

UAV-based Environmental Monitoring using Multi-spectral Imaging

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Abstract

Monitoring the soil composition of agricultural land is important for maximizing crop yields. Carinthian Tech Research, Schiebel GmbH and Quest Innovations B.V. have developed a multi-spectral imaging system that is able to simultaneously capture three visible and two near infrared channels. The system was mounted on a Schiebel CAMCOPTER® S-100 UAV for data acquisition. Results show that the system is able to classify different land types and calculate vegetation indices.

UAV



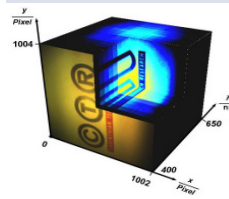
Schiebel GmbH
CAMCOPTER® S-100
MTO weight: 200kg
Power plant: 50HP
Endurance: >6 hours
Cruise speed: 55kts

Spectral Camera



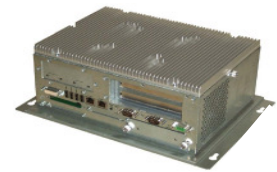
Quest Innovations B.V.
Condor 1000 MS5
3 VIS (400...800nm)
2 NIR (810&910nm)
max. 150 fps

Data Analysis



Carinthian Tech Research
Hyper-spectral classification,
data analysis & visualisation
Data acquisition software

PC Hardware



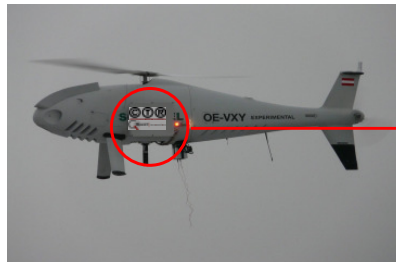
Next System
Embedded PC system
Shock resistant
Intel Celeron, 1GB RAM
4GB solid-state HDD

Mounting



Equipment mounted on UAV

Data Acquisition



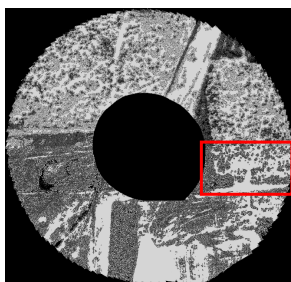
Data acquisition during flight



Data Acquisition System

- > 5 CCD camera
- > Fixed focus optics
- > Embedded PC system

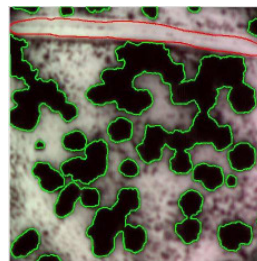
Data Analysis



Images stitched along flight path



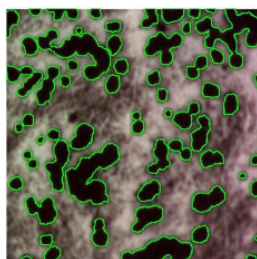
VIS data



Calculated vegetation index



NIR data



Calculated vegetation index

Application fields

- > Forestry
- > Agriculture
- > Environmental monitoring
- > Vision enhancement
- > Geology
- > Water and nutrition stress
- > Pest and parasite affection
- > ...

Flight data

- > Flight altitude: 150 to 500 feet
- > Duration: 1 hour
- > Data amount: ~1.5GB

Conclusion

- > Vegetation is identified effectively
- > Due to snow cover little vegetation
- > Further trials in summer
- > Detection of water stress and nutrient deficiency