

Lesson Plan Overview

Grade Level	4-6 (Adaptable)
Time Required	2-3 class periods (45-60 minutes each)
Subject	STEM, Environmental Science, Coding, Agriculture

→ Learning Objectives

1. Design and build an automatic irrigation system using a micro:bit, soil moisture sensor, and water level sensor.
2. Program the system to monitor water levels, detect soil moisture, and control a water pump.
3. Explain how the sensors, servo motor, and pump work together to automate irrigation.
4. Connect the project to real-world applications of smart agriculture and water conservation.

→ Materials

<ul style="list-style-type: none"> • Smart Science IoT: Kit 	For building and programming the irrigation system.
<ul style="list-style-type: none"> • Computer with internet access and MakeCode 	For programming and code execution.
<ul style="list-style-type: none"> • Soil moisture sensor 	Detects the moisture levels in the soil.
<ul style="list-style-type: none"> • Water level sensor 	Monitors the water level in the container.
<ul style="list-style-type: none"> • Servo motor 	Controls the water flow.
<ul style="list-style-type: none"> • Submersible water pump 	Delivers water to the soil.
<ul style="list-style-type: none"> • Container for water 	Acts as the water source for irrigation.
<ul style="list-style-type: none"> • Materials for building a model garden (optional) 	Enhances the project's realism and application.

5E Model Lesson Plan

Engage

Activity	Key Focus
Show images or videos of different irrigation methods and discuss their importance in agriculture and water conservation.	Building awareness of global agricultural practices and water-saving techniques.
Discuss the challenges of manual irrigation and the benefits of automating the process.	Highlighting real-world problems and the efficiency of technological solutions.
Introduce the challenge: Design and build an automatic irrigation system that waters plants only when needed.	Inspiring engagement with a practical problem-solving task related to smart agriculture.

Explore

Activity	Key Focus
Divide students into groups and provide materials, including the Smart IOT:Kit, sensors, servo motor, and pump.	Promoting teamwork and exploration of new technology.
Guide students to explore the kit's components, focusing on the sensors, servo motor, and their ability to control the pump.	Encouraging hands-on discovery of how components interact in automation.
Have students experiment with connecting the sensors, servo motor, and pump to the micro:bit and observing their behavior.	Building an understanding of how inputs and outputs work together in a system.
Allow groups to share their discoveries and troubleshoot their setups collaboratively.	Developing communication, critical thinking, and problem-solving skills.

Explain

Activity	Key Focus
Facilitate a discussion where groups share their initial observations and challenges.	Reflecting on hands-on experiences to deepen understanding.
Introduce/review key concepts: Sensors (soil moisture, water level), actuators (servo motor, pump), microcontrollers (micro:bit).	Providing foundational knowledge of sensors, actuators, and automation principles.
Explain how the soil moisture sensor detects moisture levels, the water level sensor monitors available water, the servo motor controls water flow, and the pump delivers water to the plants.	Connecting each component's functionality to its role in the automated system.
Demonstrate how these components interact through the micro:bit to create an efficient irrigation process.	Bridging theory with practice for better understanding of smart systems.

Elaborate

Activity	Key Focus
Guide students to assemble their irrigation systems, ensuring proper connections between the sensors, servo motor, pump, and micro:bit.	Applying theoretical knowledge to create a functional device.
Introduce students to the MakeCode programming environment.	Building confidence in coding and logical problem-solving.
<i>Help students write a program to:</i>	
- Read soil moisture levels from the sensor.	Teaching how to collect data from sensors.
- Read water levels from the sensor.	Expanding understanding of multi-sensor data integration.
- Activate the pump when soil moisture is below a certain threshold and water level is sufficient.	Demonstrating conditional logic and automation principles.
- Deactivate the pump when soil moisture is above the threshold or water level is low.	Reinforcing control logic and efficient use of resources.
- Optionally, add an alarm to indicate low water levels.	Introducing advanced functionality and alert mechanisms.
Encourage troubleshooting and teamwork as students refine their irrigation systems.	Enhancing critical thinking and collaboration skills.

Evaluate

Activity	Key Focus
Have groups test their automatic irrigation systems and observe their performance in maintaining soil moisture.	Assessing the functionality and efficiency of the systems.
<i>Encourage students to reflect on their learning experience by discussing:</i>	
- Challenges they faced and how they overcame them.	Promoting resilience and self-assessment in problem-solving.
- Improvements they could make to their system.	Inspiring creativity and iterative design.
- Insights gained about the importance of smart agriculture and water conservation.	Reinforcing the significance of their work in real-world contexts.

Assessment Criteria

Criteria	Details
Participation	Active involvement in group discussions and activities.
System functionality	Proper assembly and working of the automatic irrigation system.
Programming skills	Accurate and effective use of MakeCode to program the micro:bit.
Concept understanding	Comprehension of sensors, actuators, microcontrollers, and automation principles.
Creativity and problem-solving	Innovative approaches to building and testing the device.

Differentiation Strategies

Strategy	Details
Scaffolding	Offer varying levels of support for coding and building tasks.
Alternative materials	Provide substitutes for components if necessary.
Task complexity	Adjust programming challenges based on student skill levels.
Flexible presentations	Allow students to showcase their work in multiple formats (e.g., demonstration, video).

Extension Activities

Activity	Details
Real-world research	Investigate smart irrigation applications in agriculture and water management.
Device enhancements	Add features such as a rain sensor or remote monitoring system.
Advanced programming	Explore additional micro:bit features and programming concepts.
Awareness campaign	Create a presentation or video explaining the importance of water conservation and showcasing their irrigation system.

Teacher Notes

Note	Details
Safety	Ensure students handle tools, materials, and electricity safely.
Instructions	Provide clear steps for assembly and programming.
Support	Offer guidance during hands-on activities.
Collaboration	Encourage teamwork and collective problem-solving.
Real-world connection	Emphasize how the project applies to real-life agricultural and environmental challenges.