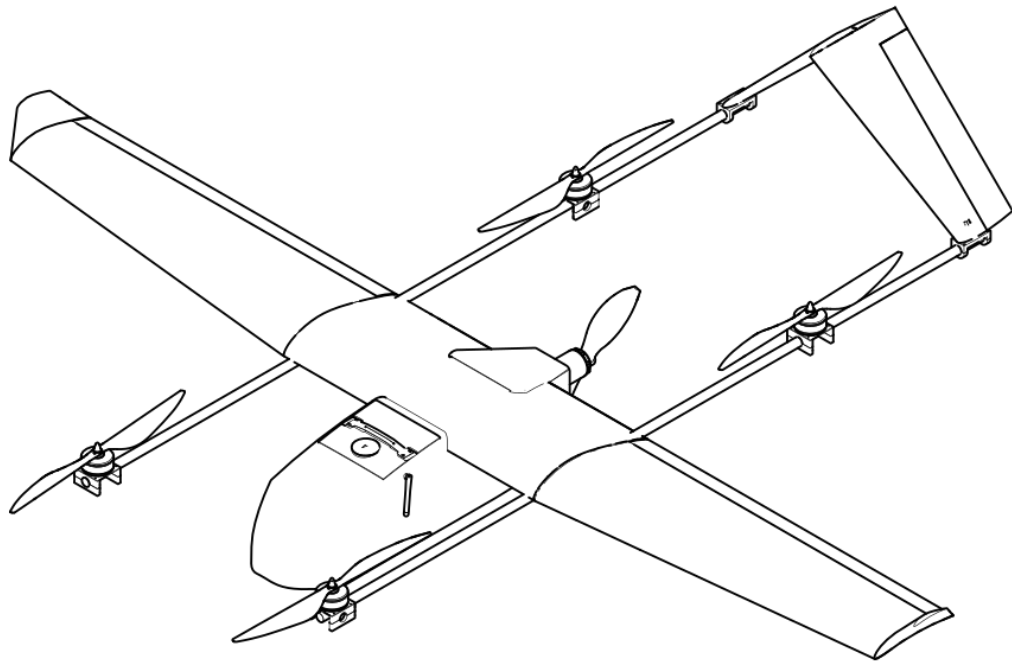


GAUTHALI

USER MANUAL v1.0

2020.9



Using this manual

Legend

To make: Warning, important, hints and tips, reference signs

Read before the first Flight

1. User Manual
2. Quick start guide
3. Disclaimer and safety guidelines

Videos

https://www.youtube.com/watch?v=5lbfTUy_7UA&t=121s

Downloading the app

The app is made available at purchase / only downloadable by the user with the account in the website/ freely available in the prokura website



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Product Profile

This section introduces Gauthali and lists the components of the aircraft and remote controller.



Product Profile

Introduction

Gauthali is a hybrid VTOL drone made in Nepal. It can Hover and Fly and Return to Launch automatically. Gauthali has a maximum flight speed of 30m/s and a maximum flight time of 45 minutes. With a payload-carrying capacity of 1.2 kg and a payload volume of 4050 cm³, it can transport most of the emergency medical supplies.

Feature Highlights

Gauthali boasts a simple convertible design and has a lightweight of 11 kilograms, making it easy to transport. Using an advanced flight controller, Gauthali is able to provide a safe and reliable flight experience. The aircraft is able to automatically return to its Home Point when the communication signal is lost or the battery is low, as well as being able to land on the current position in such scenarios.

Our redundant communication technology is built-in into Gauthali and supports both 2.4 GHz and 900Mhz frequencies and a transmission range of 1 km on 2.4Ghz frequency and anywhere in 900Mhz frequency as long as the area supports 3G/4G mobile communication.

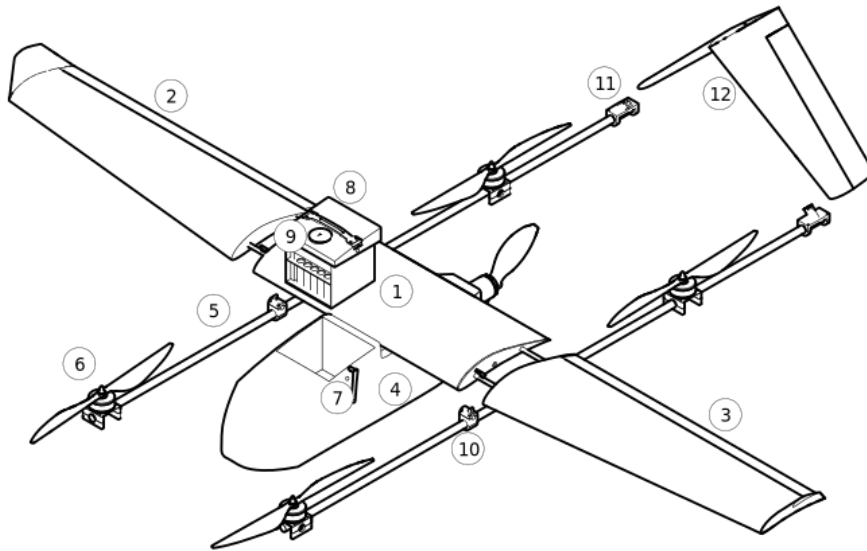
Preparing the Aircraft

Follow the steps below to assemble Gauthali.

- Step 1: Join the two wings to the wing in the fuselage
- Step 2: Put the Quadcopter Propellers
- Step 3: Put the Pusher motor propeller
- Step 4: Join the tail
- Step 5: Connect the power and signal wires
- Step 6: Connect the batteries



Aircraft Diagram



Description	ID
Antenna	7
Battery pack	8
Boom-tail mount	11

Description	ID
Center wing section	1
GPS/ Compass	9
Left wing section	3

Description	ID
Payload comartment	4
Quad boom	5
Quad rotor	6

Description	ID
Right wing section	2
Tail	12
Wing-boom mount	10

Preparing the Remote Controller

1. Disclaimer: The drone is intended for fully automatic operation in the preplanned waypoint based missions. Any manual use via remote is not recommended. Any faults and risks associated to manual flying are liabilities of the user themselves
2. Switch on the remote
3. Check for the stable green light for the indication of the connection to the drone (the drone must be powered on before the remote)
4. Then, you are ready for RC flight of the drone.

Remote controller diagram

Further information on the remote packaged with this drone can be found at https://www.rc.futaba.co.jp/english/dl_manual/4ywd_e.pdf.



Aircraft

Gauthali contains a Flight controller,
Payload Compartment,
Remote Control system, and Dual
Flight Battery System.



Aircraft

The overall aircraft of Gauthali consists of a flight controller, smart communication system, propulsion system and a battery management system.

Aircraft Status Indicator

The aircraft status indicator is an rgb led accompanied with the flight controller. It relays the status of the flight controller system. The different status as indicated by the pattern of led are:

LED Pattern	Description
Flashing red and blue	Initializing gyroscopes. Hold the vehicle still and level while it initializes the sensors.
Flashing blue:	Disarmed, no GPS lock found. Autopilot, loiter and return-to-launch modes require GPS lock.
Solid blue:	Armed with no GPS lock
Flashing green	Disarmed (ready to arm), GPS lock acquired. Quick double tone when disarming from the armed state.
Fast Flashing green	Same as above but GPS is using SBAS (so should have better position estimate).
Solid green - with single long tone at time of arming:	Armed, GPS lock acquired. Ready to fly!
Double flashing yellow:Single Flashing yellow	Failing pre-arm checks (system refuses to arm).
Single Flashing yellow	Radio failsafe activated
Flashing yellow - with quick beeping tone	Battery failsafe activated
Flashing yellow and blue - with high-high-high-low tone sequence:	GPS glitch or GPS failsafe activated
Flashing red and yellow - with rising tone:	EKF or Inertial Nav failure



Flashing purple and yellow	Barometer glitch
Solid Red	Error
Solid Red with SOS tone sequence:	SD Card missing (or other SD error like bad format etc.)
Flashing Red, Blue and Green:	Copter ESC Calibration mode entered.

Return to Launch

The Return to Launch (RTL) feature makes it possible for the vehicle to return to its preset home location without automatically based on GPS data. The vehicle can be switched to RTL mode by either switching the mode stick on the RC or tapping the RTL button in the mobile/web app.

Procedure

1. The GPS coordinates of home is recorded during initialization of the vehicle after startup
2. RTL is triggered
3. The aircraft continues in the fixed wing mode until it is close to the return point at which time it switches to a VTOL RTL. Using the fixed wing RTL the vehicle arrives at a reasonable altitude, about 15 meters at which point it switches to VTOL mode and descends to the ground.
4. After reaching the Home location, the vehicle lands and the motors stop.

Propellers

There are two types of propellers, one for the multicopter system and other for the push motor for fixed wing systems. Considering multicopter propellers they are of two types for rotation in different directions. While it is easy to detach the propellers some considerations must be taken into account while mounting them.

Attaching the Propeller

Attach the propellers to the motors with similar markings. Markings are differentiated based on their direction and copter type, and can be found on the sides of the motors and below the propeller. Propellers spinning in the same direction are interchangeable for multicopters. Make sure the pusher propeller and multicopter propellers are correctly attached.



Detaching the Propeller

Remove the propellers with care as the blades are sharp and might cause injury. Just rotate the propellers to detach them and do not use screw drivers to unmount them as the screws are there to hold the mount and not the propeller. Make sure the vehicle is in off state or in no position to fly. If a propeller is broken, replace it with the same model or if not possible might need to change the entire propellers. Make sure all propellers are in good condition and screwed properly before each flight. Maintain distance from the propellers before flight or when the propellers are spinning.

Battery Management System (BMS)

We have a highly intelligent dual battery power system - a Li-ion based primary source and Li-po based secondary source. The charging and discharging of the battery source is designated by the BMS. If one of the power systems fails the system is not completely dysfunctional but will enter into the failsafe mode and land in the nearest safe location avoiding imminent crash scenario. The BMS is a robust system that has several protection facility:

1. Overcharge protection
2. Over Discharge protection
3. Parallel cell balancing

The battery charge state can be viewed on the battery unit itself as well as the data is also displayed in the DMS app.



Flight

This section describes flight modes, safe flight practices and flight restrictions.



Flight

Flight Environment Requirements

1. Do not use the aircraft in severe weather conditions including wind speeds exceeding 8 m/s, snow, rain, and fog.
2. Fly in open areas. Tall structures and large metal structures may affect the accuracy of the onboard compass and GPS system.
3. Avoid obstacles, crowds, high voltage power lines, trees, and bodies of water.
4. Minimize interference by avoiding areas with high levels of electromagnetism such as locations near power lines, base stations, electrical substations, and broadcasting towers.
5. Aircraft and battery performance are subject to environmental factors such as air density and temperature. Be careful when flying 9842 ft (3000 m) or more above sea level, since battery and aircraft performance may be reduced.

Flight Limit and Geo Zones

Unmanned aerial vehicle (UAV) operators should abide by the regulations from self-regulatory organizations such as the International Civil Aviation Organization, the Federal Aviation Administration, and local aviation authorities. For safety reasons, flight limits are enabled by default to help users operate this aircraft safely and legally. Users can set flight limits on height and distance. Altitude limits, distance limits, and GEO zones function concurrently to manage flight safety when GPS is available. Only altitude can be limited when GPS is unavailable.

Pre-Flight Checklist

1. Make sure the remote controller, mobile device, and Flight Battery are fully charged.
2. Make sure the Flight Battery and the propellers are mounted securely.
3. Make sure the aircraft wings are properly mounted.
4. Make sure the GPS and compass are functioning normally.
5. Make sure nothing is obstructing the motors and that they are functioning normally.
6. Make sure the ground control software is successfully connected to the aircraft.



Auto Takeoff/Landing

Auto Takeoff

1. Open the Ground control software
2. Complete all the steps in the Pre Flight Checklist
3. Upload the desired mission
4. Click Start

Auto Landing

1. If the conditions are safe to land, click the Land button
2. The motors stop after landing.

Flight Modes

Modes

1. Quad mode

In this mode the drone behaves as a typical quadcopter, where it uses its X-config motors. This mode is typically used in landing and takeoff modes but may also be enabled as an assistance mode when the drone is incapable of maintaining its cruise speed (due to wind or gust). The mode is also enabled in failsafe situations when a failure of operation occurs in the plane mode.

2. Plane mode

In this mode the drone operates like a typical plane and is propelled by the pusher motor at the backside of the drone. During this mode the drone uses the servos and control surfaces on the wing and the tail parts to control its motion. This mode is highly energy efficient and is used in most of the mission parts.

Stabilize (QLoiter) Mode

This is the only manual mode in the aircraft, where the aircraft uses gps information and sensor optimization for assisted flying. The drone automatically maintains the current location, heading and altitude. The pilot may fly the drone in stabilized mode with the control sticks but when the sticks are released, the vehicle will slow to a stop and hold position.



Mission Mode

In this mode, the drone will follow a mission (a set of GPS waypoints and other commands) that are preloaded via the DMS app. When in mission mode, the pilot is not allowed to control the plane via the remote controller but can send flight commands via the app. This mode is complex, constituting several sets of actions: takeoff, transition from quad to plane mode, waypoint to waypoint navigation and hover, transition back to quad mode and land mode.

Return To Launch (RTL) Mode

RTL mode (QuadPlane Return To Launch mode) navigates the drone in fixed wing mode from its current position to hover in quad mode above the home position and then lands.

Land Mode

The drone lands in the quad mode in the location provided. The drone descends at the rate of 0.5m/s. The drone must be in hover or loiter mode before you can enable this mode. For all else, it is suggested to use RTL mode.



DroneFly App

This section introduces the main functions of the DroneFly app.



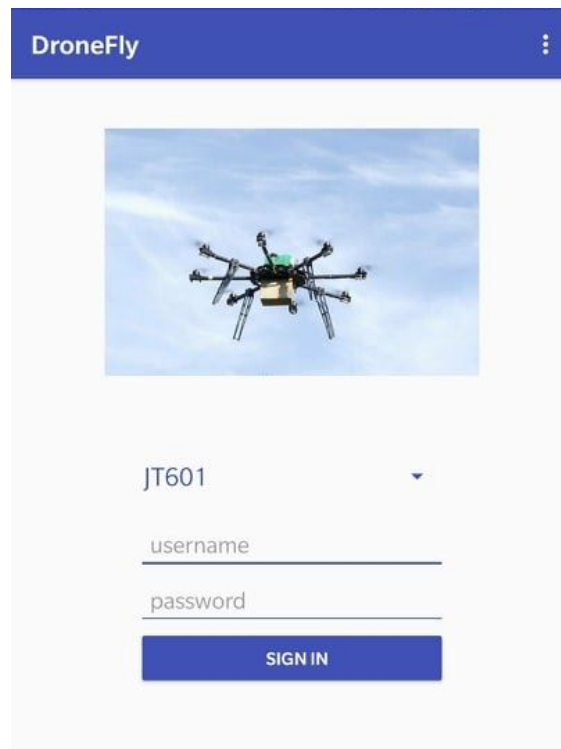
DroneFly App

There are two portions of the DroneFly App. An android based mobile app which comes with the drone and a web app (dms.prokurainnovations.com)


Mobile App

Login Screen

Login using the provided credentials (username, password) and for the provided drone.



DroneFly



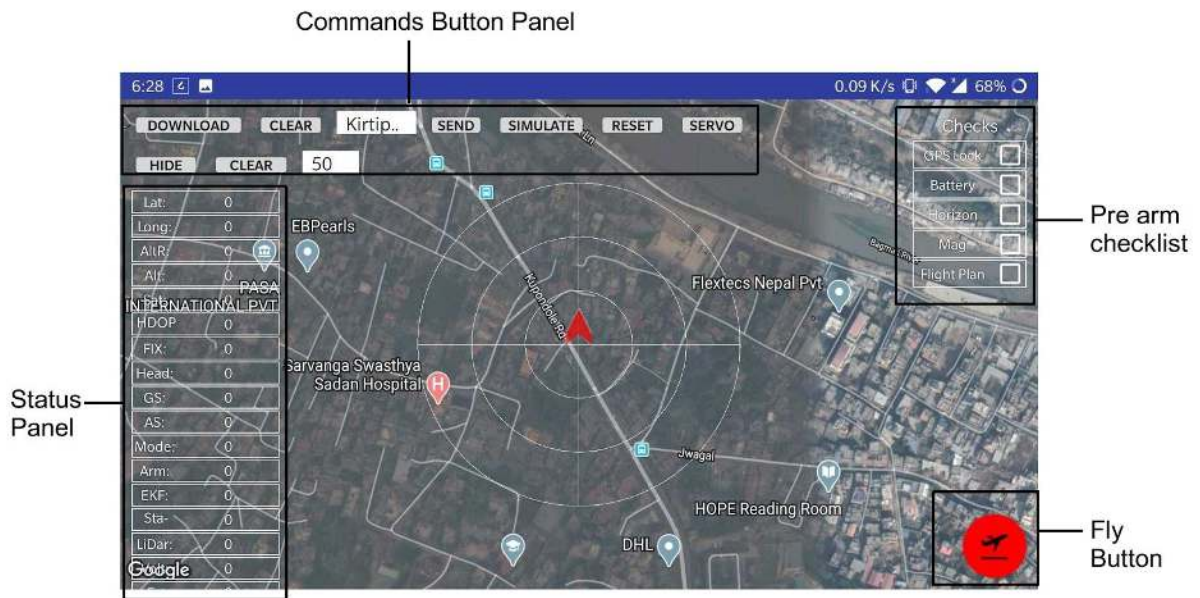
JT601

username

password

SIGN IN





Home Screen

Status Panel

The status Panel shows the status of the drone. The “show” and “hide” button from the commands button panel can be used to view or hide the drone status accordingly. The data displayed are:

Param	Description
Lat	Latitude corresponding to the current position of drone
Long	Longitude corresponding to the current position of drone
AltR	Attitude of drone relative to the home altitude
Alt	Absolute altitude of drone
Sat	Number of satellites connected for GPS
HDOP	Horizontal dilution of Precision
Fix	The type of GPS fix, 3D, 2D



Head	The heading/compass reading
GS	Ground Speed
AS	Air Speed
Mode	The current mode of Drone, Auto, Land, RTL
Arm	Arm condition of dron, True/False
Lat	Latitude corresponding to the current position of drone

Commands Button Panel

It consists of a series of buttons to interact either with the drone or app.

Button	Description
SHOW/HIDE	Shows or Hides the Status Panel
DOWNLOAD	Downloads current drone mission and displays it on the screen
CLEAR1:	Clears the current mission from the screen
DROPDOWN (Locations)	List of available missions for drone
SEND	Send the mission with the corresponding drop down value to be uploaded to drone
NUMBER INPUT	Radius to display a grid of circles for distance approximation
CLEAR	Clears the grid of circles from the screen
SERVO	Toggles servo position of drone
SIMULATE	Performs simulation of recent drone flight
RESET	Resets logs



Prearm CheckList

The pre arm check list presents a list of checks necessary to be performed by the user before each flight. It is mandatory to attain each criteria before any flight. It Lists:

Check	Description
GPS Lock	A proper GPS lock for Auto flights
Battery	Proper Battery Condition with sufficient charge
Mag	The compass is behaving well
Flight Plan	Ensure a valid flight plant is uploaded to the drone
Horizon	Ensure the drone is flat on the ground

Fly Button

The fly button is used to initiate the flight. Initially it is colored in red and the flight cannot be initiated. Once all the pre arm conditions are satisfied, it turns green and flight operation is permitted.



On Pressing the fly button three sub buttons pop out: TAKEOFF, LAND and RTL

Button	Description
TAKEOFF	Initiates the mission
LAND	Lands at current drone position
RTL	Returns to Home Position

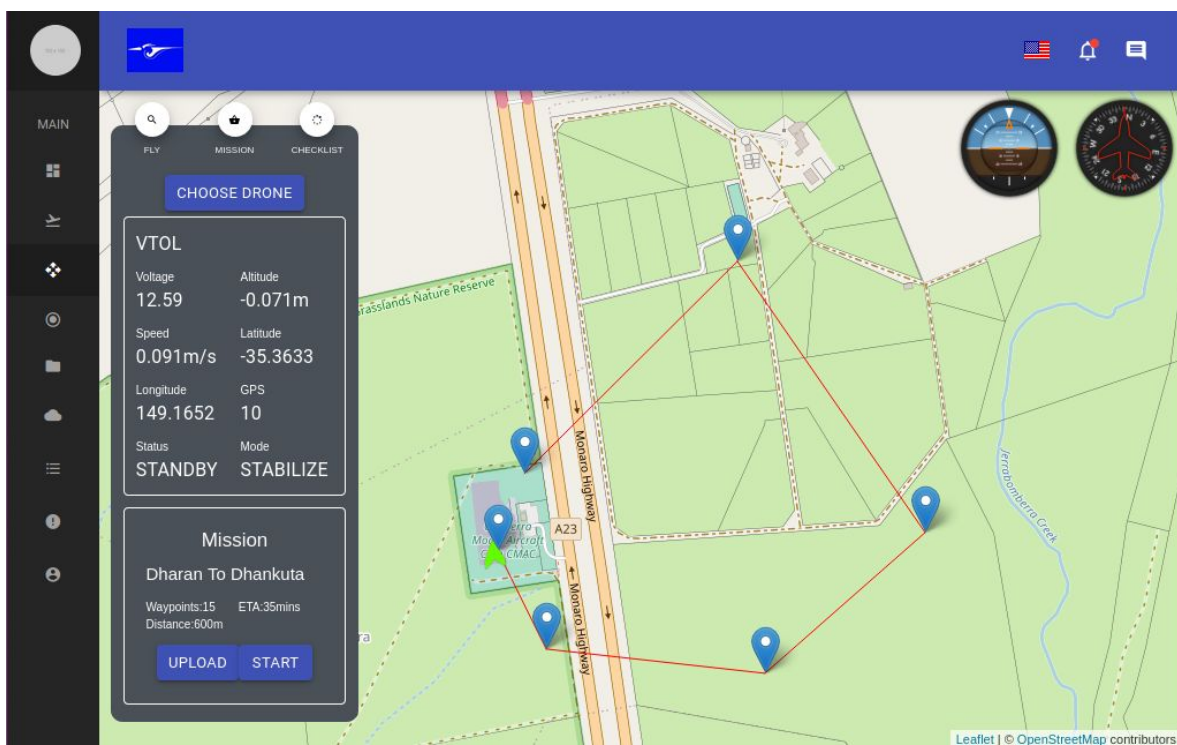
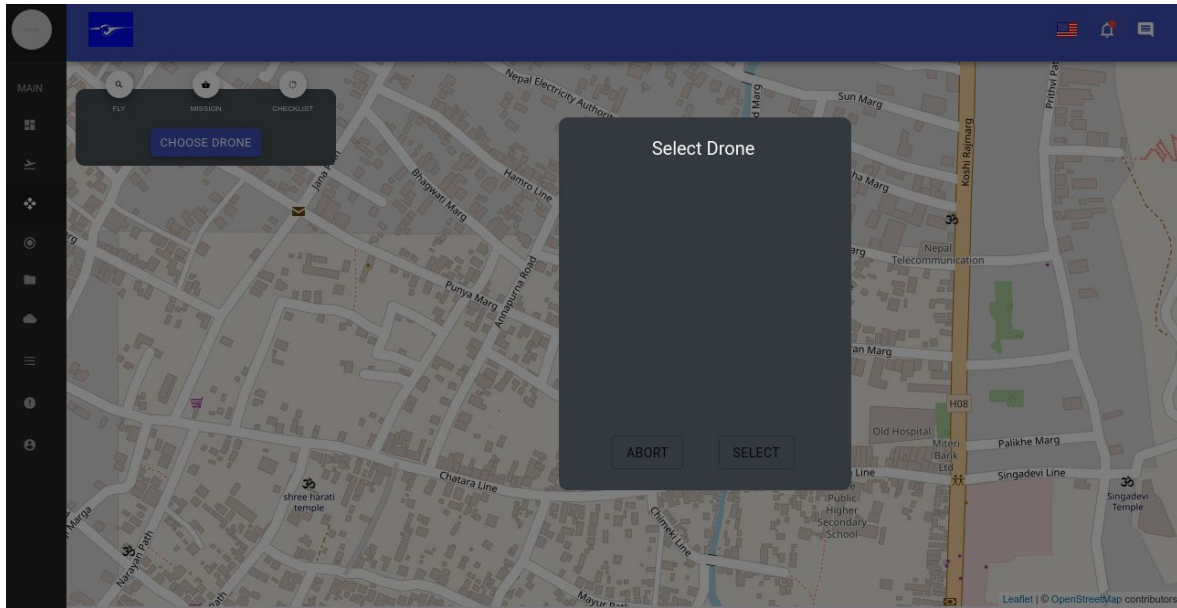
Web App

Login Page

Login to the web app with valid credentials



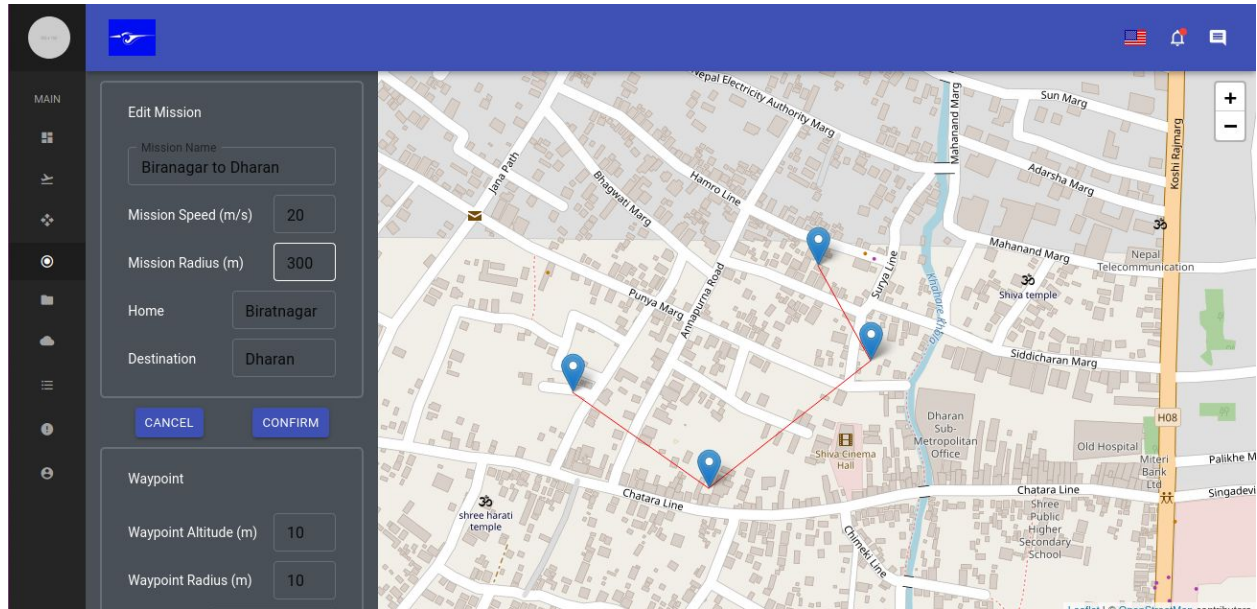
Drone Control Page



In the side nav bar click Drone Control which presents a screen with drone command options including to select a particular drone, upload mission and initiate flight.



Firstly, tap on “choose drone” which presents a list of available drones. Select the required drone and if necessary upload the mission. If the mission has already been created it will appear on the list else it needs to be created. The checklist is similar to the one on mobile app and must all be satisfied. Finally click “Fly” to initiate flight.



If need be there is also the feature to create new missions. To create new missions on the side nav bar select “Mission Planner” on “Mission” tab and click the “Create” button or if already created choose “Open”. Click on the map to create waypoints and specify the details on the form on the left specifying the mission speed, radius and other parameters. Confirm each waypoint and save the mission.



Appendix



Appendix

Specifications

Aircraft (taken at sea level)

Specification	Value
Take-Off Weight	11 kg
Dimensions	Whole Drone: 2.4x2.7x0.3 Wing: 2.67mX0.34mX0.057 Fuselage:0.88mX0.235m X0.245m
Diagonal Distance	3.6 m
Max Ascent Speed (Quad Mode)	0.5 m/s
Max Descent Speed (Quad Mode)	0.5 m/s
Minimum Airspeed (Plane Mode)	12.5 m/s
Cruise Speed (Plane Mode)	19 m/s
Max Climb Rate (Plane Mode)	5.5 m/s
Max Climb angle	16 degrees
Max Speed	35 m/s
Max Service Ceiling above Sea Level	3500 m
Max Flight Time	40 minutes
Max Range	45 kilometers
Max Wind Speed Resistance	7 m/s
Max Bank angle	22 degrees
Max Rotation speed (pusher)	7000 rpm
Max Rotation speed (quad)	7000 rpm



Operating Temperature Range	10C to 50C
GNSS	GPS, GLONASS
Operating Frequency	900 MHz, 2.4 GHz
Transmission Power (EIRP)	3 dB
Hovering Accuracy Range	0.5 m radius

Main Battery

Specification	Value
Battery Capacity	8200mah
Voltage	37V
Max Charging Voltage	42V
Battery Type	Li-ion
Energy	303.3Wh
Weight	1440gm
Charging Temperature Range	40-60 deg C
Max Charging Power	303.3Wh

Secondary Battery

Specification	Value
Battery Capacity	6000mah
Voltage	22.2V
Max Charging Voltage	25.2V
Battery Type	Li-polymer
Energy	133Wh



Weight	840gm
Charging Temperature Range	40-60 deg C
Max Charging Power	150Wh

App

App	DroneFly
Required Operating System	Android v6.0 or later

Charger

Specifications	Values
Input	220 VAC
Output	25.2 VDC
Rated Power	350 Wh

Calibrating the Compass

It is recommended that the compass is calibrated in any of the following situations when flying outdoors:

1. Flying at a location further than 31 miles (50 km) away from the location the drone was last flown.
2. The aircraft has not been flown for more than 30 days.
3. A compass interference warning appears in Ground control software.

