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Investigating the possibility of using low-cost microcontrollers for safeguarding heritage collections

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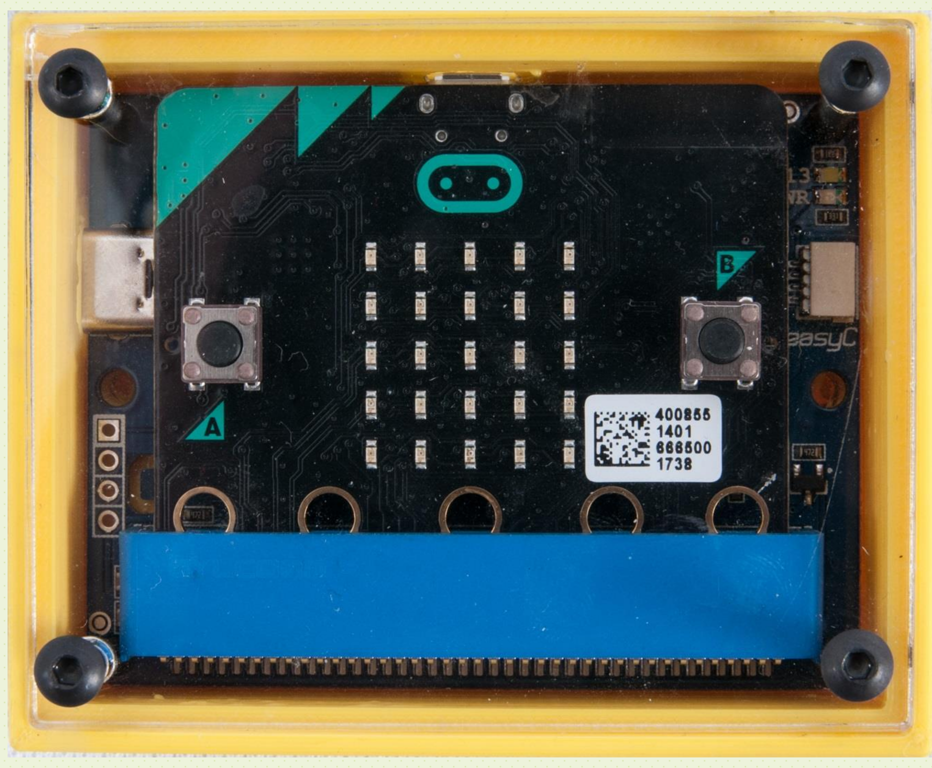
AQ:bit is a micro:bit based breadboard-compatible WiFi development board which allows the measurement of four atmospheric variables: temperature, relative humidity, air pressure and the concentration of microparticles. It has an ARM processor, an accelerometer and magnetometer sensors, Bluetooth/WiFi connectivity and an interface for other sensors. It is based on the MicroPython programming language and has a built-in web editor which allows uploading programs to the device.

To work properly, AQ:bit needs to be connected to a power supply using a USB-C cable. Tracking of the measured data is easy, as it does not require physical access to the device and additional PC software (like dataloggers), although it does require a stable Wi-Fi connection and logging in to a website where data is collected. Since all readings are sent to a remote server, it is possible to maintain an almost unlimited data history in comparison to other devices with limited internal memory capacity. For these reasons, we decided to evaluate AQ:bit as an alternative to dataloggers and similar sensing devices that operate on batteries.

Our objective was to implement a product that is innovative, reliable and cost-efficient, giving it an advantage over the existing technology for continuous monitoring of environmental conditions in heritage collections storage areas.



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For the purpose of this research, five AQ:bits were exposed to different microclimate conditions over a 6-month period in order to analyse their long-term accuracy, sensitivity to fluctuations and reliability at collecting data, and compare them with those of other types of sensing devices.

Although it was observed that all AQ:bits' measurements deviate from those of other reference devices, the deviations were constant during the tracking period. AQ:bits also detected fluctuations in RH in a precise and timely manner. We first assumed the deviations were a result of the fact that the sensor probe is located inside the AQ:bit case and close to other components that additionally heat the probe. However, the data suggest that the most likely reason is different calibration.

The results obtained indicate that AQ:bit is potentially useful tool that operates in real-time and could be helpful in rapidly changing conditions and crisis situations, when access to the collections is restricted. It can also easily be upgraded with other sensors for detecting CO2, dust, motion, light and UV level. Therefore, we can conclude that the new technologies using computing power of a microcontroller could be helpful in making collections more resilient and adaptive to change, while ensuring the transition towards more innovative and cost-efficient solutions.

AQ:bit next to a datalogger

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