

# Flight Planning



Presented By:

**Sasanka Madawalagama**

Geoinformatics Center

Asian Institute of Technology

Thailand



# Project Brief

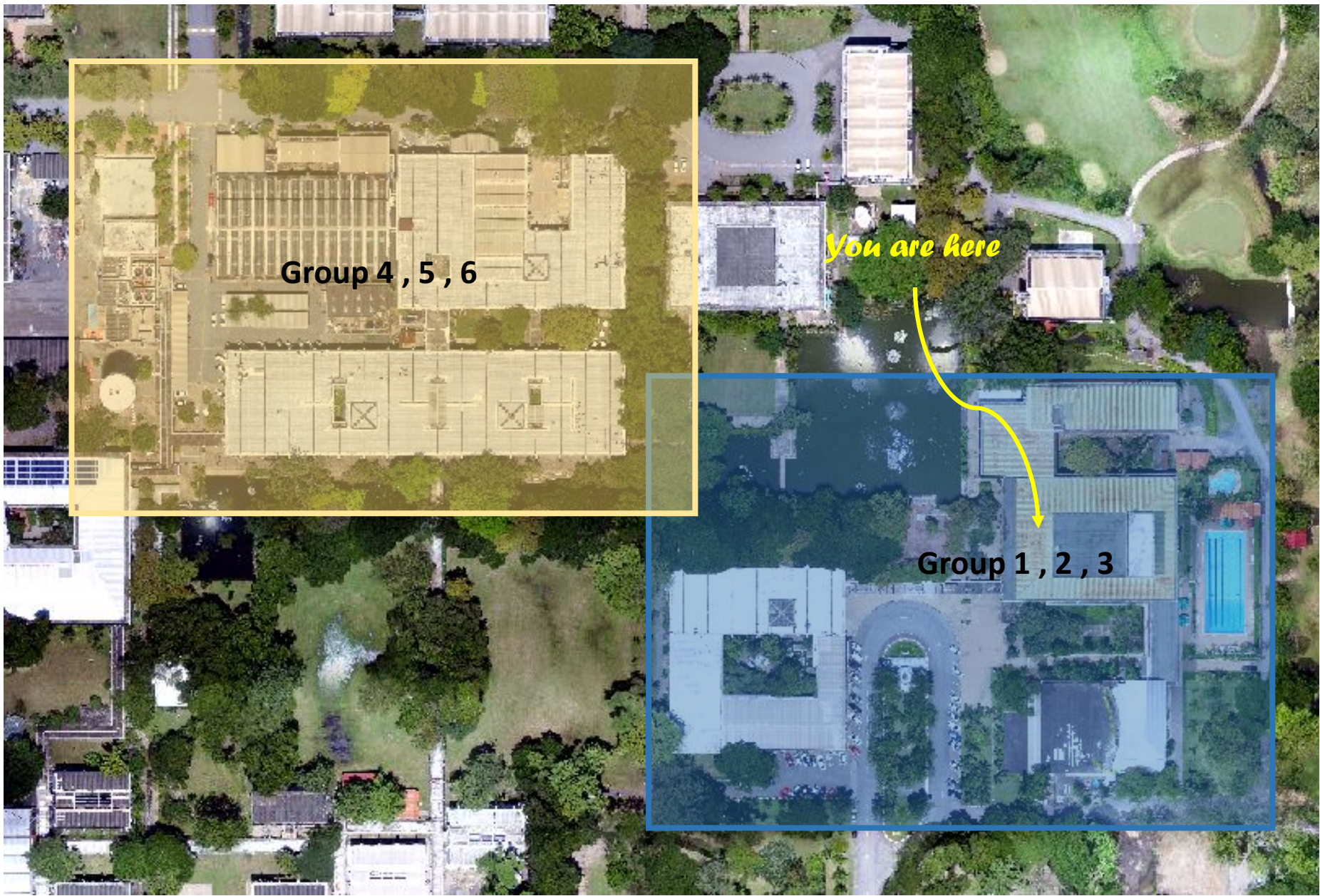
Objective: Make a photomap and DSM of AIT



**Group 1 , 2 , 3**



**Group 4 , 5 , 6**



- Specifications

|             | Flying Height |
|-------------|---------------|
| Group 1 & 4 | 50m           |
| Group 2 & 5 | 75m           |
| Group 3 & 6 | 100m          |

# Flight Planning with 'PIX4D Capture' app

# Steps

0. Download and install apps on tablet or smartphone from Google Play / App store:
  - a. Ctrl+DJI (only for android)
  - b. Pix4D capture**
  - c. DIJ GO (For drones before Phantom 4) – outside scope this lecture)
1. Step 1: Prepare the drone.
2. Step 2: Prepare the mission
  - a) Some background information
  - b) Preparing Pix4D Capture
3. Step 3: Start the mission (field demonstration)

**\*\*** *Is your device recommended to be used with DJI apps? Check check*






- Entertainment
- Apps
- Movies
- Music
- Books
- Newsstand
- Devices
- Account
- Redeem
- Buy gift card
- My wishlist
- My Play activity
- Parent Guide

Search All results




Apps

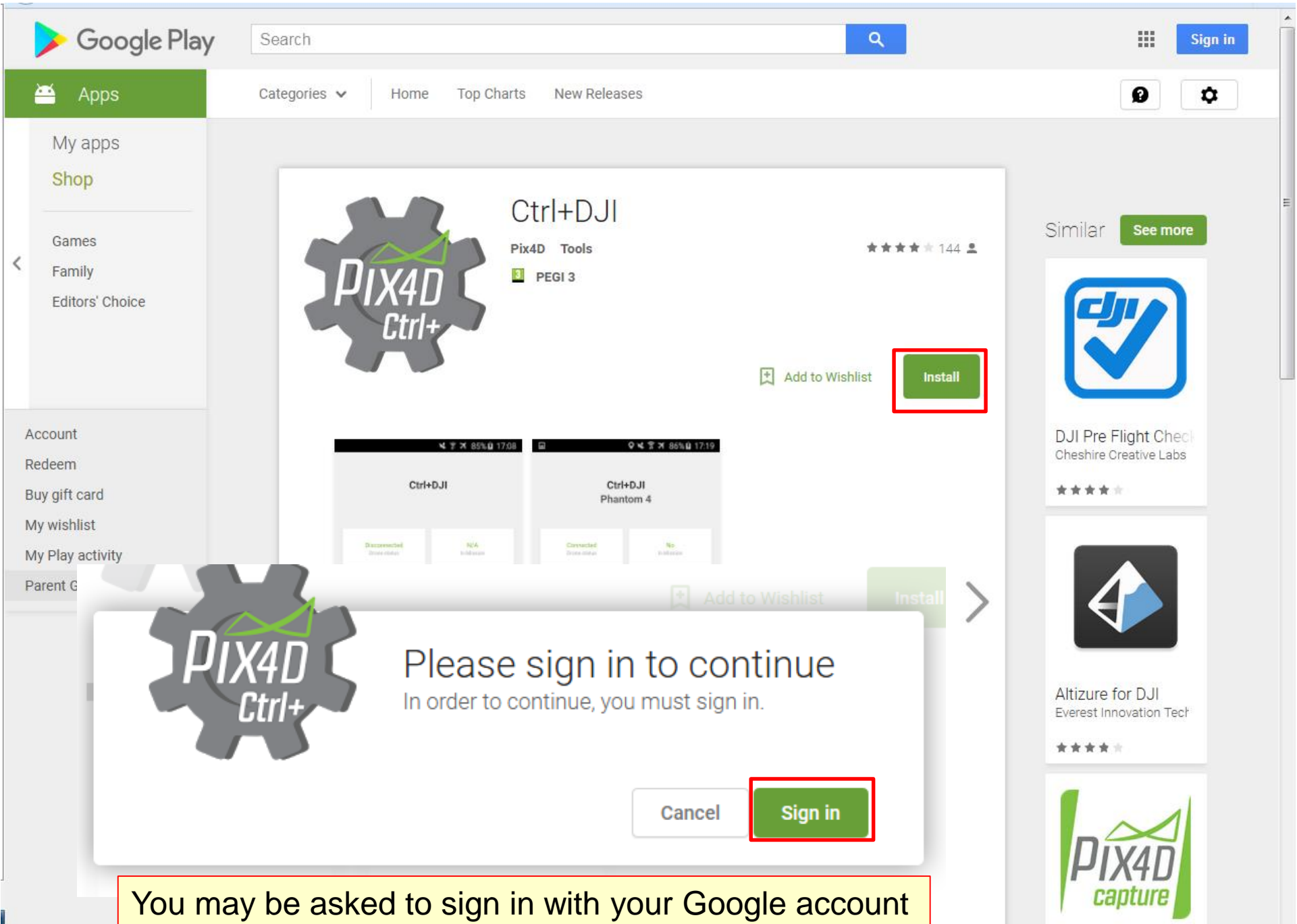
See more

|  |   |   |   |  |
|--|---|---|---|--|
|  <p>Pix4Dcapture<br/>Pix4D</p> <p>★★★★★</p> |  <p>Ctrl+DJI<br/>Pix4D</p> <p>★★★★★</p> |  <p>Ctrl+Parrot<br/>Pix4D</p> <p>★★★★★</p> |  <p>DroneDeploy<br/>DroneDeploy</p> <p>★★★★★</p> |  <p>Altizure for DJI<br/>Everest Innovation Tect</p> <p>★★★★★</p> |
|--|---|---|---|--|

Books

First install **'Ctrl+DJI'**

|  |   |
|--|---|
|  | <p>DronEzine: Edizione 11<br/>Associazione Dronezin</p> <p>DronEzine è la prima rivista italiana sui droni civili, i piccoli aerei robot che stanno popolando i cieli e cambiano per sempre il nostro modo di vivere e di lavorare. Fotografia aerea, videoriprese per il cinema e la tv, controllo del territorio e delle infrastrutture.</p> <p>€2,99 €2,48</p> |
|--|---|



- My apps
- Shop
- Games
- Family
- Editors' Choice

- Account
- Redeem
- Buy gift card
- My wishlist
- My Play activity
- Parent G



# Ctrl+DJI

Pix4D Tools  
PEGI 3

★★★★★ 144

Add to Wishlist

Install



Similar [See more](#)




DJI Pre Flight Check  
Cheshire Creative Labs

★★★★★



Altizure for DJI  
Everest Innovation Tech

★★★★★

Please sign in to continue  
In order to continue, you must sign in.

Cancel **Sign in**

You may be asked to sign in with your Google account





Ctrl+DJI  
Pix4D

Choose a device

No carrier Asus P01MA

This app has access to:

📍 Location

Uses the device's location

📷 Photos/Media/Files

Uses one or more of: files on the device such as images, videos, or audio, the device's external storage

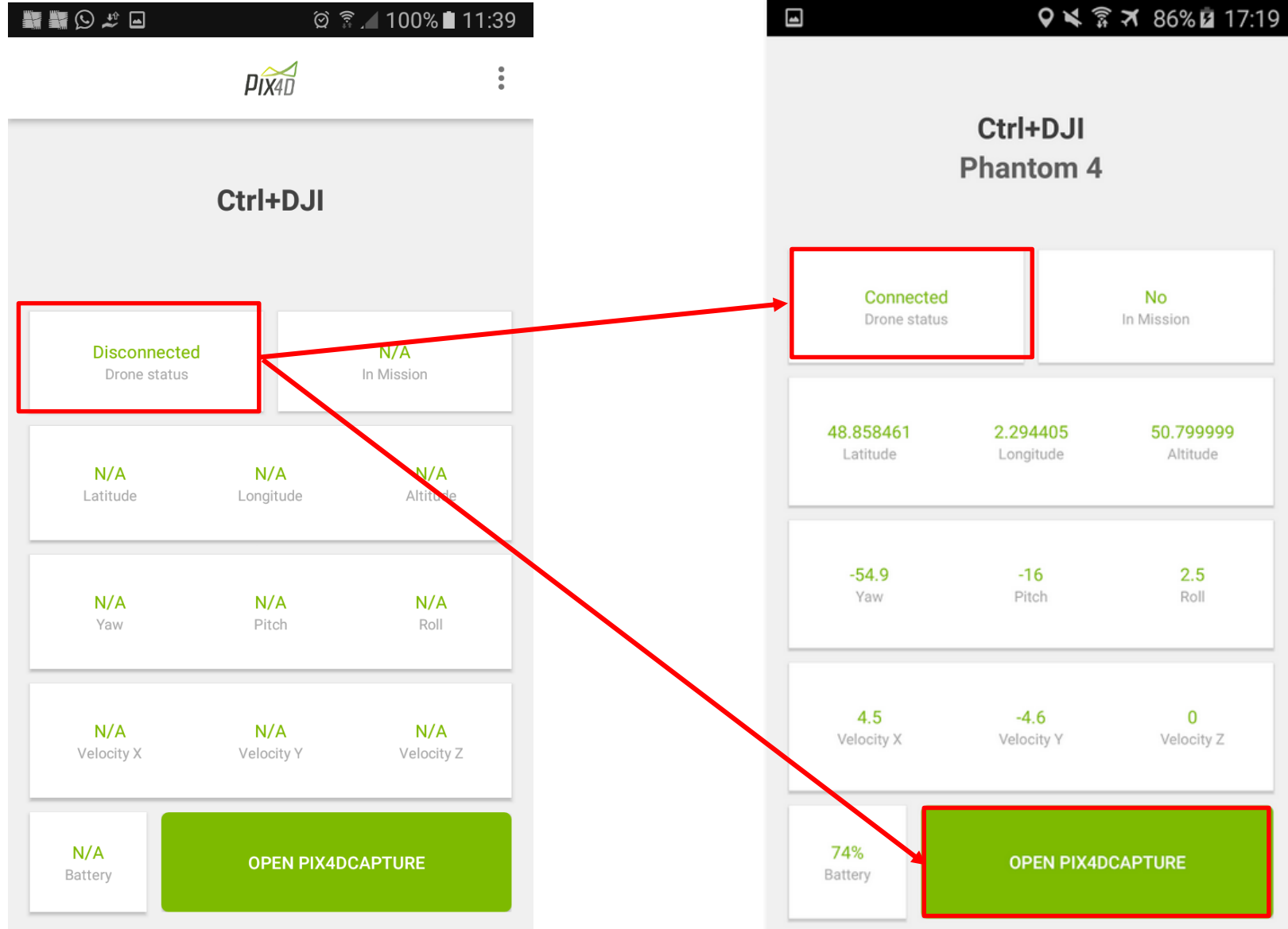
📶 Wi-Fi connection information

Install the app

CANCEL


INSTALL

Ctrl+DJI is an Pix4D plugin, required when using Pix4Dcapture.  
It is necessary to establish a connection with the drone  
After the connection is established Pix4D capture can be opened.




Apps

See more




Pix4Dcapture  
Pix4D

★★★★★




Ctrl+DJI  
Pix4D

★★★★★




Ctrl+Parrot  
Pix4D

★★★★★



DroneDeploy  
DroneDeploy

★★★★★



Altizure for DJI  
Everest Innovation Tec

★★★★★

Now install **'Pix4Dcapture'**



DronEzine: Edizione 11  
Associazione Dronezin

DronEzine è la prima rivista italiana sui droni civili, i piccoli aerei robot che stanno popolando i cieli e cambiano per sempre il nostro modo di vivere e di lavorare. Fotografia aerea, videoriprese per il cinema e la tv, controllo del territorio e delle infrastrutture.

€2,99 €2,48

# Step 1. Prepare the drone

## 1. **Warning: Know the drone and how to fly it manually.**

Before using the app, it is required to first learn how to fly the drone manually. Manual control of the drone is the only way to avoid obstacles or get back a drone that flies away due to GPS interference.

## 2. **Important:**

- Choose a clear take off/landing zone of at least 10 by 10 meters that can easily get GPS signal.
- Before taking off, check that:
  - The drone and the remote controller batteries are charged.
  - The propellers are correctly mounted.
  - The propellers/engine are functioning.
- Do not fly over crowds, respect the regional and national flight regulations.

# Step 1. Prepare the drone

## 3. Connection with the drone:

Connection is required to trigger the image capture and to be able to take over manual control of the drone at anytime during the mission.

## 4. Good GPS signal:

If the drone misreads the GPS coordinates internally, it might fly away in a random direction. This happens when the drone is flying in an environment with interference or with several high objects in the surroundings.

## 5. Obstacles:

Ensure that no obstacle is between the drone home point or takeoff point and the flight altitude during takeoff or landing.

# Step 1. Prepare the drone

## 6. Battery:

As the battery lifetime depends on multiple factors such as wind, altitude, temperature, etc., it is impossible to predict the lifetime of the battery. If the app is connected to the drone and the battery is under 20%, the drone flies home. If the connection is broken and the battery is below a certain level, the drone will behave as defined in the manufacturer's app.

## Step 2. Prepare the mission

**Please Note:**

**It is recommended to plan the mission in advance, before going to the field.**

If the option '**Save offline maps**' in '**Settings**' window is enabled, the base map will be saved and available offline on your device and will be loaded when you open the project (**see slide**).

If it is not saved, the base map loads only if there is Internet connection.

## Step 2. Prepare the mission

When designing the image acquisition plan the following issues have to be taken into consideration:

- **Image acquisition plan / mission.**  
The image acquisition plan type depends on the type of terrain/object to be reconstructed.
- **Ground Sampling Distance (GSD).**  
The GSD is determined by the flying height. A constant flying height is required to maintain Ground Sampling Distance (GSD).
- **Overlap.**  
The overlap depends on the type of terrain that is mapped and will determine the rate at which the images have to be taken.  
In order to obtain **high** accuracy results, a **high** overlap between the images is required.




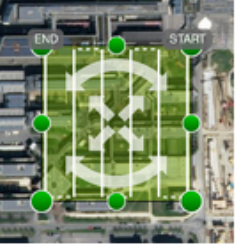


## Step 2. Prepare the mission

### Image acquisition plan / mission:







Pix4D and AgiSoft is image processing software that is based on automatically finding **thousands of common points between images**:

- Each characteristic point found in an image is called a **'key point'**.
- When a key point is identified as the same on two (or more) different images, they are **'matched key points'**.
- Each group of correctly matched key points will generate **one 3D Tie point**. *An Automatic Tie Points is a 3D point and its corresponding 2D keypoints that were automatically detected in the images and used to compute its 3D position*
- When there is high overlap between 2 images, the common area captured is larger and more key points can be matched together.
- The more key points, the more accurately 3D point cloud can be computed.
- Therefore, the main rule is to **maintain high overlap between the images**.

# Types of missions

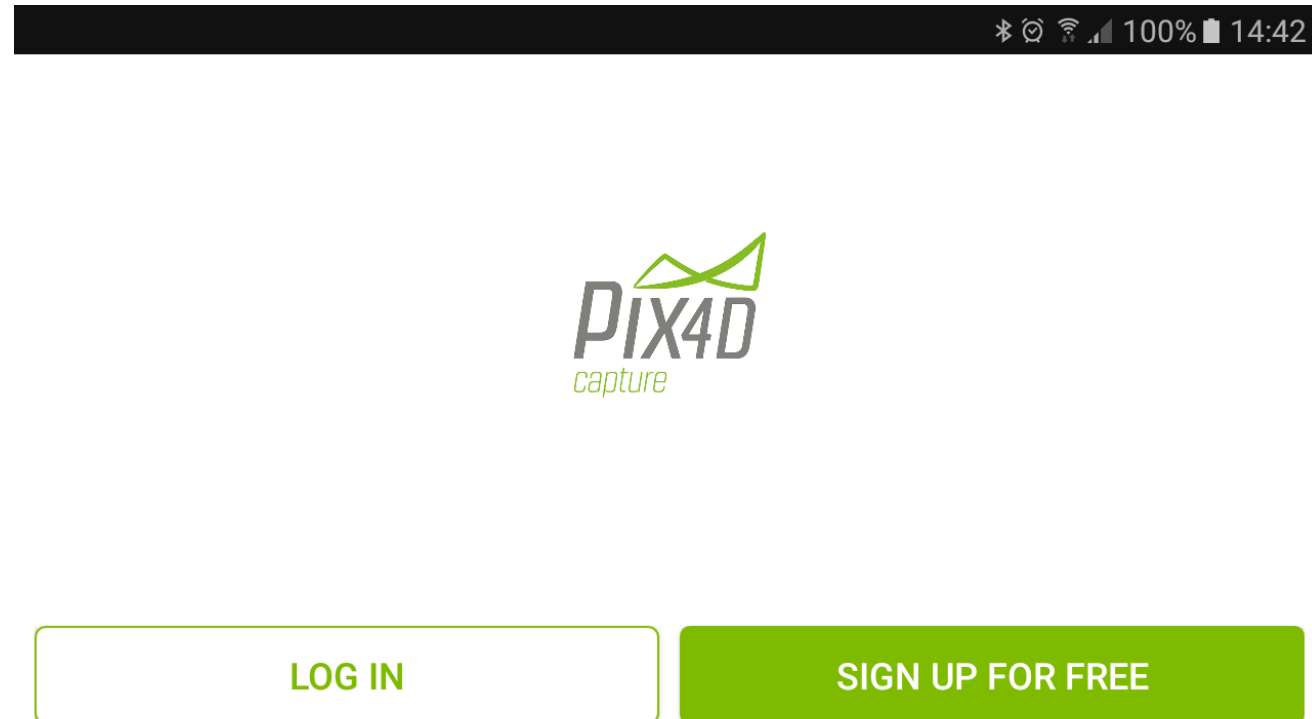
| Type of mission  | Description  | Android                     | iOS   |
|--|--|-----------------------------|---|
|  <b>Grid</b><br>         | <p>Plan and fly a nadir rectangle mission.</p> <p>Suitable for most environments.<br/>It ensures that images are taken with the overlap required for optimal processing.</p> <p>Recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• Main interest in 2D map outputs (DSM, orthomosaic, etc.).</li> <li>• Relatively flat surface (e.g. fields, earthworks).</li> <li>• Large area.</li> </ul>   | All drones                  | All drones                                      |
|  <b>Double Grid</b><br> | <p>Plan and fly a two consecutive nadir rectangle missions.</p> <p>It ensures that images are taken from multiple sides, with the overlap required for optimal processing. Compared to the simple grid, this mission is recommended for flying closer to objects in order to capture more vertical details.</p> <p>Recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• Main interest in 3D model outputs (point cloud, mesh, etc.).</li> <li>• Surface with height fluctuations or objects (e.g. buildings, forest).</li> <li>• Small and medium area as the flight time is doubled.</li> </ul> | DJI drones<br>Except P2V(+) | All drones<br>Except P2V(+)<br>Except Disco-Pro |

The type of mission depends on the application

|  |  |                                     |  |
|--|--|-------------------------------------|--|
|  <p><b>Polygon</b></p>         | <p>Plan and fly a nadir polygonal mission.</p> <p>Suitable for most environments that require flexible boundaries for flying or with a complex mapping shape. It ensures that images are taken with the overlap required for optimal processing.</p> <p>Recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• Main interest in 2D map outputs (DSM, orthomosaic, etc.).</li> <li>• Relatively flat surface (e.g. fields, earthworks).</li> <li>• Large area.</li> <li>• Complex shape and constraints in the flight boundaries.</li> </ul>  | <p>Not available yet</p>            | <p>All drones<br/>Except P2V(+)<br/>Except Disco-Pro</p> |
|  <p><b>Circular</b></p>      | <p>Plan and fly an ellipsoid mission around objects.</p> <p>It ensures that the images are taken from all angles around a target point, with the overlap required for optimal processing. For high objects, flying several circular missions at different altitude is suggested.</p> <p>Recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• Main interest in 3D model outputs (point cloud, mesh, etc.).</li> <li>• Isolated object (e.g. tower, pylon, building).</li> <li>• Small area.</li> </ul>  | <p>All drones<br/>Except P2V(+)</p> | <p>All drones<br/>Except P2V(+)<br/>Except Disco-Pro</p> |
|  <p><b>Free Flight</b></p>  | <p>Plan and fly a free flight mission (advanced users).</p> <p>Suitable to map more difficult objects that require more flexibility. The camera shutter is automatically triggered according to a horizontal and vertical distance interval. It requires to manually pilot the drone.</p> <p>Recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• Main interest in 3D model outputs (point cloud, mesh, etc.).</li> <li>• Small area.</li> <li>• Complex or vertical structures (e.g. building facade, cliff, bridge, etc.).</li> </ul> <p>For more information on how to prepare a free flight mission: <a href="#">203081219</a> (Android), <a href="#">204261889</a> (iOS).</p> <p>For information about the image acquisition plan: <a href="#">202557459</a>.</p> | <p>All drones</p>                   | <p>Only DJI drones</p>                                   |

## Step 2. Prepare the mission

1. Open the '**Pix4Dcapture**' app and log in if you have an account or sign up to create an account.

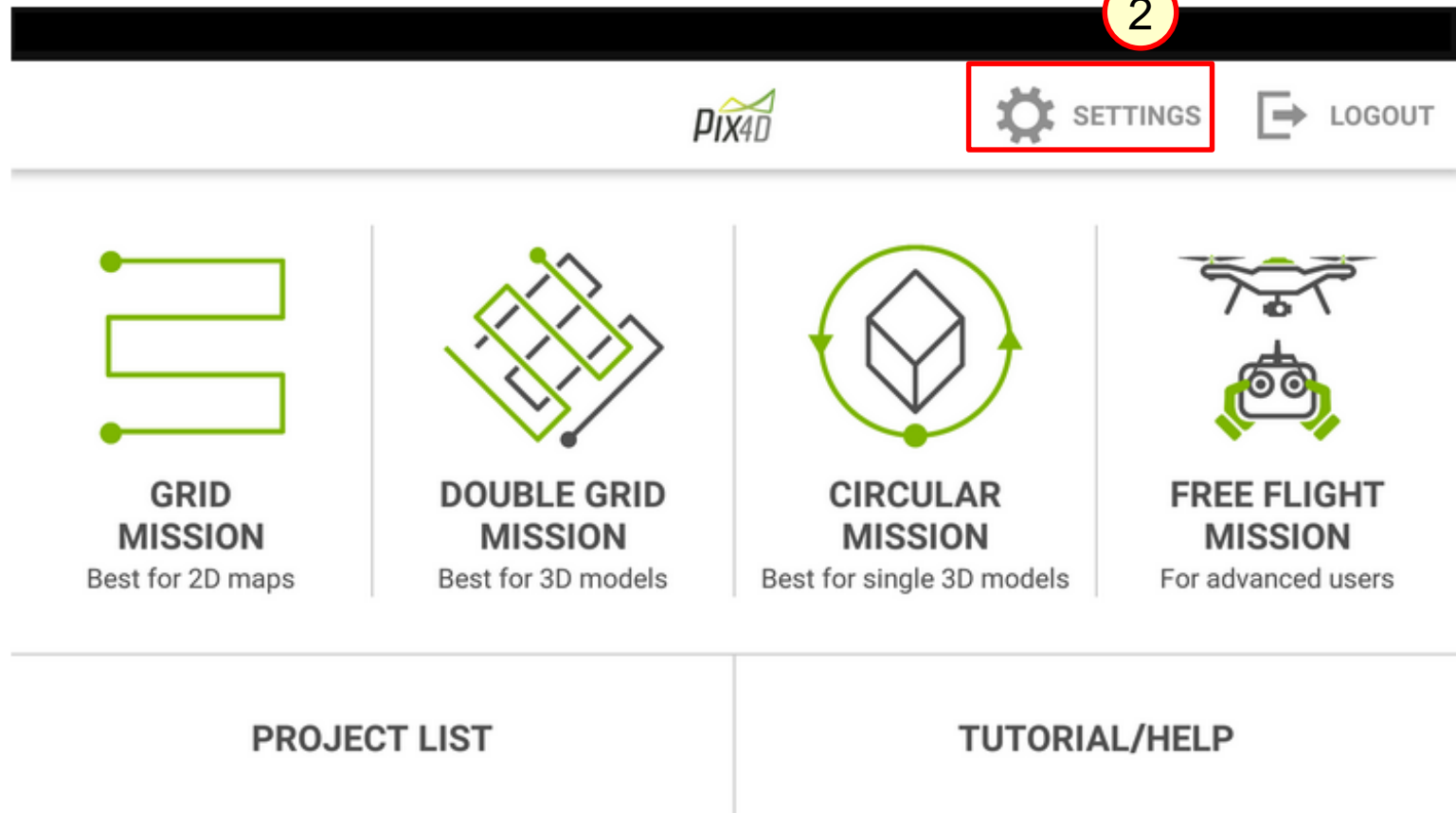


# Step 2. Prepare the mission

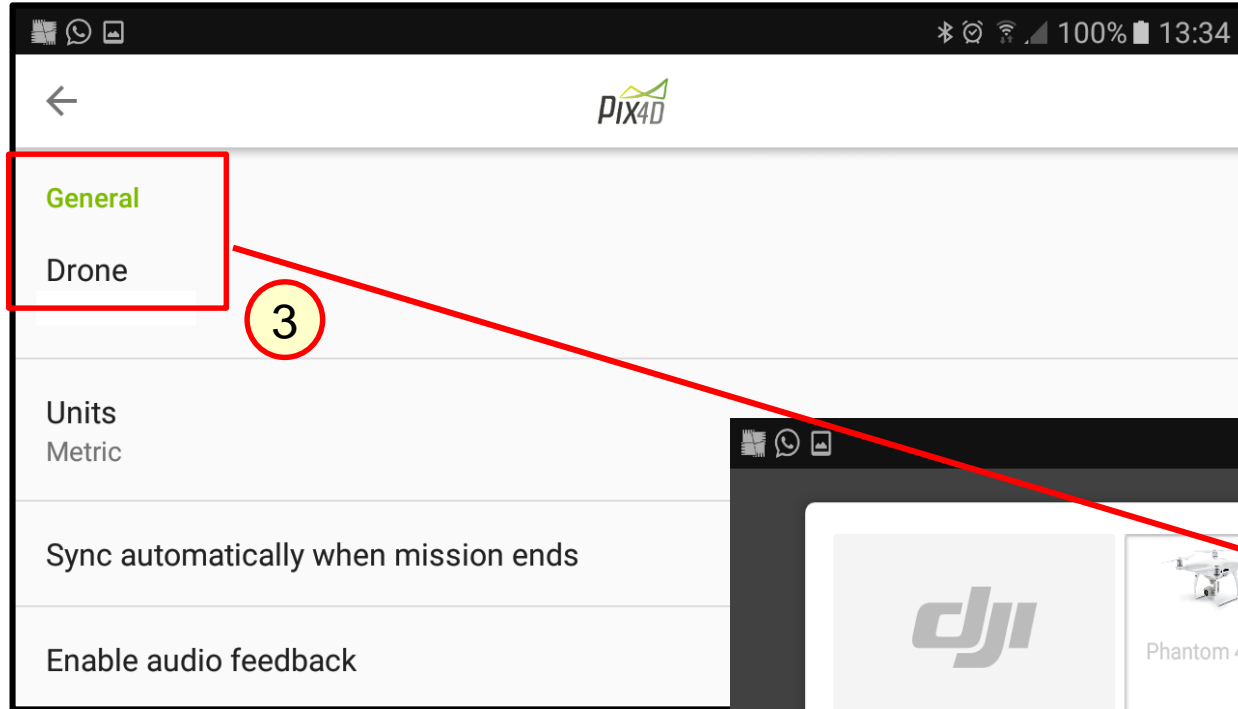
2. In the Home screen, tap **'Settings'**



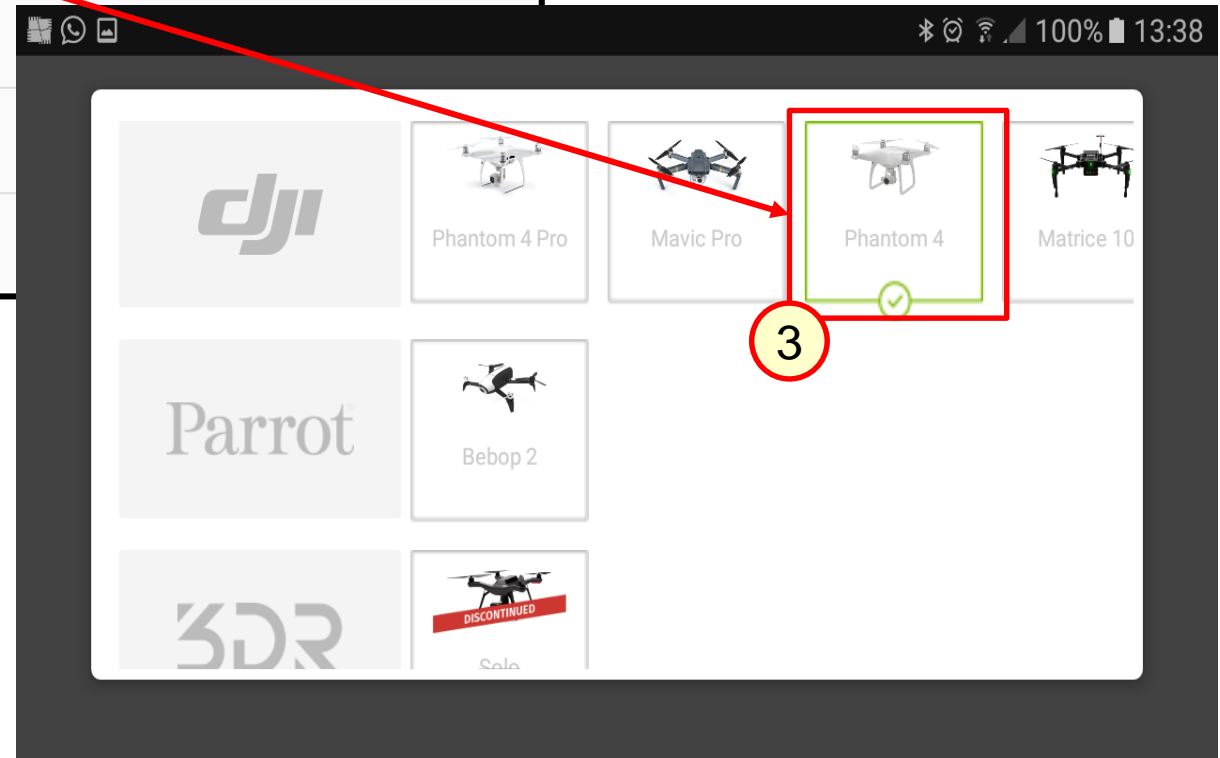
2



## Step 2. Prepare the mission



3. In the section '**General**', tap '**Drone**' and select the drone (Phantom 4 in this case).




## Step 2. Prepare the mission

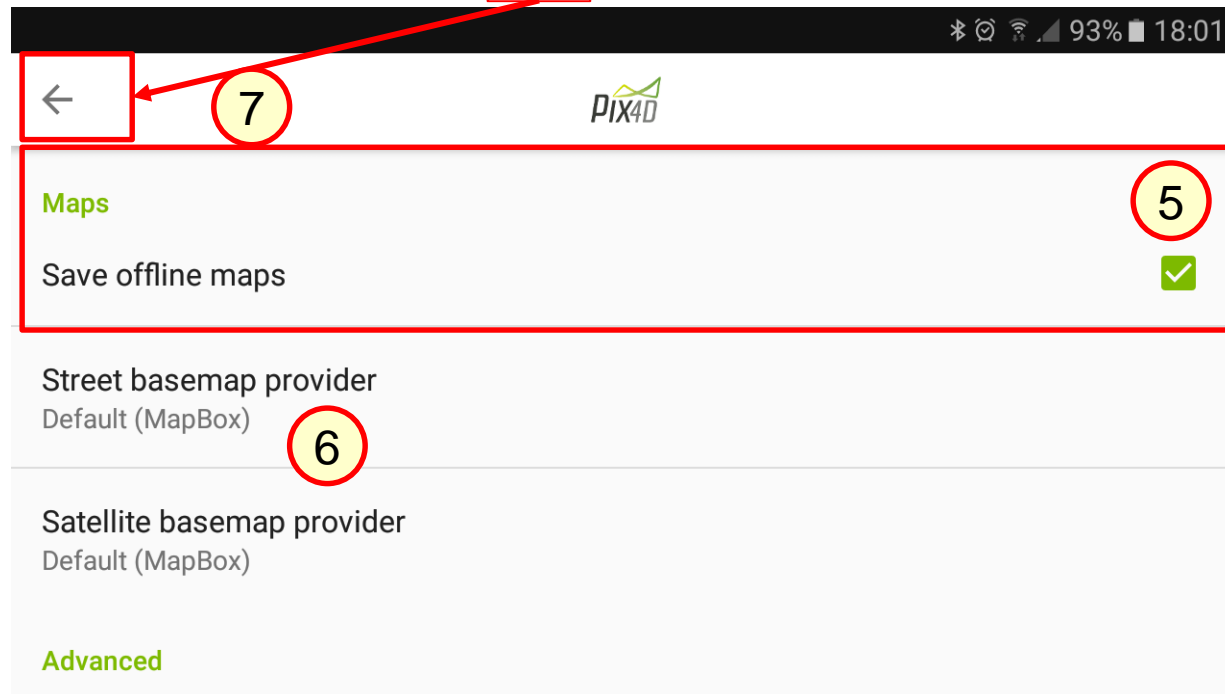
4. In the section '**General**', disable 'Sync automatically' . This prevents the images being send to you smartphone or tablet.

If you enable you run the risk your memory is overloaded.



## Step 2. Prepare the mission

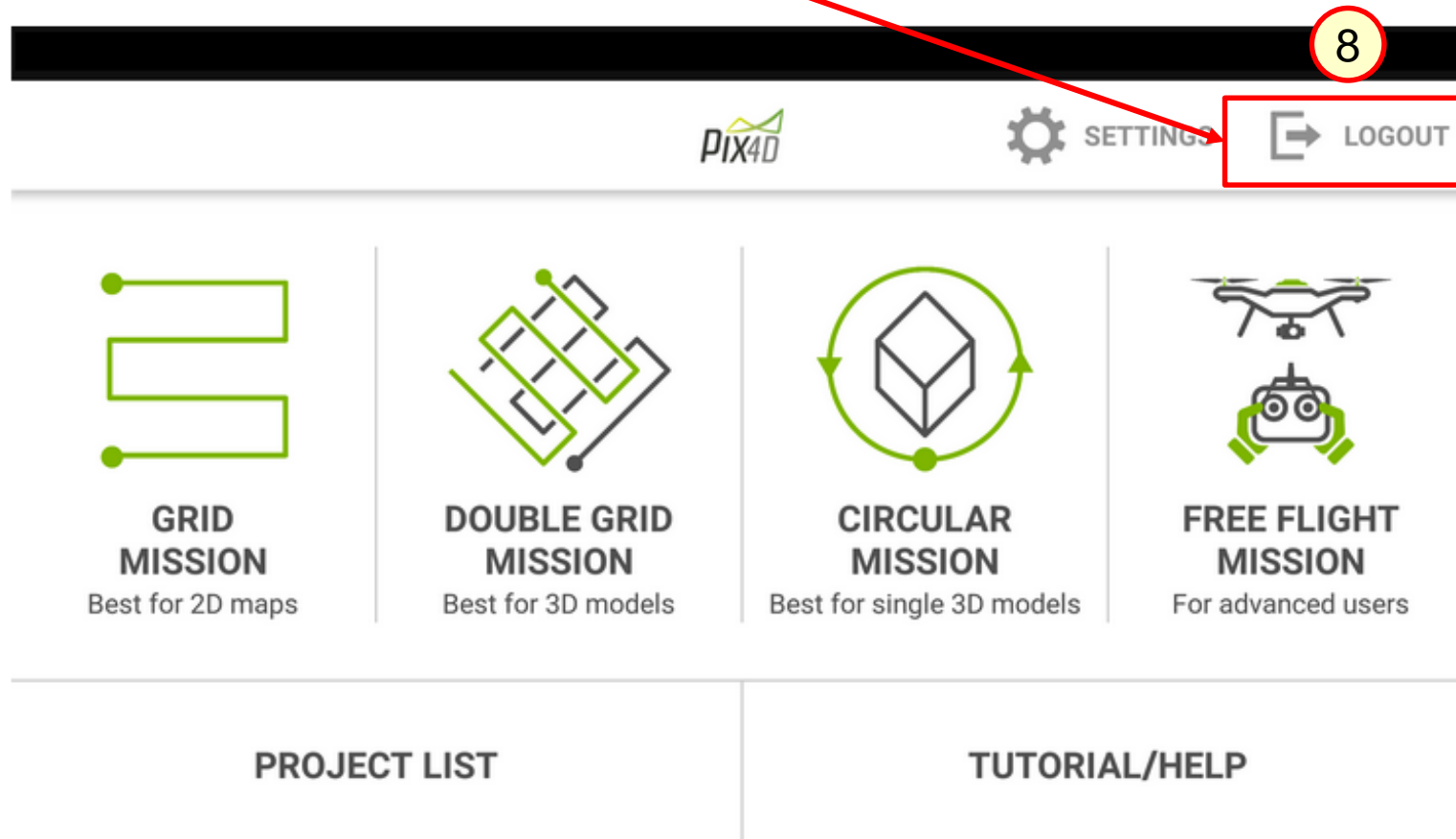
5. Scroll down to **'Maps'** and make sure the **'Save offline maps'** option is enabled. This allows to open the base map when there is no internet connection.
6. The default base-map provider is **'MapBox'**.  
By tapping this option you can change the provider.  
For this exercise we keep the default
7. Now tap **'return'** 





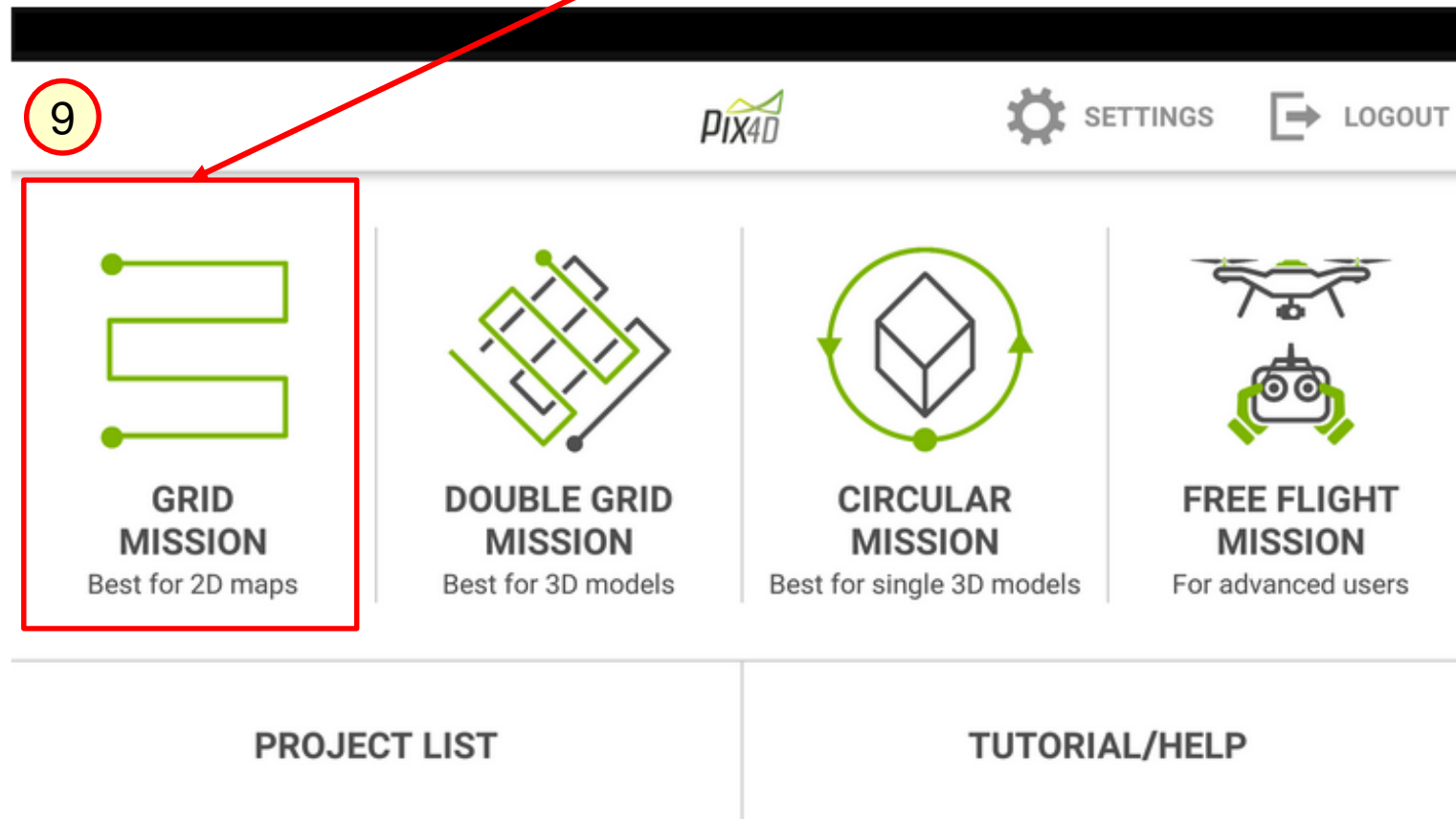
## Step 2. Prepare the mission

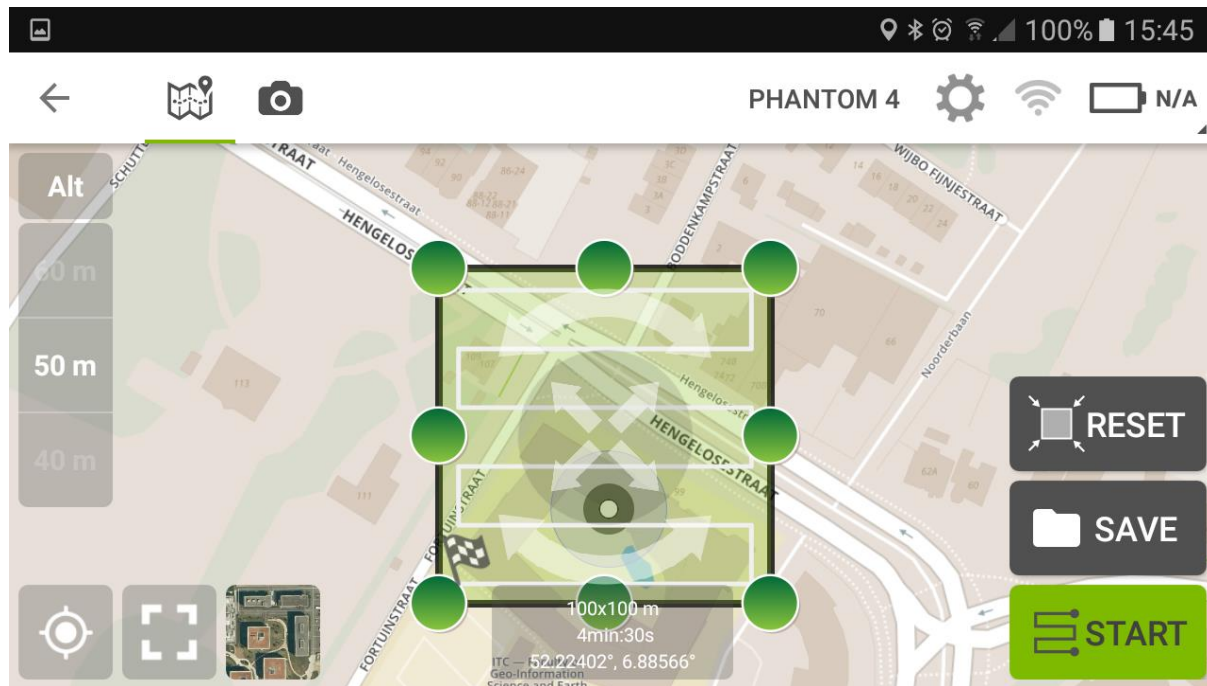
8. Select **'Logout'** and restart the app **'Pix4Dcapture'**.



## Step 2. Prepare the mission

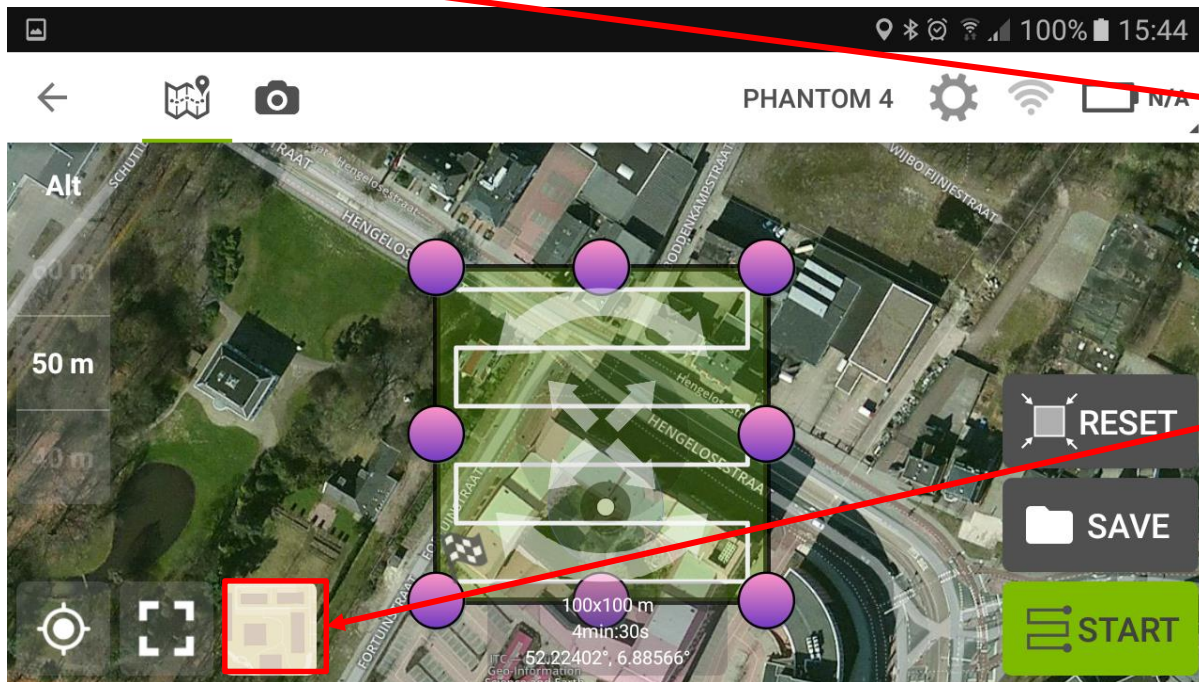
9. In the Home screen, select a type of mission, depending on object or terrain conditions.  
In this case we can select **'Grid Mission'**.

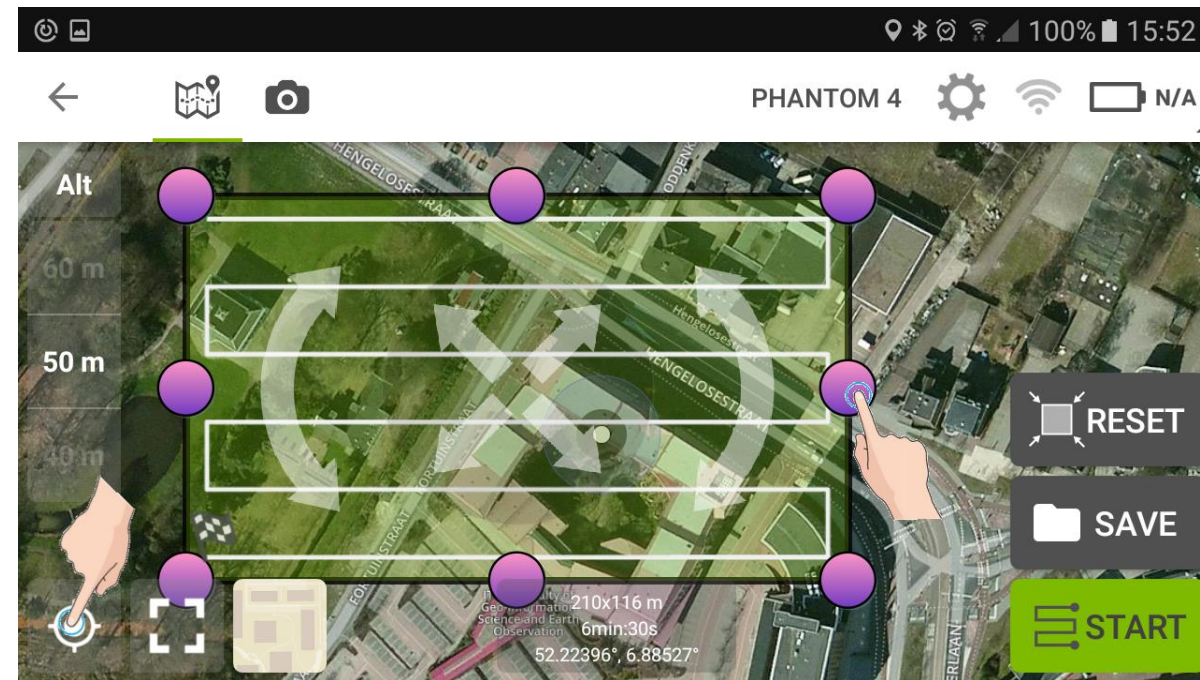
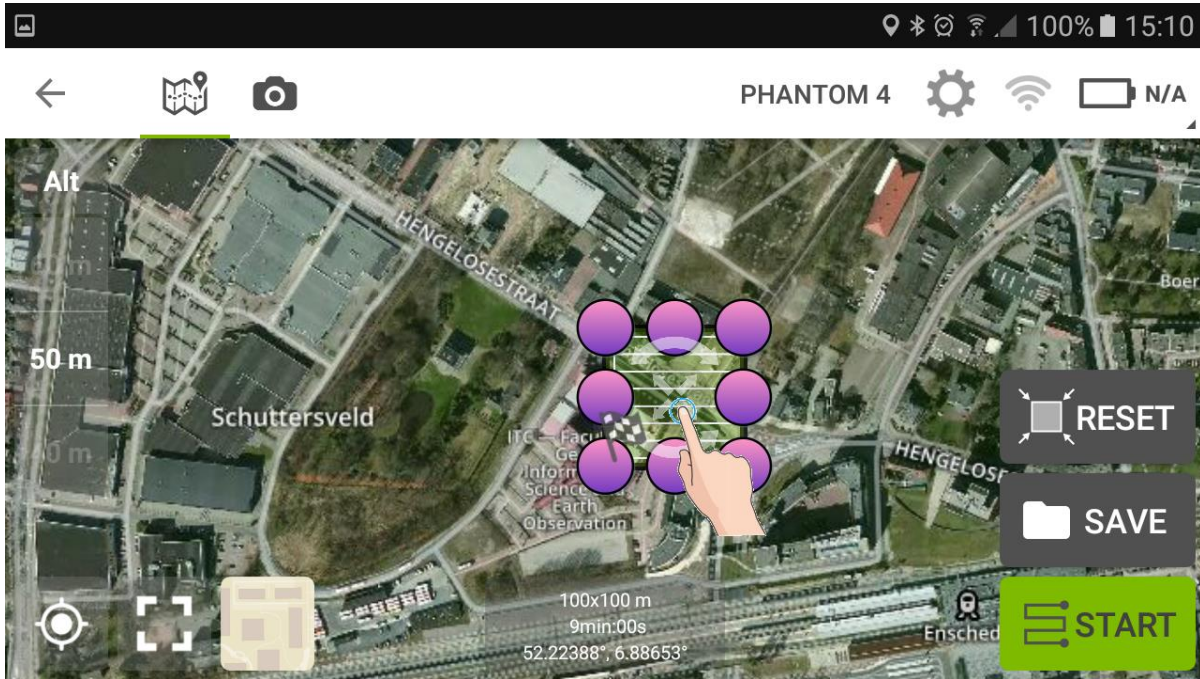




10. After selecting the type of mission, the **'Map'** viewer opens and **'Street'** or **'Satellite'** base map is loaded.


- You can switch between them by tapping the icon.






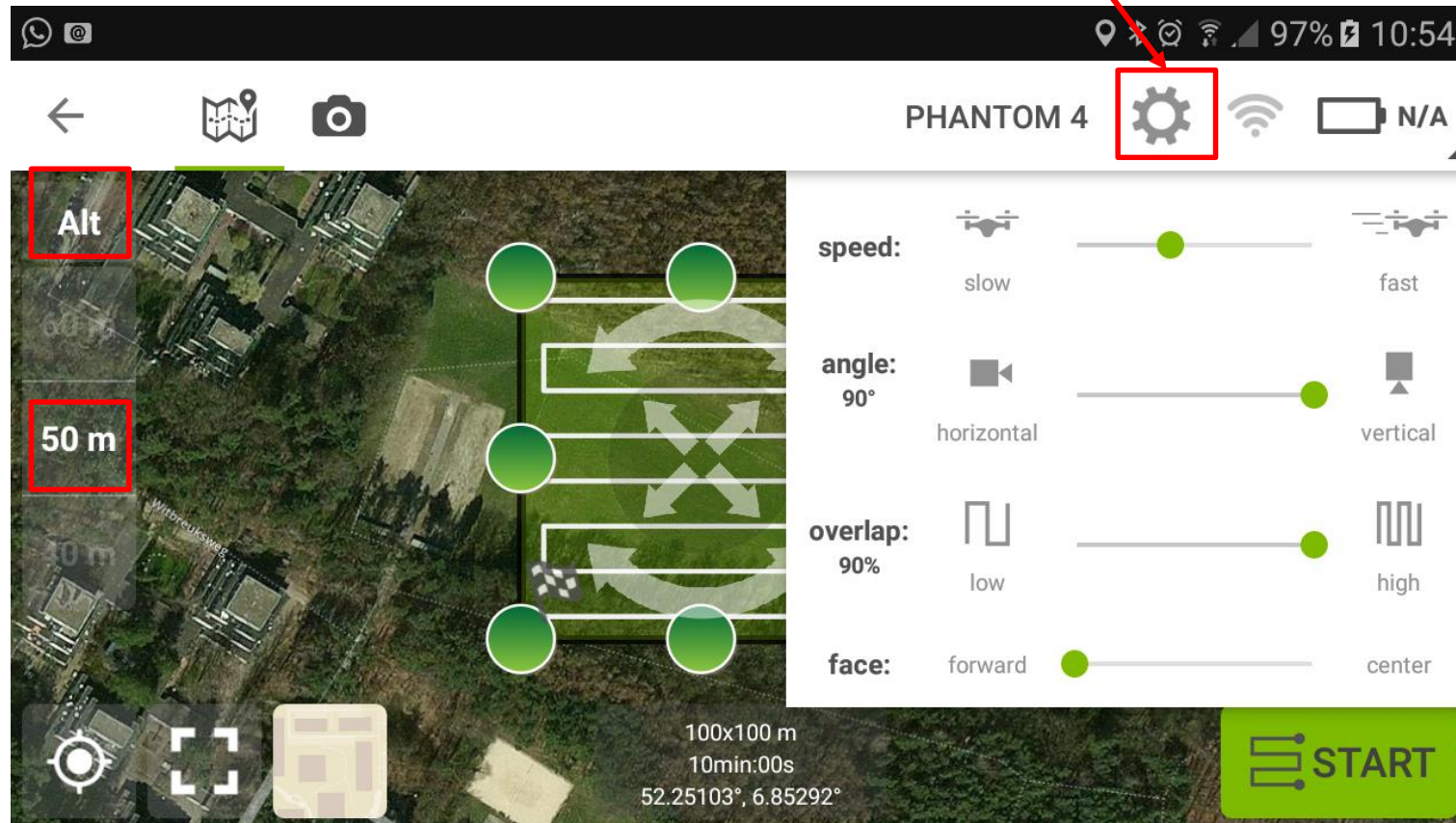
➤ You can change the location of the flight area by tapping/dragging the center.

➤ enlarge/reduce or rotate by tapping and dragging the edges.

➤ Tapping the re-center icon,  MapBox will navigate back with your current location in the center of the screen.



## Step 2. Prepare the mission

11. In the **'Home screen'**, select **'Settings'**  and set **'speed'** (somewhere in the middle), **'angle'** (vertical), **'overlap'** (maximum), **'face'** (forward) and **'Altitude'** (50m in this example).
12. Tap **'Settings'** again to return to **'Home screen'**.



# Step 2. Prepare the mission

 **Access:** In the *Home* screen, select **Grid Mission**. In the *Map* view, tap .

| OPTION           | DESCRIPTION  |
|------------------|--|
| <b>Speed</b>     | <p>Defines the drone's speed from a range between <i>Slow</i> and <i>Fast</i> (default). The maximum speed depends on the selected overlap and flight altitude. The scale has six levels corresponding to percentages of the maximum speed between 100% (<i>Fast</i>) and 50% (<i>Slow</i>). The speed should fluctuate between 2 and 8 m/s and is not constant during the flight since the drone slows down to trigger pictures.</p> <div><p> <b>Information:</b> Reducing the speed might help to avoid capturing blurry images, but the <i>Fast</i> option is reliable for an optimal reconstruction with the software.</p></div> |
| <b>Angle (°)</b> | <p>Defines the tilt (not pan) of the camera between <math>0^\circ</math>, horizontal, and <math>90^\circ</math> (default), vertical. The default value is vertical but if it was changed previously, the angle is the one of the last planned mission.</p> <div><p> <b>Information:</b> The drone rotates regardless of the camera angle. It means the drone turns by <math>180^\circ</math> between two consecutive lines, which implies the heading of the drone is not constant. Therefore, the oblique images are not orientated in the same direction if the angle is tilted.</p></div>                                     |

## Step 2. Prepare the mission

**Overlap (%)** Defines the front overlap between *70%*, *80%*, and *90%*. For more information about how to set the overlap: [202557459](#). The side overlap is computed such that the side distance between two images is twice the front distance meaning the distance between two images on the same flight line. The side overlap is adjusted with the number of lines so that it is close to the defined overlap value.

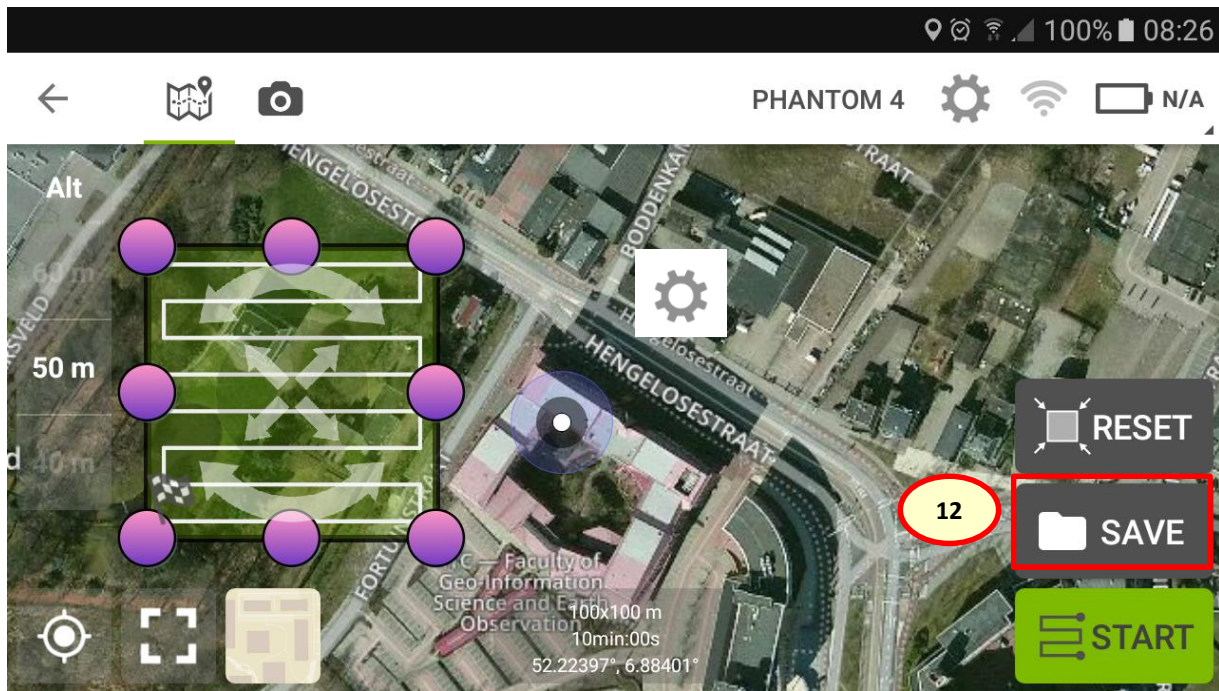


**Tip:** With the advanced mode activated, the scale is extended and more flexible (5% intervals). For more information about the advanced mode: [115001833743](#).

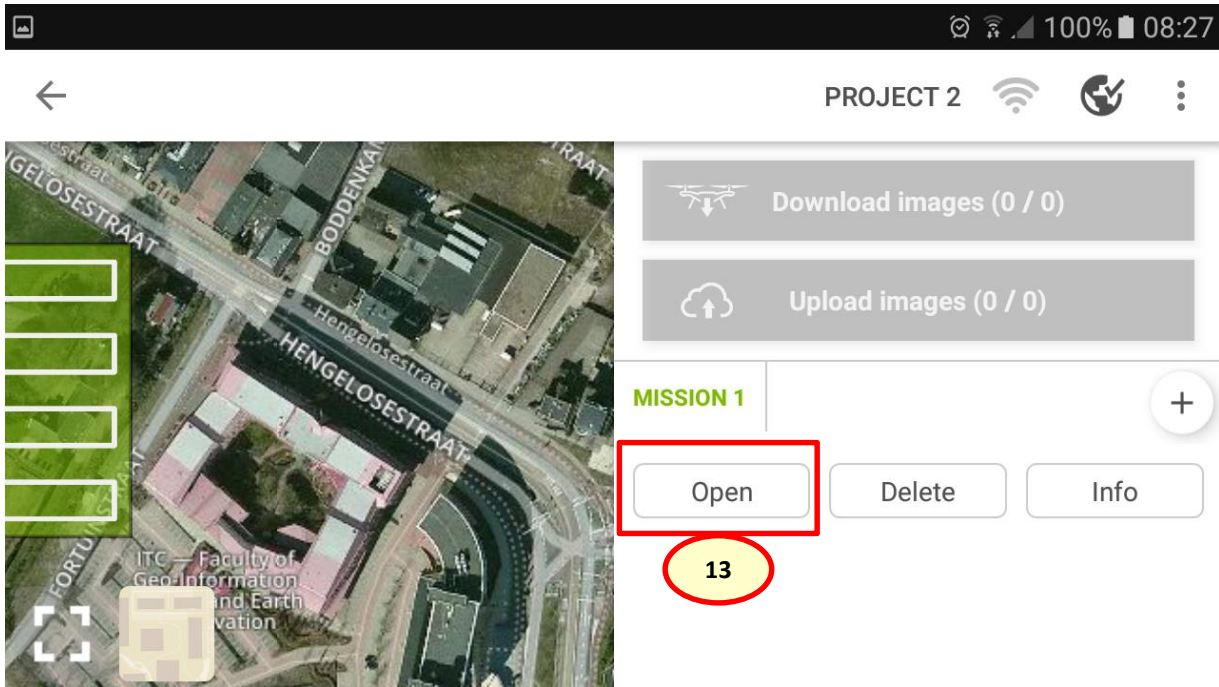
**Face** Defines whether the drone should be oriented towards the center of the mission when taking pictures, *Center*, or not, *Forward* (default). The point of interest should be the middle of the area to map.



**Important:** This option only makes a difference in terms of reconstruction if the camera is tilted. Indeed, it can for instance help to capture information from facades of objects.



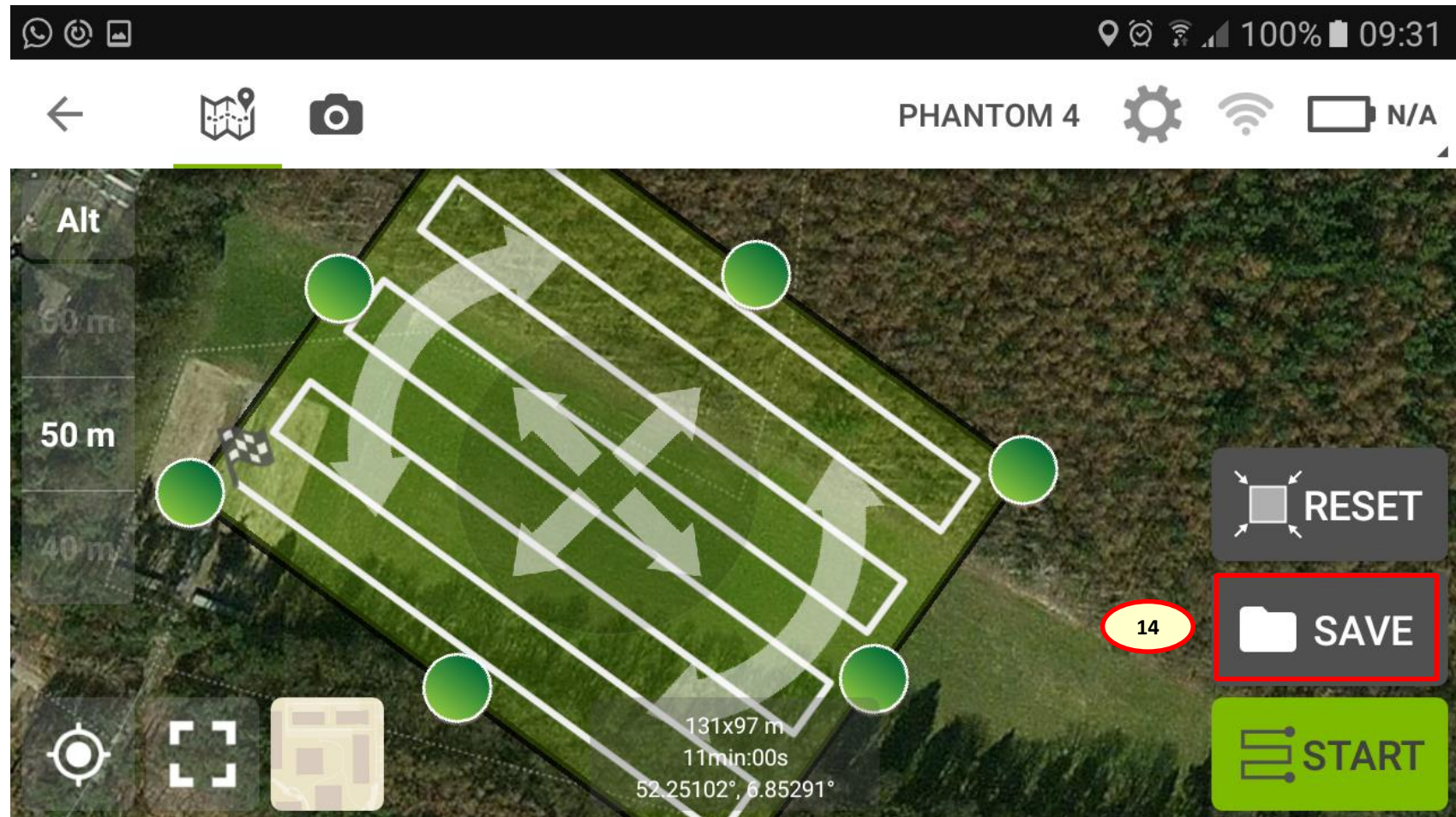
12. In **'Home screen'** tap **'SAVE'** and the lower screen will appear.
13. Tap **'Open'** to return to **'Home screen'** once more.





## Step 2. Prepare the mission

14. Drag the **'Mission Grid'** to the area of interest and tap **'Save'** again.



## Step 3. Start the mission

Happy Flying .....

