The Embedded World exhibition in Nuremberg (Germany) is an important exhibition to get an idea of the latest trends in embedded control technologies. Over 1100 exhibitors from almost 50 countries presented their products, solutions, and innovations. "The resounding response from the well over 32000 visitors from more than 80 countries emphasizes the significance of the Embedded World as the key meeting place for the embedded community," said Benedikt Weyerer, Executive Director of the trade show organizer.

Several companies exhibited in Nuremberg so-called edge devices featuring processors deploying AI algorithms and AI models. These products with local AI computing capability are called edge-AI devices enabling real-time data processing and analysis without constant reliance on a cloud infrastructure.

In some AI applications, CAN-networked sensors feed the AI processor with data collected in the local (front-end) control systems. Application examples include in-vehicle data for fleet management. Such vehicles could be road, off-highway, off-road (e.g. agriculture vehicles and forklifts), rail, or automated-guided vehicles for intralogistics. Other examples are AI-powered machine or process control systems. An example is the AI-supported laser welding as introduced in 2023 by Trumpf, a German machine builder. To ensure that the weld seam is always in the right place, the laser’s sensor technology positions the weld geometry precisely on the component – otherwise there is a risk of rejects. Dirt or scratches on the component, poor lighting conditions in the work area, or highly reflective materials such as copper make positioning difficult.

Offering only CAN hardware interfaces on edge-AI boards and computers is not convenient for system designers. In many application domains, the currently applied CAN networks connecting sensors and actuators use standardized HLPS (higher-layer protocols) such as CANopen, DeviceNet, Isobus, or J1939. The support of HLPS would decrease the effort to adapt edge-AI technology, especially for small and medium-sized companies.

On the Embedded World, many Taiwanese suppliers offered edge-AI products with CAN connectivity. According to the International Trade Administration (TITA) and the Taiwan External Trade Development Council (TAITRA), Taiwanese companies manufacture over 90 percent of AI servers worldwide. This trend seems to go on for edge-AI products.

Many of the edge-AI boards are equipped with Nvidia processors (see also article “AI evaluation boards with CAN connectivity” in this issue). Diamond Systems offers, for example, carrier boards for the Jetson processor by Nvidia designed for industrial and military applications. The Taiwanese company has married AI and the PCIe/104 board format. The carrier boards provide dedicated I/O functionality, which includes one or two CAN CC interfaces. The PCIe/104 is the stackable version of the PCIe format.
The company provides additional PCIe/104 modules with two CAN CC (classic) ports.

Advantech, another Taiwanese company, has launched AI acceleration modules and edge-AI computers powered by processors from Nvidia and Hailo. Many of these products come with two CAN CC interfaces. The company is an Nvidia distributor of industrial PCs that are certified with the AI Enterprise software platform for the development and deployment of production-grade AI applications. Edge-AI products by Advantech come with ROS (robot operating system) support. ROS is a set of software libraries and tools for robot applications, which supports CANopen and some of its profiles.

The edge-AI computers by Neousys are based on Jetson processors by Nvidia. Some of them come with one CAN CC port. They are mainly intended for camera-based AI solutions. The Taiwanese products are water-proofed and suitable for industrial and vehicle applications. Some housings are IP69K-rated. These products are suitable for unmanned ground vehicles and drones. For example, the SEMIL-2000 series, featuring IP69K protection, can operate in temperatures ranging from -40 °C to +70 °C. It is designed for enabling autonomous applications in military UGVs (unmanned ground vehicles), mining trucks, or agricultural tractors. The FLYC-300 series based on the Jetson Orin NX processor comes with a built-in CAN CC interface to interact with the flight controller.

Nexter, another Taiwanese manufacturer of edge-AI computers, which comprise AI processors from Nvidia or Intel. Some of them are designed for AGVs (automated guided vehicles), but they do not feature CAN connectivity. But the Nvidia-powered computers provide even one CAN FD interface.

The edge-AI computers by Aaeon (Taiwan) are suitable for intralogistics devices such as AGVs and AMRs (autonomous mobile robots). They use Intel processors and many of them feature one CAN CC interface.

C&T Solution from Taiwan launched in Nuremberg a series of edge-AI computers. Some of the family members feature CAN CC connectivity. The real-time industrial PCs are designed to withstand harsh-environment conditions.

Vecow located in Taiwan partners with Hailo AI chipmaker. The company also offers products with AI processors by Intel and Nvidia. The edge-AI computer for rail vehicles applications comes with two CAN CC channels. Other products like the EAC-2100 powered by a Jetson Xavier processor come with one CAN CC interface.

Forecr situated in Estonia has developed carrier boards for Nvidia processors. The company is an Nvidia partner as Diamond Systems. Their boards feature one or two CAN CC channels and several other connectivity ports including M.2 slots for expansion cards. The company offers also the Milbox-AGX ruggedized AI computer supporting two CAN CC interfaces. It is equipped with Jetson processors.

Bressner, a German company, offers fan-less edge-AI computers with CAN CC interfaces. These products use Nvidia Jetson Orin processors and measure 105 mm x 90 mm x 52 mm. This makes them suitable for applications, in which space is limited.

Al in healthcare

Edge-AI products are expected to be used in medical and healthcare equipment. This seems to become a huge market. However, there are risks and ethical impacts to be considered. The European Parliament has released a study on AI in healthcare. As in other AI applications, there are two phases: First is the training phase, in which
information is recorded, stored, and labeled. This includes information from human doctors and scientific studies. In a second step, the AI machine uses the intelligence gathered and stored to understand the new data. In this phase, the edge-AI product uses inference to identify and categorize the provided information, in order to provide a diagnosis. In such complex scenarios, the AI inference learning can be used to augment human decision making.

In many medical laboratory and healthcare equipment, embedded CAN networks are applied. CAN-connected sensors can feed the edge-AI products with dedicated information and CAN-linked actuators can be controlled by edge-AI computers. Advantech offers dedicated edge-AI devices for this purpose as well as Seco. The SOM-Smarc-Genio700 board offered by Seco (Italy) is powered by the Genio 700 processor from Mediatek (USA) featuring multiple Arm-Cortex cores. This module comes with a stand-alone CAN CC controller connected via SPI to the host processor. In addition, Seco has developed the Clea AI software platform. According to the company, it is partnering with NXP and will support in the future the eIQ processors.

Figure 2: Edge-AI computers are available in rugged housings (Source: Neousys)

CiA member Microcontrol (Germany) has introduced the µCAN-sensor module family featuring CAN CC and CAN FD hardware. It can run locally CANopen CC, CANopen FD, J1939-21/71 protocol stacks or customer-specific higher-layer protocol software. These one-euro sized products are available in customized board designs for implementation directly into the sensor casing.

According to the supplier, the board features sampling rates of up to 1 kHz. The one-channel module can handle voltage signals in a range from ±10 V, current signals from 0(4) mA to 20 mA as well as signals from strain gauges, thermocouples, and Pt100 as well as Pt1000 sensor elements. Two-channel modules are available, too.

**CAN interface module for sensors**

(Source: Microcontrol)