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Course 3:
Mechatronics in Agriculture

M4: Maintenance & Troubleshooting

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contents

In this module, learners will be introduced to key maintenance practices, common problems and solutions in agricultural robotics, and hands-on activities for diagnosing system issues.

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MAINTENANCE & TROUBLESHOOTING

01

Maintenance and Troubleshooting

Proper **maintenance and troubleshooting** are essential for ensuring the longevity, efficiency, and reliability of **mechatronic systems in agriculture**.

Regular upkeep helps prevent unexpected failures, reduces downtime, and optimises the performance of **robotic systems, sensors, and actuators**.

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Key Practices for Maintaining Mechatronic Systems

To keep **agricultural robotics and automation systems** functioning efficiently, farmers and technicians must implement a **preventive maintenance routine**.

Example: A farmer using an autonomous weeding robot should **calibrate its vision sensors weekly**, ensuring precise weed detection and removal.

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Maintenance and Troubleshooting

Regular maintenance and troubleshooting are **key to maximizing efficiency** in agricultural mechatronics. By **following structured preventive care**, identifying **common system failures**, and **performing hands-on diagnostics**, farmers and technicians can **reduce downtime, improve precision, and extend the lifespan of robotic machinery**. As **automation continues to grow in agriculture**, proper maintenance will be essential in ensuring **long-term success and reliability**.

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02

ESSENTIAL MAINTENANCE PRACTICES

Essential Maintenance Practices

- **Regular Sensor Calibration:** Ensures accurate data collection for precision agriculture tools (e.g., soil moisture sensors, GPS guidance systems).

- **Lubrication and Cleaning:** Reduces wear and tear on robotic arms, actuators, and mechanical components.

- **Battery and Power System Checks:** Maintains battery health in **autonomous robots and drones** for uninterrupted operation.

- **Firmware and Software Updates:** Keeps AI algorithms, machine learning models, and automation software **up to date**.

- **Mechanical Inspection:** Identifies potential failures in gears, motors, and hydraulic systems before they cause downtime.

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Common Problems & Solutions for Agricultural Robotics

Despite advanced technology, **agricultural robots** can experience **technical failures** due to **environmental conditions, software malfunctions, or hardware wear and tear**. Below are common issues and troubleshooting steps:

Common Issues & Troubleshooting Tips:

- **Sensor Malfunctions:** If sensors provide inaccurate readings, **clean them**, check wiring, and recalibrate.

- **Connectivity Failures:** Robots relying on **GPS or IoT networks** may experience signal loss. Ensure **firmware is updated** and **networks are stable**.

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Common Problems & Solutions for Agricultural Robotics

Common Issues & Troubleshooting Tips:

- **Mechanical Wear & Tear**: Actuators and motors can degrade over time. Regularly inspect, lubricate, and replace worn components.

- **Software Glitches**: If an autonomous tractor miscalculates field paths, check for firmware updates and recalibrate the GPS system.

- **Battery & Power Failures**: Robots stopping unexpectedly? Monitor battery cycles, replace degraded units, and optimise energy consumption settings.

03

ACTIVITIES FOR SYSTEM DIAGNOSTICS
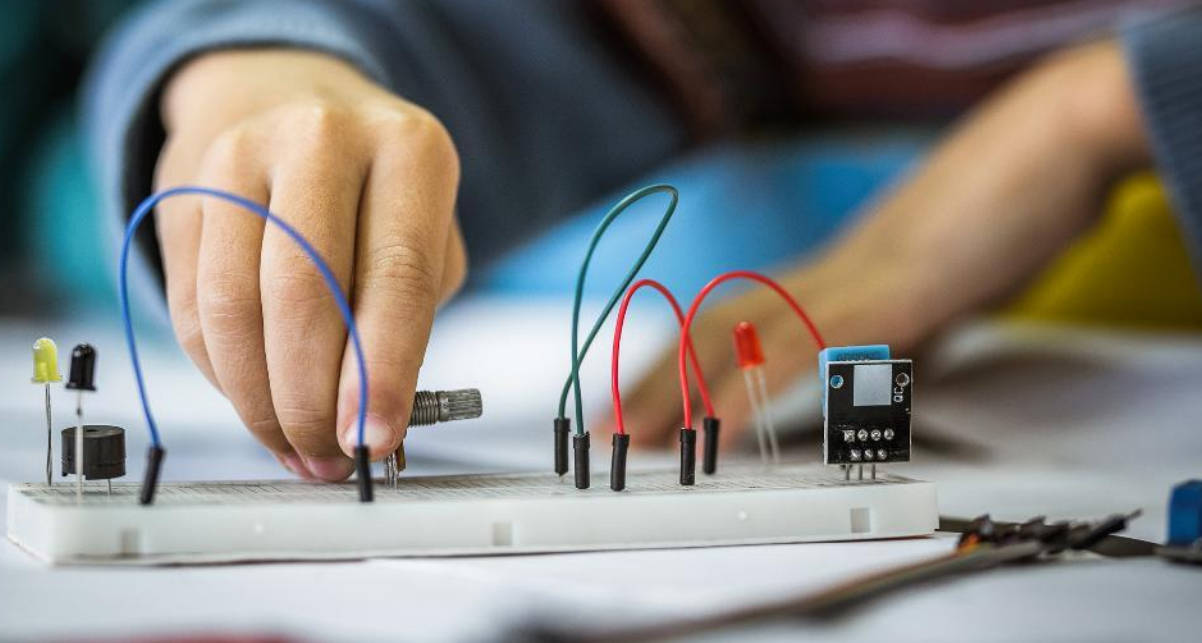
Hands-On Activities for System Diagnostics

Practical **troubleshooting exercises** help users build confidence in **detecting and resolving issues** with mechatronic systems.

Activity 1: Sensor Calibration Exercise

Task: Use a handheld soil moisture sensor and compare readings across different soil conditions. **Calibrate the sensor** to ensure accurate measurements.

Activity 2: Actuator Testing

Task: Check the movement of an **electric actuator** in a robotic system. Adjust settings, apply lubrication, and observe changes in **performance and speed**.

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Hands-On Activities for System Diagnostics

Practical **troubleshooting exercises** help users build confidence in **detecting and resolving issues** with mechatronic systems.

Activity 3: Drone System Check

Task: Inspect **aerial or ground-based autonomous systems** for power issues, faulty wiring, and connectivity errors. Run a **diagnostic report** and identify any needed updates.

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