Haptic Feedback for Real-Time Telemedicine Platform

Pariya Samandi[1], David Anton Ph.D.[2], and Ruzena Bajcsy Ph.D.[2]
[1]Department of Computer Science, West Valley College
[2]Department of Electrical Engineering and Computer Sciences, University of California, Berkeley

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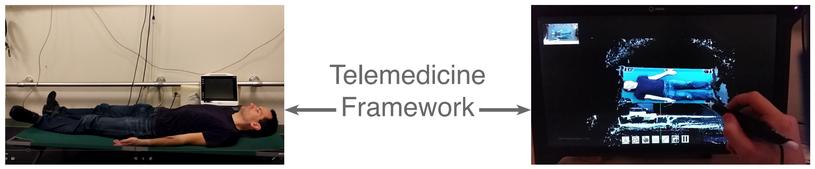
Abstract - Telemedicine has been developed to provide remote monitoring as well as audio and video conferencing between physicians and patients; however, its deficiency to provide the sense of presence and the lack of human touch calls for more advanced development. With the growing use of novel virtual reality (VR) and augmented reality (AR) technologies, researchers are orienting their efforts to develop new frameworks that improve the sense of presence. These developments will reduce the burden of adversities in efficient communication between medical professionals and patients, eventually providing faster and more cost effective treatments. By creating a telemedicine research prototype that integrates a haptic device with a VR station and an AR station to provide haptic feedback, we enable users to feel remote textures, surfaces, and forces. A framework like this will allow individuals to have advanced and enhanced communication, while experiencing a deeper sense of presence.

Introduction

- The history of telemedicine goes back to the 1880s when physicians were working with telecommunication technologies after telephone was invented in 1876[1]
- Obtaining better intercommunication requires the sense of presence[2]
- Creating a telemedicine research prototype that integrates a haptic device with a VR station and an AR station to provide haptic feedback



Methods

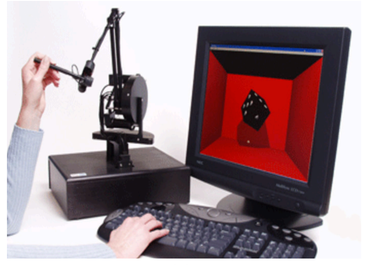
Geomagic® Phantom® Premium™ Haptic Device:
- It provides force and torque feedback to control objects in the virtual environment[3]

zSpace Semi-Immersive Interactive 3D Display:
- It improves the realism of the virtual environment by simulating interactions similar to the real world[4]

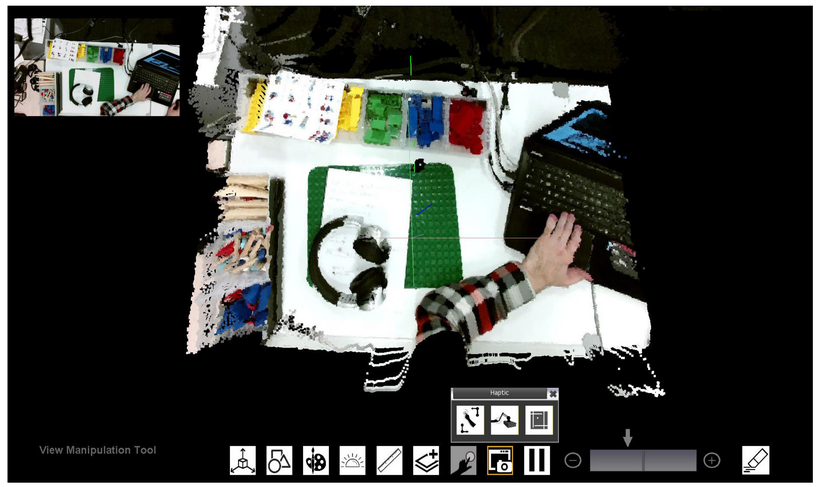
CHAI3D Framework:
- CHAI3D modules enhance the sense of presence in real-time communication by using haptic devices[5]

Chai3D Framework


zSpace Display


Haptic Device[6]

Results



Telemedicine Interface

Creating a Haptic Map:
- Developing a haptic map has increased the sensory illusion of an alternate reality[7]

Developing Haptic Control:
- Controlling the haptic tool in the virtual environment has increased the interaction for attaining the haptic feedback and haptic map

Enhancing the Interface Design:
- The haptic icons have been designed and added to the existing telemedicine application


Encoding a Multidimensional Matrix to create the Haptic Map

Conclusion & Future Work

- The enhanced telemedicine framework has increased the sense of presence.
- Better 3D interaction and communication have been achieved.
- In the future, we intend to use the haptic device to remotely control a robotic arm and use it to retrieve haptic features of a real scene. The result will be streamed back to generate the haptic map between geographically distributed users.

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Contact Information

Pariya Samandi
Email: pari.samandi@gmail.com
Phone: 408-707-4741