Open-Source Development of Portable NIR-Sensor Measurement Setups for Plant Leaves

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Project In4Food studies plant production in highly controlled environments, and NIR spectroscopic methods are developed for future quality control and monitoring as well as optimization purposes.

Small NIR sensors have become increasingly available. Also, readily available single-board computers such as the Arduinos, Raspberry Pis or similar that can be connected to normal PC hard- and software as well as to wide variety of sensors and actuators in general, plus the mechanical possibilities of affordable 3d printing together allow versatile adaptation of measurement setups to the precise needs of particular studies. This includes convenient automation of work-flows that has rarely been possible with the insular nature of bench-top spectrometers (or their portable counterparts) for fast-changing requirements such as usual in scientific research.

This convenience is of high practical importance: additional sensors allow for better characterization of samples (if only for “debugging” of the experimental data) and even saving the need to type (or copy/paste from an Excel-sheet) sample names by asking for a particular sample and confirming against a barcode frees human resources. In turn, larger or more complex experimental designs may be implemented with less need for curation and fewer errors.

We use a modular design strategy: small interoperable modules for various sensors and actuators focus on a particular task each. Parts/modules (both in a hardware and software sense) are combined into a setup for the experiment at hand, and easily adapted or re-assembled when the experimental needs change.

Our on-going work is publicly available at <https://gitea.julius-kuehn.de/claudia.beleites>

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