



SOLUTION BRIEF

Intel® Vision Products
Industrial Robotics and AI



NexCOBOT Leverages Intel® Vision Accelerator Design Products to Deliver Robotics with AI for Industry 4.0

Advancing industrial optimization and automation via the integration of machine vision and AI

Executive summary

Robots play a major role in making manufacturing processes more efficient and less labor intensive. They can help control costs and improve quality, as well as increase productivity. The complexity of robotic system design, however, creates obstacles for many manufacturers, and this is made more difficult by the need to identify and integrate subsystems from multiple vendors.

NexCOBOT, a NEXCOM company, offers a flexible, modular robotics solution integrating artificial intelligence (AI) with machine vision and powered by the new Intel® Vision Accelerator Design products. The solution brings together the insight of artificial intelligence, the mobility of robotics, and the capabilities of machine vision, providing a new level of precision and optimization for manufacturing and industrial implementations.

Challenges

Increasing automation is key for optimizing manufacturing operations across diverse industries. Traditional machine vision has its limitations, however—typically, it can only conduct defect detection and classification based on fixed rules and work in fixed environments. For example, variations in lighting or the presence of partial obstructions like dust or grease can negatively impact accuracy and quality. The introduction of AI-based approaches makes robotics more flexible, bringing better immunity to changing environmental conditions and the freedom to handle a wide range of inspection tasks. Robotic automation processes can be upgraded with vision systems to handle more complicated tasks. While the benefits of modern AI approaches are clear, integrating such capabilities into traditional machine vision processes can be complex.

As the need for industrial robots continues to rise, so do the demands for components to complete a robotic solution. These components, however, may vary between vendors and customers, making it difficult to standardize and deliver intelligent robotics solutions.

Solution

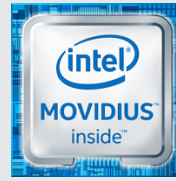
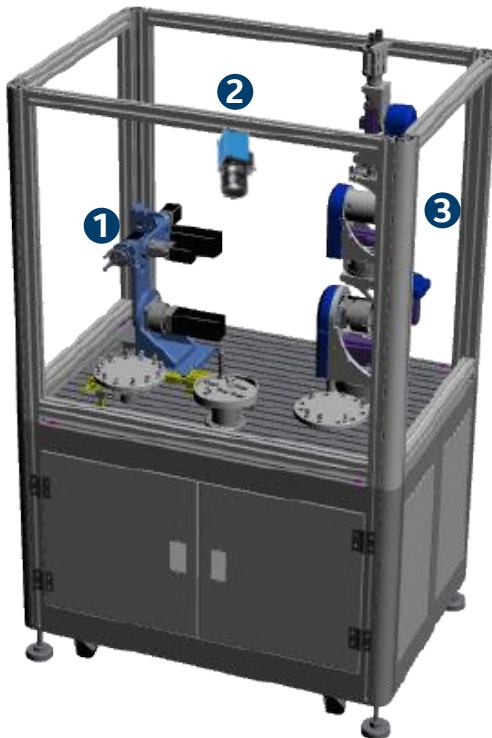
The future of robot and machine solutions is a production environment where devices, machines, robots, and sensors are interoperable. NexCOBOT integrates AI-driven vision capabilities into robotics to improve quality and accuracy over traditional machine vision—as well as deliver new levels of flexibility to industrial operations. In a recent pilot, NexCOBOT demonstrates two robots with AI vision conducting automotive assembly. This example of low-volume, high-mix manufacturing requires high levels of customization and flexibility. Patterns, colors, and the shape and arrangement of LED modules change frequently.

In this demonstration, one robot shuffles the plate to change the placement of LED modules. AI vision is then used to take photos of the plate and to classify the right module and color. Based on the AI data, the robot will take the module, plug it in, and run the test, readying the line for production. In traditional assembly lines, the task of choosing colors, patterns, and LED modules would fall to the operator. AI vision can achieve high levels of success and automation even under poor and/or changing environmental conditions.

The NexCOBOT solution is powered by high-performance Intel® technology including the Intel® Celeron® processor and Intel® Core™ i7 processor, and uses the Intel® Ethernet Controller to build EtherCAT-based robot control systems. In addition, the solution leverages the OpenVINO™ toolkit to implement AI inference and Intel® Movidius™ VPUs for computer vision acceleration at the edge.

Unlike many companies providing complete sets of industrial robots, NexCOBOT provides an open and modular solution for users to develop a robot control system that best fits their particular application requirements.

- Meet the demands of high-mix, low-volume manufacturing
- Increase accuracy under varying environmental conditions
- Speed time to results—no need to set up an identical environment each time
- Use a single statement of purpose (SOP) and model for varying tests and different applications



Intel® Vision Accelerator Design with Intel® Movidius™ VPU

Intel Vision Accelerator Design products provide power-efficient deep neural network inference for fast, accurate video analytics. Intel Movidius VPUs are capable of operating on customizable complex networks and network layers with high compute and ultra-low power consumption, resulting in industry-leading performance/watt/\$.

These VPUs are full-fledged system-on-chips (SoCs), supporting ecosystem solutions for high-quality image processing, computer vision, and deep neural networks. They drive a demanding mix of vision-centric tasks in smart devices. Solutions can scale simply by adding Intel Vision Accelerator Designs with Intel Movidius VPUs, while retaining their core efficiency. The elegant balance of performance and efficiency enables deployment for well-defined deep learning and machine vision workloads. Highly parallel programmable compute is co-located on a common intelligent memory fabric with workload-specific hardware acceleration.

As it continues to innovate in industrial robotics, NexCOBOT will utilize the new Intel Vision Accelerator Design with Intel Movidius VPU as the target platform for inference workloads, without the need to request computing resources from the CPU. This will allow NexCOBOT to integrate robot control and artificial intelligence all in one Intel® platform.

1 MiniBOT to decide LED pattern

- Interact with audience
- Shuffle LED modules

2 AI vision (OpenVINO™)

- Recognize LED modules with right color
- Get location of LED modules

3 MiniBOT 7R to assemble LED modules

- Assemble LED modules
- Test assembly result

Dual-robot demonstration allows fast customization and automation of LED module assembly

How it works

The **OpenVINO toolkit** includes the Intel® Deep Learning Deployment Toolkit with a model optimizer and inference engine, along with optimized computer vision libraries and functions for OpenCV* and OpenVX*. This comprehensive toolkit supports the full range of vision solutions, speeding computer vision workloads; streamlining deep learning deployments; and enabling easy, heterogeneous execution across Intel platforms from device to cloud.

The Intel Core processor and OpenVINO toolkit are used for inference acceleration, while Intel Celeron processors are used in the robot control system. The OpenVINO toolkit's Model Optimizer allows AI models to be easily deployed on the Intel platform.

Based on EtherCAT communication, NexCOBOT modular products include embedded computing boards, robot controllers, teach pendants, EtherCAT I/OS, and control cabinets. NexCOBOT's robot control software, NexGRC*, provides robotic control (PTP, JOG, HOME, LINE, CIRCLE, etc.) and a robot operation user interface. Those robotic control functions always come in dynamic-link library (DLL) API forms so that customers can develop their own GUI for their robot system, or integrate robot control with any other software. To save development time and effort, customers can find components from NexCOBOT to fit in a complex robot control system.

- EtherCAT communication to easily expand system's motion control and I/O (up to 32 slaves)
- Support commonly used robot types, including 6/7-axis articulated robot, delta robot, or Selective Compliance Assembly Robot Arm (SCARA)
- Powerful utility to configure, test, and simulate robots
- Robot control API to develop customized GUI or integrate robot control with other software

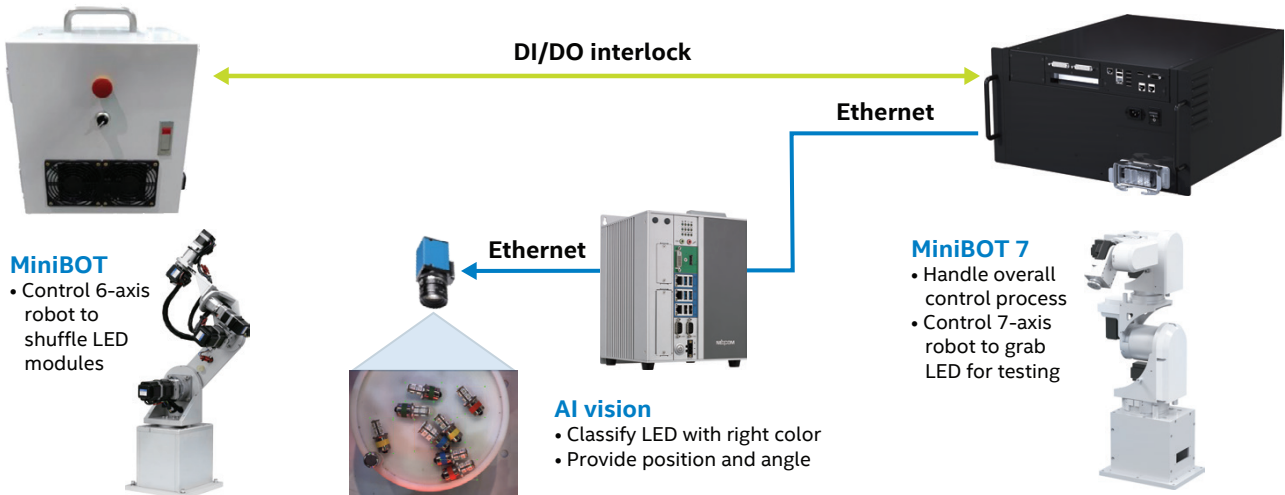
Integrated with Touch Cloud's AI software, NexCOBOT's robot control solution can be utilized with a vision solution. Touch Cloud brings AI expertise and experience on imaging and numerical analytics areas. The AI vision system generates inspection results and information, such as object position, for NexCOBOT's system to follow up the automation process with industrial robots.

Sample manufacturing use cases

By ensuring that thousands of modular products reach the market each year, NexCOBOT supports a variety of robotics use cases, from classification of modules to defect identification and inspection. Operators even interact with machines digitally using a human-machine interface (HMI). Smart factories provide many benefits, including a reduction in operator hours and opportunities to increase throughput, boost yields, improve efficiency, and reduce downtime through insights gained from advanced data analytics.

NexCOBOT smart machinery solutions facilitate the end-to-end linkage of manufacturing processes and simplify the architecture of production lines.

IMPROVE PRODUCTION LINE RESULTS WITH NEXCOBOT AND INTEL® ARCHITECTURE	
Defect classification in TFT LCD manufacturing process	<ul style="list-style-type: none">• No extra coding efforts (as required by traditional machine vision)• High accuracy and repeatability
Defect classification in LED manufacturing process	<ul style="list-style-type: none">• No extra coding efforts (as required by traditional machine vision)• High accuracy and repeatability
Car LED assembly	<ul style="list-style-type: none">• High accuracy, even in a changing environment• Precise location of objects
Touch panel manufacturing process analytics	<ul style="list-style-type: none">• Improve customer satisfaction and productivity



The robotics solution from NexCOBOT integrates machine vision and AI powered by high-performance Intel® architecture

Intel® Vision Products

Intel Vision Products accelerate the capabilities of IoT vision systems and deep learning inference from the camera to the cloud through leading heterogeneous hardware and software combinations. Intel offers a broad range of vision products and software tools to help solution providers scale vision technology across infrastructure, matching specific needs with the right performance, cost, and power efficiency at every point in an AI solution. By providing essential insights when and where they are needed, Intel is helping businesses unlock new possibilities for their visual data.

Conclusion

With preintegrated and prevalidated robotic control modules, the NexCOBOT solution performs precise robotic control for today's manufacturing plants and Industry 4.0. Together, NexCOBOT and Intel are bringing new levels of accuracy and acceleration to solution providers and industries.

Learn More

Explore Intel Vision Products at intel.com/visionproducts.

Find out more about Intel innovation for AI at intel.com/ai.

Download the free [OpenVINO toolkit](#).

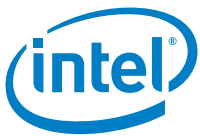
Discover NexCOBOT solutions at nexcobot.com.

About NexCOBOT

NexCOBOT, a NEXCOM company, builds open and modular intelligent robot control and motion control solutions. To surpass customers' expectations, NexCOBOT makes the difference by utilizing its industrial computing experience, having a strategic sales and marketing team in the US, a highly talented R&D team in both the US and Taiwan, manufacturing in Taiwan and in China, and by providing exceptional levels of global customer service. With these core strengths, NexCOBOT has enabled its customers to win key projects in a diverse range of industries.

NexCOBOT offerings include the modular components of a full-fledged industrial robot system, ranging from controller platforms, robotic control and simulation software, teach pendants, and control cabinets to robot bodies. As well as general robots, collaborative robots (cobots) are supported by advanced robotic control features and software. Robot gateways can allow data transfer from the robot system to an SQL database or cloud.

nexcobot.com



Performance results are based on testing as of September 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information about benchmarks and performance test results, go to www.intel.com/benchmarks.

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