Medical Education and Surgery Assisted by AR

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Augmented Reality Systems have become a centerpiece of current advancements in technology. The advent of low-cost virtual/augmented reality tools, such as head-mounted display systems, e.g., Magic Leap One or Microsoft's HoloLens, have reinvigorated the area of augmented reality with a myriad of applications in healthcare, training, and engineering due to their ability to increase retention and safety, improve the learning curve, and reduce costs. The overlaying of 3D models (or holograms) onto real-world surfaces seen through AR headsets have a multitude of applications in the medical field. Our intention is to develop applications to be used for two exemplary applications – one in a training environment, and another in the operating room.

We propose using AR to aid in the training of fundamental assessment skills for nursing students. In our application we us AR headsets to provide a holographic overlay including the internal organs heart, ribcage, and lungs to increase the understanding of accurate placement of devices required for assessing cardiac and respiratory issues using anatomical landmarks. We have also included visual landmarks required for accurate assessment of auscultation. In addition, the visual aspects are supported with audio sound tracks to further enhance learning.

Our second application is regarding the use of AR to assist surgeons in the operating room (OR). In this application, we use CT scans of a patient to extract 3D Models of their ribcage. We then transfer this 3D model to an AR headset which would then be used during surgery to accurately overlay the 3D model of the patient's ribcage on top of the patient's torso as though the patient's ribcage could be seen through their skin. This would enable easily recognizing the locations of any cracks or damage to the ribcage, and allow the surgeon to determine the exact location for the incision, thus being able to minimize the incision thereby making the surgery less invasive.

In both applications we use a custom-made marker in order to accurately place holograms in the appropriate locations. After correct placement, these markers could be removed without further effecting the holograms. Holograms could also be placed manually onto desired locations based on the spatially mapped topography of the environment.

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