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Development of an open-source broadband field spectrometer

Problem Statement

Spectroscopy is an important data collection method for various fields and applications, however, existing field spectrometers on the market are not only expensive but also come as black-boxes that prevent scientists from customizing them to their needs.

A market research has been conducted to analyse commercial solutions, their functionalities and shortcomings. Market leaders confine the users to their own software and hardware solution.

Solution/Experiment/Design

This project aims to develop a prototype of an open-source field spectrometer using easily available components. A major feature of the intended prototype is customization in both hardware and software. As a result, users can easily tailor it to suit their specific use-cases.

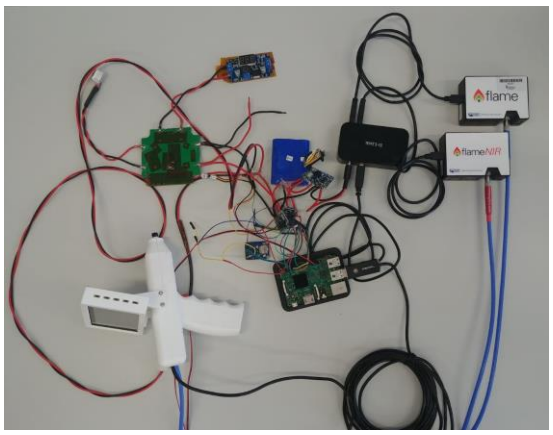

Fig. 1: Open-source field spectrometer prototype

Implementation

The field spectrometer prototype consists of 2 off-the-shelf spectrometers from Ocean Optics (Flame VIS, Flame NIR) [1, 2] and an embedded computer (Raspberry Pi 3) amongst others. The acquired sensor data is geo-referenced and timestamped. Addtionally, an RGB image of the measured area is or can be captured.

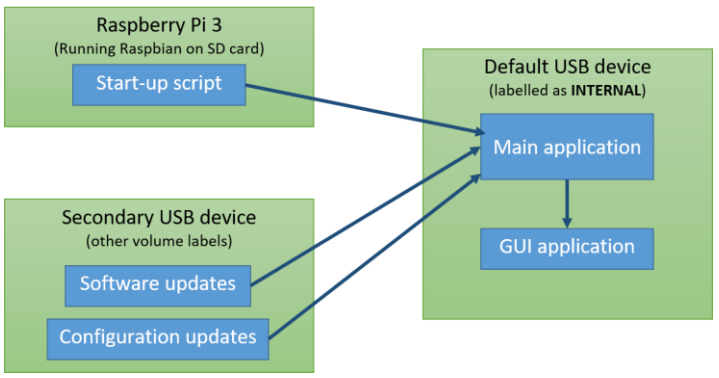

Fig. 2: High-level software architecture

Results and Discussion

The spectrum is shown live within the GUI. The project is fully documented and published on github.com.

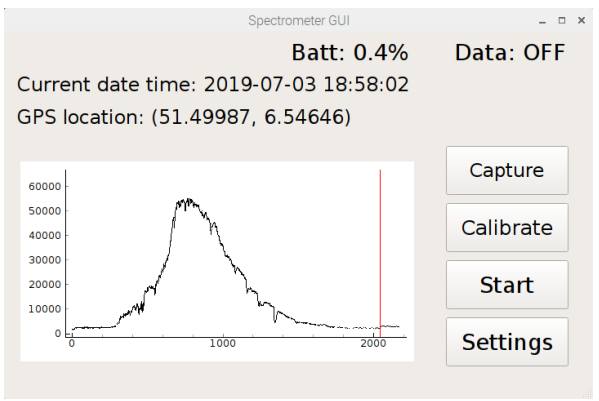

Fig. 3: GUI with real time graph depicting a reflectance panel measurement

Outlook

The prototype developed in this project acts as a reference implementation that can be modified for different use-cases. The prototype can be improved upon by adding extra features, for example, an irradiance sensor and support for different spectrometer models.

References

[1] Ocean Optics, Inc. (n.d.) Flame Spectrometer, Available from https://oceanoptics.com/product/flame-spectrometer [Accessed 03 July 2019]

[2] Ocean Optics, Inc. (n.d.) Flame-NIR Spectrometer, Available from https://oceanoptics.com/product/flame-nir-spectrometer [Accessed 03 July 2019]