



University of Rochester Using Vuzix M4000 Smart Glasses to Deliver Mixed Reality Mobile Surgical Platform to the OR

Mixed reality is the merging of real and virtual worlds to produce new environments and visualizations, where physical and digital objects co-exist and interact in real-time.

It's no surprise that mixed reality can offer great benefits in surgical training environments. As it's becoming more common across industries, mixed reality can be used in surgery, virtual operating theatres, training environments, simulations, and so on. Dr. Ahmed Ghazi MD, FEBU, MHPE, a George W Conner Dean Teaching Fellow from the University of Rochester, saw the potential for mixed reality in the OR and ways in which the university could combine multiple technologies to drive innovation.

Upskilling a surgeon remotely is no small feat. To both successfully and efficiently convey new skills to a surgeon, that surgeon must be able to utilize their

hands and brain while being guided through an actual procedure. This makes using other technologies, like tablets and other handheld devices, impossible because it would remove accessibility to one, if not both, of their hands. Therefore, finding a way to have access to see-what-I-see, handsfree technology, is critical in these environments. The technology needs to be comfortably wearable, retaining the vital hands-free element while maintaining an unobstructed, natural surgical line of view while utilizing the technology. This type of technology is critical in surgical training because it allows surgeons to train using a hands-on approach by essentially fusing two images together: what the trainee sees in their field of view and the trainers hand interposed onto that surgical view. The surgeon can then guide the trainee through the procedure in real-time – creating zero cognitive burden.

A Mixed Reality Surgical Solution

Smart glasses employing see-through waveguide technology have been shown to give the surgeon a transparent display, allowing the surgeon to have a full view of what the trainee is seeing, in their point of view. The glasses, paired with surgical software that allows text and image overlays to guide the operating surgeon, create a mixed-reality surgical training platform ideal for reinforcing skills and providing remote support.



Help Lightning: Enabling Merged Reality

Help Lightning is an AR-enabled remote assistance software available with merged reality functionality. The technology offers a unique way to improve communications in the medical field and work virtually side-by-side in an operating room. Help Lightning's remote virtual assist software provides real-time video collaboration, enabling surgeons to work alongside the trainee, virtually, in real-time, from anywhere in the world. Help Lightning software is already integrated into the M4000 smart glasses and when paired together, the hardware and software combined create the seamless mixed reality mobile surgical platform being utilized at the University of Rochester today.

Vuzix & Help Lightning: Driving Innovation in the Operating Room

Dr. Ghazi is using Help Lightning, in collaboration with the Vuzix hardware, to bring this see-what-I-see environment into the operating room, specifically when mentoring and training other surgeons or surgeons-to-be. Vuzix M4000 transparent waveguide allows the surgeon mentee to look through that view and see the surgical field, uninterrupted, while also viewing the video overlays that are being used by their remote mentor to guide them. To a surgeon, field-of-view is critical and having anything interfere with that, for even a second, could be a matter of life or death. Due to the critical need for an unaltered surgical view and for a surgeon's hands to be freed, the types of technologies allowed in the operating room are very limited (i.e., no handheld devices). Vuzix M4000 smart glasses were the first of their kind that the University of Rochester felt not only offered industry-leading collaboration benefits but did so in a safe way, allowable for the OR environment.

"Very few wearables now give you the ability to get guidance remotely, without interfering with or obscuring your vision. In addition to needing our field-of-view unaltered, it is also critical to surgeons that head-mounted wearables be lightweight and compact," said Dr. Ghazi. "Imagine being in the operating room and wearing something that is heavy,

Vuzix M4000: Total Situational Awareness on the Job



VUZIX M4000™
SMART GLASSES

Vuzix M4000 smart glasses offer an ideal wearable form factor that combines a revolutionary mix of optics, processing performance, and lightweight ergonomics. The ultra-bright, see-through waveguide optics on the M4000 smart glasses are what make them an ideal tool for training in operative settings.

Benefits:

- Revolutionary see-through waveguides
- Heads-up display
- Crystal clear, professional quality streaming for remote viewers
- Lightweight, comfortable form factor that allows for all day wear

during an extremely long procedure, and is also obscuring your field of view. As you can imagine, that could greatly impact a surgeon's performance. So, the key to Vuzix M4000 smart glasses is the ability to offer remote feedback, without interfering or causing any cognitive load to the surgery."

Innovation with 3D Printing and Mixed Reality at the University of Rochester

Dr. Ghazi and his colleagues at the University of Rochester understand the benefits of simulation when teaching. If a trainee can first operate on something that both looks and feels like the organ to be operated on, it gives them a realistic environment to not only hone their skill but to make errors and learn from them safely, in a non-life-threatening environment.

The doctors in the Urology department are practicing on ultra realistic 3D printed hydrogel replicas of the exact organs, tumors, arteries, and veins that are to be operated on. These replicas are created by using patients CT scans and X-Rays to create CAD images that then become the molds for the exact organ/tissue replications. They can print in both dissolvable and non-dissolvable molds, allowing them to build hollow vessels that simulated blood can run through. This innovative approach combining 3D printing and hydrogel casting allows for fabrication of exact tumors, vascular make up, etc., so extensive training and practice can be done, prior to the actual surgery.

Coupled with augmented reality guidance, the value of this printing technique in the world of remote training is that the remote expert can also have access to a precision replicated phantom of the body part being

operated on. This can allow for better trained surgeons going into surgeries, higher quality assistance from the remote expert, and significantly higher success rates. By combining all these innovative technologies, advancements are made possible not only in surgical training, but also in OR assistance for various complex procedures.

Smart Glasses Make Subject Matter Experts More Readily Available

Now more than ever there is a need to train and support remotely, especially in the medical field. As the healthcare industry was forced to turn to remote learning, the issue of availability of experts was brought to the forefront. It's very difficult for these subject matter experts to travel around the world to teach people their craft. However, this is something that surgeons are obligated to do in order to train the next generation of surgeons. The availability of expert knowledge has now become possible to an extent never before seen, using remote training technologies.

The Future of Surgical Practice at the University of Rochester

When asked about the future of mixed reality at the University of Rochester, Dr. Ghazi said he sees this spanning beyond just surgical upskilling. Even the most practiced of surgeons needs an assist from time to time. He can imagine a world where every surgeon and medical professional is wearing a pair of Vuzix smart glasses and using mixed reality to perform everyday operations, with access to a colleague whenever help is needed. This would allow for remote collaboration, expert to expert, that can span from one OR to the next. No matter how good you are at your surgical craft, there are always those difficult cases, and those cases will be better served by using this technology.



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