Contents

1 Specifications of UAS

Weight without battery and payload	10.960 kg
Max take-off Weight	28.2 kg
Classification of UAS	Medium
Category of UAS	Rotorcraft
Subcategory	RPAS
Max Operating Speed	10 meters per second
Max Attainable altitude	30m
Diagonal length - Folded	800±4 mm
Diagonal length - Ready to launch	2033±8 mm.
Max Ascend speed	2.5 meters / second
Max Descend Speed	1.5 meters /second
Max Endurance (full payload)	: **12:39 mins**
Endurance without payload (empty tank)	: **23: 32 mins**
Dispensing payload	: **15:16 mins**
Payloads Supported	Configuration 1: Spraying payload to spray relevant chemical mixtures on crops for crop protection.

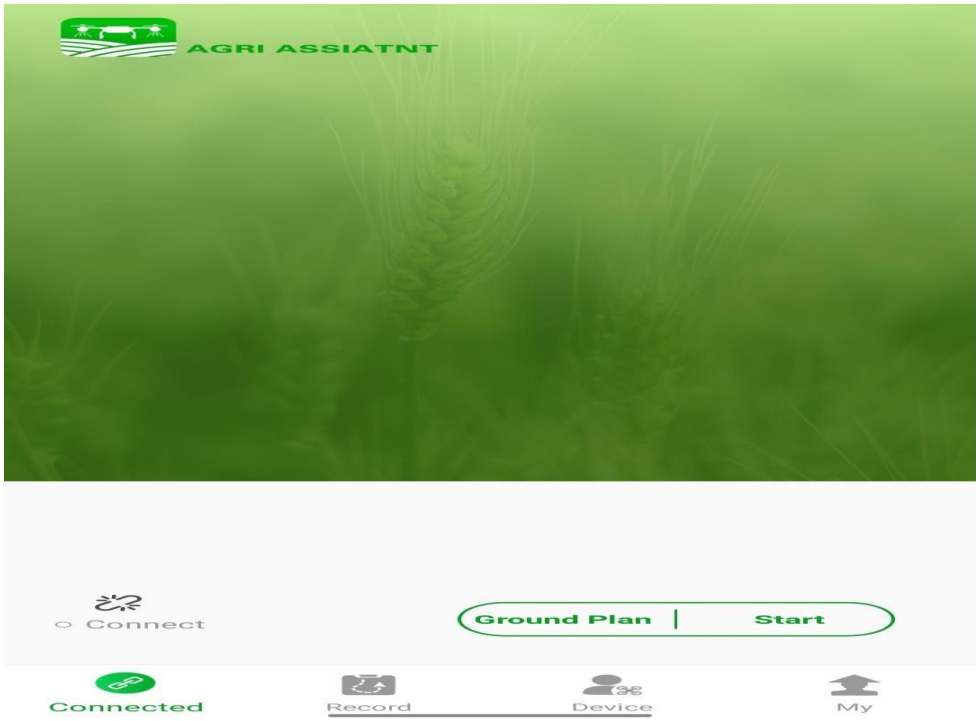
1.1 Components in the UAS

1- Propeller	6- Pipe House	11- Canopy	16- Arm Holder
2- Prop adaptor	7- Motor	12- GPS	17- Obstacle Avoidance Sensor
3- CF Tube	8- Nozzle Bar	13- Pipe Connectors	18- Vertical Landing Gears
4- Battery	9- Nozzle Tips	14- Arm Joint Clamp	19- Tank Cap
5- Pump Motor	10- Landing Gear	15- Aluminum Arm	20- Pesticide Tank

The above figure shows the brief of Drone Components

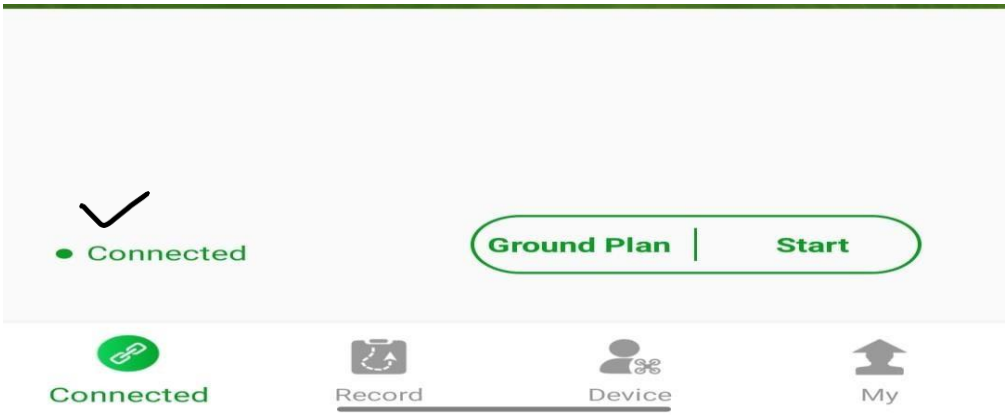
2 Connecting to AGRI ASSISTANT

- Install AGRI Assistant apk given by drones with login id and key provided.

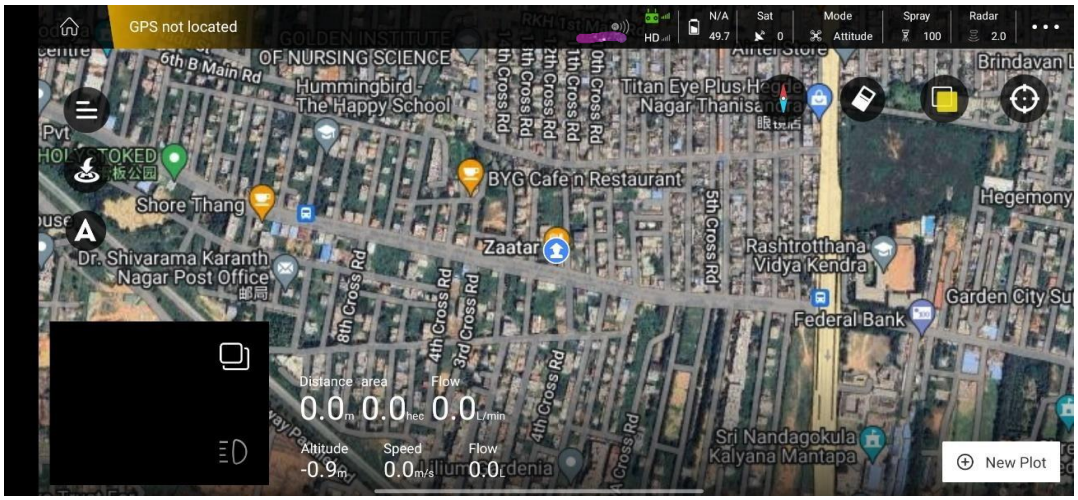


- Turn ON Bluetooth in Mobile and scan for T12 Transmitter and click on connect as shown below

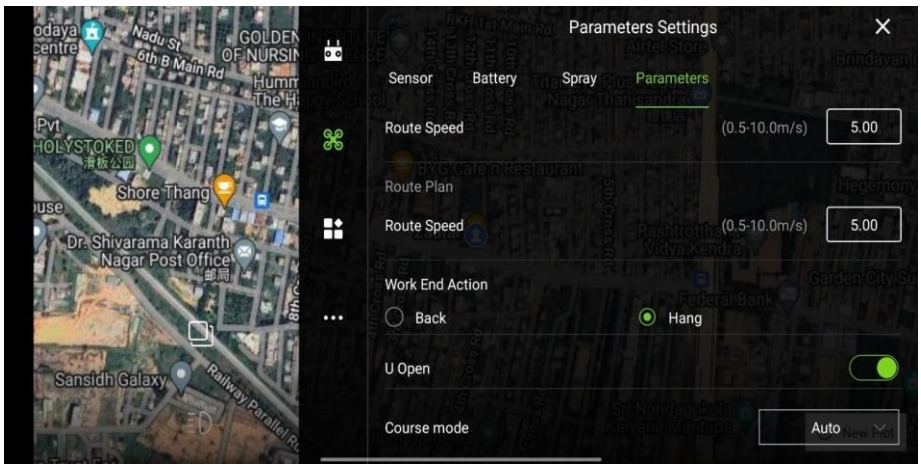
- Connection should be established once completely parameters are being loaded by the GCS.

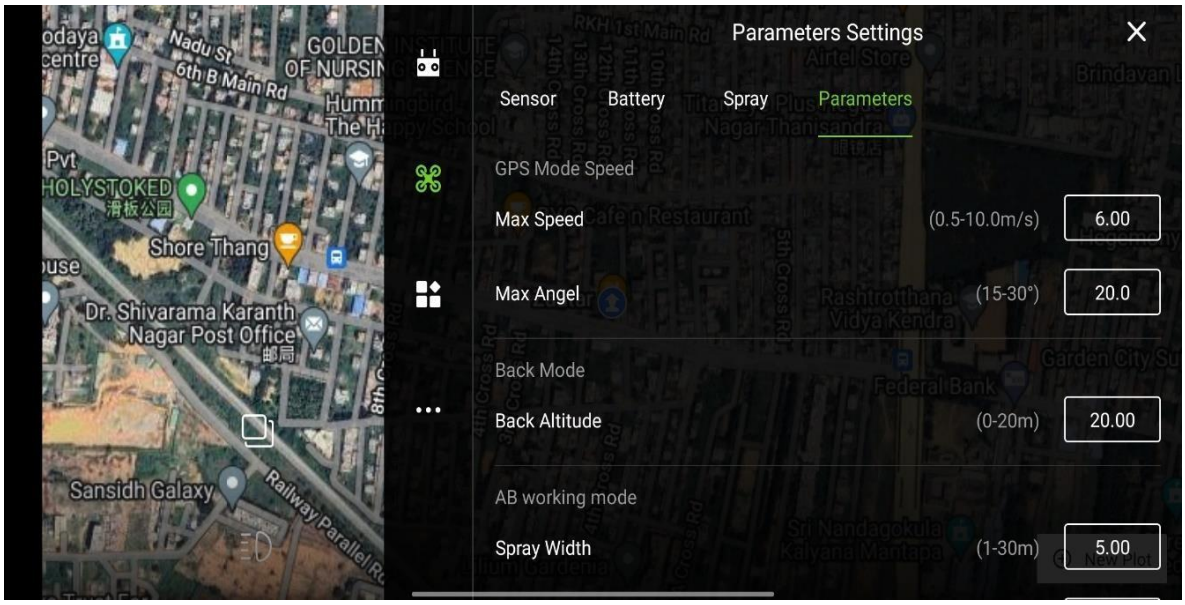


- Check the interface it should be as below, showing green color connected at top.



- Click on the three dot ICON on the upper right corner and Check for the flight parameters (Voltage, , Mode etc) and ensure sensor readings are updated.

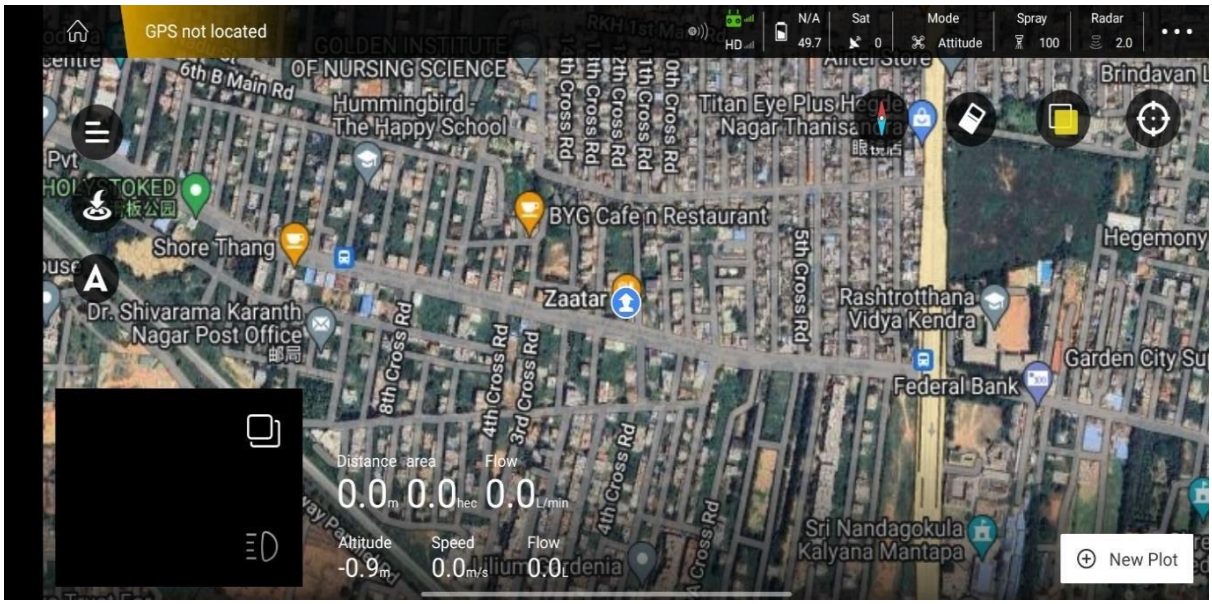




- Thus, drone is successfully connected to AGRI ASSISTANT software.
- Once the drone is successfully connected, follow the flight operation checklist 2.1.1 from Point 6, the minimum satellite count should be 11.

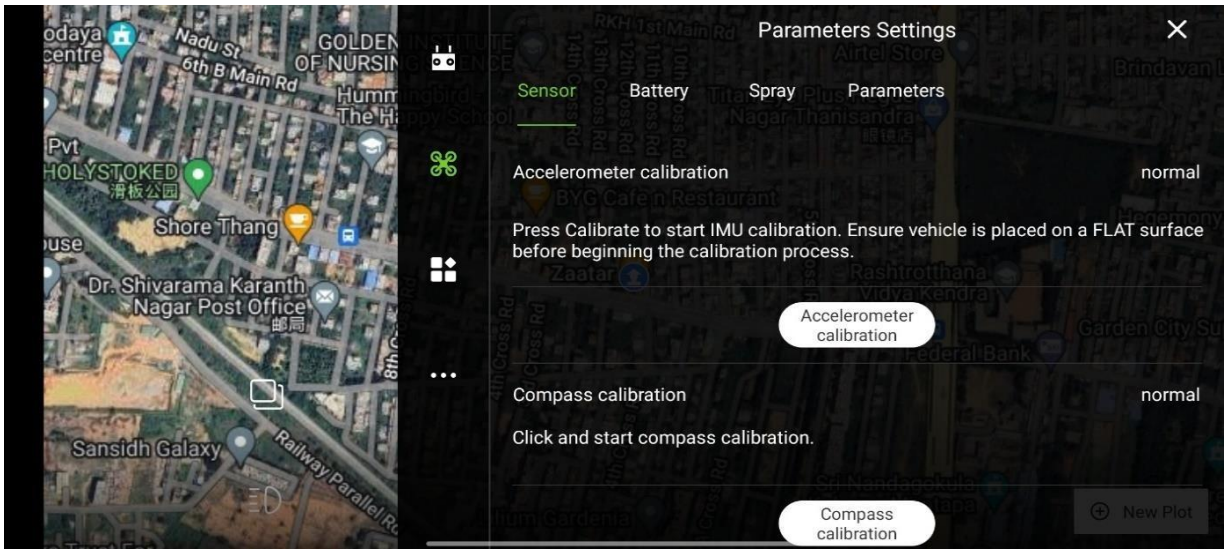
3 Planning a mission/project

- Once the GCS and drone are successfully connected, the following steps are to be performed to plan a successful mission.

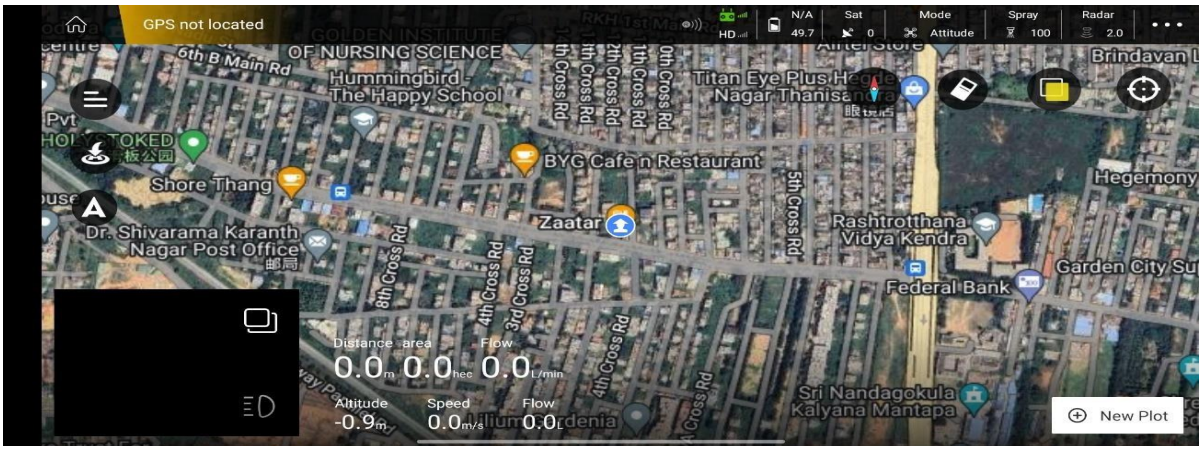


- For creating a new project click on the ‘Ground Plan’ present on the dashboard. This tab allows us to create a new project with project details such as Project name, client name, and Plan name as shown below.

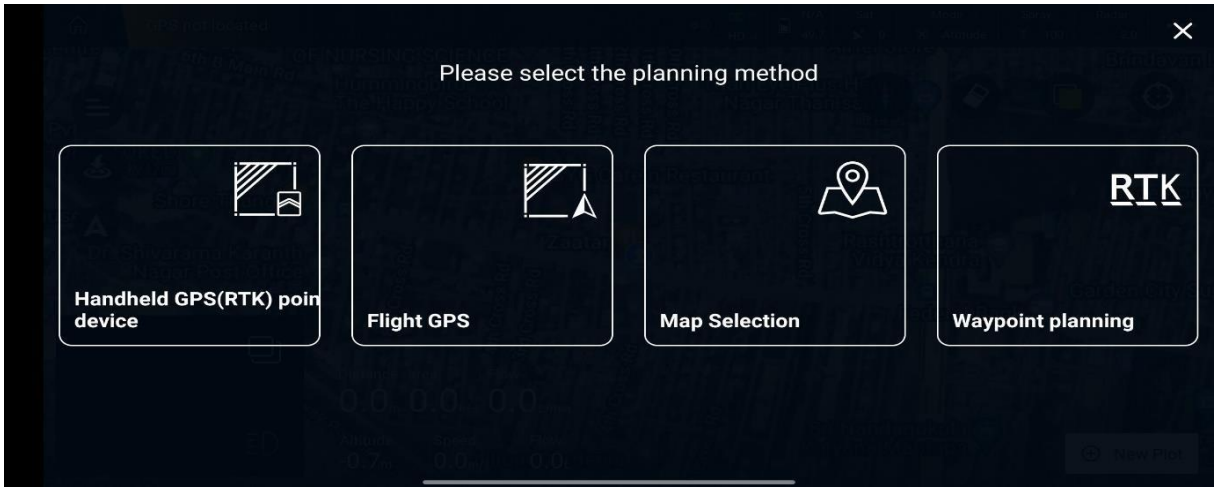
- Do compass calibration in x and z axis (nose up pos) of the drone and check for the flowmeter pressure in spray dashboard.



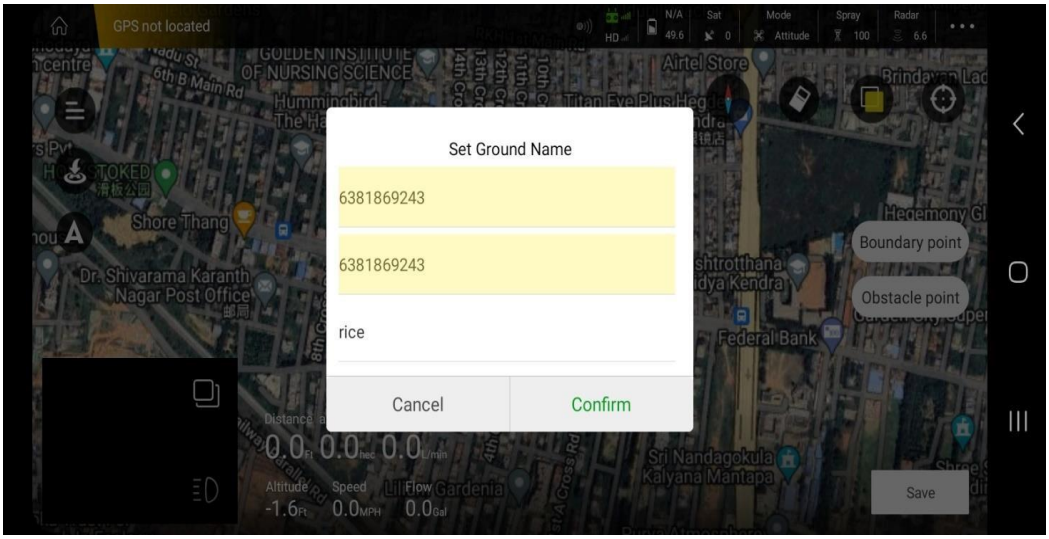
- Click on the New Plot button to plan a new mission



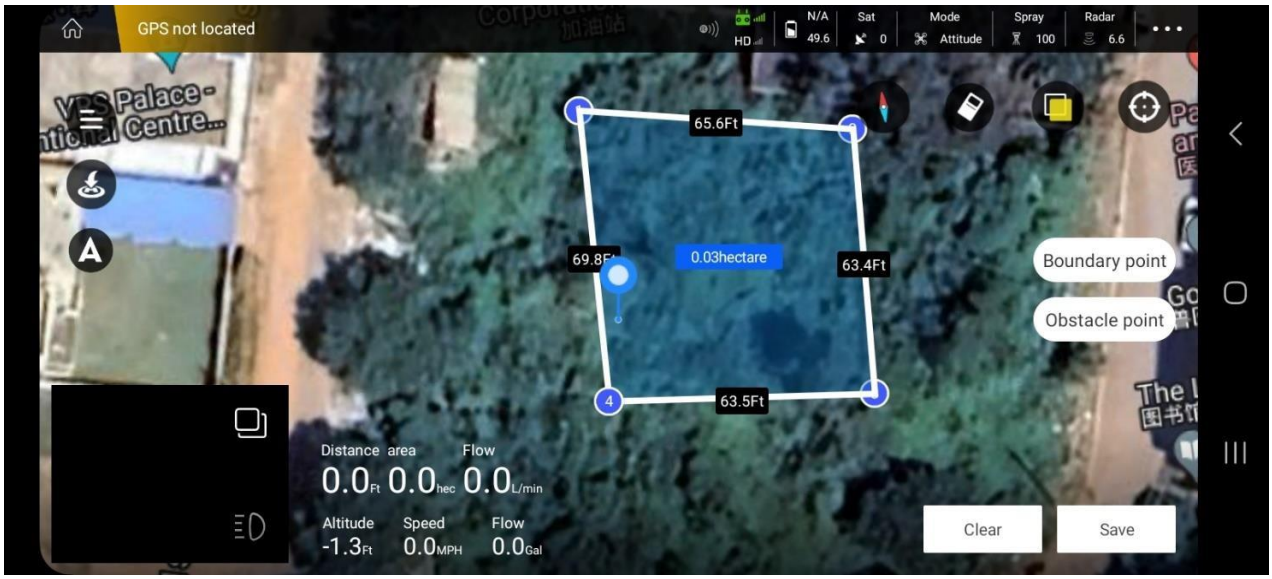
- Select the ‘Map Selection’ tab on the dashboard to perform the planning method.



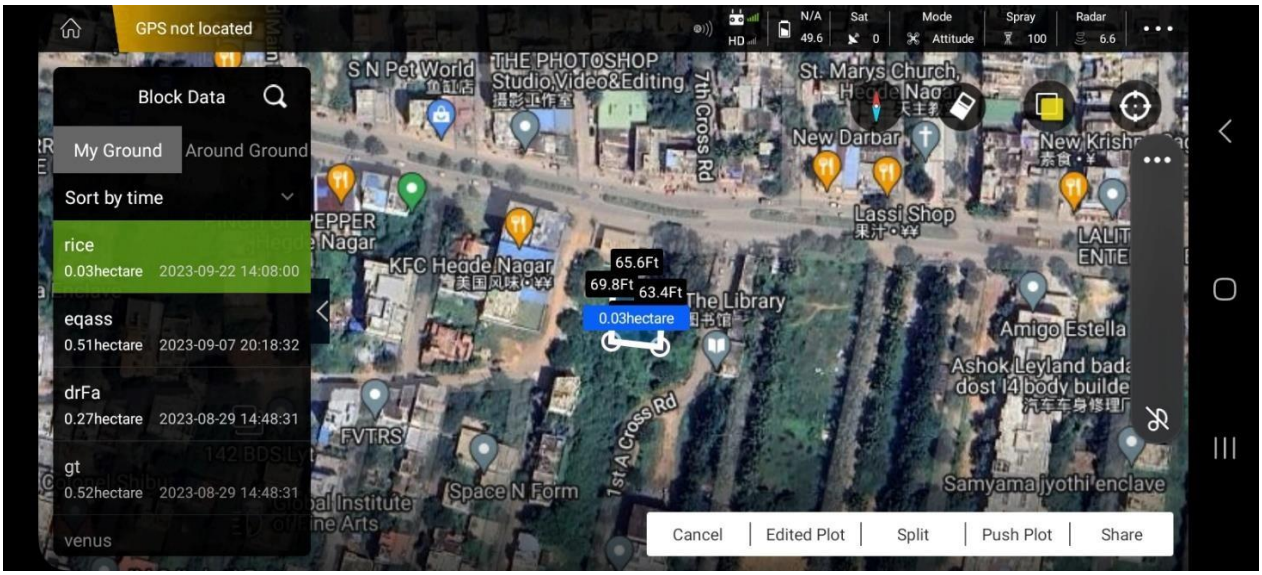
- After selecting the map, enter the details of ground name and the mobile no. in the tab as shown below and click confirm.



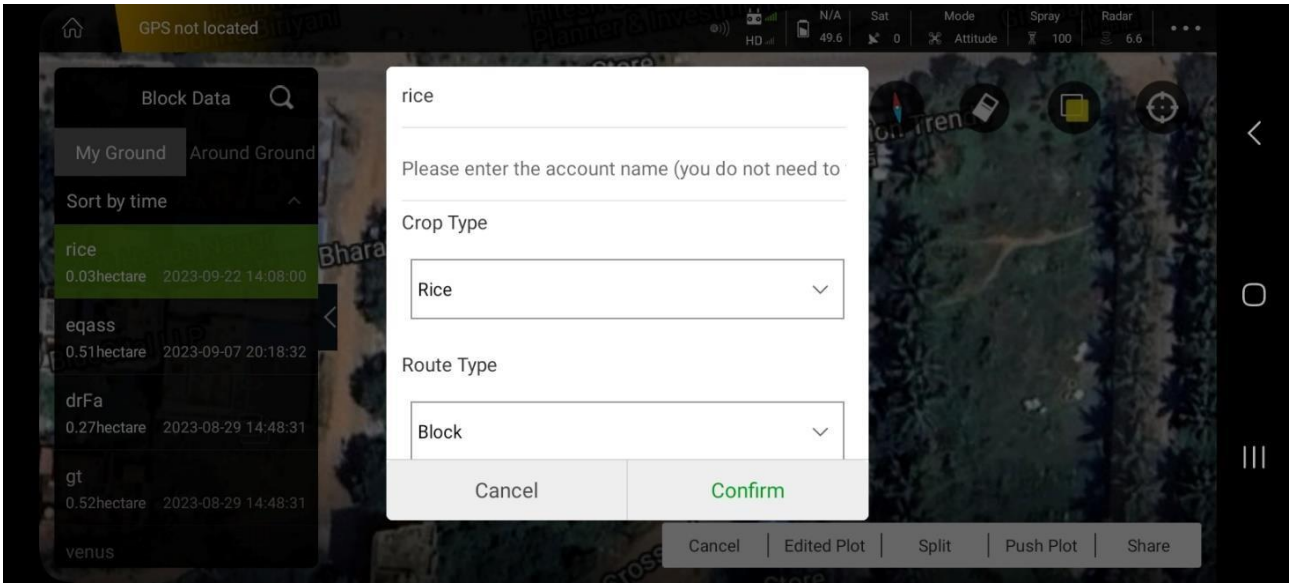
- Click on the ‘Boundary Point’ to create a mission plan as shown in below image and plot obstacle point if needed and save the mission.



- Then, click on the ‘Three Line icon’ down to the home icon to check whether the mission is saved or not. If the mission plan is saved it would be sorted in the My Ground column as per the time the plan was created



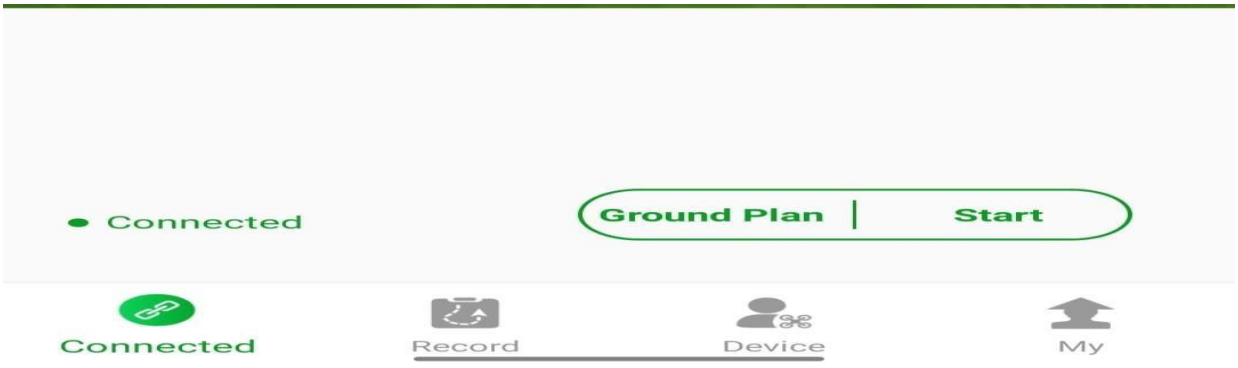
- Now select the corresponding mission that has to be perform and enter the details inquired in the below image.



- Press Confirm to ensure that the task is published in the task data.

- After the task is published, it is supposed to exit from the ground plan dashboard.

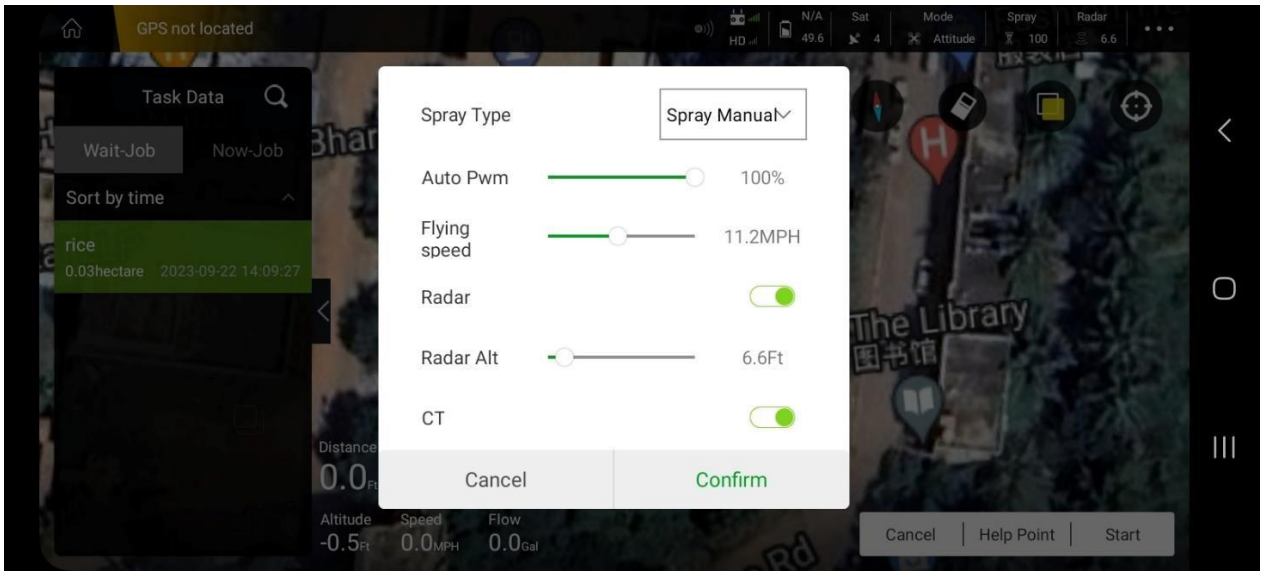
- Now press the' Strat' button to enter the mapping dashboard.



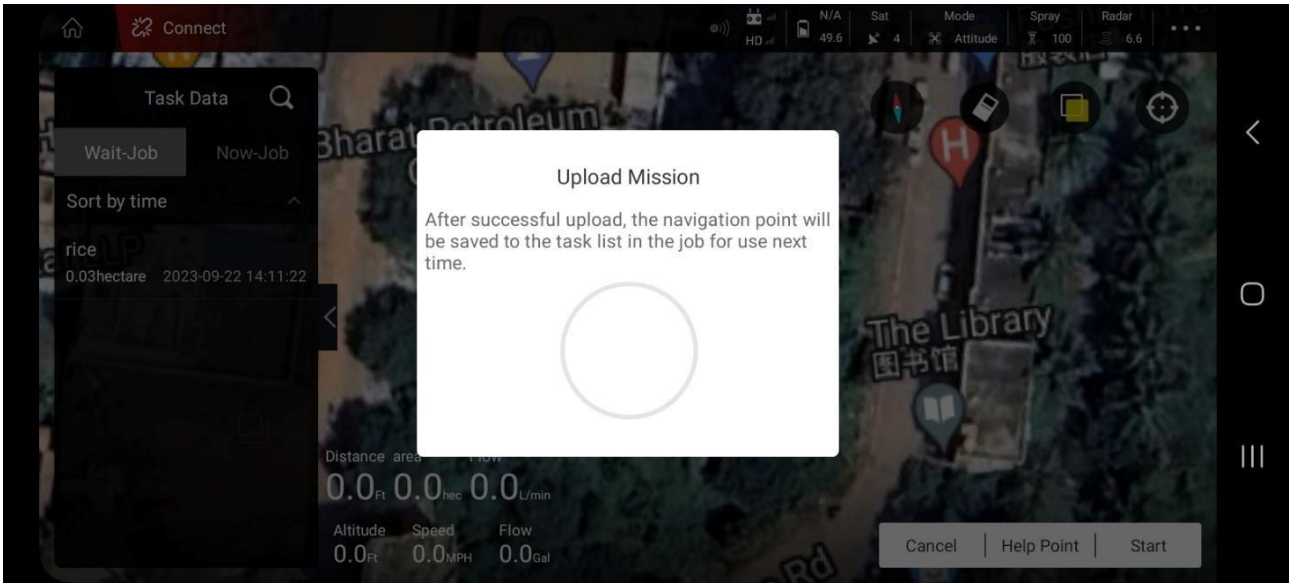
After entering, click on the 'Task Data' icon down to home button and select your wait job to be done.

- Adjust the route and grid spacing for safe, efficient and effective mission. (if needed)

- Press the start button to ensure the flying speed and altitude of the mission as shown below.



- Once the parameters are adjusted and verified, click confirm to upload the mission.



- After the mission got uploaded, the flight is set to begin.

3.1 Overview of Agri Assistant GCS

- **Take-off**

Once clicked on Take-Off, the ARM and take off commands are sent to RPA. RPA will do the basic pre-flight check and do the take off if everything is proper.

- **Land**

The land button enables you to make the RPA land. Once it is clicked, the RPA will stop by slowing down the flying and start coming back to the point given to land. This button will be enabled only if a flight has already taken off. If the take-off command is not given then this button will remain in disabled mode.

- **RTL**

Return to Land (RTL) is used for an emergency landing at home. The device will find the shortest distance to land at home. If the rally points are added to the plan, then the device will check the minimum distance between either the home or rally point for landing. The device will select a minimum distance for a safe landing.

- **Pause**

The pause command will give pause instructions to the RPA. Under this condition, the RPA will pause at the point it is flying. It will go into 'hovering' mode at the given location. Once pause is active then the RPA will enable resume action.

- **Resume**

The resume command will give operation resume instructions to the RPA. Under this condition, the RPA will resume the flight from the point where it was paused.

- **Live Details**

Few numbers of parameters of the performance of RPA has shown on the Fly view screen. The important one is the heading position of the RPA. Using the magnetometer, the AGRI Assistant GCS will show the live heading position of the heading of RPA. Similarly, the AGRI Assistant GCS will show the value of the battery available. Based on the status of the remaining power of the battery, the Agri Assistant GCS will showcase the usage and remaining power in the battery.

4 Transmitter Usage

Unfold the Antennas

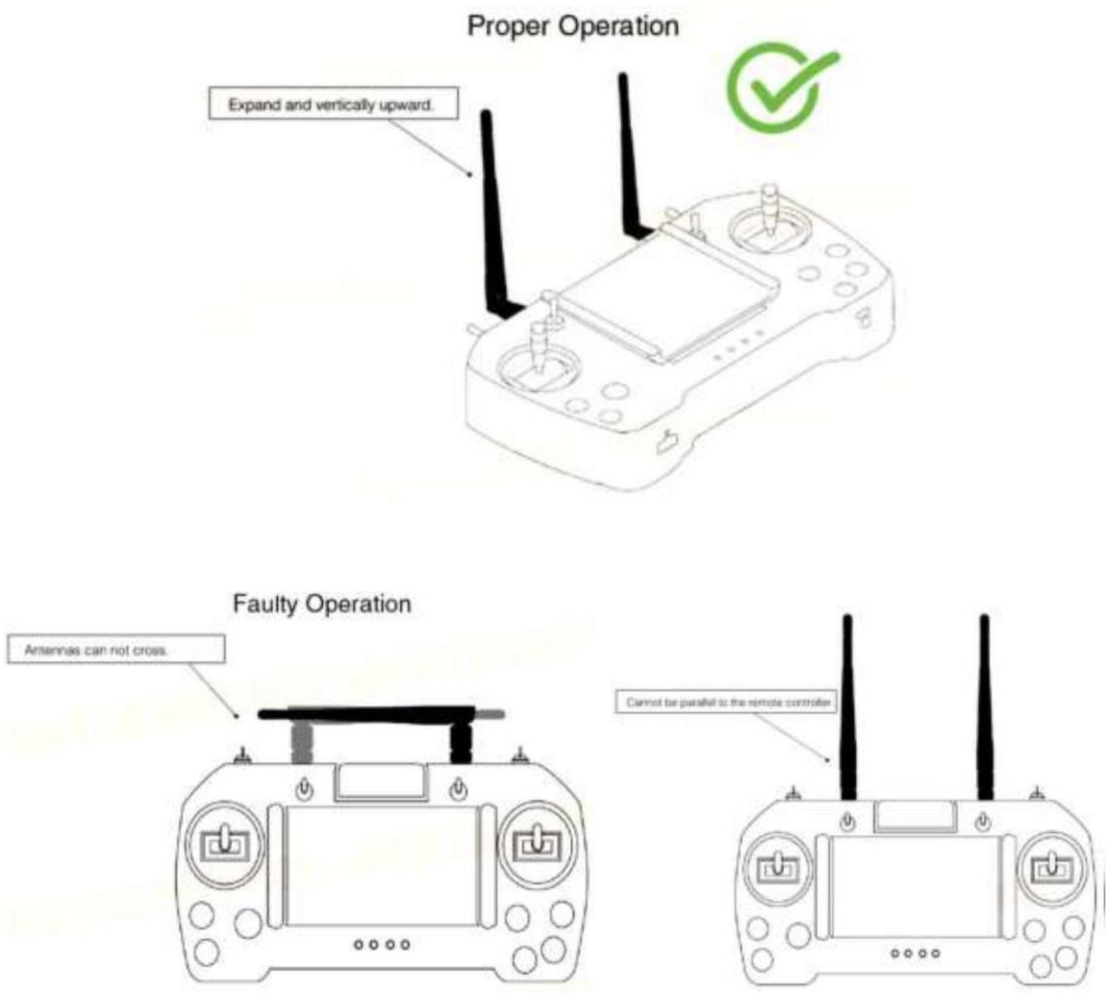


Fig: Positioning Of Antennas

4.1 Control Switches in Transmitter

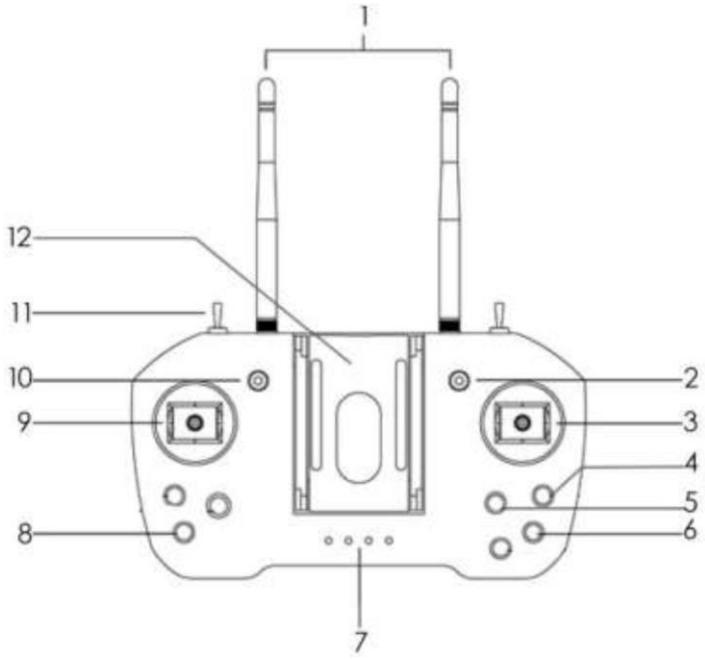


Fig: Transmitter Switches

1. Antennas
2. Auto Mode (Up or Neutral- OFF and Down- ON)
3. Joystick to control drone Forward, Backward, Left and Right
4. To Control Configuration 2 or Configuration 3 ON and OFF. (Single Press ON and OFF)
5. To Control configuration 1 Payload ON and OFF (Single Press ON and OFF)
6. Strobe Lights ON and OFF. (Single Press ON and OFF)
7. Charging indicator LED's
8. Power ON and OFF (single press and long press)
9. Joystick to control drone Up, Down, rotate left and Rotate Right
10. Flight mode switch (Up- Loiter Mode, Neutral- Position Hold, Down- Altitude Mode)
11. RTL Mode (Left or Neutral - OFF and Right - ON)

For Arming: Move 9 Stick down and then to Right for 5sec (To ON Drone) For Disarming: Move 9 Stick Down and then to Left for 5sec (To OFF Drone)

4.2 Operation of Joystick

4.2.1 Power On:

1. Switching ON the transmitter.
2. Long Press the 'Power button' (marked in to switch on the transmitter

Switch ON

4.2.2 Arming:

Arming will start the drone, and the motor will start in ideal condition.

- Hold the Throttle, YAW, Pitch, and ROLL inwards the down joystick.

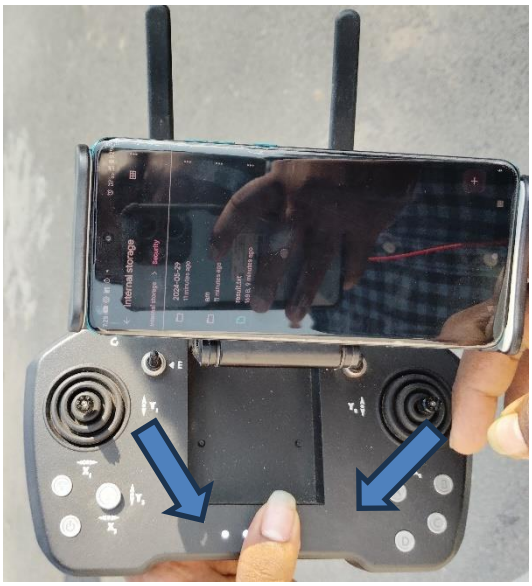


Figure 1 Arming

4.2.3 Disarming:

Disarming the vehicle stops the motors (making the vehicle safe).

Hold the throttle YAW, Pitch, and ROLL outwards the down joystick.

Figure 2 Disarming

5 General explanation of RPA operation/ Normal operating procedures

5.1 Operations

The drone operations are dependent on type of payload been used. The step -by- step procedure for flying the drone as follows:

5.1.1 For flying drone

- Place the drone on level surface and unfold the arms and clamp the folding joint firmly
- Remove prop guards and unfold the prop leaves straightly and ensure minimum play between the prop mount and prop leaves (it must not be too tight or too loose).
- Check motor angles and all screws are there and are tight enough.
- Place the batteries on battery plate / battery box provided and clamp firmly with Velcro.
- Switch on transmitter and then connect the batteries to the drone.
- Check all Drone parameter (Signal strength, GPS, no compass errors, Motor rotations and other if any) and calibrate the drone if encountered any issue before filling the liquid.
- Follow all the preflight checklist diligently.
- Follow the application specific instructions mentioned below.
- Plot the field with transmitter and map the boundary points and obstacle areas if any, if done by drone ensure there is no liquid before mapping.
- Give the required amount of swath width and indentation for grid lines obtained and reorient them for minimum and effective flight path. Also Set the correct amount of spray speed (based on discharge rate), spray height and drone speed in GCS.
- Save the flight plan and write it to the drone, and then take off manually and switch to Auto mode then drone must continue spraying along the path as excepted. (Live path feed is to be observed in GCS).
- After completion take the manual control of the drone and land it on obstacle free field.
- Check the battery voltage, if too low change it with new set and repeat the process for another new field to be sprayed.
- If not disconnect the battery and remove it from battery plate and switch off the transmitter.
- Clean the drone with soft wet cloth to remove dust or chemical over prop leaves,

canopy, arms and frame.

- Remove Arm joint Clamps and fold the arms and props, gently place prop guards and pack the drone.

  Ensure to pour clean liquid chemicals without any foreign particles (dust or any small stones) if the chemical is powder based, mix it properly according to prescribed concentration in another container.
- Pour the processed liquid (pre filtered and calculated amount <10 liters) into the drone tank through the strainer and after completion remove any foreign particles stuck over the strainer and close the chemical tank lid firmly.
- Once switched on the pump and check the spray direction and mist formation of each nozzle, if found improper, clean the nozzle filters and nozzles with clean water and brush (never ever insert pins into the nozzle holes). Check the rubber watchers in the nozzle cap and tighten the nozzle cap to nozzle bar and also tighten the side clamp on the nozzle bar to prevent leakage while spraying.
- If liquid is not even dispensing, try to remove air bubbles by simply disconnecting any one of the 6 mm to 6 mm straight pipe connector and switch on the pump and ensure liquid coming out of the disconnected tube. And after reconnecting the tube firmly (while removing and reconnecting the pipe ensure to press the connector first).
- After completion of work, clean the tank and pipes with fresh water by switching on the pump to remove the chemical compounds left over the surface which may be reactive when sprayed with other types of chemicals. Recommended operating height for this configuration is 3-10 meters.
- Set RTL height to 10m and RTL speed to 15 m/s
- Check wind speed before operations and start the mission only if wind speed is below 5 meters.
- Check atmospheric temperature before operations and start the mission only if temperature is below 55 degrees Celsius.
- Pour Dry or partially wet seeds into the hopper and check whether roller is rotating and dispensing the seeds as expected.
- Set grain type and quantity per acre (4-6Kg) for drone to choose drone speed and other parameters.
- After completion of work check for blockage in pipes and clean and remove mud if accommodated inside the tubes.
- Recommended operating height for this configuration is 1-2 meters.
- Set RTL height to 10m and RTL speed to 10 m/s.

- Check wind speed before operations and start the mission only if wind speed is below 3 meters
- Check atmospheric temperature before operations and start the mission only if temperature is below 40 degrees Celsius.
- Load the seed balls into the hopper of proper and even size to ensure weight must not be above 5kg.
- Check the rollers for any seed blockage and clear if any.
- Hover the drone over a height of 20-30 meters and start dropping the seeds manually
- If planned a mission, ensure seed ball falling continues over the path the drone travels.
- After completion of mission land, the drone gently and tighten the payload components (which may loosen during operations)
- Collect the data regarding the coordinates (geo tags) where seed balls have been dropped for future reference.
- Recommended operating height for this configuration is 20 - 30 meters.
- Set RTL height to 30 m and RTL speed to 10 m/s
- Check wind speed before operations and start the mission only if wind speed is below 5 meters.
- Check atmospheric temperature before operations and start the mission only if temperature is below 50 degrees Celsius.

5.2 Flight Logging

Flight logs are stored in the flash memory of the flight controller automatically and flight data starts recording once the system is powered on and armed the drone. A .bin file is created in the name of date and time (time at which battery is connected) and stores the data up to when the battery is disconnected.

One can collect the data by connecting the flight controller to pc by data cable, then download and analyze the previously performed flights.

Once storage reaches to max limit old data is automatically deleted and paves the way for free up the space of the flash memory of the flight control.

5.3 SOP for changing flight parameters

- Use Agri Assistant GCS licensed version to change parameters in authorized manner
- Flight critical parameters like Frame type, Maximum altitude and Maximum speed cannot be changed
- For other parameters, change parameter and click update
- Restart AGRI Assistant GCS once before planning mission

5.4 SOP for setting of geo fence boundary

5.4.1 Planning Plot:

The Plot is a user defined geo fence. Once a plot is defined, the UAS will not go outside this geofence. The Plot can be defined only in AUTO mode. Planning Plot Interface Add Plot After clicking "**Planning Land**" on the main interface of the APP, enter the "**Planning Land**" interface and click "**NEW PLOT**" in the lower right corner.

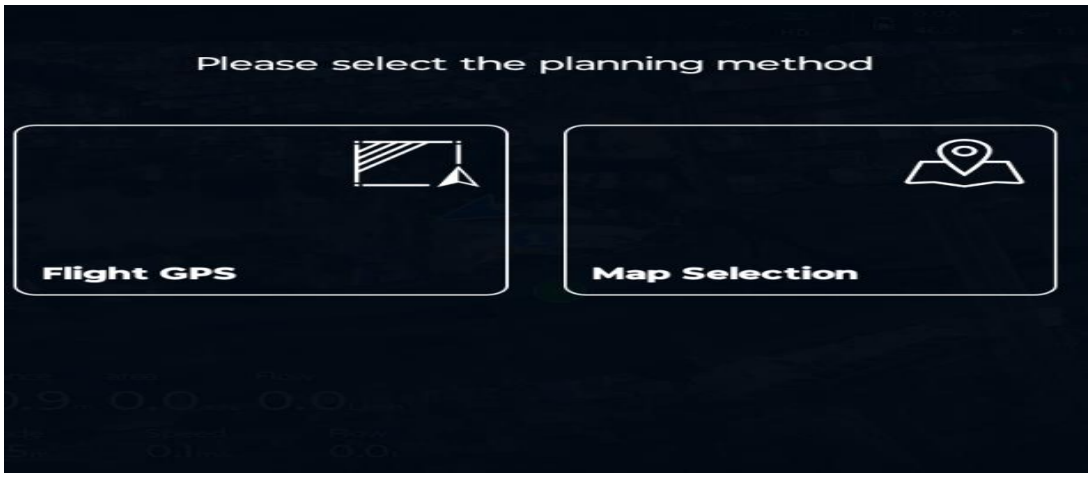
Planning Plot

5.4.2 Enter the Selection Planning Method Interface.

1. **Flight GPS:** After the APP connects to the UAS, use the UAS to circle. It is relatively easy to run around the plot without people.

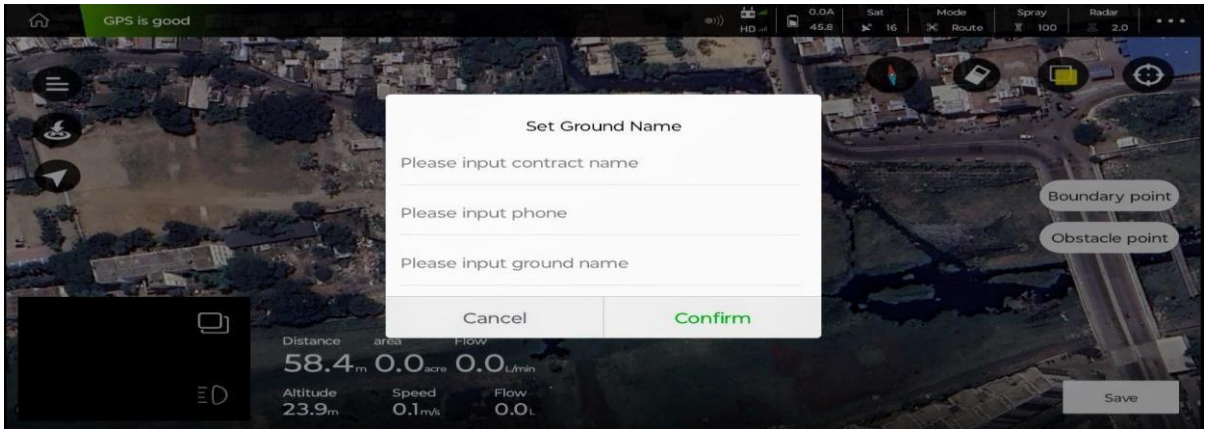
2. **Map point selection:** Use the map in the **GCS APP** to circle points and click at will. The accuracy of the collected plot boundary points is very poor;

For specific operation methods, please select the above functions.

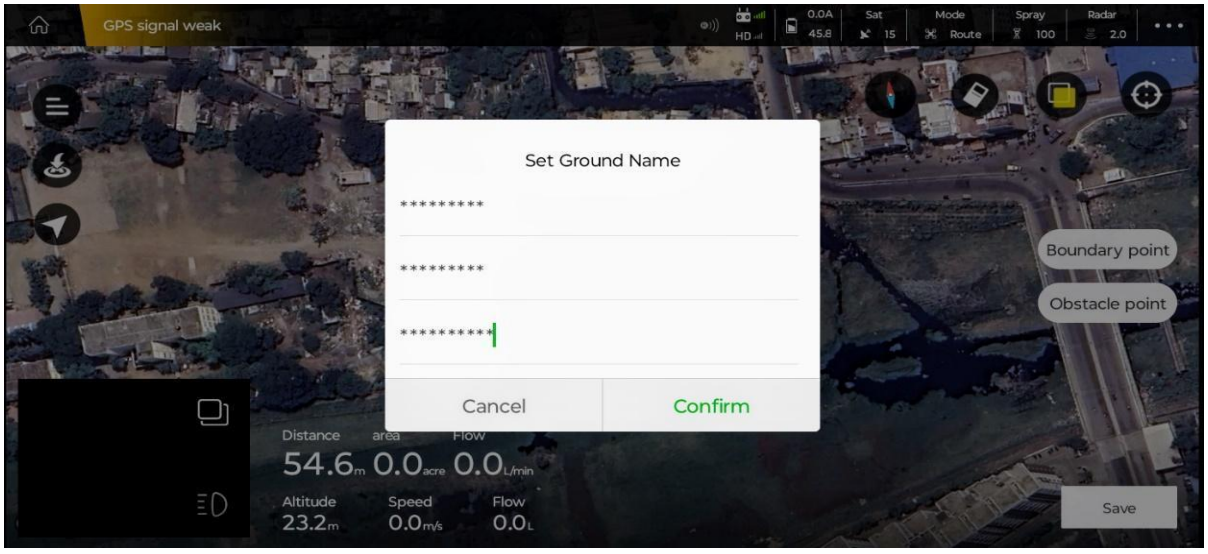


Map Selection

After selecting the plot and point, a dialog box pops up. Fill in the name of the plot to be planned, click "OK" when finished, and then start the point "**Map selection.**"



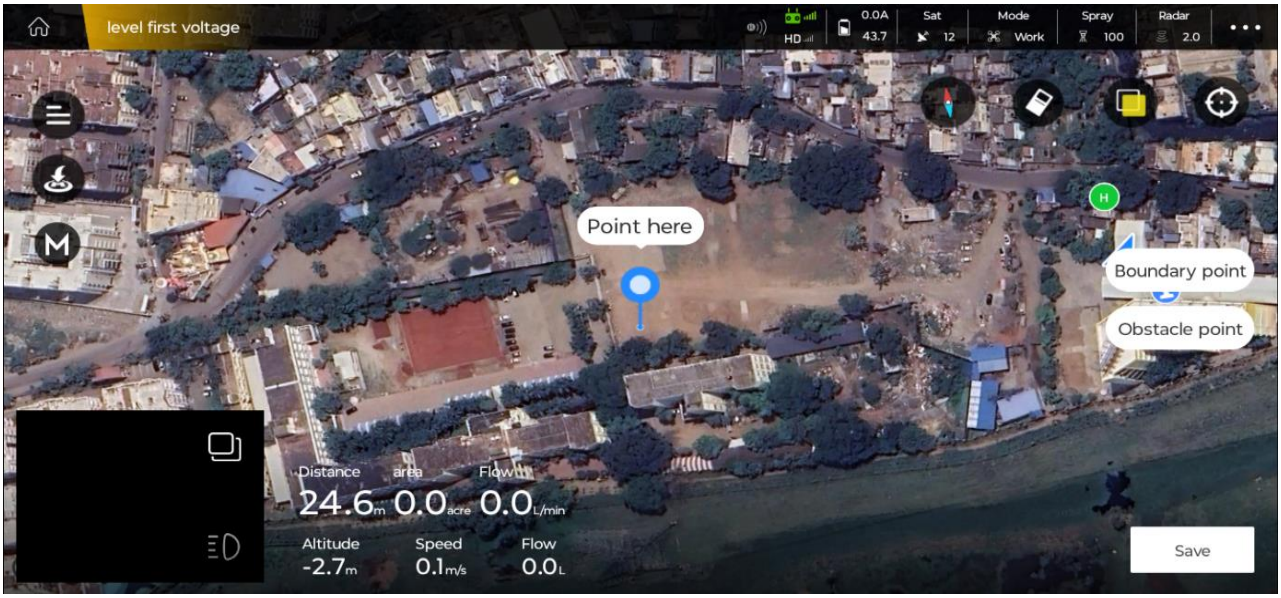
Set Ground Name Interface



Ground Name Input

After selecting the plot and point, a dialog box pops up. Fill in the name of the plot to be planned, click "**confirm**" when finished,

Move the cursor in the APP to a suitable position, click on the "**boundary point**" on the right (3 points or more can form a regional plot), and the APP will prompt "**add boundary point is successful**";

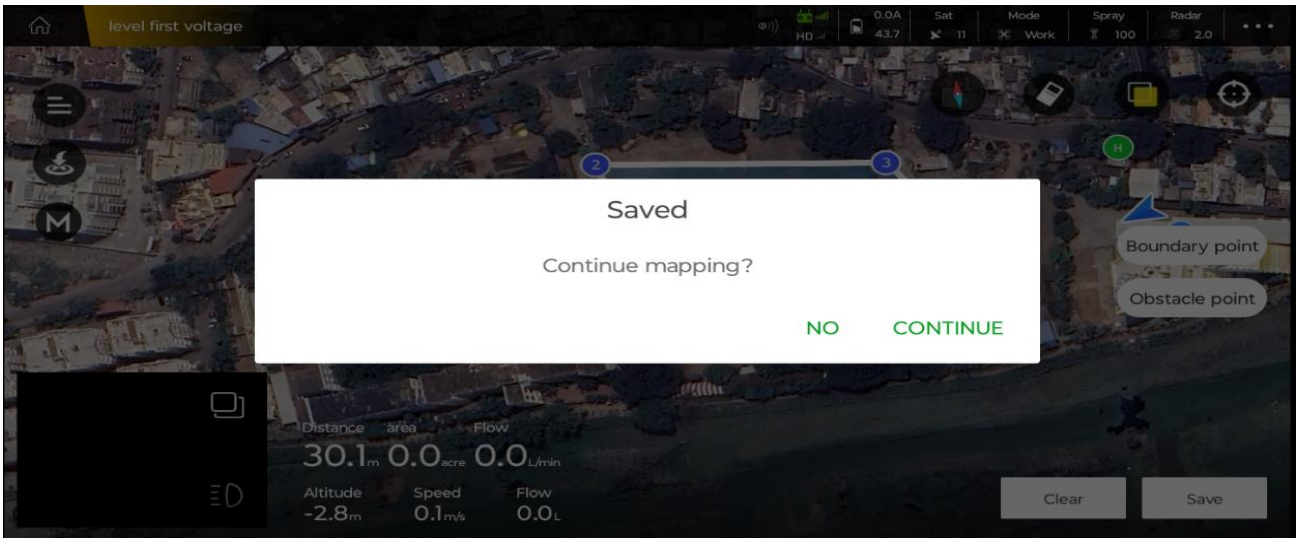


Set Boundary Point

Boundary point is same as geo fence and the UAS won't cross the geo fence boundary in auto mode.

Add Boundary Points

These points are the geo fence boundary points. UAS won't cross these boundary point in auto mode but if pilot take control and it can be breached however it won't cross the cylindrical geofence boundary set by manufacturer in advance setting.



Mapping-Saved

6 Checklist

6.1 Pre-Flight Checklist

Take off location and mission planned is under 2km range

Mission plan area should be under green zone, check in DGCA Interactive air space map before takeoff and starting the mission.

- Visually inspect to check all motors, GPS and propellers are in right condition.
- Check all propellers are in good condition and free of any breaks or cracks
- Check all propellers are mounted in fixed position with two screws intact.
- Check Ground Control Station & RC controller is charged.
- Check GPS is mounted properly. Check if there is no damage.
- Check Landing Sensor is fixed properly (TF02).
- Turn on TX & GCS. (Check flight mode in Tx and turn on loiter mode in Tx)
- Check the battery Voltage. (Full charge voltage: 25.0V/batt.)
- Set all 2 batteries in the drone and tighten the battery straps
- Unfold all arms & tighten the joints.
- Remove propeller guards & unfold all propellers properly.
- Connect Ground Control Station to the drone.
- Check all parameters in GCS. (Battery Voltage, HDOP, Sat count etc.)
- Plan your mission carefully & write the mission to the drone.
- Check payload is fixed and the tank cap is closed and locked.

- Make sure there are no potential safety hazards or people within 5m radius of the drone.
- Check Ambient temperature need to be less than 50 degrees

6.2 In Flight Checklist

- Turn off Safety switch & arm the drone from GCS or RC Controller Gimbal sticks.
- Check all the motors are spinning properly.
- Update home location.
- Flight plan is under ceiling height.
- Landing zone at destination is cleared & crew is informed
- Take off the drone.
- Monitor the flight from GCS for the desired operational requirements

6.3 Post Flight Checklist

- Monitor motor temperature, allow it to cool sufficiently before packing.
- Check the RPA for visible damages, if any, record the same in the maintenance log book.
- Check the propellers for chips and cracks.
- Check the RPA undercarriage for signs of damage, if applicable
- Remove the flight battery and inspect for damages, especially swelling.
- If the battery is excessively hot, allow it to cool before packing.
- After task completion, pack the RPA and count all the equipment.
- Complete all the required logs and/or reports.

7 Operating conditions

- Wind speed – 0- 8 m/s
- Ambient temperature – 0- 55 degrees
- Max Allowable Altitude- 30 m
- Max Range – 0.6 km
- Max Speed - 10m/s
- Minimum sat count -14 sats

7.1 Safe Landing Limits

- Safe landing height before Drop - 1 Feet
- Max Descent speed - 0.5 meters/second

8 Emergency procedures

8.1 Data link loss

8.1.1 Alerting mechanism - Aural and Visual signals

Visual : **RC disconnect** and failsafe radio event on

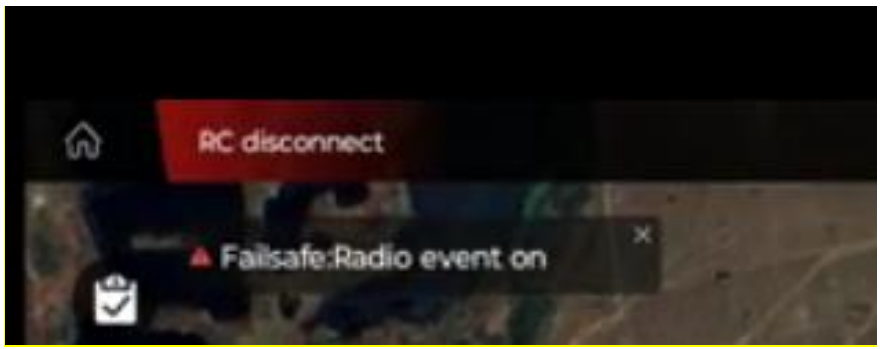
Aural is : Beep sound for ever 5 second

When a data link is lost, the GCS installed transmitter gives aural and visual signals as shown in below figure and follows a predefined path to ensure a safe end of flight within the required area restrictions.

8.1.2 Actions performed during data link loss

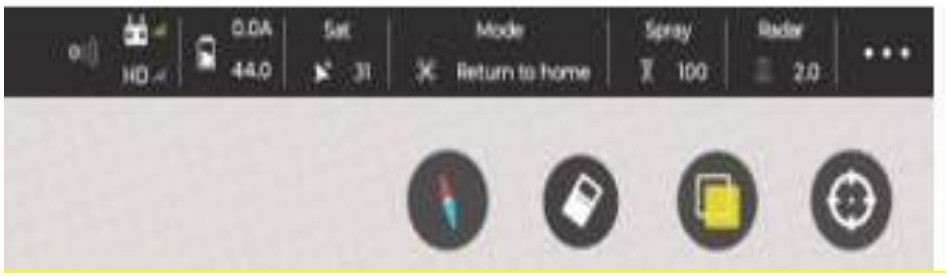
How to identify Data link loss:

In case of this emergency of communication loss, you will get to hear an aural Beep sound for ever 5 second and a popup on your screen as shown below.



8.1.2.1 *Actions to be taken*

Once the communication loss is detected by the on-board flight system, it is tuned to perform RTH.



Please make sure not to disturb the sequence of operation which are being performed during this activity.

The drone returns to the recorded home point during this activity and lands on its own upon which the drone is recovered safely.

8.1.3 Automated Response - Return to Home (RTH)

- RTH is Activated when data link is lost and in other contingencies like low voltage, low Mah, compass Variance (EKF Error) and heavy Vibrations Observed.
- The Return to home flight mode is used to fly a vehicle to safety on an unobstructed path to a safe destination, where it may either wait (hover or circle) or land.
- Multi copters use a home location return by default (and the following configuration):
- Ascend to RTH altitude
- Fly to the home position in a straight line and constant altitude (if already above the return altitude it will return at its current altitude).
- Rapidly descend to the specified altitude. Land more or less immediately
- In return altitude, the vehicle will usually first ascend to a safe altitude
- before returning, in order to avoid any obstacles between it and the destination.

- After reaching to a home point altitude, the vehicle will slow or stop its initial descent from a higher return altitude
- So we can say the flight envelope of the RTH will always is ASCEND, CRUISE, DESCENT (Land/Loiter)

- From Fig we can observe that the boundary points are 1,2,3,4 and after reaching point 3, we activated RTH and it followed RTH sequences and landed at recorded home point

8.2 Low power

8.2.1 In Terms of mah Drop

We have set 10% Capacity of our battery as reserve. When the battery capacity falls below this, fail safe is triggered and RTH is activated.

8.2.2 In Terms of Voltage Drop

When the Voltage during Operations falls below predetermined voltage (As set in GCS),Failsafe is triggered and RTH is activated.

8.3 Contingency Plans

Event	Event Action
Battery failsafe	UAS return to home (RTH)
Tank empty	UAS return to home (RTH)
Fence breached	UAS return to home (RTH)
Communication link lost	UAS RTH after 5 sec

Functional Specification: Demonstration of implementation of command link loss strategy in the UAS. It has been verified from the AGRI ASSISSANT product documentation and the working videos of GCS software that GCS allows to configure actions as loss strategy in case of loss of communication link.

It has been validated during field trials that GCS software allows to configure actions as loss strategyin case of loss of communication link

1) **Autonomous Flight Termination System or Return Home (RH)**

Functional Specification: The Autonomous Flight Termination System or Return Home (RH) option hasbeen implemented.

It has been verified from the AGRI ASSISSANT product documentation and the working videos ofGCS software that software has capability of initiating RTL (Return to Launch)/RTH.

It has been validated during field trials that software has capability of initiating RTL (Return toLaunch)/RTH within 5 sec

RTH functionality is available. Pilot can click RTL and the UAS will land at home point. Here is a screenshotof the same.

RTH functionality is available. Pilot can click RTL and the UAS will land at home point. Here is a screenshotof the same.

Pilot can click RTL and UAS will land to home point**.**

Hence, the C2C data link loss strategy has also been included in the FLIGHT MANUAL of the UAS

8.4 Geofencing Capability

- A Geo-Fence is a virtual boundary that defines where a vehicle can travel. Geo-Fences can be used to prevent a vehicle flying out of range of the RC controller, or into unsafe or restricted airspace.
- The Geo-Fence Failsafe defines a cylinder centered on the home position, with a specified maximum radius and altitude.
- This Feature Helps to Safeguard the drone to never breach predefined distance and height, which are recorded when Armed (By Default Drone Takes the Home Point from Where It Has been Flown)

Depicts Geo-Fence capability

- From the fig, we can observe that the white path is basically the mission path and green boundary is the geo fence, as the drone crosses the Geo- Fence boundary, you can notice the FENCE BREACHED & RTL ARMED, in the bottom of the screen.

- By this test we can 100 % confirm that the drone is Equipped with Geo- Fence capabilities

8.5 Actions performed during Geo-Fence Breach

How to identify Geo- Fence breach:

In general, the app is built in such a way that even if the way points are placed mistakenly outside the set Geo-Fence area, then the app won't save the mission plan/project unless until the waypoint comes inside the fence, this is a safety feature which is inbuilt.

Manual breach of Geo-Fence by the user leads to RTH action saying "RTL Armed", which can be seen on bottom corner of screen and command popup saying "Geo-Fence breached.

Actions to be taken

- Once the Geo-Fence breach is detected by the on-board flight system, it is tuned to perform RTH.
- Please make sure not to disturb the sequence of operations which are being performed during this activity.
- The drone returns to the recorded home point during this activity and lands on its own upon which the drone is recovered safely.

8.6 Actions to be performed during over temperature of motors

How to identify overheated motors

When the ESC temperature is raised up to 110 degrees centigrade, ESC sends out an alert in terms of LED light flashing, and the flashing pattern is 1 long flash followed by 2 short when Mosfet temperature of ESC increased, and 1 long flash followed by 3 short flashes when capacitor temperature of ESC increased.

Action to be taken by Pilot

Step 1: The movement pilot observes these flashing pattern of 1 long 2 short flashlights, immediately decide for landing.

Step 2: Identify a flat surface and sufficient space for landing the UAS.

Step 3: Check battery level if it is not problem drain out all the liquid in the tank.

Step 4: Take good control and decent the UAS in safe and shortest location and disarm the UAS.

Step 5: Disconnect the battery and allow the ESC to cool down or take a necessary action to cool down the ESC and motor.

8.7 Actions to be performed during over current of motors

How to identify overcurrent of motors

When the current of a motor reaches more, the LEDs starts blinking three short flash which indicates over current.

Actions to be taken by pilot

Step 1: The moment pilot observes these 3 short flashing lights blinking pattern, immediately decide for landing

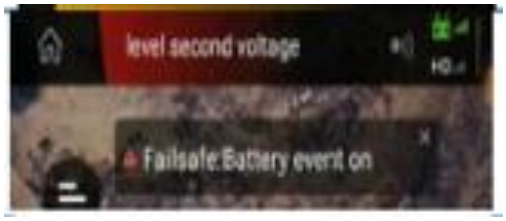
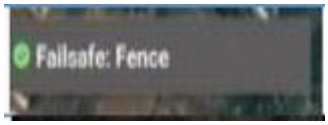
Step 2: Identify a flat surface and sufficient space for landing the UAS.

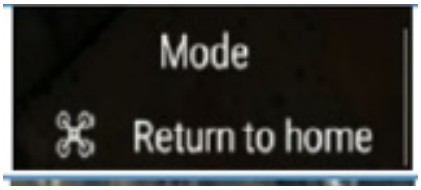
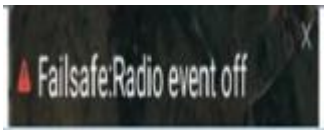
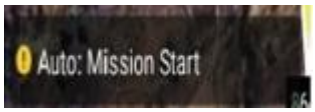
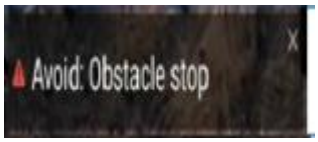
Step 3: Check battery level if it is not problem drain out all the liquid in the tank.

Step 4: Take good control and decent the UAS in safe and shortest location and disarm the UAS.

8.8 List of visual and aural alert:

For the all the alerts, GCS installed transmitter screen shows both visual and aural warning, these alerts are tabulated below with the reaction time.

S. No	Mode of occurrence	Type of Warning		Reaction time
		Aural signal	**Visual signal**	
1		Level second voltage		5sec
2		Auto: Return break point		5sec
3		Failsafe: fence		5sec

4	**Emergency Warnings**	Return to home		5sec
5.		Failsafe : radio event off		5sec
6		Auto : mission start		2 sec
7	Typical Alarm	Avoid : obstacle stop		2 sec

9 Life of UAS Components

Information to Users on life of UAS main components.

Understanding the lifespan of components is crucial for the safe and efficient operation of your Unmanned Aerial System (UAS). This section outlines the expected lifespans of various components and provides guidelines for maintenance and replacement.

Components	**Hours /cycle of operation**
Airframe	4000 Hours
Number of permissible landings	5000 landings
Battery	300 cycles
Rotor	500 hours.

Airframe Lifespan

Expected Lifespan: The lifespan of the airframe depends on various factors such as material quality, usage intensity, and environmental conditions. Typically, carbon fiber airframes can last for several hundred flight hours under normal operating conditions.

Factors Affecting Lifespan: Exposure to moisture, impact damage, and stress from aggressive maneuvers can accelerate wear and deterioration of the airframe.

Warning Signs: Cracks, delamination, or structural deformities indicate potential structural issues that compromise the integrity of the airframe.

Replacement Guidelines: Regularly inspect the airframe for signs of damage or wear, and replace it if structural integrity is compromised or if it reaches the end of its expected lifespan.

Landing Gear Lifespan

Expected Lifespan: Landing gear components, including struts, wheels, and landing skids, typically have a lifespan of several hundred landings under normal

operating conditions.

Factors Affecting Lifespan: Hard landings, rough terrain, and excessive weight can cause wear and damage to land gear components.

Warning Signs: Bent struts, worn wheels, or cracked landing skids indicate wear or damage that may affect the performance of the landing gear.

Replacement Guidelines: Inspect the landing gear after each flight for signs of wear or damage and replace components as necessary to ensure safe landings and ground operations.

Batteries

Expected Lifespan: Lithium polymer (LiPo) batteries typically have a lifespan of 300 charge cycles under normal operating conditions.

Factors Affecting Lifespan: High temperatures, over-discharging, and improper storage can shorten battery lifespan.

Warning Signs: Decreased flight time, swelling or puffiness, and increased internal resistance indicate a deteriorating battery.

Replacement Guidelines: Replace batteries that show signs of wear or reach the end of their expected lifespan to prevent in-flight failures.

Motors and Propellers

Expected Lifespan: Brushless motors and propellers have a lifespan of approximately 500 flight hours, depending on usage and maintenance.

Factors Affecting Lifespan: Frequent high-speed maneuvers, exposure to dust and debris, and inadequate cooling can reduce motor and propeller lifespan.

Warning Signs: Excessive noise, vibration, or reduced thrust may indicate wear or damage to motors or propellers.

Replacement Guidelines: Inspect motors and propellers regularly and replace them if signs of wear or damage are detected.

9.1 List of Critical Components

Agricultural Unmanned Aerial Systems (UAS), also known as drones, load-bearing critical components refer to the elements of the drone responsible for

carrying and supporting additional payloads or equipment essential for agricultural operations. These components are crucial for the functionality and effectiveness of the UAS in agricultural tasks. Here is the list

Frame: The frame of the agricultural UAS is typically designed to support additional payloads such as cameras, sensors, or other agricultural equipment. It needs to be sturdy and lightweight to carry these payloads without compromising the stability and flight performance of the drone.

Arm folding parts: This Arm folding parts of UAS is typically to fold the arms sideways to help in transportation purpose each and every flight this arm folding is to be checked of any loosening of locknuts or any cracks.

Motor and Propulsion System: The motor and propulsion system are responsible for lifting the drone, along with any additional payload it may carry. These components must be powerful enough to handle the extra weight while maintaining flight stability and efficiency.

Mounting Mechanism: A secure and reliable mounting mechanism is essential for attaching agricultural equipment such as spraying systems to the drone. This ensures that the equipment remains stable and properly aligned during flight, allowing accurate data collection or application of agricultural inputs.

Payload Interface: This includes connectors, communication links, and other interface components that allow the drone to communicate with and control attached agricultural equipment. It must be reliable and capable of transmitting data and commands between the drone and the payload in real- time.

10 Performance At various combination of weight, altitude, temperature and wind conditions)

This is to declare that the performance of UAS at various operating conditions is as follows

Type of System	AUW (Kg)	Operating Height Range(m)	Wind Speed (m/s)	Ambient Temperat e ure (°C)	Maximum Flight Time (Min:Sec)
Configuration 1	27.90	10	5-8 m/s	35°C	06 mins 03 secs

11 Cautionary Note:

- **It Is Advised Not to Operate the UAS In a High-Intensity Radiated Field (HIRF Environment)**
- **This UAS lacks an IP rating for dust and water resistance. Do not operate in dusty environments or wet conditions to avoid damage to the system**
- **UAS is not fitted with shock shock-absorbing mechanism. Therefore, the pilot executes controlled descent and landing.**
- **Not to fill the tank beyond 10 L as marked in red on the Tank. This may cause a safety hazard.**
- **UAS does not have GSM SIM and RFID option.**
- **UAS doesn't have actuators, servo controllers and other components**
- **UAS doesn't have SSR transponder or ADS-B out equipment and detect and avoid**
- **Total capacity of tank is 11 Liters**

Maximum allowable capacity of variable payload liquid is 10L , User are instructed strictly to fill only till the 10L mark
Users are not allowed to uninstall and install the tank

- **Users are not allowed to change the positions of the nozzles attached to the arms of the UAS, because CG limits are calculation based on these specific positions.**

- **The UAS Kisan Drone–V10 does not have flashing anti-collision strobe lights,. Operators are advised not operate in night .**

- **The UAS Kisan Drone–V10 does not have Barometric equipment with capability for remote subscale setting, operators are advised to be cautious will operating**

- **Please be advised that the data logging storage on the K++ V2 flight controller has a finite capacity. Once the storage limit is reached, the flight controller is designed to continue normal operation without any impact on the flight performance of the Unmanned Aircraft System (UAS). The manufacturer has confirmed that full storage will not affect the flying capabilities of the UAS**

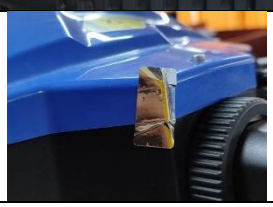
- **User are not allowed to replace any crucial components.**

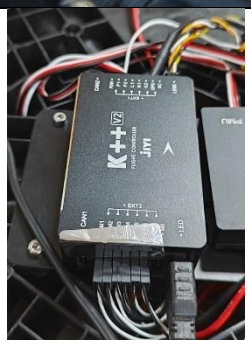
11.1 Pilot to perform the mitigation action which raised from Software risk analysis high RSI values.

Sr No.	Components	RSI	Mitigation Method
1..	Advance Settings	15	Always ensure that the right setting has been input in GCS for the UAS and the user should follow procedure check form documentation before eachflight.
2.	HUD-Battery Voltage	15	Always ensure to check display value of Battery voltage is being determined properly and its functionality has been shown by GCS for the UAS. Also, the Pilot should check form documentation and conform the right battery voltage is shown.
3.	HUD-Number of satellites	15	Always ensure to check display value of Number of satellites are being determined properly and actual functionality has been shown by GCS for the UAS. Also, the pilot should check form documentation and conform the right number of satellites are shown.
4.	HUD- Mode	12	Always ensure to check display value of Flight mode are being determined properly and actual functionality has been shown by GCS for the UAS. Also, the user should check form documentation and conform the right data is shown.

11.2 list of location of tamper proof sticker provided on the UAS

User are instructed to not to tamper these Void sticker

Front of canopy	
Right side of canopy	
Back side of canopy	
Back left side of canopy	

On GPS	
On flight controller and	
Radio receiving module