PEAK BY HMS NETWORKS

CASE STUDY

Compact CAN Interface Powers Human-Robot Interaction

Customer: ADLINK with MVP-5100

Solution: PCAN-M.2 interface

Country: Taiwan

Industry: Industrial Automation / Embedded Systems

ADLINK LEADING EDGE AI COMPUTING

PCAN-M.2 Interface Enables Control of Fully Automated Massage Robots

For the complex control of massage tables equipped with robotic arms, the Taiwanese IPC manufacturer ADLINK was looking for a robust and easily integrable CAN communication interface. The system includes three industrial PCs integrated into the table, one of which is dedicated exclusively to the precise control and actuation of robotic arms and sensors. The required CAN communication needed to be fast, reliable, and easily embedded into a Linux-based control system without additional integration effort. Besides technical performance, factors such as size, easy integration, and long-term component availability were also key. This case study tells the success story of the single-channel PCAN-M.2 interface and explains why users of these massage robots can truly relax while being massaged by the gentle robot arms.

FAIL-SAFE CONTROL: HUMAN-ROBOT INTERACTION POSES HIGH COMMUNICATION DEMANDS

Implementing a fully automated massage robot places significant technical demands on the system architecture. Communication between multiple axes and infrared sensors must be coordinated in real time to ensure smooth and precise movements. At the same time, the control system must be robust and fail-safe, since the robot operates in direct physical contact with humans. The massage tables are also used commercially in professional and public environments. Additionally, the systems had to meet the strict safety and certification standards of the U.S. market- particularly regarding UL and FCC classifications for operation in human-centered applications.
ADLINK therefore needed a solution that would ensure reliable real-time communication between sensors, actuators, and control components, while being easily installable in their own compact, fanless embedded PCs without major integration effort. Another key requirement was compatibility with Linux, to enable seamless software integration and long-term maintainability.

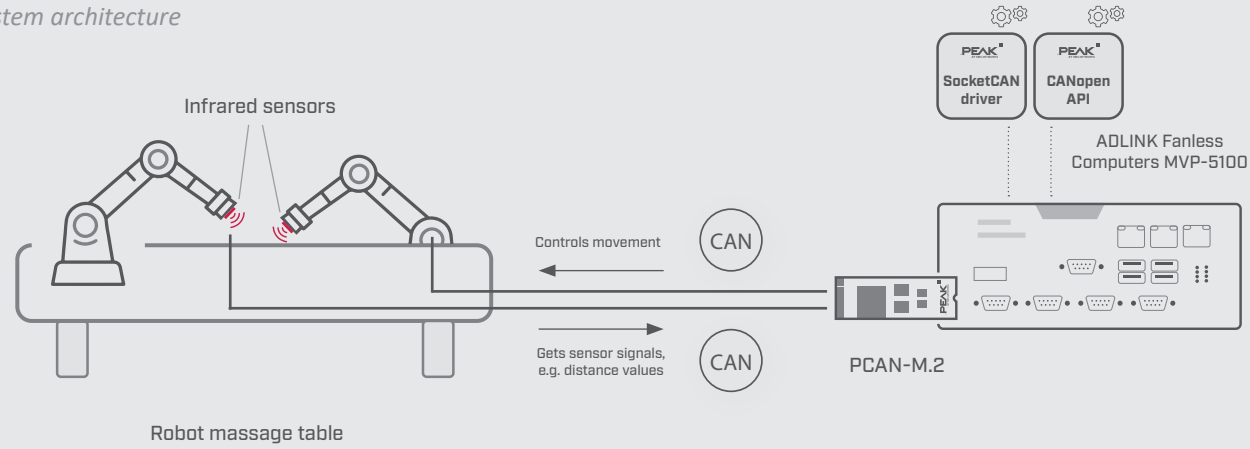
ADLINK FANLESS EMBEDDED COMPUTER POWERED BY PCAN COMMUNICATION

The control architecture of the massage robot is based on three ADLINK Fanless Embedded Computers, each integrated into one massage table.

CUSTOMER BENEFITS

- Compact and industrial-grade: Robust M.2 hardware with galvanic isolation and active bus termination.
- Direct Linux integration: Fully supported by the mainline kernel and SocketCAN, no additional drivers needed.
- Open and scalable: Combination of SocketCAN and CANopen API enables a flexible, scalable system architecture.

System architecture



One of these PCs is equipped with a CAN interface and is responsible for controlling the robot arms as well as communicating with the integrated infrared and position sensors. A second PC includes a GPU and handles image processing and motion analysis, while a third PC manages general control and diagnostic functions.
"For the sensitive CAN communication within the robot control system, our customer ADLINK chose the single-channel PEAK PCAN-M.2 interface," explains Yuan Lee, Expert for Embedded Communication Solutions at HMS Networks. "As a compact plug-in card, it is directly installed in the IPC housing and connected to the motherboard via the M.2 slot." With compact dimensions of only 80 x 22 x 46 mm (W x L x H), the interface also supports CAN FD, enabling high data rates with stable signal transmission.

An additional performance feature of the PCAN-M.2 for this application is its support for Direct Memory Access (DMA). This technology enables data to be transferred directly between the hardware and the computer's main memory without burdening the CPU. As a result, latency is reduced and overall system performance is significantly improved. While the DMA controller manages data transfers, the CPU can simultaneously handle other processing tasks. This architecture ensures stable data throughput even in complex real-time applications. Combined with the PCIe interface of the PCAN-M.2, it delivers maximum transfer efficiency, making it ideal for demanding control and testing systems.

EASY INTEGRATION AND MODULAR SOFTWARE ARCHITECTURE THROUGH SOCKETCAN AND CANOPEN API

At the software level, the system uses the SocketCAN driver established under Linux, which is already part of the standard kernel. This allows the PCAN-M.2 interface to be integrated without proprietary additional software. ADLINK also uses a community-based CANopen API to handle communication with the connected motor controllers and sensors. Through this API, individual actuators of the robot arm are addressed, status information is read, and motion profiles are controlled. The use of standardized protocols allows for a modular software architecture and simplifies the reuse of control components.
"By combining the SocketCAN driver and CANopen API, an open and extensible system is created that can be flexibly adapted to future requirements," continues Lee. "At the same time, this integration ensures stable, deterministic communication with low latency-crucial for the precise real-time motion control of the robot."

ADLINK Fanless Embedded Computer MVP-5100

CONCLUSION

With the PCAN-M.2 interface from PEAK-System, ADLINK was able to implement a reliable and future-proof communication solution for its customer, optimally integrated into the design of the ADLINK Fanless Embedded Computer MVP-5100. The native Linux support, CAN FD compatibility, and activated bus termination significantly reduced integration effort. Combined with the robust and fanless design of ADLINK's Fanless Embedded Computers, the result is a system offering maximum stability, minimal maintenance requirements, and long-term availability. Thus, the PCAN-M.2 forms a key component for the safe control of robotic arms- and contributes significantly to ensuring a consistently high-quality, automated massage experience.

FURTHER INFORMATION IS AVAILABLE AT
www.peak-system.com