

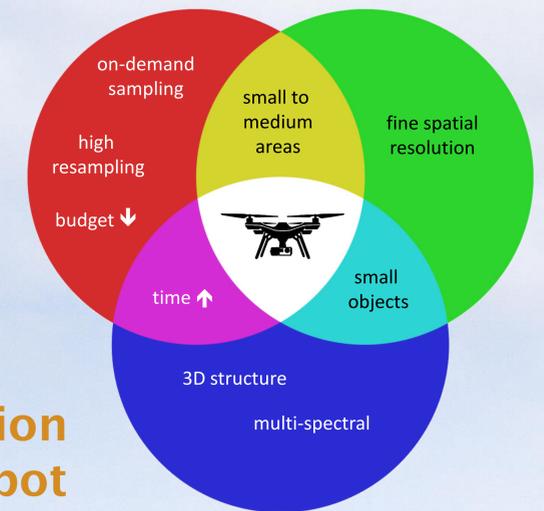
Eyes in the Sky: Applications of Drone Data Collection in Research and Extension

IGIS

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Introduction

Small unmanned aerial systems (UAS), alternatively known as drones or unmanned aerial vehicles (UAV), are rapidly taking an increasingly greater role in University of California research and extension. This is due to a convergence of affordable, cutting edge technologies and reasonable FAA regulations, which together have resulted in a surge of interest in remote sensing and mapping applications using this burgeoning technology. This poster outlines UAS technologies and applications from the UC system that address agricultural and natural resource research and extension.



UAV Data Collection Sweet Spot

Technology

Sensor Descriptions

Typical Applications

Cases Studies

Platforms

- | | | |
|--|-----|---|
| Rotorcraft | vs. | Fixed-Wing |
| <ul style="list-style-type: none"> • 18-35 min flight time • Vertical takeoff and landing • Easier to fly | | <ul style="list-style-type: none"> • 40+ min flight time • More payload • Covers more area • More expensive |



RGB Digital Cameras

Captures visible-spectrum (red, green blue, or RGB) photographs or video, usually between 390 and 700 nanometers in wavelength.

Creation of true color orthomosaics (composite imagers of large areas), topographic modeling using photogrammetry, and 3-D visualization.

IGIS uses photogrammetry on GoPro imagery to create a 9 cm digital terrain model for 1,200 acres of the Mojave Desert, to help UC Davis faculty, Dr. Brian Todd, study the migratory patterns of endangered desert tortoises.

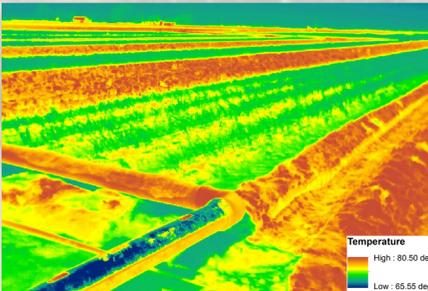


Thermal Cameras

Captures thermal images or video from the long-infrared spectrum, roughly between 7,000 and 12,000 nanometers in wavelength.

Monitoring relative surface temperatures to derive information related to water features, wildlife, evapotranspiration and soil moisture.

IGIS uses a Zenmuse Flir camera to help the Director of the UC Desert Research and Extension Center, Dr. Jairo Diaz-Ramirez, study water use efficiency for onion cultivation, in Holtville, CA.

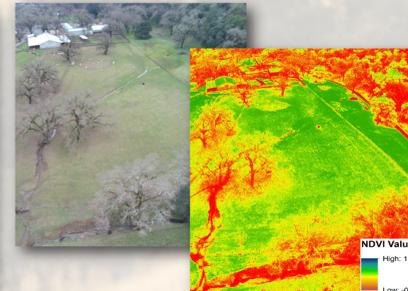


Multispectral Cameras

Captures images from the visible-spectrum (RGB) and from one or more segments of the infrared spectrum (>700 nanometers).

Monitoring agricultural and natural vegetation, by sensing reflected wavelengths associated with plant vigor and primary productivity.

IGIS uses a Parrot Sequoia camera to monitor post-fire recovery of rangelands at the UC Hopland Research and Extension Center (RGB image - left, normalized difference vegetation index - right).

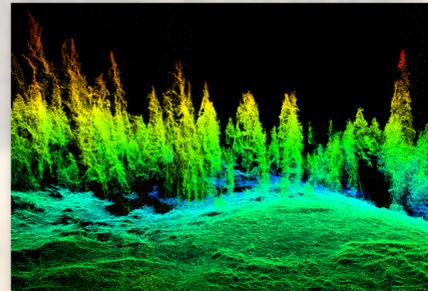


LIDAR (light detection and ranging)

Uses laser pulses to map surface elevation at a high level of accuracy.

3-D modeling of surfaces, most commonly for forestry and structural surveying.

IGIS is collaborating with Green Valley Inc. to evaluate the advantages of LIDAR over photogrammetry for forest and orchard structural modeling in California's foothills and Central Valley.



Hyperspectral Sensors

Collects imagery from a large number of narrow spectral bands (typically more than 50) over a continuous range, generally between 390 and 2,200 nanometers.

Precision agricultural monitoring requiring the detection for spectral signatures associated with specific plant traits.

UC Davis Faculty, Dr. Christian Nansen, uses a hyperspectral scanner to study how reflectance data may help detect outbreaks of spider mites in strawberries, in San Luis Obispo County, CA.

