Vitals, Devices, and Dashboards

AAEON Brings AI to the ICU

Introduction

AI is becoming an increasingly effective tool across various disciplines within healthcare. Use cases vary from highly specific functions, such as the deployment of inference models for diagnostic imaging, to broader applications, like autonomous service robots designed to perform everyday tasks in healthcare settings.

One system integrator wanted to leverage the benefits of AI adoption in healthcare in a hybrid form, developing an Intensive Care Unit (ICU) monitoring station that integrated various specific metrics for monitoring patient status into one comprehensive solution.

The objective was to expedite the identification of situations requiring staff intervention and, consequently, enhance the speed at which staff could be alerted to patients at risk.

Key Requirements for a Cutting-Edge ICU Monitoring Solution

With plans for its ICU monitoring station to track patient vital signs, monitor trends, and provide staff with alerts about abnormalities that may require attention, the systems integrator needed an embedded platform with robust and reliable features.

High-Throughput Data Processing

The primary requirement was that it had to support extremely high-throughput data processing, particularly due to the fact that a large volume of data would need to be transmitted and analyzed with minimal latency.

Additionally, the chosen platform needed to be support deep learning algorithms to detect changes in vital signs, which would require substantial computational resources.

Secure Wireless Communication

Secondly, the product chosen would need the necessary interfaces to obtain data to be analyzed. While direct connections with peripheral devices such as ECG monitors, oximeters, and temperature sensors were an option, the customer ultimately determined that wireless connectivity would be more suitable for the application.

Several factors supported this decision, the most significant being that a wired setup would require extensive retrofitting to maintain stable data transmission to the ICU monitoring station. Instead, they favored the use of medical IoT devices to wirelessly transfer the required information.

While this made sense, it also meant that the solution chosen to power the application would need to be capable of both extremely high-speed data transmission and enhanced security for the data in transit.

A Streamlined Development Platform

After careful deliberation, the client identified AAEON's MIX-Q670A1 Mini-ITX motherboard as the ideal foundation for their application.

To streamline the development process and take advantage of the new Intel® Arc™ A750E GPU architecture, they paired the motherboard with AAEON's advanced GAR-A750E graphics card.

Having already converted and optimized their AI models for the application using the Intel® Distribution of OpenVINO™ Toolkit, this meant that the process of bringing together both the software and hardware for the application was streamlined.

The Prescription: AAEON's MIX-Q670A1 + GAR-A750E

AAEON's MIX-Q670A1 served as the primary foundation for the client's ICU monitoring station. Addressing the need for high-throughput data processing, the MIX-Q670A1 gave the client a number of options to choose from, given the board's compatibility with 12th, 13th, and 14th Generation Intel® Core™ processors and support for up to 64GB of dual-channel DDR5 memory.

Ultimately, the client selected the Intel® Core™ i7-13700 Processor, which not only offered high performance for demanding tasks such as data aggregation, system orchestration, and UI rendering but also efficient compute resource allocation for background processes, thanks to the CPU's performance hybrid architecture.

This design helped maintain a manageable balance, ensuring full functionality without exceeding the heat dissipation capabilities of the motherboard's dedicated CPU fan.

A further reason this CPU choice suited the application was because the AI inference and complex data analysis tasks required for the ICU monitoring station were handled by the Intel® Arc™ A750E GPU-powered GAR-A750E.

Installed via the MIX-Q670A1's 16-lane PCIe Gen 5 slot, the GAR-A750E's purpose was to accelerate AI inference, helped by Intel Deep Link Integration to act as a bridge between the CPU and GPU. This setup ensured that the compute and AI workloads of the application were distributed in the most efficient way, minimizing latency.

The GAR-A750E's 28 Xe-Cores and 448 Intel® XMX Engines made it capable of performing large-scale matrix multiplications and other tasks essential for neural network inference. This capability allowed for the parallel execution of inference tasks on patient data received by the system, facilitating the detection of abnormalities.

As for the acquisition of patient monitoring data, the client deployed a novel combination of medical IoT devices that have been developed in recent years, supporting both Wi-Fi and Bluetooth modules. To transmit this data from the medical IoT devices to the board, the client populated the MIX-Q670A1's M.2 2230 E-Key slot with a Wi-Fi module.

To safeguard data in transit, the board was equipped with an onboard TPM 2.0 chip and utilized a Wi-Fi module that supported WPA3 (Wi-Fi Protected Access 3) encryption protocols. Furthermore, the client fully leveraged the CPU-native security features of the Intel® Core™ i7-13700 Processor, including Intel® AES New Instructions (AES-NI), Intel® Hardware Shield, and Intel® Total Memory Encryption (TME).

These features are designed to accelerate data encryption and decryption, prevent unauthorized access at the firmware level, and provide physical protection for data stored on the device's hardware, respectively.

Finally, to present complex medical data on the dashboard in an easily understandable format, the systems integrator utilized the MIX-Q670A1's dual HDMI 2.0 and display ports. This setup enabled a multi-screen configuration that displayed essential information for staff to monitor. Additionally, the audio functionality provided by the board's rear I/O facilitated the generation of alerts, thereby minimizing the risk of missed notifications.

Prognosis: A Future-Proof Setup

By combining AAEON's MIX-Q670A1 and GAR-A750E as the core components of the client's ICU monitoring station, they were able to deploy a solution capable of monitoring patient vital signs in real time, detecting potential health risks as they emerged. Advanced AI models processed by the Intel® Arc™ A750E GPU enabled faster and more accurate identification of at-risk patients.

Additionally, the board's CPU efficiently managed multiple datasets with minimal latency, allowing for earlier alerts and providing healthcare staff with a head start in responding to critical situations as they unfolded.

Moreover, the choice of an industrial motherboard over a fully integrated system-level product, such as an embedded PC, will be crucial in future-proofing the application. The modular design of the Mini-ITX form factor allows for significant advancements in processing and graphics technology, as well as more sophisticated Wi-Fi and storage modules, to be integrated. This flexibility enables the client's ICU monitoring station to make use of its modularity and upgrade components as needed, while still preserving the long-term effectiveness of its foundation.

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.

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