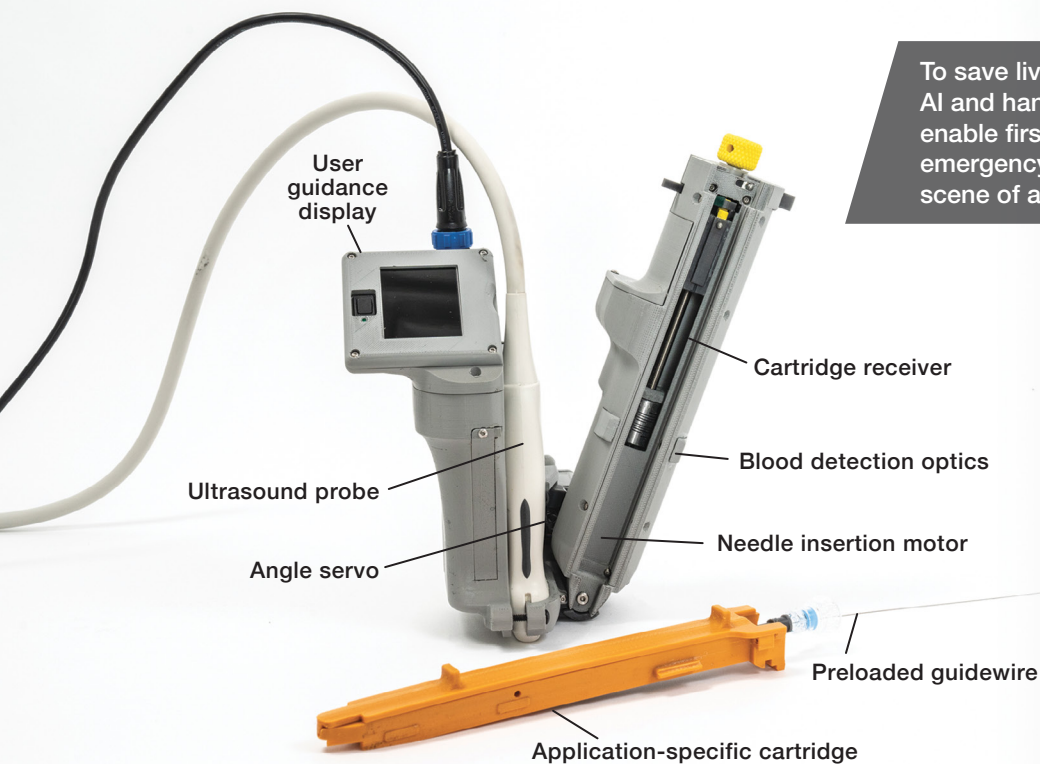# Artificial Intelligence–Guided Ultrasound Intervention Device (AI-GUIDE)

To save lives, AI-GUIDE employs AI and handheld robotics to enable first responders to perform emergency vascular access at the scene of an injury.

- User guidance display
- Cartridge receiver
- Blood detection optics
- Ultrasound probe
- Needle insertion motor
- Angle servo
- Preloaded guidewire
- Application-specific cartridge

In collaboration with physicians at Mass General Brigham, AI-GUIDE has demonstrated accurate and precise vessel tracking on animal and human data. Needle insertion has also been demonstrated with a 99% success rate in animal preclinical studies, as has reliable guidewire placement.

KEY FEATURES

- Enables rapid vascular access via the femoral artery or vein, jugular vein, or peripheral vessel

- Guides first responders through emergency intervention, from patient contact to guidewire and catheter placement

PLATFORM POTENTIAL

Expandable to other ultrasound-guided needle insertion applications

LINCOLN LABORATORY
Massachusetts Institute of Technology
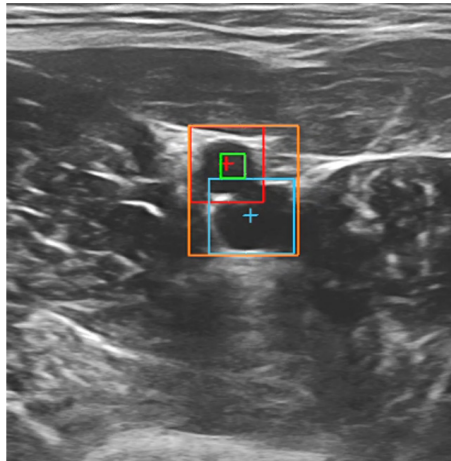
(a)
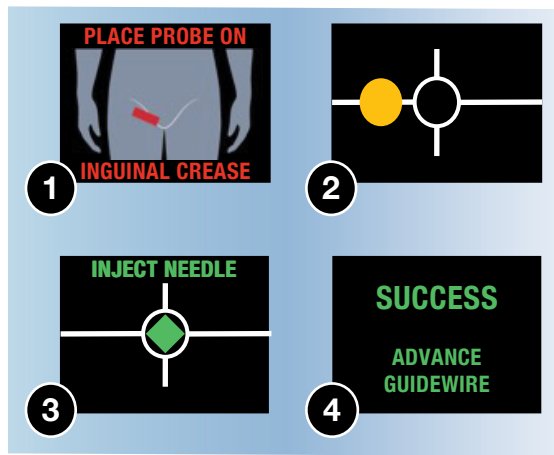
(b)

(a) Ultrasound image with boxes indicating the AI-labeled artery/vein pair (orange), artery (red), vein (blue), vessel centroid (+) and needle insertion target (green). (b) User guidance display with directions given to the operator: (1) general device placement, (2) directed mediolateral device positioning, (3) proper positioning confirmation and instruction, and (4) successful needle placement verification and further user instruction.

Challenge

For a first responder to best safeguard an injured person from a fatal hemorrhage, life-saving interventions must be rapidly applied onsite prior to transport to a hospital. Effective hemorrhage management often requires direct access to a central blood vessel, through which fluids, medications, or advanced interventions can be introduced. The precision and control required to gain central vascular access in emergency settings can demand skills beyond the typical training of first responders. Key challenges include the interpretation of ultrasound images in real time and placement of a needle and guidewire in a deep blood vessel.

Solution

AI-GUIDE is a handheld robotic catheterization tool that is easy to use and highly portable. The system consists of three key components:

- A commercial portable ultrasound device with an ultrasound probe that plugs into a smartphone or tablet

- An artificial intelligence application and real-time software to automatically identify and track the necessary blood vessels imaged by the ultrasound device

- A robotic system, which translates the AI-identified blood vessel detections into a simple dot-and-crosshairs display, and instructs the user to initiate the needle injection and guidewire placement

INTERESTED IN ACCESSING THIS TECHNOLOGY?

| Contact the MIT Technology Licensing Office
https://tlo.mit.edu/
tlo@mit.edu   617-253-6966

INTERESTED IN WORKING WITH MIT LINCOLN LABORATORY?

https://www.ll.mit.edu/partner-us

| Contact the Technology Ventures Office
tvo@ll.mit.edu

PATENT PENDING
#20210045711

More Information
L.J. Brattain et al., "AI-Enabled, Ultrasound-Guided Handheld Robotic Device for Femoral Vascular Access," *Biosensors*, vol. 11, no. 12, 2021.