

Lesson: Water Pump

Big Picture

This lesson will introduce built in sensors while allowing students to be more acquainted with the BBC micro:bit microcontroller hardware and *Javascript Blocks Editor* software tool. The students will create a program that will have a function turn on the pump when soil is dry in the plant and will turn the pump off when the soil is wet.

Objectives

Students will be able to:

- Define Soil Moisture Sensor
- Iteration(loop)
- Control
- Function

Alabama Standards Alignment

26(Eighth Grade): Create a simulation that tests a specific model.

-Examples: Demonstrate that the amount of water changes the height of a plant.

1 (Eighth Grade): Design a function using a programming language that demonstrates abstraction

-Example: Create a program that utilizes functions in an effort remove repetitive sequences of steps

7 (Fifth Grade): Identify Variables.

- Examples: Determine if a variable is required for use later in the program.

8 (Fifth Grade): Demonstrate the programs require known starting values that may need to be updated appropriately during the execution of programs

- Examples: create a program that sets a variable to an initial value then later updates (changes) the value of the variable.

Preparation

- Water_Pump_student_handout: Tutorial handout found on lesson page

Choose a presentation method:

- Instructor can walk the students through using the student tutorial handout
- Students can work at their own pace using the tutorial handout. You may also post the video and tutorial locally and allow students to choose.

Materials Required

Each student (or pair of students) requires:

- Tutorial handout
- micro:bit kit
- USB cable
- MakeCode editor
- Internet connected computer with modern browser

**Note: Browsers known to work with micro:bit software includes Firefox, Chrome, Safari, and Microsoft Edge*

For a complete list, visit this page: <https://makecode.microbit.org/browsers>

- Edge I/O Adapter for micro:bit
- Micro:bit
- Crocodile clip wires
- Gator:soil micro:bit
- Screw driver
- Battery Pack
- Five jumper wires
- 5V high/low level trigger relay
- One Crocodile clips
- Pump
- Pump Tube
- Cup of Soil
- Cup of Water

Vocabulary and Concepts

Control: The power to direct the course of actions. In programming, the use of elements of programming code to direct which actions take place and the order in which they take place. A programming (code) structure that implements control. Selection (“if” statements) and loops are examples of control structures.

Soil Moisture Sensor: sensor that estimate volumetric water content

Iteration (Loop): A repetitive action or command typically created with programming loops. Loop action of doing something repeatedly.

Function: A named piece of code that can be called repeatedly, sometimes called procedures or methods: a segment of code that includes the steps performed in a specified process.

Teaching Guide

Getting started (10 mins)

Tell the class that they will create a micro:bit program with a Water Pump. Before they start programming, everyone needs to learn the new vocabulary terms.

Activity (40 mins)

The class is now ready to create their micro:bit with the sensor . Use your chosen method to demonstrate how to complete the activity. First, connect the hardware by navigating to the hardware hookup section(Figure 1) in the water_pump_student_handout. Next, build your code in makecode by following Figure 3 in the student handout.

Wrap Up (5 mins)

Review the 5-vocabulary words.

Variable: An element, feature, or factor that is liable to change; in a programming language, a symbolic representation of some state or property of the program.

Sensor: An input device that reads or measures a physical property and converts it to a numerical value.

Soil Moisture Sensor: sensor that estimate volumetric water content

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If time permits, ask the students why this function would be useful in their daily lives.

- Organization for plant system.
- Reusability / You don't have to keep watering your plants.
- Testing plants.
- Abstraction.