Course 6: Bringing Innovation to Farms

M4: Field Automation & Real-Time Monitoring

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Objectives and Learning Outcomes

This module focuses on the use of **automation and real-time monitoring to enhance field operations in agriculture**. Learners will explore how automated irrigation systems, IoT sensors, and drones contribute to precision farming by optimising water usage, monitoring crop health, and improving resource efficiency. Through practical examples, they will understand the benefits of real-time data collection and decision-making in farm management. By the end of this module, learners will have a solid grasp of how smart technologies can drive sustainability and productivity in modern agriculture.

Learn…

…how automated irrigation and crop monitoring systems optimise field operations.

Understand…

…the advantages of real-time monitoring for resource efficiency and sustainability.

Explore…

…practical applications of drones, IoT sensors, and AI in precision farming.

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contents

This module is about the use of advanced irrigation technologies and real-time monitoring to enhance resource efficiency in agriculture. It covers the practical setup of automated systems and the integration of AI and IoT for sustainable water management and optimised crop performance.

USING CONTROL SYSTEMS FOR AUTOMATED IRRIGATION & CROP MANAGEMENT

01

Smart Irrigation for Efficient Water Management

Automated irrigation systems improve water efficiency by reducing losses and preventing underground contamination. By integrating advanced technologies, farmers can ensure crops receive the necessary water while minimising waste.

✓ Sensors track soil moisture for accurate scheduling

✓ Subsurface drip systems minimise unnecessary water loss

✓ Ultra-low flow emitters deliver water directly to plant roots

✓ DSS combines data and analytics for better decision-making

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Smart Irrigation Cycle for Efficient Water Use

Precision Water Application

Smart irrigation systems distribute water efficiently, reducing waste and ensuring plants get the right amount

Irrigation Scheduling & Decision-Making

Based on collected data, automated systems determine the optimal amount and timing for irrigation.

Evaluation & Adjustment

System performance is analysed, and water usage is optimised for future cycles, feeding back into updated monitoring.

Data Collection & Monitoring

Sensors track soil moisture, weather conditions, and plant water needs in real time.

Watch this video for more information!

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Challenges & Future Perspectives

Beyond water efficiency, automated systems also play a crucial role in crop management. Environmental variability and the absence of standardised precision irrigation technologies make it difficult to ensure optimal growing conditions. Crop productivity depends on balancing water and nutrient availability

- ✓ AI and IoT enable adaptive water and nutrient control

- ✓ RDI supports plant resilience under water constraints

- ✓ Smart irrigation improves root development and crop yield

- ✓ Policy measures encourage data-driven farming practices

BENEFITS OF REAL-TIME MONITORING FOR RESOURCE EFFICIENCY

02

Benefits of Optimising Resource Efficiency with Real-Time Monitoring

Improved Land Use Efficiency
Real-time monitoring helps track land use changes and optimise biofuel crop placement to minimise negative environmental impacts. It supports decision-making to reduce direct and indirect land use changes, preventing deforestation and biodiversity loss.

Enhanced Energy Efficiency
Continuous data collection on crop performance enables better selection of high-energy-yield crops. It ensures optimal fertilisation and irrigation to maximise biofuel energy output while reducing resource waste.

Lower Greenhouse Gas (GHG) Emissions
Real-time tracking of emissions allows farmers to adjust fertilisation and tillage practices to reduce nitrous oxide (N_2O) emissions.

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Environmental Benefits

Reduction of Eutrophication

01

Monitoring nutrient runoff ensures efficient nitrogen use, preventing water pollution. It helps farmers apply fertilisers only when needed, reducing excessive nitrogen leaching.

Sustainable Water Management

02

Tracking real-time soil needs prevents the overuse of freshwater resources. It supports data-driven decisions on crop selection to maximise yield with minimal water input.

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Economic Benefits

Cost Savings & Higher Yields

03

Real-time monitoring reduces input costs such as fertilisers, water, and energy. It increases profitability by optimising biomass production and improving biofuel conversion efficiency.

Certification & Compliance

04

By providing verifiable data on emissions, land use, and resource efficiency, real-time monitoring helps biofuel producers meet sustainability certifications.
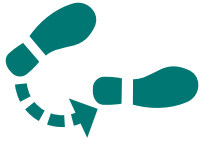
Benefits of Smart Farming Technologies

Smart Farming Optimising Agriculture with Advanced Technologies

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03

PRACTICAL SETUP OF AUTOMATED SYSTEMS FOR FIELD USE

1 Assess Current Field Operations

Evaluate existing workflows to identify inefficiencies and repetitive tasks. Define clear automation goals, such as reducing response times or improving resource allocation.

2 Choose the Right Automation Solution

Select a system that fits your industry needs and budget. Look for features like scheduling, real-time tracking, and mobile accessibility. Ensure scalability for future growth.

3 Plan System Integrations

Ensure compatibility with CRM, ERP, and other tools to streamline data flow. Set up protocols for seamless communication between platforms and test integrations for reliability.

4 Deploy Scheduling & Dispatch Software

Automate job assignments based on technician skills, availability, and location. Optimise routing to reduce travel time and costs while preventing scheduling conflicts.

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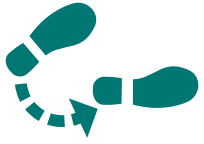
5 **Equip Field Teams with Mobile Applications**

Provide mobile access to job details, digital forms, and communication tools. Enable real-time data entry and offline functionality for remote areas.

6 **Train Employees on System Usage**

Offer hands-on training and create user guides to ensure smooth adoption. Provide ongoing support to address challenges and maximise efficiency.

7 **Monitor Performance & Optimise**

Track key metrics like response times and task completion rates. Gather feedback from employees and customers to refine automation processes and improve overall performance.

Here is an inspiring video about how Hitachi and Ag Automation are revolutionising agriculture with automated soil moisture monitoring and irrigation.

Watch now to see how technology is driving sustainability and efficiency in farming!

HITACHI

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LET'S PRACTICE

04

Arrange the Steps in the Correct Order

Below are several steps related to the implementation of a field operations automation system. Your task is to **reorder these steps in a logical sequence**, from initial assessment to optimisation. **Write the number of each step** in the correct order.

Steps:

_____ Deploy Scheduling & Dispatch Software

_____ Assess Current Field Operations

_____ Train Employees on System Usage

_____ Monitor Performance & Optimise

_____ Plan System Integrations

_____ Equip Field Teams with Mobile Applications

_____ Choose the Right Automation Solution

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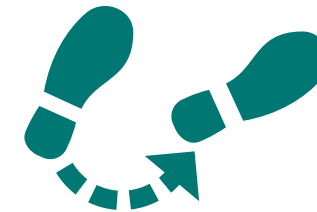
"DO WHAT YOU CAN, WITH WHAT YOU HAVE, WHERE YOU ARE."

— Theodore Roosevelt

Great Job!

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

In the **next module** you will learn about **Integrating Smart Systems for Whole-Farm Management!**

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Follow our journey

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