

# 1. Executive Summary

Marvelmind Indoor Navigation System is an off-the-shelf indoor navigation system that provides precise ( $\pm 2\text{cm}$ ) location data to autonomous robots, vehicles (AGV), forklifts, and drones. It can also track moving objects via mobile beacons attached to them. Other applications include cranes, virtual/augmented reality (VR/AR) systems, helmets for construction workers or miners, etc. See more: [Solutions](#).

The navigation system consists of a network of stationary ultrasonic beacons interconnected via a radio interface in a license-free band (915/868 MHz), one or more mobile beacons installed on objects to be tracked, and a modem or modems providing a gateway to the system from a PC or other computers. See more: [Architectures](#).

Using the trilateration algorithm, a mobile beacon's location is calculated based on a propagation delay of ultrasonic pulses (Time-Of-Flight or TOF) between stationary and mobile beacons.

The system can automatically build a map of stationary beacons. In simple cases, no additional manual data input or any manual distance measurements are required. This map formed once can be frozen and stored in the modem's memory, and the system becomes fully active within 7 to 10 seconds after the modem is powered.



*Fig. 1: Example of Starter Set based on Super-Beacons*

Minimum configuration requirements to ensure optimal performance of the Marvelmind Indoor Navigation System:

- For 3D (X, Y, Z) tracking: an unobstructed line of sight (hearing) between a mobile beacon and 3 or more stationary beacons within 30 meters
- For 2D (X, Y) tracking - an unobstructed line of sight (hearing) between a mobile beacon and 2 or more stationary beacons within 30 meters
- For 1D tracking: an unobstructed line of sight (hearing) between a mobile beacon and 1 or more stationary beacons within 30 meters in standard configuration, or up to 100–150 meters with a Horn attachment (see Horn section)





## 1.1. Key Capabilities:

Parameter	Technical Specifications
Distance between beacons	<ul style="list-style-type: none"> <li>- Reaches up to 50 meters and up to 100 meters with <a href="#">horn</a> under indoor conditions (Mini-RX or Super-Beacon to Super-Beacon with RX4 only)</li> <li>- Recommended distance is 30 meters (Transducer4 on the first beacon is looking straight at the Transducer4 on the second beacon; other transducers are switched off)</li> </ul>
Coverage area	<ul style="list-style-type: none"> <li>- Reaches up to 1000m<sup>2</sup> with the Starter Set configurations</li> <li>- Coverage for larger territories is provided using submaps – like cells in cellular networks</li> </ul>
Location precision	<ul style="list-style-type: none"> <li>- Absolute: 1–3% of the distance to the beacons</li> <li>- Differential precision: <b>±2cm</b></li> </ul>
Location update rate	<ul style="list-style-type: none"> <li>- 1/20Hz to 40Hz (Ultrasonic based only)</li> <li>- 100Hz with ultrasonic + IMU fusion enabled (Only for Beacons HW v4.9-IMU-Discontinued)</li> <li>- Can be set manually via Dashboard software</li> <li>- Depends on the distance between mobile and stationary beacons (shorter distance–higher update rate). <a href="#">See more</a></li> <li>- Depends on the number of mobile beacons (For Non-Inverse Architecture; for Inverse Architecture, there is no such dependency)</li> <li>- Depends on the radio profile (500kbps, 200kbps, 38kbps)</li> <li>- Slightly depends on the number of stationary beacons–dependence is not the same as for mobile beacons</li> </ul>
Power supply	Internal: 1000mAh LiPo battery (Super-Beacon) <ul style="list-style-type: none"> <li>- Battery lifetime: from 2 days to several months, depending on the mode of operations<sup>1</sup></li> </ul>
	External: micro-USB – recommended for permanent use
Weight	Mobile beacon (Super-Beacon) from the starter set: <ul style="list-style-type: none"> <li>- 59 grams (including 1000mAh battery, Super-Beacon housing, and 50mm antenna)<sup>2</sup></li> <li>- 27 grams (Super-Beacon, bare board w/o battery)</li> </ul>
Beacon size	Size: 55x55x33mm (with 50mm antenna: 55x55x65mm) (Super-Beacon) <sup>3</sup>

<sup>1,2,3</sup> For other types of beacons, look to the [comparison table](#)

## 1.2. Legend

The legend chapter contains small icons and signs highlighting key text points.

-  - Important
-  - For experienced users
-  - Demo or Help video
-  - Useful link