

Development of Mounted Hyperspectral Sensor on UAV for Environmental and Agricultural Studies

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Abstract:

In our previous studies, a hyperspectral array sensor system for an unmanned radio-controlled helicopter was developed. The specifications of the hyperspectral sensor were 400-1000 nm spectral range, 121 bands, 5 nm spectral resolution, and 11 kg weight. The system was controlled by note PC and total weight was about 20 kg. The unmanned radio-controlled helicopter was RMAX 18 (Yamaha Co.), the mass of vehicle was 64 kg, and the payload was 30 kg. We used the system for agricultural studies about growth estimation and nutritional diagnosis at the paddy fields. The unmanned radio-controlled helicopter was operating by the special members belong to the Yamaha Co. and that makes limited opportunity at observing period. Recently new UAVs are progressing such as cycle body type with 4 propellers, and a small unmanned airplane. We want to use this kind of platform freely. However, the payloads of these new platforms are about below 15 kg. We determined to develop a low cost, small-sized and light weight hyperspectral sensor system for loading on small UAV platforms. We made a prototype measurement system last year and are modifying now. The system is composed of a hyperspectral sensor unit, GPS sensor unit, data logger unit, power supply, information display unit, and control switch, and total weight was 8 kg. Hyperspectral sensor unit has lens, spectrometer, AD converter. The spectrometer was Mini-spectrometer MS-C10988MA made by Hamamatsu Photonics Co., Ltd. (327-763nm wavelength range, wavelength resolution 14nm, 256band, 320μsec acquisition period, and 9g weight). At three paddy rice field in Yamagata Prefecture, on 12-14 hour of August 7, 2012, we conducted a spectral observation using the system. We set up the sheet of orange and white of reflectance known to each course. Observations were performed cloudy time and solar brightness was changing, but due to the reflectance calculation method with respect to the sheet measurements, and corresponded to sunlight change. We got the spectral reflectance of rice, white sheet, and orange sheet, and the spectral reflectance curves were accurately reflect the spectral characteristics of each.

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