

Image Data Collection using Drone

The equipment used for the data collection is 3DR-Solo Drone.

Data capture Region -1 (Open Area)

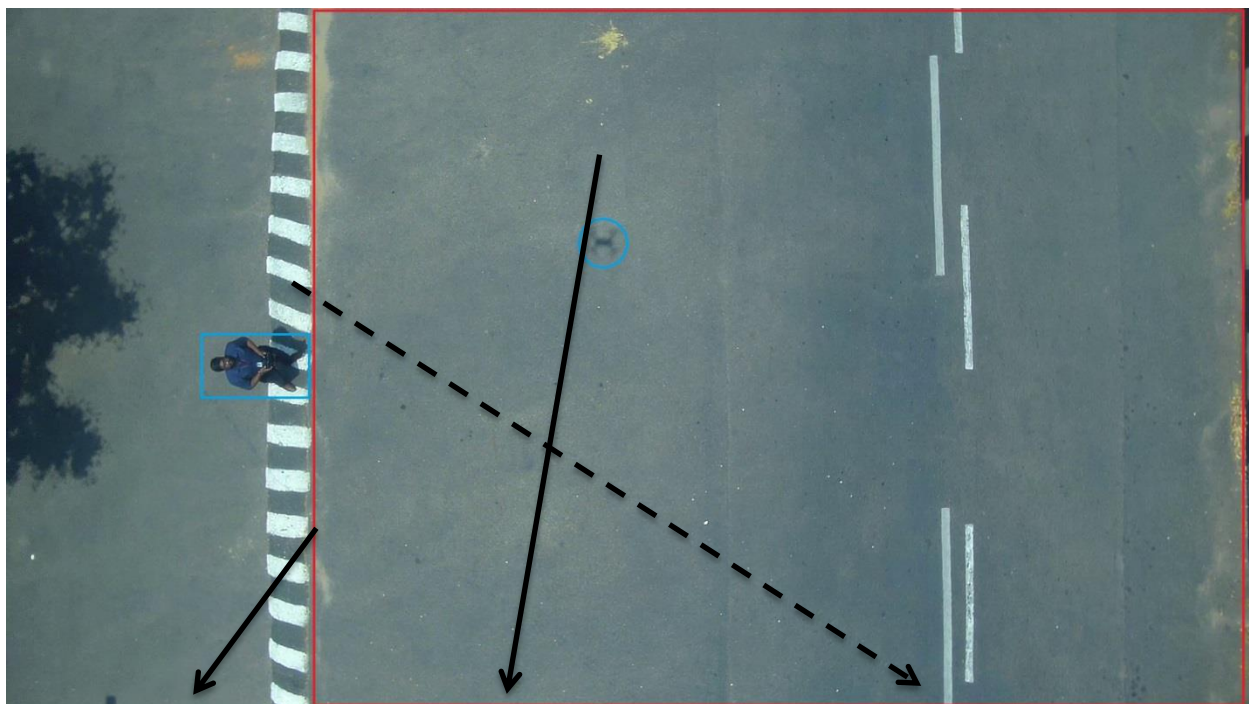
Date : 21-03-2018

Time of Capture: 11:30 AM to 12:00PM

Region Information

The drone was kept in an open area with flat surface to make sure the level of the drone is perfect and to obtain the clear sky view for the best GPS signal. The take-off region was free without any obstacle (See Figure 1 for the take-off region).

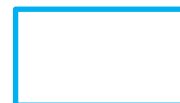
Figure 1 - Take off Region



Region selected
for Take off



Shadow of drone
in 20M height



The person
controlling the
drone

The region was free from obstacle, which helps for the smooth take-off of the drone. After reaching 30 to 50 feet height, the drone was moved around the trees to capture the images. The

camera was in a video recording mode and recorded the entire flight video, from which the images were extracted.

Camera Orientation details

The camera was kept under the drone and it was static. The camera looks downwards and there is no mechanism to change the orientation of the camera.

Camera Technical Specifications

Image Resolution	16 MegaPixel (4,608 x 3,456 px), 12MP, 8MP, 5MP, 3MP
Image Format	RAW+JPG, JPG - 24bit sRGB
Video Resolution	1440p30, 1080p60, 720p120, 480p240
Video Format	MP4 (H.264 Codec)
Lens Optics	82° HFOV (23mm) f/2.8 Aperture, -1% Extreme Low Distortion (Non-Fisheye) Glass Lens
Ground Sample Distance (GSD)	4.05 cm/px (1.59in/px) at 120 m (~400 ft) AGL
Sensor	Sony Exmor IMX206 16MP (Bayer RGB)
Chipset	Novatek NTK96660
Capture Speed	RAW+JPG: 3 Seconds / Photo. JPG: 2 Seconds / Photo
Remote Trigger	PWM via HDMI Port (see below)
Battery	Removable Li-ion (900mAh) (Not Required When USB Powered)
Power Draw	5.2V 0.2A (Without Battery), 5.2V 0.4A (With Battery)
Weight	47g (1.7 oz) (Without Battery), 64g (2.3 oz) (With Battery)
Dimensions	59 x 41 x 30mm (Length x Height x Depth)
Memory Storage	Micro SD (Up To 128GB Card) (64GB Card ≈ 12,500 JPG, 1,750 RAW+JPG)
White Balance	Auto / Daylight* / Cloudy / Tungsten / Fluorescent / Blue / Light Blue / Red / Light Red / Custom
ISO	50* / 100 / 200 / 400, Auto
Shutter Speed (s)	1/2000, 1/1000, 1/500*, 1/250, 1/125, 1/30, 2, 5, 10, 15, 20, 30, 60, Auto
Exposure	+2.0 / +1.67 / +1.33 / +1.0 / +0.67 / +0.33 / +0.0* / -0.33 / -0.67 / -1.0 / -1.33 / -1.67 / -2.0
Metering	Average* / Center / Spot

Color	Normal* / Black and White / Sepia / Vivid
Sharpness	Strong / Normal / Soft*
Capture Mode	Single* / 3 Sequence / 10 Sequence
LCD	1.5” Ultra Bright Color LCD Screen
Video Out	HD 1080p (HDMI Micro), SD 480p (Optional USB FPV Cable)
TV Mode	NTSC* / PAL
Power Input	Battery, USB (Micro-A Cable Included, Optional Micro USB FPV Cable)
Auto Power On (When Power Applied to USB Port)	ON* / OFF
OSD Language	English*, French, Spanish, Portuguese Brazil, Dutch, Czech, Polish, German, Italian, Chinese, Russian, Japanese, Korean
Frequency	60Hz* / 50Hz
OSD Display	ON* / OFF
Date Stamp	ON / OFF*
Sound	ON* / OFF
Quick Capture	ON / OFF*
Auto Power Off	OFF* / 1min / 3min / 5min / 10min / 15min / 30min / 60min
Auto Sleep LCD	1min* / 3min / 5min / OFF
Vertical Rotate	ON / OFF*
Included Accessories	Lens Cap, USB Charge Cable, Manual

Challenges faced during data capture from the Open Region:

- Tilting the drone near the target was not easy to get a side view of the tree and target.
- The trees with dense leaves gives less information when we capture the image from the top and the trees with sparsely occupied leaves gives a clear picture of the tree from top (See Figure -2)
- The movement of the drone affects the captured data. We observed that if we give enough time for the drone to stay in place above the tree and then record, the data was clear. Instead, the sudden movement during orientation of the drone blurs the image frame.

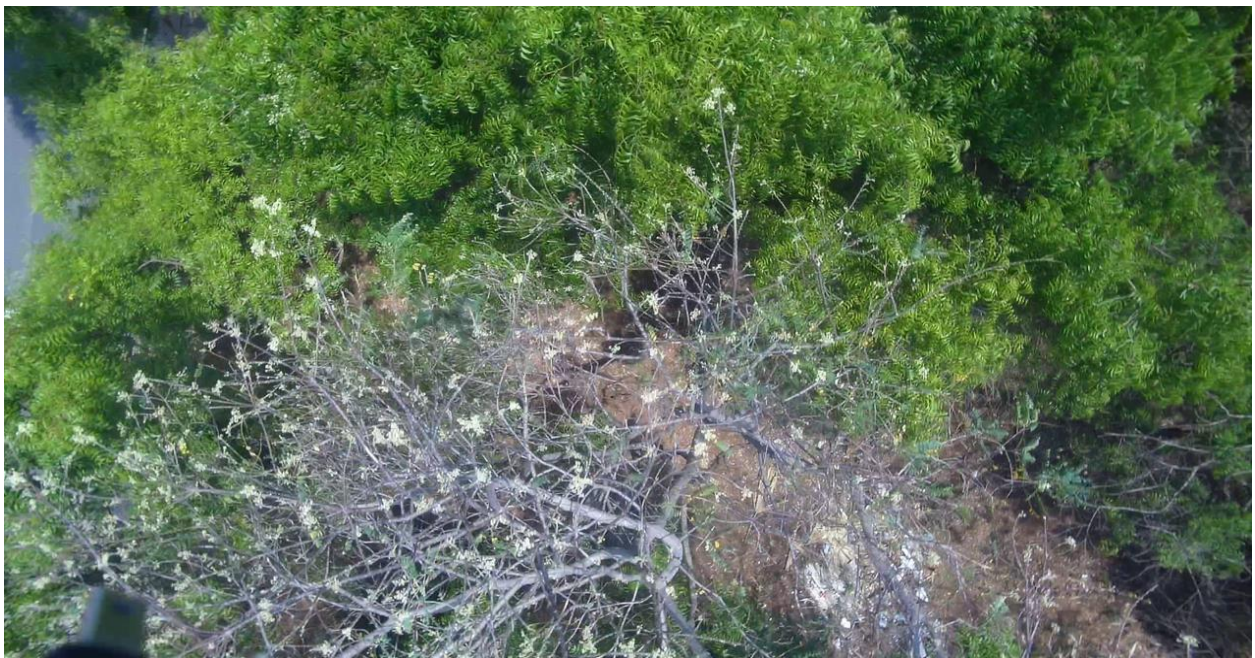


Figure 2 - Trees with thick (red border) and sparse (black border) leaves.

Survey 1 sample images

The sample images extracted from the video of survey-1 are given below:

Survey_1_Image1:



Survey_1_Image2:



Survey_1_Image3:



Survey_1_Image4:



Survey_1_Image5:



Data capture Survey Region -2 (Constrained Area)

Date: 21-03-2018

Time of Capture: 4:30 PM to 5:00 PM

Region Information

The second survey was conducted in a constrained space such that, the drone gets limited space for the takeoff. To approach the target, drone has to move upward above the tree and look for the region of interest. The drone cannot navigate upwards from the bottom of the tree. So, we kept a specific height from the ground, moved in a upward direction and then dropped downwards towards the bottom of the tree (See **Figure 3, 4 and 5**).

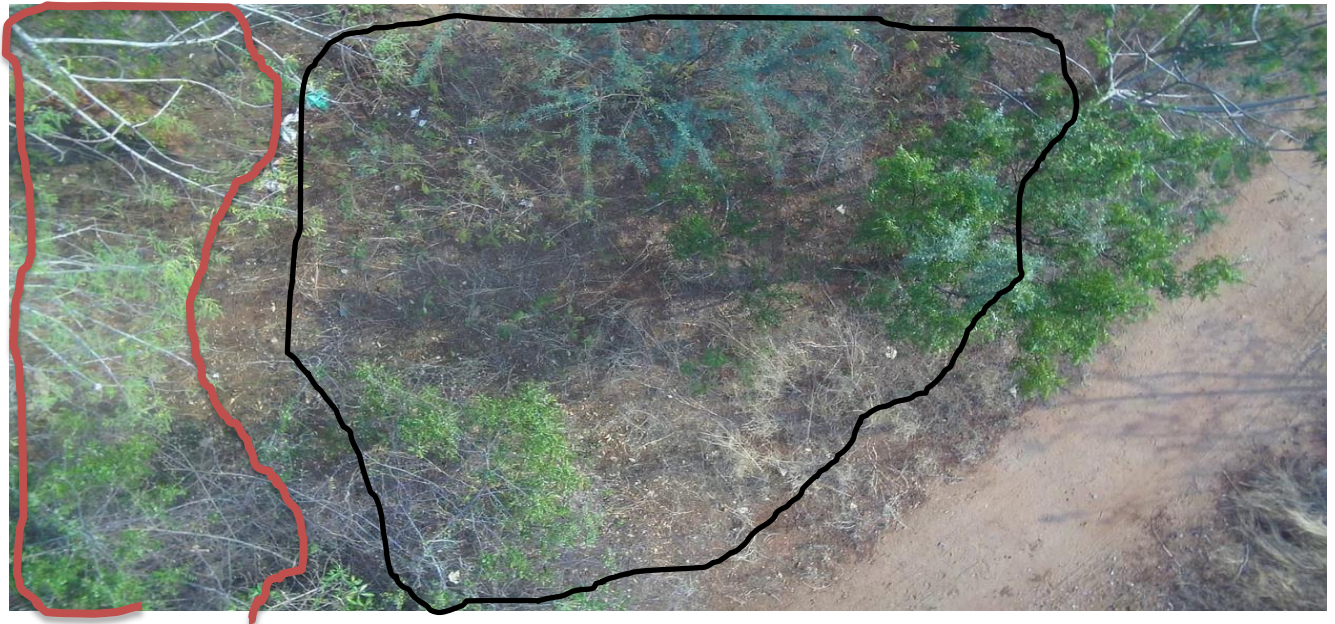


Figure 3- Survey 2 region



Figure 4 - Survey region with target and take off region

Challenge faced during survey-2 data collection:

Since the bottom of the tree is covered by shrubs (shown in Figure 4), the drone propellers will be blocked by the shrubs branches. Therefore, it's difficult for a smooth take-off. The only approach to capture the data is to bring the drone above the shrubs from limited take off region and capture the target.

Possible Solution:

The issue can be avoided if we opt for gimbal system (available in the market for the reasonable cost which fits to the 3DR Solo Drone), which can control the camera orientation. Since the camera is static in our equipment, the only approach is to reach above the tree and capture the region of interest.



Figure 5 - Trees with dense and sparse leaves top view

Survey 2 : sample images

The sample images extracted from the video of survey 2 are given in the following pages:

Survey_2_Image1:



Survey_2_Image2:



Survey_2_Image3:



Survey_2_Image4:



Survey_2_Image5:



Survey_2_Image 6:



Survey_2_Image 7:



Survey_2_Image 8:

