**Intended Audience:**

Grades K-6

**Learning Standards**

* SC.K.TI.1.1 – Explore the use of technology in everyday life.
* SC.1.PE.1.1 – Explain that a computer program can only follow a set of instructions made by people to complete a task.
* SC.4.PE.1.2 – Create a condition that will modify a situation or value in the program.

**Lesson Objectives**

Participants will:

* Youth will be able to code their Microbit.
* Youth will be able to describe how sensor technology can help with agricultural issues.
* Youth will learn more about if, then, else statements in code.

**Time Needed**

45-60 minutes

**Adapted from**

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**Material also adapted from Microbit’s Make it: code it / Sunlight sensor**

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**Sensors and AI**

**Materials**

* Microbit (A pack of 10 costs $175)
* Capacitive Soil Moisture Sensor (A pack of 5 costs $9.99)
* DC Pump (A pack of 3 cost $13.99)
* Relay Module (Costs $5.49 each)
* Ribbon Cable (Costs ($7.89)
* 2 Short Square Plastic Food Container ($4 each)
* 3 V 1Amp Power Adapted Supply ($6.29 each)
* M3 Screws ($18.99)
* Power Drill ($39-$100)
* Seasonal Plant
* Pot for the plant ($7-$10)
* Soil/Potting Mix ($5-$10)
* Alligator clips ($9)
* Chart Paper and Markers
  + Can be substituted with a Dry Erase Board
* iPads or computers with access to MakeCode

**Background**

In this lesson, you’ll be teaching on how AI uses sensors to collect information and make independent decisions based on that information. Students will explain how animals, including humans, use their senses to interact with their environment. AI tools such as self-driving cars and drones use sensors to gather data and make decisions based off the information they collect through those sensors.

**Words to Know**

* **Artificially intelligent robot (AI robot),** a robot that uses sensors to collect information and make autonomous decisions about how to complete a task even in a changing environment.
* **Algorithm -** a set of steps or rules to follow to solve a problem or accomplish a specific goal
* **Autonomous,** having the capacity to act independently or without external control
* **Sense** a faculty, such as sight, hearing, or touch, used by people or animals to perceive information
* **Sensor** a device that allows a machine to sense the natural world
* **Camera** a sensor that can “see” by sensing visual information
* **Touchpad or Touchscreen** a sensor that can “feel” by sensing touch information

**What to Do**

In this lesson, you’ll be introducing how sensors are used in AI programming. The kids will start working on coding their own sensors to determine moisture levels of plant they will water.

**lesson: Introducing the Activity**

* Ask students: How do people and animals understand the world around them?
  + Allow for a few guesses before you share “we use our senses such as sight, hearing, or touch, to perceive information.”
* Ask the students what senses you use to determine the following:
  + What do you need to do to cross a street safely?
  + Enjoy a song?
  + Decide if you like a certain food?
  + See if something is hot or cold?
* Guide students to conclude that people and animals use their senses to help them navigate their environment and make decisions about the actions they take.
* With AI and robots, they use senses too. In fact, AI and robots have what are called sensors.
* A sensor is a device that allows a machine to sense the natural world
  + Explain to students that some— but not all— robots and computers have sensors - devices that allow a machine to sense the natural world. Tell them that artificially intelligent robots and artificially intelligent computer programs can use sensors to collect information and make autonomous – or independent – decisions about how to complete a task.
* Show an example of the Self-Driving Car – <https://www.youtube.com/watch?v=uHbMt6WDhQ8>
  + Ask kids what type of sensor the car used. – A Camera – use of sight.

**Experience – Application to Agriculture**

* Ask the students what sensors are used in agriculture.
  + Drones use cameras
  + Robots use visual perception
* Show video of Microbit’s Automatic Plant Watering System – [Micro:bit Automatic Plant Watering System](https://www.youtube.com/watch?v=rv4lb-U9QUU&t=2s).
  + After the video, ask the students what sense the Microbit used in the video (feeling/touch).
* In the next class period, we are going to build a sensor for a plant, but before we do that, let’s talk about what plants need to live.
* Grab chart paper or open a document and have the kids brainstorm what plants need to survive:
  + Water
  + Light
  + Soil

**Experience – Intro to Microbit & Algorithms**

* Show the [Introduction to the BBC micro:bit](https://www.youtube.com/watch?v=u2u7UJSRuko&t=20s) video. Explain the Microbit is a computer that has many sensors on it. Pass around the Microbit so the kids can see the sensors.
* Share that we will code with MakeCode, and we will create an algorithm.
* Ask the kids if they know what an algorithm is.
  + If they are unfamiliar with an algorithm, share that is a set of steps or rules to follow in order to solve a problem or accomplish a specific goal.
* In this activity, the code is our algorithm.
* Show them the Name Tag Tutorial Activity ([Micro:bit Name Tag Tutorial - YouTube](https://www.youtube.com/watch?v=tOgVbOG5QAo)).
* Introduce Block Based Code. Ask the kids if they have ever coded with block based code.
* Introduce the basic blocks that we will use for this activity.
  + Click on the Basic category in the Toolbox.
  + Drag a show string block into the forever block.
  + Then in the show string block, change the text from “Hello!” to your name.
* Once the kids have the blocks on their Canvas, have them code their name and see if it appears on the MicroBit.

**Talk it Over**

**Process**

* What kind of sensors did you learn about today?
* Was coding your name or hello easy or hard? Why was it easy or hard?

**Generalize**

* How can robots with sensors help us in our daily life?

**Apply**

* Do you see types of robots or machines in your life that have sensors?
* What ways could robots with sensors help you in everyday tasks?

**Career Connections**

* Aerospace Engineer
* Agricultural Engineers
* Embedded Systems Engineer
* Environmental Engineer
* IoT (Internet of Things) Developer
* Robotics Engineer

**Expand and Explore**

If time allows, or to spread this across multiple lessons, have the students research what type of careers utilize sensors in robots and other AI and have them present it to the group.

**Resources & References**

Massachusetts Institute of Technology. (n.d.). *Day of AI.* AI for Early Elementary. <https://dayofai.org/curriculum/ai-for-early-elementary/>

Microsoft MakeCode. (n.d.). *Sunlight.* [Microsoft MakeCode for micro:bit](https://makecode.microbit.org/). [Microsoft MakeCode for micro:bit](https://makecode.microbit.org/)