Creating a watering schedule for your garden

Learning Objectives

Students will…

- ❑ Code a micro:bit computer to act as an environmental sensor
- ❑ Measure light, soil moisture, and temperature using a programmed micro:bit
- ❑ Apply understanding of relationships between sunlight, temperature, and soil moisture content to make decisions about watering in the garden

Materials

- ❑ Micro:bit
- ❑ USB connector cable
- ❑ Laptop
- ❑ Chart paper and markers

Procedures

Engage

1. Discuss prior experiences with needing water or being thirsty.
   - When do you get thirsty? (when it's very sunny and hot outside, when I'm playing hard, when it's been a long time since I had a drink)
   - Okay, now let's think about plants—when might a plant get thirsty? (when it's very hot outside, when they are in direct sunlight, when there isn't much water in the soil)
2. Introduce the challenge of creating a watering schedule for the garden. Ask students what might affect their watering schedule. Record all students' ideas on the board.
   - Just like humans, plants need water to survive and since they can't move to get it, we will need to decide how often and how much water we should add to keep the plants healthy.
   - Guide students to think about the possible effects of temperature, amount of sunlight, and ability of the soil to hold moisture

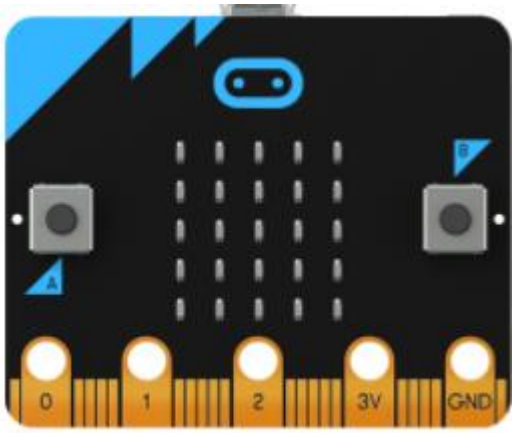
Explore

3. Provide students with micro:bits and divide students into small groups. In stations, have students follow instructions provided to program their micro:bit as a temperature, light, or soil moisture sensor and test it.

Additional resources for coding sensors:

- Temperature: https://makecode.microbit.org/courses/ucp-science/temperature/setup-procedure
- Light: https://makecode.microbit.org/examples/plot-light-level
- Soil Moisture: https://makecode.microbit.org/projects/soil-moisture

4. Once the sensors have been programmed, take students outside to the school garden or other outdoor space with plants that require watering. Spend a few minutes using micro:bit sensors to measure different areas of the garden. Once students have had a chance to freely explore, refocus their exploration by reminding students of their watering schedule task and the factors they are exploring.
5. Ask students if they think temperature, light level, and soil moisture might be related. Working with a partner with a different sensor than their own, have each student make a prediction about if their sensor measurements might be related and how. Have students record their predictions in their science notebook.
    - Is light related to temperature?
    - Is temperature related to soil moisture level?
    - Is light level related to soil moisture level?
    - How might we test if these things are related?



Micro:bit microcontroller

Explain

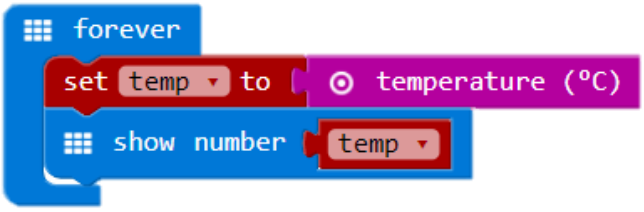
6. Ask students to investigate relationships by comparing their sensor measurements.
    - Pick a few different spots in the garden and work with your partner to take measurements together and record patterns you notice in your science notebooks. Add details about each pair of observations you make (was it sunny or shady, near water or pavement, etc.).
    - If weather is not suitable for outdoor exploration, consider options for indoor exploration.
        - Fill two identical containers such as margarine or ice cream tubs with the same amount and type of soil.
        - Add a known volume of water to each container of soil.
        - Place containers under different conditions
            (1) Light level- place under lamp or not, near window or not, etc.
            (2) Temperature- place on heating pad or not, etc.
        - Measure temperature, light levels, and soil moisture conditions with their sensors over a period of time (throughout a day or week). Record measurement in science notebook.
7. Once students have taken measurements in the garden or in the classroom, have students discuss their findings.

Wrap-up:

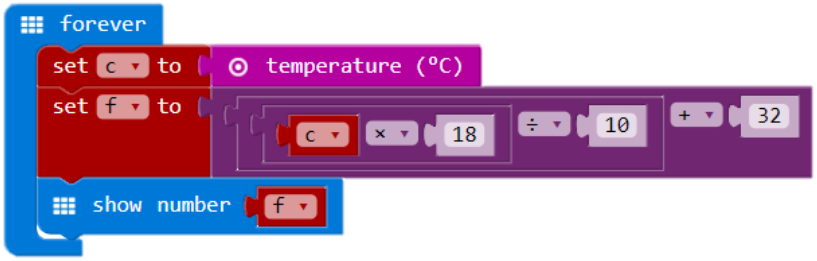
- What patterns did you notice? What relationships appear to exist between light and temperature? Temperature and soil moisture? Light and soil moisture?
- How might these relationships affect your watering schedule?
- Do you think your watering schedule will be the same in the spring, summer, and fall? Why or why not?

Instructions to make and code a temperature sensor:

1. Go to https://makecode.microbit.org
2. Use drag-and-drop code blocks to create the following program to measure temperature.
   - To measure temperature in Celsius:



   - To measure temperature in Fahrenheit:

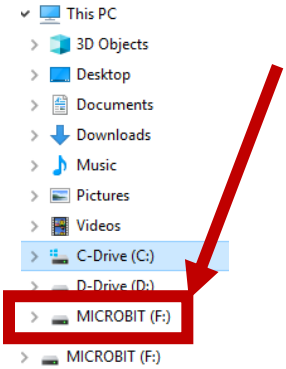


3. Name the program.

4. Click the purple "Download" button to download the program.

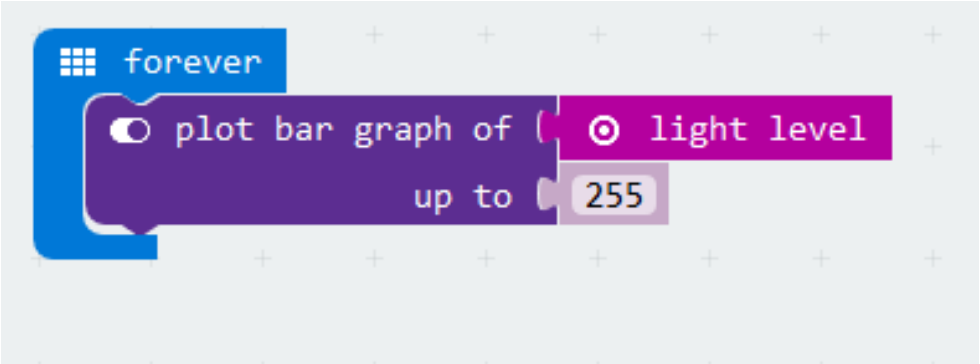
5. Using the USB cord, connect the micro:bit to your computer.

6. Upload the program to your micro:bit
   - Open Windows Explorer folder.
   - In Windows Explorer, click on the Downloads folder.
   - Find the microbit-Temperature program.
   - Drag-and-drop the program to the MICROBIT device.



Instructions to make and code a light level sensor:

1. Go to https://makecode.microbit.org
2. Use drag-and-drop code blocks to create the following program to measure light level.

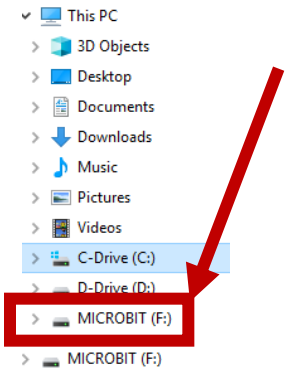


3. Name the program.

4. Click the purple "Download" button to download the program.

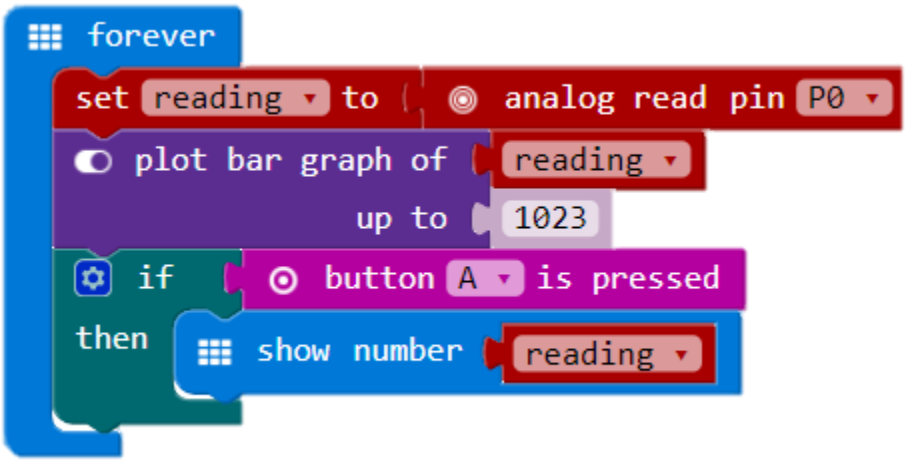
5. Using the USB cord, connect the micro:bit to your computer.

6. Upload the program to your micro:bit
   - Open the Windows Explorer folder.
   - In Windows Explorer, click on the Downloads folder.
   - Find the microbit-Light-Level program.
   - Drag-and-drop the program to the MICROBIT device.



Instructions to code a soil moisture sensor:

1. Go to https://makecode.microbit.org
2. Use drag-and-drop code blocks to create the following program to measure soil moisture level.

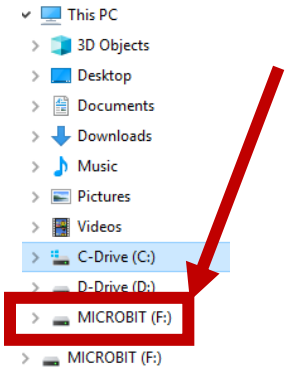


3. Name the program.

4. Click the purple "Download" button to download the program.

5. Using the USB cord, connect the micro:bit to your computer.

6. Upload the program to your micro:bit
   - Open the Windows Explorer folder.
   - In Windows Explorer, click on the Downloads folder.
   - Find the microbit-Soil-moisture program.
   - Drag-and-drop the program to the MICROBIT device.



Instructions to make a soil moisture sensor:

Materials

- ☐ 1 micro:bit
- ☐ 2 nails
- ☐ 2 alligator clips

Steps

1. Connect a nail to the **3V** pin with an alligator clip
2. Connect the other nail to the **P0** pin with another alligator clip