



Monitoring, analysis and classification of vegetation and soil data collected by a small and lightweight hyperspectral imaging system

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The increasing precision of modern farming systems requires a near-real-time monitoring of agricultural crops in order to estimate soil condition, plant health and potential crop yield. For large sized agricultural plots, satellite imagery or aerial surveys can be used at considerable costs and possible time delays of days or even weeks. However, for small to medium sized plots, these monitoring approaches are cost-prohibitive and difficult to assess. Therefore, we propose within the INTERREG IV A-Project SMART INSPECTORS (Smart Aerial Test Rigs with Infrared Spectrometers and Radar), a cost effective, comparably simple approach to support farmers with a small and lightweight hyperspectral imaging system to collect remotely sensed data in spectral bands in between 400 to 1700nm. SMART INSPECTORS includes the whole remote sensing processing chain of small scale remote sensing from sensor construction, data processing and ground truthing for analysis of the results. The sensors are mounted on a remotely controlled (RC) Octocopter, a fixed wing RC airplane as well as on a two-seated Autogyro for larger plots.

The high resolution images up to 5cm on the ground include spectra of visible light, near and thermal infrared as well as hyperspectral imagery. The data will be analyzed using remote sensing software and a Geographic Information System (GIS). The soil condition analysis includes soil humidity, temperature and roughness. Furthermore, a radar sensor is envisaged for the detection of geomorphologic, drainage and soil-plant roughness investigation. Plant health control includes drought stress, vegetation health, pest control, growth condition and canopy temperature. Different vegetation and soil indices will help to determine and understand soil conditions and plant traits. Additional investigation might include crop yield estimation of certain crops like apples, strawberries, pasture land, etc. The quality of remotely sensed vegetation data will be tested with ground truthing tools like a spectrometer, visual inspection and ground control panel. The soil condition will also be monitored with a wireless sensor network installed on the examined plots of interest. Provided with this data, a farmer can respond immediately to potential threats with high local precision. In this presentation, preliminary results of hyperspectral images of distinctive vegetation cover and soil on different pasture test plots are shown.

After an evaluation period, the whole processing chain will offer farmers a unique, near real- time, low cost solution for small to mid-sized agricultural plots in order to easily assess crop and soil quality and the estimation of harvest. SMART INSPECTORS remotely sensed data will form the basis for an input in a decision support system which aims to detect crop related issues in order to react quickly and efficiently, saving fertilizer, water or pesticides.