Next Generation UAV Spectral Systems for Environmental Monitoring

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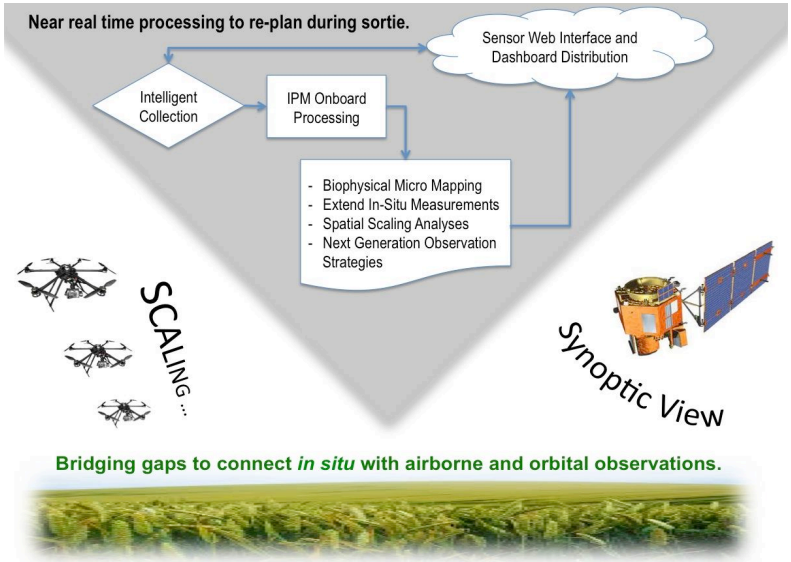
Objective

- Develop and demonstrate an innovative software system for producing and disseminating science-quality spectral data from Uninhabited Aerial Vehicles (UAV) that:
  - Ensure well-calibrated, science quality measurements
  - Leverage UAV strengths such as rapid deployment, high temporal frequencies, and high resolution
  - Allow ready integration with, or comparison to, in-situ satellite and airborne data and derived products
  - Support capability to characterize diurnal and seasonal vegetation cycles.



Accomplishments

- Implemented spectrometer and thermal IR systems on a UAV and demonstrated science quality spectral data retrieval with varying light and cloud cover. Enabling flexible seasonal and diurnal monitoring of vegetation traits that integrate with, or are comparable to NASA's single temporal / single instance satellite and airborne data. The UAV hardware and software system enabled rapid instrument changes.
- Implemented two data collection and processing workflows – one deriving traits from a push broom imaging spectrometer (Nano-Hyperspec) and another deriving radiance and reflectance for a line dual spectrometer (Piccolo).
- Tested and validated measurements in-situ at well-characterized sites and derived standard vegetation indices indicative of canopy chlorophyll content (MTCI), greenness (NDVI) and photosynthetic function (PRI).
- Developed open source python software tools for rapid data assimilation and processing systems providing indicators of the quality of the collected radiance and reflectance spectra; solar induced fluorescence (SIF) data collected in both red (685nm) and far-red (760nm) bands.
- Verified retrieved spectral data and the value of radiance and reflectance data in the scale of 10 – 120m altitude in collaboration with University of Wisconsin biodiversity science team and leveraged their online EcoSIS spectral library.

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TRL_{in}= 3 **TRL_{out}= 5**