



Improving Surgery with AR

*Using augmented reality for training surgeons and
aiding through surgeries in real-time*

EXECUTIVE SUMMARY

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PROBLEM

Every year, **50 million** patients experience complications during surgery and 1.5 million of those die as a result of poor surgical technique and inexperience.

OPPORTUNITY

With more surgical experience and real-time guidance, as many as 1.5 millions lives globally could be saved every year. This can **save** hospitals and medical institutions worldwide **\$6.25 billion/year** in possible malpractice fees.

PATENT

This system displays real-time navigation to a surgeon's see-through head-mounted display, giving them constant access to the patient's necessary anatomical information, real time-guidance by professionals for complex surgeries, and more.

PROBLEM WITH SURGICAL TRAINING AND METHODS

During Surgery

The monitors used during operations are ineffective as surgeons often have to look back and forth between the patient and them. This leads to surgeons using mental mapping as a method to locate and target specific structure. Thus, guidance can be very limited during surgery, which compromises the precision of surgeons, which increases risk of complication and even death.

50 million patients suffer from complications due to surgery, and **1.5 million** of those people die per year, due to poor surgical technique or experience.

Current augmentation systems for surgeons are not effective as they often inhibit their skills as a surgeon rather than help them due to the inaccurate displays in the technology (not enough data analyzed by their system) and for that reason, these AR methods are often overlooked.

PROBLEM WITH SURGICAL TRAINING AND SURGICAL METHODS

During Surgical Training

Current training methods for surgical interns are very knowledge-based and are inconsistent with their learning. This often leads to the lack of experience going into surgeries in residency no matter the guidance they receive from senior surgeons. This inexperience and poor technique often lead to complications and death with uncommon surgical procedures.

A recent study at the University of Michigan found that 30% of surgeons couldn't operate independently after residency. And, according to the New England Journal of Medicine lower skilled surgeons have 5X higher death rates than senior surgeons.

EACH complication and death during surgery can potentially hold the hospital liable for medical malpractice, which means this current system of surgery and training can potentially cost hospitals around the world **\$6.25 BILLION/year** assuming only half the complications can be proven to be malpractice with the average lawsuit being \$250,000.

Imagine Doing a Physics Problem in Class...

What pops up in front of you as
you look at the problem



The Equations to use
The Thought Process
Numbers Needed

EASIER RIGHT!!!

SURGICAL AR SYSTEM

An augmented reality surgical system that allows the surgeon to use 3D anatomy model and different points of view with optical markers of the patient superimposed on the physical patient to perform the surgery more efficiently, safely, and with more experience-based trainings..

3D Scanning System

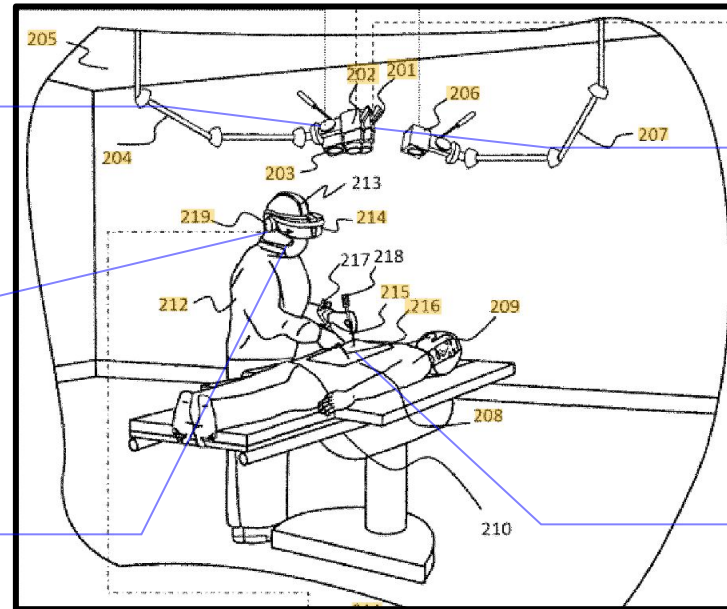
The Scanning System is able to capture the 3D surface of the target area to implement 3D anatomy models in real time.

Headphones

The headphones allow the Surgeon to hear audio guidance.

Heat-Mounted AR Display

The display allows the surgeon to make different view point and have the scan on the patient.



Stereoscopic Camera

The cameras situated at different point of view are going capture stereoscopic video of the surgical scene for the surgeon to have multiple perspective of the surgery.

Tracking Area & Patient

The tracking area is the area above the target part of the patient. The Surgeon can use hand-gestures to control the AR system.

SYSTEM PROCESS

1

Receive Preoperative Scan of the Patient

The preoperative scan can be in any format, including CT Scan, X-rays and more. The scan is used to register to 3D anatomic model for the Surgeon.

2

Receive 3D object scanning and Stereoscopic Video

The 3D object scanning constructs a 3D surface for the preoperative scan generated pose-optimized anatomy model and the the 3D volume stereoscopic video.

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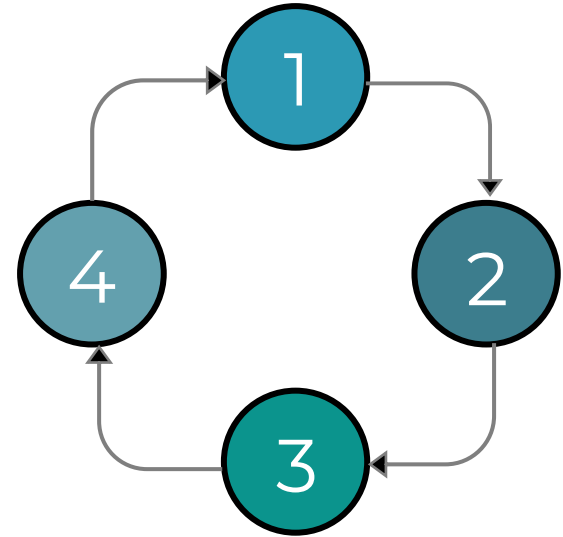
Receive Tracking from Devices, Instruments and Patient

The tracking data from the cameras compare itself to those from the 3D scanner to recognize the position of the patient and the instrument for precise display.

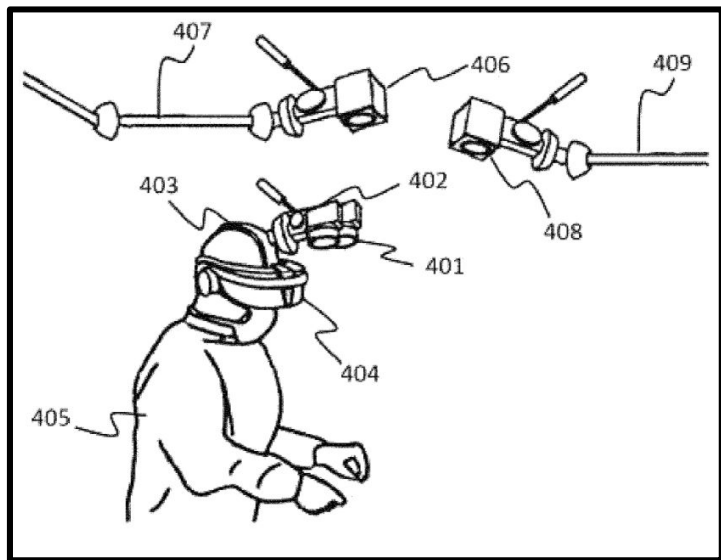
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Provide Output

The outputs are the stereoscopic video with 3D volume, the 3D image of the preoperative scan based on patient pose. Augmented reality image, real-time monitoring, and real-time user input.



THE SURGEON IS ABLE TO HAVE:



Real-Time Navigation & Monitoring

The surgeon can change the view of the AR display with hand-gestures. Real-time video from the cameras with different perspectives can allow the surgeon to have more precise incisions and more efficient monitoring.



Pose-Optimized Anatomy Model

The preoperative scan will be reconstructed into a 3D anatomy model, when combined with 3D scanning of the patient in real-time, the model changes with the posture of the patient.



Audio Guide & Collaboration with Professionals

The headphone can provide step-by-step audio instruction for the surgeon. The professionals can collaborate with the surgeon to provide opinions and guidance.

Potential Future with AR...

Immersive Surgical Training

Immersive training with guided visuals and audios by professionals through AR headset setup. This allows for better experienced graduates in residency as they have had the time to train with more cases in the 2 years of surgical training they have.

Real-time Guidance

With AR display there is an improved accuracy through guided surgery, which adjusts in real-time to the surgeon's view. This augmented view of patients that can configure and generate 3D anatomical models, and overlay the patients CT scans, MRI images, etc to aid the surgeon during the surgery rather than having to look back and forth between monitors and having to mentally map the location and target structures during the surgery.



Less Crowded Operating Rooms with Little to No Monitors

Higher Success Rate for Surgeries



POTENTIAL CLIENTS

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HOSPITALS

Surgeons will benefit from this system through training and real-time guidance during surgery. This technology may be expensive, but hospitals are heavily funded.



MEDICAL SCHOOLS

Residents would receive more practice with such a system because it would limit their need for one on one support. This leads to more high level candidates.



UNIVERSITIES

Ivy League universities would benefit through research. Top schools like Harvard University, University of Oxford, etc. could offer special courses with this system.

THE TEAM

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