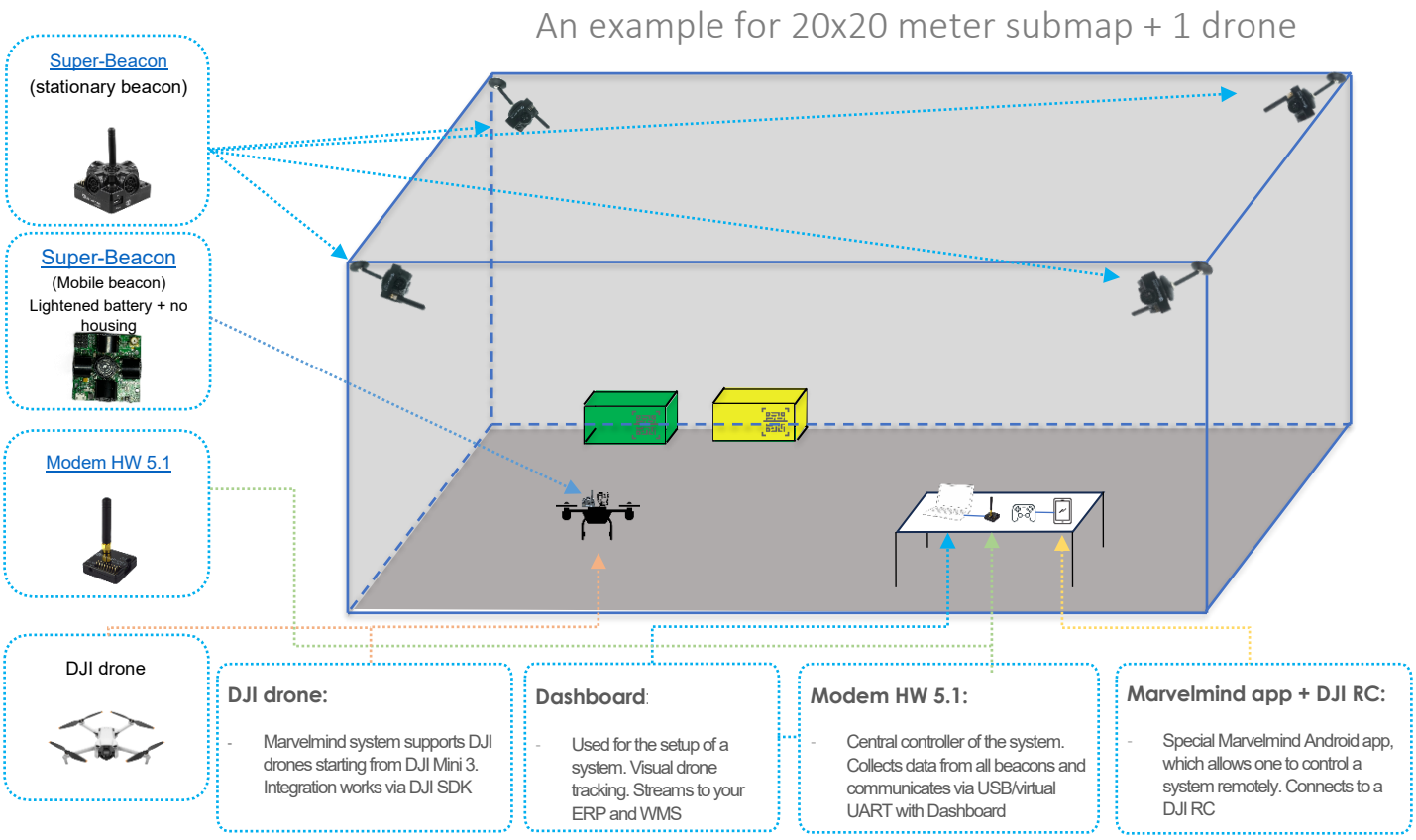
12. Solutions

12.1. Autonomous DJI Drones Indoors

Marvelmind provides a solution for integrating Marvelmind Indoor “GPS” system with DJI drones. Using the DJI SDK, we provide tracking and control DJI drones using DJI RC and Android phone with a Marvelmind app.



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 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 (see the list of supported DJI drones below)
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

List of supported drones:

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 by request. Request us by email info@marvelmind.com*

13. Frequently Asked Questions

Here we will answer the most common questions

1 What is the proper way to place the beacons?

- The actual distance between beacons must be ≤ 30m. Provide the line of sight from one beacon to a minimum of two others

2 How far can beacons be located from the modem?

- In the open space, the distance from the modem to the beacon can reach several hundred meters

3 What if the hedgehog is shown as an orange circle or transparent inside the Dashboard?

- **Blue** - normal mode and confident tracking
- **Orange** - system provides the best location data possible, but confidence is lower than blue
- **transparent** - lost radio packets or no ultrasound coverage

4 What is the obstacle for ultrasound?

- The natural obstacles for ultrasound are walls (concrete), glass, and metal. If you need to cover a multiple-floor territory, you can use our Submap feature, in which case the tracking will not be interrupted

5 How the system works in very low and very high temperatures?

- System is designed for normal office-like conditions and temperatures 0 ºC - 40 ºC
- You can see some other types of beacons (outdoor, explosion safe, etc.) in the comparison table
- We can also produce some special versions which will suit your case. Please write to info@marvelmind.com

6 Are beacons resistant to explosions, dust, dirt, water, and noise?

- - Low-frequency noise (motor noise, industrial equipment) does not interfere with the normal operation of the system
- You can see some other types of beacons (outdoor, explosion safe, etc.) in the comparison table

7 What is the time of delay between positioning the object and responding?

- The delay is directly proportional to the update rate. For example, if the update rate is 16 Hz, the delay is 1.2:1.5x60ms
- The limit is 1.5 times the maximum distance between the stationary beacons. Please follow the instructions in the attached screenshot to expand the service area. Notice that positioning the mobile beacon far from stationary beacons and close to their plane may result in increased positioning error because of lousy geometry of measurement

8 How do I define IMU or not IMU beacon?

- Check the white sticker on the box and the beacon's bottom /IMU - with IMU
- Connect beacon via USB: Dashboard => View => Accelerometer data

9 Can we use a non-IMU beacon as a mobile beacon or not?

- Yes, you can (https://www.youtube.com/watch?v=A4aRsjH2-_E)

10 What is the reason to choose 915Mhz vs 433Mhz?

- The 915MHz version is designed for the US, Canada, and the Americas in general. The ISM band (license-free band for industrial, science, and medical applications) in those countries is 915MHz
- In Europe, it is 433MHz

11 Devices do not connect via USB?

- Use a USB cable with a long metal part. If you have any problems with the USB connection, change the cable first. One cable can work for one device and do not work for other

12 Does the orientation of the beacon matter?

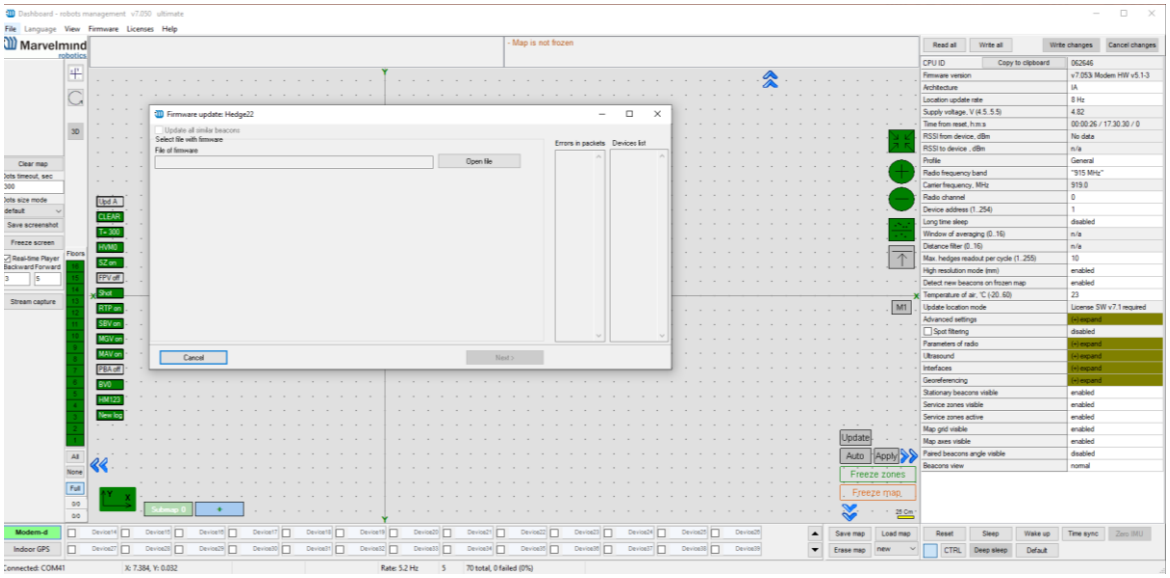
- Yes, it is. Place and orientate it in positions where sensors can “hear” each other. v4.9 beacon has ≈90° per sensor coverage(illustration), Mini-RX and Industrial-RX have ≈180° coverage(illustration)

13 Why Dashboard does not see more than 4 beacons

- System has a limitation of 4 beacons per submap. If you have more than 4 beacons, create another submap, and beacons will appear

14. Troubleshooting Checklist

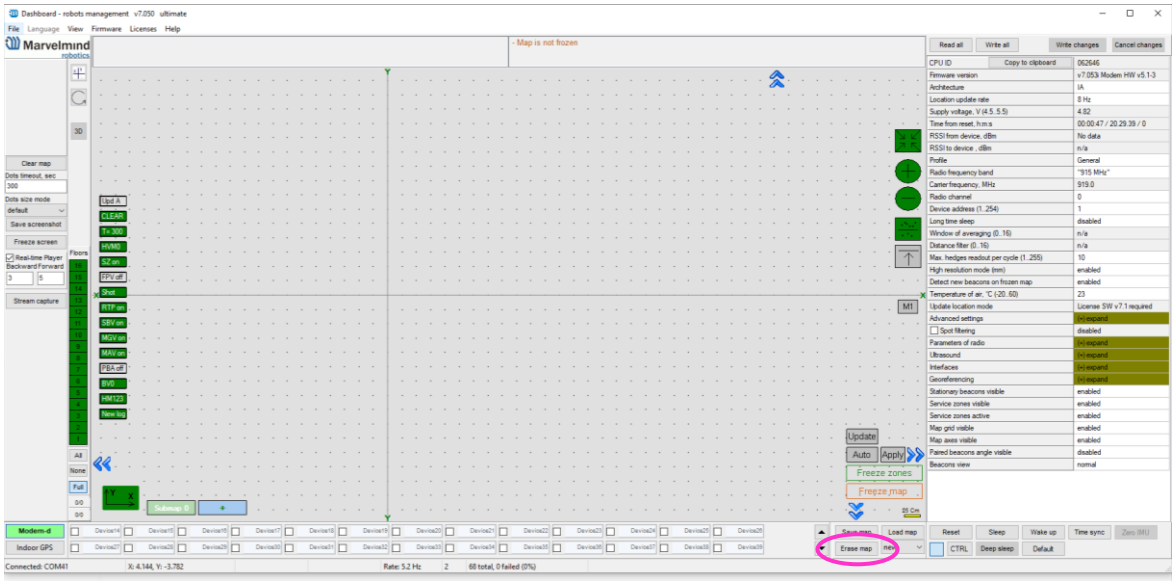
If you have any problems with the system, follow these simple steps:



- **Update SW** on modem and beacons

- Now, connect all beacons and modem one by one and press the **Default** button in the Dashboard (When updating the SW, please press the **Default** button to make sure that beacons have default settings. Otherwise, the modem may be calling on the wrong channel or something)

- Press **Erase map** when the modem is connected to the PC



Check our help video:

[Typical mistakes with Precise Indoor “GPS”]

14.1. Checklist Before Starting the System:

IA and NIA SW differs
For IA, you should use stationary beacons with different frequencies
Make sure that you use the correct SW. Inverse Architecture(IA) SW for Inverse system, Non-Inverse Architecture(NIA) SW for Non-Inverse system (Architectures comparison)
Make sure that your beacons are 3.5V and higher before using them. If not, charge it for 2-3 hours.

- Keep modem 1-2m away from beacons. if closer, the beacon radio may be overloaded
- Antenna's recommendations:
  - The antenna must be kept as straight as possible. Otherwise, it will reduce the effective range
  - The antennas must be kept away from conductive materials, such as metal and carbon, by at least a half inch
  - Keep the antennas away from the motors and other noise sources as much as possible
- Use a USB cable with a long metal part. If you have problems with the USB connection, change the cable first. One cable can work for one beacon and not work for other
- Be sure that you use SW from the same pack
- When updating the SW, please press the Default button to make sure that beacons really have default settings. Otherwise, the modem may be calling on the wrong channel or something
- Start with a simple configuration (10x10m square, 2 stationary beacons)
- Do not obstruct the line of sight between beacons
- Build the map first, freeze it, then wake up the "hedge"
- Number of periods. By default – 5 for HW v4.9. 20 for Super-Beacon, 50 for Mini-TX. For longer distances, you can put 10-50

Mini-RX beacon may be over-discharged. In that case, do the following:

- Turn off the beacon with DIP switches
- Charge it for 1 hour
- Turn the beacon on, flash the latest SW via DFU Programming, and charge it for 1 hour again

15. Contacts

For more information about the company, check About us

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