



Semi-Autonomous Surgical Robot

PikeOS RTOS & Hypervisor

Proven Platform for a Safe & Secure Operation

The digitization of medicine has become much more important in recent years and offers many advantages for both patients and doctors. The use of electronic health records, telemedicine and medical devices connected to the Internet can make treatment more efficient and accurate. Embedded systems play an important role in this by enabling data processing and facilitating communication between different medical devices.

Embedded systems are small computers used in medical devices to control and monitor them. They enable the transmission of data in real-time and thus support the rapid and precise diagnosis as well as treatment of patients. They are also capable of recording and analyzing data, which in

turn supports the development of new therapies and treatments. Overall, the use of embedded systems contributes to the improvement of medical care and facilitates the work of doctors and nurses.

A special use case for an embedded system in a semi-autonomous surgical robot is to control and monitor the robot's movements during surgery. An embedded system can be used to control and monitor the robot's motions by receiving signals from sensors and performing the appropriate actions. It can also be used to track and correct the robot's position and orientation in space to ensure that it operates accurately and safely.

SOLUTION

With the combination of PikeOS, PikeOS for MPU and a system-on-a-chip module (SoC) from TQ Systems' i.MX8 series, such as the TQMa8Mx, embedded systems for medical technology can be realized in a convenient way.

The TQMa8Mx offers Security functionalities for the highest demands, real-time capability, graphics support (VP9/4K HDR10) and high-speed communication via Gbit Ethernet PCIe and USB interface. This allows the implementation of a control system as required in semi-autonomous surgical robots for instance. One or more applications can run in parallel per core. Thus it is possible to implement functionally safe and cyber-safe control, regulation, monitoring and data exchange on one module.

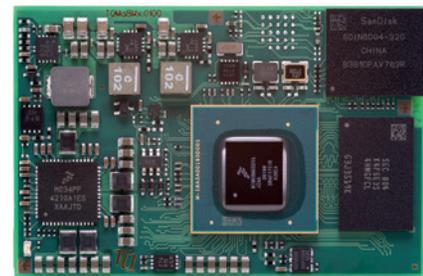
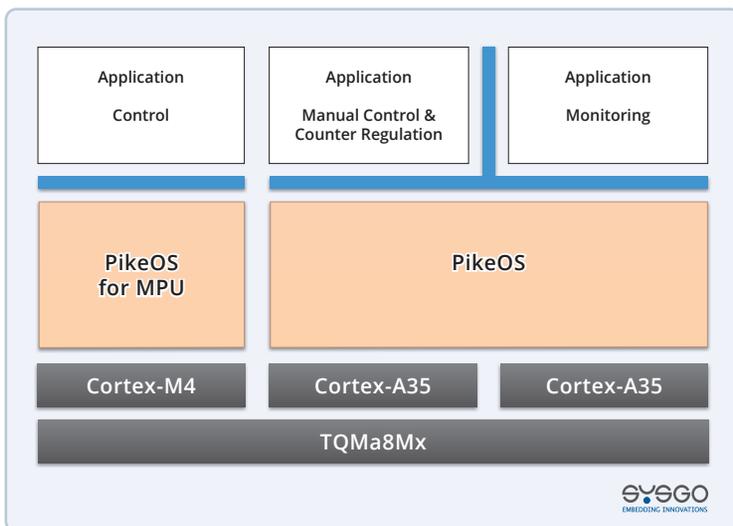
The real-time operating system (RTOS) and hypervisor PikeOS provides the basis for separating applications in the embedded system in a functionally safe manner in space and time. Functional safety can be achieved via SYSGO's certification kits, which are available for the medical technology Safety standard IEC 62304 for PikeOS in order to achieve the highest Safety level class A, among others.

With its pre-certification against the Common Criteria Security standard at level EAL 5+, the PikeOS Separation Kernel (version 5.1.3.) also offers Cyber Security at the highest level.

On customer request, after appropriate customization via Board Support Package, PikeOS for MPU can run as a safely separated partition on the microcontroller (Arm Cortex-M4), which is located on the heterogeneous TQMa8Mx. PikeOS for MPU takes over important tasks, where one prefers a microcontroller over a CPU for reasons of higher-level Safety or manageability, among other things. This can be for example the deterministic processing of large amounts of data.

With the integrated development environment CODEO such embedded systems, which make highest demands on Safety, determinism or real-time and consolidation, can be created within one tool. PikeOS and PikeOS for MPU do not require a large toolchain, but find a common roof on the Eclipse-based IDE CODEO.

POSSIBLE SYSTEMATIC EXAMPLE ARCHITECTURE



TQMa8Mx

The TQMa8Mx is suitable for medical technology with high Safety, real-time and communication requirements as well as the need for graphics support.

About TQ Systems

As a technology service provider and electronics specialist, the TQ Group implements customized, innovative solutions for various industries – from development to production and other services to product lifecycle management. One focus is embedded processor technology: whether x86, Arm, QorIQ Layerscape or Power Architecture – the goal is to provide the latest processor technology in the form of embedded modules, SBCs, industrial PCs, modular solution platforms and finished systems. More information at www.tq-group.com

About SYSGO

Founded in 1991, SYSGO became a trusted advisor for Embedded Operating Systems and is the European leader in hypervisor-based OS technology offering worldwide product life cycle support. We are well positioned to meet customer needs in all industries and offer tailor-made solutions with highest expectations in Safety & Security. More information at www.sysgo.com/medical