DATA COLLECTION AND PRODUCTIONWITH UNMANNED AERIAL VEHICLES

USAGE AREAS OF UAVS

It is not possible to limit the areas of use of UAVs for remote sensing and photogrammetry. Today, UAVs can be used in many areas.

Some of these areas are;

- Large-Scale Map Making
- Documentation of Archaeological Sites
- Applications for Forest Areas
- Agricultural Applications
- Disaster Management

Data collection and production processes for both photogrammetric and remote sensing purposes using unmanned aerial vehicles (UAVs) are studies that require a good planning and implementation phase.Photogrammetric data collection using UAVs is carried out in accordance with a flight plan, as in classical aerial photogrammetry.However, since these vehicles have a limited time to stay in the air, the time that the vehicle will stay in the air should be evaluated in the most efficient way.

STEPS OF DATA COLLECTION AND PRODUCTION

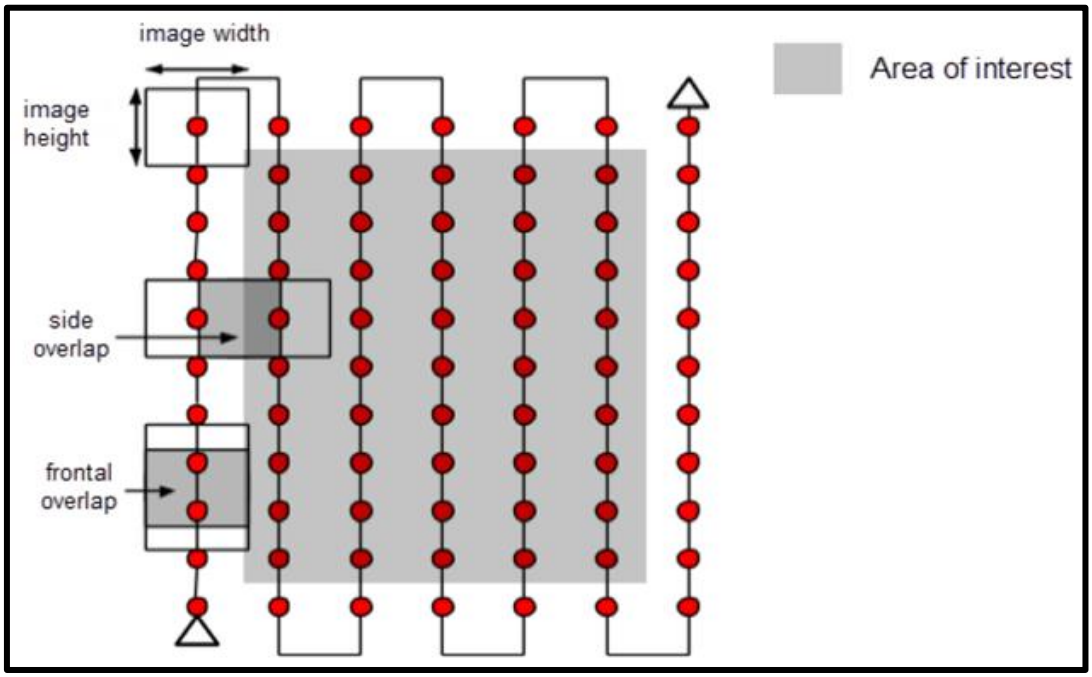
- Acquisting the base data of the area
- Preparing the flight plan
- Installation and Measurement of Ground Control Points (GCP)
- Shooting Images
- Data processing
- Production of photogometric products

ACQUISTING THE BASE DATA OF THE AREA

In order to make a good flight plan, it is very important to have base maps showing the boundaries of the study area. As all the planning to be done during the flight, planning phase are based on these maps. Data showing the boundaries of the study area can be obtained using programs such as Google Earth.

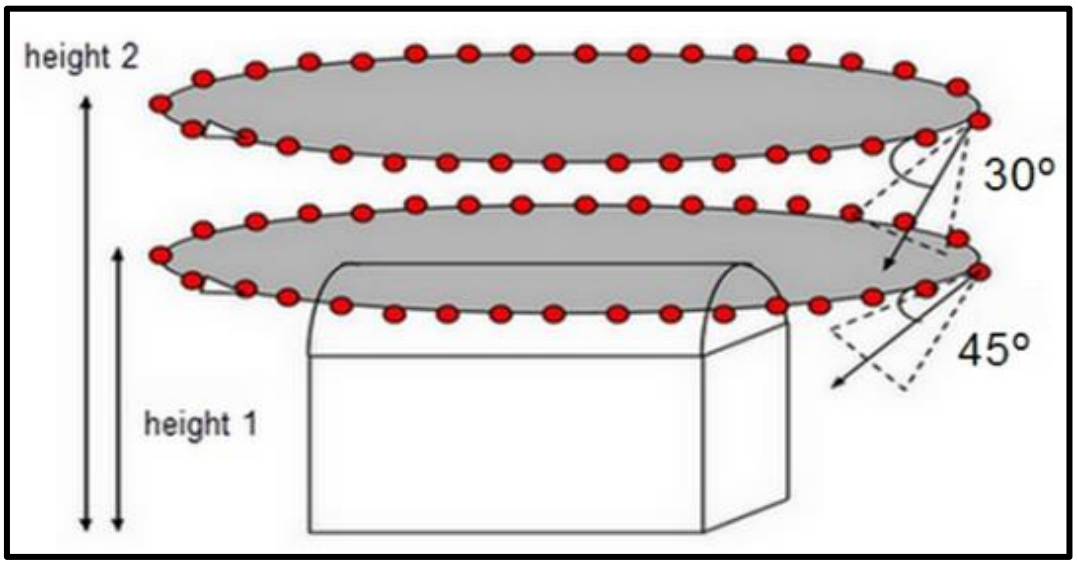
PREPARING THE FLIGHT PLAN

In most cases, the recommendation is at least 75% front overlap (with respect to the direction of flight) and at least 60% side overlap (between flight paths).It is suggested that images be taken with a regular grid pattern.The camera should be kept at a constant height above the terrain/object whenever possible to achieve the desired GSD.



ideal image acquisition plan (general plan)

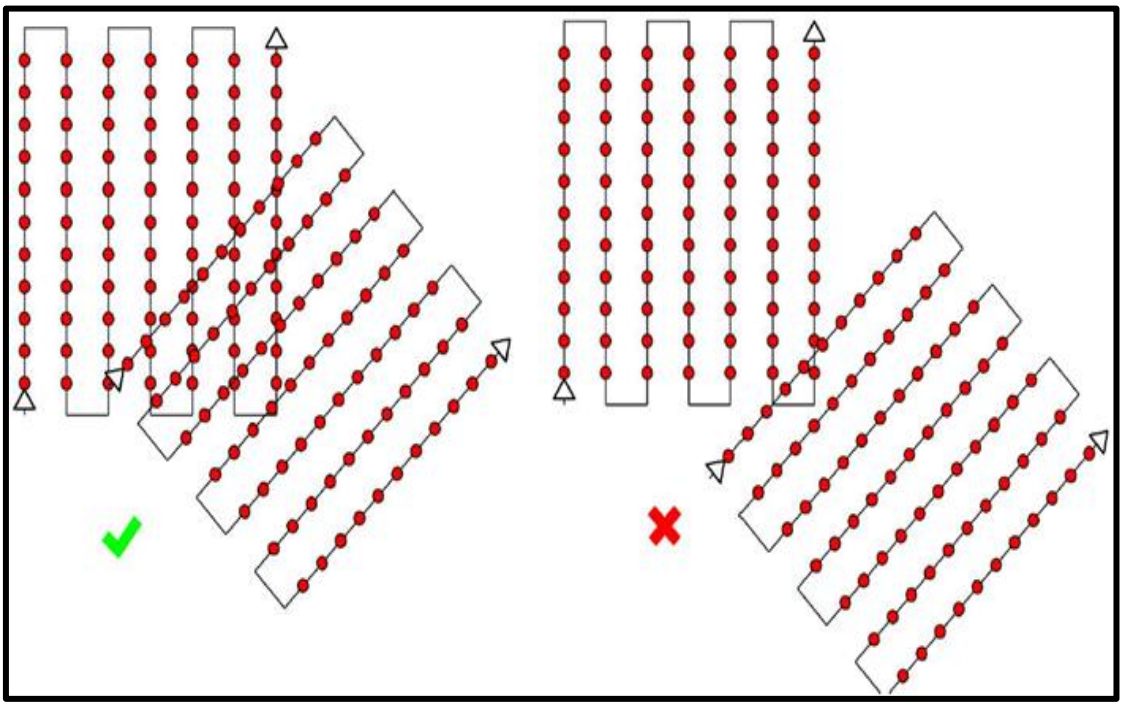
3D reconstruction of buildings requires a specific image acquisition plan. In such studies, it is necessary to fly around the building a second and third time with a 45° camera angle on the first flight, then increasing the flight height and reducing the camera angle on each lap.

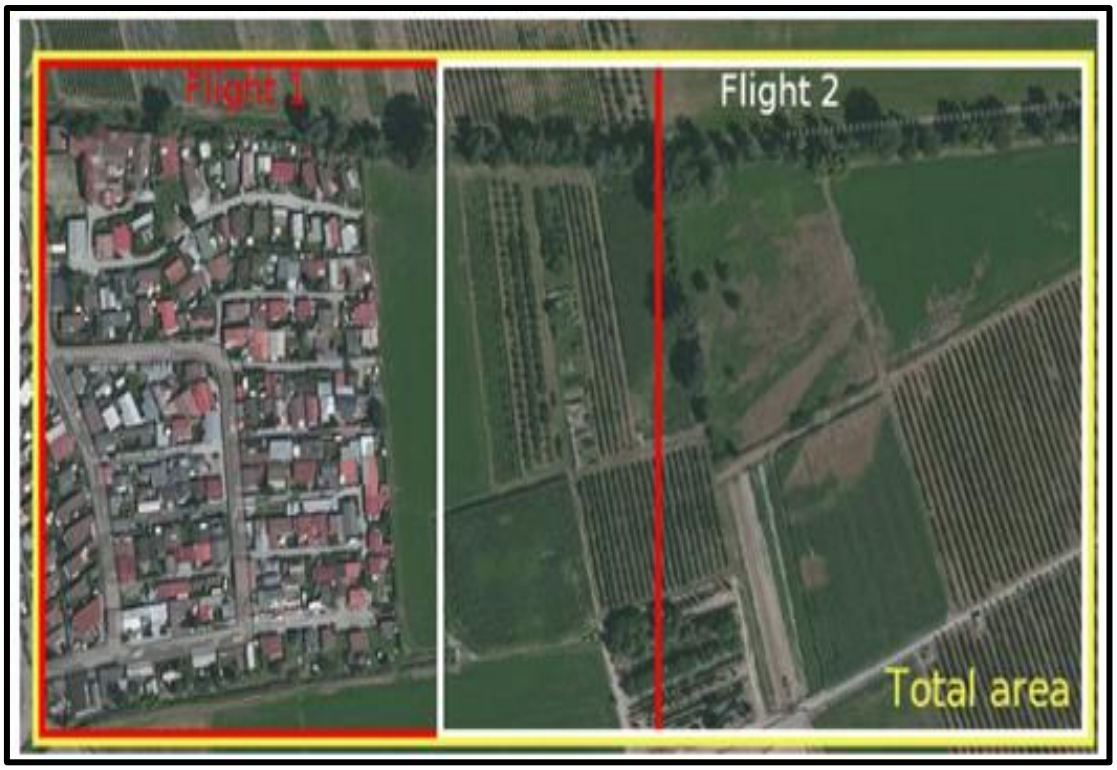


ideal image acquisition plan (building plan)

MULTIPLE FLIGHTS:

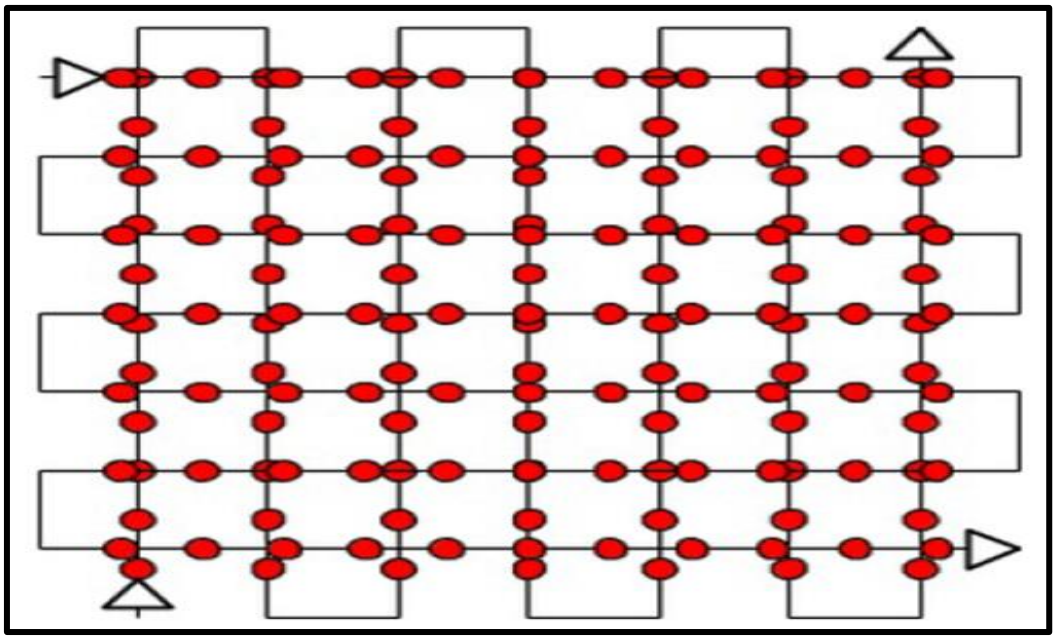
There should be sufficient overlap in acquisition plans for multiple flights. In such cases, different flights should be planned under the same conditions (sun direction, weather conditions, absence of new buildings, etc.).





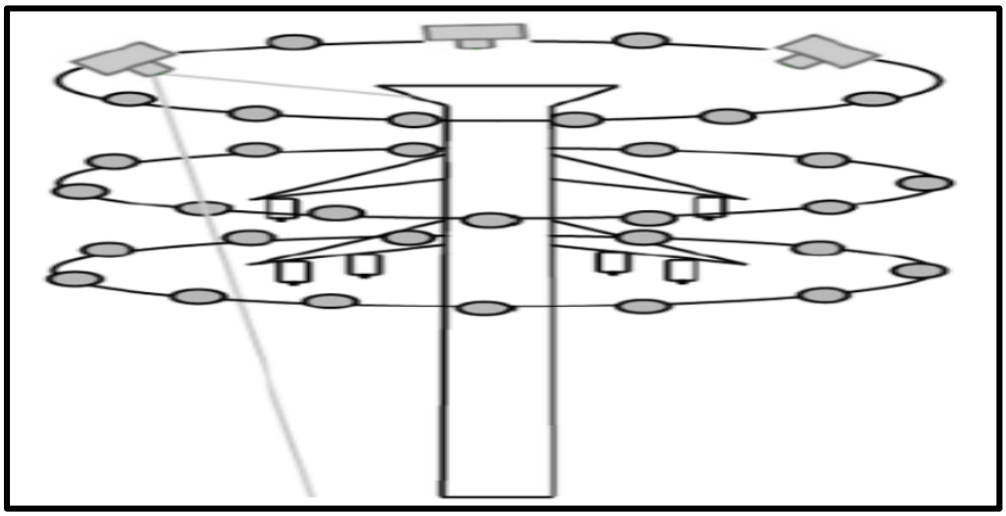
DOUBLE GRID:

For 3D studies in urban areas, a **double grid** image acquisition plan should be used so that all facades of the builings (north, west, south, east) can be seen in the images.



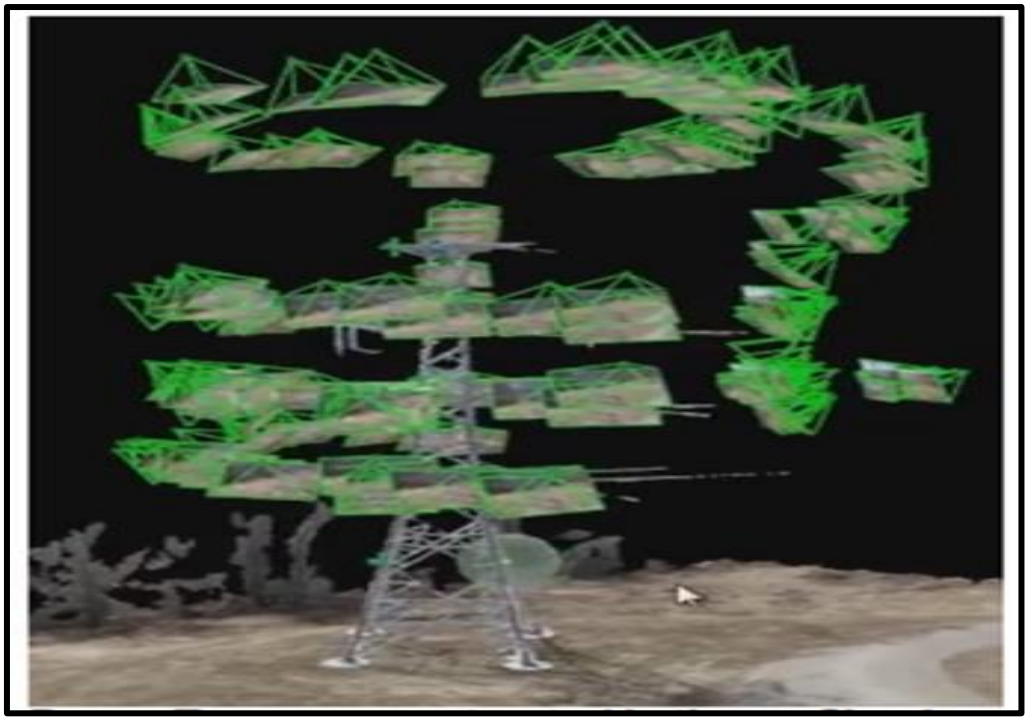
Reconstruction of Large Vertical Objects: Power towers, wind turbines etc. 3D reconstruction of objects requires a special image acquisition plan

- It should be flown close to the structure.
- The perimeter of the structure should be turned several times at several heights.



RECONSTRUCTION OF LARGE VERTICAL OBJECTS:

- Images should be captured with high overlap (90% overlap between images taken at the same height and 60% overlap between images taken at different heights).
- The optimal camera angle for the upper circle is 45 degrees. Images should be as focused as possible (both the main subject and background should be in focus).
- It is recommended to have the geolocation of the image



WHAT IS GROUND SAMPLE DISTANCE AND HOW DOES IT AFFECT UAV DATA?

GSD: Ground Sample Distance

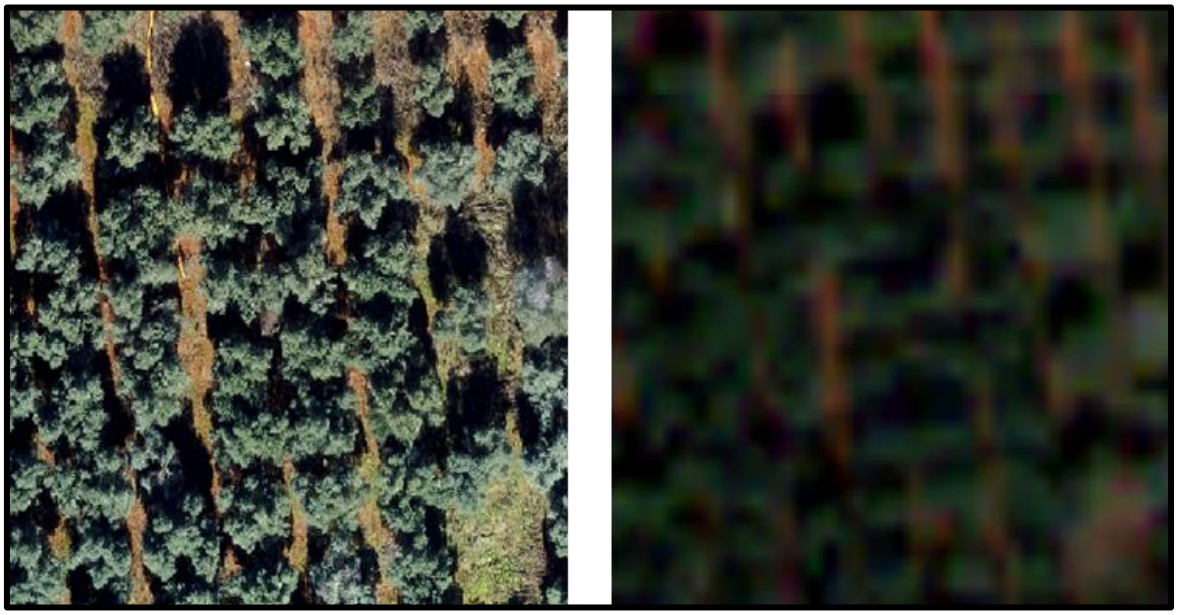
GSI: Ground Sample intervance

The ground sample distance (GSD) is the distance between the center points of each sample taken from the ground.Since it is about digital photographs in UAV measurements, each "sample" is a pixel.

**GSD represents the size of a pixel on the ground.

WHAT IS GROUND SAMPLE DISTANCE AND HOW DOES IT AFFECT UAV DATA?

GSD 5 CM	GSD 5 M
Higher accuracy	Lower Accuracy
More image details	Less image details
Lower flight altitude (altitude)	Higher flight altitude (altitude)
More data	Less Data



GROUND SAMPLE DISTANCE (GSD) CALCULATION:

Problem: Calculate the GSD (ground sampling distance) value to be obtained from the flight to be performed at an altitude of 80 m with the UAV whose camera features are given below.

Image height:3078 px

Image width: 5472 px

Sensor width: 13.2 mm

Focal lenght:8.8 mm

Sensor height: 8 mm

$$GSD_h = \frac{Fh * Sh}{Fl * Ih}$$

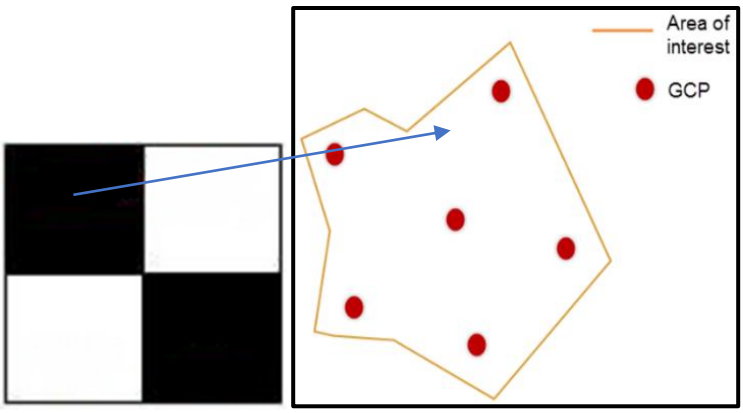
$$GSD_w = \frac{Fh * Sw}{Fl * Iw}$$

$$GSD_h = \frac{8000 * 0.8}{0.88 * 3078} = 2.36\ cm$$

$$GSD_w = \frac{8000 * 1.32}{0.88 * 5472} = 2.19\ cm$$

INSTALLATION AND MEASUREMENT OF GROUND CONTROL POINTS (GCP)

Before proceeding to the data collection process, ground control points are placed in appropriate places in the work area to precisely balance, combine and position the acquired images according to the project reference system.

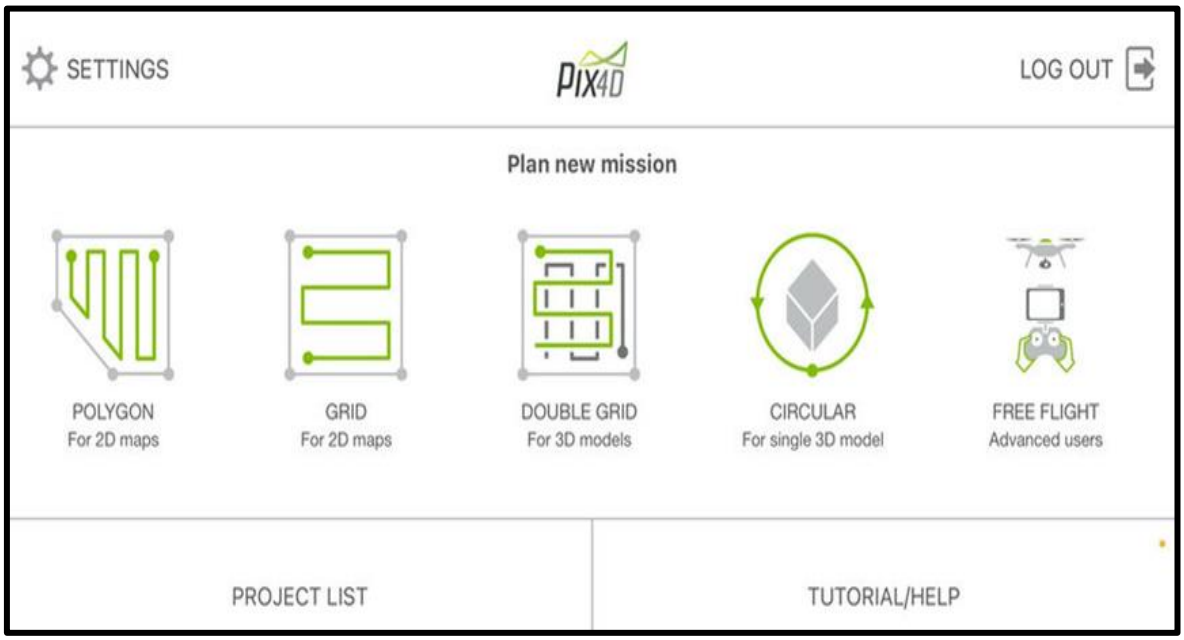


GCP

Care should be taken to ensure that these points are large enough to be seen on the image taken, in accordance with the resolution of the sensor system. Ground control points need to be measured with geodetic methods before or after the flight with precision.

SHOOTING IMAGES

According to the flight plan, the data of the study area is collected at an appropriate time, taking into account the weather conditions. Data collection can be done manually or autonomously, depending on the flight characteristics of the UAV



The data collected after the flight process is transferred to the computer environment and the images obtained are processed with photogrammetric data processing software. GCP and connection points are used to obtain orthophoto images by combining the images. These points can be obtained by field measurements or by hand images.

DATA PROCESSING

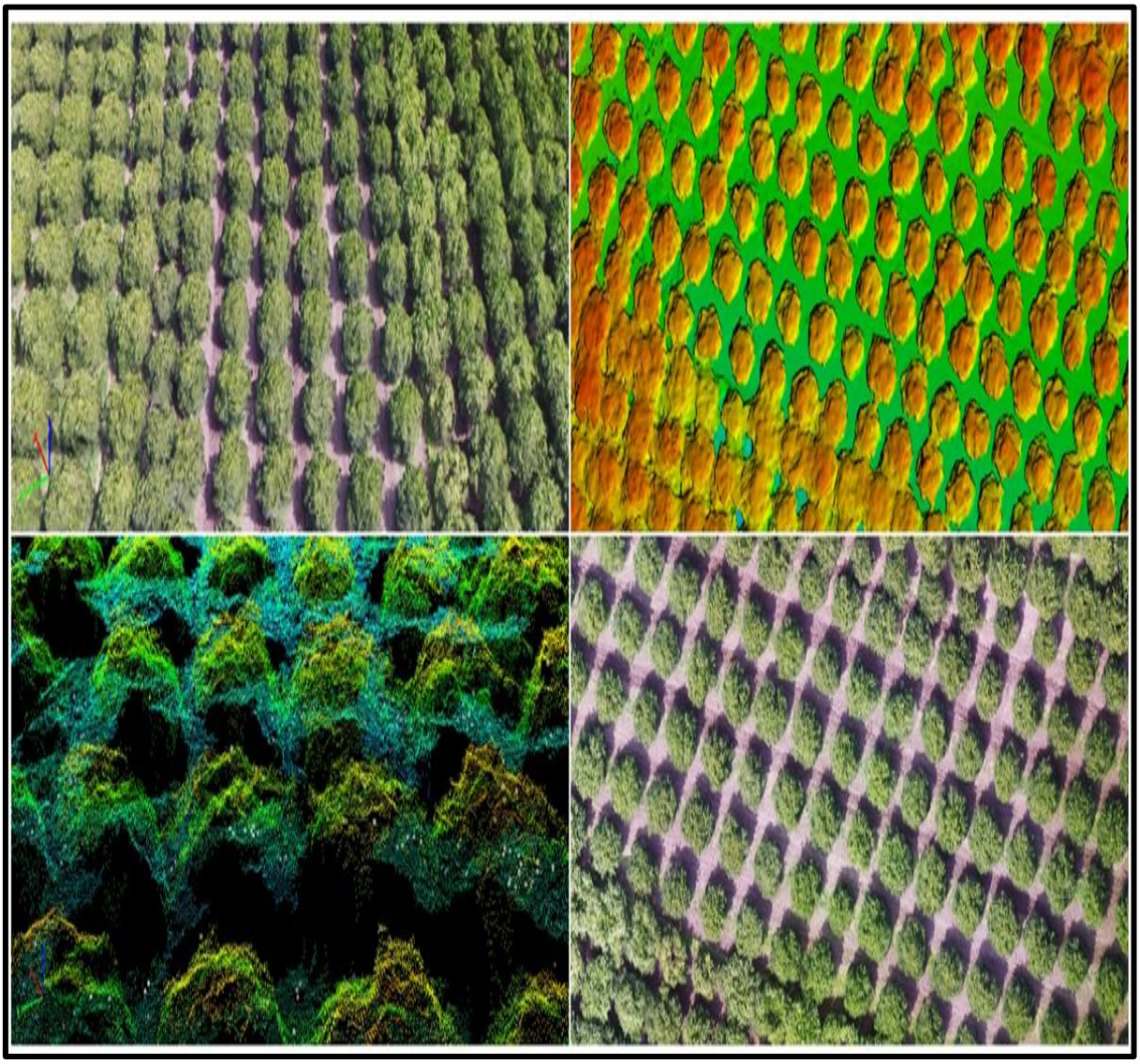
PIX4Dmapper

Agisoft

Metashape

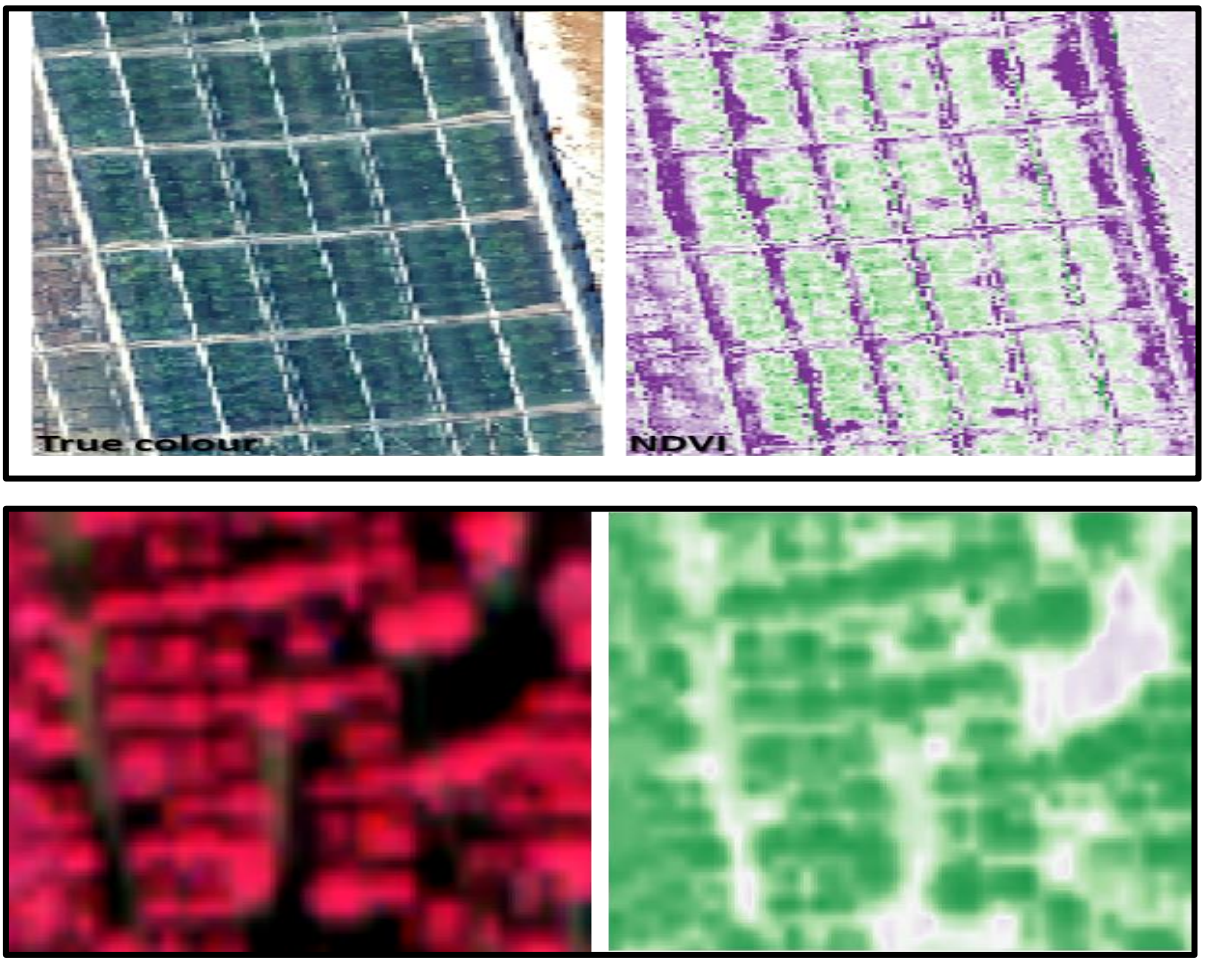
PRODUCTION OF PHOTOGOMETRIC PRODUCTS

As a result of processing the data, orthophoto images, digital surface models, digital terrain models and 3D models can be produced from the data at hand, depending on the purpose of the study.



In remote sensing data collection studies using UAVs, if three-dimensional data is needed, data collection in single-camera systems can be done in a similar way with photogrammetric methods.In cases where stereo images are not desired, data collection is carried out according to the flight plan, taking into account the speed of the UAV, the resolution desired in the planned project and the resolution of the sensor system used, in a way that covers the working area in accordance with its purpose.

The data obtained from the sensor platform used in the data collection process can be used for visual analysis or quantitative analysis (different index calculations-NDVI, image classification, monitoring of surface temperatures) by processing in classical remote sensing software or software developed for its purpose.



RESOURCES

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