Design Document Specification
Smart Mode - Photogrammetry

Introduction:

The purpose of photogrammetry is to provide a fast, accurate, and cost-effective way of capturing data about objects and environments that would be difficult or impossible to obtain through other means.

Photogrammetry is a technique that uses photos to create 3D models of objects and environments. By taking multiple images from different angles and using software to analyze them, photogrammetry can provide accurate data for a variety of applications, such as mapping, surveying, and monitoring changes over time. It is widely used in industries such as engineering, construction, and archaeology.

We plan to offer 3 types of photogrammetry : 2D mapping, 3D mapping and Single Object.

Intended Audience And Pertinent Sections
- Sam Tse (Project Owner)
- Baizhou.Li (Developer)
- Bonnie (Support)

Our Product
- 4K High image quality drone with interchangeable lens
- 8inch and 5.5inch dual screen controller
- Cloud Platfrom for Mapping

Project Scope
- With this function it will be the highest image quality photogrammetry solution.
- We target the site surveyor who needs to collect high quality images.

Target finish time : 3 months

Design Considerations
- Pre-flight Settings: The design should consider the pre-flight settings, including the front and side overlap, altitude, rotate, speed, battery limitation, signal lost action, and finish task action.
- Saving and Recalling Missions: The design should allow for saving and recalling missions, enabling surveyors to easily repeat previous flights.
- Data Transfer: The design should include a method for transferring captured data from the drone to a computer or storage device.
- Disconnect Situations: The design should consider potential disconnect situations and include mechanisms for ensuring the drone can safely return to its starting point in the event of a lost connection.
- Aircraft Altitude Range: The design should allow for a range of aircraft altitudes, from a minimum of 10m to a maximum of 500m, with the ability to adjust within this range as needed.
- Best Camera Setting: The design should provide options for camera settings, such as aperture, shutter speed, ISO, and white balance, to ensure high-quality images are captured. Additionally, the design should consider the need for a large screen to properly plan the flight path and set the capture area.

Hypotheses:

- Surveyors may need to repeat the data capture process on a weekly basis.
- Surveyors require a large screen to properly plan the flight path and set the capture area, as this is a critical aspect of photogrammetry. Prior experience with setting up the capture may also be beneficial.
- Surveyors require high-quality images to accurately capture the details of a construction site.
- Surveyors may not have extensive experience with flying drones and may prefer a fully automatic function.
- Surveyors need a means to transfer the captured data from the construction site.

General Constraints

Networking

- The controller does not have a SIM card and requires a hotspot for data transfer. However, due to the large size of data, it could pose difficulties. Additionally, poor network signals on construction sites could also be a problem.

No Obstacle Avoidance

- Lack of obstacle avoidance can pose a potential risk of collisions with objects during fully automatic operation. Inexperienced surveyors may not be able to set the appropriate altitude, further increasing the risk.

Flight time

- Battery replacement is one of the significant challenges for surveyors, including setting battery limits and resuming the drone mission. Although the maximum flight time is around 25 minutes, the capture process may take more than 35 minutes, which increases the risk of running out of battery during the mission.

Different lens option

- Using different lenses results in different field-of-view (FOV), which affects the overlap percentage. It's essential to consider the impact of varying FOVs on the overlap percentage during data capture.

Goals and Guidelines

- The function should allow surveyors to efficiently collect and transfer all necessary data with flexibility to accommodate different types of sites. The design should also ensure accuracy in capturing every single picture.

Technical Requirements

Gimbal Angle

- The gimbal angle is crucial for obtaining the best results. For 2D mapping, it's important to have a straight-down gimbal angle. However, for 3D mapping, a gimbal angle between 15-35 degrees may be more appropriate to achieve optimal results.

Image Overlap:

- The camera must be positioned and oriented properly to ensure adequate overlap between images.
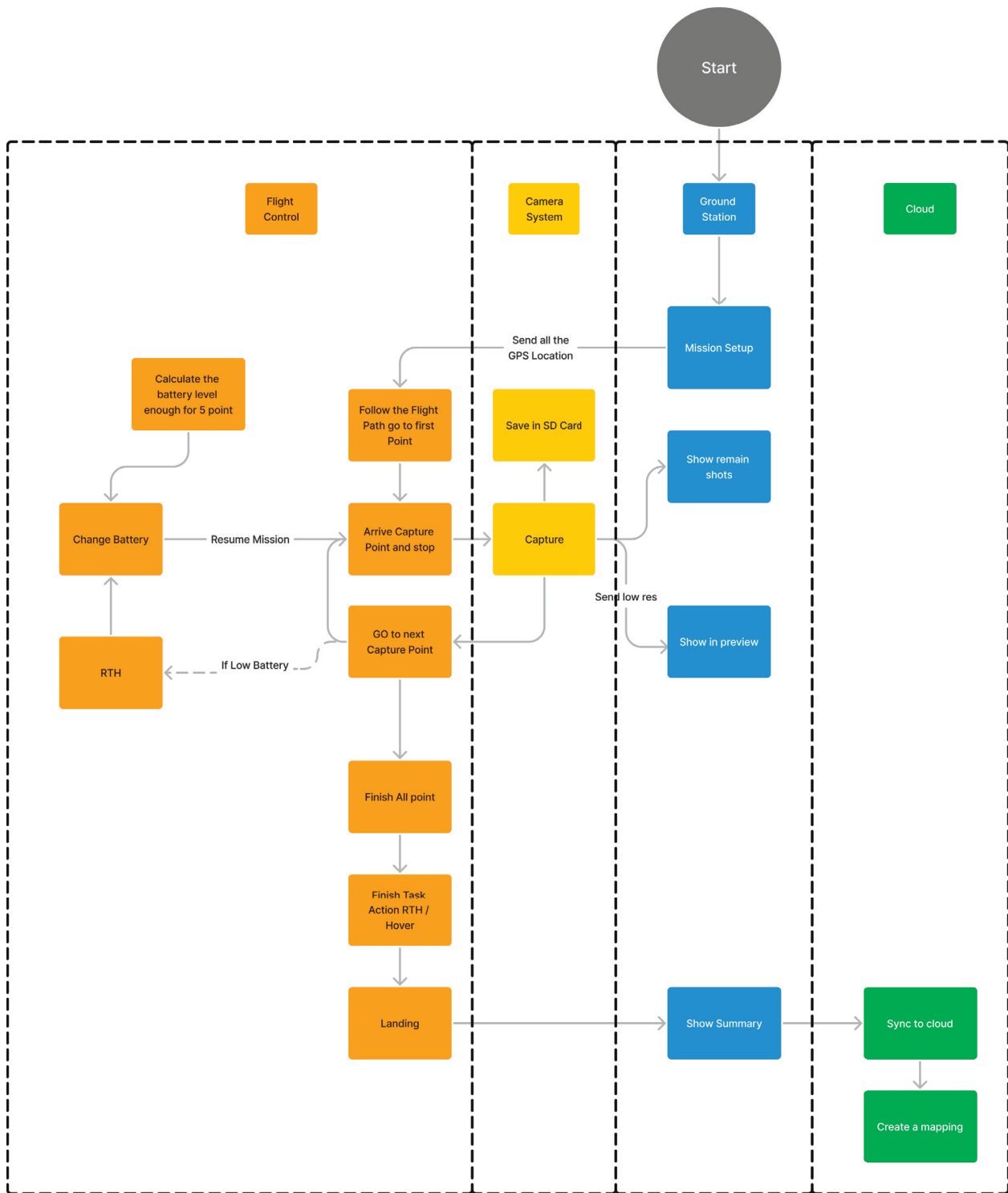
Ground Control Points (GCPs):

- The use of GCPs must be considered to improve the accuracy of the photogrammetric data.

Deployment:
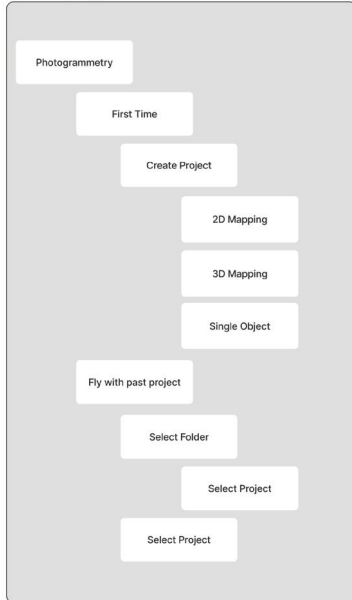
- OTA (Version number TBC)

System Architecture

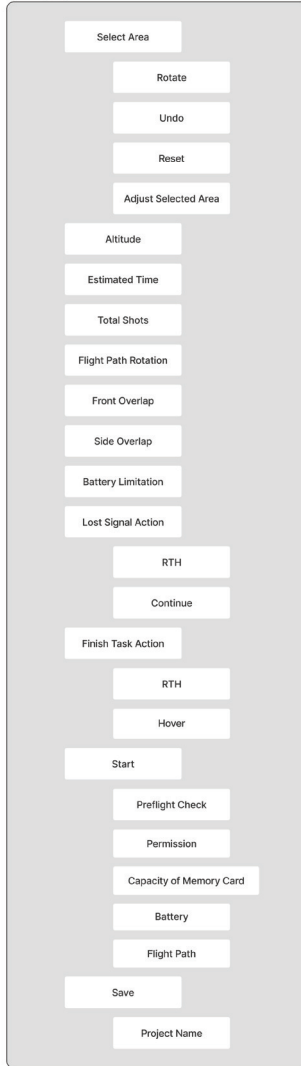# Categorize & prioritize content

- We categorize all the items into choose project, Pre flight, Flight operation and Post flight.
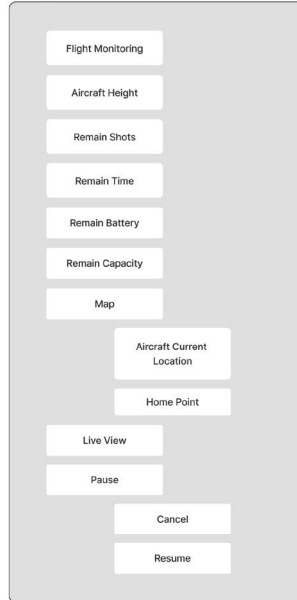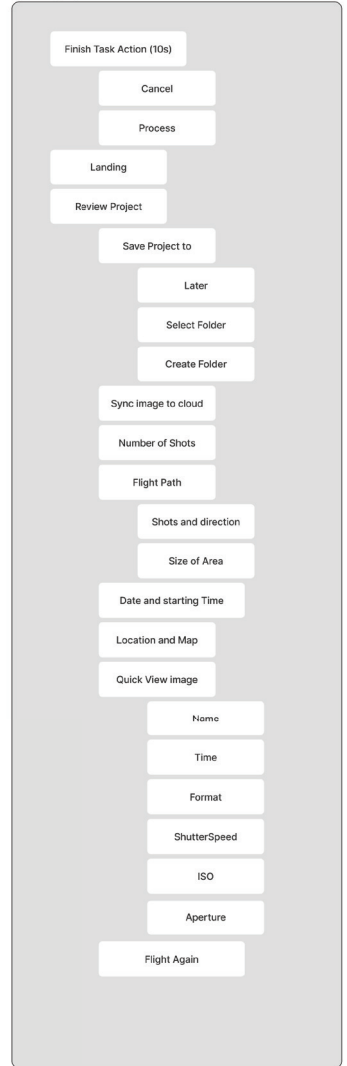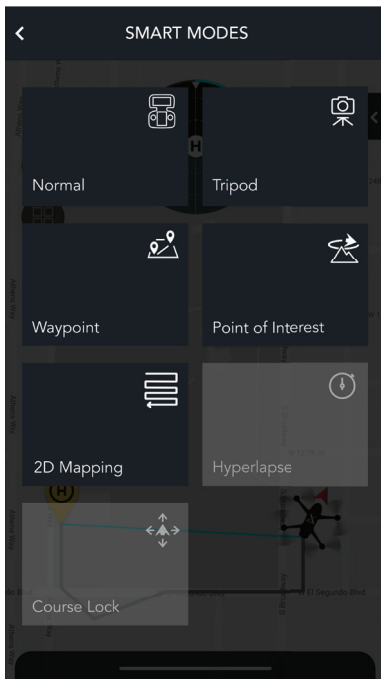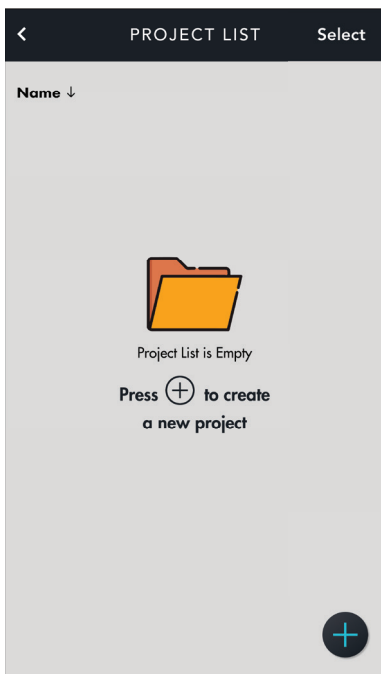
Choose Project

- Photogrammetry
- First Time
- Create Project
- 2D Mapping
- 3D Mapping
- Single Object
- Fly with past project
- Select Folder
- Select Project
- Select Project

Pre Flight

- Select Area
- Rotate
- Undo
- Reset
- Adjust Selected Area
- Altitude
- Estimated Time
- Total Shots
- Flight Path Rotation
- Front Overlap
- Side Overlap
- Battery Limitation
- Lost Signal Action
- RTH
- Continue
- Finish Task Action
- RTH
- Hover
- Start
- Preflight Check
- Permission
- Capacity of Memory Card
- Battery
- Flight Path
- Save
- Project Name

Flight

- Flight Monitoring
- Aircraft Height
- Remain Shots
- Remain Time
- Remain Battery
- Remain Capacity
- Map
- Aircraft Current Location
- Home Point
- Live View
- Pause
- Cancel
- Resume

Post Flight

- Finish Task Action (10s)
- Cancel
- Process
- Landing
- Review Project
- Save Project to
- Later
- Select Folder
- Create Folder
- Sync image to cloud
- Number of Shots
- Flight Path
- Shots and direction
- Size of Area
- Date and starting Time
- Location and Map
- Quick View image
- Name
- Time
- Format
- ShutterSpeed
- ISO
- Aperture
- Flight Again

Main Component

Smart Mode Menu (Entry Point)
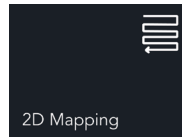
- Pass 2D Mapping to enter to 2D mapping Page

File Managment Page

- No Folder and Project screen
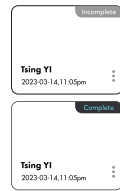
 - Create Project or Folder

 - Create Project
- Create Folder
- Cancel
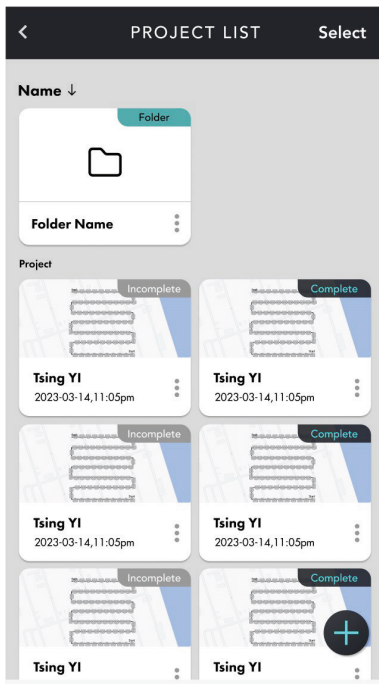
File Managment Page

Two Status of the Project

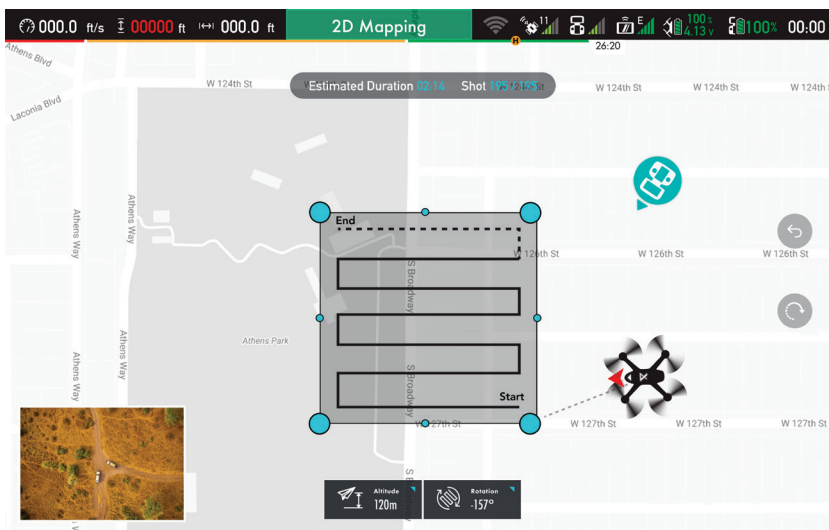Incomplete - Aircraft did not finish final capture action

Complete - Aircraft finish final capture action

—— Option Click Area

Folder Name - Default Folder Name XXX
 (Continus Number of the folder) Maximum 32words
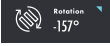

Route Planning Rules

- Default starting area is 100m x 100m.

- Default starting point is current location

- If GPS is not available, it will show up "Please wait for aircraft to detect sufficient GPS signals" toast

- Any modifications made will be saved, and returning to the app will restore the previous settings.

- The smallest allowable area is 15m x 15m, and the bounding box cannot be smaller than this size.

- The largest allowable area is 2000m x 2000m.

- The minimum altitude is 10m.

- The maximum altitude is 500m.

Route Planning Index
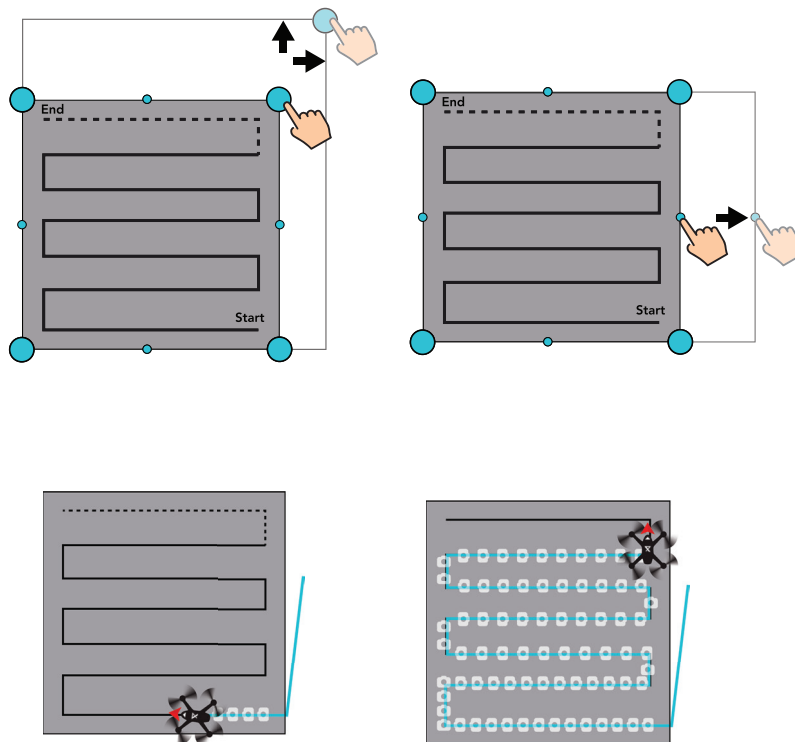
⬤ (large cyan circle)	Drag to resize muplite direction
• (small cyan circle)	Drag to resize single direction
—	Flight Path show enough battery
----	Flight Path show not enough battery
▨ (gray box)	Capture Area
Start	Starting Point (First Capture Point)
End	End Point (Final Capture Point)

|	
📷	Capture Point Location
← 📷	Orientation of Capture Point
— (cyan line)	Flight Path Passed
↺	Undo (revert up to 5 previous steps)
⟳	Reset (Back to open status)
Altitude 120m	Change the Altitude of the Aircraft
Rotation -157°	Change the angle of the Capture area
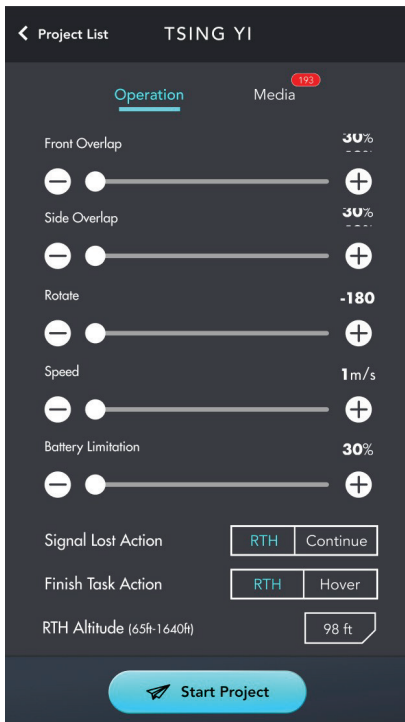
Operation Setting Page

- Front Overlap - The percentage of overlap between rows in a flight plan, ranging from 30% to 70% with a default value of 50%.
-
- Side Overlap - The percentage of overlap between adjacent flight lines in a flight plan, ranging from 30% to 70% with a default value of 50%.

- Altitude - The target altitude for a drone flight, ranging from 10m to 500m with a default value of 20m.

- Rotate - The angle between the flight path and the building face, ranging from 30% to 70% with a default value of 50%.

- Speed - The flight speed during a mission, ranging from 1m/s to 12m/s with a default value of 6m/s.

- Battery Limitation - The remaining battery percentage at which the drone will automatically return to home, ranging from 30% to 50% of the battery capacity with a default value of 40%.

- Signal Lost Action - The action to take when the drone loses signal: Continue the mission or Return-to-Home (RTH), with a default setting of RTH.

- Finish Task Action - The action to take upon completing a mission: Return-to-Home (RTH) or Hover, with a default setting of RTH.

- RTH altitude - The altitude at which the drone will return to home, ranging from 20m to 500m with a default value set to the user's current setting.
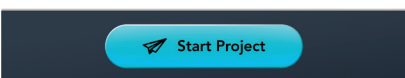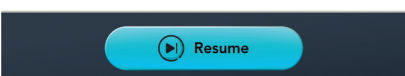
Start Project button
- Appear in the project never start before
- Ground station will send the commond to Flight Control
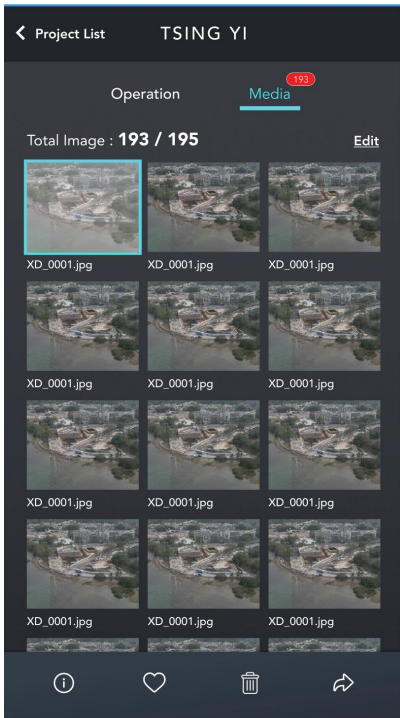- Once get the Flight control response. Then it will jump to Operation Page
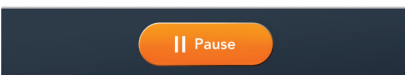
Paused button
- Only appear during the operation.
- Press pause button the aircraft will back to position mode.
- It will show the Pause dialogue

Resume button
- Only Appear in incomplete project (First point is reached before)
- Ground station will send the commond to Flight Control to finish the rest of the project
- Once get the Flight control response. Then it will jump to Operation Page

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TSING YI

Project List

Operation   Media   193

Front Overlap   30%

Side Overlap   30%

Rotate   -180

Speed   1m/s

Battery Limitation   30%

Signal Lost Action   RTH | Continue

Finish Task Action   RTH | Hover

RTH Altitude (65ft-1640ft)   98 ft

Start Project

Start Project

Pause

Resume

Media Page

 Right Top corner is showing Number of Media

 Number of image already take / Number of image will take in the mission

 Selected Image

ⓘ Image Detail

♡ Favorites

🗑 Delete jump to Delete Dialogue

↪ Share

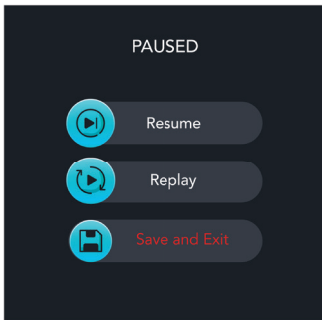## Image Detail Page

- File Name
- Date and Time
- Format
- Camera Parameter
- Shutter Speed
- Aperture
- ISO
- Location : gps coordinates
- Lens

Quick swipe image function

- Tap to select the image
- Swipe left or right to see more image

Dialogue System

Paused Dialogue

- Press pause button aircraft change to position mode immediately and pop up Paused Dialogue

PAUSED

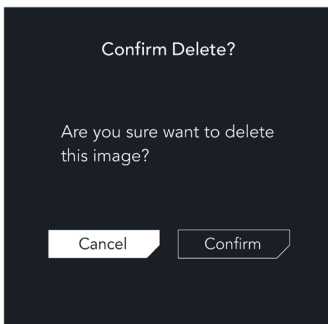Resume

Replay

Save and Exit

- Resume - Aircraft will continue the Mission

- By selecting this option, the project will be reset, and the aircraft will return to the first point to start the mission again. All captured images will be retained and not overwritten.
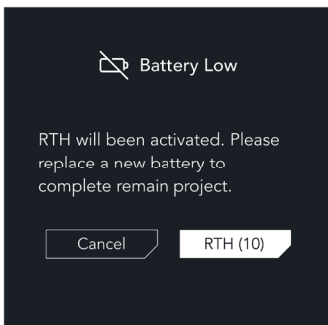
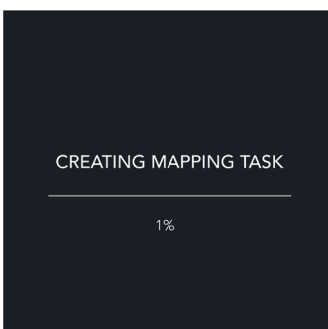- It will save and current status and jump to File Managment Page

Confirm Delete?

Are you sure want to delete this image?

Cancel   Confirm

Confirm Delete Dialogue

- Press delete button pop up Delete Dialogue

Battery Low

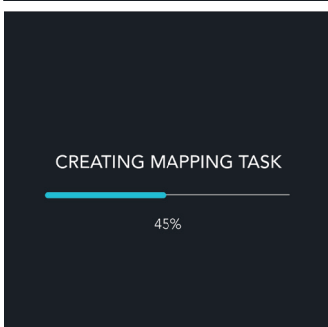RTH will been activated. Please replace a new battery to complete remain project.

Cancel   RTH (10)

Battery Low Dialogue

- When the battery low hit the RTH requirment. It will pop up Battery Low Dialogue.

CREATING MAPPING TASK

1%

Creating Mapping Task Dialogue

- When press the Start Project button. it will pop up Creating Mapping Task Dialogue.

CREATING MAPPING TASK

45%

WebPlatform

Icon	Label
📷	Capture Point Location
⌄	Minimize
📁	Project Library
⚙	Setting
Project Name ▾	Sort by Name / Sort by Date
New	New Project
‹ › Tsing Yi	Previous / Next Poject
▦ ☰	Show item as a icon / in a list
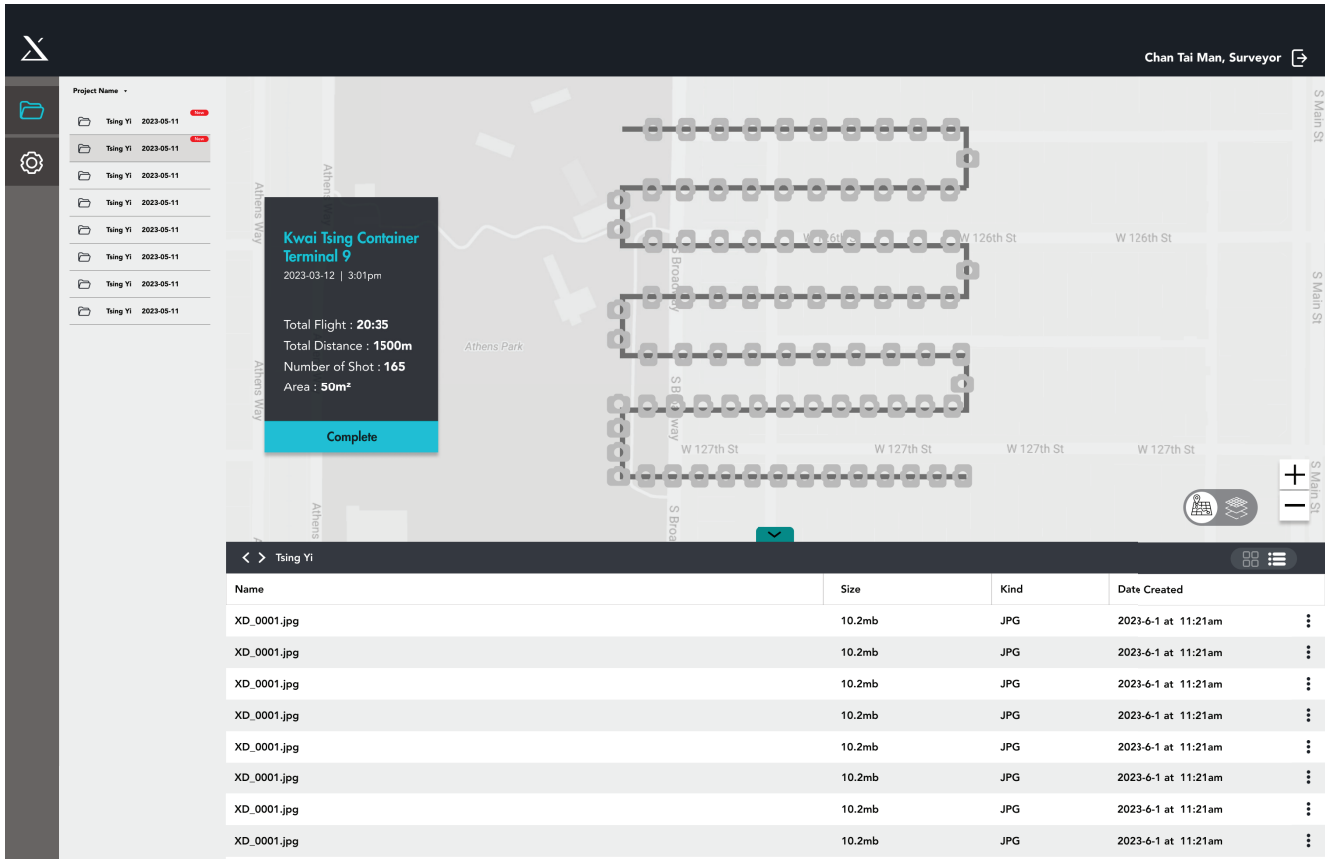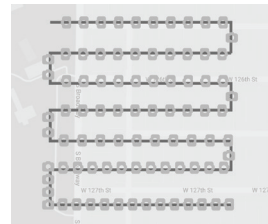
Chan Tai Man, Surveyor →   User Name / Level / Signout

Show Flight path / Show Mapping