Cephasonics Ultrasound

Interoperability between Medical Devices and Ultrasound Systems

How Medical Procedure Support Can Be Enhanced with Interoperability between Medical Devices and Ultrasound Systems

A Cephasonics Ultrasound White Paper

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The Challenge of Standalone Systems

Ultrasound has long served as an essential imaging tool for diagnostics and procedural guidance, yet traditional standalone systems often work in isolation, creating challenges when integrating with other medical technologies. In many operating rooms and treatment settings, a physician might rely on a diagnostic or procedure support device alongside a separate ultrasound machine.

As ultrasound is being augmented with AI, it is being deployed more and more for quantitative tasks such as patient telemetry and navigation within the body. This transition is making the need for interoperability between the ultrasound system and other medical devices even more essential.

In such scenarios, an ultrasound technician typically performs a scan and gathers both imaging and quantitative data—information that could include Doppler flow measurements, tissue elasticity, or 3D volumetric assessments. This data is then manually conveyed to the operator of the medical device, who inputs it to guide the procedure.

If additional imaging or data is needed, the cycle repeats: the operator communicates back to the technician, who then performs further scans. This back-and-forth process not only extends the duration of the procedure but also increases the workload and the risk of miscommunication and errors. This separation can introduce inefficiencies, requiring manual data entry, multiple personnel, and increased procedure time.

The Challenge of Traditional Ultrasound Use in Procedural Support.

In a typical operating room (OR) or treatment setting, where a physician is utilizing a diagnostic or procedure support device, a standalone ultrasound system is often used in conjunction with other procedure-specific medical devices such as robotic surgery, ablation guidance, etc. Traditionally, this process mandates a labor-intensive and segmented workflow that includes separate operation of the ultrasound system and the medical device:

1. **Initial Ultrasound Scan:** A trained ultrasound technician or sonographer performs an initial scan, capturing relevant images and quantitative data such as Doppler flow measurements or tissue elasticity readings.

2. **Manual Data Transfer:** The sonographer communicates the findings to the medical device operator, who manually inputs key measurements into the procedure support device.

3. **Medical Device Response:** Based on this input, the medical device may adjust its functionality or prompt the physician for further action. However, it may also require additional imaging or updated data.
4. **Additional Imaging Needs:** The operator of the medical device relays the request back to the ultrasound technician, who performs another scan and extracts additional information.
5. **Repetitive Exchange of Information:** This back-and-forth process continues, often requiring multiple rounds of manual interaction, increasing the likelihood of delays, miscommunication, and potential errors.

Separate standalone systems can introduce several inefficiencies:

- Increased procedure time
- Higher workload on staff
- Greater training requirements

Interoperability: The Future of Integrated Ultrasound and Medical Devices

In contrast, an interoperable ultrasound platform offers a more streamlined approach by enabling direct machine-to-machine communication and control between the ultrasound system and the medical device. With such integration, quantitative data captured by the ultrasound system can be automatically transmitted in real time to the medical device, eliminating the need for manual data entry.

The medical device can instantly process the incoming data, adjust its functionality, and, if necessary, request further imaging information without requiring an operator to manually transfer information. This seamless, automated exchange reduces the risk of error and significantly improves procedural efficiency.

Another fundamental challenge is the requirement for two separate control systems and user interfaces, each functioning independently. In a non-integrated setup, the medical device operator and the ultrasound system operator must enter instructions separately into their respective systems, leading to workflow inefficiencies, potential delays, and an increased risk of errors.

Example - robotic-assisted surgical procedure

For example, in a robotic-assisted surgical procedure, a surgeon may be controlling a robotic system while needing live ultrasound navigational data for guidance. However, without interoperability, the ultrasound machine remains a standalone system, requiring a separate operator to adjust imaging parameters, change scanning angles, or capture new measurements based on verbal instructions from the medical device user.

Similarly, in cardiac interventions, an interventional cardiologist might rely on real-time Doppler ultrasound data to guide catheter placement, but they must manually request the ultrasound technician to perform additional scans or adjust settings—adding unnecessary steps and room for miscommunication.

This lack of machine-to-machine communication forces medical staff to constantly shift focus between two independent systems, breaking the procedural flow and reducing overall efficiency. More critically, the primary medical device is unable to directly control the ultrasound system, preventing a more automated, synchronized workflow.

A truly interoperable system allows the primary medical device to send control commands directly to the ultrasound system, enabling real-time adjustments based on procedural needs. Instead of requiring manual intervention from a separate ultrasound technician, the medical device could dynamically request new imaging angles, adjust frequency settings, trigger measurements, or capture additional imaging frames based on predefined procedural workflows. This direct integration eliminates redundant user inputs, allowing the medical device and ultrasound system to function as a single, coordinated unit rather than two independent machines.

By moving beyond simple data exchange and enabling bidirectional control and automation, interoperability transforms ultrasound from a passive imaging tool into an active, responsive component of the procedural workflow. This approach not only streamlines operations but also enhances precision, reduces human error, and ensures that real-time imaging data is fully leveraged to improve patient outcomes.

With an integrated interoperable approach:

- **Automated Data Flow:** The ultrasound system automatically streams quantitative data—such as elastography measurements, Doppler flow velocities, or 3D volumetric imaging—directly into the medical device.
- **Real-Time Adjustments:** The medical device can request updated imaging parameters or additional data as well as taking direct control of the ultrasound

system, prompting the ultrasound system to adjust settings dynamically, do scanning and data acquisition, all without operator intervention.

- **Reduced Human Error:** By eliminating manual data transfer as well as dealing with multiple device interfaces and control requirements, there is less risk of operator errors, ensuring greater precision and reliability.

- **Enhanced Efficiency:** Physicians and medical staff can focus on the procedure rather than managing device interactions, reducing overall procedure time and improving patient outcomes. Interoperability can also reduce the need for multiple operators, systems, and user interfaces.

The Bottom Line

This narrative of integration highlights a significant evolution in medical device functionality. The ability to connect imaging and treatment devices directly not only streamlines workflows but also minimizes the potential for human error, thereby enhancing patient outcomes. By reducing the reliance on manual data transfer, clinicians can focus more on the procedure itself rather than on coordinating between multiple systems. This integration ultimately transforms the operating room into a more efficient, responsive, and safe environment.

Partnering with Cephasonics: The Future of Interoperable, Integrated Ultrasound and Computer-Aided Medical Devices

For medical device manufacturers looking to build the next generation of AI-driven, robotic-assisted, and computer-aided medical procedure devices, Cephasonics is the ideal partner in ultrasound integration and interoperability. Unlike traditional ultrasound systems that operate in isolation, our advanced real-time imaging, AI-powered analytics, and open API architecture enable seamless communication between ultrasound and medical devices, eliminating workflow inefficiencies, redundant data entry, and disconnected user interfaces.

By combining real-time quantitative imaging, AI-driven analysis, robotic integration, and open API support, Cephasonics' ultrasound platform transforms ultrasound from a passive imaging tool into an active, intelligent component of medical devices. Whether used in robotic surgery, AI-driven diagnostics, or catheter-based interventions, Cephasonics enables medical technologies to work more efficiently, reducing errors, improving precision, and streamlining workflows.

With seamless interoperability, Cephasonics is helping to shape the future of medical imaging, enabling smarter, more responsive, and highly automated medical devices that enhance patient care and procedural success.

Cephasonics is at the forefront of transforming ultrasound from a standalone imaging tool into a fully integrated, intelligent system that works seamlessly with medical devices used in diagnostics, procedural support, and robotic-assisted interventions. By

leveraging AI-driven analytics, real-time quantitative data generation, and an open integration architecture, we make medical device interoperability, where ultrasound becomes an integral part of surgical navigation, decision support, and automated procedural control a reality.

By working with Cephasonics, you can fully integrate ultrasound technology into your medical devices—allowing real-time control, automated adjustments, and direct machine-to-machine collaboration. Whether in robotic-assisted surgery, AI-driven diagnostics, interventional cardiology, or image-guided procedures, we can provide a scalable, high-performance ultrasound engine that transforms passive imaging into an active, intelligent system embedded directly into medical workflows.

The future of computer-aided medical procedures demands seamless, intelligent, and interoperable imaging solutions. We deliver technology, expertise, and partnership to make your vision a reality. Let's build the next era of smart, integrated medical devices—together.

Additional content: Cephasonics AI and Quantitative Data: Enhancing Decision Support and Automation

A key advantage of Cephasonics' ultrasound platform is its ability to generate real-time quantitative imaging data, which is essential for modern medical devices that require precision measurement and analysis. Traditional ultrasound systems provide qualitative images that rely on operator interpretation, but Cephasonics takes this further by offering the ability for ultrasound to generate AI-enhanced quantitative metrics.

Designed for Seamless Integration with Medical Devices

Unlike standalone ultrasound systems that require manual operation and data entry, Cephasonics' platform is designed for **seamless interoperability** with other medical technologies. Its **modular and scalable architecture** allows it to be embedded into a wide range of devices, from handheld diagnostic tools to complex robotic-assisted surgical platforms.

By integrating Cephasonics' ultrasound system with **medical robotics, AI-powered diagnostics, and interventional platforms**, device manufacturers can develop highly automated systems that:

- **Continuously adapt and respond** to real-time imaging feedback.
- **Improve surgical precision** by allowing robots to "see" inside the body using ultrasound.
- **Enhance AI-driven procedural guidance**, assisting physicians with real-time data analysis.

This level of integration enables advanced medical workflows where ultrasound no longer exists as an external tool but as a **real-time intelligence layer** within medical devices.

AI-Enhanced Analysis for Smarter Decision-Making

Cephasonics' ultrasound system integrates **AI-driven imaging algorithms** that help medical devices interpret and act on ultrasound data in real time. This capability is particularly valuable in:

- **Automated anomaly detection**, where AI can highlight potential areas of concern such as tumors, abnormal blood flow, or tissue abnormalities.
- **AI-assisted procedural recommendations**, guiding surgeons based on live imaging and predictive analytics.
- **Autonomous or semi-autonomous surgical workflows**, where AI uses ultrasound data to optimize robotic movement and instrument positioning.

By embedding AI directly into the ultrasound platform, Cephasonics enables medical devices to function with greater autonomy, reducing reliance on manual interpretation and improving procedural efficiency.

Measurement Capabilities for Precision in Medical Procedures

Cephasonics provides **highly accurate, automated measurement tools** that medical devices can use to improve precision and safety. These include:

- **Real-time distance, volume, and area measurements** for guiding catheter-based interventions.
- **Automated tracking of anatomical landmarks**, ensuring accuracy in robotic-assisted procedures.
- **Quantitative assessments of soft tissue elasticity**, used for cancer detection and biopsy guidance.

By offering direct access to these precise measurements, Cephasonics allows medical devices to operate with greater confidence and accuracy, reducing errors and improving patient outcomes.

Robotic Control Interfaces for Advanced Surgical Integration

As robotic-assisted surgery continues to expand, the ability for robots to "see" in real-time is critical. Cephasonics' ultrasound platform provides direct robotic control interfaces to ultrasound, allowing surgical robots to integrate real-time ultrasound

operational control as well as the resulting data into their operational workflows. This opens possibilities such as:

- Real-time ultrasound guidance for robotic-assisted procedures, ensuring instruments are precisely positioned within soft tissues.
- Automated robotic adjustments based on live imaging, improving procedural accuracy and reducing reliance on human input.
- Haptic feedback integration, where ultrasound data informs robotic systems to adjust force and movement based on tissue properties.

With low-latency, high-speed ultrasound processing, Cephasonics ensures that robotic systems can respond in real time to changes detected in the imaging field, making surgeries safer and more precise.

Cephasonics APIs for Custom Device Development

Recognizing the diverse needs of medical device manufacturers, Cephasonics offers a comprehensive ultrasound programming API that allows developers to:

- Customize ultrasound functionality based on specific device requirements.
- Integrate real-time imaging directly into third-party software and AI models.
- Automate ultrasound scanning procedures, reducing the need for manual operation.

These flexible API capabilities empower companies developing next-generation AI-driven, robotic, and interventional medical devices to create highly tailored solutions that leverage ultrasound data seamlessly.