ENGR 491-515: AUGMENTED REALITY (AR)-COUPLED HAPTIC SYSTEM FOR ORTHOPAEDIC SURGERY TRAINING

Our Grand Challenge
Virtual-reality (VR) simulations have been used for surgical training, but are often constrained by space and costly equipment requirements. Augmented reality (AR) provides an alternative option and is more portable and connected to the real world. Our grand challenge is to realize an AR-based surgical simulator coupled with a haptic device to provide both visual and tactile feedback to the user.

Project Goals
The ultimate goal of this one-year project is to create and test a functional prototype. Specific aims include:
• Characterize forces/vibration and incorporate into the haptic device control.
• Develop a functional AR interface and setup.
• Establish a synced connection between the haptic device and AR system.
• Develop a voxel modeling algorithm to simulate material removal.

Impact to Society
This proposal addresses the Engineer the Tools of Scientific Discovery and in part, the Engineer Better Medicines challenges listed on the NAE Grand Challenges for Engineering. Our work promises to provide insights into the evolutionary constraints that govern invasive behavior and is expected to aid in the development of strategies for the design of next-generation drugs.

Key challenges:
• Significant coding work to establish 3D virtual objects and simulate material removal scenarios.
• Accurate geometric registration between real world and virtual objects.
• Algorithms to communicate between the graphic module and the haptic device.
• The realism of the proposed AR-framework.

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Desired Engineering Majors
Computer Science & Engineering, Electrical & Computer, Mechanical, Engineering Technology & Industrial Distribution