National University Health System (NUHS) HoloMedicine Program: Enhancing Clinical Care through Mixed Reality Technology

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INTRODUCTION

Mixed reality (MR) devices such as the HoloLens2 have not yet gained widespread adoption in the context of clinical care but comes with so much potential in improving the lives of both patients and health professionals. Within NUHS, the HoloMedicine team has been developing clinical applications for the use of Hololens2 to aid clinicians in a wide array of subspecialties.

Clinical Applications

1. Using VSI HoloMedicine® (medically certified cloud-based platform), we transform medical images (such as CT, MRI, ANGIO-CT, CBCT, SPECT, PETCT, and more) into an interactive 3D mixed reality environment. The holograms generated serves mainly as an aid for doctors to better plan surgery and anticipate potential difficulties, potentially reducing trauma and bleeding complications that might arise during surgery.
2. HoloPocus utilizes Microsoft's HoloLens 2 for sensing and visualization. By utilizing images generated on ultrasound, HoloPocus generates 3D reconstruction and 2D overlayed ultrasound images as holograms. This would aid clinicians with ultrasound guided procedures in the future for better visualization and guidance to minimize complications for patients
3. HoloVein; a clinical application we have developed which utilizes the infrared capabilities of Hololens2 that helps differentiate deoxygenated blood in the veins from blood seen in arteries.
4. HoloTwin; a clinical application that aims to use computer vision to track objects and recreate the objects as a hologram is currently undergoing development to aid clinicians with procedures. (e.g., Tracking the exact location of the needle with relation to other important structures of the patient's body when inserted) This will aid interventional radiologist and other clinicians aiming to do interventions such as biopsies gain better accuracy and help minimize complications to the patient.

Figure 1: The use of Hololens2 and VSI HoloMedicine® to superimpose a hologram of the heart and the thoracic chest wall for Cardiac surgeons planning their incision site for minimally invasive coronary artery bypass

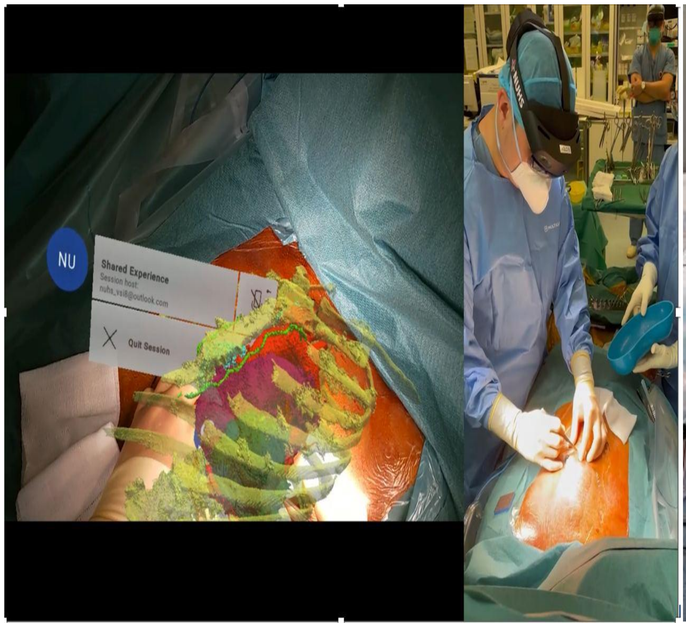


Figure 2: The rendering of scans and superimposition of a PET CT over a patient prior to surgery

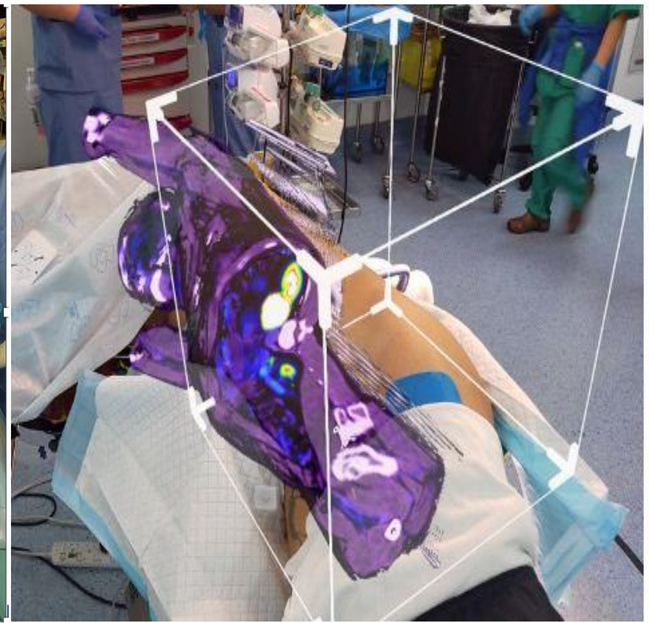


Figure 3: 'First-person view' using HoloVein (left), with vein overlay shown around the grey sticker and control panel visible. 'Third-person view of user (right), with Hololens 2 and sticker in view

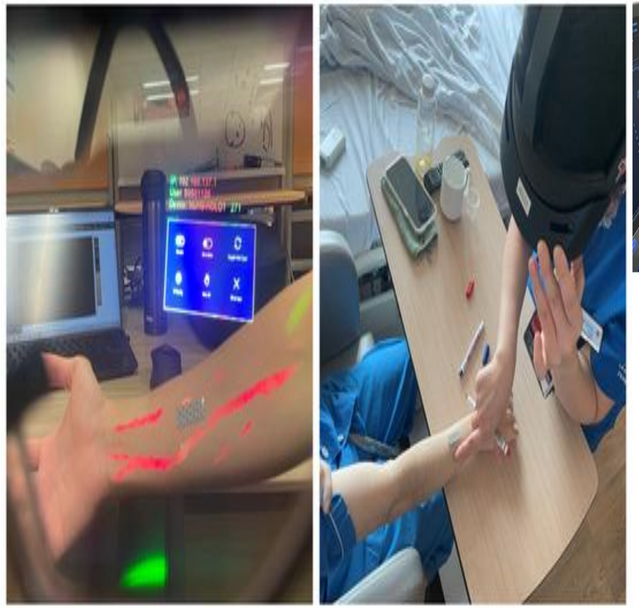


Figure 4: (Top Left) Clinician using HoloPocus; (Top Right) First person view with 2D overlay, large virtual screen for viewing fine detail (G); (Bottom) Tracking of US slices over time/space allows for 3D reconstruction of thyroid nodule (blue)

