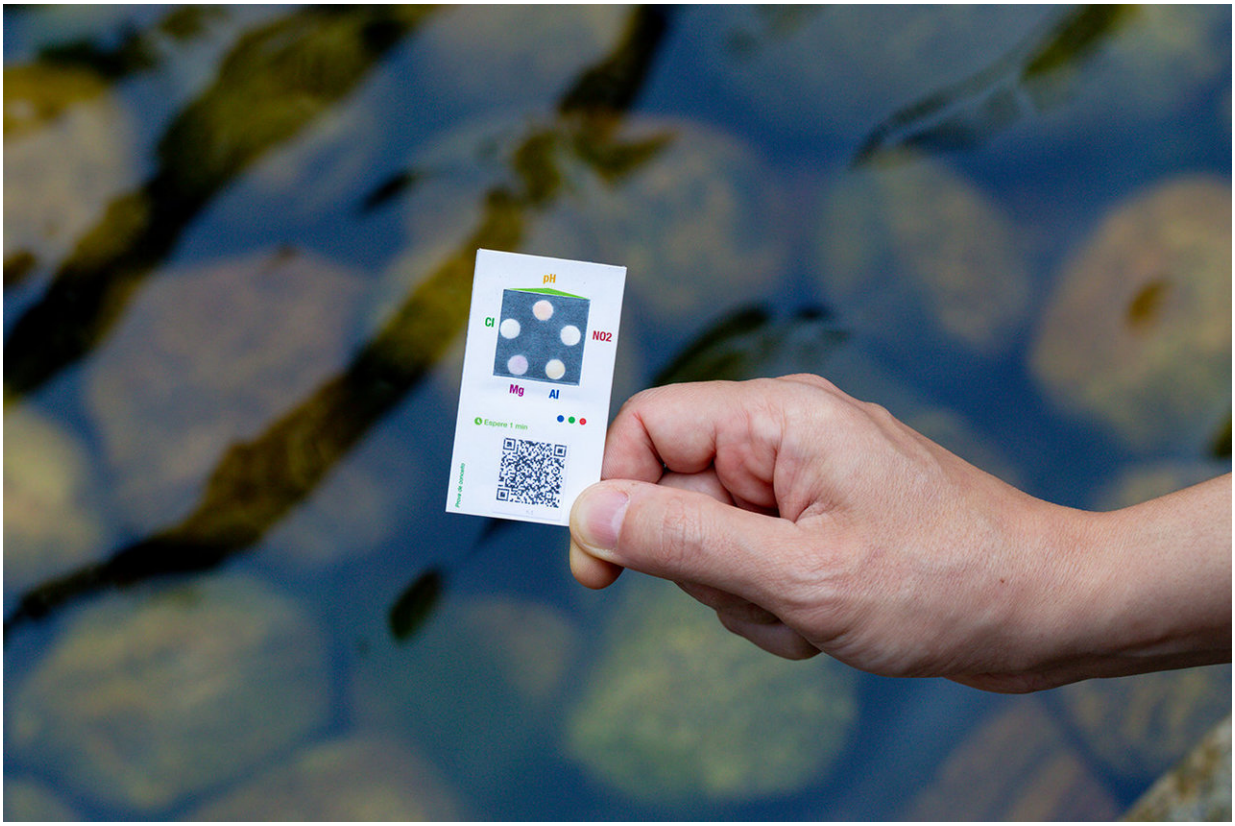
No farms, no food

September 5 2018, by Mathias Steiner



AgroPad: A set of circles on the back of the card provide colorimetric test results; the color of each circle represents the amount of a particular chemical in the sample. Credit: IBM

Agriculture consumes more than 70 percent of the world's annual water usage. With small farms producing nearly 80 percent of food for the developing world, ensuring the quality and safety of our water supply is

critical. Environmental analysis for agriculture often relies on expensive and time-consuming laboratory tests performed far away from the farm. As a result, chemical analysis is quickly outdated and limited to small sample numbers.

My team set out to find a way to simplify the testing process and make it affordable for small farmers to monitor the health of their soil and water. Our prototype, the AgroPad, enables real-time, on-location, chemical analysis of a soil or water sample, using AI.

So – how does it work?

A drop of water or soil sample is placed on the AgroPad, which is a paper device about the size of a business card. The microfluidics chip inside the card performs on-the-spot a chemical analysis of the sample, providing results in less than 10 seconds.

The set of circles on the back of the card provide colorimetric test results; the color of each circle represents the amount of a particular chemical in the sample. Using a smartphone, the farmer would then take a single snapshot of the AgroPad by using a dedicated mobile application and immediately receives a chemical test result.

AgroPad: "AI on the edge"

This "AI on the edge" computing approach uses machine learning and machine vision algorithms to translate the measured color composition and intensity into concentrations of chemicals in the sample, making it more reliable than tests based on human vision alone. Test data can be simultaneously streamed onto a cloud computing platform and labeled with a digital tag that uniquely identifies the time, location and results of the chemical analysis. The cloud platform allows management and

integration of millions of individual tests performed at various times and locations. This is an important feature for monitoring, for example, the change in fertilizer concentration in a particular region throughout the year.

We currently have a five-parameter prototype solution for soil and water testing that measures pH, nitrogen dioxide, aluminum, magnesium and chlorine. We're continually extending the library of chemical indicators available for deployment; each AgroPad could be personalized based on the needs of the individual user.

Since the paper-based tests can be reliably performed by non-experts, public data collection with instant digitization in chemical sensing becomes a real possibility. Along with low cost, mass production of the paper based device and large scale deployment through mobile and cloud technologies, the exploratory prototype could revolutionize digital agriculture and environmental testing.

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