

Marvelmind DJI Autonomous Flight Manual

V2025_01_09

www.marvelmind.com

Contents

1.	Executive Summary	4
2.	Supported DJI Drones.....	5
3.	Example Case.....	6
4.	Drone Control Menu.....	8
4.1.	Telemetry and Status Messages	10
4.2.	Flight and Calibration Paths Windows.....	11
4.3.	Drone Control Panels	13
4.3.1.	Path Execution Control Buttons	14
4.3.2.	Manual Control Buttons.....	15
4.3.3.	Additional Flight Options	16
4.4.	Telemetry and QR Detection Log Panels	17
4.5.	Checkpoint Indicators	18
4.6.	Drone Location Data.....	19
4.7.	Calibration Result and Settings	20
5.	Flight Preparation.....	21
5.1.	Safety Net.....	22
5.2.	Spare Propellers	23
6.	Flight Setup	24
6.1.	What Beacon to Use as Mobile Beacon?	25
6.2.	Lightening Super-Beacon	26
6.3.	Lightening Beacon Mini-TX.....	27
6.4.	Phone Requirements	28
6.5.	System Setup	29
6.6.	Flight Calibration.....	35
6.7.	Flight Path Setup	38
6.7.1.	Manual Change of Z-coordinates	40
6.7.2.	Additional Waypoint Parameters	43
7.	Advanced Settings	44
7.1.	Details and Advanced Settings.....	45
7.2.	Drone Command Language	49
8.	Troubleshooting.....	51
9.	Contacts	52

Version changes

V2025_01_09

- Basic polishing and updating

V2024_12_02

- Chapters 4.3...4.7 are added
- Chapters 7.1., 7.2. are added

V2024_11_29

- Chapter 5.2. is updated
- Chapters 4.1., 4.2. are added

V2024_11_28

- Chapters 5.1., 5.2. are added

V2024_11_25

- Chapters 4.1., 4.3., 4.5., 4.6. are added
- Chapters 4.7. and 4.8. were moved to 4.7.1. and 4.7.2. respectively

V2024_11_19

- "Setup Instruction" chapter is added

V2024_11_12

- Initial manual release

1. Executive Summary

Marvelmind developed an integration system for the Marvelmind Indoor Navigation System with DJI drones to provide autonomous indoor flight, tracking, and other utilities. Using the DJI Mobile SDK, we developed a unique Android app that connects to a DJI Remote Controller. This app, together with Marvelmind Dashboard on a computer, allows users to set the flight path fully autonomously indoors and execute tasks, such as taking pictures, scanning QR codes, sending location data, etc.

Marvelmind Indoor Navigation System supports up to 250 beacons per modem to cover a huge area. For example, 4 stationary beacons cover up to 1000 m² indoors. If you need more than 250 beacons in the system, you can use the Multi-Modem Architecture for very large networks (check chapter 2.2.4. [here](#)). Additionally, the navigation system can work outdoors if necessary.

This manual assumes the user is familiar with the Marvelmind Indoor Navigation System and does not contain instructions on how to set up one.

For more information on gathering a Marvelmind Indoor Navigation System, check the links below:

- [Marvelmind Indoor Navigation System Operating Manual](#)
- [Marvelmind presentation](#)
- [YouTube](#)
- [Website](#)



2. Supported DJI Drones

Below is a list of supported drones (25.Nov.2024):

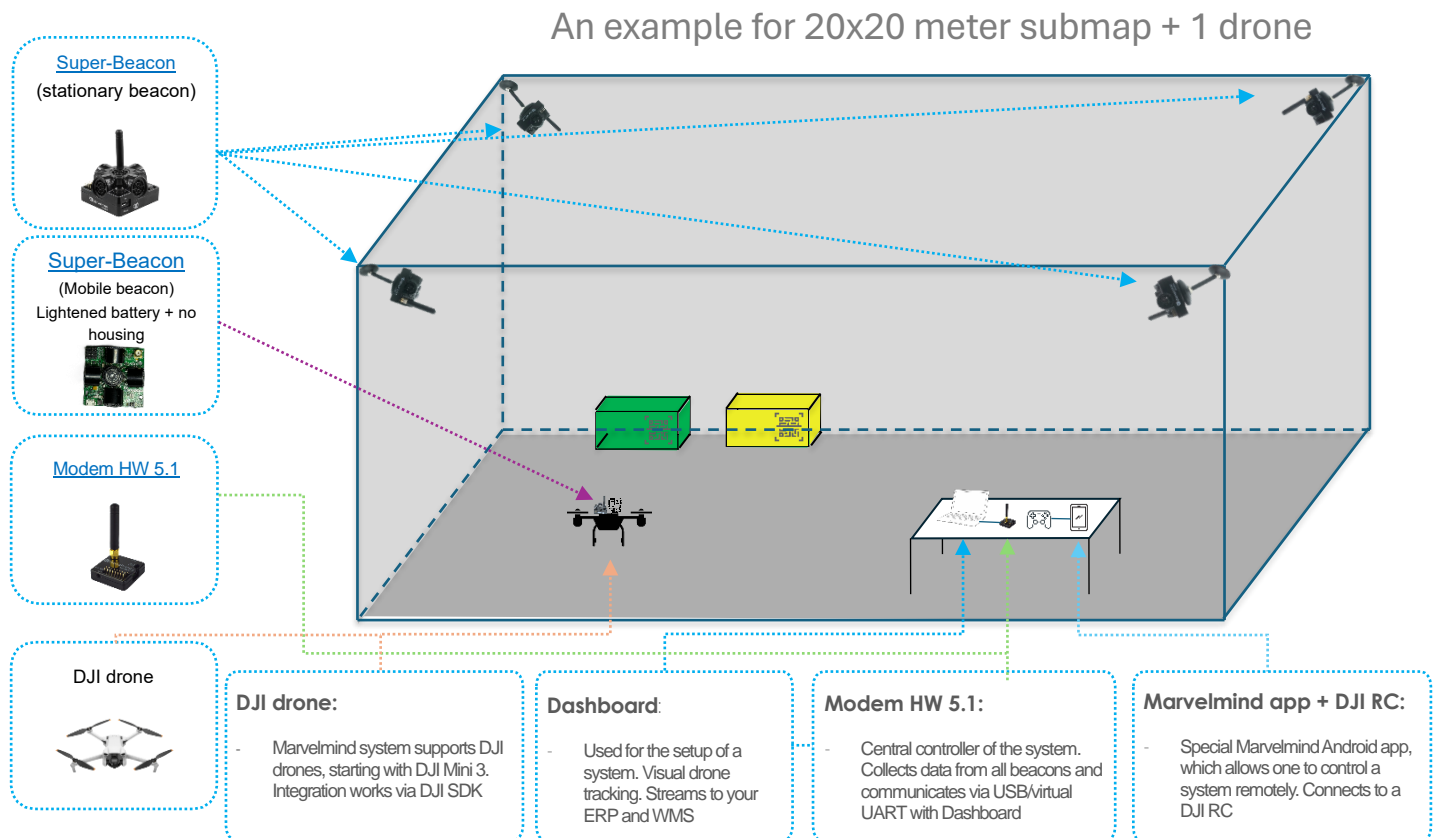
DRONE	RC	EARLIEST COMPATIBLE VERSION OF MSDK
MATRICE 350 RTK*	DJI RC Plus	5.4.0
MATRICE 300 RTK*	DJI RC Plus	5.4.0
MATRICE 300 RTK*	DJI RC Enterprise with Screen	5.0.0
DJI MINI 3	DJI RC N1	5.3.0
DJI MINI 3 PRO	DJI RC N1 DJI RC Pro	5.3.0
DJI MAVIC 3 M*	DJI RC Pro Enterprise	5.2.0
DJI MAVIC 3 ENTERPRISE SERIES*	DJI RC Pro Enterprise	5.1.0
MATRICE 30 SERIES*	DJI RC Plus	5.0.0

**Expected to work well because it supports MSDK 5.0 but wasn't tested. We can perform your tests on request. Request us by email info@marvelmind.com*

All the tests were performed on DJI Mini 3 with DJI RC N1; the instructions below are based on it.

3. Example Case

Below is an example case using a DJI drone with the Marvelmind Indoor Navigation System. **The example is limited to introductory purposes; the system isn't limited to 20x20 meters. For example, Multi-modem architecture supports thousands of square meters (check Chapter 2.2.4 [here](#)).**



Task:

- To provide an autonomous indoor flight for DJI drones
- Automatically take pictures, scan QR codes, send location data

Solution:

- Marvelmind Indoor “GPS” system with a Marvelmind app for autonomous flight

Principle of operation:

- The Marvelmind Indoor GPS system in this configuration provides tracking an autonomous flight of a DJI drone using DJI SDK

Result:

- DJI drones autonomously flying according to waypoints in the Dashboard, taking pictures or scanning and recognizing QR/bar codes, and sending them along with their precise coordinates to WMS or ERP
- Autonomous return to the base

Configuration:

1. 4 x [Super-Beacon](#) – stationary beacons
2. 1 x [Super-Beacon \(lightened\)](#) – a mobile beacon
3. 1 x [Modem HW 5.1](#) – a central controller of a system
4. 1 x DJI drone – a trackable object ([Supported DJI drones](#))
5. 1 x DJI RC + Android phone with a Marvelmind DJI app – a controller of an autonomously fly pattern of a drone
6. 1 x Windows/Linux laptop – used to install Dashboard and set up a system



4. Drone Control Menu

We developed a special functional menu for drone control. It contains everything the user needs to set up a path, control the drone, manage waypoints, calibrate the drone, and more. This chapter describes its vital functions.

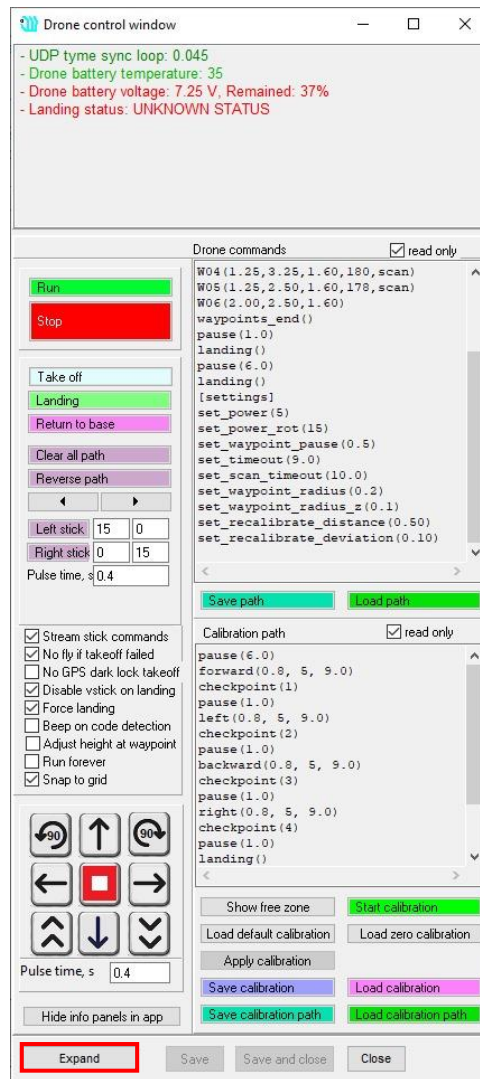
Below is a picture of the menu:

The screenshot displays the 'Drone control window' interface, which is divided into several functional areas:

- Status Panel (Top Left):** Shows system metrics such as 'UDP time sync loop: 0.029', 'Drone battery temperature: 31', 'Drone battery voltage: 8.15 V, Remained: 93%', and 'Landing status: UNKNOWN STATUS'.
- Connection Status (Top Right):** Indicates 'Marvelmind Android drone app connected via UDP', 'RC connected: DJI_RC_N1_S', and 'Drone status: Ready to GO'.
- Drone Commands (Middle Left):** A list of commands including 'takeoff()', 'pause(6.0)', 'waypoints_begin()', and a series of waypoints (W01 to W10) with coordinates. It includes buttons for 'Run', 'Stop', 'Take off', 'Landing', 'Return to base', 'Clear all path', and 'Reverse path'.
- Drone Telemetry Log (Middle Center):** A scrollable log showing the execution of commands and the current status of the drone.
- Calibration Path (Bottom Left):** A section for setting up a calibration path with commands like 'forward(0.8, 5, 9.0)', 'left(0.8, 5, 9.0)', etc., and buttons for 'Start calibration', 'Apply calibration', and 'Save calibration'.
- Control Panels (Bottom Left):** Includes 'Left stick' and 'Right stick' controls with numerical values, 'Pulse time, s' input, and a 'Reduce' button highlighted in red.
- QR Code Detection (Bottom Center):** A section for QR code scanning, currently displaying 'QR code not detected'.
- Settings Panel (Right):** A comprehensive settings menu with tabs for 'Read all', 'Write all', 'Write changes', and 'Cancel changes'. It lists various parameters like 'APP version', 'SDK version', 'Power scale', 'Reply timeout', 'App command timeout', 'Hedge address', 'Vision positioning', 'Precision landing', 'Radar connected', 'Virtual stick roll/pitch mode', 'Angle calibration correction in flight', 'Default flight height', 'Use waypoints Z', 'Fly in dark/no GPS conditions', 'Virtual stick enable 10Hz', 'Improved recalibration', 'Yaw scan during QR reading', 'Show only camera when scanning code', 'Camera work during all flight', 'Flight parameters', 'Obstacle avoidance', 'Colors in App', and 'UDP settings'.
- Bottom Bar:** Contains buttons for 'Reset', 'Sleep', 'Wake up', 'Time sync', 'Ctrl', 'Deep sleep', and 'Default'.

To open a miniature version of the menu, press the “Reduce” button.

Below is a smaller version of the menu:



To open a large version, press the “Expand” button.

Next chapters explain different parts of the menu.

4.1. Telemetry and Status Messages

Below are two panels of telemetry and status messages, respectively:

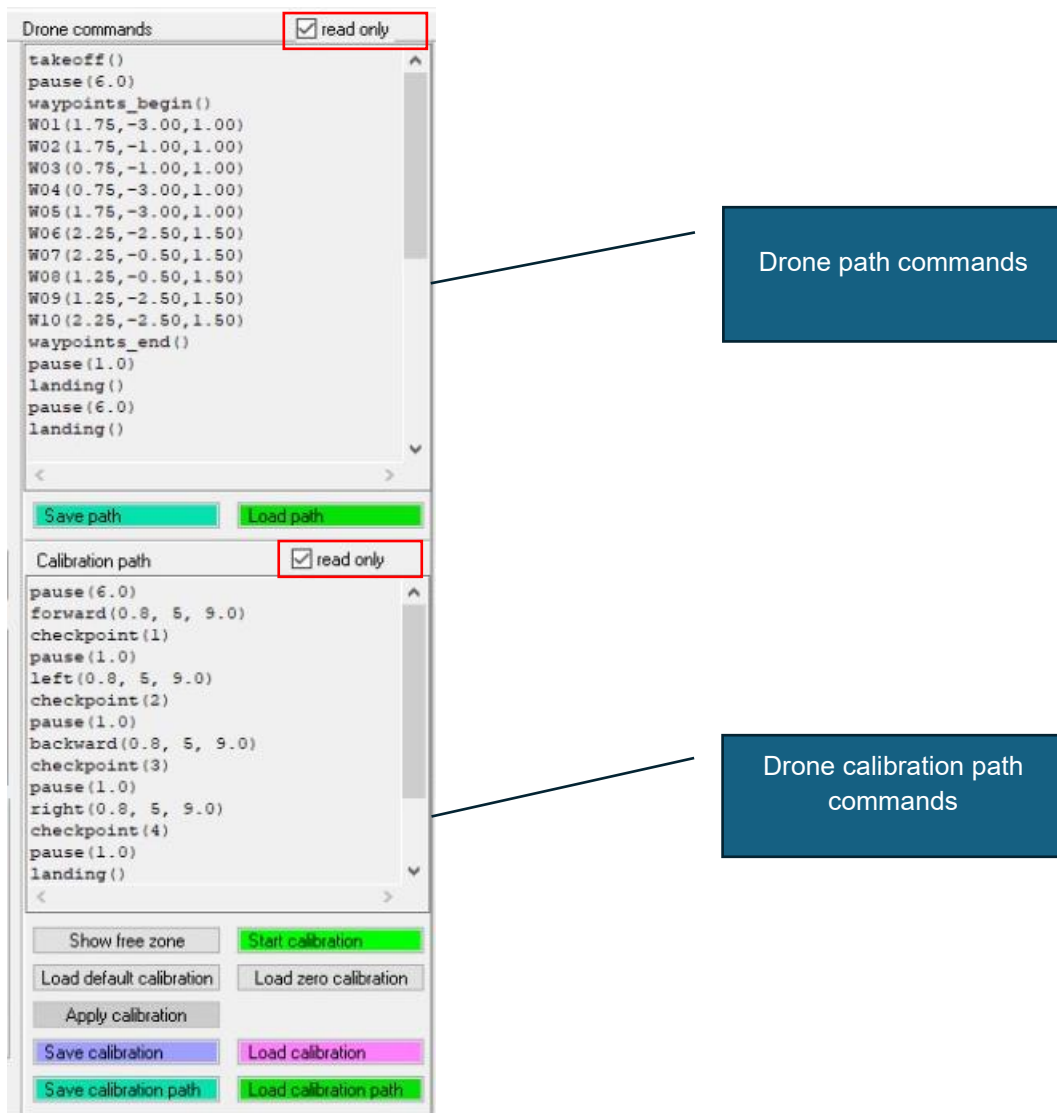
<ul style="list-style-type: none">- UDP tyme sync loop: 0.029- Drone battery temperature: 31- Drone battery voltage: 8.15 V, Remained: 93%- Landing status: UNKNOWN STATUS	<ul style="list-style-type: none">- Marvelmind Android drone app connected via UDP.- RC connected: DJI_RC_N1_S- Virtual stick enabled- Calibration applied. Drone ready to go.- Camera status: LEFT_OR_MAIN. Count= 1- Flight mode: GPS_NORMAL- Drone status: Ready to GO
---	---

Drone telemetry
messages

Drone and application
status messages

4.2. Flight and Calibration Paths Windows

Below are two command panels for path and calibration paths:



To manually change commands, uncheck the “Read only” mark.

Drone Path:

- Save path – saves a path to a file
- Load path – loads a path from a file

Drone Calibration Path:

- Show free zone — show on the map the area where the drone can fly during calibration.
- Start calibration – start execution of calibration (commands from the ‘calibration path’ panel)
- Load default calibration – load default calibration setting (without flight)
- Load zero calibration – loads zero calibration settings (without flight)

- Apply calibration – applies the calibration results (executed during the calibration flight or loaded by default or zero calibration button)
- Save calibration – save calibration settings to a file
- Load calibration – load calibration settings from a file
- Save calibration path – saves a calibration path to a file
- Load calibration path – loads a calibration path from a file

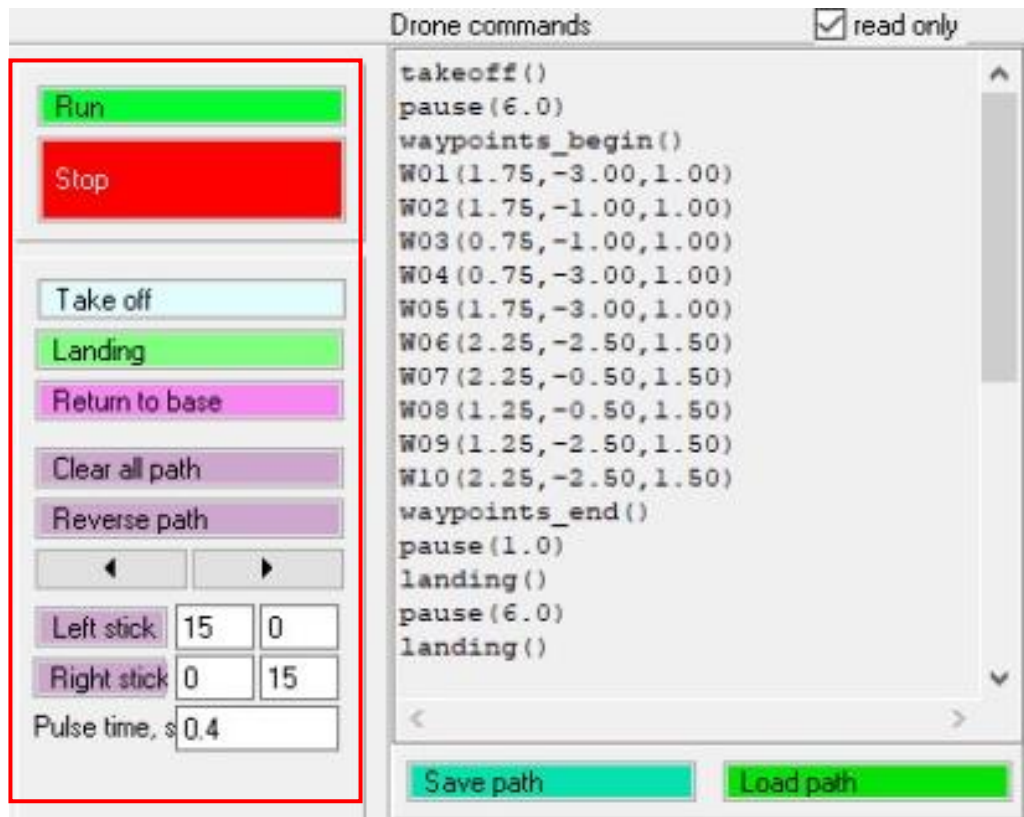
For more info about calibration, check the related [chapter](#).

4.3. Drone Control Panels

Below are chapters with specific control areas and functions.

4.3.1. Path Execution Control Buttons

Below is a panel to execute the path containing commands from the “Drone commands” window.



- Run – start execution of the flight (from the “Drone commands” window). Changes to ‘pause’ / ‘continue’ during flight
- Pause – causes the drone to hover at the current point
- Continue – continue the flight
- Stop – stops the drone and terminates command sequence execution
- Take off – take off the drone; works only when the drone is still not in flight. The drone starts rotors, moves to a height of 5 feet, and hovers
- Landing – executes landing (if the drone is in flight)
- Return to base – terminates the command sequence execution and returns to the starting point (when the drone is in flight)
- Clear all paths – remove all waypoints
- Reverse path – reverse the waypoint sequence (first waypoint becomes last and last becomes first)
- Left/right arrows – select which waypoint will be the first one
- Left/right stick – manual command to left or right virtual stick. Digits in the fields on the right – X, Y “coordinates” of the stick (for test purposes)
- Pulse time – minimum time of applying a corresponding movement

4.3.2. Manual Control Buttons

You can manually control the drone with the arrows in the bottom left corner of the menu. Additionally, you can vary the power of rotors in the top left window for each direction.

Pulse time – minimum time for the execution of a single command

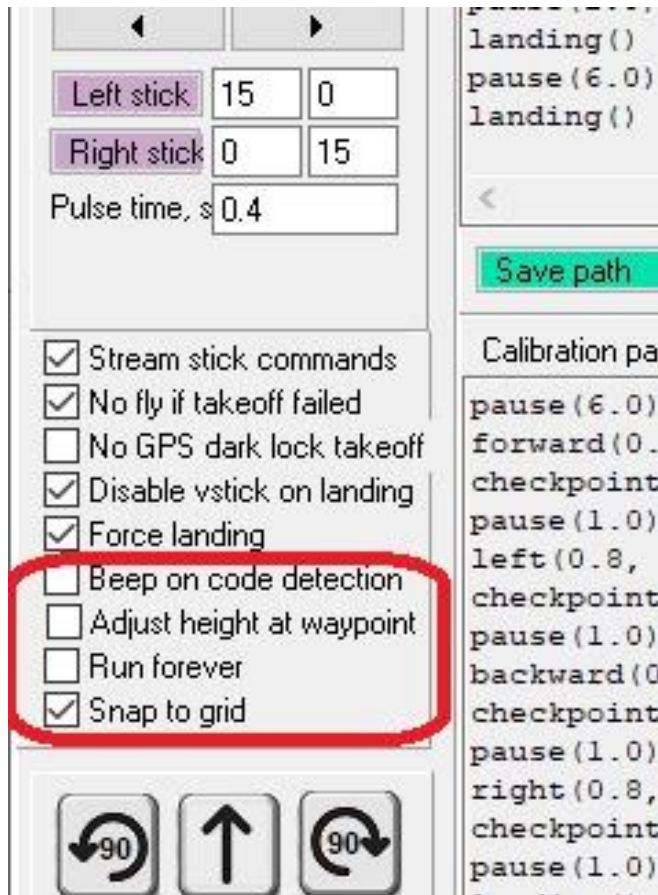
The screenshot displays a drone control application interface. On the left, there are several control panels. The bottom-left panel contains manual control buttons: a red square in the center, surrounded by eight directional arrows (up, down, left, right, and four 90-degree rotations). A red box highlights these buttons, and a red arrow points from this box to the rotor power table on the right. The rotor power table is also highlighted with a red box. It shows the pulse values for various commands across four rotors (LX, LY, RX, RY).

	LX	LY	RX	RY	Pulse
Forward 0.5m	0	0	0	5	0.4
Backward 0.5m	0	0	0	-5	0.4
Left 0.5m	0	0	-5	0	0.4
Right 0.5m	0	0	5	0	0.4
Rotate left 90	-45	0	0	0	0.4
Rotate right 90	45	0	0	0	0.4
Up 0.5m	0	5	0	0	0.4
Down 0.5m	0	-5	0	0	0.4

Below the table, there are input fields for 'Apply power to all' (value: 15) and 'Apply pulse to all' (value: 0.4). The interface also shows a 'Drone commands' list, a 'Calibration path' list, and various status indicators like 'QR code not detected' and 'Angle, deg 45.40'.

4.3.3. Additional Flight Options

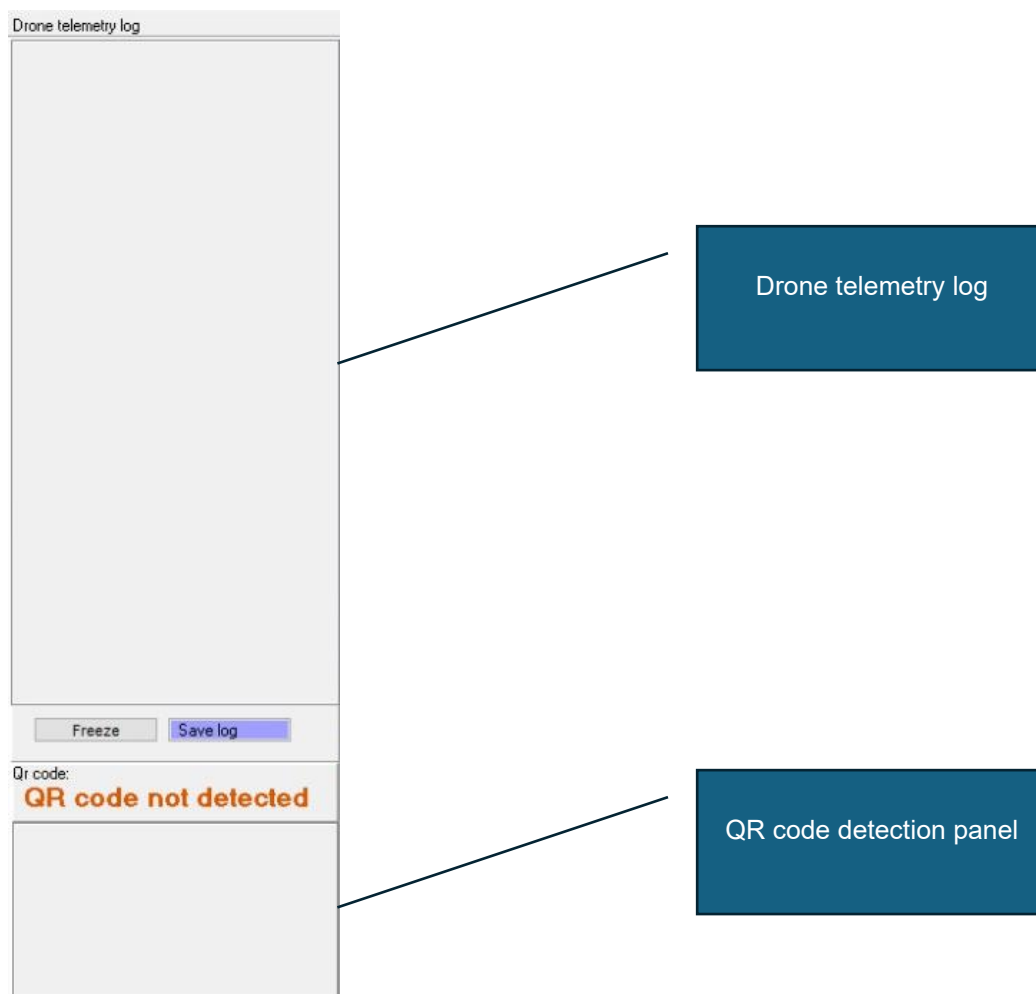
You can turn on additional flight parameters for the drone flight. Below is the description of four options. The other five will be disabled in future updates.



- Beep on code detection – the phone will indicate by sound attempts to recognize and successful/unsuccessful recognition of the QR code by the drone's camera
- Adjust height at waypoint – the drone will adjust its height to the waypoint height setting (move up or down) after achieving the waypoint by X, Y
- Run forever – the drone will execute moving through waypoints infinitely in the loop without landing. Press "stop" or "return to base" commands to stop the drone
- Snap to grid – snap waypoints to the map grid while placing or moving them on the dashboard map

4.4. Telemetry and QR Detection Log Panels

You can dynamically check changes in the drone's state. Below the telemetry log, you can also check the QR code detection status and QR code detection log.



- Freeze – freeze filling the flight log window
- Save log – save the flight log to the file

4.5. Checkpoint Indicators

You can add specific checkpoints to the program. These checkpoints will highlight when the drone reaches a particular point.

The screenshot shows a drone control interface with a code editor on the left and a control panel on the right. The code editor contains a flight path with four checkpoints. Red arrows point from the 'checkpoint(1)' through 'checkpoint(4)' commands to numbered indicator buttons (1-8) in the control panel. The control panel displays flight data, calibration tables, and status messages.

```
W04(0.75,-3.00,1.00)
W05(1.75,-3.00,1.00)
W06(2.25,-2.50,1.50)
W07(2.25,-0.50,1.50)
W08(1.25,-0.50,1.50)
W09(1.25,-2.50,1.50)
W10(2.25,-2.50,1.50)
waypoints_end()
pause(1.0)
landing()
pause(6.0)
landing()
```

Save path Load path

Calibration path read only

```
pause(6.0)
forward(0.8, 5, 9.0)
checkpoint(1)
pause(1.0)
left(0.8, 5, 9.0)
checkpoint(2)
pause(1.0)
backward(0.8, 5, 9.0)
checkpoint(3)
pause(1.0)
right(0.8, 5, 9.0)
checkpoint(4)
pause(1.0)
landing()
```

Show free zone Start calibration

Load default calibration Load zero calibration

Apply calibration

Save calibration Load calibration

Save calibration path Load calibration path

Rotate left 90	-45	0	0	0	0.4
Rotate right 90	45	0	0	0	0.4
Up 0.5m	0	5	0	0	0.4
Down 0.5m	0	-5	0	0	0.4

Apply power to all 15

Apply pulse to all 0.4

1 2 3 4 5 6 7 8

Start location 0.00 0.00 0.00

Current location 2.06 0.50 1.49

Target location 0.00 0.00

Freeze Save log

Qr code:
QR code not detected

Calibration: Overlay distances, m

	Needed	Flown	Delta	Samples
Forward, m	0.80	0.89	0.09	0
Backward, m	0.80	0.95	0.15	0
Left, m	0.80	0.94	0.14	0
Right, m	0.80	1.04	0.24	0

Angle, deg 45.40

Calibration applied. Drone ready to go.

Discard,% Max sigma,% Min delta, m Max delta

0	20	-0.20	1.00
---	----	-------	------

no saved calibrations

<-- Prev Next -->

Save Save and close Close Freeze Capture Clear captures Clear

4.6. Drone Location Data

Below is the drone location data panel. The coordinates of the points are shown in the X, Y, and Z systems.

It contains of:

- Flight start location
- Current drone location
- Current target location

The screenshot displays the drone location data panel. At the top, there are two input fields: "Apply power to all" with a value of 15, and "Apply pulse to all" with a value of 0.4. Below these are eight numbered buttons (1-8). A red rounded rectangle highlights the location data section, which includes:

	X	Y	Z
Start location	0.00	0.00	0.00
Current location	2.06	0.50	1.49
Target location	0.00	0.00	

Below the location data is a calibration table for overfly distances in meters:

	Needed	Flown	Delta	Samples
Forward, m	0.80	0.89	0.09	0
Backward, m	0.80	0.95	0.15	0
Left, m	0.80	0.94	0.14	0

4.7. Calibration Result and Settings

Calibration determines the overflight distance during the drone's forward, backward, left, and right movement and orientation angle.

For more information about the calibration, check the [Flight Calibration](#) chapter.

The screenshot displays a drone's calibration interface. At the top, it shows location data in X, Y, and Z coordinates. Below this is a table for calibration results, which is highlighted with a red box. The table includes columns for movement type, Needed Flown, Delta, and Samples. The Delta values are highlighted in green. Below the table, the current angle is shown as 45.40 degrees, also highlighted in green. A green message indicates that calibration is applied and the drone is ready to go. At the bottom, there are buttons for Freeze, Save log, and other settings.

	X	Y	Z
Start location	0.00	0.00	0.00
Current location	2.06	0.50	1.49
Target location	0.00	0.00	

	Needed Flown	Delta	Samples
Forward, m	0.80	0.89	0.09
Backward, m	0.80	0.95	0.15
Left, m	0.80	0.94	0.14
Right, m	0.80	1.04	0.24
Angle, deg	45.40		0

Calibration applied. Drone ready to go.

Discard, %	Max sigma, %	Min delta, m	Max delta
0	20	-0.20	1.00

no saved calibrations

<- Prev Next ->

Freeze Capture Clear captures Clear

Reset Sle Ctrl Deep

5. Flight Preparation

We recommend that you complete some prerequisites before you start your flight. This chapter lists some valuable things to do before the flight.

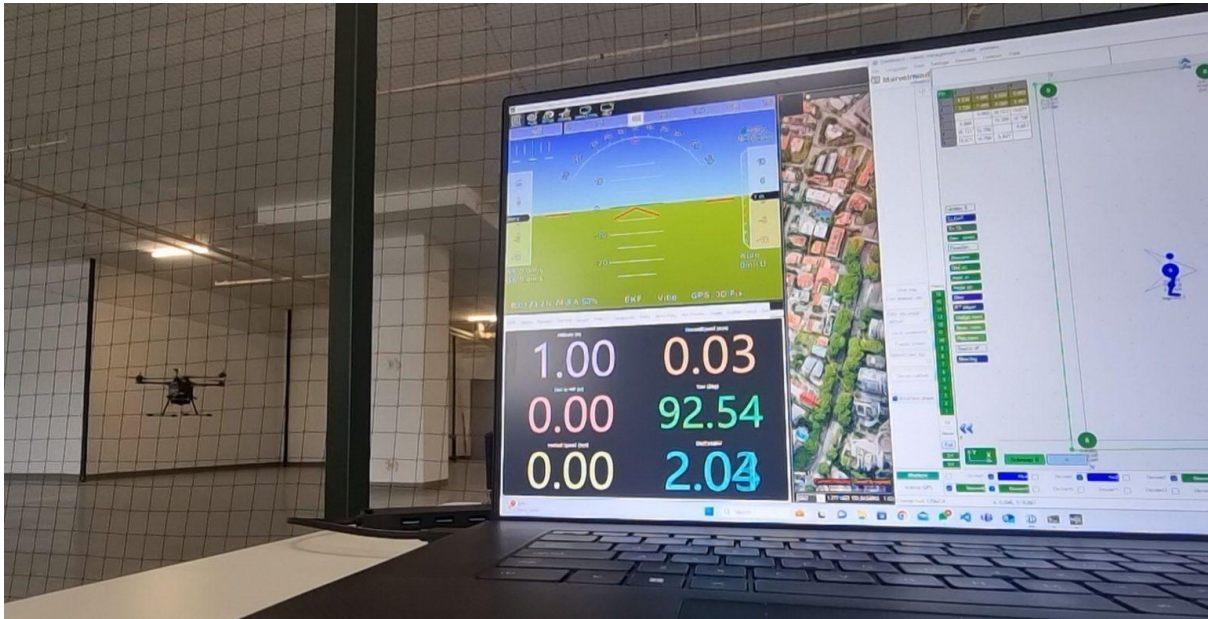
5.1. Safety Net

We recommend making the flight area safe and surrounding it with a safety net. To make it safe, attach the net to the ceiling and add some weight to the bottom to prevent it from unnecessary moves.

Here is the list with videos as an example where we use a safety net:

- [Fully autonomous flight indoors](#)
- [Demo: tracking mini-copter indoors](#)

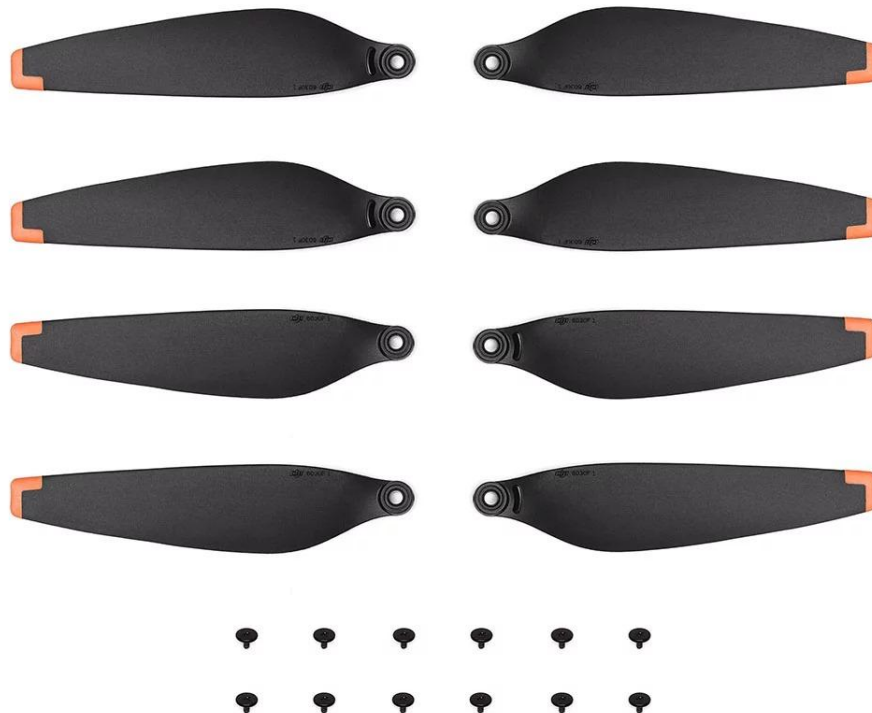
Below are some photos as an example:



5.2. Spare Propellers

We recommend having spare propellers for smooth drone usage because unexpected things can happen sometimes. Combined with a safety net, you decrease the chance of breaking the drone completely.

If the drone's flight becomes poor in manual mode, change ALL propellers. Mixing bad and good propellers can cause problems in flight.



6. Flight Setup

This manual only explains the Marvelmind Indoor Navigation System integration with a DJI drone. Instructions on how to set up a Marvelmind Indoor Navigation System can be found [here](#).

Before setting up the system, don't forget to charge all the devices (inc. Beacons, drone, and RC)

Additionally, download a special SW pack for this setup from email.

6.1. What Beacon to Use as Mobile Beacon?

Two types of beacons can be used as a mobile beacon: [Super-Beacon](#) and [Beacon Mini-TX](#).

Super-Beacon has the same functionality as stationary beacons, except it should be lightened to use as a mobile beacon. It has an external antenna and full-size ultrasonic sensors, which provide better radio coverage and ultrasonic signal.

Beacon Mini-TX is a “small brother” of a Super-Beacon. It has an inner antenna and tiny sensors, but its weight is significantly smaller than Super-Beacon's. Because of this, Beacon Mini-TX has worse radio coverage and receives ultrasonic signals at a narrower angle, but it has increased maneuverability and extended flight duration.

The main differences are:

	SUPER-BEACON (LIGHTENED)	BEACON MINI-TX (LIGHTENED)
WEIGHT	~35g	~10g
ANTENNA	50mm	Embedded ceramic antenna
ULTRASONIC SENSORS	16mm	8mm

- Weight. It is much lighter than a Super-Beacon. Mini-TX's weight without housing and battery can be lowered to 6.37 grams.
- Smaller antenna. The radio coverage is smaller, so the distance may be lowered to 30-50 meters
- The sensor's diameter is smaller. The diameter is 10 mm instead of 16 mm on Super-Beacon. The stable radius is 1.5 times smaller than on Super-Beacon

To conclude, we recommend using Super-Beacon as a fully functional mobile beacon. If your system doesn't include large distances, you can use a Beacon Mini-TX as a mobile beacon to increase maneuverability and increase flight duration.

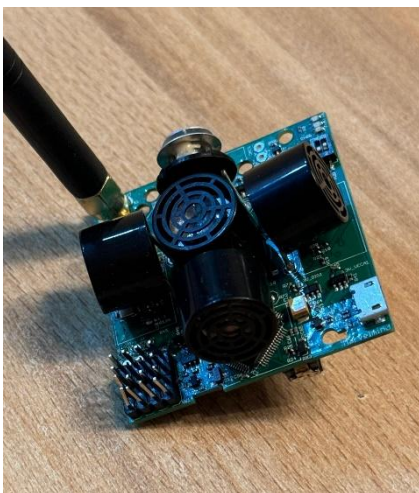


Figure 1. Lightened Super-Beacon



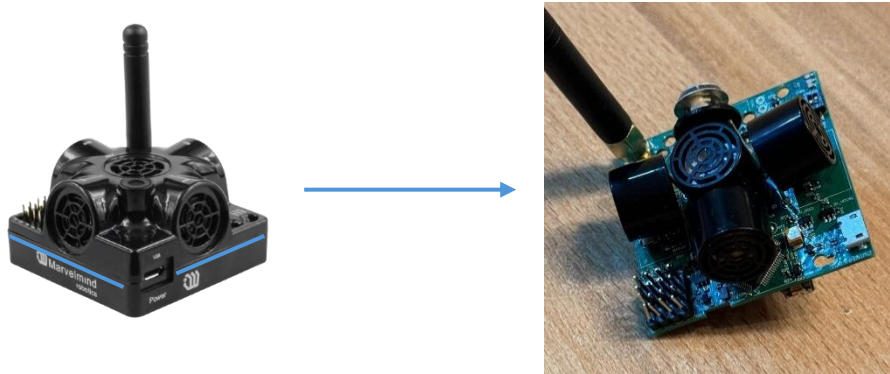
Figure 2. Lightened Beacon Mini-TX

6.2. Lightning Super-Beacon

It's better to lighten Super-Beacon for better performance. Making it lightweight will increase a drone's flight duration. The process consists of removing the housing and soldering a new light battery.

Changing the battery requires soldering skills. In case you don't know how to solder, stop after Step 1.

1. Open the Super-Beacon, which will be used as a mobile beacon. Using a card or something flat, carefully detach the top part of the housing from the bottom.



The next step requires soldering.

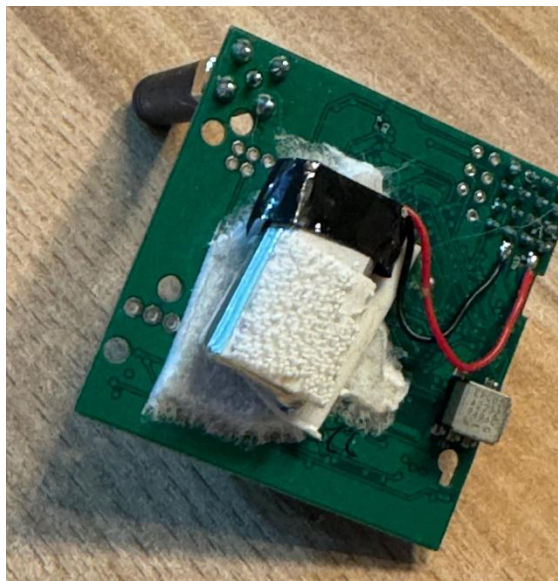
2. Carefully detach the battery from the board (it is attached with two-side tape) and unsolder the battery
3. Solder a new 100-300 mAh Li-Po battery
4. Attach it to the board with two-side tape

Requirement for the battery:

- At least 1 A & 1 ms

To achieve this, check the C-Rate for the battery and use this formula:

$$A = \text{Capacity} * \text{C-Rate}$$

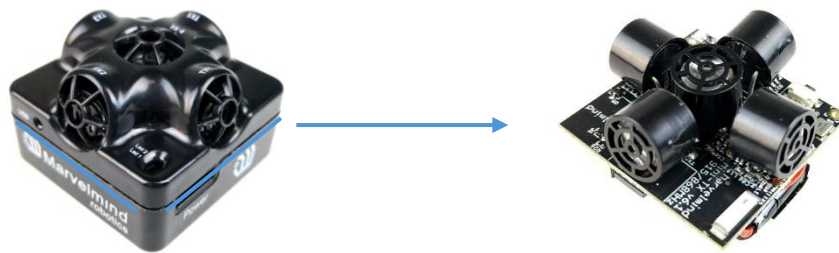


6.3. Lightning Beacon Mini-TX

You can also lighten Beacon Mini-TX for better performance. Due to its initial weight, this is not necessary, but if you want to achieve even less weight you can perform steps explained in this chapter. The process consists of removing the housing and soldering a new light battery.

Changing the battery requires soldering skills. In case you don't know how to solder, stop after Step 1.

1. Open the Beacon Mini-TX, which will be used as a mobile beacon. Using a card or something flat, carefully detach the top part of the housing from the bottom.



The next step requires soldering.

2. Carefully detach the battery from the board (it is attached with two-side tape) and unsolder the battery
3. Solder a new 100-300 mAh Li-Po battery (recommended, at least, 1 A & 1 ms)
4. Attach it to the board with two-side tape

Requirement for the battery:

- At least 1 A & 1 ms

To achieve this, check C-Rate for the battery and use this formula:

$$A = C * C\text{-Rate}$$



6.4. Phone Requirements

Minimum requirements for the phone for the system:

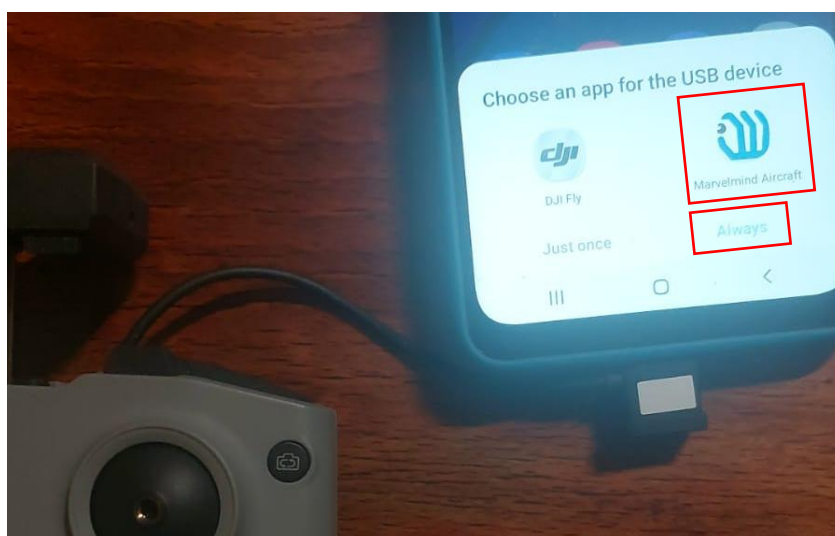
- Android 11 OS
- Type-C port
- 1080 x 2340 pixels display

6.5. System Setup

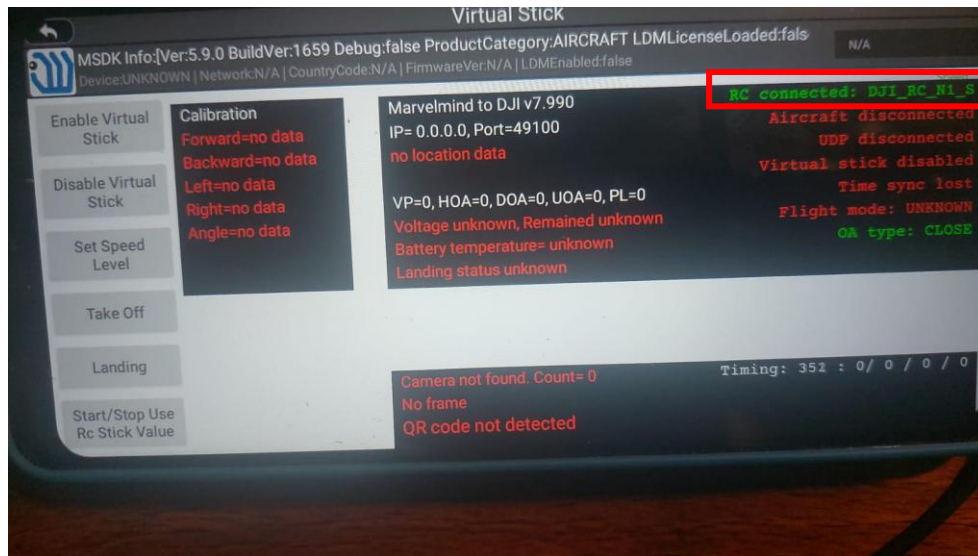
You can begin setting up the system after charging all devices and downloading the SW pack.

Below are listed the instructions:

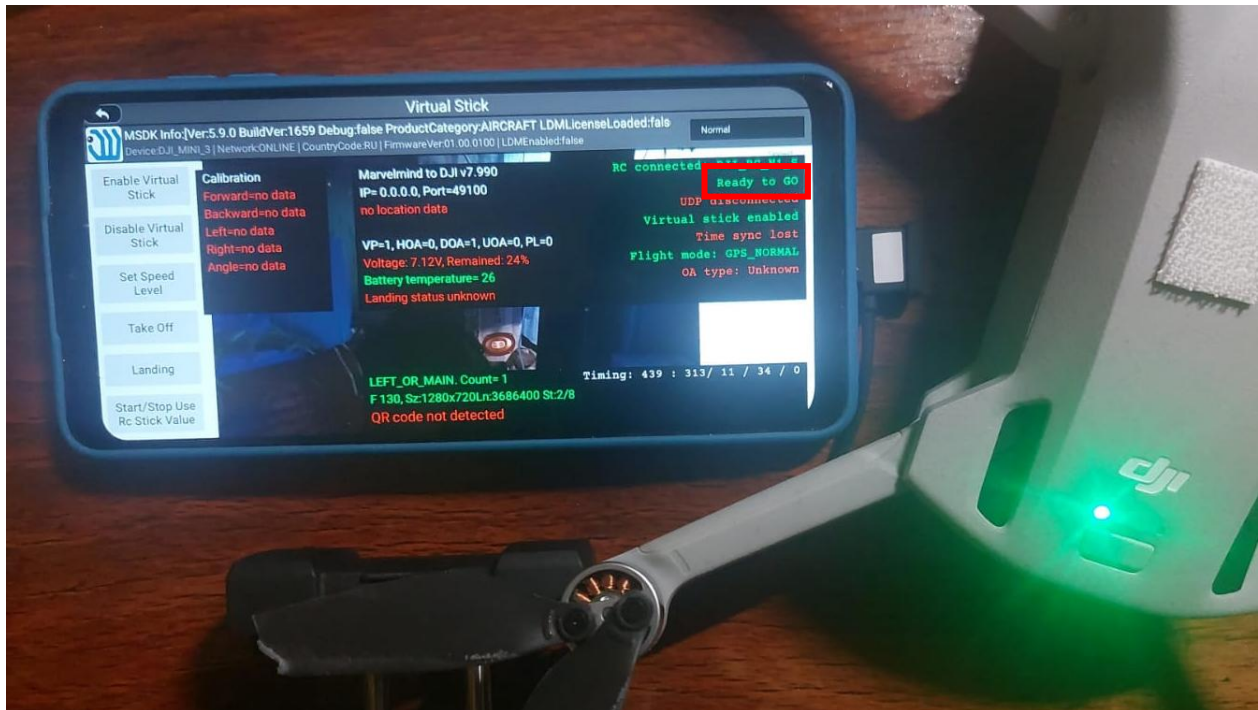
1. Open the SW pack folder
2. From the “10_Android_app_vX_XXX” folder, copy **apk** file to your Android phone
3. Install the **apk** file
4. Set up a 3D map using 3-4 stationary beacons ([Link](#) for a manual; chapter 6.3.)
 - Use the SW from the pack that is sent to you
 - In the abovementioned chapter, the map is 2D, based on 2 stationary beacons. The difference between 3D is that you will gain a Z-coordinate, and a mobile beacon can't intersect a plain of stationary beacons. This means you must place stationary beacons on the ceiling so the drone won't intersect the plain of stationary beacons
 - Check that the map isn't mirrored to the actual position of the beacons
 - No need to enter the height for a mobile beacon because it will be measured automatically
 - Before proceeding to the next step, check the tracking of a mobile beacon without a drone
5. Turn on the RC with one short and one long press on the power button
 - Before proceeding to the next step, check that the DJI drone is linked to the RC. If not, check this [YouTube video](#) by [Droneblog](#) or [DJI support blog](#)
6. Connect it to the phone using the Type-C cable on the back of the RC
7. Choose the “Marvelmind Aircraft” app and press “Always”



After connecting the RC in the app will be shown “RC connected”

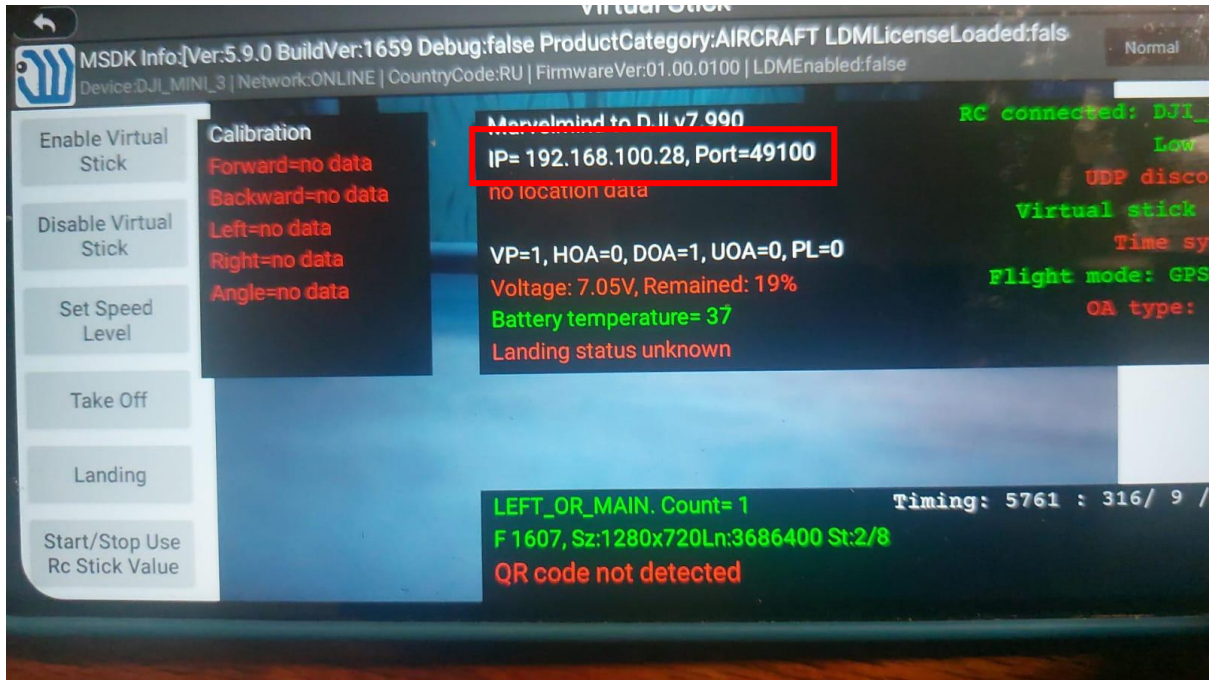


8. Turn on the drone with one short press and one long press on the power button
9. After 10-20 seconds, on the phone screen, “Ready to GO” will appear

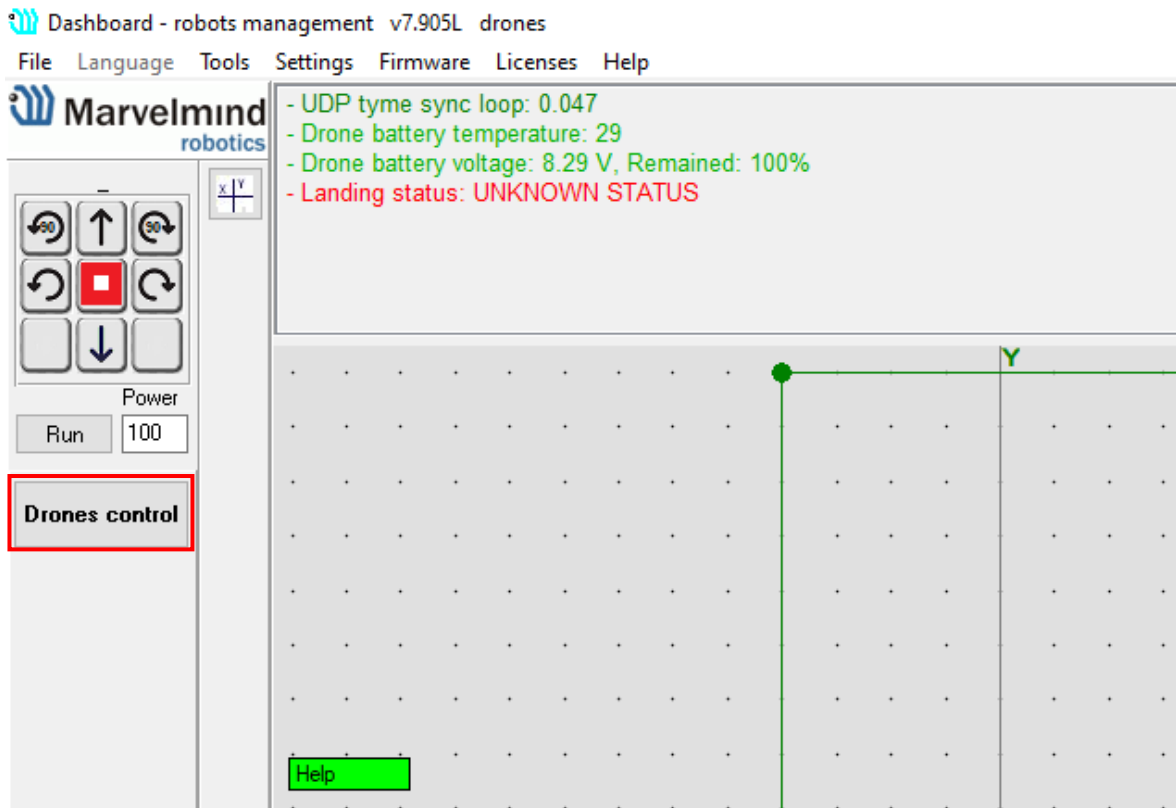


10. Turn on Wi-Fi on the phone and connect it to the same Wi-Fi network as a computer with a dashboard

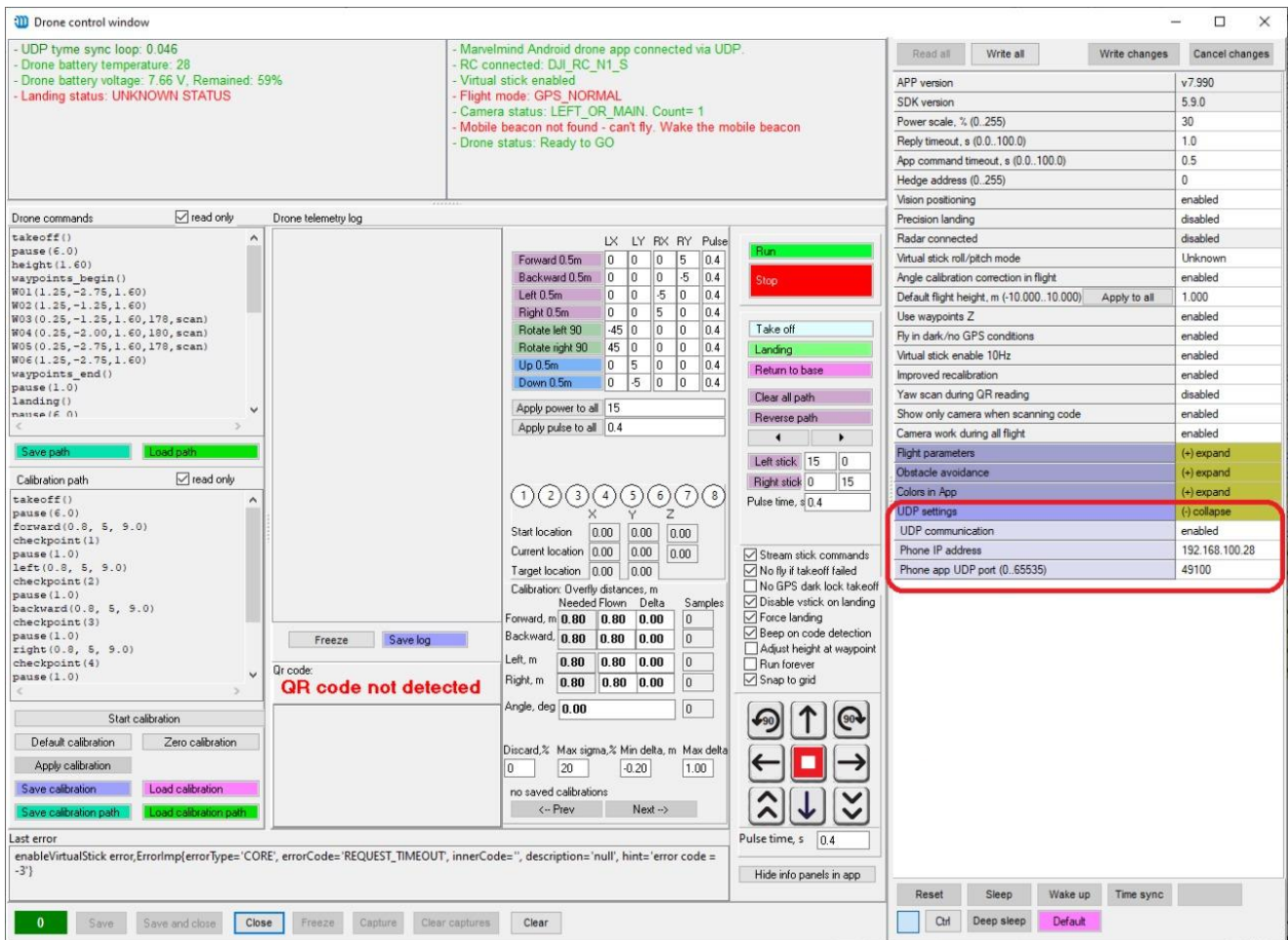
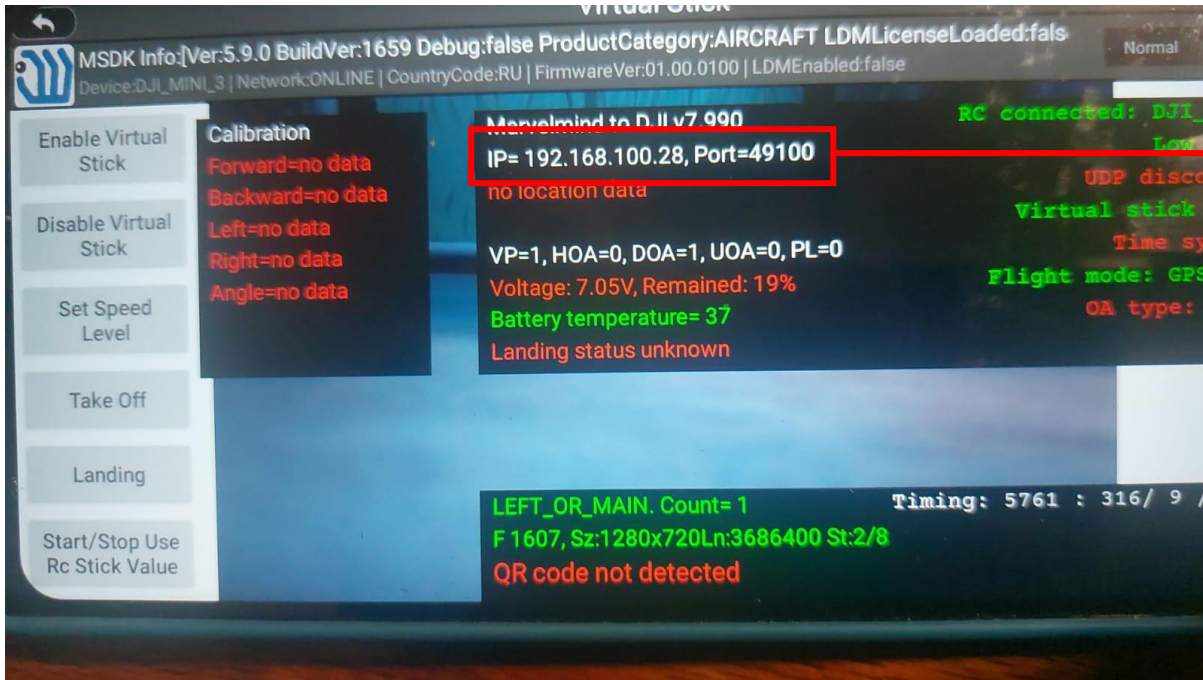
11. IP address and port will appear on the left side of the phone screen



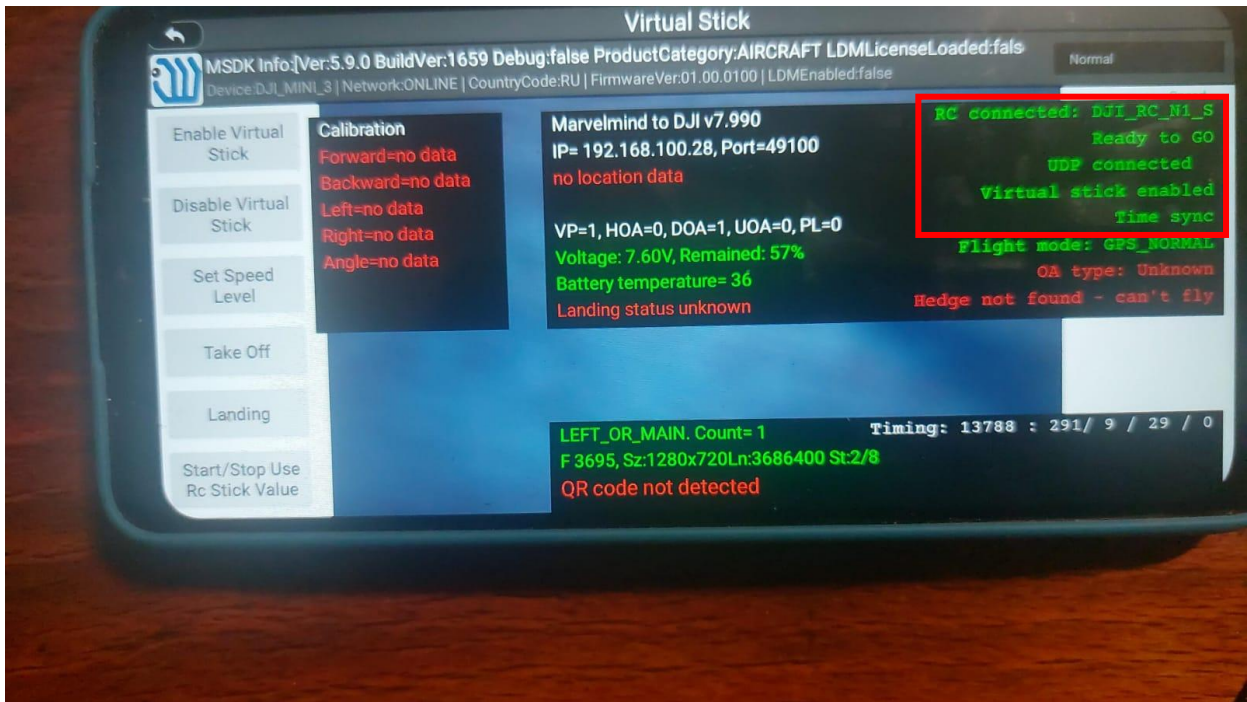
12. In the Dashboard, open the “Drone Control” window if it wasn’t opened automatically



- Enable "UDP communication" and enter the IP address and UDP port that is shown in the top left corner of the phone



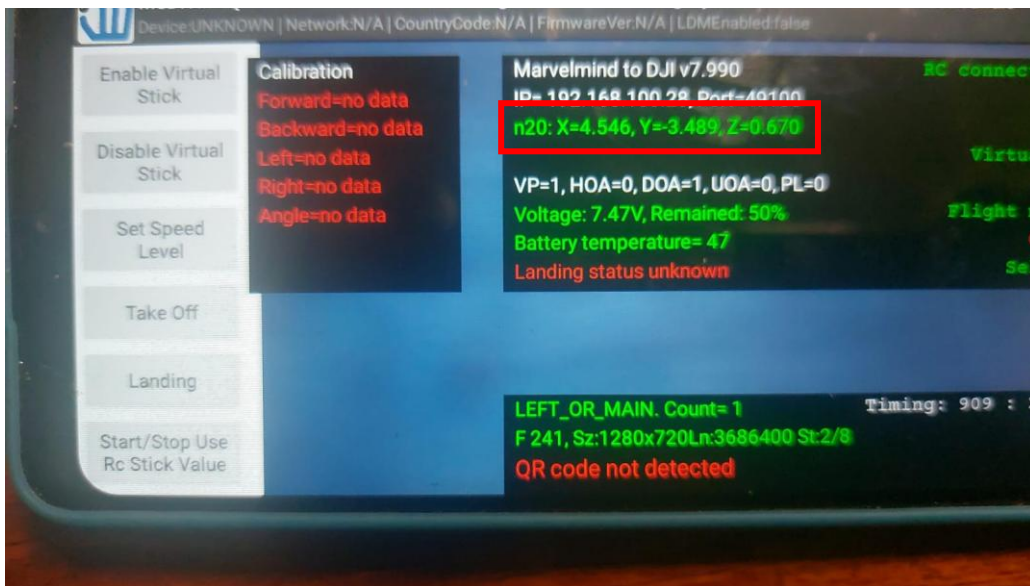
14. On the phone will appear “UDP connected” and “Time sync”



15. Attach the mobile beacon to the drone



16. Coordinates will appear on the phone



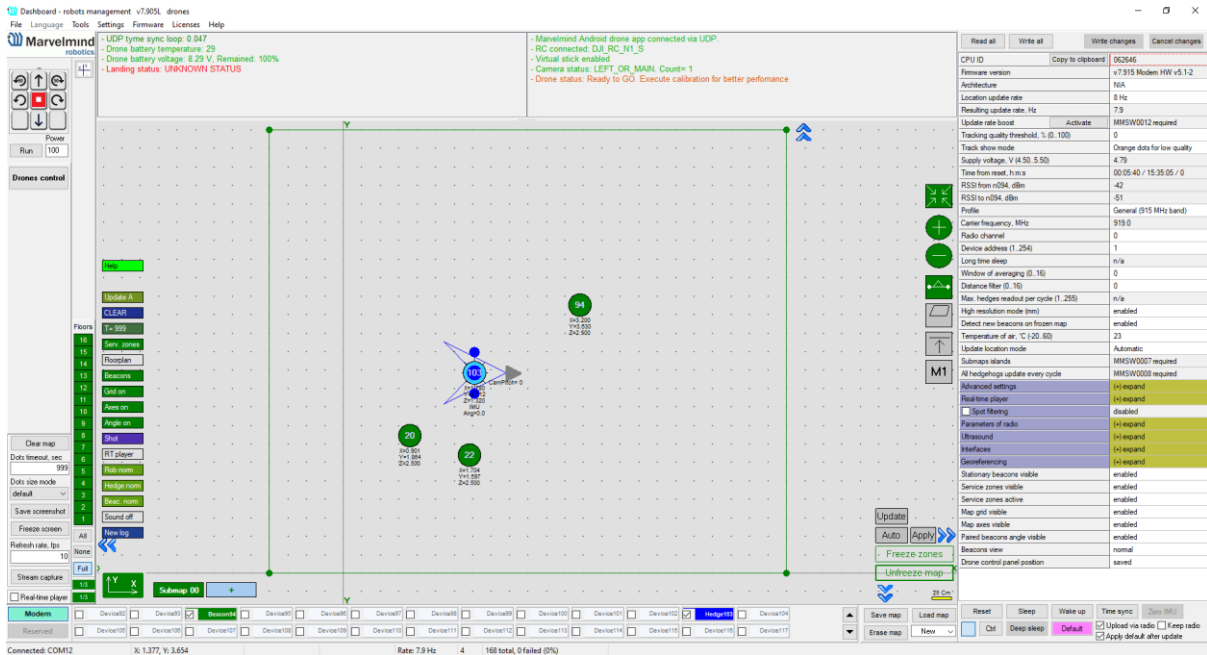
The initial setup is completed. The next chapter will describe the calibration of a waypoint flight.

6.6. Flight Calibration

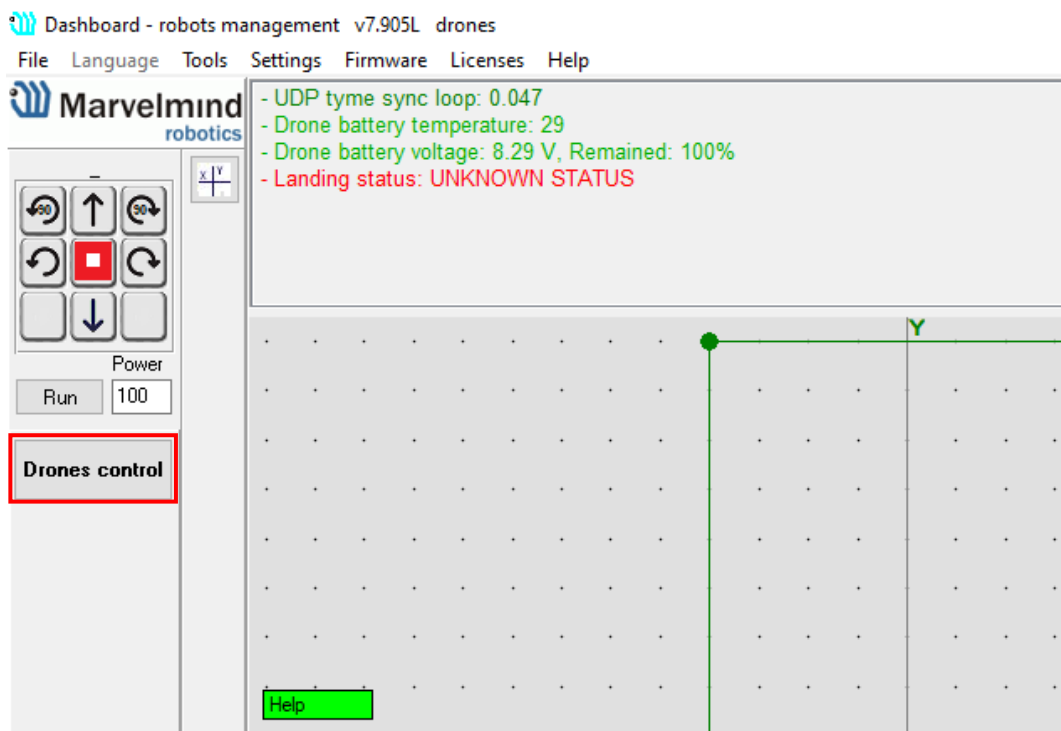
Flight calibration is necessary for a drone to fly. By default, the flight path is a square: 0.8m forward, 0.8m left, 0.8m backward, 0.8m right. Make sure that there are no obstacles on this path!

Below is the description of the calibration:

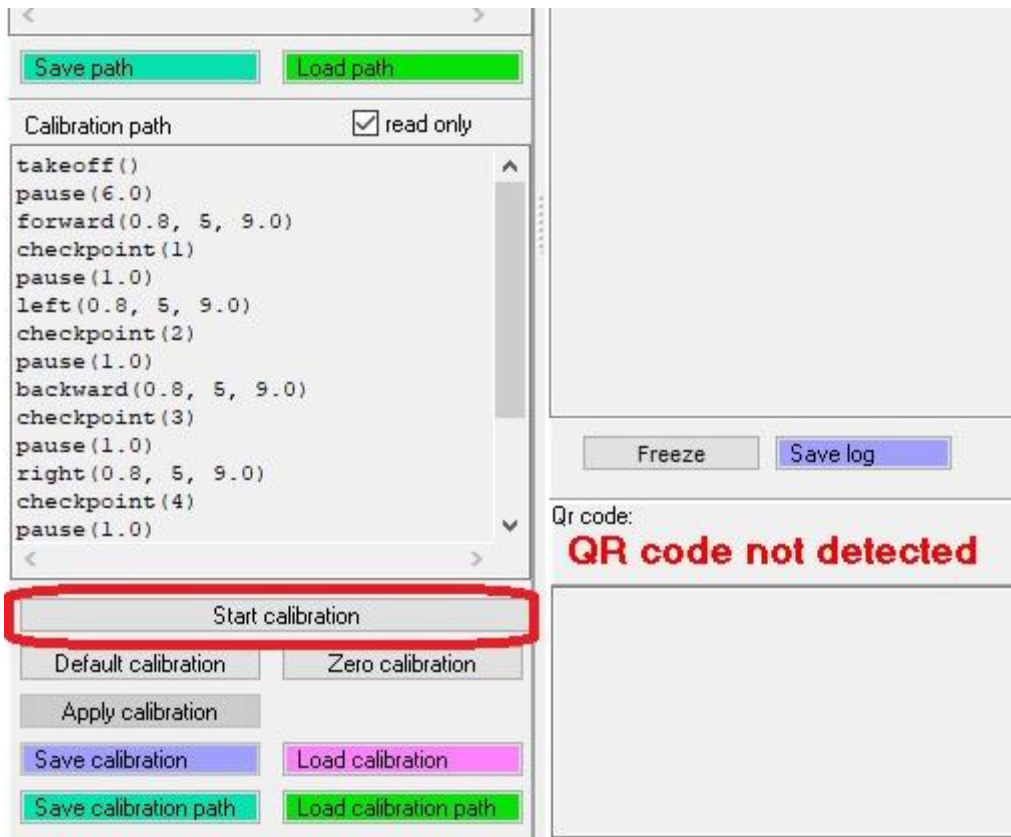
1. Place the drone in the center of a service zone of a submap



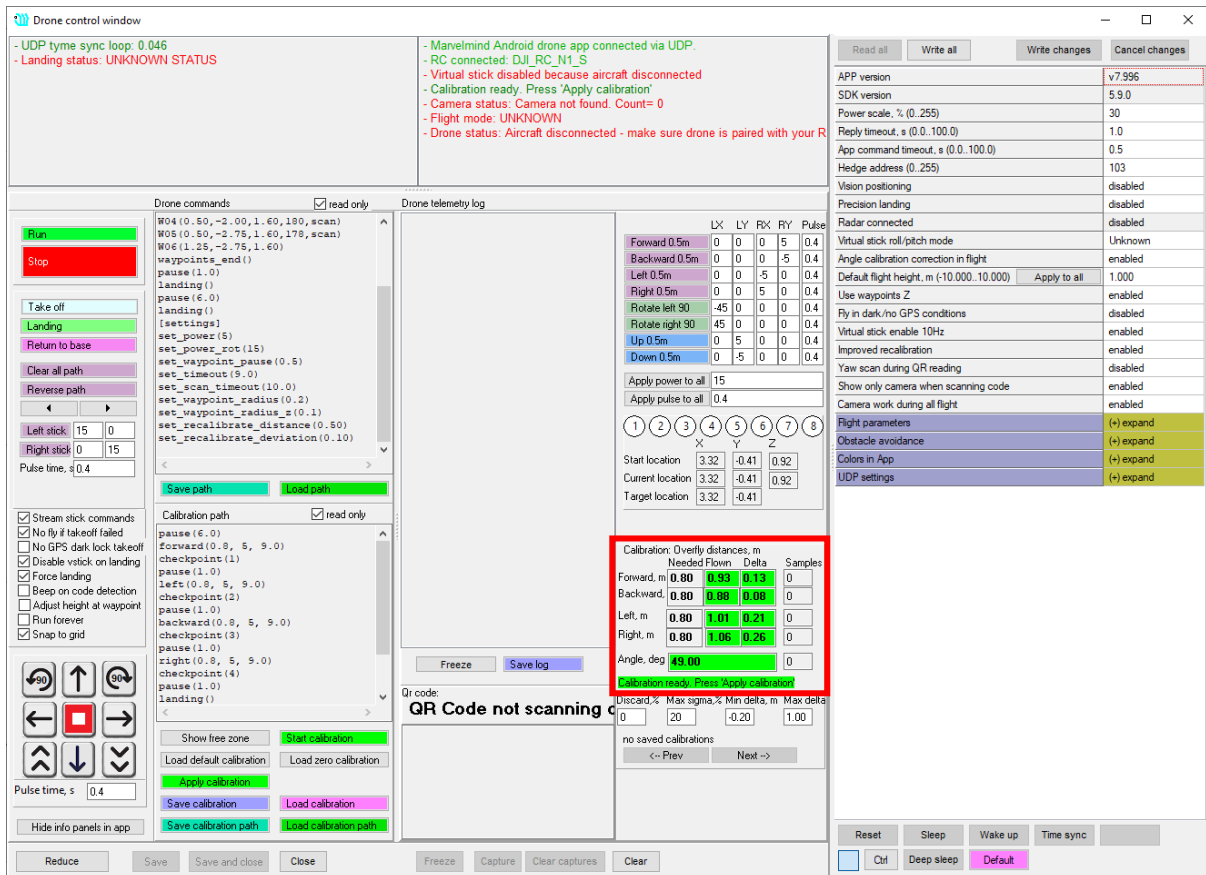
2. Make sure there are no obstacles in a range of 0.8 meters in each direction
3. Open "Drone Control" window



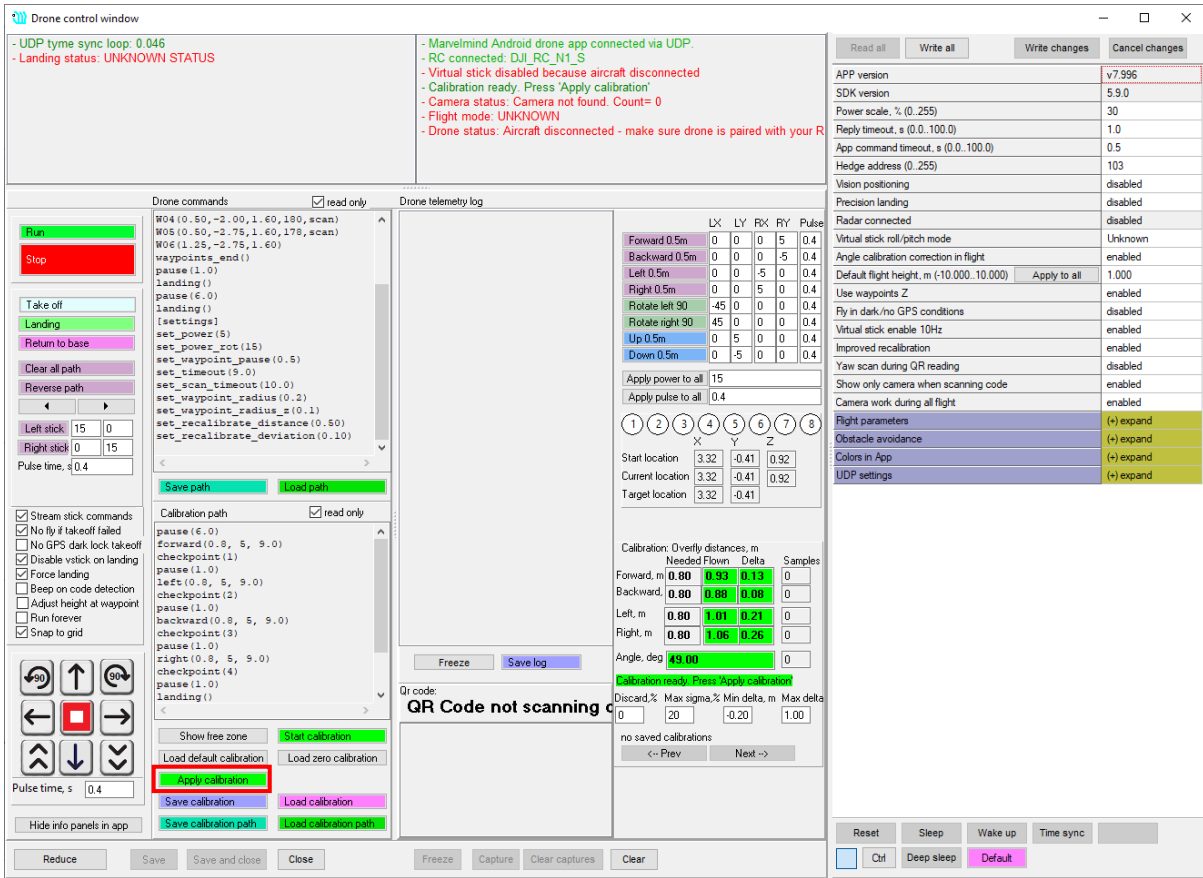
4. Press "Start calibration"



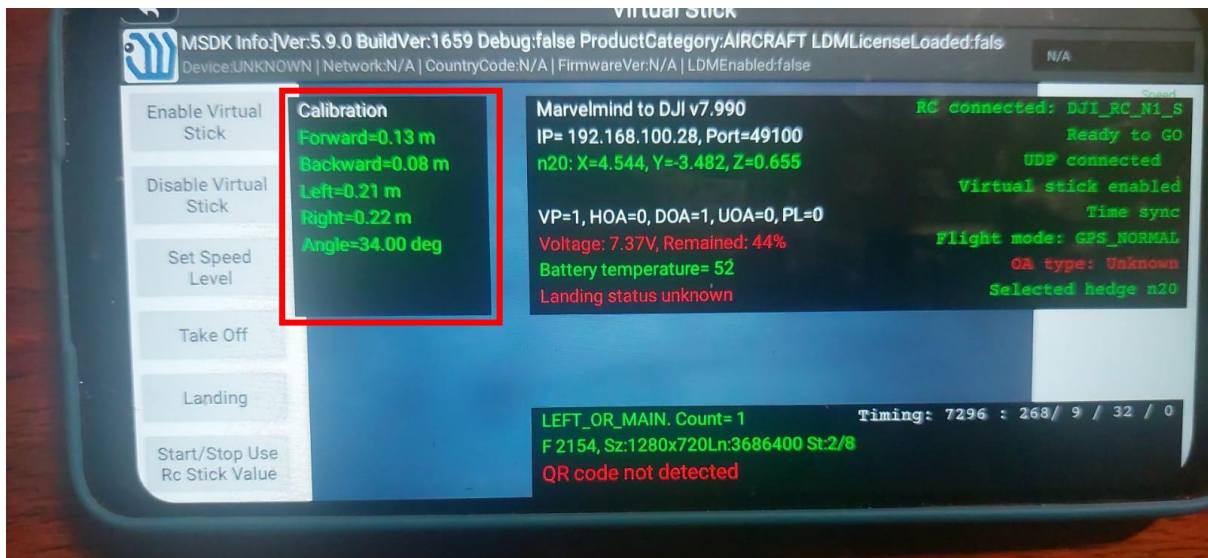
5. Check that after calibration, value fields will turn green



6. Press “Apply calibration”



On the phone, the “Calibration” field will show values of the calibration

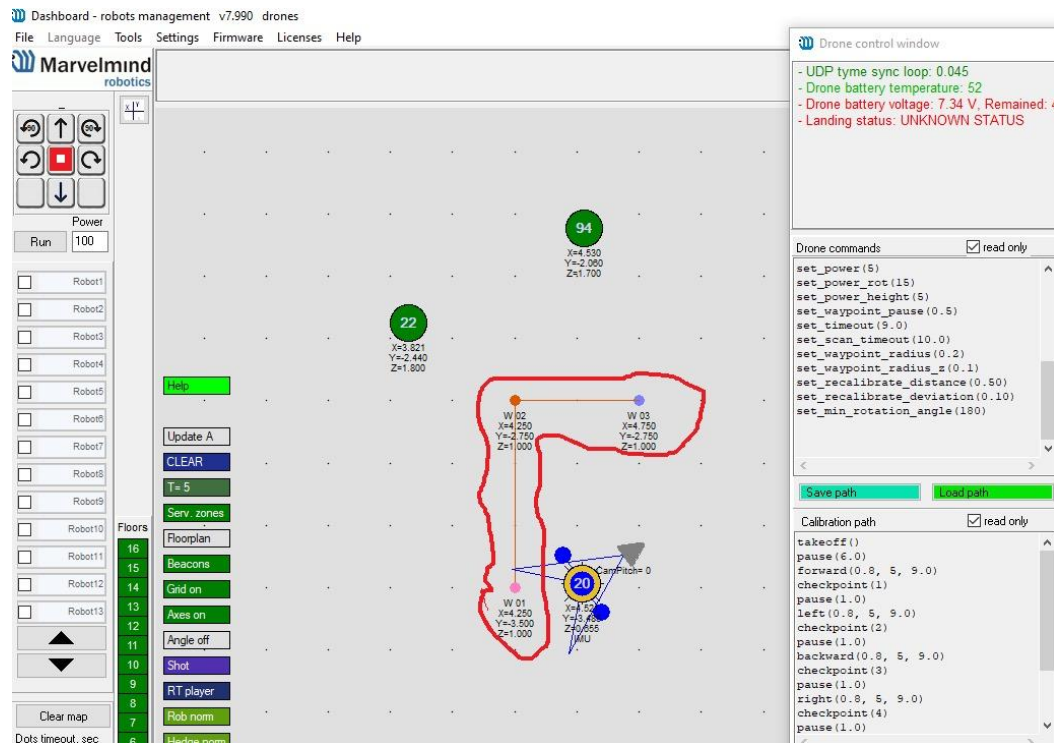


Calibration is complete. The next chapter describes how to set a flight path.

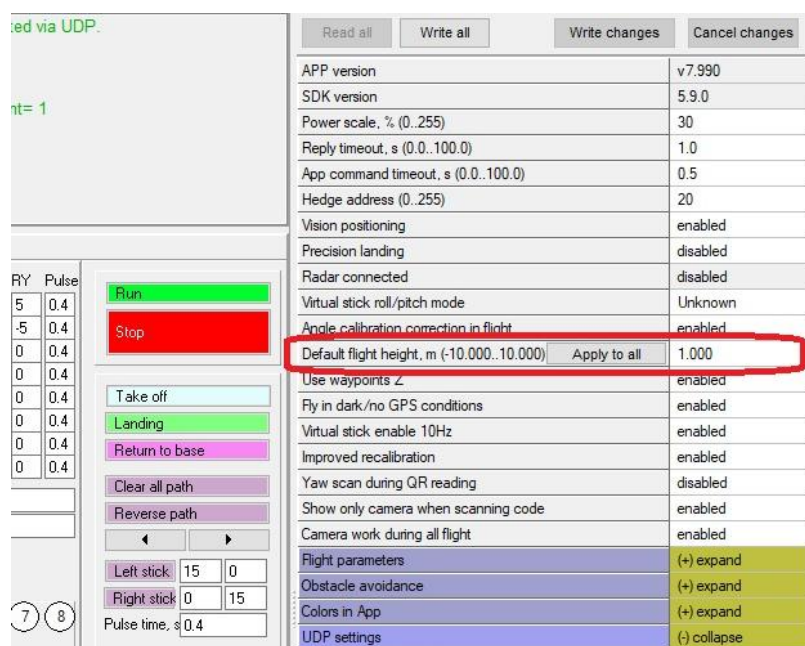
6.7. Flight Path Setup

This chapter describes how to set up a work path for the drone. The mechanics are the same as with a robot, so check Chapter 11.14 in the [Marvelmind Indoor Navigation System Operating Manual](#) for more information.

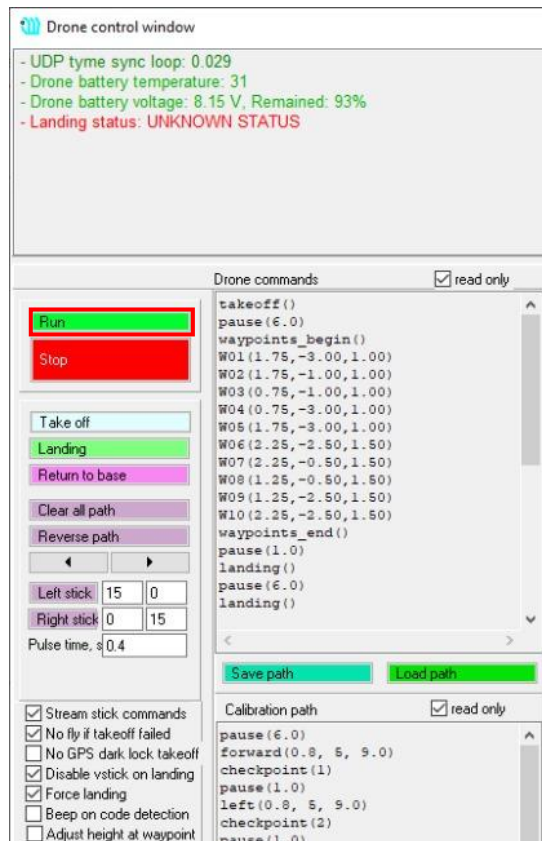
Press the **Shift + Left Mouse Button** on the map to set a waypoint for the drone.



The main difference between a robot and a drone is the Z-coordinates. You can set the drone's default flight height in the settings, as shown below. "Apply to all" will apply this height to every waypoint.



After you place waypoints, you can start flying by pressing the “Run” button in the “Drone control” menu:



6.7.1. Manual Change of Z-coordinates

For advanced users only!

You can manually change the Z-coordinates of each point to make the path more complex. We recommend using this option after getting proper tracking with a default waypoint height.

There are two ways to do so:

- Change by dragging
- Change by entering values

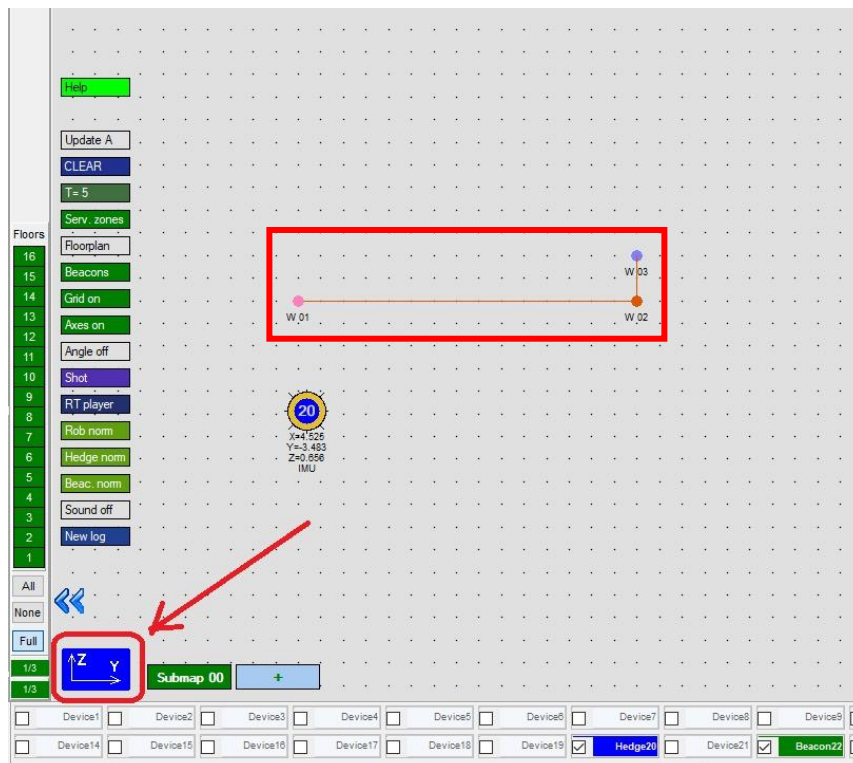
6.7.1.1. Change by Dragging

For advanced users only!

You can manually change the height of the points by dragging them in the Z/Y plane.

Below are the instructions:

1. Change the view to Z/Y plane in the bottom left corner of the map
2. Hold the Left Mouse Button on point and drag it up or down



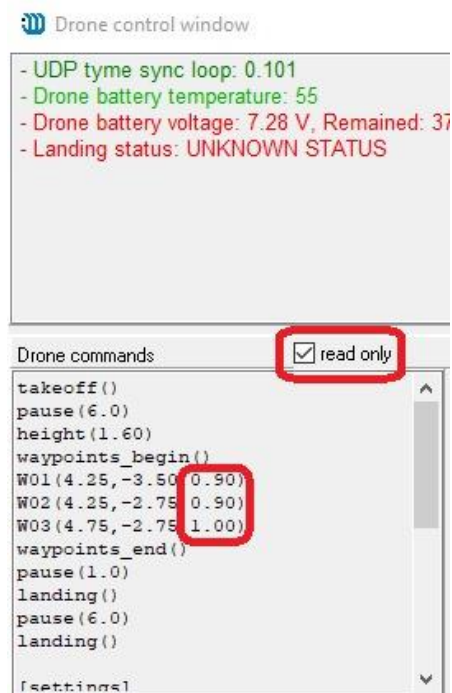
6.7.1.2. Change by Values

For advanced users only!

You can manually change the height of the points by changing the values in the “Drone Control” window. The “Read only” checkmark prevents accidental changes in the coordinates.

Below are the instructions:

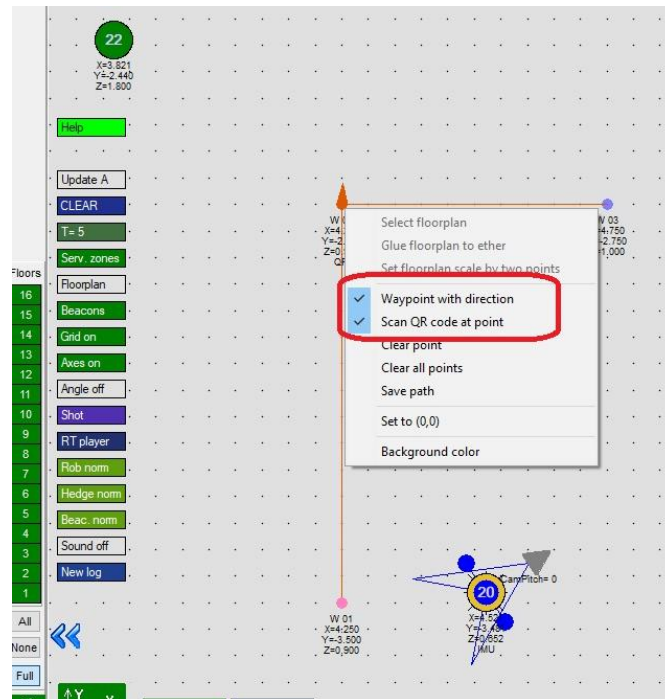
1. Open the “Drone Control” window
2. Uncheck the “Read only” mark
3. Enter values (X, Y, Z) for desired waypoints



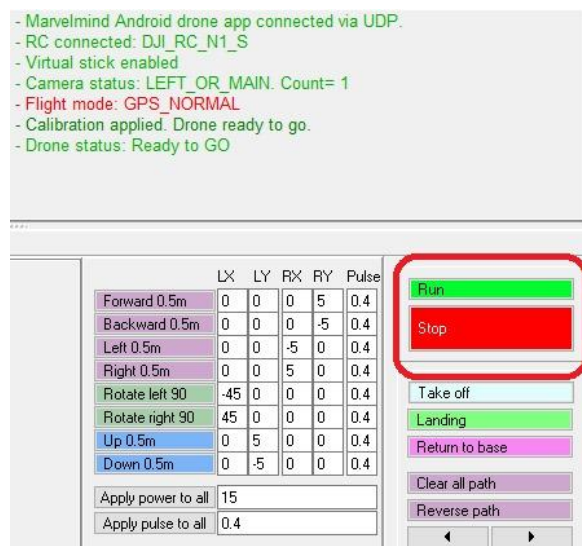
6.7.2. Additional Waypoint Parameters

You can set up additional parameters on a waypoint by clicking on it with the **Right Mouse Button** and enabling them.

- **Waypoint with direction**; at this point, the drone will rotate the facing direction according to the arrow on the point
- **Scan QR code at point**; after reaching the point and (if enabled) rotating the facing direction, the drone will scan a QR code. Recognized code will be sent to the Dashboard and shown above the waypoint.



After setting up the path and placing the drone in the starting position, you can start the flight by clicking the **“Run”** button in the **“Drone Control”** window. To stop the flight, press the **“Stop”** button. Additionally, you can land the drone or return it to the starting point by pressing the corresponding buttons.



7. Advanced Settings

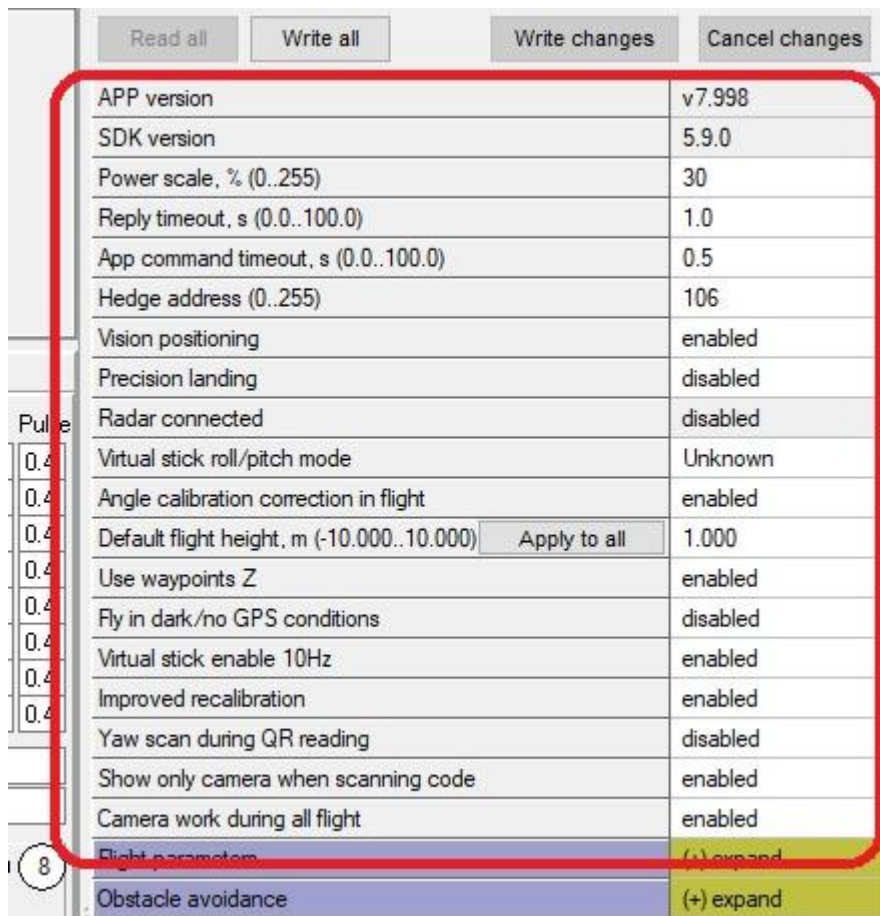
For advanced users only! Don't change it if not necessary.

Additional settings are available in the Dashboard for advanced users. Some of them, such as PID settings, aren't available yet. For standard flights, there is no need to change these settings.

<input type="button" value="Read all"/> <input type="button" value="Write all"/> <input type="button" value="Write changes"/> <input type="button" value="Cancel changes"/>	
APP version	v7.990
SDK version	5.9.0
Power scale, % (0..255)	30
Reply timeout, s (0.0..100.0)	1.0
App command timeout, s (0.0..100.0)	0.5
Hedge address (0..255)	20
Vision positioning	enabled
Precision landing	disabled
Radar connected	disabled
Virtual stick roll/pitch mode	Unknown
Angle calibration correction in flight	enabled
Default flight height, m (-10.000..10.000) <input type="button" value="Apply to all"/>	1.000
Use waypoints Z	enabled
Fly in dark/no GPS conditions	enabled
Virtual stick enable 10Hz	enabled
Improved recalibration	enabled
Yaw scan during QR reading	disabled
Show only camera when scanning code	enabled
Camera work during all flight	enabled
Flight parameters	(-) collapse
Nominal power, % (0..100)	5
Nominal rotation power, % (0..100)	15
Nominal height power, % (0..100)	5
Pause at waypoint, s (0.0..100.0)	0.5
Waypoint timeout, s (0.0..100.0)	9.0
QR code scan timeout, s (0.0..100.0)	10.0
Waypoint spot radius (X,Y), m (0.00..100.00)	0.20
Waypoint spot radius (Z), m (0.00..100.00)	0.10
Recalibration distance, m (0.00..100.00)	0.50
Recalibration deviation, m (0.00..100.00)	0.10
Min rotation angle, degrees (0..180)	180
Angle control mode	Discrete correction
PID for angle distance (0.00..100.00)	0.20
PID for angle - P (0.000..1000.000)	1.000
PID for angle - I (0.000..1000.000)	0.000
PID for angle - D (0.000..1000.000)	0.000
Obstacle avoidance	(+) expand

7.1. Details and Advanced Settings

This chapter describes the details and advanced settings of the system.



	Read all	Write all	Write changes	Cancel changes	
APP version					v7.998
SDK version					5.9.0
Power scale, % (0..255)					30
Reply timeout, s (0.0..100.0)					1.0
App command timeout, s (0.0..100.0)					0.5
Hedge address (0..255)					106
Vision positioning					enabled
Precision landing					disabled
Radar connected					disabled
Virtual stick roll/pitch mode					Unknown
Angle calibration correction in flight					enabled
Default flight height, m (-10.000..10.000)			Apply to all		1.000
Use waypoints Z					enabled
Fly in dark/no GPS conditions					disabled
Virtual stick enable 10Hz					enabled
Improved recalibration					enabled
Yaw scan during QR reading					disabled
Show only camera when scanning code					enabled
Camera work during all flight					enabled
Flight parameters					(+) expand
Obstacle avoidance					(+) expand

- APP version – version of the phone app
- SDK version – version of the DJI MSDK used in the app
- Power scale – scales the power applied to the drone rotors. Changing this setting increases or decreases the speed of all drone movements. **For advanced users only!**
- Reply timeout – timeout of receiving UDP reply from the drone app on the phone. UDP connection warning appeared if a timeout was exceeded
- App command timeout – timeout of receiving UDP command in the app. UDP connection warning appeared if the timeout is exceeded
- Hedge address – address of the mobile beacon on the drone. If only one mobile beacon is in the system, it is assigned to the drone automatically. If you have multiple mobile beacons, assign the correct beacon manually
- Vision positioning – the DJI drones' vision positioning system (VPS). Don't change this setting
- Precision landing – landing can be softer, but the landing place should meet more requirements. Refer to the DJI documentation for more information
- Radar connected – some DJI drones have integrated radar. This parameter shows the status of the radar connection
- Virtual stick roll/pitch mode – this setting is unavailable. Please don't change it manually!

- Angle calibration correction in flight – keep enabled. Angle correction allows to correct the orientation angle if the calibration was not executed ideally or if the orientation angle was unexpectedly changed during the flight
- Default flight height – all new waypoints on the map have 'default flight height'. Pressing 'apply to all' allows to change the height of all already placed waypoints
- Use waypoints Z – if enabled, the drone will try to achieve waypoint height during the flight
- Fly in dark/no GPS conditions – allows DJI drone to fly in darkness and without GPS. **Set with caution!** As in most cases when GPS is not available indoors, light can be a must for drone stabilization
- Virtual stick enable 10 Hz – don't change. This option is unavailable
- Improved recalibration – advanced mode of in-flight angle correction
- Yaw scan during QR reading – if enabled, the drone slightly rotates left and right during QR code scanning to find the code
- Show only camera when scanning code – when the drone scans the QR code in flight, the phone app hides all message windows over the image from the camera
- Camera work during all flight – if enabled, the camera works and tries to scan the QR codes during all flights. If disabled, the camera scans QR codes only at points assigned for scanning QR codes

Show only camera when scanning code	enabled
Camera only during all flight	enabled
8 Flight parameters	(-) collapse
Nominal power, % (0..100)	5
Nominal rotation power, % (0..100)	15
Nominal height power, % (0..100)	15
Pause at waypoint, s (0.0..100.0)	1.0
Waypoint timeout, s (0.0..100.0)	9.0
QR code scan timeout, s (0.0..100.0)	10.0
Waypoint spot radius (X,Y), m (0.00..100.00)	0.20
Waypoint spot radius (Z), m (0.00..100.00)	0.10
Recalibration distance, m (0.00..100.00)	0.50
Recalibration deviation, m (0.00..100.00)	0.10
Min rotation angle, degrees (0..180)	15
Angle control mode	Discrete correction
PID for angle distance (0.00..100.00)	0.20
PID for angle - P (0.000..1000.000)	0.100
PID for angle - I (0.000..1000.000)	0.010
PID for angle - D (0.000..1000.000)	0.010
Obstacle avoidance	(+) expand
Colors in App	(+) expand
UDP settings	(+) expand

- Nominal power – default power for flight forward, backward, left, and right
- Nominal power – default power for rotation (clockwise/counterclockwise)
- Nominal height power – default power for moving up and down
- Pause at waypoint – pause after achieving each waypoint before moving to the next one
- Waypoint timeout – timeout of achieving a waypoint. Increase this time if the distance between waypoints is large
- QR code scan timeout – time of attempts of scanning QR code at waypoint
- Waypoint spot radius (X, Y), Waypoint spot radius (Z) – if the distance from the drone to the waypoint is less than the waypoint spot radius, the waypoint is achieved, and the drone can fly to the next waypoint
- Recalibration distance – the minimum distance the drone needs to pass before in-flight angle recalibration
- Recalibration deviation – if improved recalibration is enabled, the recalibration is applied only if the distance from the drone to the line between waypoints is more than the recalibration deviation
- Min rotation angle – the minimum angle to rotate. If the drone comes to the waypoint with a specified direction, it will rotate only if its current orientation differs from the required more than by this angle

- Angle control mode:
 - Discrete correction – discrete correction after passing 'recalibration distance' intervals.
 - PID – angle correction is executed permanently after passing the first short interval of the path
- PID for angle distance – distance to pass for initial PID angle correction
- PID for angle: P, I, D: PID coefficients

Additional parameter settings:

- Obstacle avoidance – don't change these setting
- Colors in app – you can change some colors in the phone application
- UDP setting

7.2. Drone Command Language

Below is the description of the drone's commands. They are used in “Drone commands” and “Calibration path”.

- Takeoff(height_limit) – execute takeoff. If the 'height_limit' parameter is omitted (just 'takeoff()'), the drone will fly to the default height for the DJI takeoff, usually 5 feet above the floor by the drone optical sensor. If 'height_limit' is specified, the drone will terminate elevation after reaching the specified height (in meters) by the Marvelmind coordinates.
- landing() - execute landing. The command is executed until landing and stopping the rotors
- pause(T) - pause for a specified time in seconds
- waypoints_begin() - start of waypoints section
- waypoints_end() - end of waypoints section
- qrcode(timeout) - a separate command used to scan the QR code. The drone will try scanning the QR code until a specified timeout in seconds (if the QR code is not recognized) or until successful QR code recognition
- checkpoint(index) - specifies a checkpoint with a selected index. The dashboard indicates the reached checkpoint in the drone control window
- forward(distance, power, timeout) - fly forward (relative to current drone orientation)
 - 'distance' is the required parameter – a flight distance in meters
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied
 - 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- backward(distance, power, timeout) - fly backward (relative to current drone orientation)
 - 'distance' is the required parameter – a flight distance in meters
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied
 - 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- left(distance, power, timeout) - fly left (relative to current drone orientation)
 - 'distance' is the required parameter – a flight distance in meters
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied
 - 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- right(distance, power, timeout) – fly right (relative to current drone orientation)
 - 'distance' is the required parameter – a flight distance in meters
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied
 - 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- return() - return to base - return to the starting point
- down(dh, power, timeout) - move down
 - 'dh' is the required parameter - the delta of the height in meters from the current position. dh should be positive
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied

- 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- up(dh, power, timeout) - move up
 - 'dh' is the required parameter - the delta of the height in meters from the current position. dh should be positive
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied
 - 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- height(h, power, timeout) - setup the height
 - 'h' is the required parameter - a height in meters to be achieved (by Marvelmind coordinates)
 - 'power' is an optional parameter, power in percents. If the parameter is not specified, the default power is applied
 - 'timeout' is an optional timeout in seconds. If not specified, the default waypoint timeout is applied
- [settings] - parameters specified after the '[settings]' line in the drone commands window, duplicate the 'Flight parameters' in the menu on the right side of the drone control window. Changing the settings via the menu affects the settings in the drone commands window, and vice versa - if you change the value of settings in the text window, the corresponding setting is updated in the menu. The '[settings]' section is not present in the calibration path window; it is only in the drone commands window.
- Wnn(X, Y, Z, dir, cmd) - waypoint command.
 - nn - index of the waypoint, starting from 01, automatically assigned when the dashboard GUI places waypoints on the map.
 - X, Y, Z - coordinates of the waypoint (meters) on the Marvelmind map
 - dir - optional parameter, orientation direction in degrees. 0 degrees mean direction along the X axis, 90 degrees along the Y axis, and so on. If this parameter is assigned, the drone will rotate in the specified direction after reaching the waypoint
 - cmd - optional parameter, additional command. Not only one command is available: 'scan'. If this parameter is assigned, the drone will scan the QR code at the waypoint,
- Dir and 'scan' parameters can be enabled in the context menu of the waypoint by right-clicking on the waypoint on the map.
- For example: W07(2.25,-0.50,1.50,54,scan) - move to point X=2.25m, Y=-0.5m, Z=1.5m, rotate to angle 54 degrees, scan QR code

8. Troubleshooting

Here are presented typical problems that users may face:

1. In case of poor tracking, check that the map is built correctly. Before flying with the drone, check the tracking by walking with the mobile beacon
2. DJI drones might overheat, so they can shut down automatically



The screenshot shows a window titled "Drone control window" with a list of error messages:

- UDP tyme sync loop: 0.058
- Drone battery temperature: unknown ,last= 53
- Drone battery voltage: unknown, Remained: unknown
- Landing status: UNKNOWN STATUS

3. The drone may appear active before shutting down but won't respond to any commands. This lasts 40 seconds, so no need to worry if this happens to you.

Please report any bugs to info@marvelmind.com.

9. Contacts

For more information about the company, check [About us](#)

For additional support, please send your questions to info@marvelmind.com