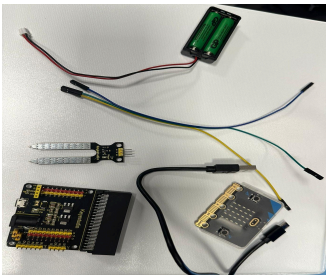
Activity
Lesson Plan

Activity Name	Lesson Name	Lesson #
Soil Data Logging and Analysis	Micro:Bit Soil & Environment Analysis with Colab	3

Lesson Description:	In this lesson, students will learn how to use the micro:bit V2 as a data logger to capture soil moisture and environmental values(light, sound, temperature). They will export the logged data as a CSV file and analyze it in Google Colab. Using Python and XGBoost, student will create plots, explore data patterns, and forecast future soil moisture. This activity connects electronics with cloud-based machine learning, showin how IoT devices can support environmental decision-making.

Lesson Objective(s):	The learner will configure and flash a micro:bit with a pre-built data logger program, collect and export soil/environment data as a CSV file, perform exploratory data analysis(EDA) using Python and visualizations, train a simple XGBoost model in Colab to forecast soil moisture, interpret results to understand soil conditions and watering needs.

Equipment & Supplies	• 1 x micro:bit (V2 recommended) • 1 x Soil Moisture Sensor • 1 x micro:bit Sensor Shield V2 • 3 x Jumper Wires • 2 AAA batteries and a micro:bit battery holder • 1 USB-C Cable • Access to a computer with internet access and a running camera • Small cup/pot of soil for testing

Room Preparation & Materials Setup	The stations for the attendees need to include a computer for each with the whole kit (micro:bit, sensor shield, soil moisture sensor, jumper wires, USB-C cable, battery pack). A small soil sample should be available at each station for testing. You will need a large screen connected to your computer so attendees can follow the code and wiring demonstration comfortably. 

Instructional Steps	Facilitation Tips:
1. **Introduce the repository:** ● Show the GitHub repo on your screen(Introduction-to-Electronics-on-microbit/3-Microbit_Soil_Data_Analysis at main · WestHoustonInstitute/Introduction-to-Electronics-on-microbit). ● Confirm all attendees navigate to: 3-Microbit_Soil_Data_Analysis/Software_Setup 2. **Software Setup:** ● Option A: Download and flash the prepared microbit-data-log.hex to your micro:bit using Microsoft MakeCode for micro:bit(Import the .hex file to your workspace). ● Option B: Demonstrate how to import it into MakeCode for customization. ● Walk students through flashing the .hex to the micro:bit via USB. 3. **Hardware_Setup:** ● Guide students to wire the sensor: VCC → 3V, GND → GND, SIG → Pin 0. ● Confirm wiring is secure before starting logging. ● The logging is actual data taking, so it takes some time, for example, if you configure the logging interval every 3 seconds in MakeCode, it will log 20 rows in a minute. For the best analysis, we usually require a minimum of 1000 rows, but if it is not realistic, go with 100 rows, which equals 5 minutes with every 3 seconds logging configuration. ● Encourage testing in both dry and wet soil samples for comparison. 4. **Data Logging & Export:** ● After everything is set, unplug the USB cable, insert the probe into the soil, and plug the battery in. ● After you have waited for the logging, unplug the battery and plug the USB cable back into the computer. ● Open the MY_DATA.HTML file in the micro:bit folder that appears on your computer and click "Download". ● Walk around to check that participants can export CSV successfully. 5. **Data Analysis & ML in Colab:** ● Download the notebook: Soil_Moisture_ML_Microbit.ipynb from our GitHub repo. ● Upload the notebook to Colab and follow the steps to upload the CSV file. After that, “Run All” and interpret the results. ● Check everybody’s results.	The best setting to do this module activity is a “computer lab” where each participant has their own computer and the instructor also has a computer connected to a large screen that every participant can follow comfortably. The best way to track the success of the participant is to go and see their screen after each instruction step if it is doable (the number of attendees matter in this).

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Lesson Reflections	Future Actions