Main Objective:
Combine Virtual Reality and Augmented Reality to allow interaction between the two systems.

Background:
Hololens and Meta 2 are both Augmented Reality (AR) headset made respectively by Microsoft and Meta. They allow users to access to some extra information inside the real world around them. Contrary to the Head Mounted Display (HMD) in Virtual Reality (VR) where it is not possible to see the real world, in the present context some virtual elements can be added in a real world.

We want to combine these devices with a VR HMD (Oculus Rift or HTC Vive). These VR systems are based another tracking solution. The AR system use an Inside-out tracking with several camera mounted on the headset whereas the VR systems use an Outside-in tracking with external cameras (or emitters). Thus, we have to combine these two tracking system.

Project Idea:
In the laboratory, we are developing a simplified human skeleton calibration system for our motion capture system. The user needs to be able to check in real-time if the calibration is sufficiently good and to be able to adjust it if necessary. Thus, we provide a project with a basic skeleton calibration and the objective is to improve this calibration thanks to an AR headset. This project uses the Vive Tracker system to track the full body in VR.

However, Vive Tracker and AR headset have two different coordinates system because of the different tracking technologies used. Thus, it is necessary to transform these coordinates in the same reference system.

Since the AR headset is used to edit the calibration in real-time, the operator has to be able to see the virtual avatar superposed with the real user body. Then, new interaction metaphors have to be implemented in order to allow the AR operator to adjust the virtual avatar skeleton. The operator should be able to do such adjustment for each joint (time independent and order independent).

Finally, your project has to be modular and work easily with a new device. Hence, the project has to work with the two different AR headsets. At the end of the project, it should be possible to compare the two AR devices and choose the best.
Goal:
- Implement a calibration tool, in Unity with the Vive Trackers, easy and fast to use.
- Register the two coordinate system (Vive Tracker and AR headset).
- Implement a checking tool for the skeleton calibration in Unity with the AR Headset.
- Unity plugin ready to use has to be produced.

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

Information, materials and resource:
Unity3D game engine: http://unity3d.com/learn
Final IK: http://root-motion.com/
Meta: http://www.metavision.com/

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