



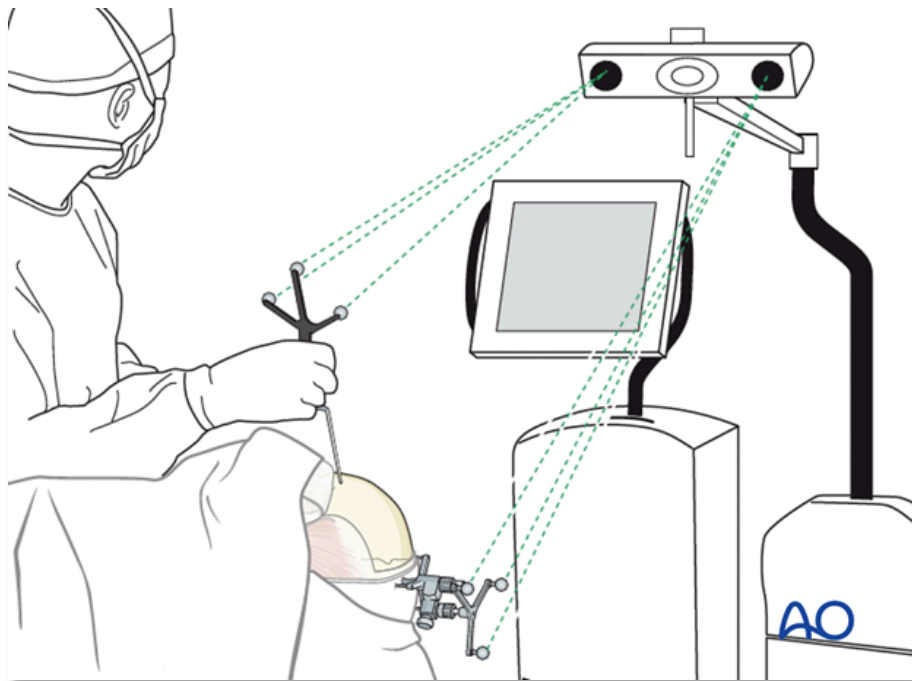
Multiview, Markerless, Magnetic Location (3M) Surgical Navigation System

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*AO Surgery Reference

What is it?

Surgical Navigation Technology is a technique that uses computer and medical imaging to assist surgeons in precisely locating and operating during surgery.

Components

- Infrared stereoscopic camera and reflective marker spheres;
- Computer Platform, screen, and navigation software.

Importance

Enhancing surgical safety and precision: it allows surgeons to locate surgical targets more accurately, reducing surgical risks and complications.

Promoting minimally invasive surgery: it reduces surgical trauma and shortens patient recovery time.

Supporting complex surgeries: it provides crucial assistance in complex surgeries, particularly in neurosurgery and orthopedics.

Large spatial requirements

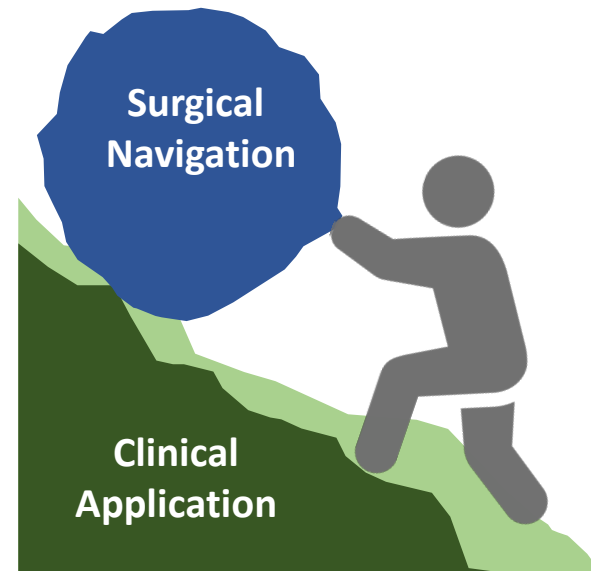
Bulky equipment requires significant space in the operating room and takes up valuable space around the operating table.

Obstruction cause locating failure

Unintentional cover of reflective markers by operators often leads to frequent camera locating failures.

High equipment cost

Infrared optical components take up a lot of hardware costs, and the high price remains a barrier to widespread adoption.



Poor usability

Surgeons need to change their operating habits to adapt to specialized surgical instruments, and complex operations require specialized training and practice.

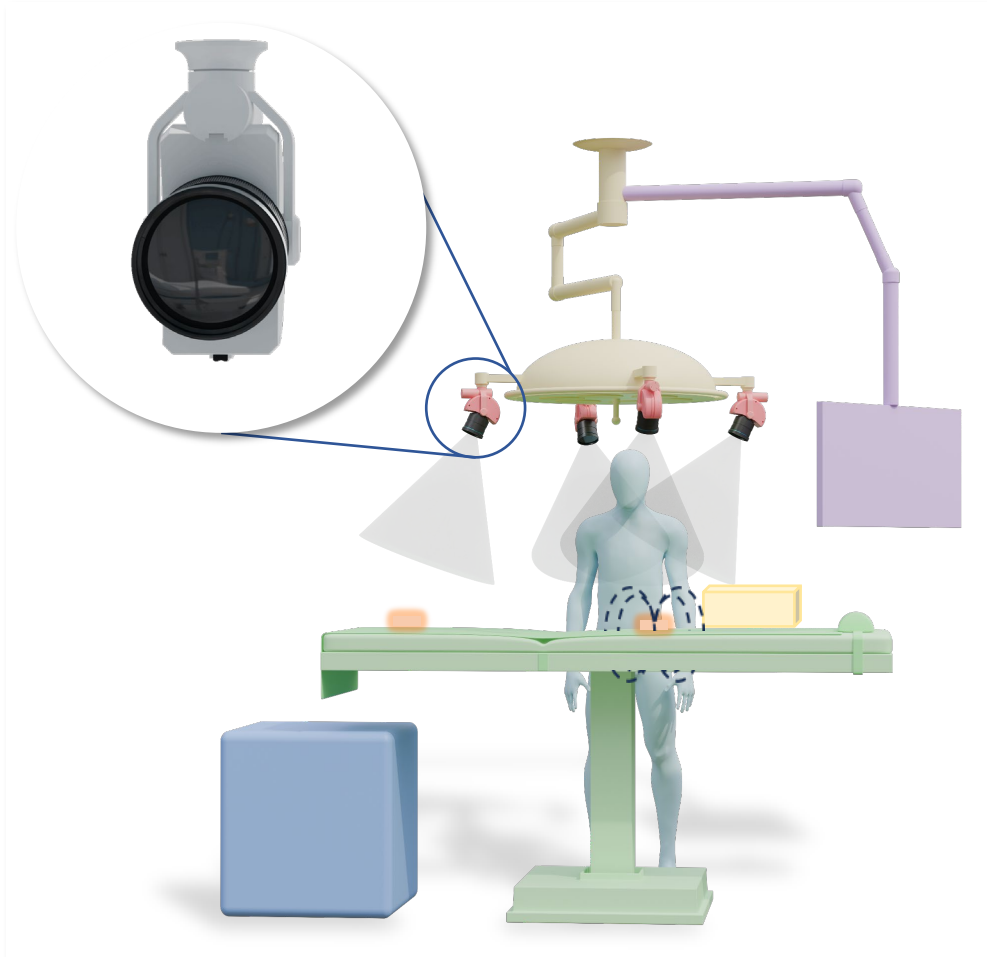
Limited supporting instruments

Navigation systems rely on reflective marker spheres to track surgical instruments, limiting the types and numbers that can be supported.

Fixed detectable range

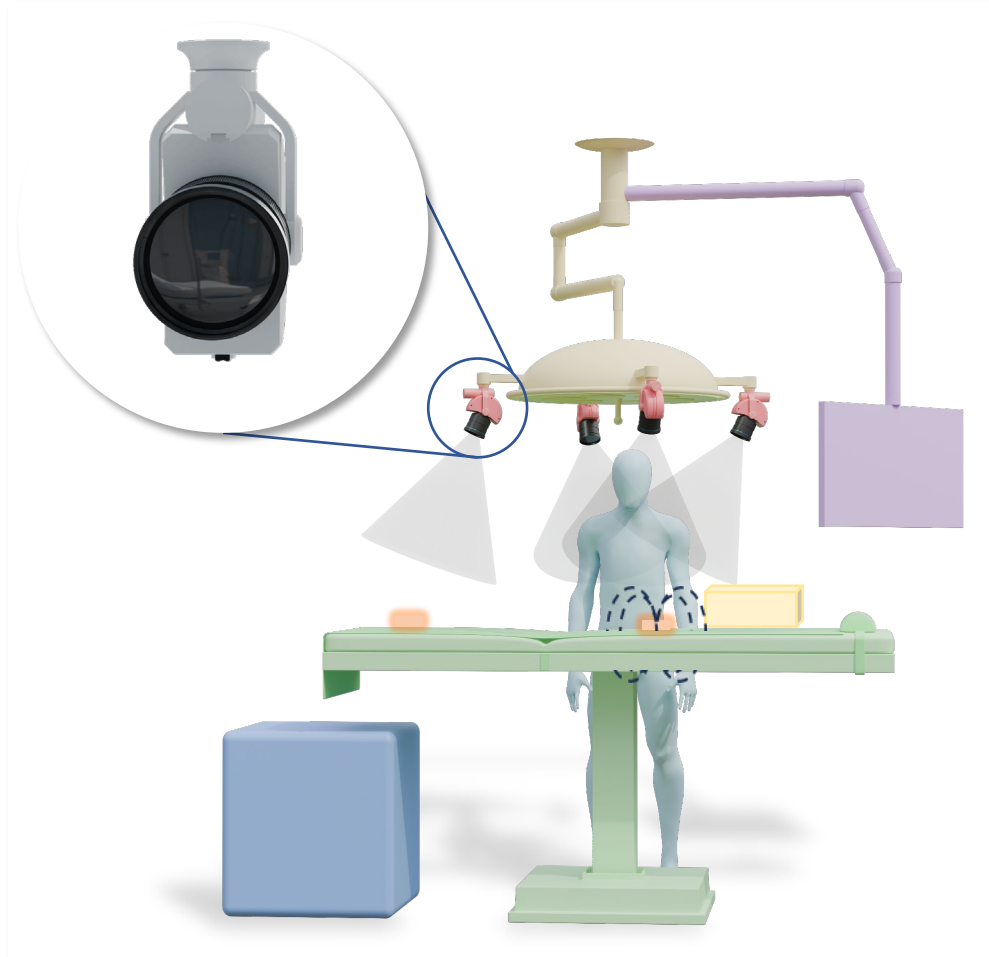
The effective detection range is located in the center of the binocular camera view, any operations beyond this range cannot be accurately tracked.

3M Surgical Navigation System



Multiview, Markerless, Magnetic Location (3M)

- A surgical navigation based on computer vision AI and light field.
- Multiple low-cost cameras mounted on the shadowless lamp to form a light field.
- The AI analyzes the video stream obtained from cameras.
- Location of surgical instruments no longer relies on reflective spheres.
- Adaptive camera module, automatic gaze at new object, then start tracking.
- A magnetic field sensor array with magnetic beacons enables in vivo localization.
- Appropriate for minimally invasive surgical scenarios.
- Fast registration, unaware localization, no concern for occlusion, and ease of use.



Highly compatible modules

Modular design, compatible with existing equipment, no need to add many equipment.

Occlusion-insensitive localization

Markerless based on computer vision AI and light field technology.

Low hardware costs

Uses inexpensive HD visible light sensors instead of expensive infrared sensors.

Fast learning easy to use

Unaware identification, registration, and localization without having to change the existing operation.

Supporting any surgical instrument

Trained AI can recognize and locate any surgical instrument on the market.

Adaptive detection range

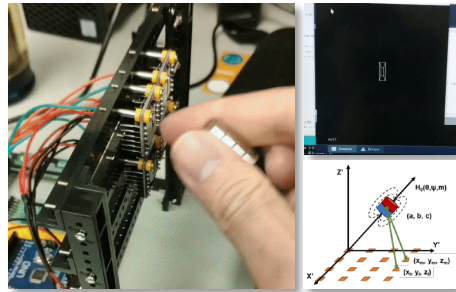
Automatically determines the detection range based on the surgical field, ensuring that the object is always in the center of the field of view.

Progression of 3M Surgical Navigation



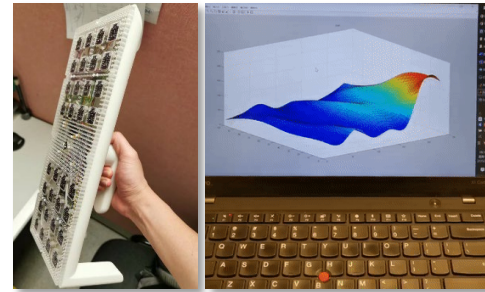
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Early Explorations in Mag Location

We were concerned about the potential application of magnetic field localization technology in the field of surgery and have done early technology exploration.



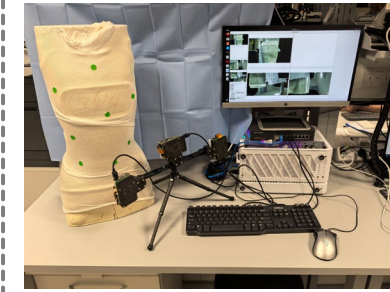
Principle prototype of OI-GPS

We fabricated a principle prototype to verify the feasibility of the OI-GPS technology.



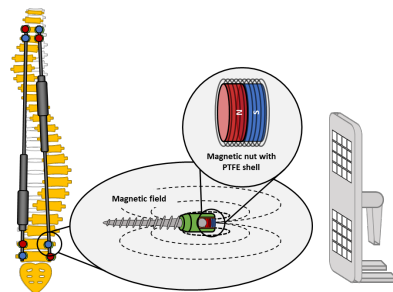
International Exhibition of Inventions Geneva 2022

We participated in the 48th International Exhibition of Inventions Geneva and won a silver medal.



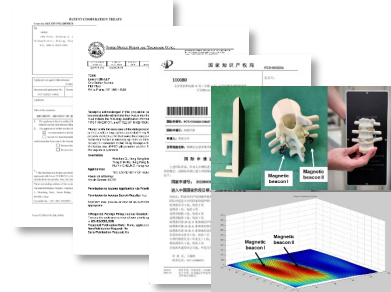
Early Explorations in Multiview

We were concerned about the potential application of multiview technology in the field of surgery and have done early technology exploration.



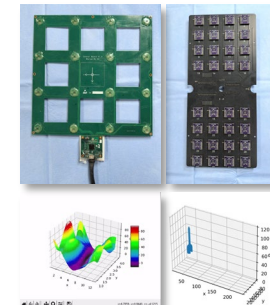
Proposing the concept of OI-GPS

We proposed the concept of the Orthopedic Implant Generalized Positioning System (OI-GPS), which locates implants and surgical instruments inside the patient's body by magnetic field.



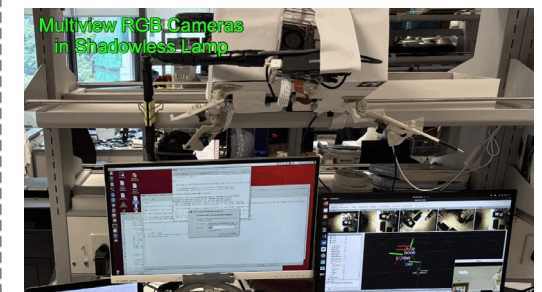
PCT Patent Filing of OI-GPS

We applied for a PCT patent for OI-GPS technology through HKU TTO under PCT/CN2022/108627. It is now in the national filing stage in the U.S. and China.



Magnetic Location Devices

We developed a variety of magnetic field positioning devices based on OI-GPS for different scenarios.



Early Explorations in Navigation

We were concerned about the challenges faced by existing surgical navigation systems and attempted to achieve markerless localization through multiview and magnetic location.

Progression of 3M Surgical Navigation



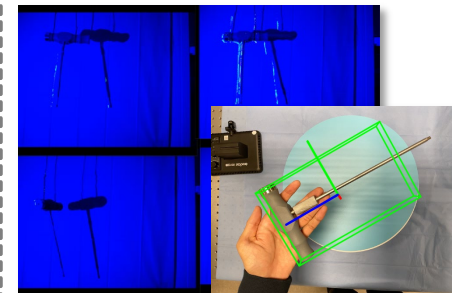
Optical Navigation by 2D Tag

We attempted to use a 2D Tag instead of an infrared reflective sphere for surgical navigation using Multiview RGB images.



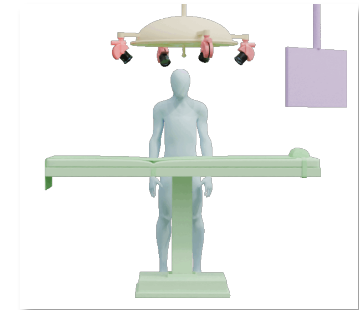
Simulated Operating Table

We built a simulated operating table to mimic a multiview camera on a shadowless lamp while accomplishing surgical navigation through optics and magnetic fields.



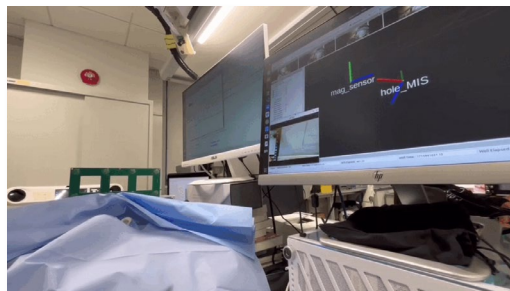
Early Explorations in Markerless

We trained the AI on a simulated surgical table to use the features and colors of surgical instruments for localization.



Principle prototype of 3M Surgical Navigation

We fabricated a principle prototype to verify the feasibility of the OI-GPS technology.



Optical & Magnetic Location Alignment

We have aligned the optical and magnetic location results to allow positioning even when the camera is obstructed.



Optical 3D Reconstruction

We use multiview camera for rapid 3D reconstruction of the simulated operating table and surroundings, which helps to improve location accuracy.



Self-Organizing & Adaptive Camera Module

We designed and assembled the 3M camera module, which is self-organizing with other modules and adaptive to perform capture tasks.



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Thank You

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