



analogic
Innovative Solutions for Life

Designing a Multi-Modality Medical Imaging System

Expanding the functionality of an ultrasound device

Project Goal

Design a hardware system that combines an existing ultrasound device with an additional imaging modality.

This new system will simplify current procedures for more effective diagnosis and improved patient experience.

Ultrasound

Ultrasound is used as a diagnostic tool and as an aid during surgical procedures. Ultrasound transducers use a series of high frequency pressure waves (2-16MHz) to image internal organs and blood flow through analysis of the reflected waves.

Purpose

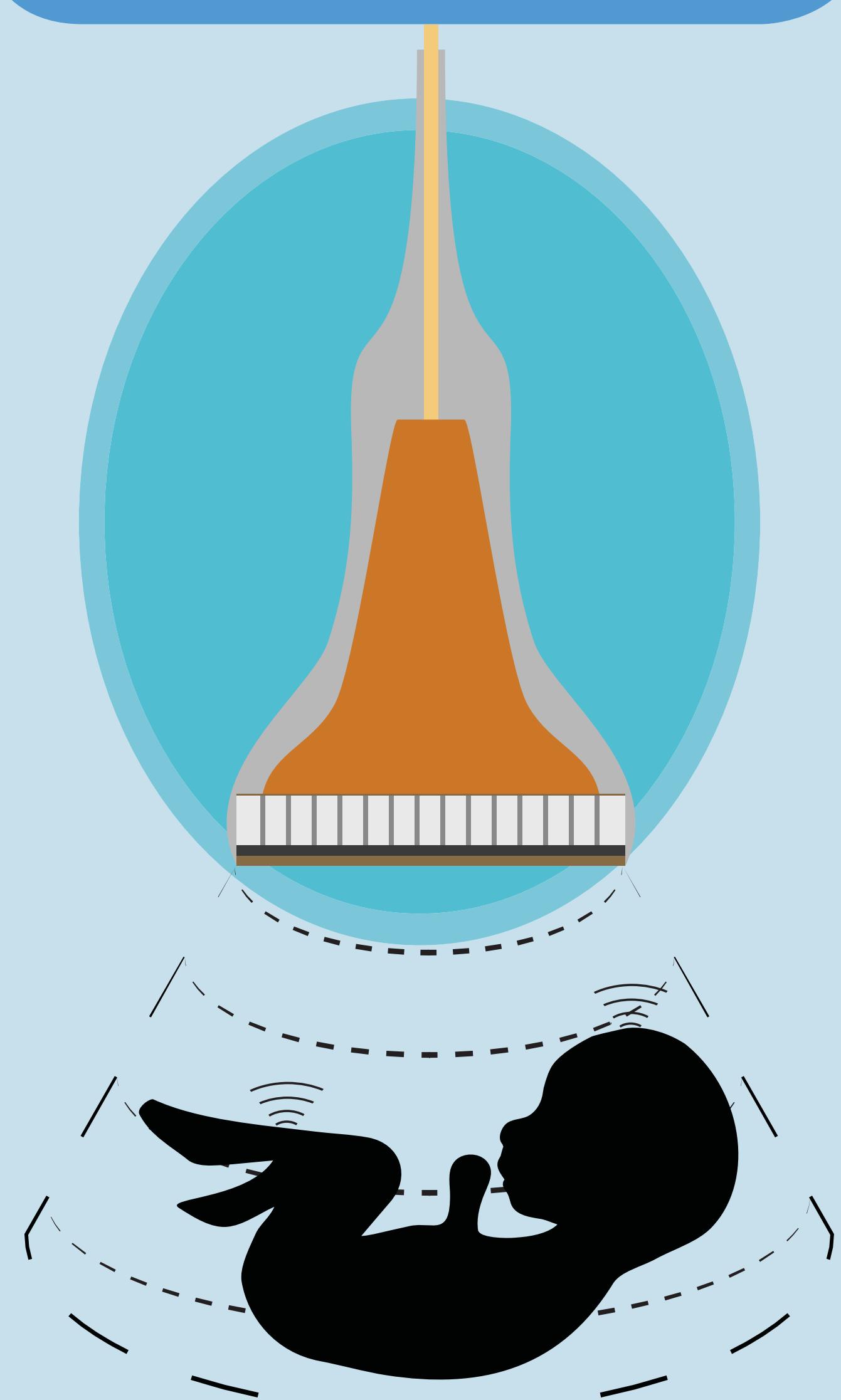
Increasingly, medical professionals are using multiple imaging modalities to obtain a holistic view of the problem. In many cases, multiple modes require multiple devices, making it difficult to quickly obtain different images of the same location. Combining modalities allows easy switching between modes and results in fewer devices to clean and in shorter procedure times.

Space Constraints

The overall dimensions of the current device are fixed by the dimensions of cleaning equipment and procedural constraints. The existing device was not designed with the intention of adding another modality, leaving limited space available.

Variety

Various imaging devices assess bone fragility, view tissues, visualize blood flow, and more. Most devices create 2D images, although another dimension can be gained by adding more crystals or sweeping them while imaging.



Impedance

The ultrasound waves reflect off boundaries between materials with a large impedance differential. For a clear image, only a very narrow range of materials can be in the imaging path between the crystals and the body.

Interference

Applying an electrical potential across piezoelectric crystals deforms them and creates pressure waves. When reflected back, the waves deform the crystals, creating an electrical potential used to generate an image based on time delay.

The sensitivity of the crystals makes them vulnerable to noise. Just the presence of unconnected wires near the ultrasound crystals causes noticeable interference in the image. However, the additional modality requires wiring in the vicinity of the transducer. To reduce interference, additional shielding is required.

Conclusion

The team successfully integrated the new modality with a functional prototype and recommends that Analogic continues the project.



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