Marvelmind Boxie

Operating manual

v2021_02_01

www.marvelmind.com

Table of contents

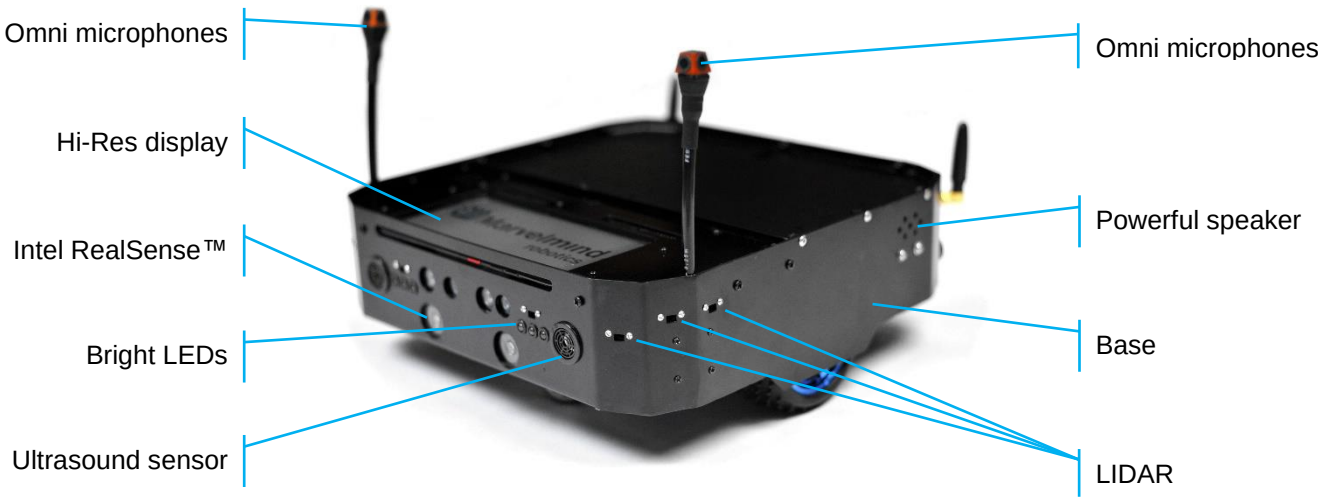
Version changes

V2021_02_01

- Initial release

1. Executive summary

- Marvelmind Boxie is an autonomous mobile robot designed for smart warehousing, industrial applications, research and education.
- Fully autonomous move between any points covered by Marvelmind Indoor "GPS"
- Payload capacity up to 10kg
- Driving time more than 6h on a single charge (no payload)
- Automatic obstacle avoidance and detection
- The route can be reconfigured by 1 button click in 1 second
- Charging time is less than 2h with optional charger. Default – 6 hours (with supplied charger by default)
- Smart screen for status display and interactions
- Up to 250 robots per system
- Reconfigurable multi-shelves top
- It is also can be equipped with QR-scanner to eliminate errors in the delivery of goods



Key specs:

Parameter	Technical Specifications
Navigation	Marvelmind Indoor “GPS”
Top speed	4km/h
Weight	4.5kg
Payload	Up to 10kg
Driving time	More than 6h on a single charge with no payload
Charging time	- Less than 2 hours with optional charger (Hi-power Marvelmind charger) - Default – 6 hours (with supplied charger by default)
Sensors	- Marvelmind Indoor "GPS" for positioning. The system has been delivered to hundreds of projects worldwide - Location + Direction based on Marvelmind precise indoor positioning system - LIDARs - Intel RealSense™ - Several IMUs - Odometer on each wheel - 12 x 1D LIDARs - Sonars - Current sensing

1.1 Legend

Legend chapter contains small icons and signs to highlight some key points of the text.

 - Important

 - For experienced users

 - Demo or Help video

 - Useful link

2. System elements

2.1 Marvelmind Boxie

It relies on Marvelmind Indoor “GPS” navigation system. The robot is equipped with additional sensors for detecting and avoiding obstacles. It has a long battery life, high payload capacity compares to its size.

- Fully autonomous driving unit from Marvelmind Robotics
- Can be flexible tuned for different cases and projects
- Shockproof housing
- Bright lights
- Noticeable sound
- Programmable hardware buttons

2.1.1 Powertrain

Our team brought together capacious batteries, powerful motors and smart controllers in one device, making it budget and very productive.

It gives the perfect balance between battery life and performance.

- Up to 6 hours driving (no payload)
- Emergency stops with breaks
- Recuperation (future optional)

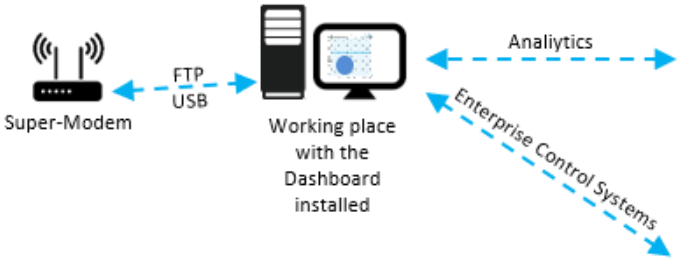
2.2 Marvelmind Indoor “GPS” system

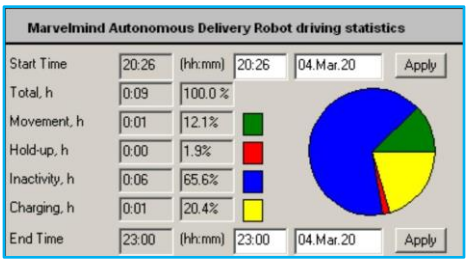
Marvelmind Indoor Navigation System is an off-the-shelf indoor navigation system, designed to provide precise (±2cm) location data to autonomous robots, vehicles (AGV), and copters. It can also be used to track moving objects via mobile beacons attached to them. Other applications include, for example, forklifts, virtual reality (VR) systems, helmets for construction workers or miners, etc.

The navigation system consists of a network of stationary ultrasonic beacons interconnected via radio interface in a license-free band.

2.3 Control system

The control system allows you to configure the system, receive various data, collect statistics. The center of the control system is Dashboard. It communicates with the modem, receives data from it, and can send data in various formats.



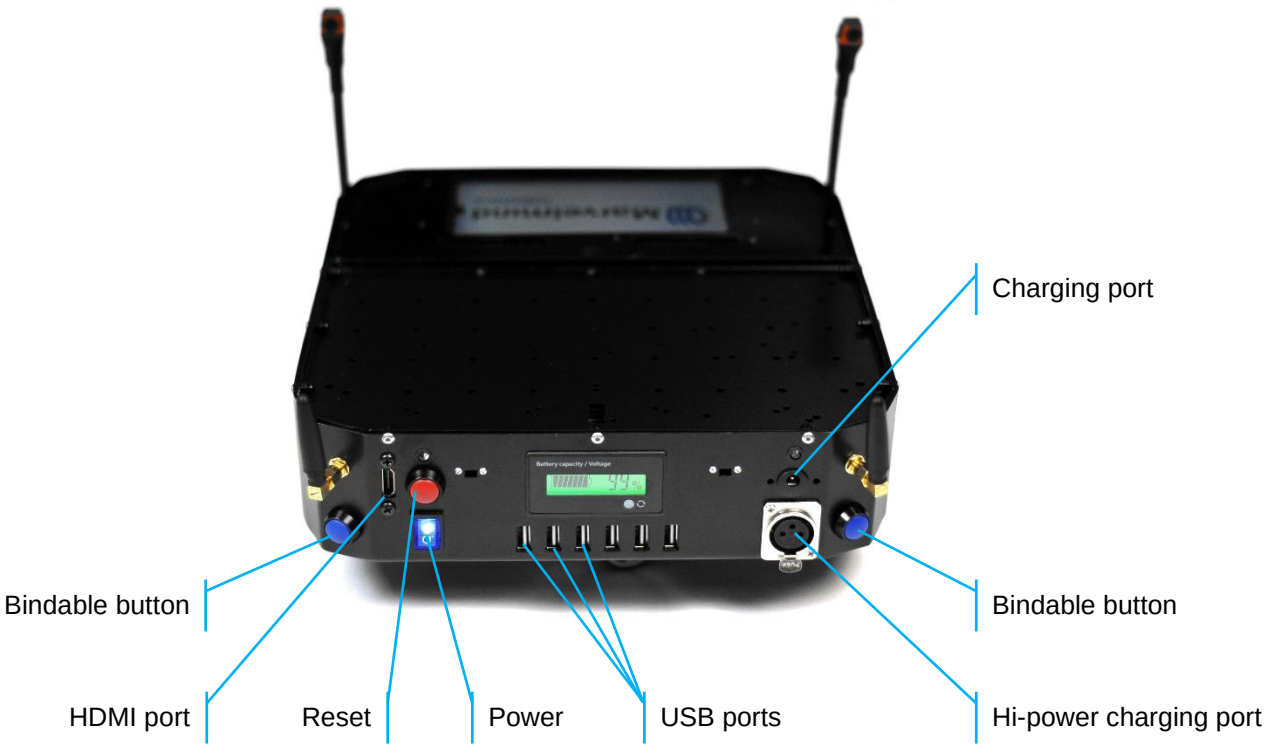


3. Robot’s controls and basic operations description

This chapter describes interactions with basic robot controls.

3.1 Controls

3.2 Back control panel



3.3 Charging

Turn of the robot and connect a charger. Charging time: less than 2 hours with optional charger (Hi-power Marvelmind charger) and 6 hours (with supplied charger by default). Operating time at full battery is 6 hours (No payload).

Use only Marvelmind supplied chargers

4. Setting up the autonomous robots

The steps below describe setting up the system with Marvelmind Boxie.

Notice that Marvelmind Small Robot relays upon Inverse Architecture.

4.1 Test launch

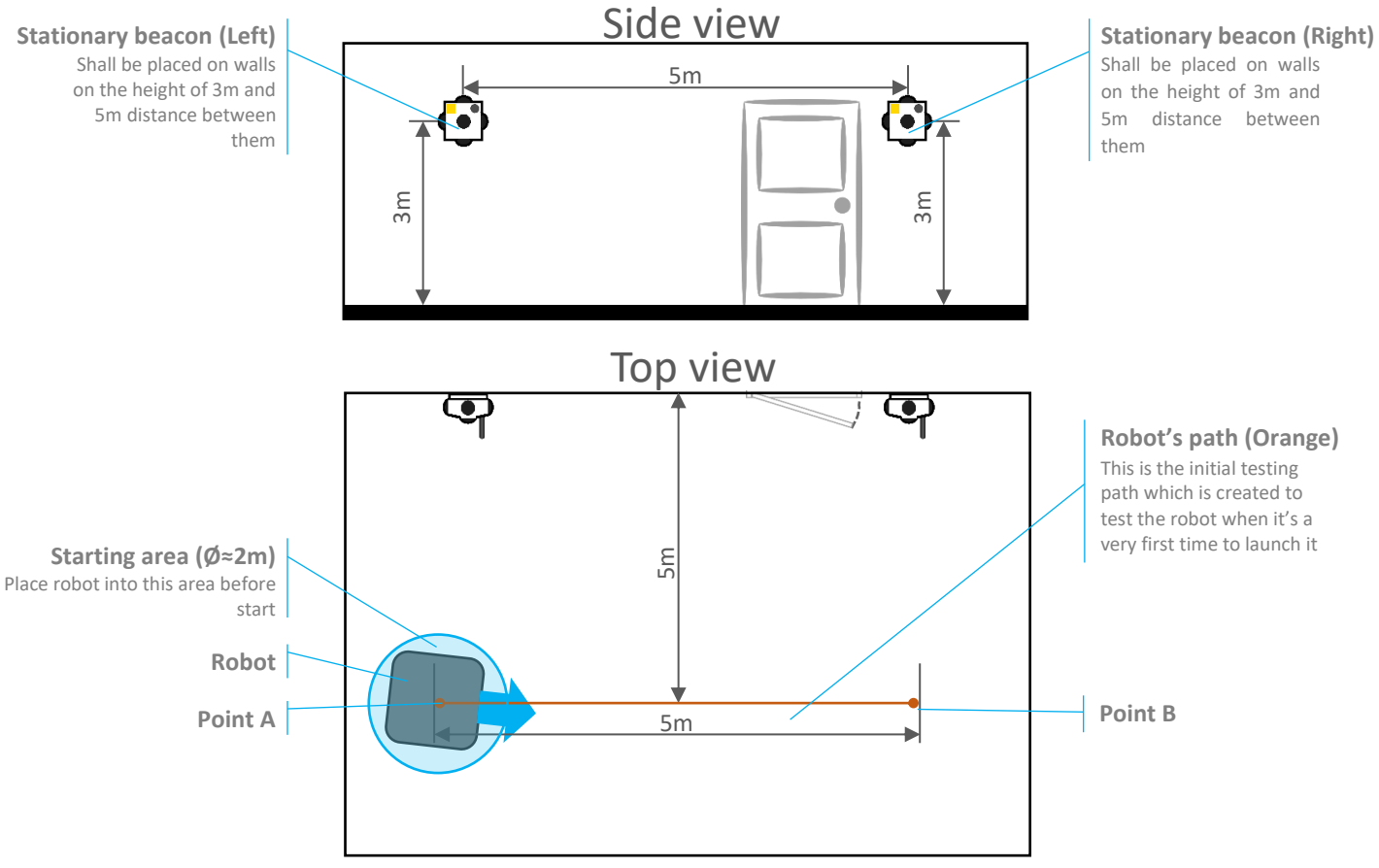
When you receive the robot, you can start a testing launch process. Test launch is a process of testing for Marvelmind Small Robot. Test launch consists of 5 autonomous rides from point A to point B and back. If you are experienced enough, you can skip this part and go forward to “Launching robots in custom maps” chapter.

When you received the Marvelmind Small Robot, you also got 2 stationary Super-Beacons and Modem.

It is included to make it possible to do a test launch of the robot and ensure that the robot works correctly.

How to:

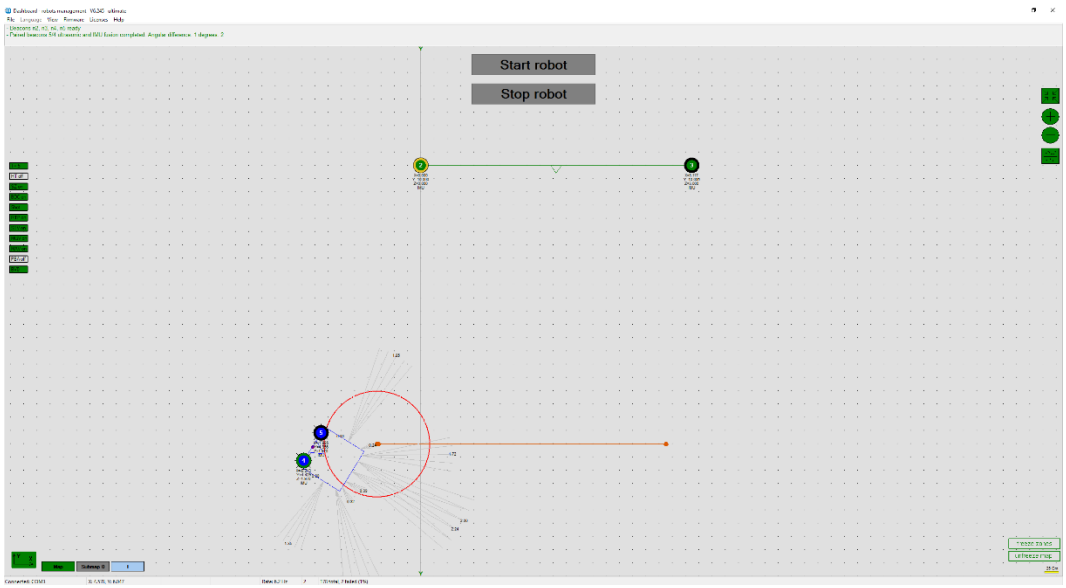
1) Place stationary beacons as described on the picture below

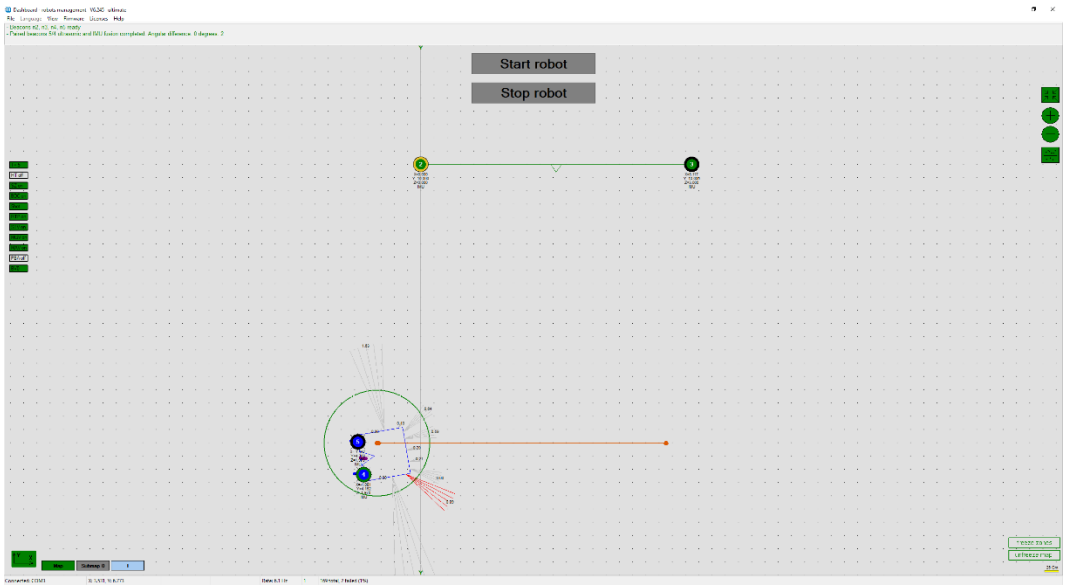


2) Install and launch Marvelmind Testing Software

3) Connect Modem to your PC via USB

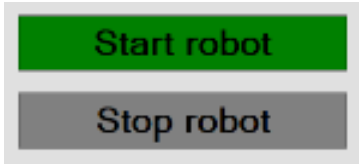
4) Place robot into starting area (If placed correctly – area colors green)



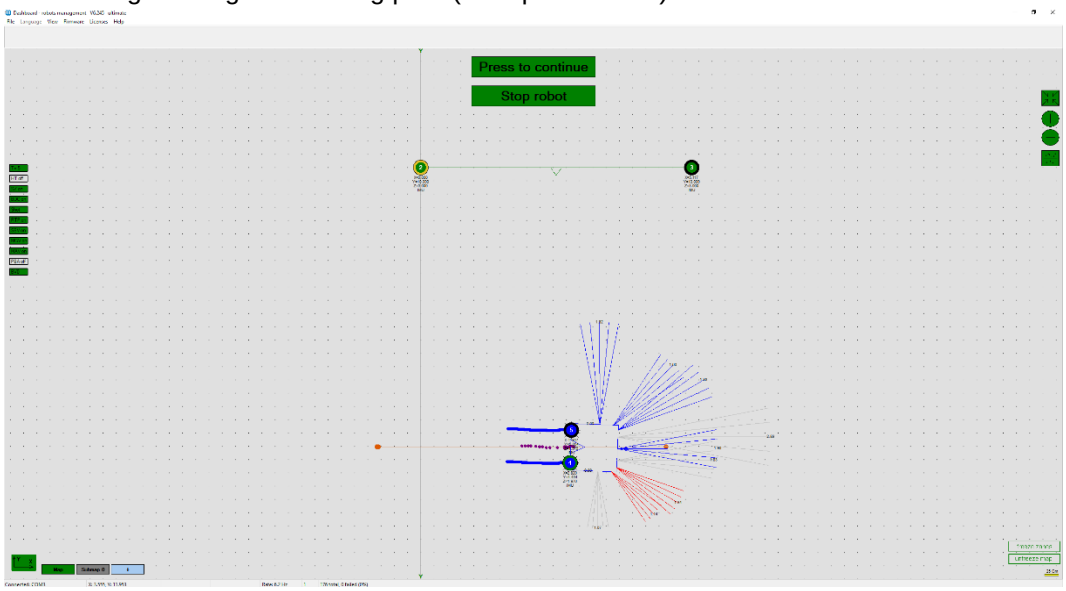


Make sure that you have enough space for the test launch.

5) When robot is ready to go and everything automatically checked by the system, “Start robot” button will color green



6) Press “Start robot” button to launch the robot
Robot will go through the testing path (from point A to B) and back five times



- To pause the movement – press **“Press to pause”** button while moving
- To continue the movement – press **“Press to continue”** button while stopped
- To stop the movement – press **“Stop robot”** button

7) Test launch complete. Now, you can build your custom maps and launch the robot in it

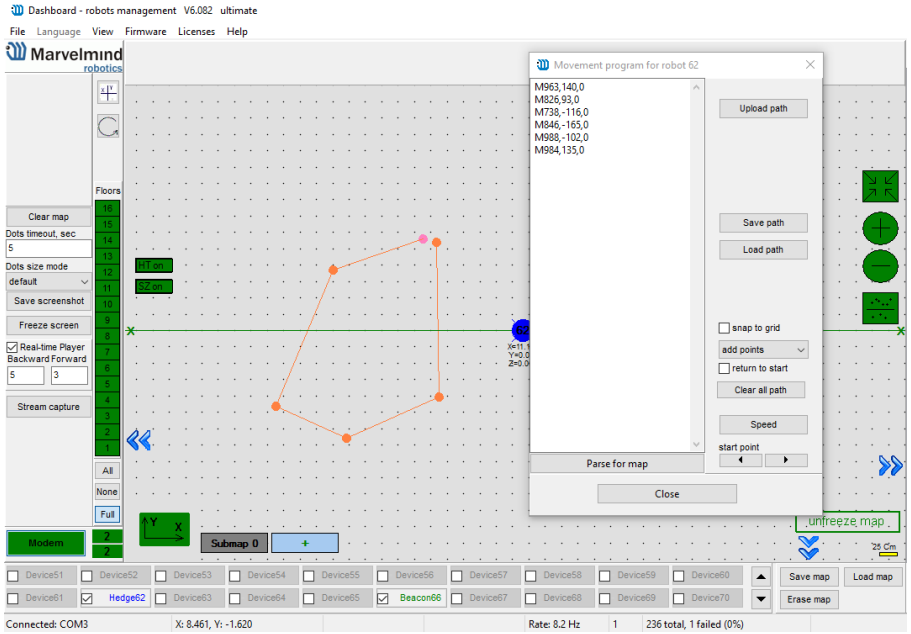
4.2 Launching Boxie in the custom map

When you made a test launch of the robot and succeed, you can build more complex maps and launch the robot in it.

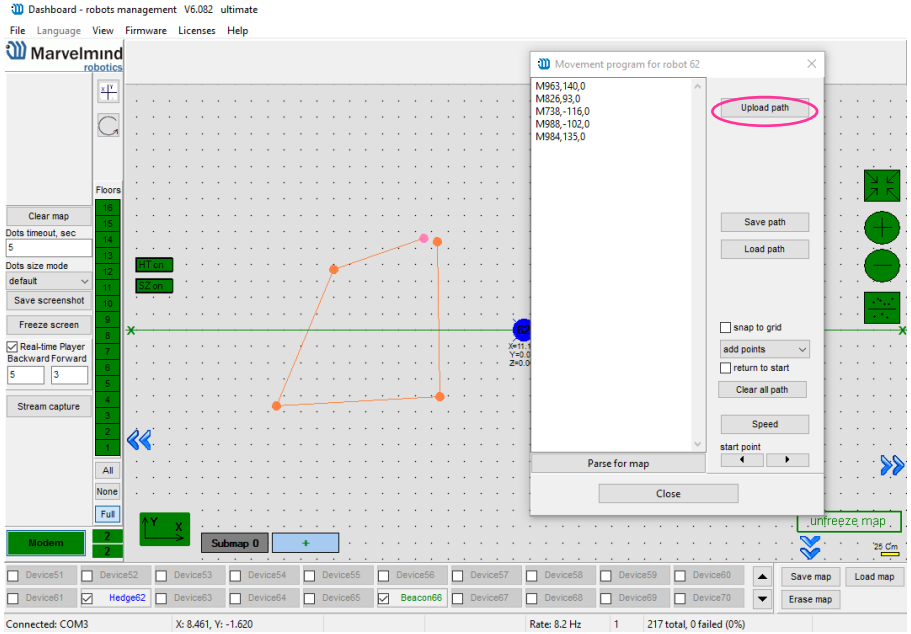
How to:

1) Set up the Marvelmind Indoor “GPS” system. It’s detailed described in the Operating Manual – Sending Path to Robot chapter

2) Configurate paths and start/end points (Use **Shift+Left mouse button click** to create point, click on point – to remove)



3) Upload path to robot (**Upload path** to send it to robot)



4) Reset the modem and connect it to the network.

5) Wait for 30 seconds after connecting (keep the modem and antenna vertically).

6) Position the robot on the driving zone/path.

7) Press the blue button (go to point 2 - end point).

8) After arrival at end point press the black button (go to point 1 - start point)

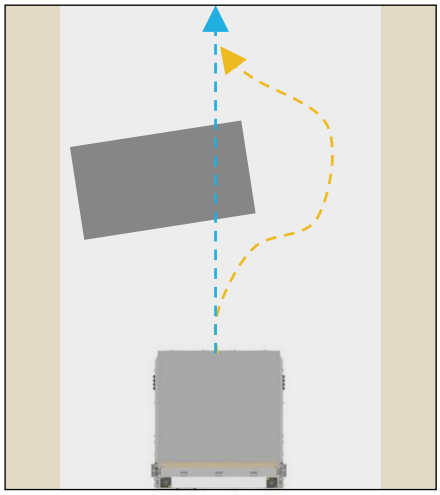
5. Robot’s functionality

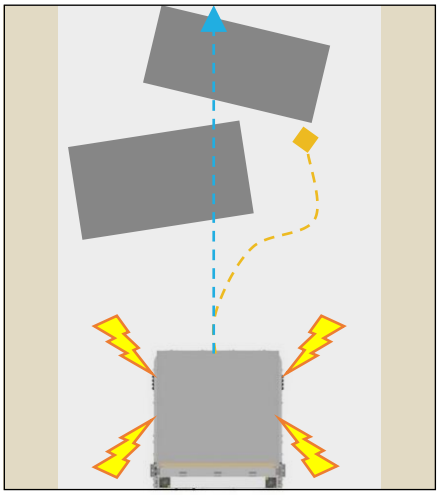
This chapter describes some key features of Marvelmind Small Robot.

5.1 Obstacle avoidance and detection

Marvelmind team installed multiple low-cost lidars into the robot to make it possible to be safety and guarantee solid coverage in different cases.

- Adjustable detection distance (0.3-4m)
- Emergency stop - https://youtu.be/efOc-ItVvgg?t=67
- Rebuilding paths and alarming if stuck





6. Robot’s optional features

This chapter describes some additional parts and components which can be installed to the robot depending on your case. If you need something more, you can request some features you want to see in robot (contact info@marvelmind.com for details)

6.1 Touch screen control

Touch screen gives advanced experience and control level of Marvelmind Autonomous Robots. It replaces and complements hardware buttons on the robot’s housing.

What new abilities it gives:

- Displays information about current task
- Highlights goods code and delivery stage
- Displays statistics in real time
- Edit tasks and order
- Edit paths
- Displays whole map with robots and paths
- Other functions you may need (contact info@marvelmind.com for details)

7. Contacts

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