Advancing Neurosurgery with AR Technology

About

Traditional 2D imaging limits neurosurgeons' ability to fully visualize and comprehend complex 3D structures. This challenge not only increases the risk of complications but also prolongs preoperative planning. eXtra Vision, a cutting-edge augmented reality application tailored for neurosurgical procedures like tumor resections and cranial surgeries, addresses these issues by overlaying detailed 3D anatomical models directly onto the physical workspace in real time.
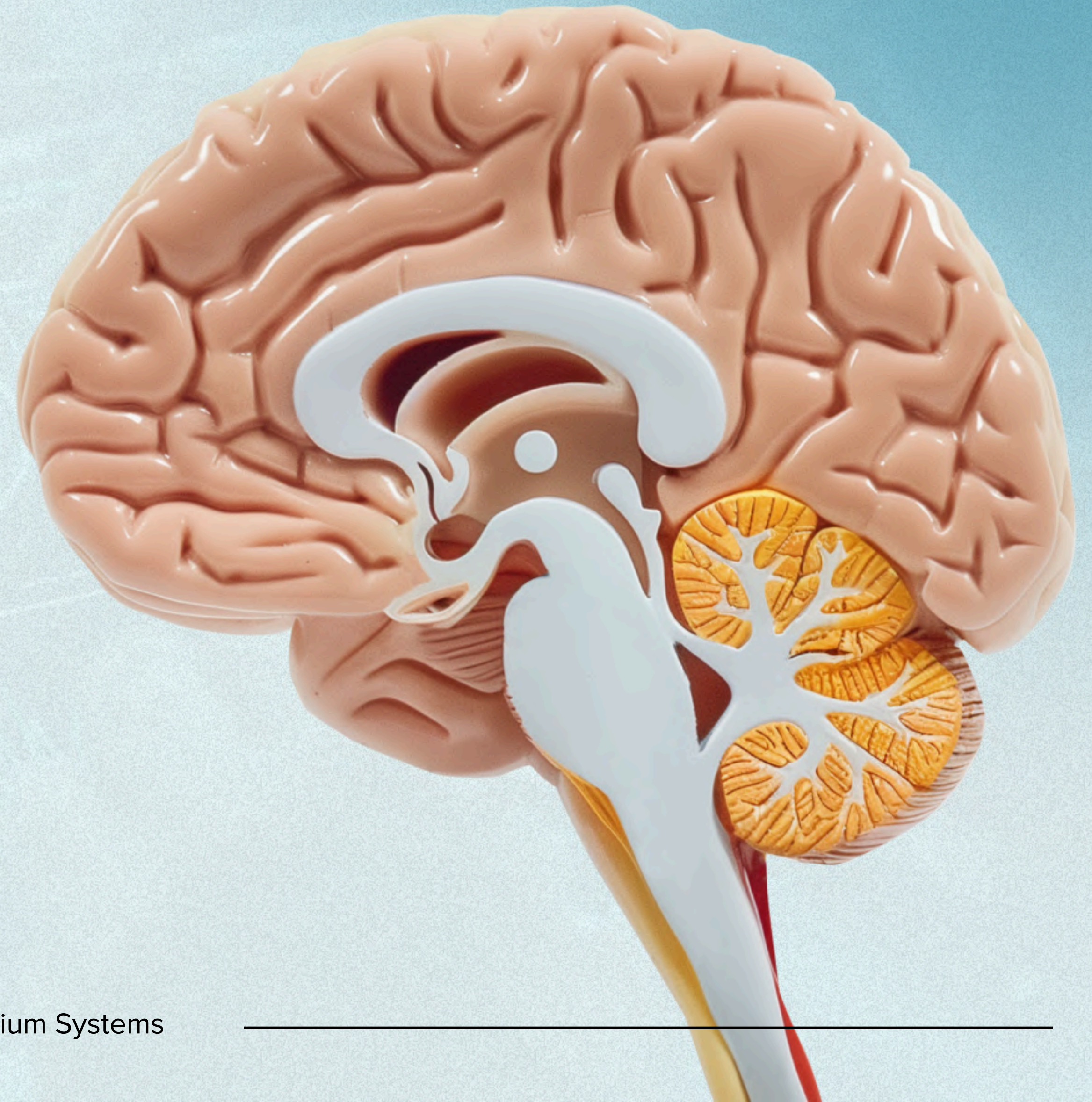
Challenge

Our team joined the project to turn the existing basic prototype into a functional high-performance product, addressing the following challenges:

Application Performance

The development of an AR application to seamlessly process high-load 3D models and DICOM files.

Connectivity and Rendering

Implement a local WebRTC-based client-server rendering solution for stable offline processing.

Synchronization and Compatibility

Ensure that headset position, hand gestures, and event tracking are synchronized across multiple hardware platforms.

Optical Tracking Reliability

Maintain continuous optical tool tracking for precise spatial synchronization during complex surgical movements.

Qualium Systems

Solution

To overcome the challenges identified and deliver a robust solution, it was required to develop a series of innovative approaches that go beyond standard practices. Each solution is carefully designed to address specific pain points while ensuring the system remains adaptable and future-proof, laying a strong foundation for continued innovation and reliability.
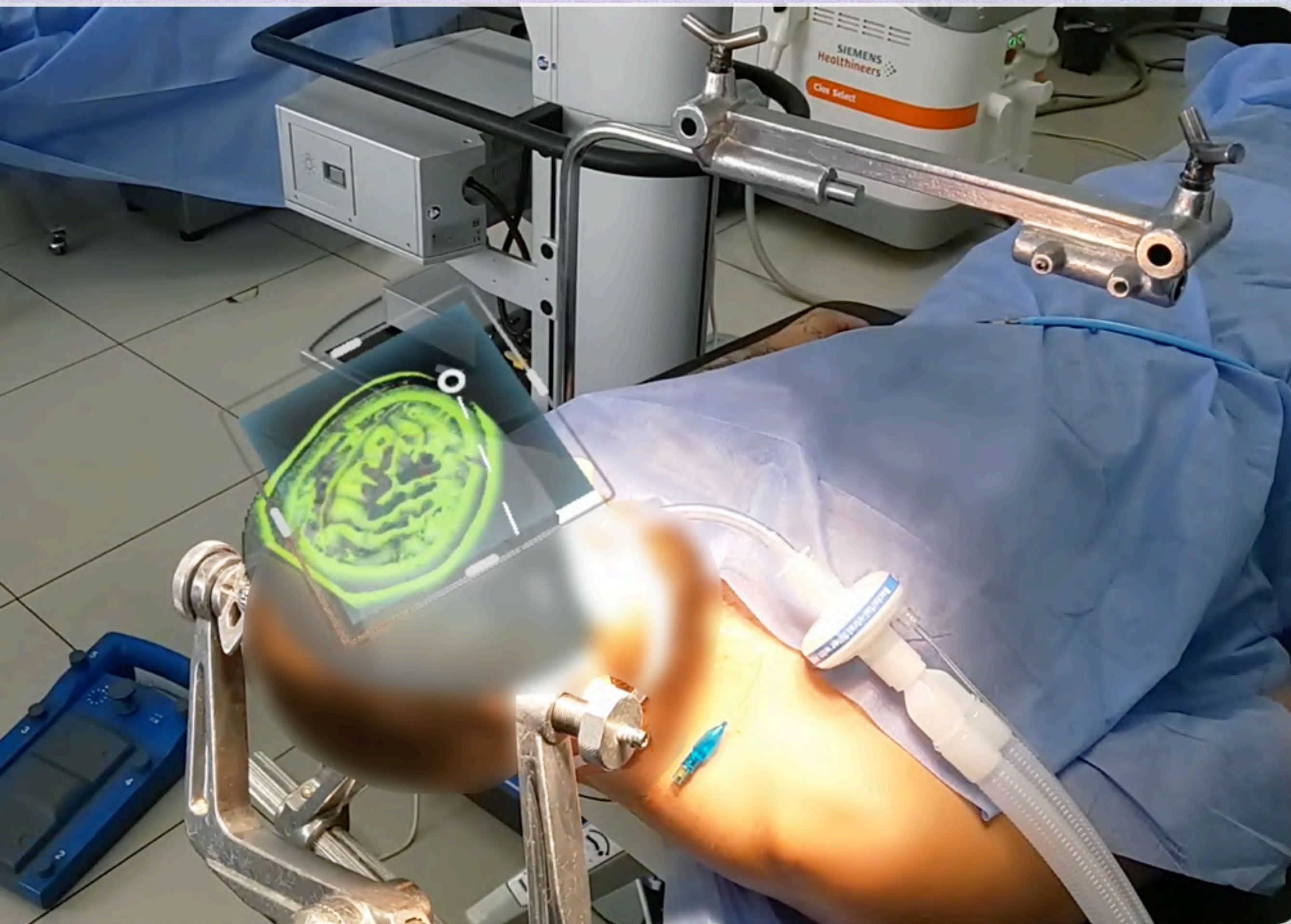
Optical Tool Tracking Integration

We leveraged QR code recognition and synchronization mechanisms to have surgical instruments aligned with spatial coordinates of Mixed Reality or Spatial Computing glasses and thus enhance overall operational accuracy.

Qualium Systems

Real-Time AR 3D Model Alignment

AR 3D model alignment functionality with 3D QR code markers was incorporated to accurately position virtual models in real-world environments and ensure continuous tracking.
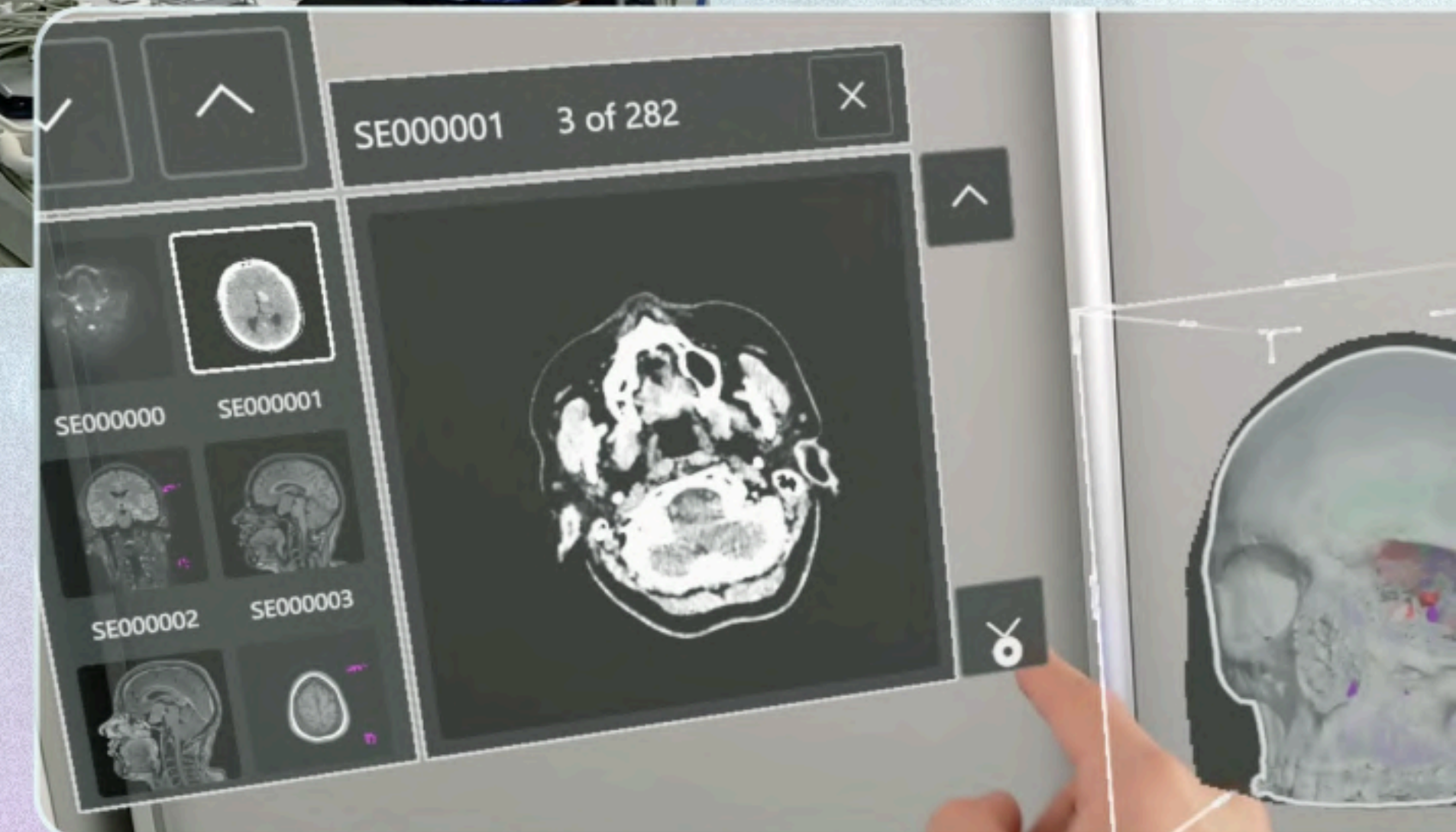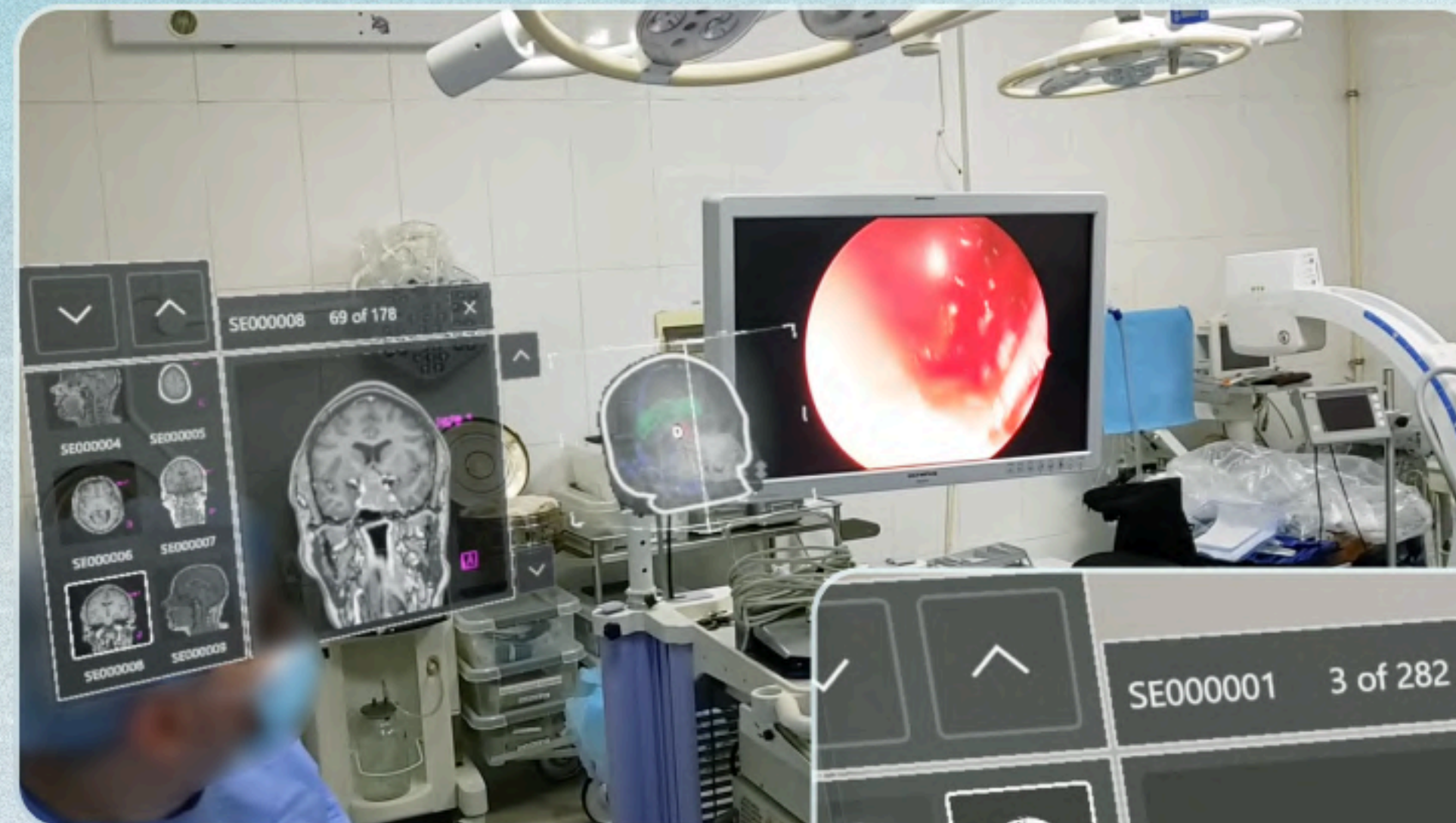

Qualium Systems

Local Client-Server Rendering with WebRTC

To eliminate internet connection dependency, all application functionalities were transitioned to a desktop-based solution. The implementation of a WebRTC-based rendering engine allowed us to stream pixels directly to the Mixed Reality or Spatial Computing glasses over a local network.

Qualium Systems

Cross-Platform Hardware Compatibility

We achieved broader compatibility and future adaptability by decoupling hardware-specific functionalities through the transmission of positional and event data to a PC.

Qualium Systems

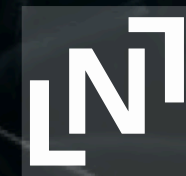# Technologies

Unity

Vuforia

MRTK

WebRTC

Microsoft®
DirectX®

DirectX

LiteNetLib

Fellow Oak DICOM

Zenject

Zenject

UniRx

Team and Duration

4 experts

4 months

Qualium Systems

Like this project?

Let's discuss your project right away!

Estonia

50 Vesivärava,
Tallinn, 10152

info@qualium-systems.com

Ukraine

56 Nauky avenue, of. 526
Kharkiv, 61072

info@qualium-systems.com

United Kingdom

The Echo Building 18 Albert Road
Bournemouth BH1 1BZ

uk@qualium-systems.com

Qualium Systems