Semester project: Combining leapMotion and ManusVR to Improve Finger tracking.

Main Objective:
Combine two different finger tracking system in order to get a portable and robust finger tracking system. Then evaluate this combination in terms of efficiency, embodiment and presence through a user study.

Background:
Leap Motion is a sensor that can be attached in front of a HMD to track the finger of the user. However, since it consists in two monochromatic IR cameras, it has some limitations. It can only detect fingers in its Field Of View(FOV) which is 135° and need a good luminosity. ManusVR is a pair of glove with flexible sensors to track the finger rotation according only to one axis and an IMU for the thumb. So the system will not have occlusion issues but the position of the fingers is obtained only indirectly.

Project Idea:
In a first part, we want to track fingers precisely without using any external camera/emitters to have something easily portable. That is why we want to use the leap motion where the camera is directly attached to the HMD. However, its FOV is reduced and there are a lot cases where the leap motion is not able to track the fingers (too much occlusions). Therefore, we have decided to combine the leap motion with the ManusVR which is not subject to occlusions. ManusVR itself cannot be used alone because it is not as accurate as the leap motion. Thus, when the user looks at the hand (no occlusion) the leap motion is used and when the user uses the hands without looking at them the ManusVR is used. In the case where the user looks at the hands while some occlusions are present, the data of the two systems are combined.
Then, in a second part we want to study if the lack of accuracy of the ManusVR can be a cause of a Break of Embodiment when the fingers are out of the center of attention of the user. It means, we want to know if the users notice it and if so whether it prevents them to consider these virtual hands as their own. For that purpose, a protocol will be elaborated, followed by a user study in order to assess the proposed solution.
Goal:
- Combine different finger tracking system (ManusVR, Leap Motion).
- Design a protocol to evaluate our current system and the new proposed approach.
- Master Project: Evaluate this combination in terms of efficiency, embodiment and presence through a user study.
- Provide a Unity plugin

Requirements:
- Unity (scripting in C#/DLL in C++)
- 3D geometry and quaternions (Vectors, cross products, rotations)
- Matlab/R (statistical tool).

Information, materials and resource:
Unity3D game engine: http://unity3d.com/learn
Manus VR: https://manus-vr.com/#product-anchor
Phasespace active tracking system: www.phasespace.com/
Machine learning: C. Bishop: Neural Networks for Pattern Recognition
The project with our finger tracking system (Unity project and Notice) will be given

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