Student Worksheet
IoT Automated School Gardening System (micro:bit)

Team: _____ **Class/Group:**_____

Date: ____ / ____ / _____ **Teacher:** _____

Instruction: Work in teams of 3–4 students. Complete the tasks, test, record data, and improve the system step by step.

PART A: Introduction: Why do we need an Automated Watering System at school?

Scenario:

The school has a garden. What happens with watering on weekends, holidays, and especially during the summer? How can we water only when necessary, saving water?

Time:

45–90 minutes (2 class periods)

Materials:

Pencil, paper/notebook, internet access

Activity 1. What do we gain from a school garden?

Write 3 benefits of a school garden (e.g., environment, nutrition, learning, responsibility, collaboration).

1) _____

2) _____

3) _____

Activity 2. The "holiday problem"

Discuss in your team and complete:

1) When is the garden most at risk of having no water?

☐ Weekend ☐ Holidays ☐ Easter/Christmas ☐ Summer ☐ Other: _____

2) What can happen to plants if they are not watered properly? (list two)

_____

_____

3) What problem can occur if we have continuous watering?

_____

_____

Activity 3. What are the benefits of the proposed solution?

Circle the 3 most important constraints for your solution:

☐ Low cost

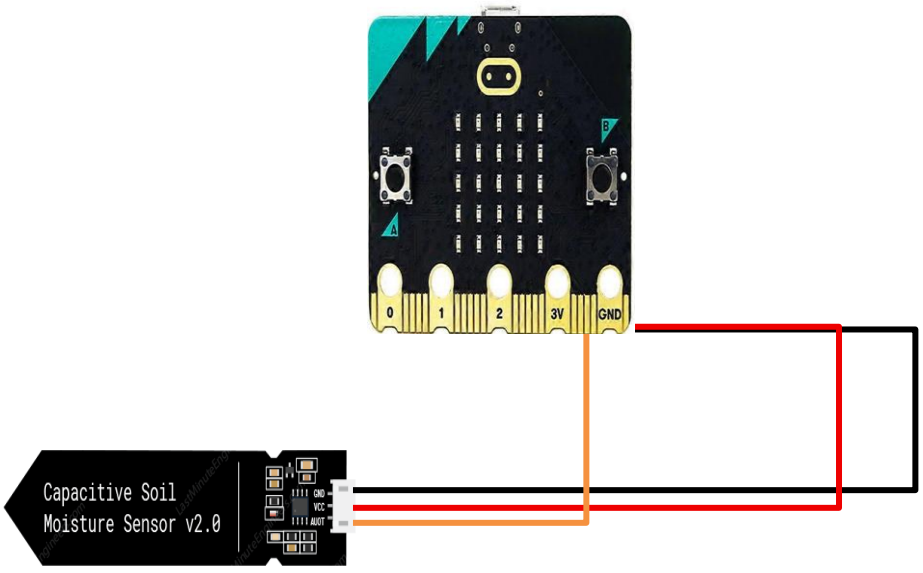
☐ Saves water

☐ Works without a person (autonomous)

☐ Safe

☐ Easy to maintain

☐ Works with solar power (optional)



PART B: Implementation: From problem to solution (IoT thinking)

Activity 1. What does IoT mean in this project?

Complete in simple words:

IoT = devices that have sensors/data, connect to the internet, and can be programmed.

In our garden, the system will:

Measure: _____

Decide: _____

Act: _____

(Hint: soil moisture → decision → pump/watering)

Activity 2. The "decision chain"

Put the following in the correct order (1–5):

☐ The sensor sends a value to the micro:bit

☐ The micro:bit compares the value to a limit (threshold)

☐ Is the soil dry or wet?

☐ The pump waters for a few seconds

☐ The relay works as a switch for the pump

Activity 3. Where is the "smartness"?

For each element, write whether it is a Sensor, Controller, or something else

Soil Moisture Sensor: _____

micro:bit: _____

Relay: _____

Water Pump: _____

Activity 4. Why do we need a relay?

Mark the correct answer:

☐ Because the sensor does not work without a relay

☐ Because the pump needs more power/voltage than the micro:bit can provide, so we need a “switch” with an external supply

Part C: Connecting Components

Goals

- To connect the soil moisture sensor with the micro:bit.
- To read/log values (dry vs wet).
- To set a threshold for starting the water pump.
- To write the first algorithm “if…then”

Team roles (suggested)

- Connections technician
- Measurements lead
- Programmer (MakeCode)
- Safety & documentation lead

Activity 1. System flow diagram

Draw a flow diagram that shows how the system will work (Moisture sensor → micro:bit → Relay → Pump → Plant watering)

Then add the power supply (battery pack/USB/solar panels):

micro:bit is powered by: _____

Water pump is powered by: _____

After you complete Activity 1 (above), assemble the basic parts of your system - micro:bit, moisture sensor, relay, water pump. Then evaluate how your system will work effectively.

Activity 2. Evaluation of the proposed solution/system

Write 3 statements: “It will succeed if…”:

1) It will succeed if _____

2) It will succeed if _____

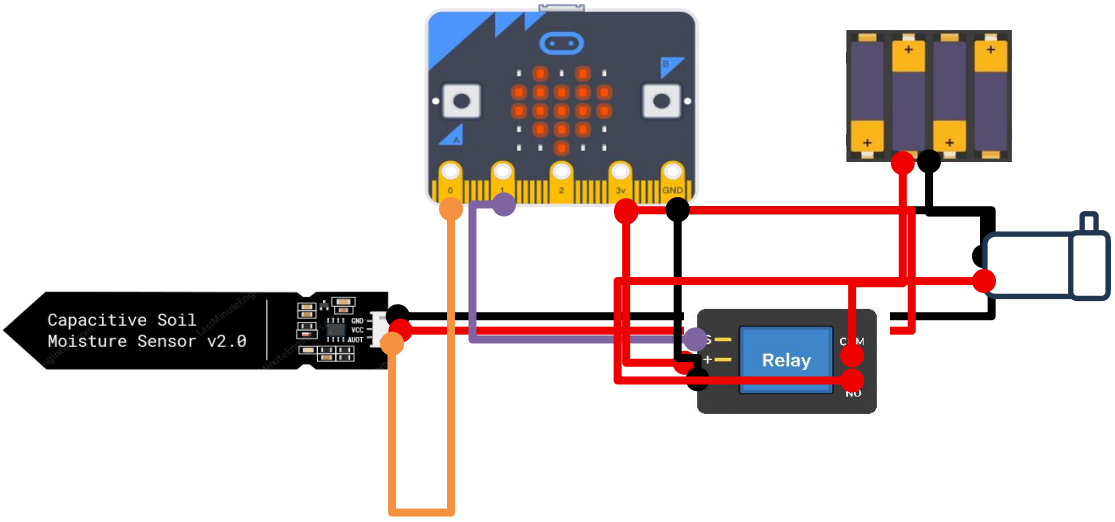
3) It will succeed if _____

(Example: “only waters when the soil is dry”, “it saves water”, “it is safe to operate”)

Activity 3. Taking measurements with the soil moisture sensor

Soil moisture sensors output values are in a range (e.g.: 0–1023) and on some models the values may be “reversed” (0=wet ή 0=dry).

Question: Why is it important to check this before writing code?



Activity 4: «Waste vs Savings»

Compare:

Manual watering:
Advantages: _____ Disadvantages: _____

Automatic IoT watering:
Advantages: _____ Disadvantages: _____

Activity 5 — Safety & Connection

A. Safety rules (circle "True/False")

1) We never get the micro:bit or cables wet. T/F

2) We connect the wires first and then power on. T/F

3) If something heats up/smells, we keep going. T/F

4) We do not touch bare wires when powered. T/F

B. What will we connect today

• Moisture sensor: receives values from _____ to _____

• micro:bit: reads from _____ (i.e. P0/P1/P2)

• Ground (GND) means _____

Additional Activity:

The most important problem our system/solution solves is:

_____

The most important "smart" part of the solution is:

_____

PART D: Evaluating & Expanding the Project

Activity 1. Self-Reflection

Please circle the option that you think reflects your project best.

Scale (circle one): 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

1. **I understand the real problem this project solves** (watering needs, holidays, water saving).
   1 2 3 4 5
2. **I can explain how the system works as an IoT solution** (sensor → micro:bit → relay → pump → watering).
   1 2 3 4 5
3. **I contributed actively to my team** (roles, collaboration, communication).
   1 2 3 4 5
4. **I can interpret our sensor data and justify our threshold choice** (including any adjustments).
   1 2 3 4 5
5. **Our testing was systematic and helped us improve reliability** (e.g., cooldown, smoothing, hysteresis).
   1 2 3 4 5
6. **If we installed this in the real school garden, I know what would be needed for durability and safety** (power, waterproofing, maintenance).
   1 2 3 4 5

Activity 2. Improvements

Please suggest at least 3 improvements you can make to your existing project. Justify your suggestions (i.e. “change the components to reduce the cost”). Please be specific with your suggestions.

1. _____
2. _____
3. _____

Activity 3. Expanded features

Please suggest at least one expanded new feature of your system, and elaborate on how you could make it work, estimated cost, and components. For example, how could you make the system self-sustained? Think of water tank, power source, even in the most remote schools in your country.

_____

_____

_____

_____

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_____