



White Paper

The first X86 AMR controller with a GMSL interface aims at heavy-duty with high-depth camera

In the rapidly expanding market of Autonomous Mobile Robots (AMRs), companies are vying for market share by releasing increasingly advanced and innovative vehicles. Axiomtek, one of the most innovative leaders in the industry, has set itself apart with a blue ocean strategy focused on heavy-duty AMRs for future use cases such as autonomous forklifts, excavators, and road rollers.

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Creating autonomous heavy equipment for unmanned operations

In pursuit of this strategy, Axiomtek is preparing to release the ROBOX500, a rugged and high-performance AMR controller that promises to meet the demands of low-latency, long-distance, and high-resolution image processing, improve the signal quality and sighting range. Featuring the most advanced Depth Camera in the Intel® RealSense™ family, the D457, the ROBOX500 is the first AMR controller in the X86 architecture with the GMSL interface on the market, positioning Axiomtek and Intel to carry out complex image transmission for even the most complicated working needs.



Figure 1. The heavy-duty AMR controller, the ROBOX500, brings the best performance with the D457 depth camera via the GMSL interface

Nowadays, most AMRs connect with cameras via LAN or USB ports. Although it can be more cost-effective, the image transmission could be slower and the sighting range is shorter. Or, as the distance from the camera to the controller gets longer, signal attenuation may occur.

On the other hand, the camera on the heavy-duty AMR does not only help autonomous cruising, more important but also the working tasks. For instance, as a forklift places the fork under a cargo, and places the cargo in designated places, it requires real-time image processing for accurate positioning. The USB and LAN cannot meet the needs of long-distance and low latency. The GMSL depth camera can also be installed on the robotic arms to identify objects in real-time. The working scenario also applies to excavators and road rollers.

To meet the needs mentioned above, Axiomtek plans to release the controller with GMSL interface soon and include the high-end depth camera from Intel, the D457 in the AMR builder package to accomplish the autonomous heavy-duty AMRs.

The ROBOX500, the first X86 controller with a GMSL interface

The ROBOX500 is designed to be a workhorse with precision in challenging environments with its rugged design. From the mechanism, every detail on the ROBOX500 is designed for heavy-duty, including longer and thicker cooling fins, and M12-type lockable connectors. Also, the operating temperature is extended from -20°C to +70°C.

Positioned as a high-end AMR controller, the applications that the ROBOX500 run are expected to be extremely demanding in computer vision. Therefore, to enhance computer vision, the selection of the camera is no easy task. The controller provides a 4-channel GMSL interface for low latency and a high-resolution camera for long distances. The ROBOX500 is the first AMR controller in the X86 architecture with a GMSL interface and Intel's D457 is their first GMSL/FAKRA high-bandwidth depth camera that tops in the business.

With exclusive technical know-how in sensor fusion, the AMR with the ROBOX500 and D457 is extraordinarily accurate in cruising and performing a variety of tasks.

To process mass information, the ROBOX500 uses parallel computing to enable real-time actions. To enhance the AI computing performance additionally, the platform also provides an extra M.2 Key M slot for an AI module, which is tested to be scalable with the Hailo-8 AI processor. As a result, collision avoidance, object detection, and volumetric measurement in the working process can be accomplished effortlessly.

In terms of performance, it is equipped with a 12th Gen Intel® Core™ processor and AI accelerator module scalability. Its fast processing and real-time data collection enable sequential movements and predictive/reactive actions, making it the ideal solution for optimizing workflows. Moreover, it provides numerous I/O interfaces needed to connect with cameras, sensors, etc. Also, the controller has four COM ports and two CAN 2.0.

To carry out connectivity with the fleet and management center, Wi-Fi/Bluetooth or 5G/LTE connections are available for fleet management and advanced data analytics. The controller takes wide voltage input from 9 to 60 VDC and supports Linux Ubuntu 20.04 LTS.

Why the ROBOX500 and the D457 make good solutions for heavy-duty applications

Overall, the mass amount of data brought in by the D457 requires a high-performance controller to process and utilized it effectively. The depth camera and the controller are complementary to each other to perform complicated tasks.



Figure 2. The rich I/O of the ROBOX500 meets the need to connect to several sensors

The D457 improves environmental awareness for the AMR. The D457 is based on SerDes to enable long-distance, high-resolution and low-latency image transmission. In the meanwhile, the

Intel RealSense Depth Camera provides abundant information on RGB, Depth, IR, and IMU, with a range from 0.4 to 20 meters.

Certain heavy-duty applications, like forklifts, require precise angles and placement to support loads. Road rollers must be careful of their surroundings and roll along the correct path on bitumen. Excavators must identify the shape of a dirt pile and approach it at the proper angle to maximize their load capacity.

Therefore, to complete complicated tasks, in addition to a 2D LiDAR and ultrasonic, a 3D depth camera is a must-have for the AMR controller to provide volumetric data to improve precision and efficiency.

In conclusion, with the advanced features and functionalities that the ROBOX500 and the D457 offer, end users can undoubtedly create autonomous heavy-duty equipment that can revolutionize various applications. The combination of cutting-edge technology and impressive performance makes these machines a great investment for those looking to enhance their productivity and efficiency. As technology continues to evolve, it's exciting to see how these advancements will continue to shape and transform the world we live in.

Learn More

- [AMR Builder Package](#)
- [Axiomtek achieves high-accuracy movement with DigiHub for AMR](#)
- [Axiomtek's AMR Builder Package - ROS 2 Based AMR Turnkey Solution](#)

About Axiomtek

Axiomtek has experienced extraordinary growth in the past 30 years because of our people, our years of learning which resulted in our tremendous industry experience, and our desire to deliver well-rounded, easy-to-integrate solutions to our customers. These factors have influenced us to invest in a growing team of engineers including software, hardware, firmware, and application engineers. For the next few decades, our success will be determined by our ability to lead with unique technologies for AIoT and serve our key markets with innovatively-designed solution packages of hardware and software – coupled with unmatched engineering and value-added services that will help lessen the challenges faced by our systems integrator, OEM and ODM customers and prospects alike. We will continue to enlist more technology partners and increase collaborations with our growing ecosystem who are leaders in their fields. With such alliances, we will create synergy and better deliver solutions, value, and the expertise our customers need.

Axiomtek is a Member of the Intel IoT® Solutions Alliance. A global ecosystem of more than 800 industry leaders, the Alliance offers its members unique access to Intel technology, expertise, and go-to-market support—accelerating the deployment of best-in-class solutions.



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