

Educational Rotary Scanning Hyperspectral Imager

ATH3500

Features

- High-performance sensor
- Stable mounting bracket & motorized external scanning.
- High-quality optical design, spot size < 0.5 pixels.
- Standard C-Mount for interchangeable lenses.
- Wavelength range: 400-1000nm (customizable).
- Hyperspectral resolution: 1.3 nm @ 696nm.
- Field of view: 11.46° @ 35mm (interchangeable focal length).
- Outstanding imaging performance.

Description

The Optosky Educational Rotary Scanning Hyperspectral Imager is a high-resolution spectral imaging tool designed for research and education. It features advanced transmission grating technology and a rotary scanning system, enabling precise, continuous imaging without camera rotation.

Ideal for precision agriculture, environmental monitoring, and industrial quality control, it analyzes materials such as plants, soil, and water. The imager provides detailed spectral data, supporting applications like plant health monitoring and environmental assessment.

With its cutting-edge technology, the Optosky Hyperspectral Imager is a powerful solution for research and innovation across various scientific fields, enhancing studies in agriculture, environmental science, and material analysis.

Application

- **Agricultural Applications:** Pest and disease monitoring, nutrient tracking, disaster assessment, crop yield estimation.
- **Forestry Applications:** Tree species identification, biomass estimation, nutrient monitoring, forest health.
- **Water Environment Applications:** Water quality parameter inversion, analysis of water pollution distribution and migration.
- **Soil Monitoring:** Soil impurity identification, moisture content monitoring, soil fertility assessment.
- **Geological Applications:** Mineral composition detection, mineralization prediction.
- **Urban Applications:** Surface change detection, road monitoring, feature recognition, environmental protection.



1. Parameter

No.	Specifications	ATH3500	ATH3500-17
1	Spectral Range	400-1000nm	900-1700nm
2	Spectral Resolution	1.3 nm@696nm	3.5@1550nm
3	Sampling Interval	0.37nm	0.37nm
4	F-Number	F/2.4	F/2.0
5	Detector	CMOS	InGaAs
6	Interface	USB3.0	USB3.0
7	Power	USB Power, 3.4W	USB Power, 3.6W
8	Sensor Size	11.26mm x 7.03mm	9.6mm x 7.68mm
9	Native Resolution	1920 × 1200	640 × 512
10	Pixel Size	5.5 μm x 5.5 μm	5.5 μm x 5.5 μm
11	Pixel Bit Depth	12 bits	14 bits
12	Slit Width	25 μm	25 μm
13	Pixel Merging Method	4x4、2x2、1x1	2x2、1x1
16	Field of View (FOV)	11.46°@f=35mm	11.46°@f=35mm
17	Instantaneous FOV (IFOV)	0.7mrad@f=35mm	0.7mrad@f=35mm
18	Max Frame Rate	156fps	256 fps
19	Dimensions	285 mm x 285 mm x 188mm	285 mm x 285 mm x 188mm
20	Weight	< 5.5 Kg	< 5.5 Kg
21	Working Temperature	-10 - 50°C	-10 - 50°C
22	Storage Temperature	-30-70°C	-30-70°C
23	Spectral Channels	1920 (1x Pixel Binning Modes) 960 (2x Pixel Binning Modes) 480 (4x Pixel Binning Modes)	640 (1x Pixel Binning Modes) 320 (2x Pixel Binning Modes)
24	Spatial Channels	1200 (1x Pixel Binning Modes) 600 (2x Pixel Binning Modes) 300 (4x Pixel Binning Modes)	512 (1x Pixel Binning Modes) 256 (2x Pixel Binning Modes)
26	Scanning Mode	External Push-Broom Scanning Measurement	
27	Acquisition Software	Flexible Exposure Settings with Real-Time Hyperspectral Image and Spectral Curve Display	
28	Analysis Software	One-Click Access to Clustering Analysis, Single-Band Images, True/False Color, 20+ Customizable Vegetation Indices, 3D Image Cropping, and Target Spectral Recognition All functions support automated, unattended batch processing without the need for third-party software.	
29	Software Display	Allows scientific brightness and focus adjustment, eliminating human errors in visual focusing.	
30	Interface	USB3.0	

31	Light Source	● High-Stability Constant Power High Blue Light Surface Light Source ● High-stability constant power blue light linear light source, with optical lens group compressing and stretching the point light source to enhance energy utilization efficiency.
32	Length (Optional)	$\geq 220\text{mm}@400\text{mm}$
33	Width (Optional)	$\leq 30\text{mm}@400\text{mm}$
34	Lifespan (Optional)	$\geq 2000\text{h}$

Model	Max Spectral Channels	Max Spatial Channels
ATH3500	1920	1200
ATH3500-17	640	512

2. Physical Image

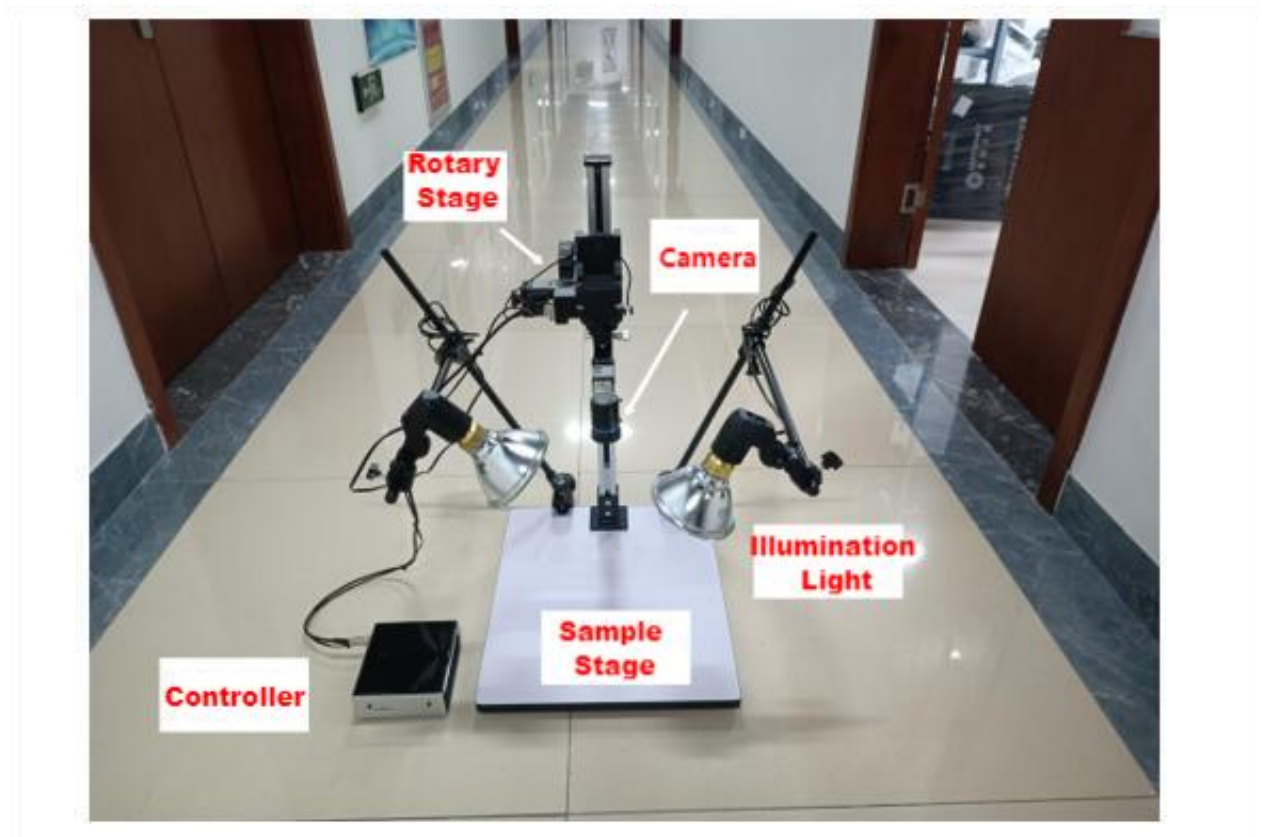


Figure 2: ATH3500 Physical Image

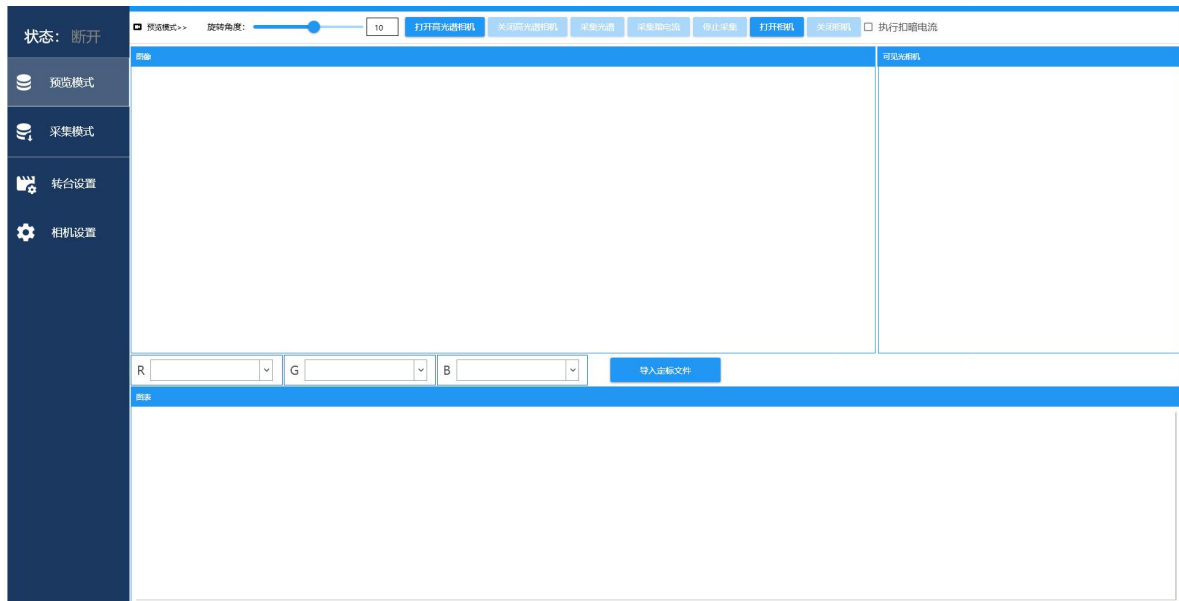
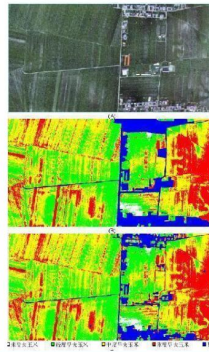
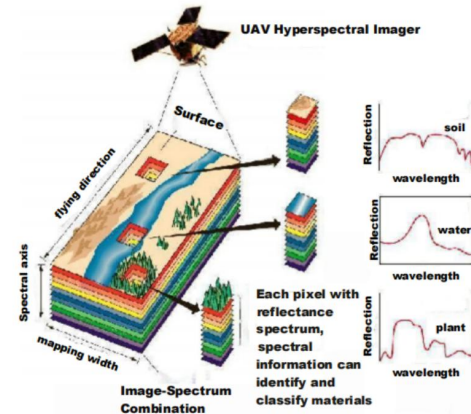


Figure 3: ATH3500 Software Interface

3. Hyperspectral Applications

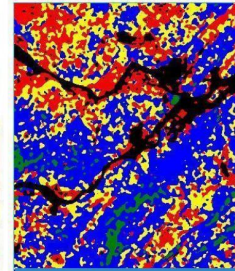


Applications



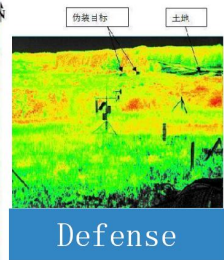
Agricultural

- Pest Warning
- Pesticide Guidance
- Yield Assessment
- Acreage Assessment
- Water Shortage Warning
- Nutritional Quality Warning

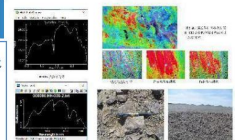


Forestry

- Forest Coverage Assessment
- Timber Stock Assessment
- Forest Pest Control
- Tree Identification
- Biomass Estimation
- Nutrient Monitoring
- Forest Health Monitoring
- Tea Garden Pest Control
- Irrigation Guidance
- Fertilization Guidance
- Smart Planting

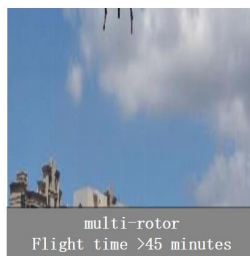


Defense

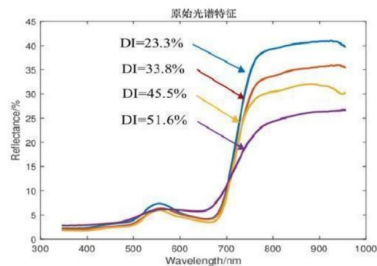


Mining

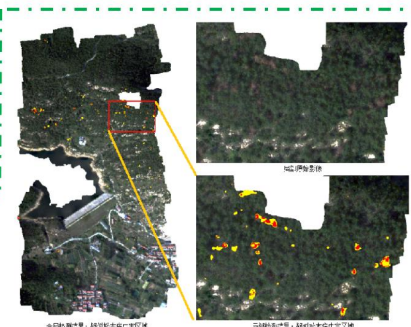
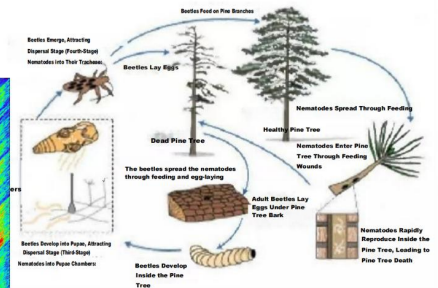
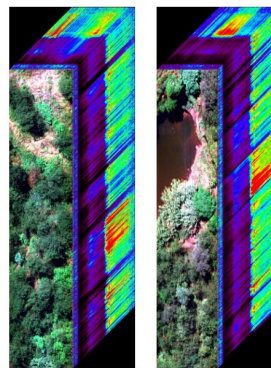
- Prospecting
- Ore Quality Screening
- Mineral Mapping
- Mineral Composition Detection
- Metallogenic Prediction



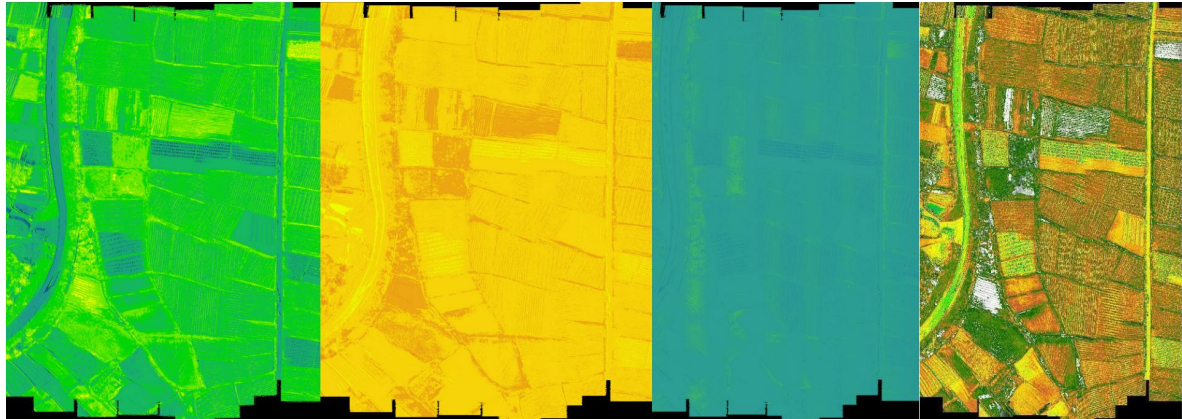
Pests and Diseases of Forest



Spectral Characteristics of Masson Pine under Different Disease Indices



Agriculture



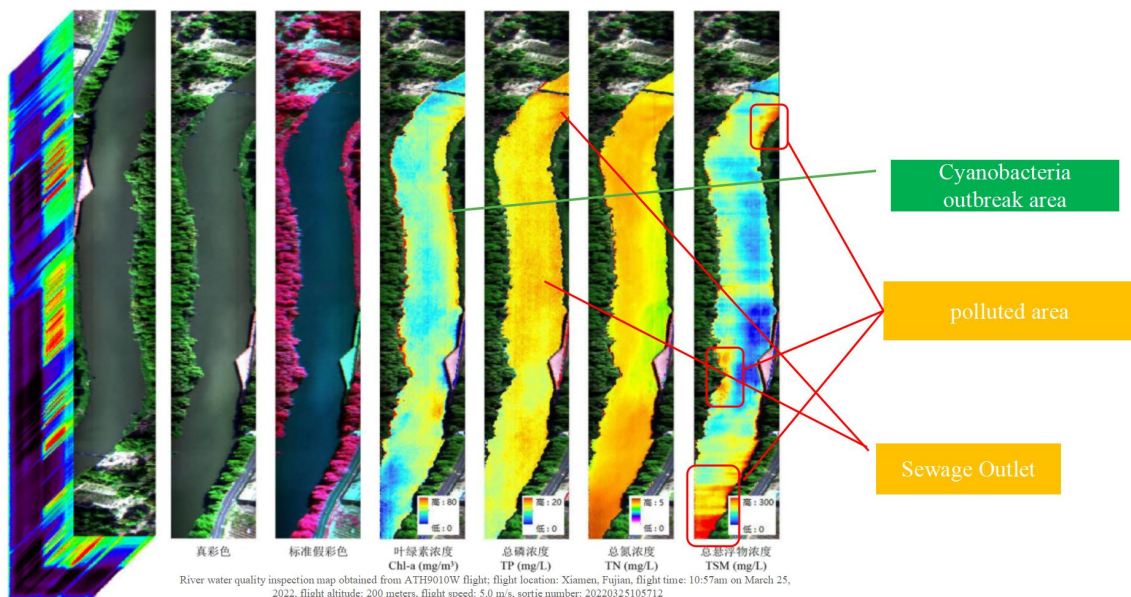
Crop growth status (i.e. yield assessment) patromap, the darker the green area, the better the growth status

Vegetation health monitoring and yield assessment, the darker the yellow color, the healthier the plant and the higher the yield.

Pest patromap

Crop nutrient inspection map, the darker the color, the poorer the plant health index and the lack of nutrients.

Water Quality Inspection



Water Quality Inspection



- **Flight location:** Kunshan, Jiangsu
- **Flight time:** 10:57am, July 25, 2019
- **Flight altitude:** 100 meters
- **Flight speed:** 4.6m/s
- **Flight number:** 20190725103410



COD



TP



TN



ABS600

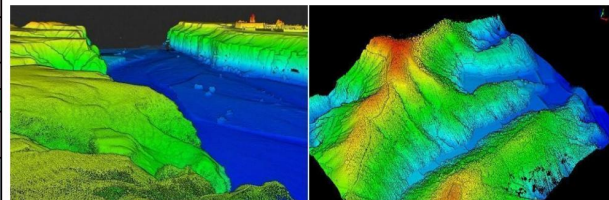


UAV-borne Hyperspectral Imager + lidar ATHL9010

	ATHL9010	ATHL9010P	ATHL9010W
Lidar			
Principle of Lidar	TOF		
Laser WL	1550nm, Eye-safety		
Speed	0.5 M point/s, up to 1Mpoint/s (depend on the distance)		
Scan lines	1750 lines		
FOV	Horizontal 15°		
Angle Res.	Horizontal 0.009°		
Scan speed	500 Hz		
Height	1~300 m, Max. 600 m		
laser return mode	multiple returns		
height deviation	<20 mm		
Weight	1.5 Kg		
Reliability			
Working Temp.	-10 ~ 45℃		
Storage Temp.	-20 ~ 65℃	-20 ~ 65℃	-20 ~ 65℃
Working Humidity	≤85% RH	≤85% RH	≤85% RH

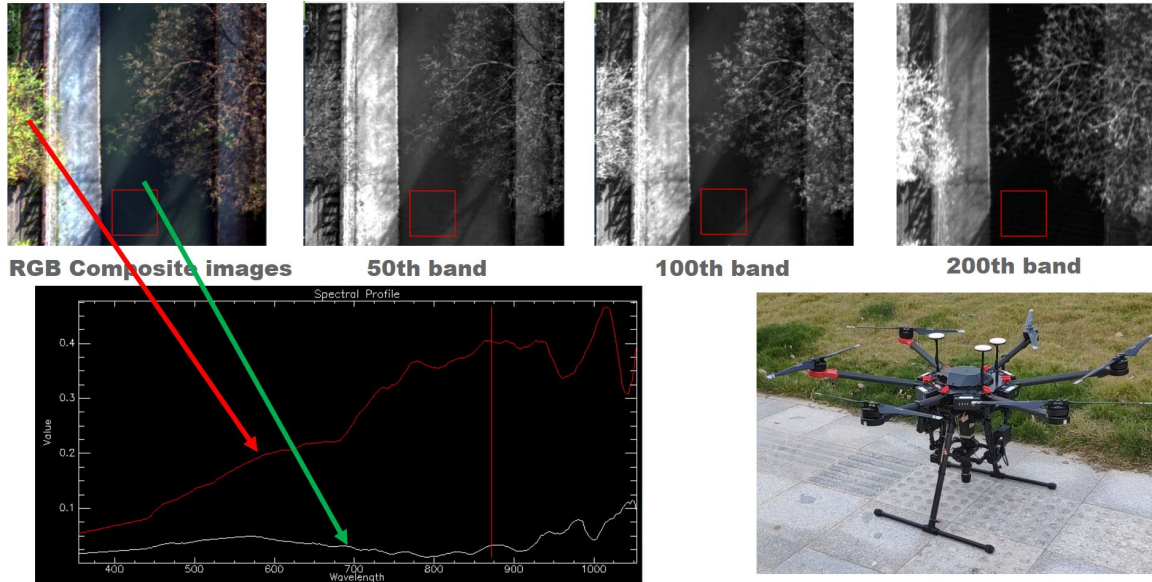


Principle of Lidar

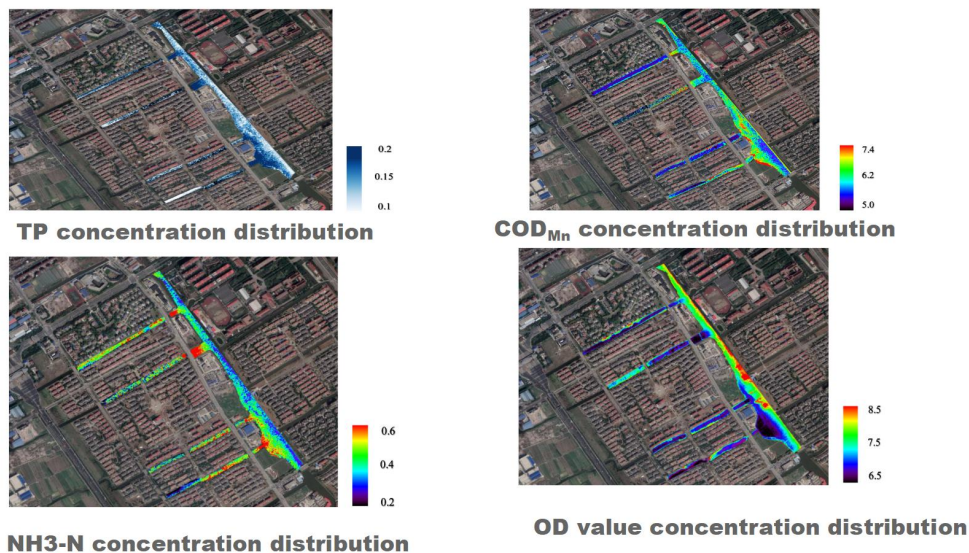


Actual Images

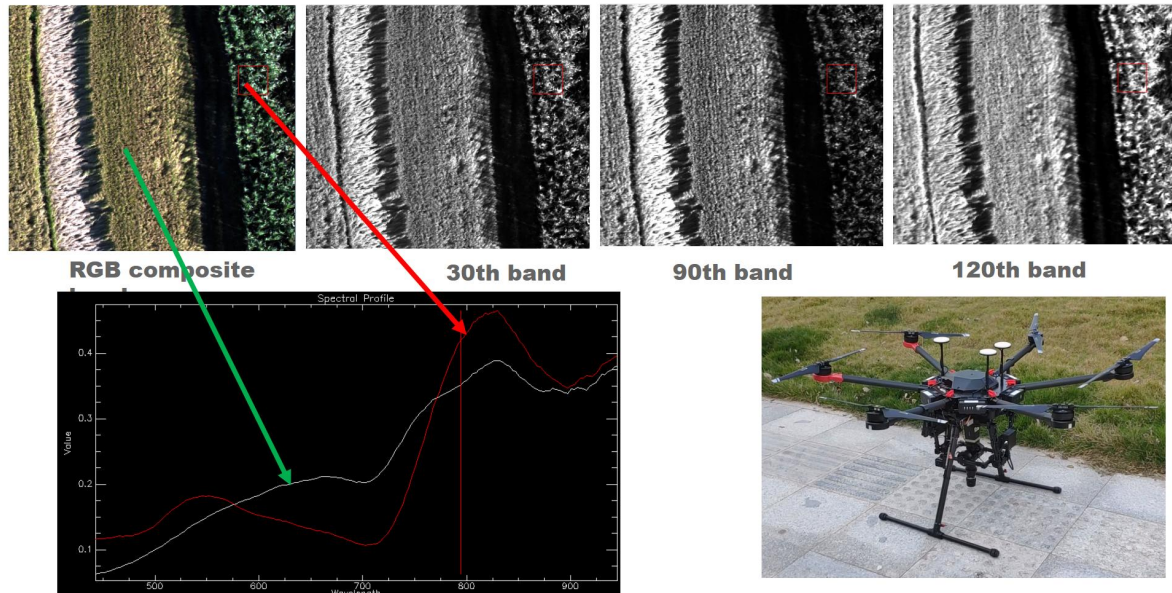
UAV Hyperspectral Imager for River Channel



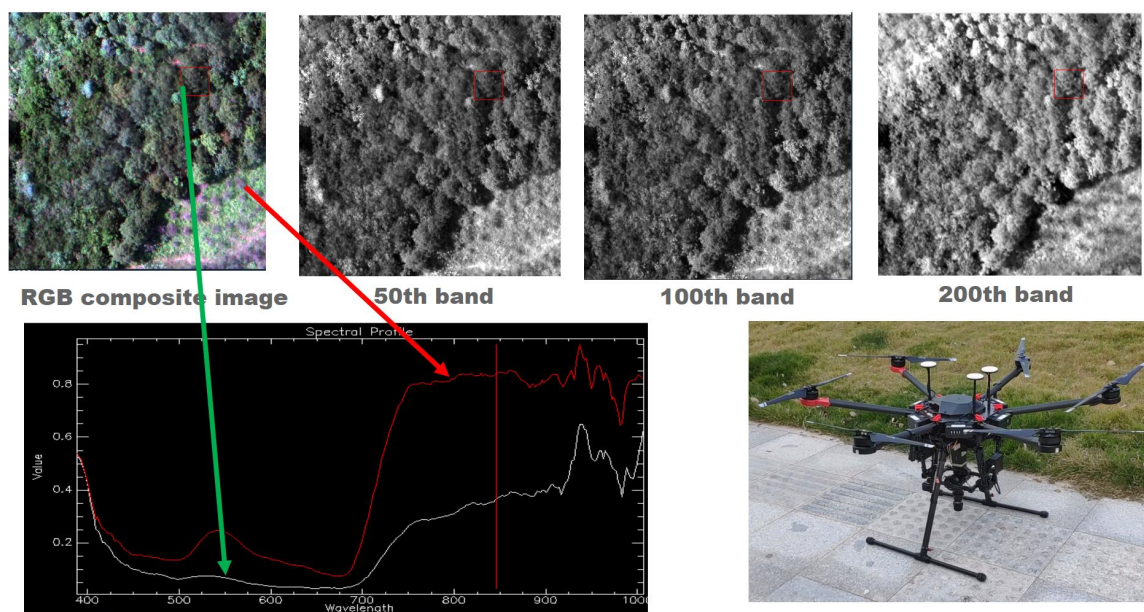
UAV Hyperspectral Imager for River Channel



UAV Hyperspectral Imager for Agriculture



UAV Hyperspectral Imager for Forestry

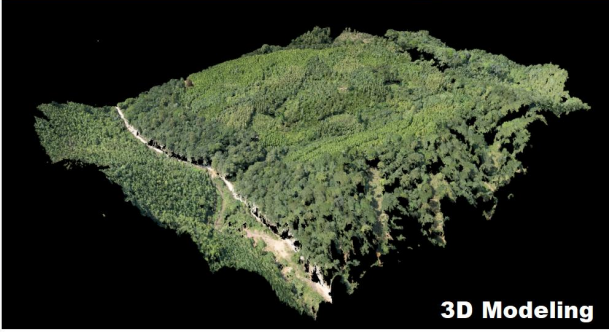


3D Imaging (ATP9011/2)





orthophoto mosaic



3D Modeling



3D Modeling



3D Modeling

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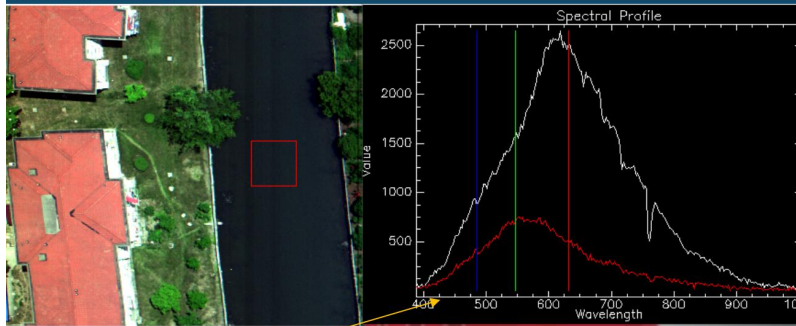
UAV Hyperspectral Imager Application



 Agriculture • Pest and disease analysis • Helps in guiding pesticide application. • Yield assessment • Crop area assessment.	 Forest • Forest and grass cover assessment • Timber volume assessment • Forest pest and disease control • Tree species ID, biomass, nutrient monitoring, forest health • Tea garden: pest control, irrigation, fertilization, smart planting	 Environment • Environmental monitoring • River pollution analysis • Soil pollution assessment • Heavy metal contamination	 Hydrology • Water quality parameter inversion • Water pollution spatial distribution and migration analysis • Hydrological environment monitoring of rivers and lakes • Algae and red tide warning
 Insurance • Damage area assessment • Disaster loss valuation	 Mining • Exploration • Ore quality screening • Mineral mapping • Mineral composition detection • Ore deposit prediction	 City Management • City object classification and identification	 Defense • Enemy reconnaissance • Counter-camouflage • Counter-mining

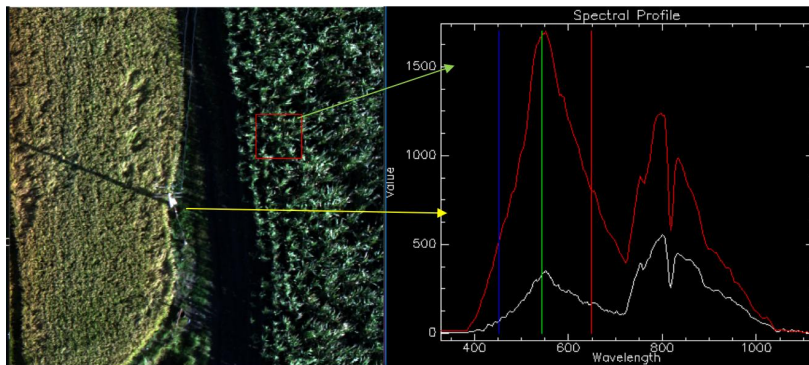
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Case Studies



Water Quality Flight Data:

- ◆ Ititude: 150m
- ◆ Exposure Time: 0.2m
- ◆ speed: 6.8m/s
- ◆ Frame Rate: 50Hz
- ◆ Location: Shanghai
- ◆ Gimbal: In-house developed



Agriculture Flight Data:

- ◆ Altitude: 70m
- ◆ Exposure Time: 0.8ms
- ◆ Speed: 3.4m/s
- ◆ Frame Rate: 50Hz
- ◆ Location: Jiutai, Jilin
- ◆ Gimbal: In-house developed

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Agricultural Application (Precision Agriculture)

Crop Identification and Classification

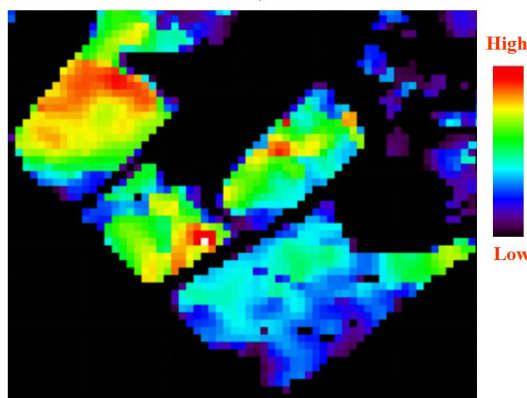
Left: Crop identification results in southern Shiojiri, Nagano, Japan

Purple: Rice
Yellow: Grapes
Green: Pears
Blue: Soybeans

Right: Crop identification results in northwest Nagano, Japan

Yellow: Apples
Blue: Rice

Bottom: Relative growth status of grapes, with red areas indicating better growth



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Ecosystem - Requirements and Challenges



Water ↔ **Solubility, Flowability, Self-Cleaning Ability**

Surface Water Pollution Issues Induced by Social Development



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Ecosystem - Requirements and Challenges



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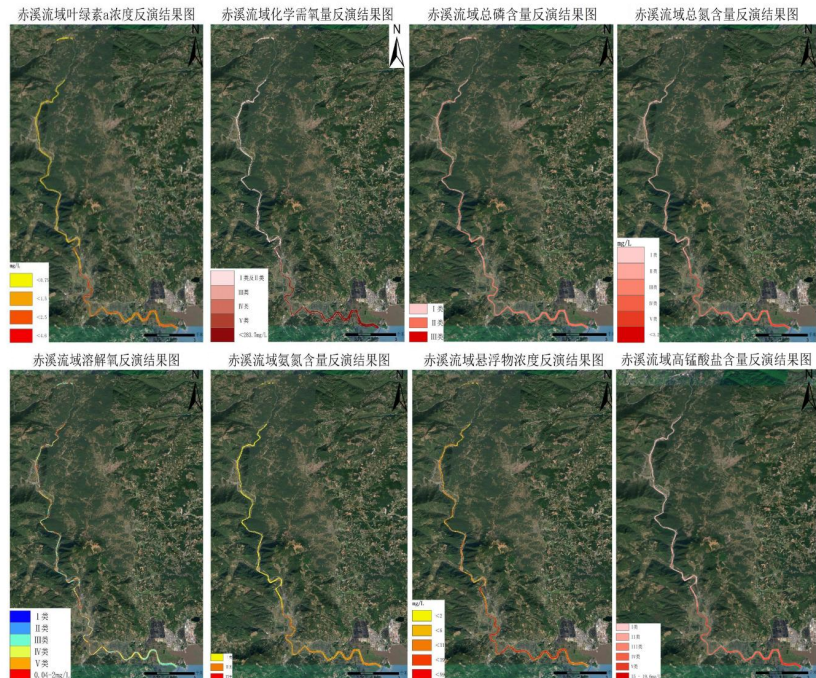
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Ecosystem - Monitoring Metrics

Water Quality Monitoring and Pollutant Detection

- ✓ Dissolved Organic Matter
- ✓ Heavy Metals
- ✓ Suspended Solids
- ✓ Algal Blooms



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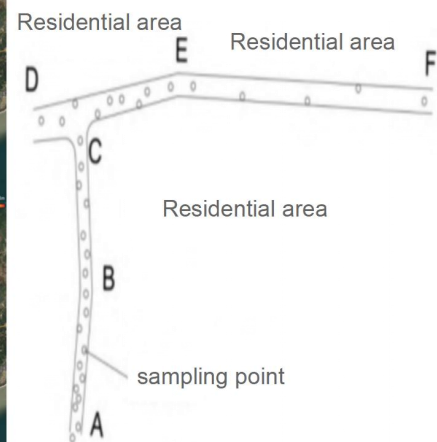
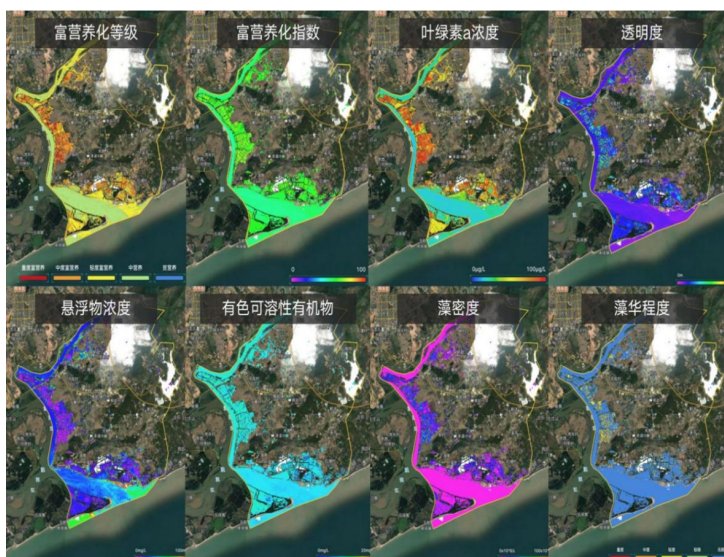
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Ecosystem - Water Environment

High efficiency and accuracy with hyperspectral data for informed decisions

Optimal sampling point and inverse models for full area contaminant levels



Monitored river sections and sampling points

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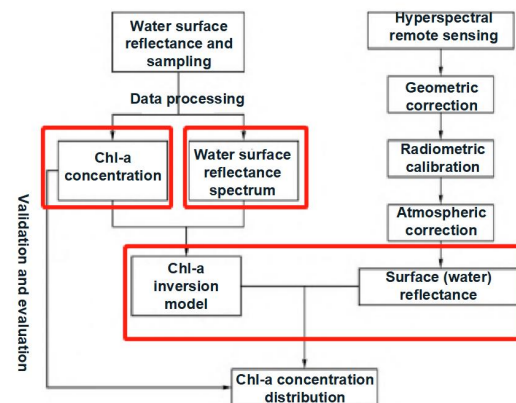
Ecosystem - Monitoring Principles



Water Quality Parameters

Best with Land and Hyperspectral Data Combo

Principle

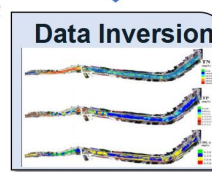
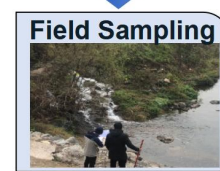
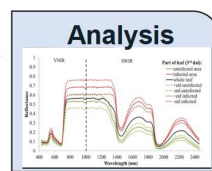
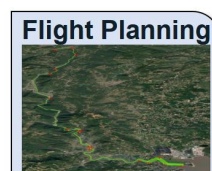


ATH9010 Series Hyperspectral:
Does not directly measure parameter concentrations

Ecosystem - Products and Processes

Products Application and Processes

- A: ATH9010
- B: ATE2000

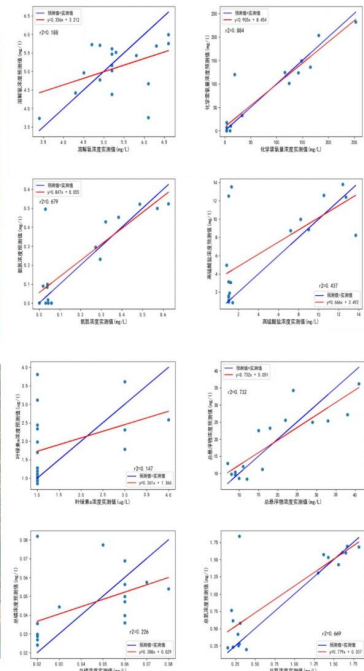
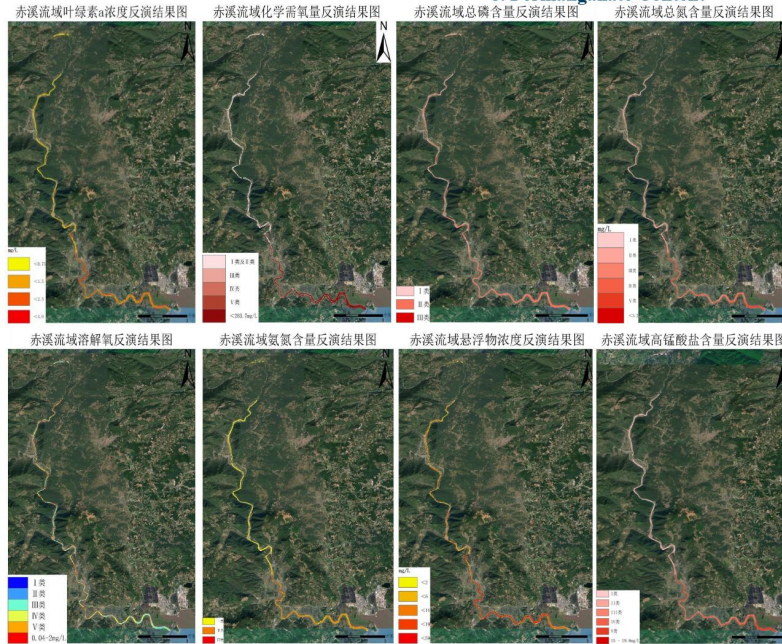


- Preprocess UAV hyperspectral data such as radiometric correction and stitching
- Collect spectral data from river samples with evenly spaced and targeted points
- Analyze spectral data from UAV imagery and water quality parameters
- Quickly generate concentration maps for water quality over time and space

Ecosystem - Case Studies Chixi Watershed

1. Chlorophyll-a Concentration
2. COD (Chemical Oxygen Demand)
3. Total Phosphorus
4. Total Ammonia

5. Dissolved Oxygen
6. Ammonia Nitrogen
7. Suspended Solids Concentration
8. Permanganate Content



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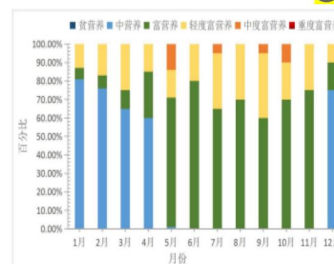
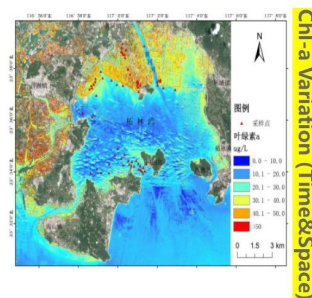
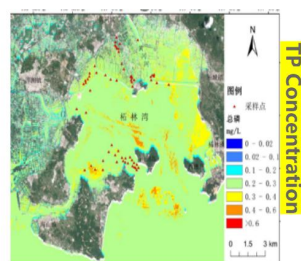
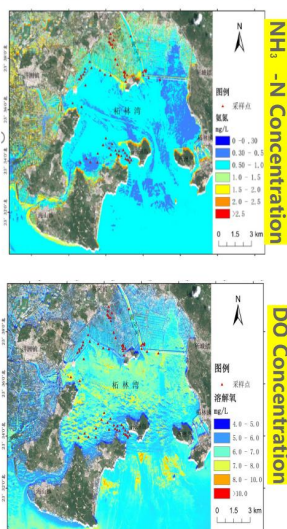
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Ecosystem - Case Studies Environment

Content: Used spectral and remote sensing data to model and analyze aquaculture pollution patterns and assess pollution sources.

Clients - Environmental Departments and Resources Institutes

Conclusion: Model accuracy over **86.32%**, aiding in optimizing aquaculture layout, promoting sustainable practices, and reducing pollution



Result

Water Trophic Changes

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Agriculture - Requirements and Challenges

Monitor Requirements

- Monitor growth, yield, and efficiency to optimize fertilization and boost crop production
- Automate disease detection to cut pesticide use and minimize losses
- Infer key vegetation traits
- Monitor soil quality and heavy metals to protect health and the environment. Protect Body health and environment.

Challenges

Limited monitoring scope
inefficient pesticide use

Incomplete monitoring systems

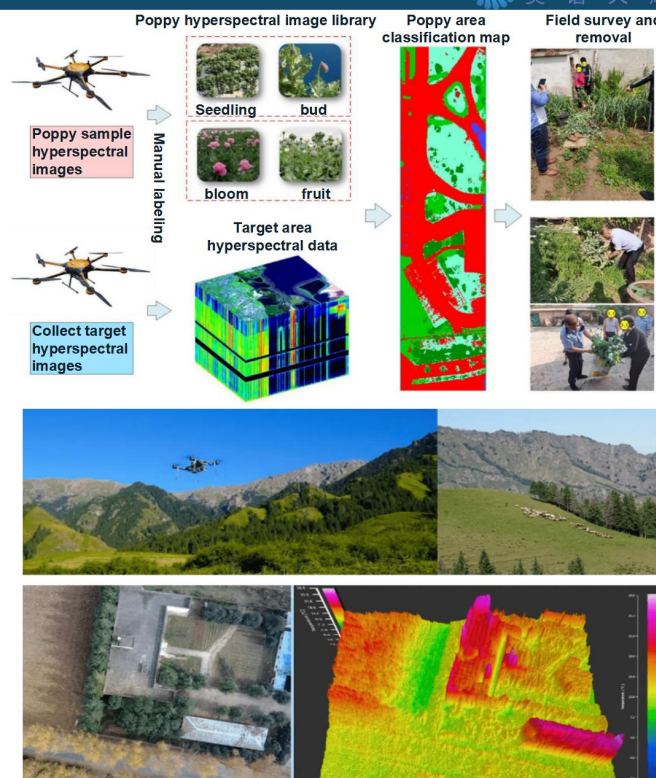
pests and diseases

Low fertilizer efficiency

Agriculture - Monitoring Metrics

Crop and Soil Monitoring

- ✓ Nitrogen nutrition
- ✓ Crop pest and disease
- ✓ Heavy metal pollution
- ✓ Biomass estimation
- ✓ Tech-managed yield phenotyping



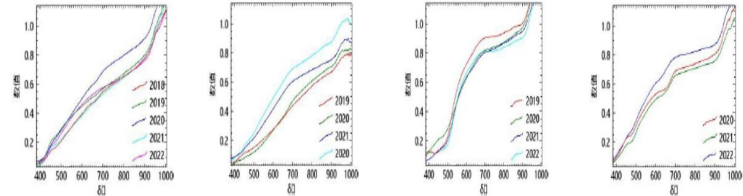
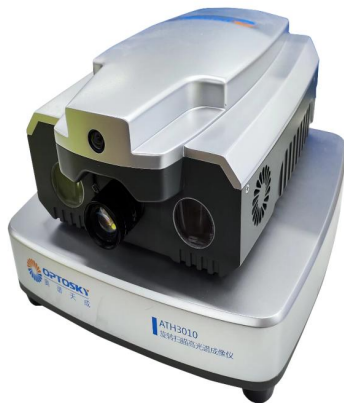
Agriculture - Case Studies



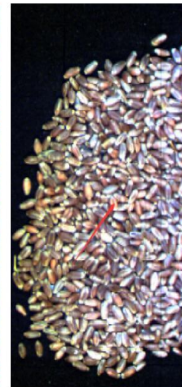
Meizheng Bio-Tech

Hyperspectral crop detection by year

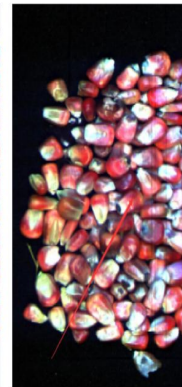
Instrument: ATH3010
Lens Distance: 25cm
Exposure Time: 8500us
Frame Rate: 25FPS



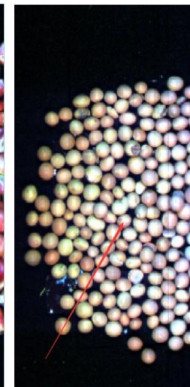
Rice



Wheat



Corn



Soybeans

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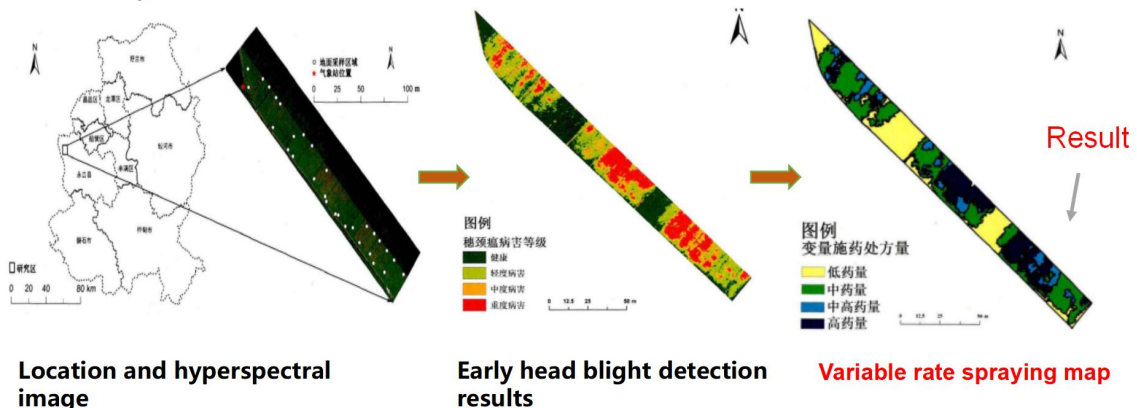
Agriculture - Case Studies



Content: Use rice disease spectral data to build a detection and warning model

Client - Agriculture Departments

Conclusion: Model accuracy: **90%**, mapping accuracy: **82.25%**. Enhances modernization and increases yields and farmer income



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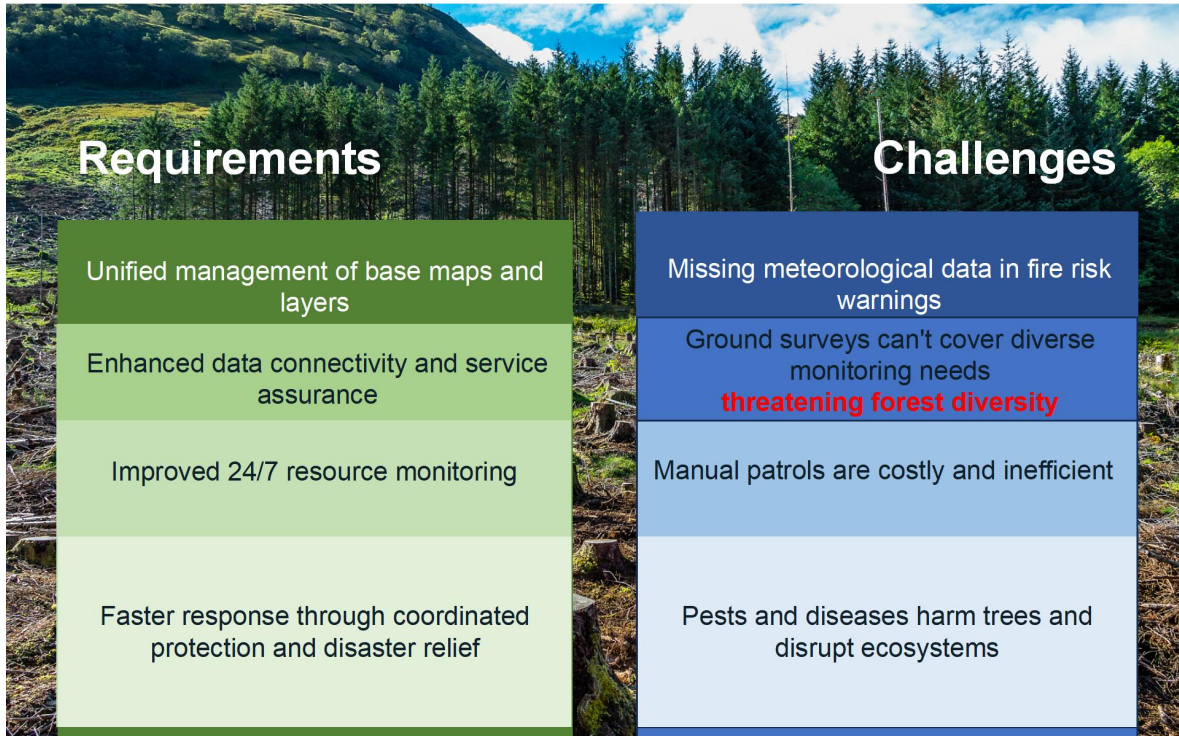
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Forestry - Requirements and Challenges



Requirements	Challenges
Unified management of base maps and layers	Missing meteorological data in fire risk warnings
Enhanced data connectivity and service assurance	Ground surveys can't cover diverse monitoring needs threatening forest diversity
Improved 24/7 resource monitoring	Manual patrols are costly and inefficient
Faster response through coordinated protection and disaster relief	Pests and diseases harm trees and disrupt ecosystems

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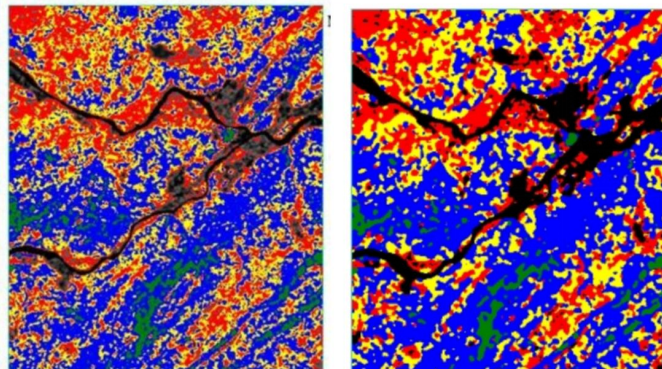
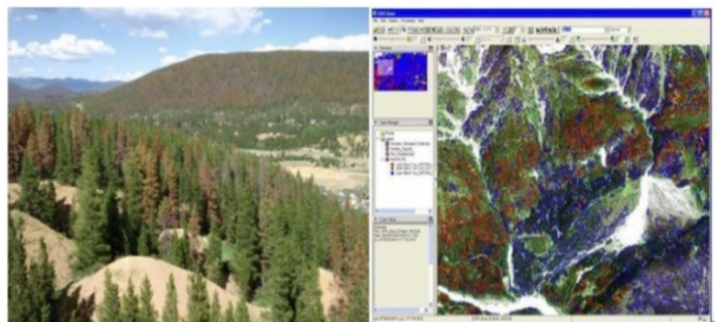
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Forestry - Monitoring Metrics

Forestry Monitoring

- Pests and diseases monitor
- Fires monitor and prevent
- Resources changes track
- Information
 - Identify species
 - Measure LAI
 - Extract canopy density
- Assess forest health



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Forestry - Case Studies

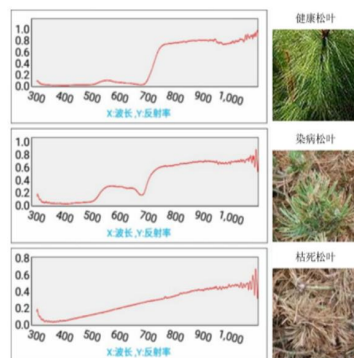
Content: Use spectral differences in diseased trees to monitor pests and assess forest health

Clients - Forestry departments and fire stations etc.

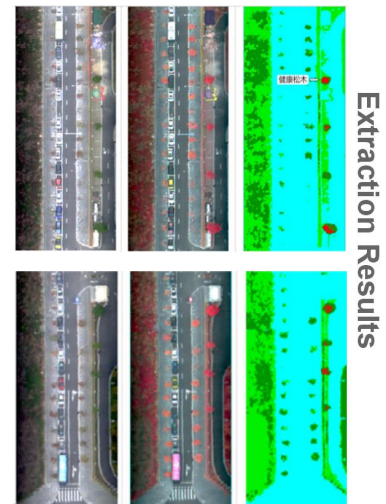
Conclusion: Accurately estimate pine changes quickly, laying the groundwork for a large-scale remote sensing monitoring system



Pine forest and diseased tree diagram



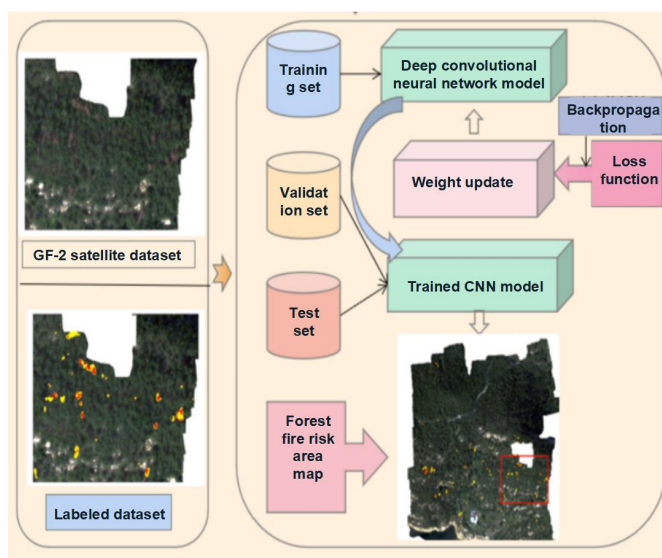
Various health conditions of pine needle spectra



Extraction Results

Forestry - Data Services

Process



1. Extract forest pest areas using satellite imagery
2. Collect hyperspectral data for key areas of interest
3. Combine with ground-based spectral sample database
4. Develop model using deep convolutional networks
5. Validate model accuracy with ground-based spectral samples
6. Input drone hyperspectral data into the model and create maps

Forest Fire Prevention Platform - Unified Network



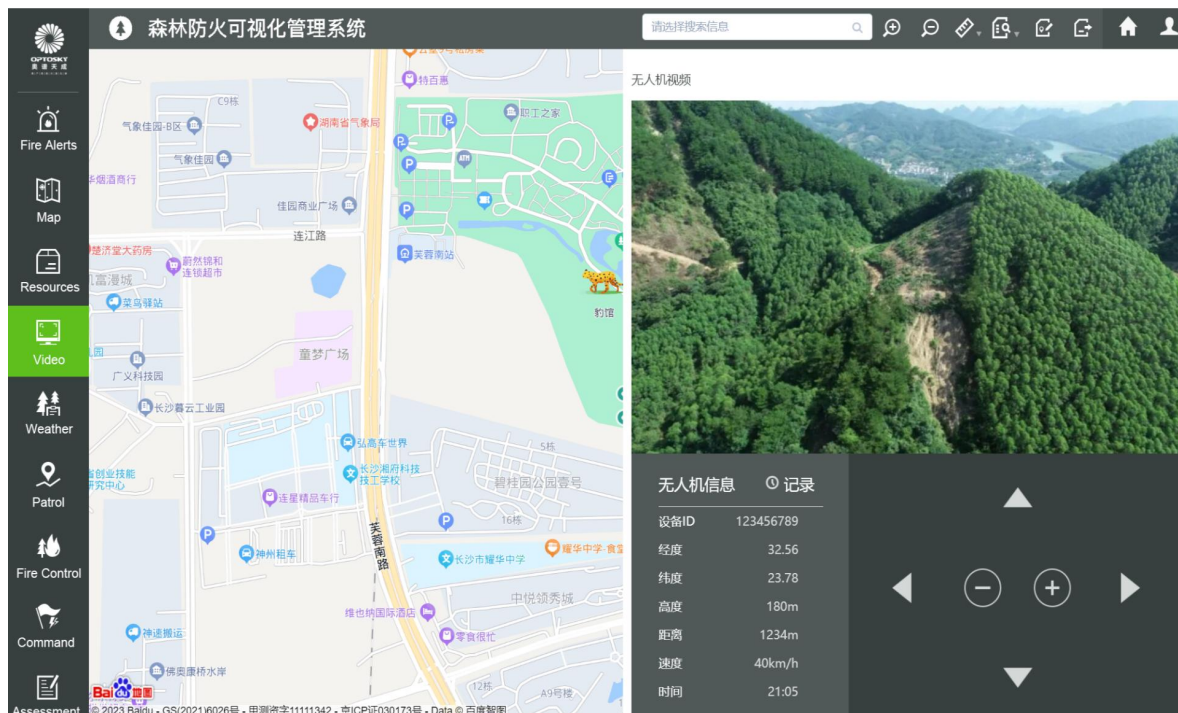
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Forest Fire Prevention Platform - One-Stop Service



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Forest Fire Prevention Platform - Visible Data



森林防火可视化管理系统

资源管理

消防车辆

请搜索内容

添加

物资库1号
位置: A区

物资库2号
位置: B区

物资库3号
位置: C区

ID: 123456789

名称: 动物园社区

地点: 平顶山

经度: 23°78'

纬度: 23°78'

负责人: 张三

联系方式: 131 111 111

关联站点: 避难所1号

备注: -

消防车辆

输入查询内容

查询

添加

名称	车牌号	单位	责任人	联系方式	位置
红旗	湘A 123456	湘A	张三	15766659999	长沙天心
红旗	湘A 123456	湘A	张三	15766659999	长沙天心
红旗	湘A 123456	湘A	张三	15766659999	长沙天心
红旗	湘A 123456	湘A	张三	15766659999	长沙天心

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Forest Fire Prevention Platform - One-Click Insight



森林防火可视化管理系统

防火应急预案

输入查询内容

查询

添加

名称	预防范围	预防等级	响应等级	预防解析部门	发布时间	实施时间	记录人
qwe	长沙	1级	1级	平顶山居委会	2022-12-21	2022-12-12	lisi
qwe	长沙	1级	1级	平顶山居委会	2022-12-2	2022-12-12	lisi
qwe	长沙	1级	1级	平顶山居委会	2022-12-2	2022-12-12	lisi
qwe	长沙	1级	1级	平顶山居委会	2022-12-2	2022-12-12	lisi

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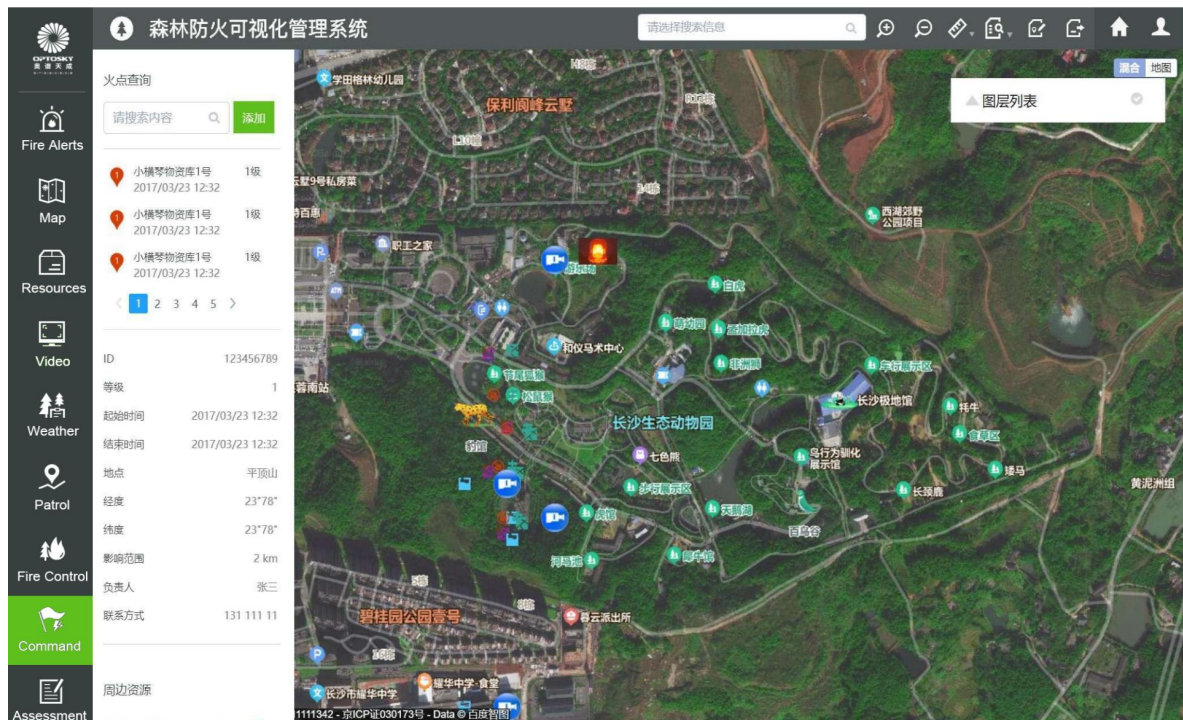
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Forest Fire Prevention Platform - Unified Strategy



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Forest Fire Prevention Platform - Demo Video



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Applications



Hyperspectral LAB Series

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Lab Hyperspectral Imager

Model	Specifications
ATH8010	Spectral range: 400-1000nm Spectral resolution: 2.2nm Spatial resolution: <1mm High-stability linear light source High-precision scanning stage Built-in reflectance calibration panel HD camera

Description:

This device merges hyperspectral imaging with HD photography, capturing high spectral and spatial resolution data. It can accurately detect the unique spectral and spatial characteristics of materials. It's ideal for material sorting, forensic analysis, authenticity verification, etc applications.

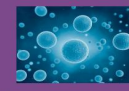
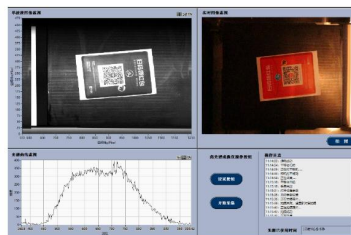
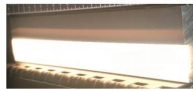


Advantages and Applications



Advantages

- Corrects radiation intensity for better calibration accuracy.
- Line light source design improves energy efficiency.
- Auto-focus adjusts for sample thickness to ensure clear imaging.
- Auto-recommends exposure time based on sample reflectance.
- Automated scanning streamlines data collection.
- HD camera integration enhances spatial resolution and data navigation.
- Custom development based on client needs.



Archaeology & Artifacts:

- Artifact scanning and restoration
- Mural restoration
- Digitizing ancient paintings



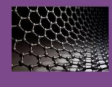
Textiles:

- Fabric pattern copying
- Image replication



Forensic Identification:

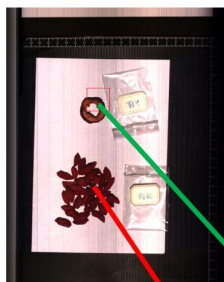
- Digitizing important documents
- Authenticity verification of contracts



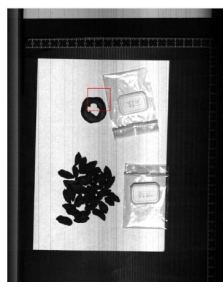
Agriculture & Medicinal Herbs:

- Screening of traditional Chinese herbs

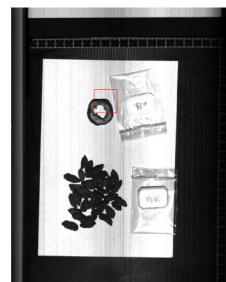
Differentiating Goji Berries from Hawthor



RGB Composite Image



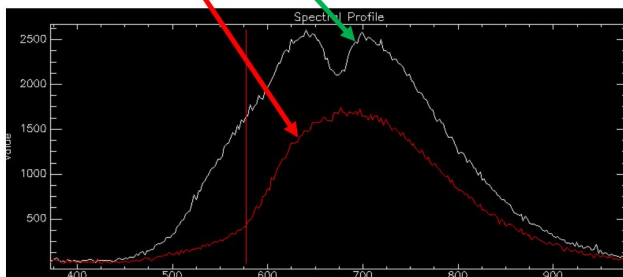
Band 50 Image



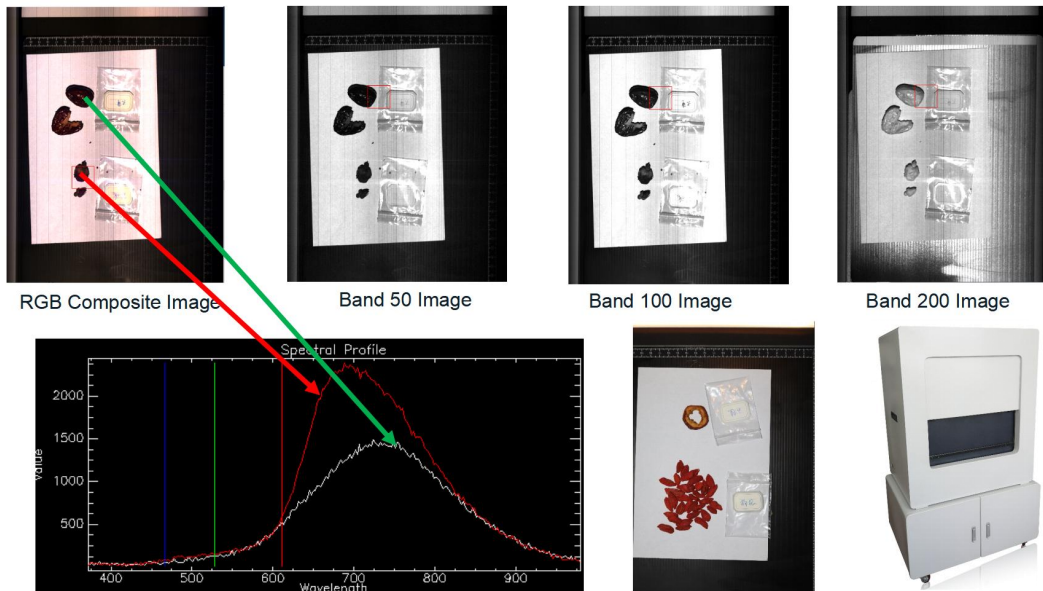
Band 100 Image



Band 200 Image



Differentiating Jujube from Rose



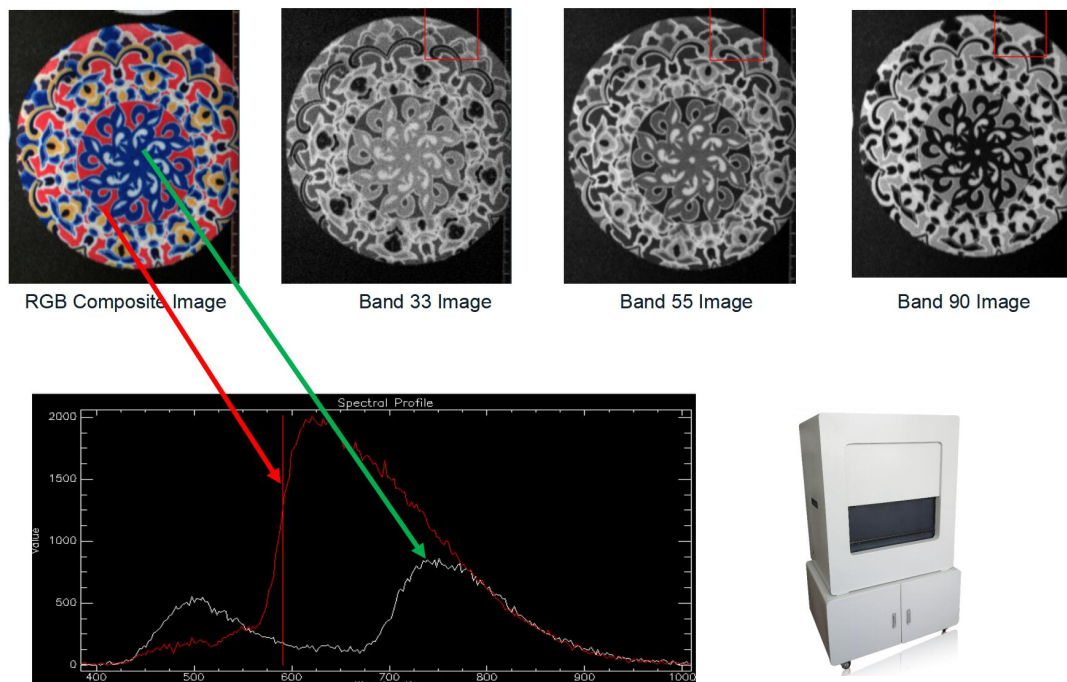
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Testing Fabric Colors



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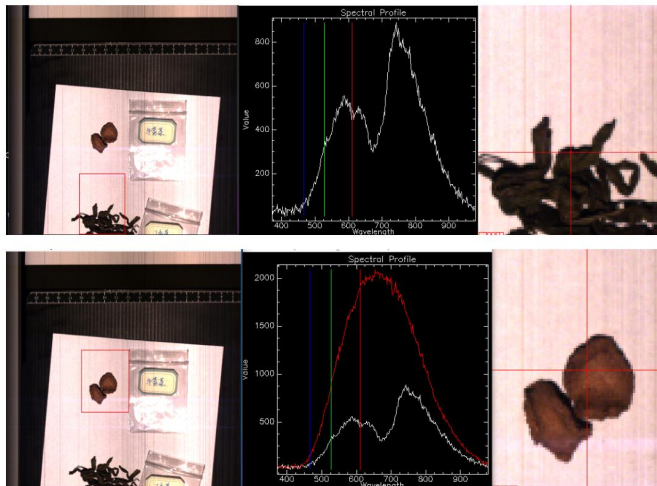
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Application Case



Sample: Burdock Tea, Clove Tea
Data Type: Raw Data
Measurement Environment: Darkroom



Applications



Mobile Hyperspectral Imager

Model	Specifications
ATH6010	Built-in scanning Spectral range: 400-1000nm Spectral resolution: 2.2nm Built-in high-definition visible light camera Auto-focus
ATH6020	Built-in scanning mirror Spectral range: 400-1000nm Spectral resolution: 2.2nm
ATH6030	Full sweep Spectral range: 400-1000nm Spectral resolution: 2.2nm



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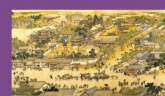
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Advantages and Applications

Advantages

- **Integrated Power System:** No separate power needed for the hyperspectral imager and motion control system.
- **Advanced Motion System:** Provides a stable and reliable measurement environment.
- **Multiple Models:** Choose from built-in scanning, scanning mirror, or overall scanning.
- **Motion Control:** Options for Bluetooth or wired control.
- **Tripod Compatibility:** Works with quick-mount tripods for various settings.
- **Custom Development:** Customizable based on user requirements.

Applications



Archaeology & Artifacts:

- Artifact scanning and restoration
- Mural restoration
- Digitizing ancient paintings



Textiles

- Fabric pattern copying, image reproduction

Agriculture

- Leaf and tobacco scanning

Document Analysis

- Digitalization and authenticity verification of important documents

Forensic Identification

- Contract authenticity verification

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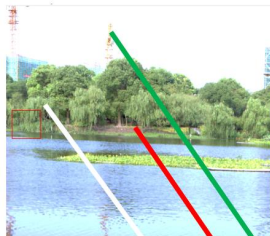
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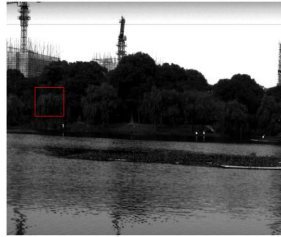
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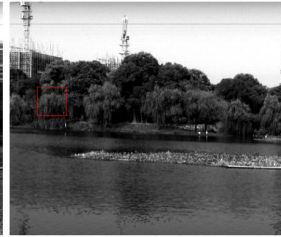
Field Vegetation Testing



RGB Composite Image



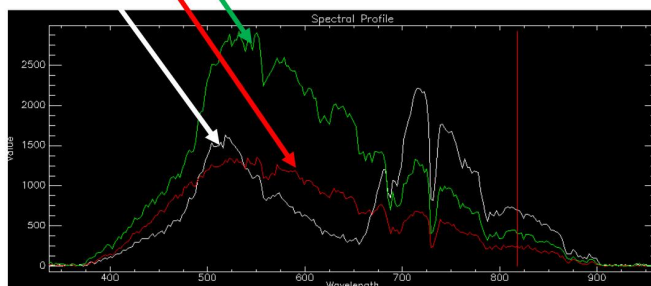
Band 50 Image



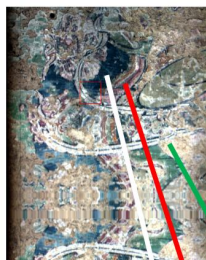
Band 100 Image



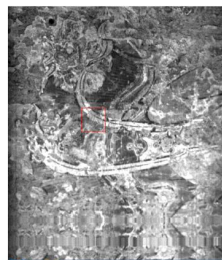
Band 200 Image



Archaeological Mural Testing



RGB Composite Image



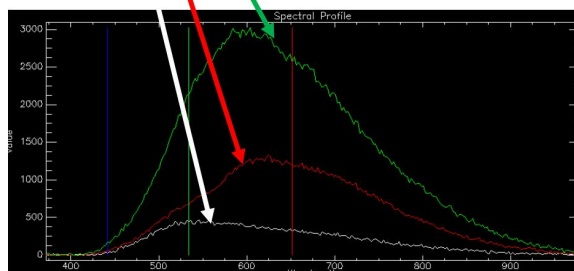
Band 50 Image



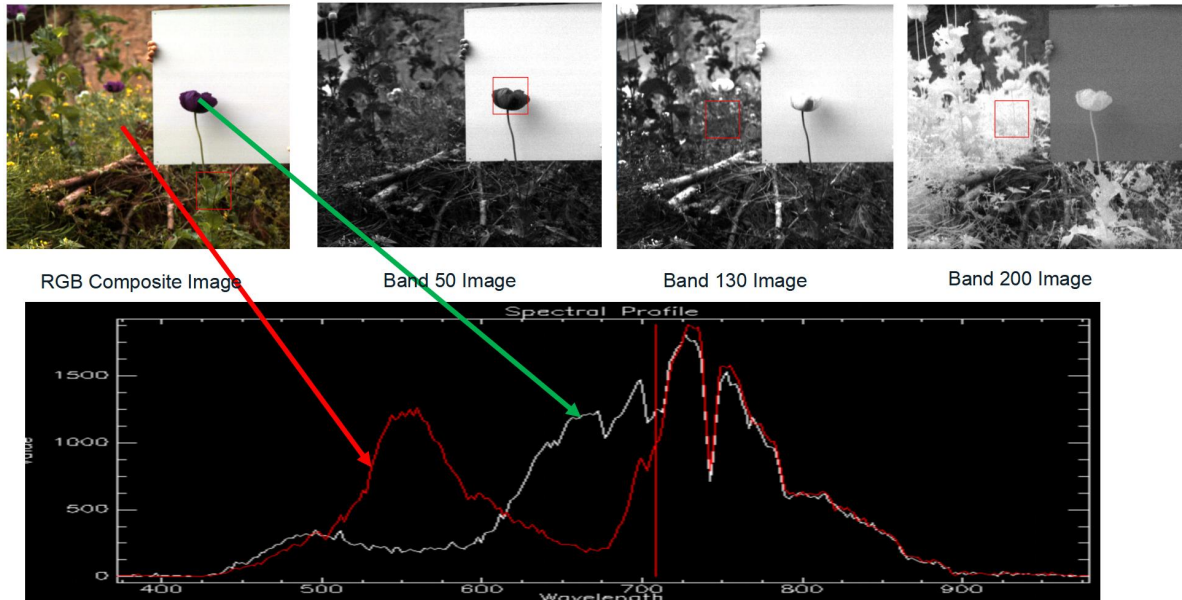
Band 150 Image



Band 200 Image



Poppy Flower Detection



Applications

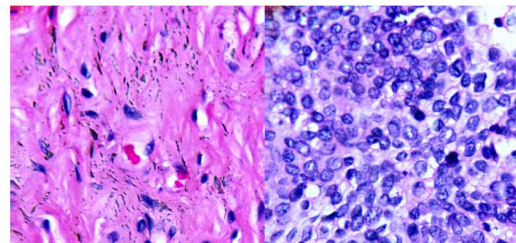
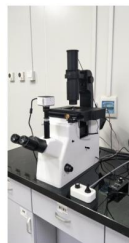
Hyperspectral Microscopic Series



Microscopic Hyperspectral Imager



Model	Specifications
ATH5010 (Inverted Type)	Platform: Inverted Microscope Spectral Range: 400-1000nm Spectral Resolution: 2.2nm High-Precision 2D Scanning Stage Industrial-Grade CCD Camera
ATH5011 (Research Grade)	Platform: Inverted Microscope Spectral Range: 400-1000nm Spectral Resolution: 2.2nm High-Precision 2D Scanning Stage Scientific-Grade CCD Camera
ATH5020 (metallographic type)	Platform: Upright Microscope Spectral Range: 400-1000nm Spectral Resolution: 2.2nm High-Precision 2D Scanning Stage Industrial-Grade CCD Camera



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Applications



Medicine

- Scanning biological tissues
- Cancer detection
- Diabetic retina analysis
- Blood cell analysis



Biology

- Bacteria
- Cell analysis



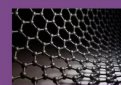
LED

- Uniformity analysis



Forensics

- Document examination
- Digitalization of important documents
- Sequence identification of ink layers



Materials science

- Microscopic material testing

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