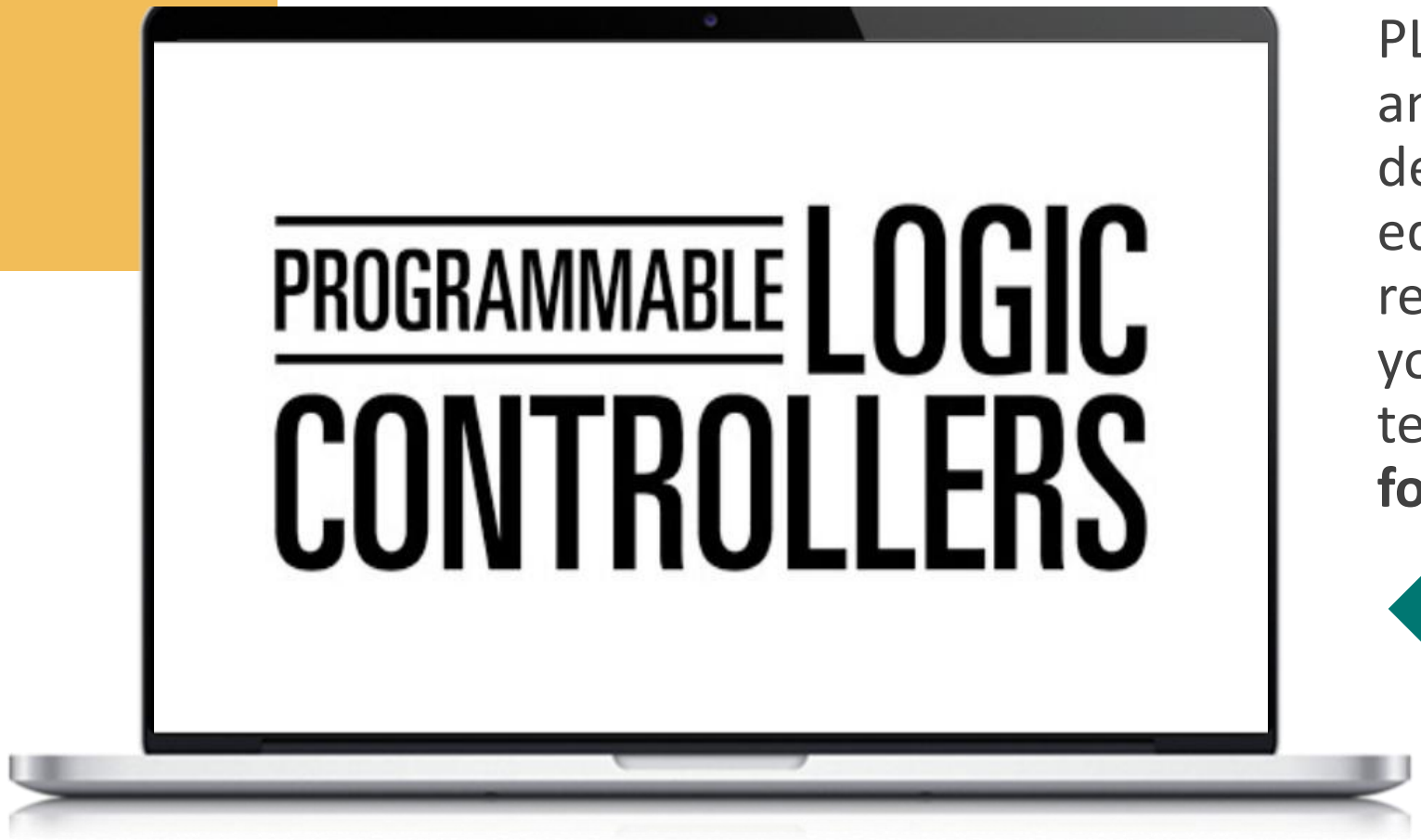


PLC Control Systems

Programmable Logic Controllers (PLCs) are industrial computers that automate key agricultural processes like irrigation, climate control, and livestock management, ensuring precision and efficiency.

- **Reliable and Customisable Automation:** PLCs automate water distribution, fertilisation, and greenhouse adjustments, allowing tailored control for improved yields. Their flexibility allows farmers to tailor automation to specific crop or livestock needs, improving yield consistency.
- **Real-Time Monitoring and Quick Response:** Sensors collect real-time data on soil, temperature, and humidity, enabling automated adjustments that reduce errors and conserve resources. The system then automatically adjusts operations based on preset parameters, reducing human error, conserving resources, and ensuring optimal growing conditions.

PLC Control Systems



PLCs can integrate with IoT devices and AI-driven analytics to enhance decision-making, predict equipment failures, and optimize resource allocation in real time. If you want to learn more about the technology of PLCs, **click on the following video.**

Programmable Logic Controllers

03

AUTOMATION BASICS

What is Automation in Agriculture?

Agricultural automation has progressed from simple mechanisation, which primarily aids in performing tasks, to advanced digital technologies that automate diagnosis and decision-making. Modern systems, including sensors, AI, and robotics, enable precise, data-driven farm management by integrating all three phases of agricultural operations. This evolution enhances productivity, optimises resource use and improves environmental sustainability by reducing waste and increasing efficiency.

Check out this video for more information!

Key Components of Automation in Agriculture

Automation in agriculture relies on **three components** that work together to optimise farming operations with minimal human intervention.

SENSORS → Measure environmental and operational variables such as soil moisture, temperature, humidity, light levels, and livestock health. They collect real-time data, providing the foundation for automation.

CONTROLLERS → Process sensor data and make decisions based on predefined algorithms or AI models. They send commands to actuators to adjust farming operations automatically.

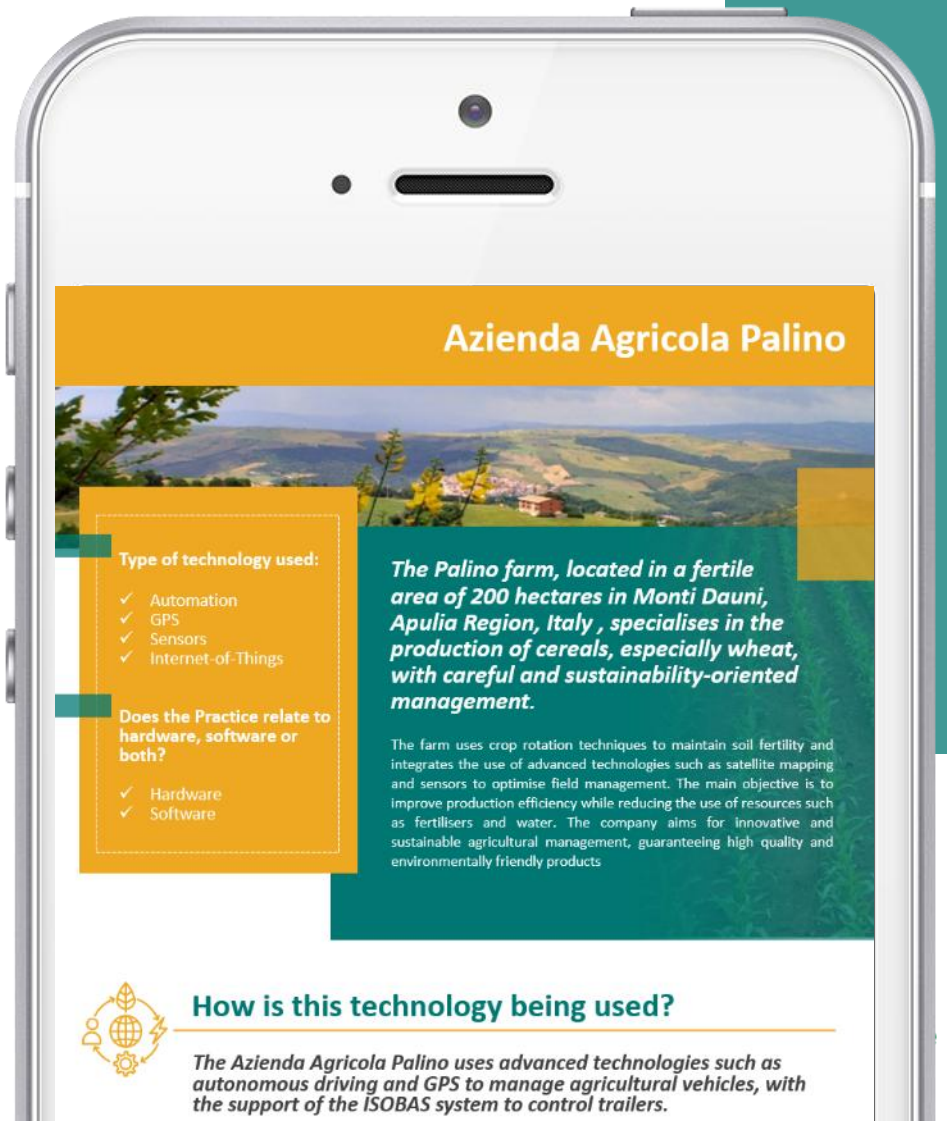
ACTUATORS → Carry out physical actions based on controller signals. Examples include opening irrigation valves, adjusting greenhouse ventilation, activating feeding systems, or operating robotic arms for harvesting.

Be Inspired…

Be inspired by how the **Palino Farm** combines technology and sustainability, using data-driven decision-making to maximise productivity while minimising the environmental impact.

This good practice highlights the **role of control systems in optimising farm management. Azienda Agricola Palino** demonstrates how automation, georeferenced fertilisation, and real-time data improve efficiency and sustainability.

Download the Smart Skills Good Practice Guide for more inspirational examples!



04

LET’S PRACTICE

Drag and drop the correct term into the corresponding definition.

Sensors – Controllers – Actuators

_____ collect real-time data on environmental conditions such as soil moisture, temperature, and humidity, forming the foundation for automation.

_____ process sensor data and make decisions based on predefined rules or AI models, sending commands to other components.

_____ execute physical actions such as opening irrigation valves, adjusting greenhouse ventilation, or operating robotic arms.


A LITTLE PROGRESS EACH DAY
ADDS UP TO BIG RESULTS

Well Done!!!

You finished the first module of **Course 6**! Keep going on this learning journey.

In the **next module** you will learn about **Greenhouse Automation**.

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