White Paper

GIGAIPC™

intel partner Titanium IoT Solutions

Edge Computing Boosts Retail Applications Through Improved Image Recognition

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Introduction

AI is showing up more often in the retail sector due to its ability to enhance efficiency, personalize customer experiences, and drive sales, while boosting security. As consumer expectations rise, retailers can leverage AI to provide tailored shopping experiences, such as personalized product recommendations and targeted marketing. This personalization boosts customer satisfaction and loyalty, leading to higher sales.

AI also optimizes operations, such as inventory management and dynamic pricing. By predicting demand and adjusting prices in real-time, retailers can minimize stock shortages (and reduce the risk of running out of items completely), decrease overstock, and maximize revenue. In supply chain management, AI improves logistics, reducing costs and delivery times.

Moreover, AI-powered tools like chatbots offer 24/7 customer service, handling inquiries and processing orders more efficiently. When combining the AI tool with smart displays, or even as part of an over-arching platform, visual search and virtual try-ons, powered by AI, can significantly enhance the online shopping experience, bridging the gap between digital shopping and the more traditional in-store shopping experience.

As competition intensifies, AI can provide a competitive edge for retailers by enabling them to respond quickly to market trends, optimize their supply chains, and engage customers far more effectively than ever before. Retailers can stay agile and customer-focused in a rapidly evolving market.

Keeping Data at the Edge

The Edge of the IoT plays a crucial role in AI for retail by enabling real-time data processing and decision-making directly at the point of data collection, such as in stores, warehouses, or customer interaction points. Unlike traditional cloud-based systems, Edge computing processes data locally, reducing latency and allowing for faster responses to dynamic retail environments.

Edge computing can manage key retail functions such as inventory management, personalized shopping experiences, and in-store analytics. For instance, IoT sensors on shelves can instantly detect when a product is running low and trigger automated restocking. AI algorithms running at the Edge can analyze customer behavior in real-time, providing personalized offers or adjusting digital signage on the spot.

A hardware-based smart retail system that takes advantage of Edge-based AI offers several key advantages. Firstly, it enhances data processing speed by analyzing information directly at the edge of the network, reducing latency compared to Cloud-based solutions. This real-time processing enables quicker decision-making and more responsive customer interactions. Secondly, it improves data security and privacy, as sensitive information is processed locally rather than transmitted over potentially insecure networks.

Edge-based AI can minimize the dependency on Internet connectivity, ensuring more reliable system operation, even if there's a disruption in the network. This approach also reduces bandwidth usage and operational costs, as less data needs to be sent to the Cloud. Overall, the combination of rapid processing, enhanced security, and reduced costs makes Edge-based AI a powerful solution for optimizing retail operations and improving the customer experience.

Note that the Edge of IoT is less effective for AI in retail when dealing with complex data processing or large-scale analytics that require significant computational power or centralized data integration. Tasks like deep-learning model training, global sales trend analysis, or cross-channel customer insights typically need resources that would reside in the Cloud. In addition, Edge devices might struggle with tasks requiring extensive data storage or where real-time updates across multiple locations are critical, as they depend on broader, centralized data access and processing capabilities that edge computing alone cannot efficiently provide.

Embedded Computing at the AI Edge

In most cases, an embedded computer can handle the functions required for AI at the Edge. At the same time, that embedded computer comes with lots of benefits, particularly with respect to its compact size, energy efficiency, and ability to process data locally. These computers are designed to operate in specific, often constrained environments where space and power availability might be limited.

The advantages of embedded platforms run the gamut, and include real-time processing, reduced latency, cost efficiency, enhanced security and privacy, and scalability and flexibility. Such computers can operate in a single boutique store or a large multi-store chain. Their modular nature allows for tailored solutions that meet specific business needs.

Challenges of the Embedded Computer in Retail AI

Obviously, there could be some tradeoffs when deploying embedded computers in AI retail applications, starting with potentially limited computational power. Such platforms typically aren't optimized for complex AI tasks, such as deep learning model training or large-scale data analytics, which can restrict their functionality.

Storage constraints could also pose a challenge, as embedded systems have limited memory, making it difficult to handle large datasets or retain extensive historical data needed for advanced AI applications. Lastly, scalability can be an issue; as a retail environment needs grow, the capacity of embedded systems may not easily expand, necessitating frequent hardware upgrades or replacements.

Customers use AI to enhance surveillance in the retail sector by leveraging computer vision and machine learning function to monitor store activity in real time, but it requires PoE-based AI-powered cameras and sensors to detect suspicious behaviors, such as shoplifting or vandalism, by recognizing patterns like unusual movements or loitering. These systems also need to alert security personnel immediately, reducing response times. The challenge here is to choose the right embedded platform with compatible software, too.

When it comes to people counting, we use AI to support to analyze customer traffic and behavior, helping retailers optimize store layouts, improve product placement, and enhance customer service. The challenge is to choose the graphic computing power both in hardware and software to identify peak shopping hours and areas of high interest, allowing for better staffing and inventory management. In addition, AI-based facial recognition also requires 24/7 stability in working environment to identify REPEAT customers, enabling personalized services and loyalty programs.

Overall, AI improves security, operational efficiency, and customer experience in retail.

The Hardware-Software Combo For AI in Retail

Smart Advertising Systems

Bundling the GIGAIPC **QBiX-Lite-RPLA1340PH-A1** with the CLOUDMATRIX **Smart Advertising System** creates a powerful AI-driven retail solution that enhances customer engagement and operational efficiency by serving up personalized and dynamic content. This combination lets retailers analyze customer behavior, preferences, and demographics on-site, enabling the CLOUDMATRIX system to display highly targeted advertisements and promotions in real-time.

The ability to tailor content to individual customers based on real-time data significantly increases the relevance and effectiveness of marketing efforts, driving higher engagement and sales. The result is a more engaging, data-driven shopping experience that enhances customer satisfaction and boosts sales.

The GIGAIPC **QBiX-Lite-RPLA1340PH-A1** is powered by an Intel® Core™ i5-1340P processor. This embedded computer offers a balance of performance and energy efficiency, making it ideal for the continuous operation sometimes required in retail settings. Its compact (155- by 234- by 30-mm) design ensures reliable performance in space-constrained environments, such as kiosks, digital signage, or point-of-sale systems, where quiet and uninterrupted operation is crucial.

One of the key features of the **QBiX-Lite-RPLA1340PH-A1** is its ability to support AI workloads at the Edge. That's due to its dual-channel DDR5, dual SO-DIMM configuration, supporting up to 64 Gbytes, as well as multiple I/O ports and expansion options, including dual HDMI ports, two Display Ports, and a pair of USB type C interfaces, which support up to 8K resolution for dynamic advertising across multiple screens. Hence, it can integrate with various sensors, cameras, and other peripherals, enabling real-time data processing for the tasks discussed here.

Additionally, the device's durability and support for wide operating temperature ranges make it reliable for a host of retail conditions, from storefronts to warehouses. Its connectivity options, including LAN and Wi-Fi, ensure seamless integration with existing retail networks, facilitating smooth data flow between Edge devices and central systems.

Smart Surveillance System

The GIGAIPC **QBiX-Pro-RPLA1355H-A1** with CLOUDMATRIX **Smart Surveillance System** can reduce theft and security risks by integrating AI-powered surveillance with digital signage. It can detect suspicious behavior in real-time, such as loitering or unusual movements, and trigger alerts to store security personnel. The system can display deterrent messages or security warnings on screens near high-risk areas when potential theft is detected, subtly discouraging criminal activity.

This industrial system is powered by Intel®'s Core™ i7-1355U processor in a fanless design thanks to its power efficiency. Performance is augmented by the use of up to 64 Gbytes of dual-channel DDR4 memory, two HDMI interfaces, and a pair of 2.5-Gbit/s Ethernet LAN ports. The space-saving chassis measures 125 by 178 by 52.7 mm.

People Counting System

The GIGAIPC **QBiX-RPLA1315EH-A1** with CLOUDMATRIX **People Counting System** lets a retailer optimize its workforce allocation by analyzing customer traffic patterns and storing those activities in real-time. The embedded computer processes data from sensors and cameras to identify peak times and areas of high customer concentration. This data is then used by the CLOUDMATRIX system to predict when and where more staff is needed, ensuring that employees are allocated in the most efficient manner. The system can also trigger on-screen alerts for staff to reposition themselves during busy periods, reducing wait times and improving customer service, ultimately leading to better resource management and operational efficiency.

The GIGAIPC **QBiX-RPLA1315EH-A1** boasts similar specifications as the **QBiX-RPLA1355EH-A1**, but comes in an even smaller package, measuring just 118 by 138 by 74.2 mm, with a lockable DC connector. It also adds a USB Type C DisplayPort connection and a COM port (RS-232/422/485). It's suited for retail applications with very tight space requirements.

Product Infomation

Model Name	QBiX-Pro-RPLA1355H-A1	QBiX-RPLA1315EH-A1	QBiX-Lite-RPLA1340PH-A1
Dimension	178W x 125D x 52.7H(mm)	138W x 118D x 74.2H(mm)	234W x 155D x 30H (mm)
CPU	Intel® Core™ i7-1355U Processor Intel® 7, 10 cores, 2P+8E, 12 threads, up to 5.0 GHz	Intel® Core™ i3-1315UE Processor Intel® 7, 6 cores, 2P+4E, 8 threads, up to 4.5 GHz	Intel® Core™ i5-1340P Processor Intel® 7, 12 cores, 4P+8E, 16 threads, up to 4.6 GHz
Chipset	SoC	SoC	SoC
Memory	2 x DDR4 SO-DIMM sockets, Max. Capacity 64 GB Support Dual Channel DDR4 3200 MHz memory modules	2 x DDR5 SO-DIMM sockets, Max. Capacity 64 GB Support Dual Channel DDR5 5200 MHz memory modules	2 x DDR5 SO-DIMM sockets, Max. Capacity 64 GB Support Dual Channel DDR5 5200 MHz memory modules
Ethernet	2 x 2.5GbE LAN Ports (Intel® I226V)	1 x 2.5 GbE LAN Port (Intel® I226V) 1 x GbE LAN Port (Realtek RTL8111H)	2 x 2.5GbE LAN Ports (Intel® I226V and Intel® I226LM)
Graphic	Integrated Graphics Processor - Intel® Iris® Xe Graphics : 2 x HDMI 2.0 ports, supporting a maximum resolution of 4096x2160 @60Hz (2 independent display outputs)	Integrated Graphics Processor - Intel® UHD Graphics for 13th Gen Intel® Processors: 2 x HDMI 2.0 ports, supporting a maximum resolution of 4096x2160 @60Hz 1 x DP 1.4 through USB Type C (DP Alt. mode), supporting a maximum resolution of 7680x4320 @30Hz, requires designated graphic driver (3 independent display outputs)	Integrated Graphics Processor - Intel® Iris® Xe Graphics : 2 x HDMI 2.1 2 x DP 1.4 (8K) 1 x DP 1.4 (USB Type C (8K)) (4 independent display outputs)
Audio	Realtek® ALC269	Realtek® ALC269	Realtek® Audio Codec
Storage	1 x 2.5” HDD/SSD (SATA 6Gb/s)	1 x 2.5” HDD/SSD (SATA 6Gb/s)	1 x 2.5” HDD/SSD (SATA 6Gb/s)
Expansion Slots	1 x 2280 M.2 M-Key (PCIe Gen 4x4, SATA 6Gb/s) 1 x 2230 M.2 E-Key 1 x Full-size Mini PCIe with SIM slot	1 x 2280 M.2 M-Key (PCIe Gen 4x4, SATA 6Gb/s) 1 x 2230 M.2 E-Key (PCIe x1, USB 2.0)	1 x 2280 M.2 M-Key (PCIe x2, SATA 6Gb/s) 1 x 2230 M.2 E-Key 1 x 3052 M.2 B-Key with SIM slot (Support 5G)
Front I/O	2 x RJ45 LAN Ports 4 x USB 3.2 Gen 2x1 2 x HDMI 1 x Power button with LED 1 x HDD LED 1 x COM Port (RS-232/422/485 & RI/5V/12V) 1 x External Antenna Hole (Optional)	2 x USB 3.2 Gen 2x1 1 x USB 3.2 type C with DP 1.4b (DP Alt. mode) 1 x Power button with LED 1 x HDD LED 1 x COM Port (RS-232/422/485) 1 x Combo Audio Jack (Headphone & Headset)	1 x USB type C (USB 3.2 Gen 2x1, DP Alt Mode & PD Out -30W)(-100W requests to use 250W adapter) 1 x USB type C (USB 3.2 Gen 2x1, PD input-100W) 4 x USB 3.2 Gen 2x1 2 x HDMI 2 x DP 2 x RJ45 LAN Ports 2 x USB 2.0 1 x HDD LED 1 x Power button with LED 2 x External Antenna Holes (Optional)
Rear I/O	2 x USB 2.0 2 x COM Ports (RS-232/422/485) 1 x GPIO (8 bits) 1 x Headphone Jack 1 x 3-pin Terminal block	2 x HDMI 2 x RJ45 LAN Ports 2 x External Antenna Holes (Optional) 2 x USB 3.2 Gen 2x1 1 x Screw type DC Jack	1 x COM Port (RS-232) 2 x USB 2.0 1 x Headphone Jack 1 x Screw type DC Jack 2 x External Antenna Holes (Optional)
Side I/O	2 x External Antenna Holes (Optional)	--	1 x External Antenna Hole (on each side)
TPM	Onboard TPM 2.0 security chip INFINEON SLB9672VU2.0	Onboard TPM 2.0 security chip INFINEON SLB9672VU2.0	Onboard TPM 2.0 security chip INFINEON SLB9670VQ2.0
Power	+9~36VDC (Full Range)	+12V~24VDC (Adapter 19.5V/135W)	+12V~24VDC (Adapter 19.5V/135W)
Ordering Information	6BQP1355AMR-SI (Box packing)	6BQB1315AMR-SI (Box packing)	6BQL1340AMR-SI (Box packing)