



Sapio Solutions Pty. Ltd.
with impact...

Background

- ✓ Sapiosolutions is a fusion of experienced technocrats in technology, domain, finance and business development.
- ✓ Our team has wealth of knowledge in building many software application's for Governments, private and public Corporates both National and International.
- ✓ With Artificial Intelligence, Machine Learning, Deep Vision image and video analytics being the future we established this venture with focus on these emerging technologies.
- ✓ With great access to Government, Farmers and the technology ecosystem we have done some amazing programs using fixed wing and multi copter UAVs for image capture, process and deep vision analytics on some key problems and provided solutions.
- ✓ We created best practices, process and frameworks for UAV and Sensor fusion for best outcomes in Agriculture, Urban, Irrigation and Dam Monitoring, Smart Cities, Insurance and Mining.
- ✓ Sapiosolutions is a collaboration of 1 year effort to build a focused machine vision analytics company. Founder of Sapiosolutions is also an investor in Aegis Consulting Services.
- ✓ Sapiosolutions Labs LLP is DIPP, Ministry of Commerce, Govt of India recognized start up.
- ✓ Building eco system for UAV sprayers on rent with APMAS and other FPOs in India.
- ✓ Make in India Partner assembly unit for UAVs in Chennai.
- ✓ Training and Capacity building for UAV pilots in India .

Building Proprietary Data Sets and Spectral Library

- Established and mastered the framework of capture, stitch, process, analyze of UAV imagery.
- Sapiosolutions would automate this using deep learning on proprietary algorithms and data sets.
- Automated detection of Diseases, Insects, Weeds, Nutrient deficiencies and abiotic stress.
- Currently doing research in building machine learning algorithms for specific use cases in the able guidance of Dr E G Rajan a knowledge bank in image and video analytics.
- To identify and detect color based and shape based feature extraction.
- Implementation of agriculture drones vary depending on crop type, farm size, terrain landscape, and crop protection challenges. The aerial mobility, location landing, and payload delivery features of agriculture drones introduce a convenient navigation and accessibility solution to monitor and manage fragmented, small, and irregular terrain farm area.
- Repository of UAV based Multispectral and RGB imagery for multiple outcomes development.
- Knowledge partnerships with ICRISAT, Prof Jaishankar Telangana Agriculture University, Directorate of Rice Research, Plant Protection Society of India and ICAR-National Bureau of Plant Genetic Resources, Hyderabad.
- OEM alliance with Sensefly, Switzerland, MMC Global UAV, Parrot France, TT Aviation, Optim Japan.
- Research alliance for Palm Oil Plantations with FGV Holdings, Malaysia and Skoruz USA.

Sector wise application of drones

 Agriculture • Crop health monitoring • Soil health assessment • Improved resource utilisation	 Traffic management • Road surface condition monitoring • Improve traffic management • Traffic feedback
 Forest and wildlife • Wildlife conservation • Managing human wildlife conflict • Forest protection	 Homeland security • Real time surveillance • Security planning • Drugs/Narcotics detection
 Urban development • City survey • Improved urban planning • Project monitoring • Project quality assessment	 Disaster management • Real time surveillance • Search and rescue • Delivery of essential goods
 Healthcare • Epidemic control • Cleanliness & hygiene • Healthcare delivery	 Mining • Mineral scouting • Managing encroachment • Contract monitoring

Our UAV fleet and sensors



High Endurance UAV fleet and sensors



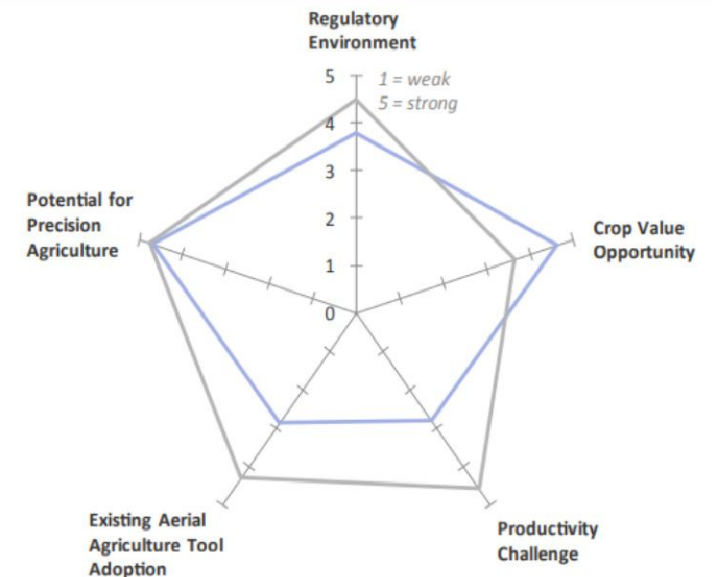
Combining capabilities from parallel innovations. Industry 4.0



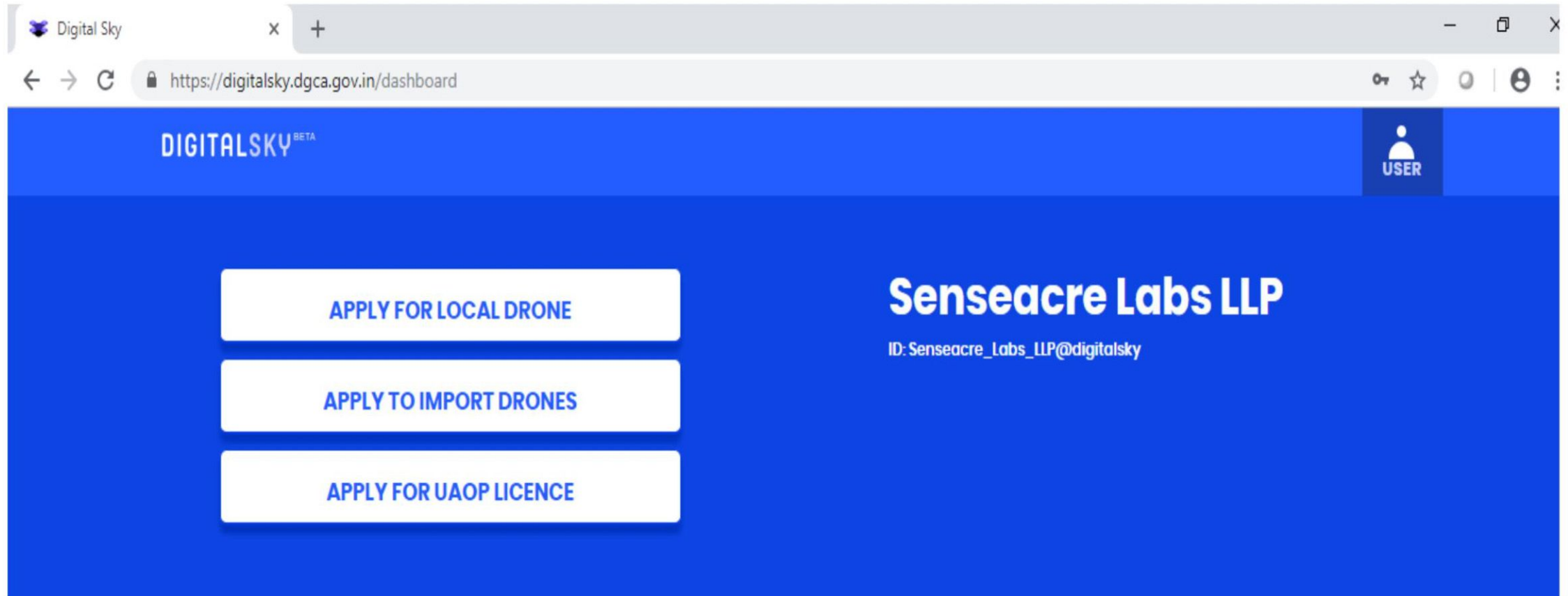
Regulations with drones in digital sky

	Nano	Micro	Small	Medium	Large
Classification criteria	<=250 g	>250 g<=2kg	>2 kg <=25kg	>25 kg <=150 kg	>150 kg
UIN	✗	✓	✓	✓	✓
UAOP	✗	✗	✓	✓	✓
NPNT	✗	✓	✓	✓	✓
Approval time for UIN UAOP	✗	2 days	2 days/7 days	2 days/7 days	2 days/7 days
Equipment standardisation	✗	✗	✓	✓	✓
Max. height allowed (AGL)	50 ft. (Above 50 ft. not exempt from requirements)	200 ft. (above 200 ft. not exempt from requirements)	400 ft.	400 ft.	400 ft.
VLOS	✓	✓	✓	✓	✓
Day operations	✓	✓	✓	✓	✓
Flight plan	✗	✗	✓	✓	✓
ADC/ FIC	✗	✗	✓	✓	✓
Local police	✗	✓	✓	✓	✓
Area of operation	Uncontrolled airspace and indoor	Uncontrolled airspace	Controlled and uncontrolled airspace	Controlled and uncontrolled airspace	Controlled and uncontrolled airspace
Security clearance	✗	✓	✓	✓	✓
Import clearance	✗	✓	✓	✓	✓
Training for pilots	✗	✗	✓	✓	✓
All responsibility with operator	✓	✓	✓	✓	✓

The five pillars illustrate different areas of potential attractiveness for agriculture drone adoption in India



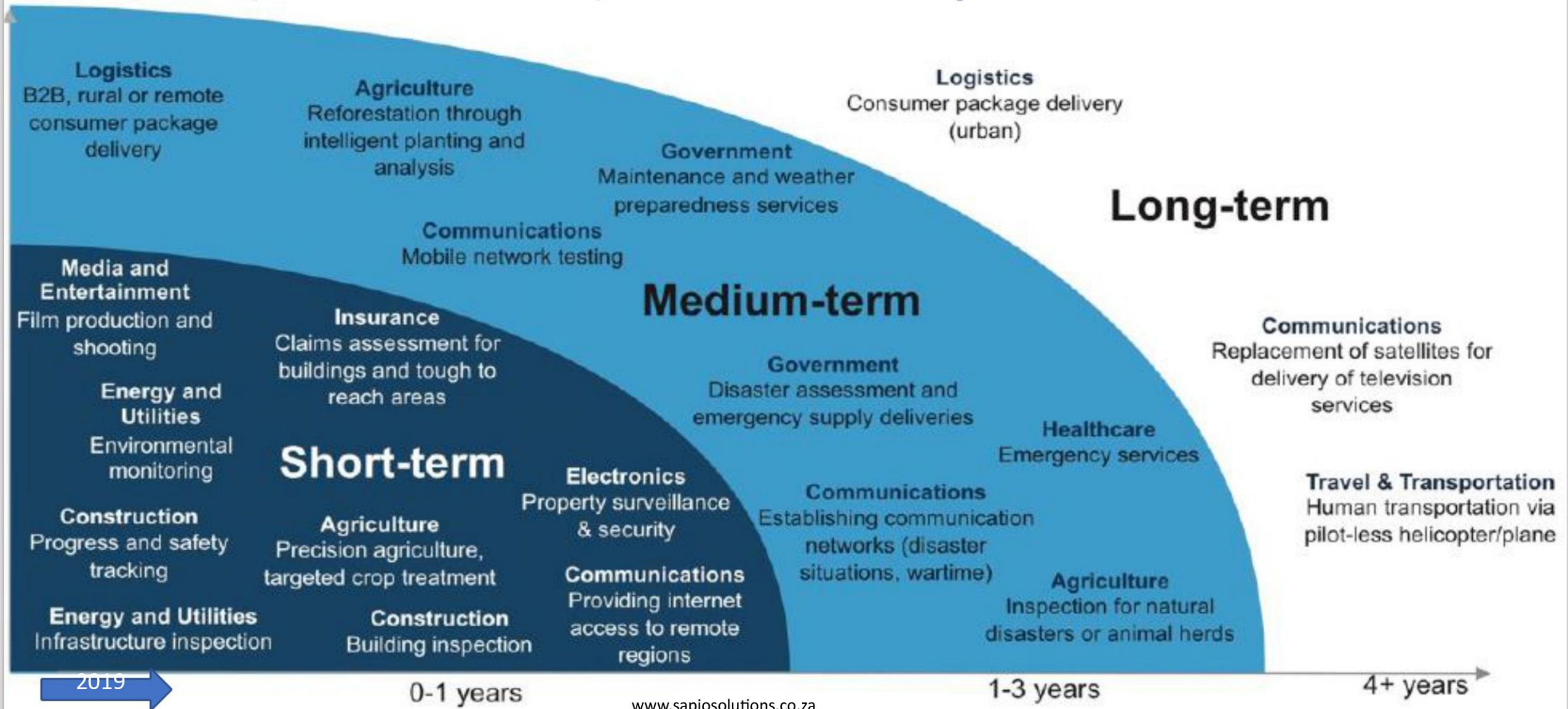
Digital Sky Registration



We have registered and awaiting OEMs approval in the system.

We will comply as per the DGCA guidelines and drone policy as required. Since the policy is under development, we seek District Collector / Police permission and initiate the program upon go ahead.

Drone adoption in visual inspection and intelligence.



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Experience

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Agriculture Programs



INTERNATIONAL CROPS RESEARCH
INSTITUTE FOR THE SEMI-ARID TROPICS



NDVI

Uses

1. plant vigour
2. differences in soil water availability
3. foliar nutrient content (when water is not limiting)
4. yield potential

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

CIR Composite (Colour Infrared)

Uses

1. assessing plant health
2. identifying water bodies
3. variability in soil moisture
4. assessing soil composition

NDRE (Normalized Difference Red Edge)

Uses

1. leaf chlorophyll content
2. plant vigour
3. stress detection
4. fertilizer demand
5. Nitrogen uptake

$$NDRE = \frac{(NIR - RE)}{(NIR + RE)}$$

Chlorophyll Map

Uses

1. Detect chlorotic crops
2. Stress detection
3. Identify vigorous, healthy crops
4. Estimate chlorophyll content
5. Estimate N content if you know that N is limiting

OSAVI (Optimized Soil-Adjusted Vegetation Index)

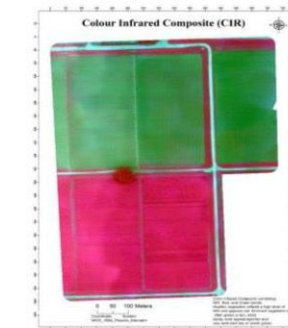
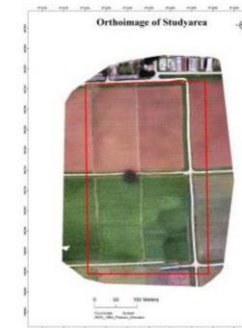
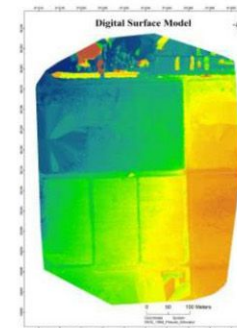
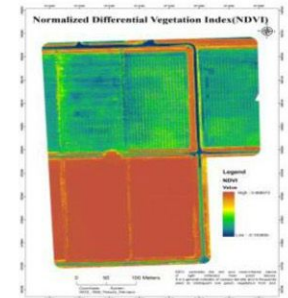
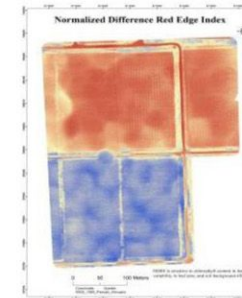
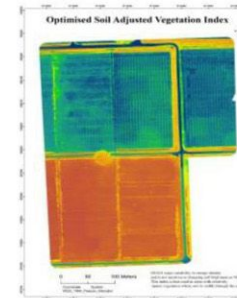
Uses

1. Differentiate soil pixels
2. Related to LAI at some levels where NDVI saturates
3. Accounts for non-linear interactions of light between soil and vegetation
4. Used as a structural index for some combined indices designed for chlorophyll detection

DSM (Digital surface Model)

Uses

1. estimate relative crop volume
2. identify surface properties
3. model water flow & accumulation



Crop sown area, crop identification, crop health monitoring, weed & pest detection, Crop cutting experiments, yield prediction, nitrogen deficiency, moisture and water management 12

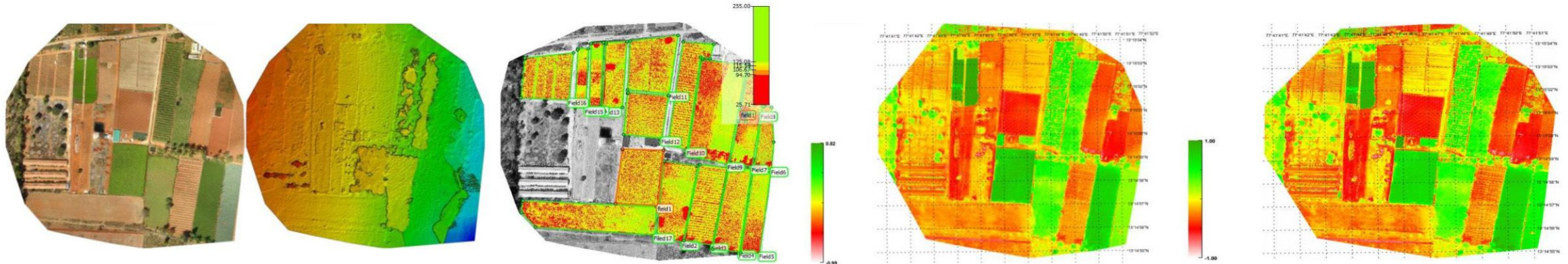
Original UAV image

Weed Detection

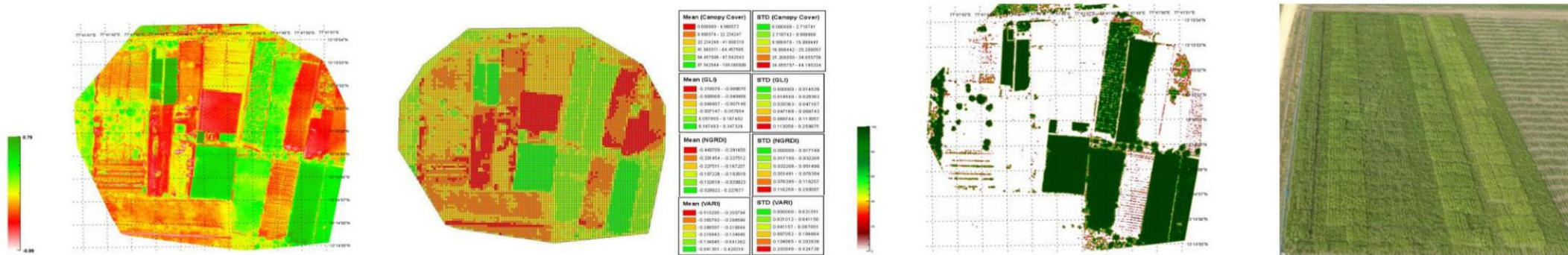
Magnified Weed
detection

Annotation of Weed
across crop area

Multiple Index Outcomes : Crop Area Coverage, Crop health and Yeild Prediction using UAVs.



Orthomosaic | Digital Surface Model | Crop Area Identification | Green Leaf Index | Visible Atmospherically Resistant Index



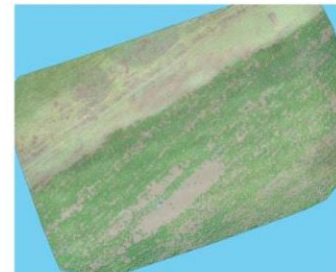
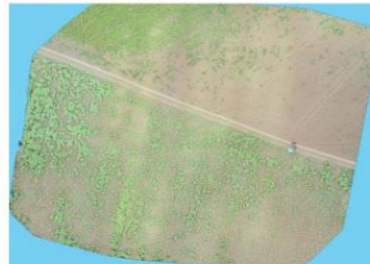
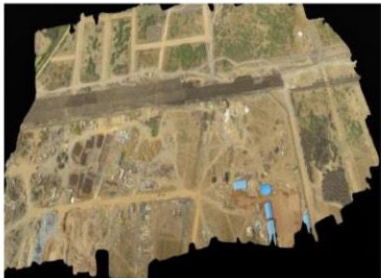
Normalized Green Red Difference Index

| Field Uniformity |

Canopy Cover |

3D View

Multiple sites, Multiple outcomes : Every Image is a program delivered...



Case Studies



URBAN : Capital development project in AP

Pre-construction

- Design and planning
- Site survey
- Site mapping
- Estimation of capital

Construction

- Site monitoring
- Project execution
- 3D modelling
- Inventory management
- Warehouse management

Post-construction

- Operation and maintenance
- Detection of defects
- Disaster recovery



Panchayat Raj : Land Use land Map integration in AP

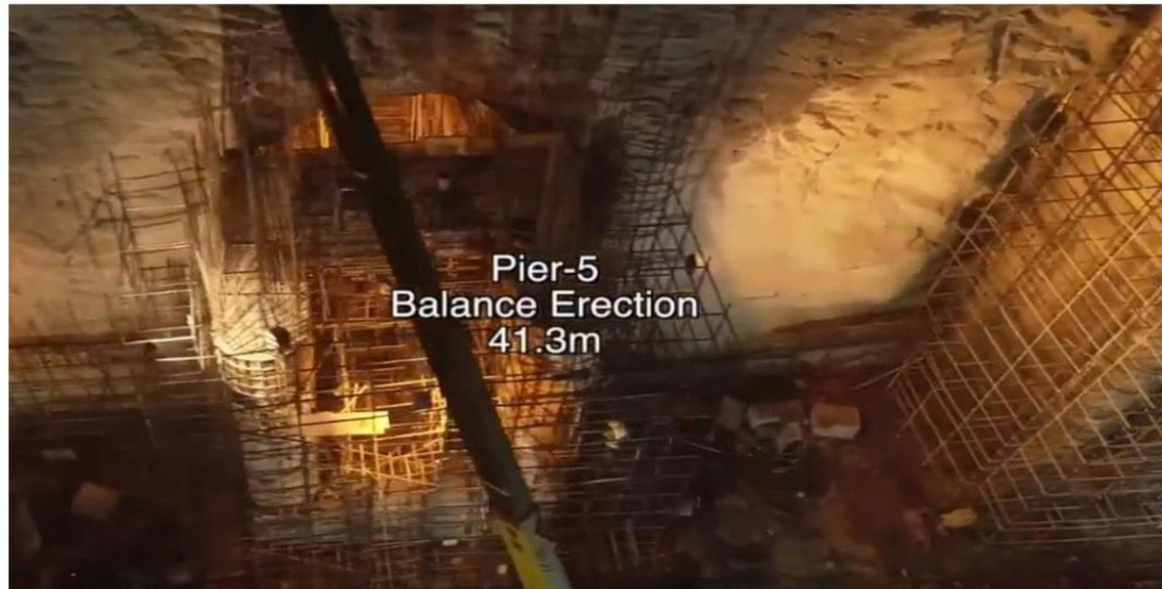


Panchayat Raj : Land Use land Map integration in AP



Every element of the legend is represented by a color and an icon. Used as input for fund allocation, fund utilization and impact of the fund. both short term and long term. Also input to property management system and add revenue to governments.

Irrigation and Dam monitoring in Telangana : Most Complex Mission Underground



This is a confidential program audited by the Global audit firm. One of the worlds largest dam project in India.