Magic Leap | sentiar

Magic Leap and SentiAR:

Pioneering the future of healthcare through AR

With the power of augmented reality, Magic Leap and SentiAR have partnered to innovate healthcare solutions. Together, we are helping physicians visualize ablation procedures in a whole new dimension.

A keen partnership

Founded in 2017 by pediatric electrophysiologist, Dr. Jennifer Silva, digital health software company, SentiAR, Inc., is adding a new dimension to clinical practice in interventional procedures. SentiAR developed the first 3D visualization platform using real-time holography of patient anatomy and catheter location with a goal to empower clinicians and physicians with more control and better precision to provide safer delivery of care.

With Magic Leap's mission to amplify human potential by delivering the most immersive augmented reality (AR) platform so that people can intuitively see, hear, and touch digital content in the physical world, the partnership with SentiAR was inevitable.

2D information with 3D thinking

Cardiac ablation is a minimally invasive procedure where specialized cardiologists use a catheter to burn or freeze specific areas of heart tissue to cure abnormally fast heart rates, known as *arrhythmias*. Cardiac ablation is a first-choice therapy for treatment of arrhythmias, and it's approaching 75,000 procedures per year[1] in the United States alone.

As ablations are minimally invasive, physicians cannot directly visualize the heart. Instead, they use different imaging techniques to navigate catheters to the appropriate treatment areas of the heart. The most common imaging technique used for nearly all ablations is called Electrical Anatomic Mapping (EAM). EAM uses powerful computers, magnets, and electrical impedance algorithms to not only track catheter movements, but to create a computer-generated model of the patient's heart. Using this model, physicians can navigate through the procedure without exposing patients to X-rays.

However, there are some limitations with all non-invasive imaging including EAM systems. Primarily, the data or model that the EAM produces is presented on a 2D screen while the heart itself is three-dimensional. It takes significant skill and time for physicians to become experts at converting this 2D information into a 3D mental image. And it takes even more skill to then navigate catheters accurately with 2D information and 3D thinking.

Even for experienced physicians, what they see in their mind to perform the procedure is still informed by data they cannot individually control. A "mapping specialist" is in control of the computer, creating the model physicians must use to make decisions during the procedure. If a physician wishes to see something from a different angle, or needs to alter the view of the model, it must be done by someone else following the verbal commands of the physician.

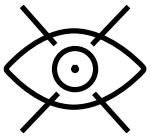
What and how we image in electrophysiology: A new reality

Cardiac ablation procedures are challenging. Current visualization modalities used in electrophysiology may not fully describe the complex 3D relationships that exist between a patient's anatomy and catheters. The cognitive load from multiple data inputs, abstract visualization, and catheter manipulation create complexity—complexity that is enhanced by a lack of control.

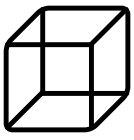
To solve these challenges, SentiAR created an innovative AR engine, CommandEP. Used on the Magic Leap AR platform, CommandEP takes real-time data from EAM systems and renders that data in 3D holography for physicians. This is the first time operating physicians in a surgical procedure can visualize their patient's anatomy in 3D without having a direct line of sight to the anatomy itself. Presenting the anatomy in 3D enables physicians to intuitively visualize the borders of the anatomy, as well as volume, shape, and contours. Physicians can also visualize their catheters in 3D, allowing them to see how those catheters interact with the anatomy.

One of the foundational features of the CommandEP user interface on the Magic Leap headset is the ability to "gaze and dwell" hands free—that is, the physician can use small head movements and advanced eye tracking to control the device when their hands are busy. As ablation procedures have been around for more than 30 years, there are imaging views, learned from using X-ray, that have proven to be beneficial to physicians during these procedures. Those views are preset on the CommandEP tool menu, and they are easily selectable. For example, the "move and zoom" tool lets physicians rotate the model in any direction and increase or decrease the size of the model as well. And with Magic Leap's advanced optics functionality, including a larger field of view and dynamic dimming capabilities that boost the solidity of digital content in bright environments, the size can be increased and focused to such an extent that the physician can feel as though they are inside the heart chamber.

CommandEP features:



Advanced field of view
and innovative optics for minimally invasive procedures



3D interactive visuals
using real-time data and 3D electroanatomic mapping

HD holography
that improves recognition of anatomic variances

Extreme comfort
for extended wear

Hands-free control
to maintain a sterile environment

The accuracy of catheter placement is a fundamental key indicator of success in cardiac ablation procedures and is directly correlated to long-term outcomes for patients. Whether the patient has focal lesions or a line of lesions, the precision of catheter placement impacts case time and recurrence. The heart itself contains sensitive structures that can be damaged just by a catheter touching them, and some of these structures play a role in arrhythmias or are adjacent to the tissue in need of treatment to stop an arrhythmia. Using AR, and therefore seeing in 3D, simply increases physician precision when placing a catheter. CommandEP on the Magic Leap AR headset reduces navigation errors and simplifies procedural workflow by putting the physician in control of the cardiac map—and they can view any aspect of that map from any angle with small inputs from the head and eyes. No hand movements required.

Better ablation procedures

CommandEP on the Magic Leap AR headset represents a fundamental shift in the way physicians visualize anatomy during ablations. Designed to make physicians more effective in ablations, CommandEP gives them better control of the size, location, opacity, and orientation of the model—all hands free, which is critical in a sterile environment like an operating room.

In a trial that was designed to evaluate how physicians using CommandEP changed their practice during ablation procedures while also collecting data on the user experience, it was evident that putting the physician in control of the procedure reduced their reliance on support staff, decreased the possibility of error, and freed the mapping specialist to focus on other important work during these procedures. In fact, there was a 90% reduction[2] in communication between the physician and the mapping specialist. With fewer verbal commands, the physician is in more control, and there are fewer opportunities for errors.

Other results showed that when physicians used CommandEP, they were 50% more accurate[3] in catheter placement than they were using only the EAM. Seeing structures in 3D provided an intuitive visualization experience to physicians performing cardiac ablations.

Beyond performing the procedure, AR is an excellent way to develop any skills and knowledge that relate to specific competencies and behaviors. CommandEP on the Magic Leap headset provides an intuitive way for physicians to understand exactly what's happening during procedures and then afterward explain to colleagues and patients easily how the procedure went by showing them the 3D.

According to Dr. Jose Osorio, MD EP at Grandview Medical Center in Birmingham, Alabama:

"This is a transformational tool that will improve 3D mental visualization which many EPs find challenging, and it's a game changer for skill development. I am hoping this will revolutionize peer-to-peer education."

Dr. Jose Osorio, MD EP

The solution's built-in sharing mode enables physicians to share their view of the cardiac map to several other Magic Leap devices, empowering collaboration in complex cases and detailed education for new and experienced physicians alike.

Moving forward with CommandEP on Magic Leap 2

CommandEP is a transformational advancement in the way physicians interact with the data and information they need to make therapeutic decisions during cardiac ablation procedures. And with Magic Leap's next-generation device, Magic Leap 2, the solution will provide even more benefits.

Magic Leap 2 is poised to be the most advanced and immersive AR platform on the market, with industry-leading optics, a larger field of view, and the world's first dynamic dimming capability. It is 50% smaller and 20% lighter than the previous version, Magic Leap 1, making it the lightest AR headset on the market. Magic Leap 2 was designed to be worn comfortably through the longest procedures without limiting the user's ability to interact with the environment and people around them.

Starting with CommandEP, the Magic Leap and SentiAR partnership will bring this solution to scale and truly realize the potential of spatial computing in healthcare.

Why CommandEP matters:

~75K
Patients seeking cardiac ablation therapy each year in the US[1]

90%
Reduction in communication between physicians and mapping specialists[2]

50%
More accurate in catheter placement than using only EAM[3]

*Magic Leap 2 is not yet available for sale. Regulatory approval pending. Specifications subject to change.

Footnotes:

1. Mansour, M., Karst, E., Heist, E. K., Dalal, N., Wasfy, J. H., Packer, D. L., Calkins, H., Ruskin, J. N., Mahapatra, S. (2017). The Impact of First Procedure Success Rate on the Economics of Atrial Fibrillation Ablation. JACC: Clinical Electrophysiology, 3(2), 129-138. doi:10.1016/j.jacep.2016.06.002

2. Silva, J. N. A., Privitera, M. B., Southworth, M. K., & Silva, J. R. (2020). Development and human factors considerations for extended reality applications in medicine: The enhanced electrophysiology visualization and interaction system (ELVIS). In J. Y. C. Chen & G. Fragomeni (Eds.), Virtual, augmented and mixed reality: Industrial and everyday life applications (pp. 341-356). Springer. https://doi.org/10.1007/978-3-030-49698-2_23

3. Silva, J. N. A., Southworth, M. K., Blume, W. M., Andrews, C., Van Hare, G. F., Dalal, A. S., Miller, N., Sodhi, S. S., & Silva, J. R. (2020). First-in-human use of a mixed reality display during cardiac ablation procedures. JACC: Clinical Electrophysiology, 6(8), 1023-1025.

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7500 W Sunrise Blvd | Plantation, FL 33322 | 954.889.7010 | magicleap.com