SOLUTION BRIEF

AI for Edge Computing
Autonomous Mobile Robots

AAEON Accelerates Design and Deployment for Autonomous Mobile Robots

Solution built with Intel® Edge Insights for Vision simplifies robotic fleet management and communication

With demand accelerating for same-day fulfillment and automated e-commerce, autonomous mobile robots (AMRs) are a growth area for factory and warehouse automation. By 2025, over four million robots are projected to be installed in over 50,000 warehouses worldwide.[1] In addition to locating and transporting items, AMRs can perform cleaning and maintenance tasks to maximize operational efficiency.

Now, AAEON has built the UP Squared RoboMaker Pro Kit to make it easier and faster to design and deploy AMRs. From easy setup of testing simulations in virtual environments to robotic controller integration and robot fleet management, RoboMaker Pro Kit provides a scalable, simplified solution for any organization deploying AMRs.

AAEON built UP Squared RoboMaker Pro Kit using **Intel® Edge Insights for Vision**—a package of integrated, validated solutions for accelerated machine vision—to improve overall 3D vision performance for AMRs. Using Intel Edge Insights for Vision, AAEON improved frame rates from 5–8 fps to 30 fps and enabled improved depth and object mapping.[2]

Challenges: Device integration and accurate simulation building with highly scaled fleets

AMRs require multiple components working in tandem to provide a robot with the information and capabilities it needs to perform tasks. AI units, processors, cameras, and motors must communicate with multiple software packages in order to interpret and analyze the information received by the robot, then automate its movement. Sourcing compatible hardware and software components can be a challenging task, with the potential to significantly hinder deployment of AMR fleets.

Another challenge emerges from safety concerns, due to the potential of collisions or operational problems on the factory or warehouse floor. Before prototype deployment, simulations are critical to ensure that robotic operations are likely to be smooth and efficient. Simulating the behavior of robotic fleets allows programming to be revised when abnormal behavior or interaction is detected between multiple robots or robots and their environment.

Solution: Prevalidated, scalable AMR prototype development in a box

Using the UP Squared RoboMaker Pro Kit, developers can develop demos and proofs of concept (POCs) for AMRs directly from the box. All necessary parts are included—not just hardware and software, but even the motors and wheels to build functional AMRs, as well as Intel® RealSense™ cameras for 3D vision. Using the included components, developing a machine vision application takes hours, and a full working demo can be built in days.[2]

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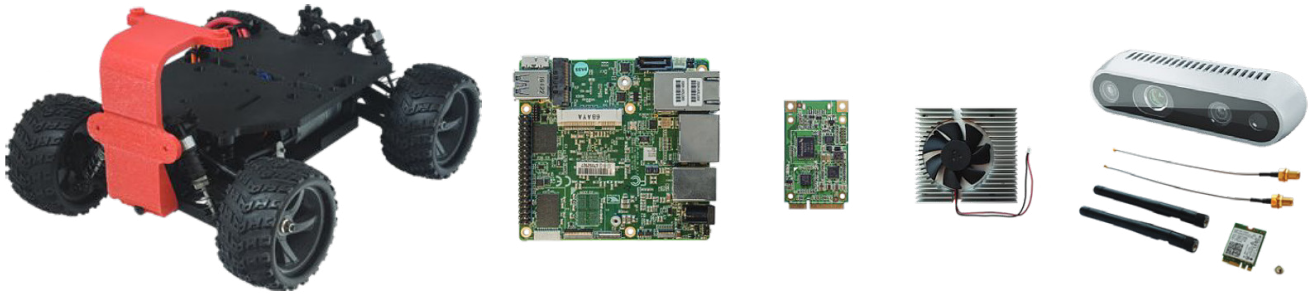
Sample applications, including navigation and object detection, are preloaded with the RoboMaker Pro Kit, allowing even users without a background in robotics programming to quickly use applications out of the box. All components have been prevalidated and checked for compatibility, eliminating the guesswork from sourcing and integrating multiple parts to an AMR solution.

RoboMaker Pro Kit also provides validated software to help developers scale quickly from POC to full-production use cases, including simple controls for managing large robot fleets and virtual optimization of simulated fleets to reduce the time needed for full-scale testing. Machine vision capabilities—including localization, 3D depth perception, obstacle detection and avoidance, and context-aware mapping—are accelerated by the included Intel® Distribution of OpenVINO™ toolkit and Intel RealSense cameras.

Benefits of AAEON UP Squared RoboMaker Pro Kit include:

- **Fast, scalable development:** Demos and POCs can be built rapidly, using only included software and hardware components. Every piece of the kit, including the Cogniteam motor control board, is designed to work at every level of AMR project development.
- **Cloud-based AI training:** Programmers can replace physical testing of robotic fleets with AI software models and algorithms optimized in a virtual environment (included with Intel Edge Insights for Vision), then loaded onto the physical robot using AWS RoboMaker.
- **Simplified fleet management:** With built-in AWS IoT Greengrass (included with Intel Edge Insights for Vision), fleet management tasks—including AI models, life-cycle management, and fleet synchronization—can be implemented with simple, easy-to-use controls.



Hardware overview

- UP Squared board with Intel Atom® X7-E3950 processor, on board 4 GB DDR4, 64 GB eMMC
- Intel® RealSense™ depth camera D435i (IMU inside)
- UP AI Core X – Mini PCIe card with the Intel® Movidius™ Myriad™ X
- Intel® AC9260 Wi-Fi Kit (via M.2 2230)
- Servo and DC motor with encoder
- Cogniteam motor control board
- Wheels

Preinstalled software

- Ubuntu 18.04 desktop
- ROS1 – melodic/ROS2 – Dashing
- Intel® Distribution of OpenVINO™ toolkit
- Intel® Media SDK
- Drivers for Intel® VTune™ amplifier, Intel® Energy Profiler, Intel® Graphics Performance Analyzers
- MRAA and UPM I/O and sensor libraries for C++, Python, Java, and JavaScript

How it works in brief

To simplify component integration and provide a unified, accelerated developer experience, AAEON used Intel Edge Insights for Vision. This software package integrates many popular software components, prevalidated to work effectively together, including the Intel Distribution of OpenVINO toolkit, AWS IoT Greengrass, and Ubuntu 18.04.

Using the included components makes it easier to connect multiple robots in a synchronized fleet, as well as to effectively implement 3D machine vision algorithms for AMRs. Using the Intel Distribution of OpenVINO toolkit, AAEON load balanced GPU and Intel® Movidius™ Myriad™ X VPU capabilities for optimized frame rates without requiring additional cooling.

A key need for robotic project developers is the ability for robots to see in 3D, with capabilities for autonomous decision-making. For instance, when a robot is about to collide with a shelf, it perceives the obstacle and changes its trajectory. With Intel Edge Insights for Vision, including Intel® RealSense™ SDK and paired with Intel RealSense cameras, frame rate performance was improved from 5–8fps to 30fps.[2] Mapping was improved to become context aware, with stereo vision. These components ensure that obstacles can be detected, classified, and avoided.

Conclusion: Automated robotic fleets powered by Intel® technology

As factories and warehouses begin to develop and scale AMR projects, developers need a simple way to design, test, and deploy AMR prototypes with 3D machine vision and manage large fleets of autonomous vehicles. Using Intel Edge Insights for Vision, AAEON created the UP Squared RoboMaker Pro Kit, which includes everything developers need to implement an AMR POC.

Using the prevalidated, integrated components from the RoboMaker Pro Kit makes it faster and easier to implement 3D cameras and stereo vision—including depth perception—for robots working on factory and warehouse floors. As projects scale up, AMR project leaders can also accelerate testing, using virtual environments and AI algorithms to predict robot behavior. Every component in the RoboMaker Pro Kit is designed to work at every scale, from single-robot prototypes to large-scale fleets conducting synchronized operations.

Learn more

The all-in-one AAEON UP Squared RoboMaker Pro Kit can help your organization to develop and deploy AMRs for improved operational efficiency. To learn more and purchase the kit today, visit **up-board.org/up-squared-robomaker-pro-kit**.

Intel® Edge Software Hub:
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The Intel Edge Software Hub is a one-stop resource to simplify edge solution development and accelerate deployment. With robust software tools and deployment-ready software packages, the Intel Edge Software Hub provides prevalidated, pretested, and interoperable solution ingredients.

Reduce setup time and bring your edge solution vision to life with software optimized for Intel's expansive portfolio of hardware solutions. Each Insights package includes components designed to meet the specific needs of edge use cases:

- **Edge Insights for Retail** improves data accessibility to simplify development of relevant, highly engaging consumer experiences.
- **Edge Insights for Industrial** enables advanced AI workloads at the edge for video and time series data ingestion, analytics, and automation for machine vision solutions.
- **Edge Insights for Vision** accelerates innovation in computer vision applications and edge-to-cloud integration.

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About AAEON and UP

Committed to innovative engineering, AAEON provides reliable and high-quality computing platforms, including industrial motherboards and systems, industrial displays, rugged tablets, embedded controllers, network appliances, and related accessories, as well as integrated solutions.
aaeon.com

UP is a brand founded by AAEON Technology Europe in 2015. The UP team aims to deliver innovation in technology, business models, and integrated solutions. The UP team collaborates with market leaders to develop integrated solutions and build a large online community that works closely with developers.
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1. https://roboticsandautomationnews.com/2019/03/26/50000-warehouses-to-use-4-million-robots-by-2025-says-report/21545/.
2. Source: Internal AAEON Healthcare testing results.

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