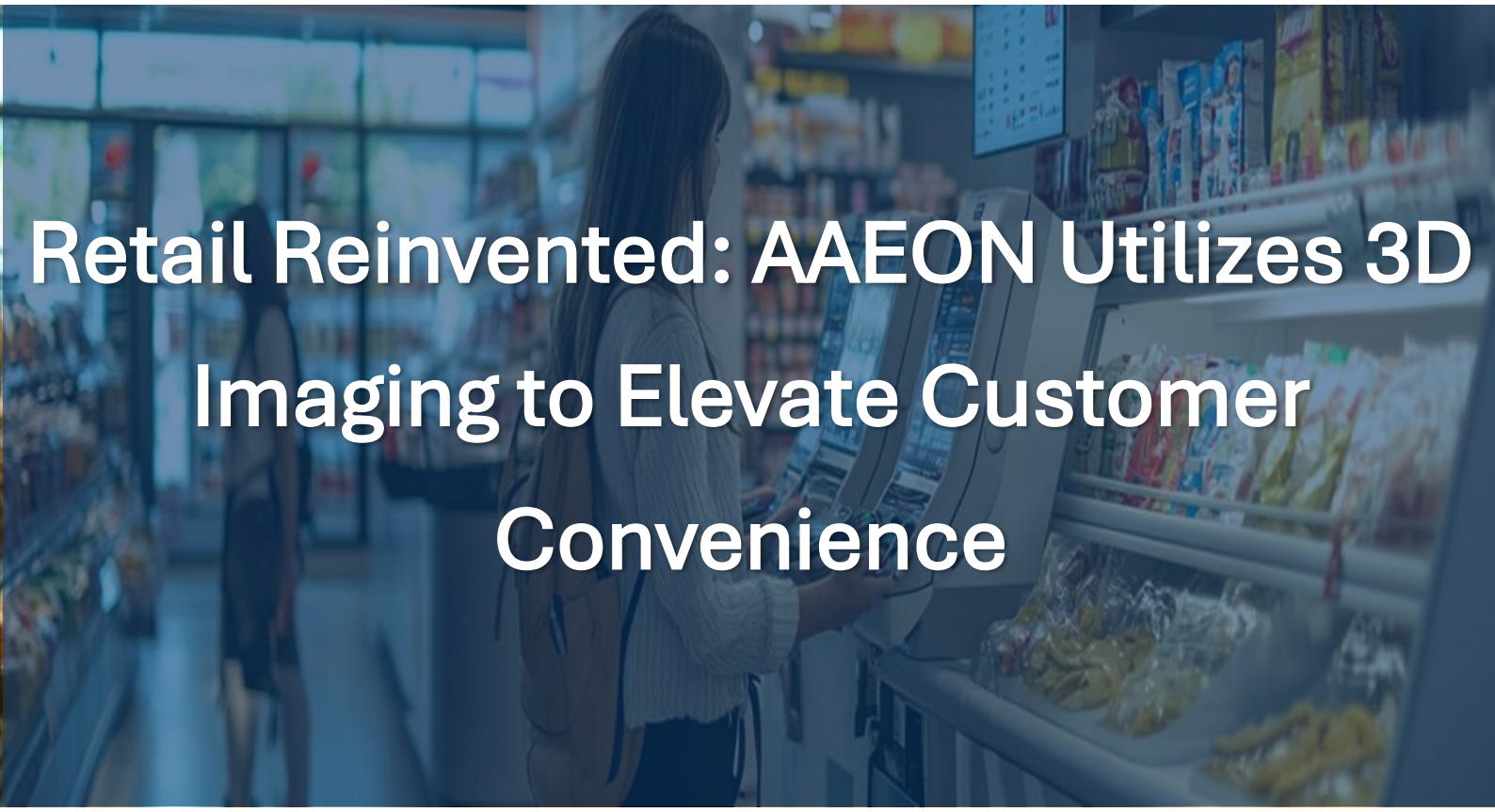


Retail Reinvented: AAEON Utilizes 3D Imaging to Elevate Customer Convenience

Introduction

Smart retail solutions come in many forms, but all share a relatively similar objective – to provide a more positive experience for customers. A popular convenience store recruited AAEON to help them create an AI inference-based automated self-checkout that could reduce the time customers spent queuing and deliver a more convenient and streamlined way to shop.

There were several advanced functions and non-standard features that the convenience store chain required of the application, and so they tasked AAEON with developing a tailor-made embedded solution, knowing that AAEON had the technical knowhow and design flexibility required to deliver it.

When the Prerequisite is Excellence

Because the convenience store chain had a stellar reputation as a brand that delivered both quality and consistency across all aspects of its business model, they needed its self-checkout to be exceptionally fast, but also accurate.

As such, they required a product that could host multiple 3D cameras with high-bandwidth data transmission to obtain images of products passed through the checkout kiosk from multiple angles, without any latency.

In addition to this, the cameras chosen would need to pass the client's rigorous testing criteria, including being able to withstand being continuously turned on and off over a period of seven days while maintaining a frame drop rate of below 0.1%, thus ensuring they would be able to obtain stable, high-resolution image data for AI inferencing purposes.

To obtain the most accurate image classification possible, the cameras selected needed to provide the application's inference engine with an extremely detailed imaging dataset, and so the customer requested a system that could support cameras with extremely high bandwidth. It was decided that 3D cameras were the most suitable option for the client's system, given both RBG and depth data streams could be transmitted and processed simultaneously, resulting in an increase in the total volume of data that the AI model could draw upon for product recognition purposes.

The high bandwidth offered by 3D cameras further solidified this decision, given they could ensure fast, latency-free data transmission while maintaining high frame rates. When combined, the high and wide bandwidth that 3D cameras could offer the application made them the perfect solution for multi-dimensional data capture and real-time image processing.

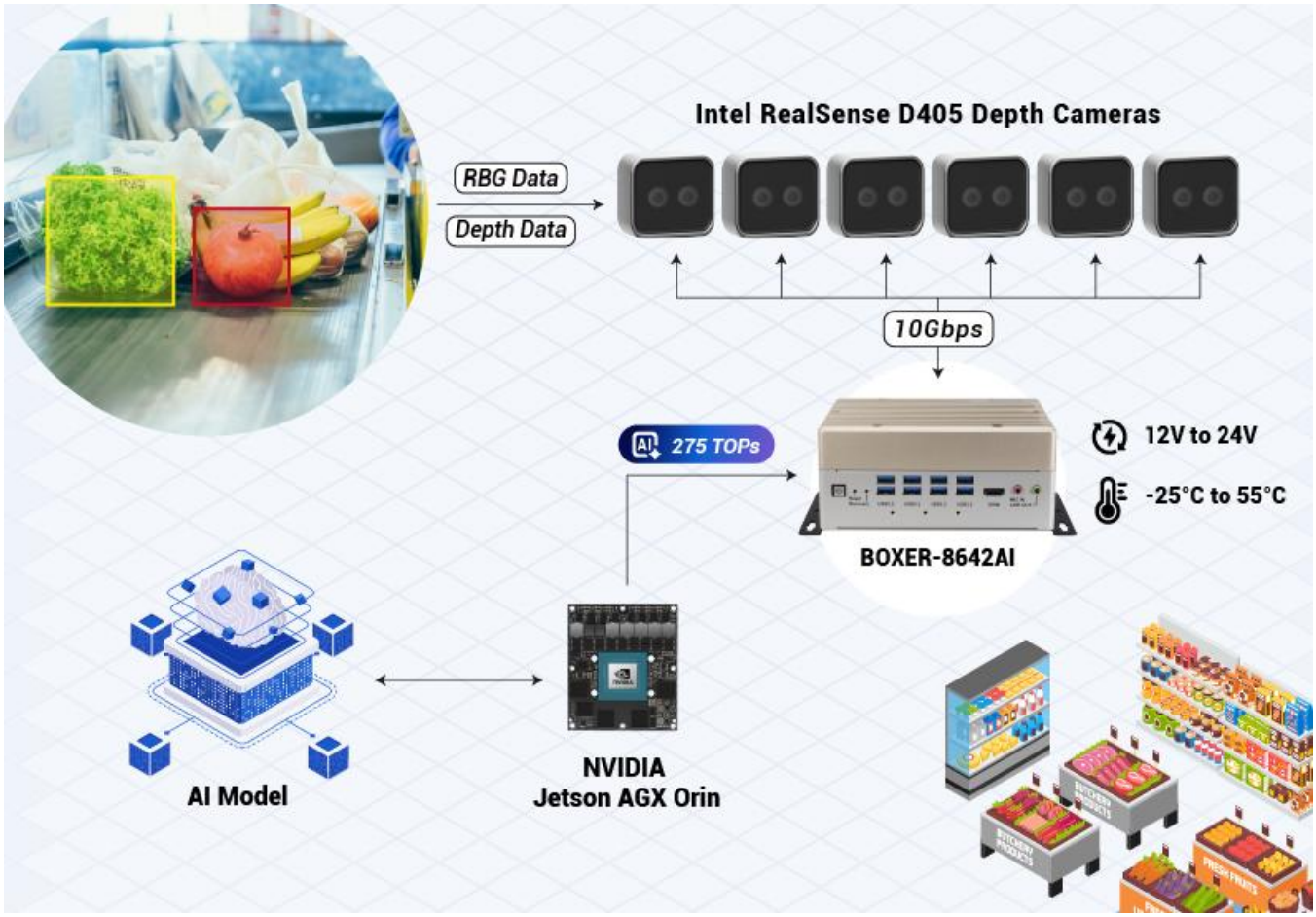
Due to the nature of the application, it goes without saying that the client required a product with the capacity to run complex AI inference models, able to perform object classification tasks in real time, identifying products as they were captured by the aforementioned 3D cameras. Once again, the focus of client was quality, and so only a product with the highest possible AI engine would be suitable.

While the speed, stability, and accuracy of the product's image acquisition and AI inferencing capabilities were the most important of the client's prerequisites, the product they selected would also need to have suitable environmental durability in order to operate in a retail environment.

Unique requirements required an innovative solution, and so the project led AAEON to develop the BOXER-8642AI, a Fanless Embedded AI System powered by the NVIDIA® Jetson AGX Orin™.

The client was aware of AAEON's reputation as a company that approaches its customer's needs with flexibility, technical expertise, and a willingness to go the extra mile to make sure applications are market-ready. As such, it came as no surprise that the BOXER-8642AI precisely addressed each of the client's requirements to optimize the application's success.

Application Architecture



The BOXER-8642AI: A Tailored Approach to Fit Complex Needs

Intel RealSense D405 Depth Camera Support

To accommodate the high-bandwidth 3D cameras needed for the application, the BOXER-8642AI, equipped with eight USB 3.2 Gen 2 ports running at 10Gbps, supports up to six Intel® RealSense™ D405 depth cameras. This setup ensures precise, latency-free image capture from multiple angles. The system's high-speed USB interfaces allow for faster, more detailed image processing, eliminating scanning errors and enhancing the customer experience.

AAEON verified the compatibility of the Intel® RealSense™ D405 depth cameras with the BOXER-8642AI to ensure they met the client's need for continuous on and off cycling while maintaining a frame drop rate below 0.1%. The knowledge and experience of AAEON's technical teams were instrumental in making sure the BOXER-8642AI could satisfy the client's requirements, no small feat given the lack of existing embedded products with this capability anywhere else in the market.

Precise Object Classification

The need for high-performance AI inferencing was much easier to satisfy, given AAEON's longstanding position as an Elite partner of the NVIDIA Partner Network (NPN).

Having built a catalog of embedded AI systems equipped with NVIDIA technology ranging from the NVIDIA® Jetson Nano™ to the NVIDIA® Jetson AGX Orin™, AAEON was more than capable of ensuring the system chosen had adequate AI performance.

Because of the application's need to run complex AI algorithms in order to recognize and categorize scanned products, AAEON felt that the NVIDIA® Jetson AGX Orin™ was the best fit for the BOXER-8642AI. Offering up to 275 TOPs of AI performance, the module provided the BOXER-8642AI with more than enough horsepower to run trained AI models and classify the image data retrieved from the system's 3D cameras, the quality of which ensured a high degree of precision as well as speed.

Retail-Ready Environmental Spec

Measuring in at just 180mm x 136mm x 78mm, the system is compact, making it suitable for integration into the store's self-checkout kiosks. In terms of durability, the BOXER-8642AI was suitable by design, with the primary concern of fluctuating power supply negated by the system's broad 12V to 24V DC power input range.

In addition to this, the BOXER-8642AI can reliably operate in temperatures ranging from -25°C to 55°C without the use of a system fan.

The Benefits of Choosing AAEON

During the planning stages of their project, AAEON's client was unable to find an off-the-shelf embedded system capable of fulfilling all of their application requirements. The main barrier for them was finding a solution that could support independent USB ports with 10Gbps transmission speed. Due to the knock-on effect of running inferencing tasks on unstable or imperfect image data, they sought AAEON's help. Thanks to its technical support and flexible approach to product development, AAEON was able to engineer the BOXER-8642AI in a way that could support this, which ultimately led to its successful deployment.

As a consequence, the convenience store chain has begun rolling out its AI-assisted self-checkout kiosks across a number of stores, achieving their broader goal of increasing customer satisfaction, while also benefiting from other effects the application has had, such as reducing the manpower needed to man manual checkouts, reduce shrinkage from incorrectly scanned items, and maintaining its brand image as a leader in the smart retail sphere.

About AAEON

Established in 1992, AAEON is one of the leading designers and manufacturers of industrial IoT and AI Edge solutions. With continual innovation as a core value, AAEON provides reliable, high-quality computing platforms including industrial motherboards and systems, rugged tablets, embedded AI Edge systems, uCPE network appliances, and LoRaWAN/WWAN solutions. AAEON also provides industry-leading experience and knowledge to provide OEM/ODM services worldwide. AAEON works closely with premier chip designers to deliver stable, reliable platforms. For an introduction to AAEON's expansive line of products and services, visit www.aaeon.com.