

MANDEYE DEV manual (firmware v0.1)

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Chapter 1

Introduction

MANDEYE DEV is 3D LiDAR (Light Detection and Ranging) data recorder introduced in ENRICH 2023 (<https://enrich.european-robotics.eu/>). "ENRICH is the world's first and only robotics trial that gives you pure and unspoiled real world scenarios for testing." It can be mounted on any vehicle having 1kg payload or being hand held. MANDEYE DEV was integrated with small 4x4 autonomous mobile robot ClearPath Jackal. It received 3D mapping award after it delivers 3D map of the scenario in fully automatic way. It is robust, reliable, accurate, precise and 10x more affordable than competitive 3D mapping systems. It can collect 3D data more than 4 hours in continuous mode. The 3D map is processed off-line using open source software available in <https://github.com/MapsHD/HDMapping/>. Data can be also converted to ROS rosbags (please send me email: januszbedkowski@gmail.com), so You can test it with plenty of LiDAR mapping open-source software. It is designed for:

- collecting 3D data for INDOOR and OUTDOOR scenes,
- providing ground-truth trajectory,
- enhance autonomous navigation and mapping of Your mobile robot,
- improve the robotic system deployment,
- professional applications,
- having fun from 3D mapping.

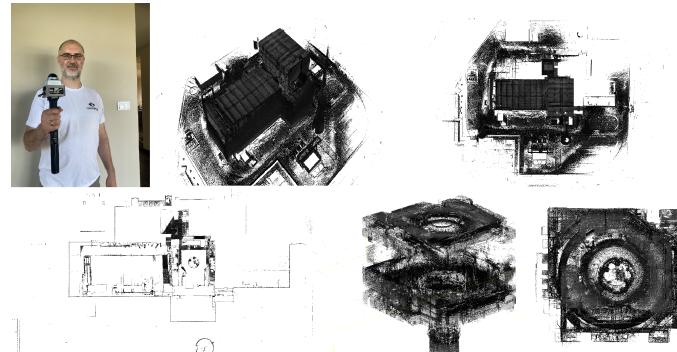
Following photos will show MANDEYE DEV and what it can do.



(a) MANDEYE DEV with 3D mapping award.

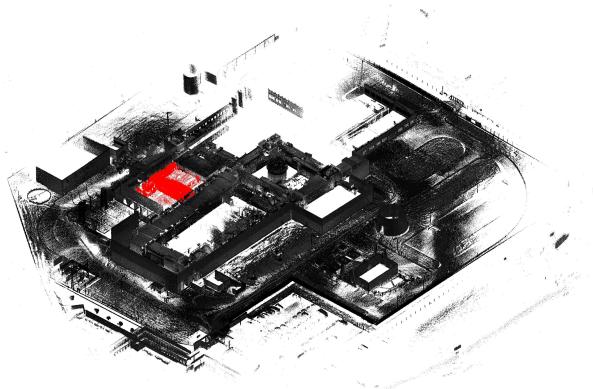


(b) MANDEYE DEV integrated with 4x4 Jackal robot.



**MANDEYE - REVOLUTION IN AFFORDABLE 3D MAPPING
TESTED IN ENRICH2023 - NUCLEAR POWER PLANT FACILITY**
1kg, 4 hours work, accurate, precise, affordable (1999EUR)

(c) 3D map of entire Nuclear Plant acquired with hand-held MANDEYE DEV.

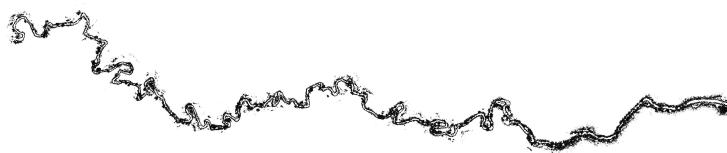


(d) Red color: 3D map delivered by autonomous 4x4 Jackal equipped with MANDEYE DEV. Gray scale: 3D map of ground floor of Nuclear Plant acquired with hand-held MANDEYE DEV.

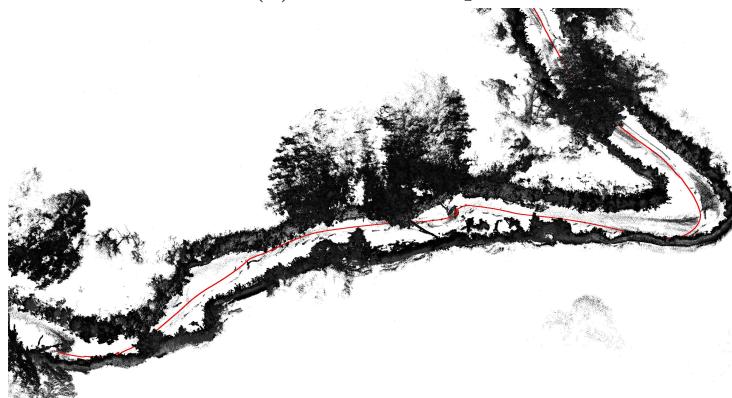
Figure 1.1: MANDEYE DEV for professional use in action during ENRICH 2023 <https://enrich.european-robotics.eu/>.



(a) MANDEYE DEV mounted onto water vessel.



(b) 3km river trip.



(c) Red line: ground truth trajectory of water vessels.
Gray scale: 3D map.

Figure 1.2: MANDEYE DEV for having fun with 3D mapping.

Chapter 2

Hardware description

MANDEYE DEV is composed of (figure 2.1a):

- MANDEYE DEV main unit,
- Tool for nuts,
- Charger.

It is stored in suitcase for secure transport (figure 2.1b).

2.1 Turn on device

Please click button on the bottom of the RONIN grip (figure 2.2a). Green square lights on RONIN grip should be visible. Blue light on MANDEYE DEV head indicates that device is ready for action. Otherwise please check section 2.6.

2.2 Turn on continuous scanning

The procedure for starting continuous data collection is as follows:

- 1: Turn on device and check if no error indicators (figure 2.5). Please click button on the bottom of the RONIN grip. Green square light should be visible. If ok then goto 2:
- 2: Place MANDEYE DEV steady on the ground.
- 3: Push white button (figure 2.2c.) and wait around 30 seconds.

- 4: Gently take MANDEYE DEV to hand and go around your scanning area.
- 5: Go back to starting point (if possible) and gently place MANDEYE DEV on the ground.
- 6: Push white button while red light is not indicating the fact that device is copying data from local memory to USB drive.
- 7: Turn off device (figure 2.2d). To turn off continuous scanning recording press white button when red light is not lightning. Press shortly RONIN button and then press longer RONIN button. All RONIN lights should turn off.

2.3 Turn off continuous scanning

Turn off device (figure 2.2d). Press shortly RONIN button and then press longer RONIN button. All RONIN lights should turn off.

2.4 Turn on stop scan

- 1: Turn on device and check if no error indicators (figure 2.5). Please click button on the bottom of the RONIN grip. Green square light should be visible. If ok then goto 2:
- 2a: Place MANDEYE DEV steady on the ground.
- 3a: Push black button (figure 2.2c.) and wait till yellow and red lights will turn off.
- 2b: Place MANDEYE DEV steady on the ground in second location.
- 3b: Push black button (figure 2.2c.) and wait till yellow and red lights will turn off.
- 2c: Place MANDEYE DEV steady on the ground in third location.
- 3c: Push black button (figure 2.2c.) and wait till yellow and red lights will turn off.
- 2d: ...
- 3d: ...

- 2N: Place MANDEYE DEV steady on the ground in N-th location.
- 3N: Push black button (figure 2.2c.) and wait till yellow and red lights will turn off.
- 4: Turn off device (figure 2.2d). Press shortly RONIN button and then press longer RONIN button. All RONIN lights should turn off.

2.5 Turn off device

Press shortly RONIN button and then press longer RONIN button. All green lights on RONIN grip should turn off.

2.6 Error indicators

MANDEYE DEV is capable indicating two errors:

- 1: "No USB drive", red light is blinking (figure 2.5a),
- 2: "No communication with LiDAR", yellow and green lights are blinking (figure 2.5b).

2.7 Data structure on USB drive

MANDEYE DEV starts with empty USB drive that has to be formatted as FAT, otherwise error "No USB drive" can appear. Ones MANDEYE DEV will be turn on it will create following data on USB drive:

- *continuousScanning_0000* (this is folder for continuous scanning data)
- *stopScans_0000* (this is folder for stop scan scanning data)
- *mandala_manifest.txt* (this is MANDEYE DEV internal file)
- *version.txt* (this file contains firmware version, so please check the title of this documentation if it is the same as on USB drive).

Ones, You operate with MANDEYE DEV more *continuousScanning_0000*, *stopScans_0000* appear. New folders are creating for each turn on of the MANDEYE DEV, so sometimes the can be empty. Ones You approach full USB drive, please remove all files from it.



(a) MANDEYE DEV all components - 1: MANDEYE DEV, 2: Tool for nuts, 3: Charger.



(b) Suitcase with MANDEYE DEV for secure transport.

Figure 2.1: MANDEYE DEV ready for action.



(a) STEP 1: Turn on: please click button on the bottom of the RONIN grip. Green square light should be visible.



(b) STEP 2: Once the MANDEYE DEV is turned on, it should turn on blue light.



(c) STEP 3: Push white button for starting continuous scanning procedure.



(d) STEP 4,5: To turn off continuous scanning recording press white button when red light is not lighting. Press shortly RONIN button and then press longer RONIN button. All RONIN lights should turn off.

Figure 2.2: MANDEYE DEV ready for action.



(a) MANDEYE DEV is showing by green light that 3D continuous scanning data are recorded in local memory.



(b) MANDEYE DEV is showing by green and red light that it copies continuous scanning data from local memory to USB stick.

Figure 2.3: MANDEYE DEV during continuous scanning.



(a) MANDEYE DEV is showing by yellow light that 3D data are recorded in local memory.



(b) MANDEYE DEV is showing by yellow and red light that it copies data from local memory to USB stick.

Figure 2.4: MANDEYE DEV during stop/scan scanning.



(a) MANDEYE DEV "no USB drive" error - blinking red light.



(b) MANDEYE DEV "no communication with LiDAR" error - blinking yellow and green lights.

Figure 2.5: MANDEYE DEV error indicators.

