

Edge Insights for Autonomous Mobile Robots (EI for AMR) Release Notes

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Chapter 1: Edge Insights for Autonomous Mobile Robots Release Notes

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EI for AMR Features

EI for AMR 2022.2 is deployed via Docker* prebuilt images, grouped into five use cases: Robot Base Kit, Server Complete Kit, UP Xtreme i11 Robotic Kit, Robot and Server Complete Kit, and Robot Complete Kit.

You can customize your Edge Insights for Autonomous Mobile Robots installation and only download the Docker* images you need from the SDK.

PCL and FLANN Optimization

- This is the first release of Point Cloud Library (PCL) and Fast Library for Approximate Nearest Neighbors (FLANN) optimized to use the Intel® oneAPI Base Toolkit for offloading tasks to an Intel® GPU.

Intelligent Sampling and Two-Way Search (ITS) Global Path Planner

- This is the first release of the ITS planner, a plugin for the ROS 2 Navigation package that conducts a path planning search on a roadmap from two directions simultaneously.

Collaborative SLAM

- Added support for visual-inertial based tracking with enhanced performance. If a robot or a camera contains Inertial Measurement Unit (IMU), IMU can be leveraged to improve tracking. Monocular and RGBD inputs are supported. For monocular input, IMU can be used to obtain the absolute scale.
- Improved the localization mode using odometry data
- Fixed the dropping frames issue generated by the QoS ROS 2 subscribe policy (Before, the tracker could drop up to 20% of the frames.)
- Fixed the issue where rviz2 does not show the full trajectory

ADBSCAN

- Added Intel® RealSense™ depth camera and 3D LIDAR support
- Added rviz2 visualization
- Added ROS 2 configurable parameters

FDO Implementation

- Update the FDO implementation to version 1.1.0

Fast Mapping Algorithm

- Added multiple camera support
- Fixed updating the free space on the occupancy grid

Wandering AI Algorithm

- Added support for collaborative SLAM
- Updated the AAEON* configuration

Object Detection Node

- Fixed the issue of displaying old object markers

Basic Fleet Management

- Added new application, vda5050-ros2-bridge that translates VDA5050 message to simpler messages that are sent via ROS 2.

- Enabled Application-Over-The-Air (AOTA) update solution which is based on Intel® Smart Edge Open fleet management architecture, using a ThingsBoard* server. The AOTA chain is triggered after the ThingsBoard* AOTA form is filled and submitted. The Intel® Smart Edge Open control plane receives an MQTT message via an encrypted channel and updates the Helm* chart on the EI for AMR.

EI for AMR Containers

- Restructured the container layout five sections: Robot Base Kit, Server Complete Kit, UP Xtreme i11 Robotic Kit, Robot and Server Complete Kit, and Robot Complete Kit
- Refactored components for a multistage build: debug and build tools eliminated from deployment-ready images to obtain smaller images and the binaries removed from SDK images to reduce their size
- Added joystick teleoperation support to the AAEON* wandering app
- Added IMU support and enabled sensor fusion for the AAEON* wandering app: enabled IMU with a Madgwick filter and added a Kalman filter node to fuse IMU, raw odometry, and visual odometry
- Updated the AAEON* EI for AMR interface to version 1.2.0 to add battery bridge support
- Updated the AAEON* configuration to improve the localization precision of the robot
- Added a robot localization container
- Added the IMU tools container which includes ROS 2 tools for IMU devices
- Added a container with the ROS 2 OpenVINO™ wrapper.
- Updated to use collaborative Slam in the Robot Base Kit instead of RtabMap

Intel® Smart Edge Open

- Added a script (add_node.sh) used by ThingsBoard* for the device onboarding
- Added a Python* script (mqtt_onboard_aota.py) to handle MQTT messages from ThingsBoard* for AOTA
- Added a script (run_aota.sh) to perform the Helm* update for AOTA

Known Issues and Limitations

- The Inertial Measurement Unit (IMU) cannot be started on Intel® RealSense™.
- The AAEON* UP Xtreme i11 Robotic Kit loses its orientation and redraws the walls in the test area multiple times. Due to this improper mapping, the robot cannot correctly identify the position of the obstacles and might collide with them.
- Due to the EOL of the LIDAR L515 camera, L515 is no longer supported by EI for AMR.
- Gazebo* simulation does not work on the Intel® Atom® 3000 processor family like the Apollo Lake-based UP2 (UP Squared). Intel recommends creating the Gazebo* simulation environment on more powerful systems that have, for example, 11th generation Intel® Core™ or Intel® Xeon® Scalable processors.
- It currently takes up to 100 minutes to install the EI for AMR package. The time varies depending on the speed of your internet connection and system's capabilities.
- The installed TensorFlow* version in EI for AMR contains Intel® Advanced Vector Extensions (Intel® AVX) instructions. These Intel® AVX instructions are not supported by Intel® Atom® CPUs like the CPU in Elkhart Lake platform. Any action, including the OpenVINO™ sample application, fails on a platform with an Intel® Atom® CPU. To be able to run TensorFlow* on an Intel® Atom® CPU, it must be re-compiled without the Intel® AVX instructions using the steps from: [How to Build and Install the Latest TensorFlow* Without CUDA GPU](#).

Wandering AI Application

- RTAB_MAP is not best suited for indoor navigation. Therefore, some obstacles may not be detected with the highest accuracy, due to reflections, etc.

ADBSCAN

- ADBSCAN is configured to work with low resolution (360). Using higher resolutions like 1440 will make ADBSCAN report inconsistent findings on each run.

Collaborative SLAM

- In case of long runs where the server nodes accumulate more than 80,000 keyframes, the shutdown process takes more time to exit cleanly.

- There is no support for stereo input for the EuRoC dataset.
- For visual-odom fusion with monocular input, after the visual tracking is lost, the system only relies on odometry input (if enabled) to sustain tracking and is never able to switch back to visual tracking.
- For visual-inertial fusion in localization mode, the system is under development.
- For visual, inertial, and odometry data fusion, the system is under development.
- Map merge does not happen if robots are moving in opposite directions through a common area.
- Running the collaborative SLAM server with an IMU input using the OpenLORIS dataset (RGBD input) for more than 20 minutes crashes the server.

Intel® Smart Edge Open

- OpenVINO™ model Server playbook searches for edge-server-ubuntu2004-ovms-tls instead of edge-server-ovms-tls
- When running the wandering playbook, the playbook waits for a “yes” input from the user.

Intel® Edge Software Device Qualification (Intel® ESDQ) for Edge Insights for Autonomous Mobile Robots (EI for AMR)

- The Intel® RealSense™ Camera test will fail if there is no Intel® RealSense™ Camera attached to the Target System. The test will report the following error message: `[ERROR]: No RealSense devices were found`

For the test to PASS, Intel® RealSense™ camera D435i needs to be connected to the Target System.
- The Object Detection on Intel® Movidius™ Myriad™ X VPU fails if there is no Intel® Movidius™ Myriad™ X connected to the target system.

Related Documentation

To get Edge Insights for Autonomous Mobile Robots up and running for the first time and for quickly running scenario-based samples, see:

- [Get Started Guide for Robots](#)
- [Get Started Guide for Robot Orchestration](#)

For more information about complex scenarios, advanced features, and debugging, see the [Developer Guide](#).

Where to Find the Release

You can find the release on the [Product Download](#) page.

Release Content

Subproject (component)	Revision
amr-aaeon-amr-interface	2022.2
amr-adbscan	2022.2
amr-battery-bridge	2022.2
amr-cartographer	2022.2
amr-collab-slam	2022.2
amr-fastmapping	2022.2
amr-fdo-client	2022.2
amr-fleet-management	2022.2
amr-gazebo	2022.2

Subproject (component)	Revision
amr-gstreamer	2022.2
amr-imu-tools	2022.2
amr-kobuki	2022.2
amr-nav2	2022.2
amr-object-detection	2022.2
amr-realsense	2022.2
amr-ros2-openvino	2022.2
amr-ros-arduino	2022.2
amr-ros-base	2022.2
amr-ros1-bridge	2022.2
amr-robot-localization	2022.2
amr-rplidar	2022.2
amr-rtabmap	2022.2
amr-sick-nanoscan	2022.2
amr-slam-toolbox	2022.2
amr-turtlebot3	2022.2
amr-turtlesim	2022.2
amr-vda5050	2022.2
amr-vda5050-ros2-bridge	2022.2
amr-wandering	2022.2
eiforamr-base-sdk	2022.2
eiforamr-full-flavour-sdk	2022.f2
eiforamr-openvino-sdk	2022.2
edge-server-base	2022.2
edge-server-fdo-manufacturer	2022.2
edge-server-fdo-owner	2022.2
edge-server-fdo-rendezvous	2022.2
edge-server-fleet-management	2022.2
edge-server-ovms-tls	2022.2
AMR_containers	2022.2
AMR Edge Server containers	2022.2

Subproject (component)	Revision
AMR Test Module	2022.2
AMR Bag Files	2022.2
Intel® Edge Software Device Qualification (Intel® ESDQ)	8.0
Docker* Compose	1.29.0
Docker* Community Edition (CE)	20.10.5
Source Code Distribution under GPL	2022.2

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