White Paper

GIGAIPC

intel partner Titanium IoT Solutions

The Latest Intel® Processors Lead the Charge to Enhanced Industrial Automation

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Introduction

Machine vision has traditionally played a crucial role in industrial automation. For example, it's been used to meet the requirements of pick-and-place machine positioning, object sorting, product defect detection, and more. Given the environment and relatively low volumes, these systems have historically required specialized software and hardware.

But now, the advent of neural networking technology that can run on general-purpose processors like 12th and 13th generation Intel® processors is driving a new wave of resource-efficient platforms from industrial PC (IPC) vendors that are poised to revolutionize the machine vision industry as we know it.

The latest machine-vision technologies are poised to reposition industrial automation by providing visual perception and inspection capabilities to machines and automated systems. This involves the use of cameras, image processing algorithms, and computer-vision techniques to analyze and interpret images or video streams in real-time.

Common applications of machine vision in industrial automation include quality inspection, looking for defects or substandard products; object recognition and sorting, based on size, shape, color, or other characteristics, or even barcodes or labels; safety and security, by monitoring the work environments; and guidance, navigation, and positioning for robots.

Systems used in these automation environments are built using a combination of high-speed cameras, frame grabbers, ADCs and DSPs, control platforms, and specialized, proprietary machine vision algorithms tailored to the use case. Depending on the application and use case, these systems can be complex and expensive.

From Actual Product To Analyzed Image

The process a traditional machine vision system runs through goes as follows:

1. Image acquisition
2. Pre-processing
3. Feature extraction, where relevant features or patterns are extracted from the pre-processed images
4. Feature representation in a format that allows for efficient processing
5. Feature analysis
6. Decision making, based on the results of the feature analysis

The emergence of neural networking technology is now enabling computer vision in systems that had not been previously considered. Such systems run the gamut from smart phones to cars to self-service kiosks. The key requirement in these systems is that vision applications must be able to run on general-purpose processors outfitted with vision accelerators rather than specialized DSPs.

Enter 12th /13th generation Intel® Core processors

Economies of scale are now seeing these general-purpose processors, such as 12th /13th generation Intel® Core™ processors (codenamed Alder Lake-S & Raptor Lake-S), make their way into industrial automation and machine vision environments where they are redefining system architectures and value propositions.

Alder Lake-S & Raptor Lake-S, built on Intel®'s 10-nm process technology, represents a significant architectural shift for the company's desktop CPUs, introducing a hybrid design that combines up to eight high-performance cores with up to eight high-efficiency cores to provide a balance between performance and power efficiency. The high-performance cores are designed to handle tasks that require single-threaded performance, while high-efficiency cores are optimized for multi-threaded workloads. The processor employs a thread scheduling mechanism that intelligently assigns tasks to the appropriate Core™ type based on the requirements of those tasks.

The 12th/13th generation Intel® Core™ processors also integrate Intel®'s Xe Graphics architecture, which improves graphics performance compared to previous generations. This potentially removes the separate discrete graphics card for many applications. Support is included for the latest DDR5

memory technology, offering higher data transfer rates and improved bandwidth compared to DDR4. Sixteen lanes of PCIe 5.0 and four lanes PCIe 4.0 are available for connection.

Intel® is also making embedded variants of the Alder Lake-S processors available. These devices contain a suite of features that are well-suited for machine vision system consolidation. For example, the hybrid architecture can reserve some of the high-performance cores for video processing and AI tasks while reserving efficiency cores for control and management functions. AI acceleration is available through integrated Intel® Deep Learning Boost (DL Boost) technology and is compatible with the Intel®'s OpenVINO™ toolkit.

Rethinking the Systems Architecture

A byproduct of the performance that's available thanks to the 12th generation Intel® Core™ processor's robust feature set is an opportunity for machine vision system designers to rethink their system architectures to reduce cost, energy consumption, physical footprint, and overall cost for their customers. Specifically, it allows multiple pieces of equipment to be consolidated. For example, many of the processing functions that previously had to be sent out to the Cloud for processing can now be handled at the Edge of the IoT, much closer to where the data resides. This simple act saves time and power, and increases overall security by never having the data leave the premises.

The modern machine vision system differs from the more tradition system in that lighting and optics play a crucial role in achieving the best image quality. Optics would include the cameras and sensors that are used. And obviously the algorithms deployed are far more advanced than what had been previously available. Those algorithms can be tailored for the specific application. Finally, communications and storage have come a long way recently, with 5G being available on the wireless front and far faster Ethernet and USB speeds for applications that permit wires. From a usability perspective, the HMI has evolved tremendously. In fact, many applications can be controlled remotely from a smart phone or dedicated tablet.

GIGAIPC Has You Covered

Platforms available off the shelf from suppliers like GIGAIPC give machine vision engineers the flexibility to capitalize on all the capabilities of 12th generation Intel® Core™ processors in a single piece of equipment. The company can extend the machine-vision and AI compute performance required by machine vision workloads. It does this by employing power-efficient cores that can interface with PLC automation controllers or perform control functions themselves. Its latest products contain Ethernet, USB, and PCIe interfaces for seamless integration of high-speed cameras and are rated for use in harsh environments.

For example, the uATX-Q670A board, based on the Micro ATX form factor, can operate in temperatures ranging from 0°C to +60°C. Supporting 125-W Intel® Core™ i3-i9 processors and the Q670 chipset, it can accommodate up to 128 Gbytes of DDR4 RAM DIMMs. Other features include one Gigabit Ethernet and one 2.5-Gigabit interfaces, eight USB connections, and other I/O and graphics support for integrating cameras, lighting, and peripherals.

GIGAIPC's QBiX-JMB-ADLA67EHG-B1 platform contains the processing needed to handle machine-vision automation applications. That includes the latest Intel® microprocessors as well as abundant I/O.

The GIGAIPC mITX-H61EC board, designed to the Mini-ITX form factor, is designed with a 12th generation Core-based networking-centric board with six Gigabit Ethernet interfaces and eight USB ports, all safeguarded by a TPM 2.0 chip, a LAN surge protector, and a watch dog that makes the board an ideal hub/switch for multi-machine vision installations.

Finally, the GIGAIPC QBiX-JMB-ADLA67EHG-B1 is more of a system-level solution. The completely solid-state fanless platform is powered by the 12th generation Intel® Core™ processor and Q670E chipset that accommodates discrete graphics cards, and four SSDs or HDDs. It is designed with four Gigabit Ethernet ports and other I/O useful for managing multiple machine-vision installations from one platform.

Aside from the machine-vision-enhanced automation applications discussed here, boards and systems based on 13th generation Intel® Core™ processors are also making their way into other commercial and industrial applications, bringing features such as overclocking and enhanced multitasking to the mix that deliver superior performance over the previous generations.

All of the aforementioned GIGAIPC platforms will be available with a 13th generation Core™ processor variant, as will the ATX-Q670A ATX motherboard. It's feature list includes dual 2.5 Gigabit LAN connections, 128 Gbytes of memory through 4x dual-channel DDR4 DIMM sockets, ample graphics support, expansion slots and I/Os, and an onboard TPM. It too operates in temperatures ranging from 0°C to 60°C.

Although the industrial automation sector has been on the leading edge of machine vision technology for decades, the impact of consumer markets on the technology is undeniable and will only become more apparent in the coming years. Thanks to innovations in software, hardware is changing. And that hardware now enables more efficient, cost-effective, resource-conservative machine vision for all.

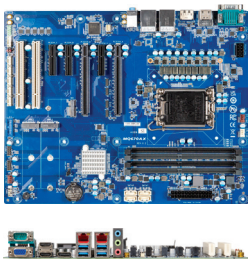
About GIGAIPC

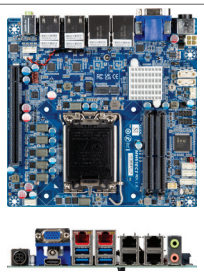
GIGAIPC CO, LTD, established in 2018 as an embedded solution-focused subsidiary of GIGABYTE, is driven by passion for technology and sophisticated R&D capabilities. The company leverages its experience in the computing market to offer board-level and system-level products for 5G, IoT, Machine Vision, Industrial Automation, Smart Retail and Healthcare. GIGAIPC operates an awardwinning manufacturing facility in Taiwan, synchronizing with GIGAIPC's R&D department to deliver high quality and reliable products. GIGAIPC is a young and energetic organization driven by surpassing our customer's expectations, and we promise to offer our customers not only high-quality computing platforms but also world-class service and support. As a result, GIGAIPC's service centers have been established in most major cities worldwide, and our global presence continues to grow, offering the best service to our customers.

"Building a Smarter Tomorrow"
The strengths of GIGAIPC are based on the advantages, skills, and expertise we have built to realize this vision, including being customer-focused and striving for high quality. GIGAIPC is determined to keep reinforcing these strengths as our principles to achieve maximum customer satisfaction.

GIGAIPC

Product Infomation





Model Name	ATX-Q670A	uATX-Q670A	mITX-H61EC
CPU	Support for 13th/12th Generation Intel® Core™ i9/i7/i5/i3, Pentium® & Celeron® processors	Support for 13th/12th Generation Intel® Core™ i9/i7/i5/i3, Pentium® & Celeron® processors	Support for 13th/12th Generation Intel® Core™ i9/i7/i5/i3, Pentium® & Celeron® processors
Socket	LGA 1700	LGA 1700	LGA 1700
Chipset	Intel® Q670 Chipset	Intel® Q670 Chipset	Intel® H610E Chipset
Memory	4 x DDR4 DIMM sockets, Max. Capacity 128 GB, Support Dual Channel DDR4 3200MHz	4 x DDR4 DIMM sockets, Max. Capacity 128 GB, Support Dual Channel DDR4 3200MHz	2 x DDR4 SO-DIMM sockets, Max. Capacity 64 GB, Support Dual Channel DDR4 3200 MHz
Ethernet	2 x 2.5GbE LAN Ports (Intel® I226LM and Intel® I226V)	1 x GbE LAN Port (Intel® I219LM) 1 x 2.5GbE LAN Port (Intel® I226V)	6 x 2.5GbE LAN Ports (Intel® I226V)
Graphic	Integrated Graphics Processor - depends on CPU: 2 x HDMI 2.0, 1 x DP 1.4b, 1 x VGA 4 independent display outputs	Integrated Graphics Processor - depends on CPU: 2 x HDMI 2.0, 1 x DP 1.4, 1 x VGA, 1 x LVDS 4 independent display outputs	Integrated Graphics Processor - depends on CPU: 1 x HDMI 2.0, 1 x VGA 2 independent display outputs
Audio	Realtek® ALC897	Realtek® ALC897	Realtek® ALC897
Storage	4 x SATA 6Gb/s Ports (RAID 0/1/5/10)	6 x SATA 6Gb/s Ports (RAID 0/1/5/10)	2 x SATA 6Gb/s Ports
Expansion Slots	1 x PCIe x16 (Gen 4x16)(PCIEX16_1) 1 x PCIe x16 (Gen 4x8)(PCIEX16_2) 3 x PCIe x4 (Gen 3x4), 2 x PCI 1 x 2280/2242 M.2 M-Key (PCIe Gen3x4, SATA 6Gb/s)(M2M_1) 1 x 2280/2242 M.2 M-Key ((PCIe Gen3x4) (M2M_2)) 1 x 2230 M.2 E-Key (PCIe x1, USB 2.0)	1 x PCIe x16 (Gen 4x16)(PCIEX16_A) 1 x PCIe x16 (Gen 4x8)(PCIEX16_B) 1 x PCIe x4 (Gen3 x4) 1 x PCIe x1 (Gen3 x1) 1 x 2280/2242 M.2 M-Key (PCIe Gen 4x4, SATA 6Gb/s) 1 x 2230 M.2 E-Key (PCIe x1, USB 2.0)	1 x PCIe x16 (Gen4 x16) 1 x 2280 M.2 M-Key (SATA 6Gb/s) 1 x 2230 M.2 E-Key (PCIe x1, USB 2.0)
Internal I/O	1 x 24-pin ATX main power connector 1 x 8-pin ATX 12V power connector 1 x CPU fan header 2 x System fan header 1 x Front panel audio header 1 x Front panel header 4 x USB 2.0 headers 2 x USB 3.2 Gen 1 headers 1 x COM header (RS-232/422/485 & RI/5V/12V) 4 x COM headers (RS-232) 1 x GPIO (8 bits) & SMBus header 1 x Clear CMOS jumper, 1 x Buzzer 1 x AT/ATX mode select jumper	1 x 24-pin ATX main power connector 1 x 8-pin ATX 12V power connector 1 x CPU fan header 1 x System fan header 1 x Front panel header 1 x Front panel audio header 6 x USB 2.0 headers 2 x USB 3.2 Gen 1 headers 3 x COM headers (RS-232) 1 x GPIO (8 bits) & SMBus header 1 x Backlight Control header 1 x Clear CMOS jumper, 1 x Buzzer 1 x AT/ATX mode select jumper 1 x Case open header	1 x 4-pin ATX main power connector 1 x SATA power connector 1 x CPU fan header 1 x System fan header 1 x Front panel header 1 x Front panel audio header 4 x USB 2.0 headers 1 x COM header (RS-232/422/485 & RI/5V/12V) 1 x COM header (RS-232) 1 x GPIO (8 bits) & SMBus header 1 x Clear CMOS jumper 1 x Buzzer header 1 x AT/ATX mode select jumper
Rear I/O	3 x Audio Jacks (Line in, Line out, Mic in) 1 x COM Port (RS-232/422/485 & RI/5V/12V) 2 x HDMI 1 x Display Port 1 x VGA 2 x RJ45 LAN Ports 4 x USB 3.2 Gen 2x1	3 x Audio Jacks (Line in, Line out, Mic in) 2 x HDMI 1 x DisplayPort 1 x VGA 1 x COM Port (RS-232/422/485 & RI/5V/12V) 2 x RJ45 LAN Ports 2 x USB 3.2 Gen 2x1, 2 x USB 3.2 Gen 1	2 x Audio Jacks (Line out, Mic in) 1 x HDMI 1 x VGA 6 x RJ45 LAN Ports 4 x USB 3.2 Gen 1 1 x DC Jack (+12V/+19V~+24VDC)
TPM	Onboard TPM 2.0 security chipINFINEON SLB9670VQ2.0	1 x TPM header	Onboard TPM 2.0 security chip Infineon SLB9670VQ2.0
Operating Temp.	0°C to 60°C	0°C to 60°C	0°C to 60°C
Ordering Information	9MQ670AXMR-SI (Box packing)	9MQ670AMMR-SI (Box packing)	9MH61ECIMR-SI (Box packing)

GIGAIPC

Product Infomation

Model Name	QBiX-JMB-ADLA67EHG-B1
Dimension	224W x 368D x 166.3H (mm)
CPU	Support for 13th/12th Generation Intel® Core™ i9/i7/i5/i3, Pentium® and Celeron® processors in the LGA1700 package
Chipset	Intel® Q670E Chipset
Memory	2 x DDR4 SO-DIMM sockets, Max. Capacity 64 GB, Support Dual Channel DDR4 3200 MHz
Ethernet	4 x GbE LAN Ports (1 x Intel® I219V and 3 x Intel® I211AT)
Graphic	Integrated Graphics Processor - Intel® HD Graphics: 1 x Display Port 1 x DVI-D 1 x VGA 3 independent display outputs
Audio	Realtek® Audio Codec
Storage	4 x 2.5” HDD/SSD (SATA 6Gb/s)
Expansion Slots	1 x 2280 M.2 M-Key (PCIe x4, SATA 6Gb/s) 1 x 2230 M.2 E-Key (PCIe x1, USB 2.0) 1 x Full-size Mini PCIe with SIM slot (PCIe x1, USB 2.0) 1 x PCIe x4 (Gen3 x4) 2 x PCIe x16 — Single at Gen3 x16 only or — Dual at Gen3 x8 + Gen3 x8
Front I/O	1 x Power Switch /Power/ HDD LED 3 x Audio Jacks (Line in, Line out, Mic in) 1 x Display Port 1 x DVI-D 1 x VGA 2 x COM Ports (RS-232/422/485 & RI/5V/12V) 2 x COM Ports (RS-232) 4 x RJ45 LAN Ports 4 x USB 3.2 Gen 1 6 x USB 2.0 1 x 4-pin Terminal Block 2 x External Antenna Holes (Optional)
Rear I/O	—
Power	+24V~48VDC (Full Range)
Operating Temp.	-20°C to 50°C (CPU TDP 65W) -20°C to 60°C (CPU TDP 35W)
Ordering Information	—
Build in Components	
Note	—