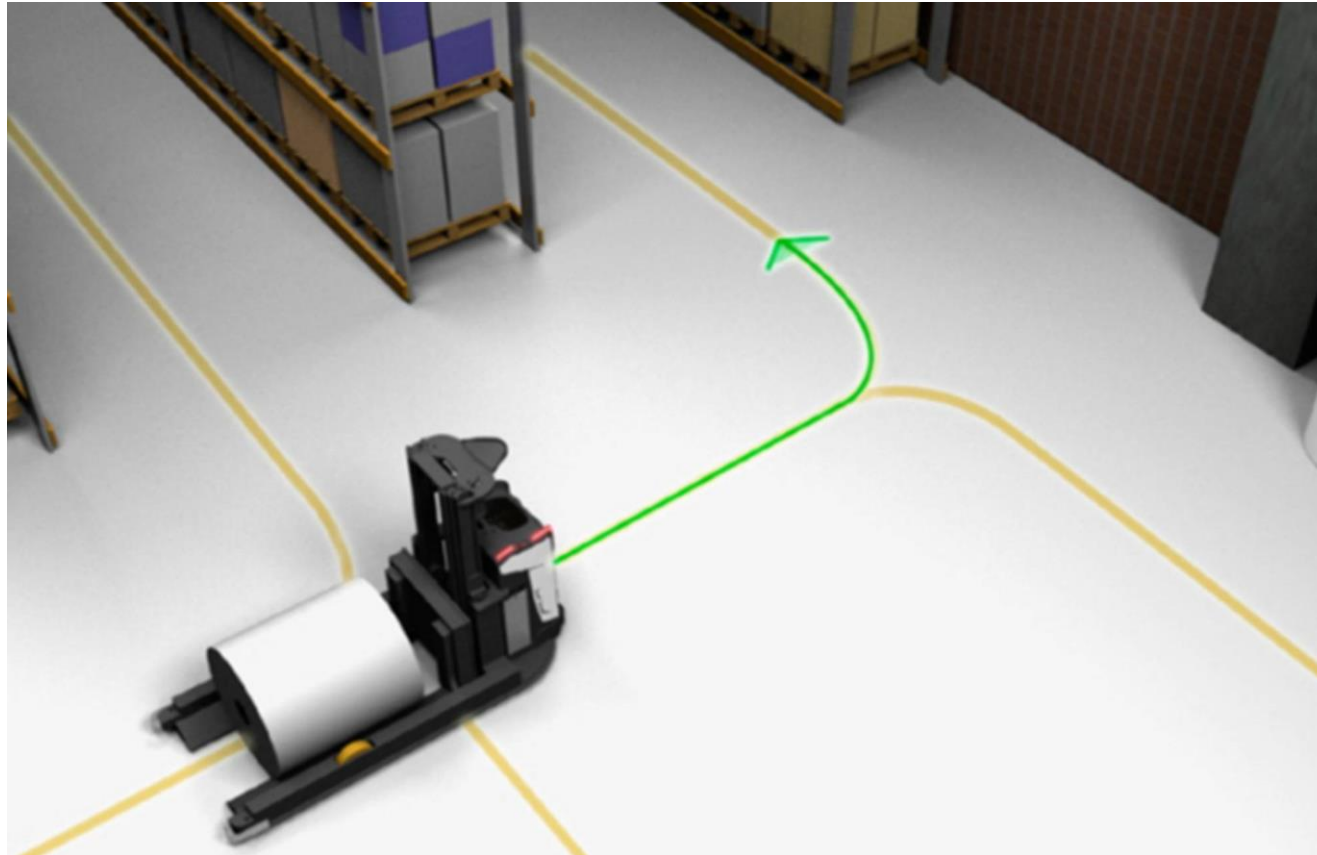


MiR | A Better Way

MiR

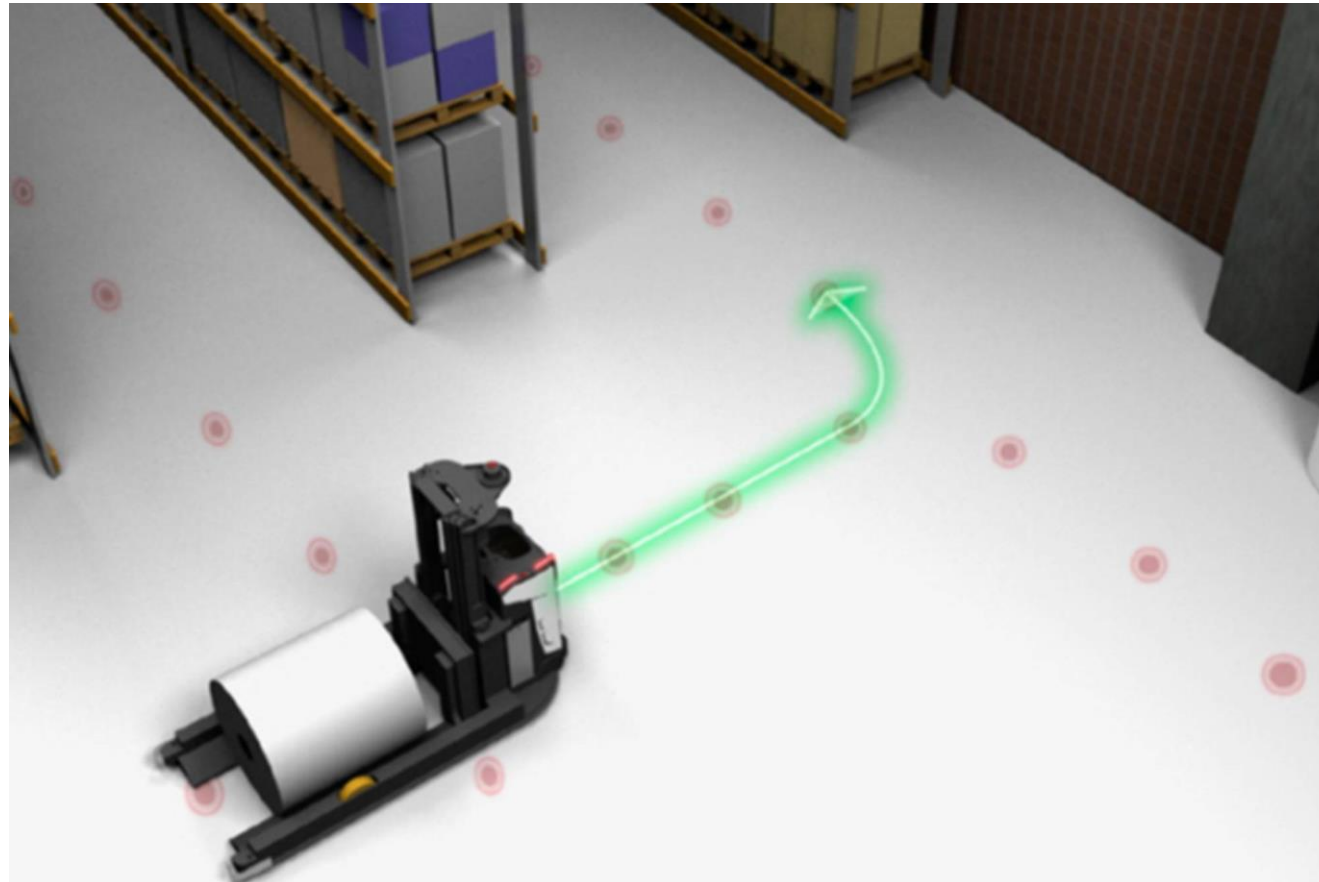
AGV: Automated Guided Vehicle

Navigazione a filo guida



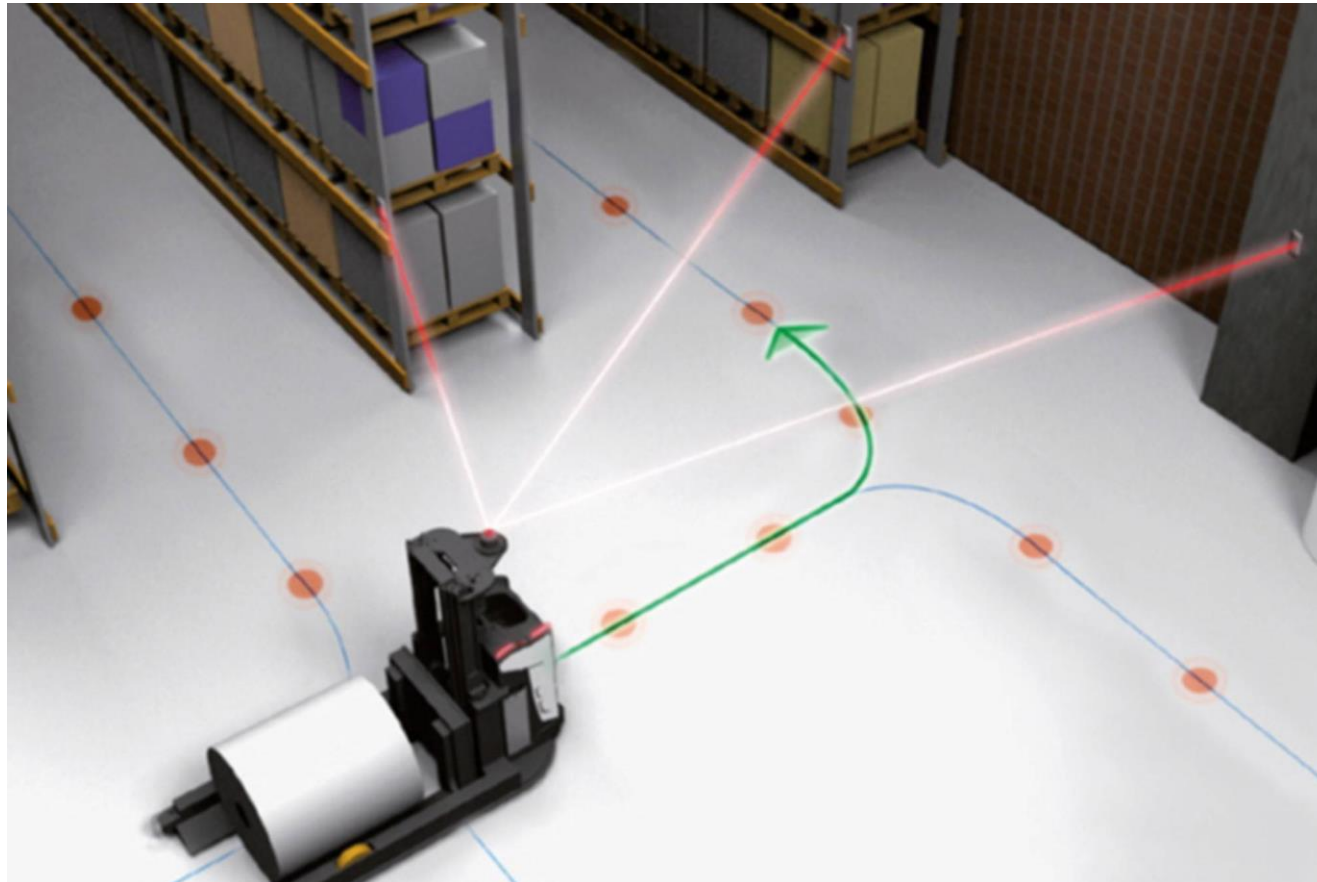
AGV: Automated Guided Vehicle

Navigazione a spot o banda magnetica



AGV: Automated Guided Vehicle

Navigazione laser



Why MiR is an AMR?
How does it work?

MiR – Autonomous Mobile Robots

Automatic Navigation

AMR vs AGV



AMR Autonomous (collaborative) Mobile Robot

- ▶ Trackless, autonomous navigation
- ▶ Travels safely around people and obstacles
- ▶ Easy to expand/change work area
- ▶ Navigates dynamically while planning it's own path and sequence

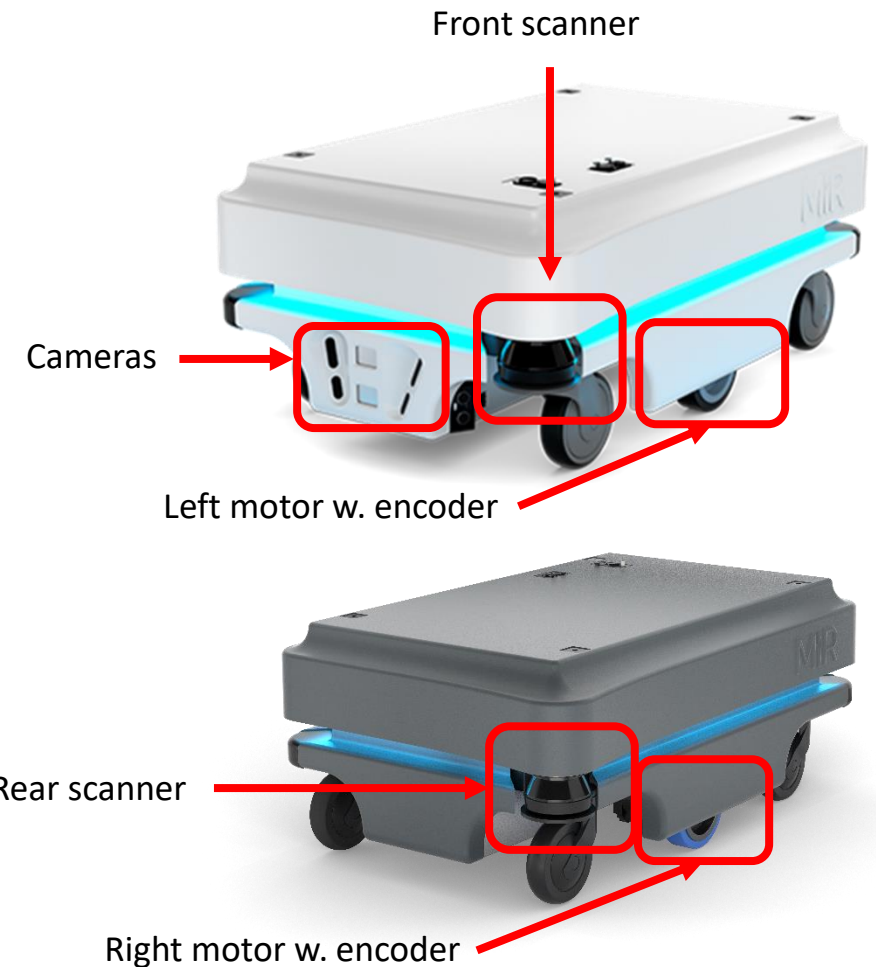
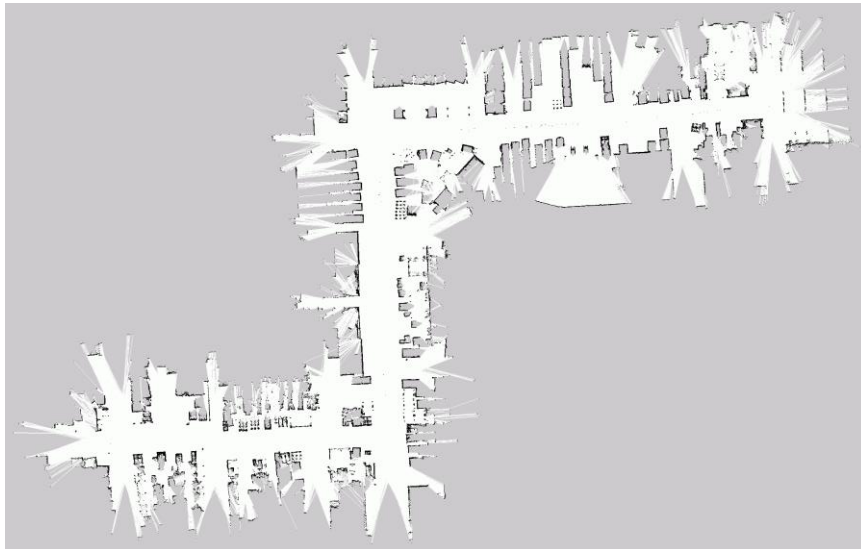


AGV Automated Guided Vehicle

- ▶ Requires "tracks" – e.g. magnetic stripes in the floor or wires
- ▶ Stops at any obstacle without possibility to change route
- ▶ Expensive and time consuming to expand/change work area
- ▶ Restricted to fixed routes and controlled sequence

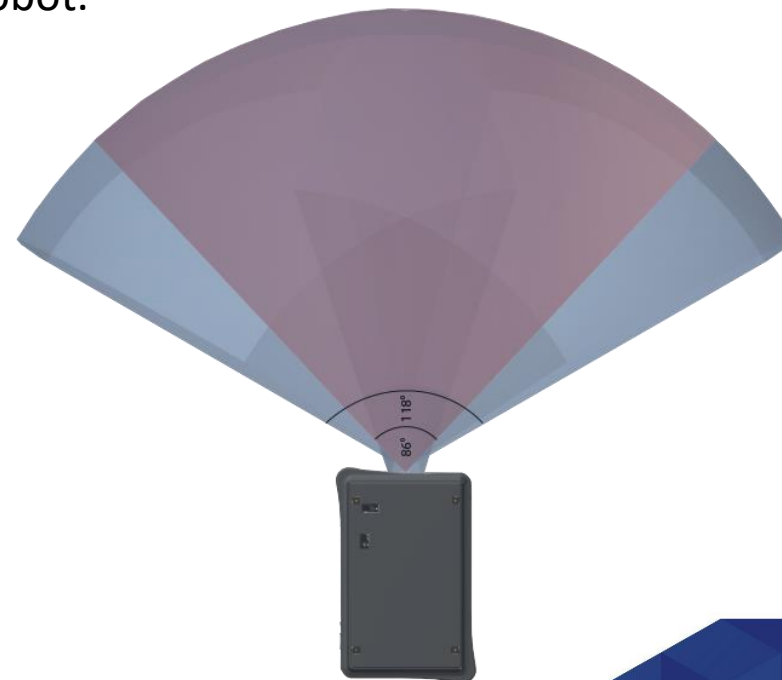
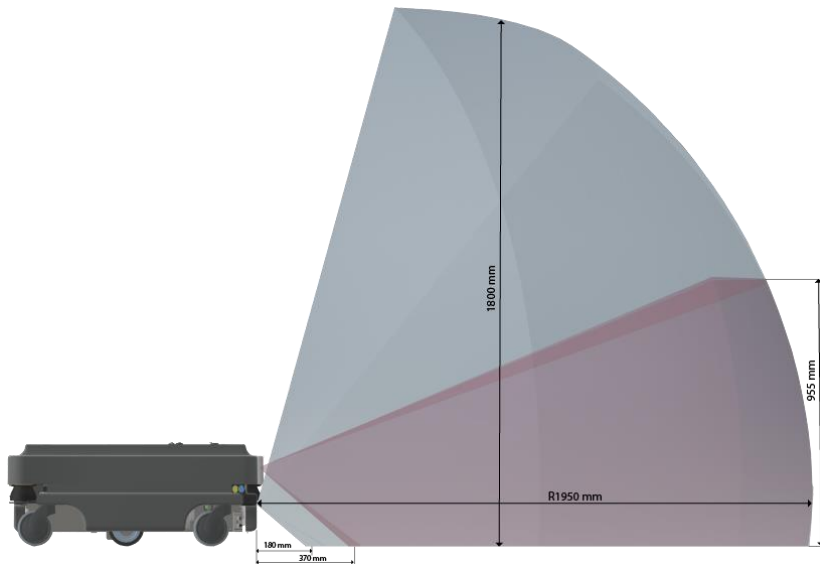
Automatic Navigation

- ▶ MiR relies on 2 laser scanners, 2-4 motor encoders, IMU and two cameras to navigate;
- ▶ This information is combined with a map to create safe movement paths;
- ▶ Example of a map can be seen below. Maps will be explained in detail later.



New front camera - MIR100/200

- ▶ The front camera in the top cover has been replaced with two dual front cameras in the front cover;
- ▶ The two 3D depth cameras positioned on the front of the robot detect objects:
 - ▶ Vertically up to 1800 mm at a distance of 1950 mm in front of the robot;
 - ▶ Horizontally in an angle of 118° in front of the robot.



Collaborative Operations

Sensory input – MiR100 and MiR200



4 ultra sonic sensors
reduce blind angles and risk
of driving into pallets

2 SICK microScan 3.
FoV: 360° up to 30 m in
a plane at 200 mm
height.



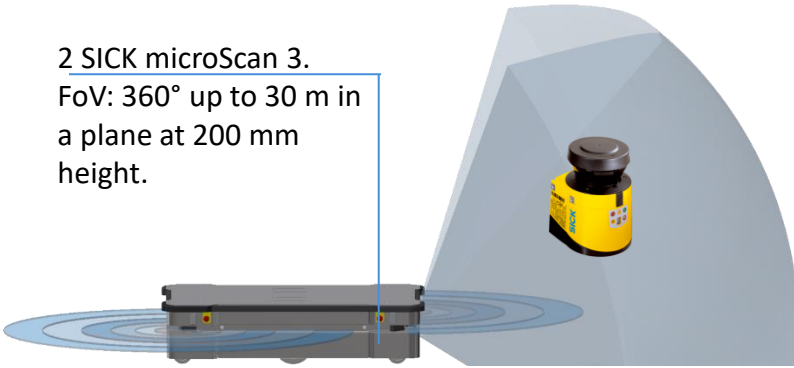
Two 3D cameras
FoV: Detects objects 0-1800 mm high
118° horizontal view



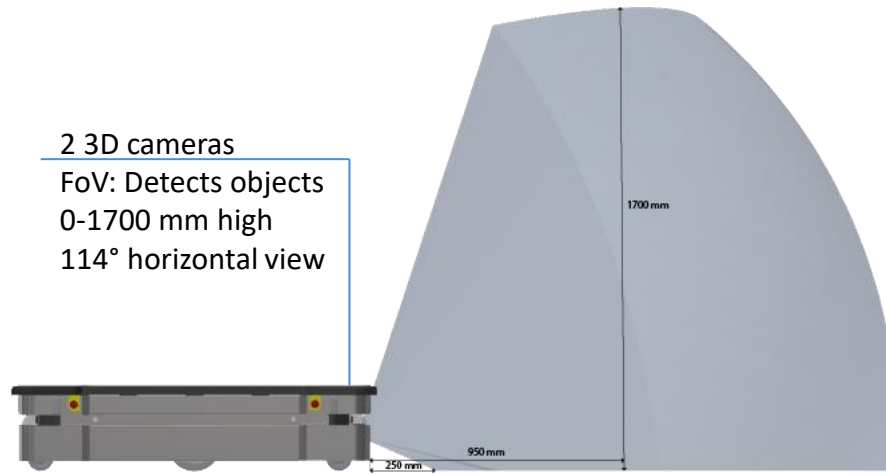
Collaborative Operations

Sensory input – MiR500 and MiR1000

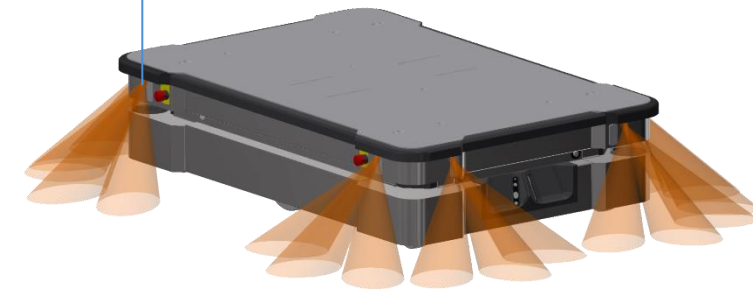
2 SICK microScan 3.
FoV: 360° up to 30 m in a plane at 200 mm height.



2 3D cameras
FoV: Detects objects 0-1700 mm high
114° horizontal view



4 proximity sensors in each corner
Pallet and feet detection



Collaborative Operations

Safety functions in the MiR robots

Function	Mode of operation	Triggering event	Result	MiR100	MiR200	MiR500	MiR1000
E-stop	Always on	Actuation of E-stop device	Removal of power to power drive (category 0 stop)	PLd, cat 3	PLd, cat 3	PLd, cat 3	PLd, cat 3
Field switching	Always on	Speed monitoring	Field switching according to speed	Fail-safe**	PLd, cat 3*	PLd, cat 3	PLd, cat 3
Personnel detection	Always on (can be muted)	Object within selected protective field	Removal of power to power drive, brake and maintain stop	PLd, cat 2	PLd, cat 2	PLd, cat 3	PLd, cat 3
Overspeed detection	Always on	Speed exceeding maximum rated speed	Removal of power to power drive (category 0 stop)	Fail-safe**	PLd, cat 3*	PLd, cat 3	PLd, cat 3
Field muting	Always on	Enable by control system	Muting/reducing of protective field possible AND Safety-limited speed SF is enabled			PLd, cat 3	PLd, cat 3
Safety limited speed	Enabled by field muting SF OR input pair in safety interface driven LOW	Speed on one of the motors exceeding 0.3m/s	Removal of power to power drive (category 0 stop)			PLd, cat 3	PLd, cat 3
Safe guarded stop	Always on	Input pair in safety interface driven LOW	Removal of power to power drive (category 0 stop)			PLd, cat 3	PLd, cat 3
Locomotion	Always on	Speed on one of the motors exceeding 0,1m/s	Output pair is safety interface are driven LOW			PLd, cat 3	PLd, cat 3
System E-stop	Always on	Input pair in safety interface driven LOW	Removal of power to power drive (category 0 stop)			PLd, cat 3	PLd, cat 3

*Implemented from MK4 HW revision.

**Fail-safe means it is designed to fail to a safe state and is single failure tolerant but not designed according to ISO 13849.

Product portfolio

- MiR100™
- MiR200™
- MiRHook™
- MiR250™
- MiR250 Shelf Carrier™
- MiR500™ e MiR1000™
- MiR600™ e MiR1350™
- MiR Pallet Rack EU & US
- MiR Pallet Lift EU & US
- MiR Shelf lift
- MiRCharge™
- MiRFleet™
- Wise Module

MIR100™

Technical Specifications

Payload:	100 kg – 220 lbs.
Precision:	+/-50 mm - +/- 2" of position +/- 10 mm - +/- 0.4" to docking marker
Max speed forwards:	1.5 m/s – 5.4 ft/s
Max speed backwards:	0.3 m/s – 1 ft/s
Battery run time:	10 hours or 20 km
Weight:	65 kg – 143 lbs.
Battery charging:	0-80%: 2 hours
Communication:	Wi-Fi, Bluetooth, Ethernet and PLC
Safety:	Complies with EN1525 safety regulations, SICK safety lasers, PL=d cat. 3
CE certified:	Yes



MIR200™

Technical Specifications

Payload:	200 kg – 440 lbs.
Precision:	+/-50 mm - +/- 2" of position +/- 10 mm - +/- 0.4" to docking marker
Max speed forwards:	1.1 m/s – 3.6 ft/s
Max speed backwards:	0.3 m/s – 1 ft/s
Battery run time:	10 hours or 20 km – 12.5 mi
Weight:	65 kg – 143 lbs.
Battery charging:	0-80%: 2 hours
Communication:	Wi-Fi, Bluetooth, Ethernet and PLC
Safety:	Complies with EN1525 safety regulations, SICK safety lasers, PL=d cat. 3
CE certified:	Yes
ESD approved:	Yes
Clean Room certified:	Yes



MiR Hook™

Technical Specifications

Collaborative mobile robots with hook for fully-automated pick-up and delivery of carts

Length: (hook arm)	1180-1275 mm (highest to lowest positions of hook arm)
Width:	580 mm
Height: (hook arm)	550 to 900 mm (lowest to highest positions of hook arm)
Height above floor: mm	Robot: 50 mm, Gripping height: 50 mm - 390 mm
Weight (without load):	98 kg - 216 lbs.
MiRHook100 towing capacity: incline	Up to 300 kg at <1% incline - 200 kg at 5% incline
MiRHook200 towing capacity: incline	Up to 500 kg at <1% incline - 300 kg at 5% incline
Battery time:	8-10 hours (depending on load)
Max speed forwards:	MiRHook200: 1.1 m/s – 3.6 ft/s MiRHook100: 1.5 m/s – 5.4 ft/s
Communication:	Wi-Fi, Bluetooth, Ethernet and PLC
Safety:	Complies with EN1525 safety regulations SICK safety lasers, PL=d cat. 3



MIR250™

Technical Specifications

Payload:	250 kg – 440 lbs.
Towing capacity (with MiRHook250):	500 kg – 1100 lbs.
Precision:	+/-50 mm - +/- 2" of position +/- 5 mm - +/- 0.2" to docking marker
Max speed forwards:	2.0 m/s
Battery run time:	10 hours
Battery charging:	10-90%: 1 hours
Communication:	Wi-Fi, Bluetooth, Ethernet and I/O
Safety:	Complies with EN1525 safety regulations, SICK safety lasers, PL=d cat. 3
CE certified:	Yes
ESD approved:	Yes
Clean Room certified:	Yes



MiR Shelf Carrier 250™

Technical Specifications

Payload:	250 kg – 440 lbs.
Towing capacity (with MiRHook200):	500 kg – 1100 lbs.
Precision:	+/-50 mm - +/- 2" of position +/- 5 mm - +/- 0.2" to docking marker
Max speed forwards:	2.0 m/s
Battery run time:	10 hours
Battery charging:	10-90%: 1 hours
Communication:	Wi-Fi, Bluetooth, Ethernet and I/Os
Safety:	Complies with EN1525 safety regulations, SICK safety lasers, PL=d cat. 3
CE certified:	Yes
ESD approved:	Yes
Clean Room certified:	Yes



MiR500™

Technical Specifications

Payload:	500 kg – 1100 lbs.
Precision:	+/-50 mm - +/- 2” of position +/- 10 mm - +/- 0.4” to docking marker
Max speed forwards:	2.0 m/s – 6.5 ft/s
Max speed backwards:	0.3 m/s – 1 ft/s
Battery run time:	8 hours
Weight:	230 kg – 550 lbs.
Battery charging:	10-90%: 1 hour
Communication:	Wi-Fi, Bluetooth, Ethernet and PLC
Sensors:	SICK Microscan3 safety system for 360° visual protection, 3D Cameras
Safety:	Compliant with ISO/CD 3691-4, EN1525, ANSI B56.5, EMC EN61000-6-2, & EN61000-6-3.
CE certified:	Yes



MiR1000™

Technical Specifications

Payload:	1000 kg – 2200 lbs.
Precision:	+/-50 mm - +/- 2” of position +/- 10 mm - +/- 0.4” to docking marker
Max speed forwards:	1.2 m/s – 3.9 ft/s
Max speed backwards:	0.3 m/s – 1 ft/s
Battery run time:	8 hours
Weight:	230 kg – 550 lbs.
Battery charging:	10-90%: 1 hour
Communication:	Wi-Fi, Bluetooth, Ethernet and PLC
Sensors:	SICK Microscan3 safety system for 360° visual protection, 3D cameras
Safety:	Compliant with ISO/CD 3691-4, EN1525, ANSI B56.5, EMC EN61000-6-2, & EN61000-6-3.
CE certified:	Yes



MiR EU Pallet Rack™

MiR Pallet Rack™

Technical Specifications

Pickup and unloading station for the MiR500 and MiR1000 when using lifts

Pallet size MiR EU Pallet Rack:	1200 x 800 mm
Pallet size MiR Lift Pallet Rack:	Standard supports 40" x 48"
Payload:	1000 kg – 2200 lbs.
Dimensions MiRLift Pallet Rack:	1300 x 1182 x 442 mm
Dimensions MiR EU Pallet Rack:	1300 x 1182 x 452 mm



MiR EU Pallet Lift™

MiR Pallet Lift™

Technical Specifications

Designed for autonomous pickup/dropoff of pallets

Pallet lift height and speed:	60 mm in less than 7 sec.
Payload MiR500 EU Pallet Lift:	500 kg – 1100 lbs.
Payload MiR500 Lift:	500 kg – 1100 lbs.
Payload MiR1000 EU Pallet Lift:	1000 kg – 2200 lbs.
Payload MiR1000 Lift:	1000 kg – 2200 lbs.
Surface of pallet lifts:	Non-slip
Dimension of pallets – MiR EU pallet lift:	1200 x 800 mm
Dimensions of pallets – MiRLift:	Universal size
EU Pallet Lift 500/1000 dimensions:	1200 x 162 x 95 mm
Pallet Lift 500/1000 dimensions:	1430 x 1142 x 357 mm



MiR Shelf Lift™



Technical Specifications Frame

Designed for autonomous pickup/dropoff of frames

Dimension: 1304, 910, 1174, 710 mm

Total height in lowered position: 94 mm

Total height in lifted position: 156 mm

Payload: 1000 kg – 2200 lbs.

Lift height: 60 mm

Minimum number of lift cycles: 50.000

MiR Charge 24V™

MiR Charge 48V™

Technical Specifications

MiRCharge 24V for autonomous charging of MiR100 and MiR200

MiRCharge 48V for autonomous charging of MiR500 and MiR1000

Includes a VL Marker for accurate docking

Weight MiRCharge 24V:	Output: 24 V, max 25 A
	Input: 100 - 230 V ac, 50-60 Hz

Weight MiRCharge 48V:	Output: 48 V, 40 A at 230V, 20 A at 110 V
	Input: 100 V - 230 V, 50-60 Hz

Dimensions MiRCharge 24V :	580 x 300 x 120 mm
----------------------------	--------------------

Dimensions MiRCharge 48V :	620 x 340 x 200 mm
----------------------------	--------------------

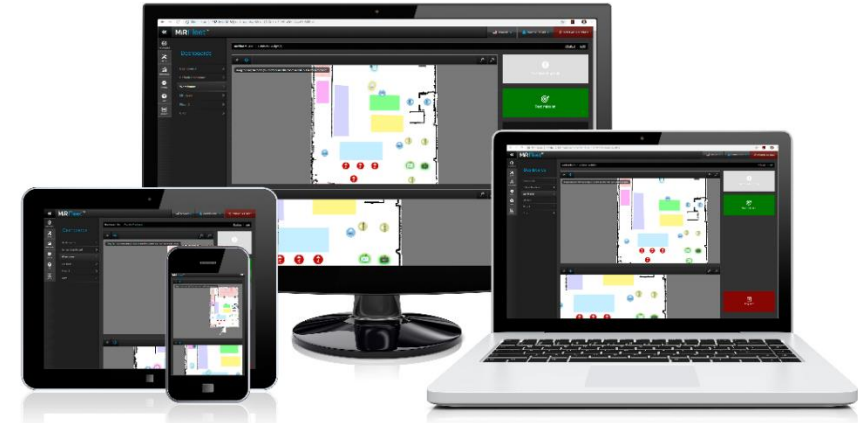
Weight MiRCharge 24V:	10.5 kg / 22 lbs.
-----------------------	-------------------

Weight MiRCharge 48V:	21 kg / 46 lbs.
-----------------------	-----------------



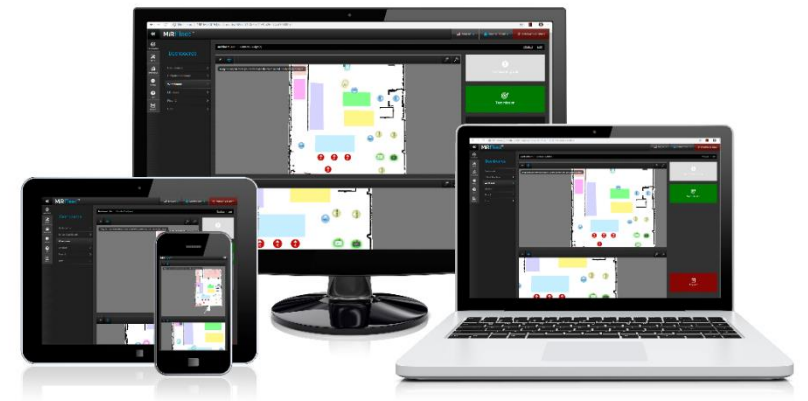
MiRFleet™

- ▶ MiRFleet™ gives you centralized control of robots throughout your facility from a single, user-friendly, web-based interface.
- ▶ You can easily program and control a fleet of robots, including managing robots with different top modules, hooks or other accessories.
- ▶ Once programmed, the system automatically prioritizes and selects the robot best-suited for a job based on position and availability.



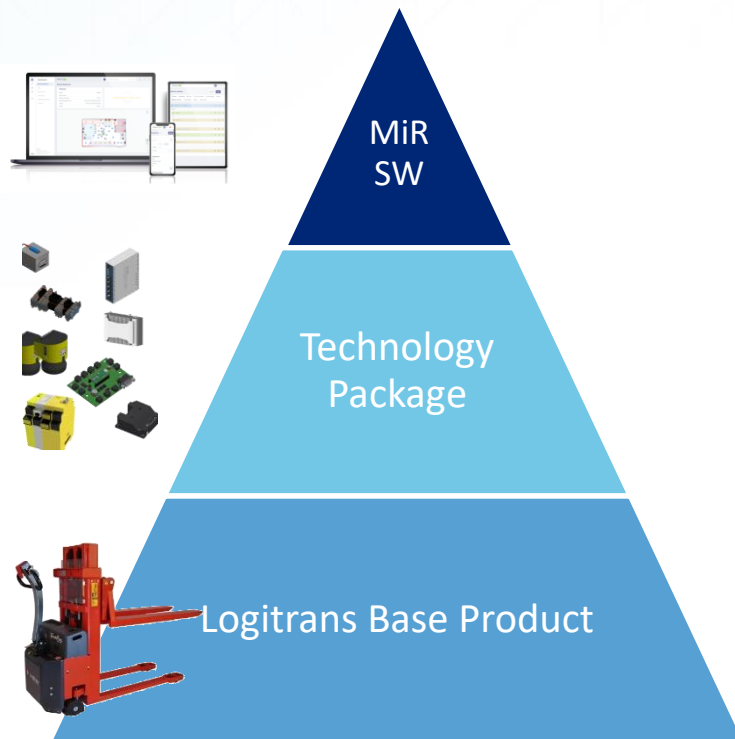
MIR Fleet™

- ▶ Fleet Management for optimized robot traffic;
- ▶ Automatic prioritization and selection of the robot best suited for a job, based on position and availability;
- ▶ Group robots with different top modules;
- ▶ Manage resources such as chargers automatically;
- ▶ Now also available as a Server Solution (Docker container).



The MiR Pallet Jack – combining the best of two worlds

The Pallet Jack is made in collaboration with Danish-based Logitrans A/S, who has +80 years of experience making lift products. Together with MiR's hardware package, knowledge and software we are making a groundbreaking AMR Pallet Jack.



Core Use Cases – inspiration to where you can start

At launch the Pallet Jack is aimed at some key movements of EU pallet in floor-2-floor use cases. This will enable multiple added benefits of MiR robots.



Staging pallets



Staging



End-Of-Line Put Away

Benefits:

- > ROI & TCO
- > Compliance
- > Flexibility
- > Cycle time
- > Useability

Capabilities at launch:

- > Same environments as today
- > Floor-2-Floor applications
- > Standard EUR-Pallets with 1200 kg payload

Differentiation of the MiR Pallet Jack



Draft 3D picture - final product could be different

Maximize throughput with optimized pick&place cycle times enabled by machine learning based perception system



Scalable and easy-to-deploy solution with lowest TCO, empowered by the same mature and user-friendly SW for all MiR robot types



Increase efficiency with the reliable robot for operations in challenging environments enabled by MiR's HW & SW combined with LogiTrans' extensive lift product know-how



Ensure employee safety by complying with latest safety and compliance standards



Enhanced performance and uptime by end-to-end service & support to customers on entire AMR journey backed by Teradyne – trusted provider to enterprise customers



APPLICATION

Application

MiR 200

- ▶ Can transport box with roller conveyor
 - ▶ Is comfortable for load and unload by operators
 - ▶ You can have gravity conveyor or horizontal conveyor
 - ▶ You can have also motorized conveyor
-
- ▶ Runtime: 10 h
 - ▶ Payload capacity: 200 kg



Application

MiR 200

- ▶ Picks up and delivers small objects
- ▶ Docks to VL-marker
- ▶ Uses RG2 gripper

- ▶ Runtime: 10 h
- ▶ Payload capacity UR: 5 kg

UR 5 e-series



Application

Station

- ▶ Storage for pallet
- ▶ It can communicate with MiR directly
- ▶ It can take or delivery empty pallet



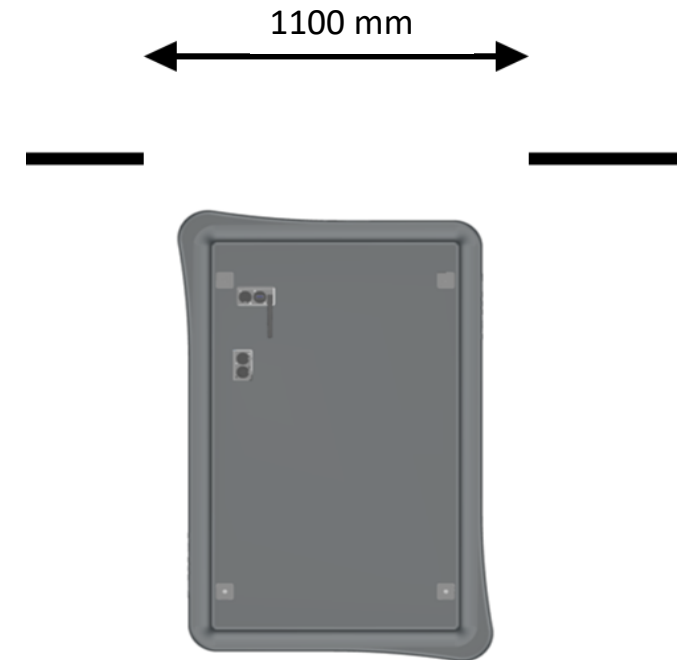
IP Rating

- IP20 classification for MiR 100/200;
- IP21 classification for MiR 500/1000;
- The first number indicates the resistance to solid objects such as dust; it also indicates if dangerous parts of the equipment can be touched by a person:
 - A “2” rating indicates protection against objects of sizes above 12.5mm (effective protection against fingers or similar sized objects);
- The second number indicates the resistance to liquids:
 - A 0 rating indicates no protection from liquids;
 - A 1 rating indicates protection against mist.

Ps. IP52 for MiR600/1350

Space Requirements

- The MiR100 and MiR200 can drive through doorways of width 90cm or above; they need a total width of 1100 mm to navigate in a corridor.
- MiR500 and MiR1000 have different space requirements (will be introduced in MiR500/1000 presentation), so it's recommended a width of 2500 mm.
- For MiRHook please refer to the MiRHook technical documentation on the MiR website.



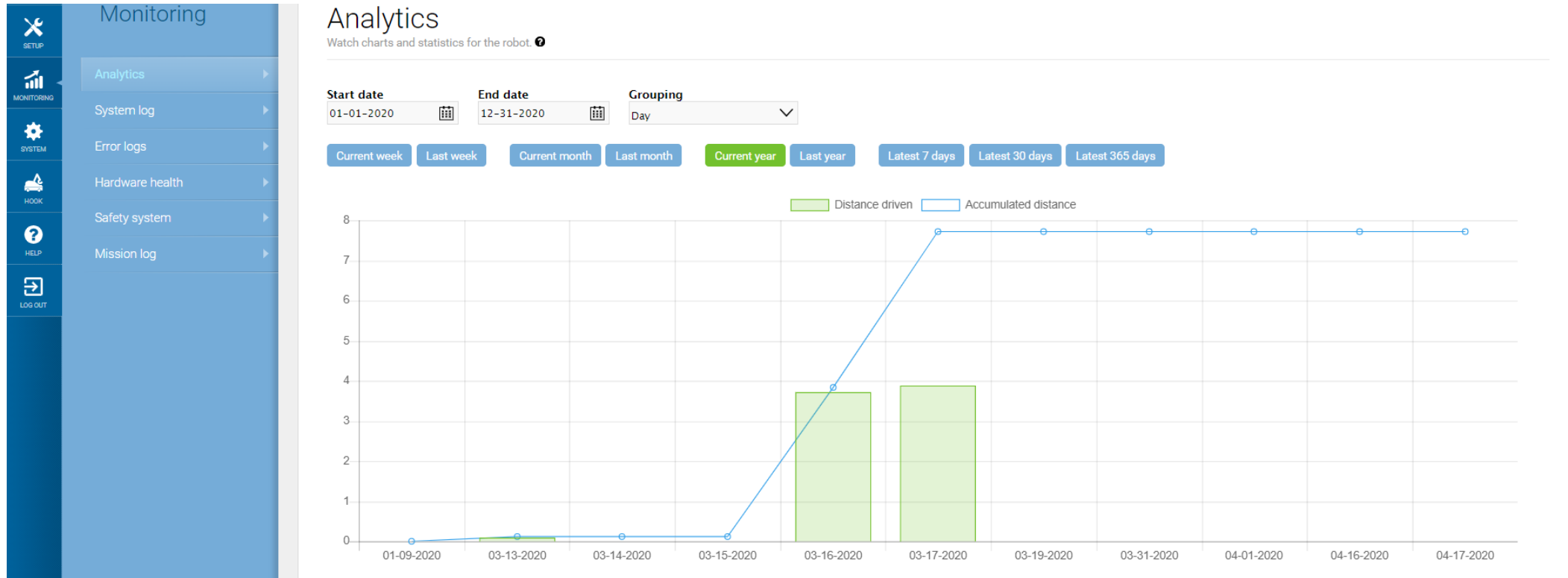
Monitoring

Monitoring

In monitoring section you can able to see different sections which report robot's status.

- ▶ Analytics
- ▶ System log
- ▶ Erros log
- ▶ Hardware health
- ▶ Safety system
- ▶ Mission log

Analytics



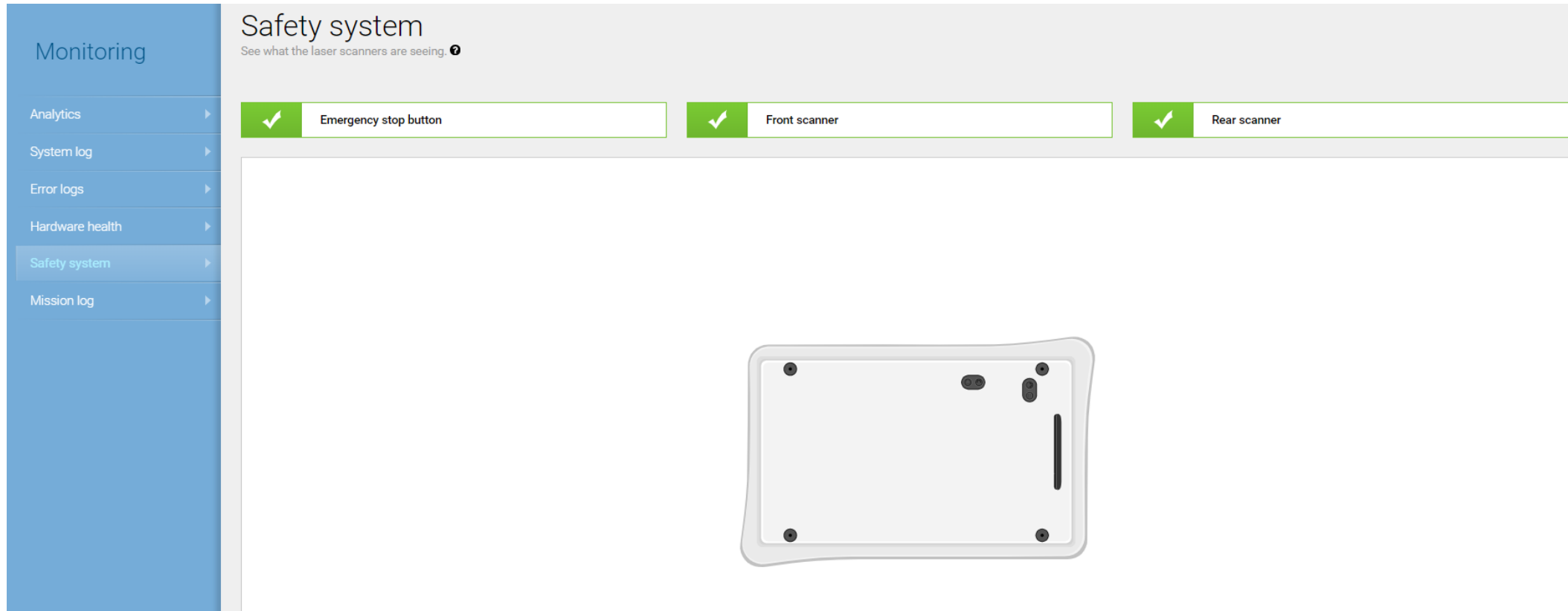
In this section you can see distance driven divided by week, month or year.

System log

Monitoring	Status	Source	Message	Time
	●	move_base_node	collision_avoidance_P_lin_reg_: 7.81411e-312	01:00:25
	●	move_base_node	min_rot_speed_: 0.1 max_rot_speed_: 0.7min_lin_speed_0.02 max_lin_speed_: 1.5	01:00:25
	●	move_base_node	kp_trolley_cte_: -5 kp_trolley_angle_: 2.5	01:00:25
	●	move_base_node	lookahead_multiplier_: 1.5 pid_dist_offset_: 0.4pid_dist_offset_min_0.15 pid_dist_ramp_max_: 0.2 pid_dist_ramp_min_: 1	01:00:25
	●	move_base_node	kp: 5 ki: 0Kd_0 angleKp_: 5 angleKi: 0 angleKd_: 3	01:00:25
	●	move_base_node	stall_topic: /stall_detection	01:00:25
	●	move_base_node	hook_status_topic: /hook/status	01:00:25
	●	move_base_node	odom_topic: /odom	01:00:25
	●	wifi_diagnostics	Error reading wpa_supplicant log file fake_wpa_supplicant.log exception: IOError(2, 'No such file or directory')	01:00:25
	●	move_base_node	cmd_vel: /cmd_vel	01:00:25
	●	move_base_node	initiating relative move	01:00:25
	●	move_base_node	disable_collision_check_dist_markers_: 0.2 disable_collision_check_dist_pallet_rack_: 0 relative_move: /relative_move_action max_linear_speed: 0.15 max_rotational_speed 0.400029	01:00:25
	●	move_base_node	State changed to 0, from MoveBase	01:00:25
	●	move_base_node	Initialising recovery mir_escape_recovery	01:00:25
	●	supervisor	Got joystick velocity command without being in Manual control or error state..	01:00:24
	●	move_base_node	Got: 'none' as value for for 'Obstacle history clearing' this is not a valid option, defaulting to 'none'	01:00:24
	●	move_base_node	updateTimeout: Path timeout changed from '5' to '0	01:00:24

In this section you can see logs of the system. This section updating continuously in according with processes called inside the robot.

Safety system



The screenshot shows a web-based monitoring interface for a safety system. On the left is a blue sidebar menu with the following items: Monitoring, Analytics, System log, Error logs, Hardware health, Safety system (highlighted), and Mission log. The main content area has a title 'Safety system' with a subtitle 'See what the laser scanners are seeing.' Below the title are three status indicators, each with a green checkmark in a green box: 'Emergency stop button', 'Front scanner', and 'Rear scanner'. The central part of the interface is a large white rectangular area containing a top-down view of a robot. The robot is a white rectangular platform with four black circular markers at the corners, representing wheels or sensors. There are also some internal components visible on the robot's top surface.

In this section is reported the status of safety system, you can see laser scanners and emergency stop button.

If the robot is near something a blue line appears around the robot.

Mission log

Monitoring

Analytics ▶

System log ▶

Error logs ▶

Hardware health ▶

Safety system ▶

Mission log ▶

Mission log

View the mission log.

Filter: 76 item(s) found
 Page 2 of 8

	Mission	State	Message	Put in queue	Start time	Ran for	Started by	Functions
	Linea5C	Done	ActionList was executed without p roblems..	2020-03-17T09:19:42	2020-03-17T10:13:58	0:6:41	Distributor	
	Linea4C	Done	ActionList was executed without p roblems..	2020-03-17T09:19:39	2020-03-17T10:07:14	0:6:44	Distributor	
	Linea3C	Done	ActionList was executed without p roblems..	2020-03-17T09:19:36	2020-03-17T10:00:30	0:6:44	Distributor	
	Linea2C	Done	ActionList was executed without p roblems..	2020-03-17T09:19:34	2020-03-17T09:53:24	0:7:6	Distributor	
	Linea1C	Done	ActionList was executed without p roblems..	2020-03-17T09:19:31	2020-03-17T09:46:33	0:6:51	Distributor	
	Linea4M	Done	ActionList was executed without p roblems..	2020-03-17T09:19:28	2020-03-17T09:40:08	0:6:25	Distributor	

In this section are reported all mission started on the robot.

It's reported the name, state, message, when put in queue, start time, ran for, started by.