An immersive system for 6D manipulation of objects in a liquid medium

Location: Experiments at ISIR, 4 place Jussieu, 75005 Paris

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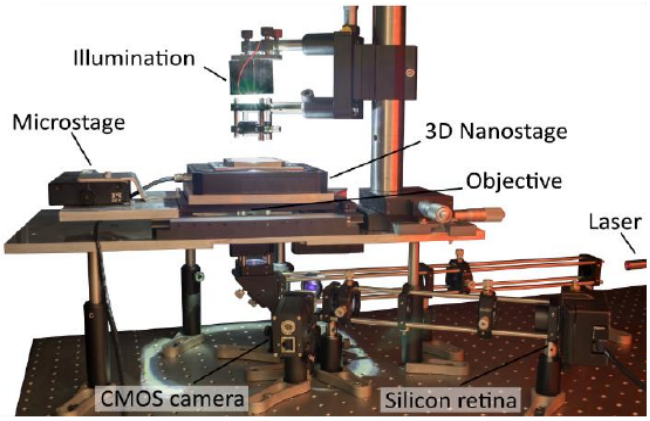
1. CONTEXT AND OVERVIEW OF THE PROJECT

Optical tweezers are considered as one of the best solution to manipulate biological entities. They enable contactless interactions in a liquid medium. ISIR has recently proposed a setup to manipulate objects in 3 dimensions. This setup also provides force measurements in real-time. However, the platform is quite complex from a robotic point of view, and its use is not intuitive from a user point of view. For example, when the tool and the object do not appear in the image together, it becomes difficult for the user to precisely control the position between the two of them.



The system exhibits very good performances regarding the resolution while measuring forces. We have demonstrated that a resolution of 10pN can be reached. However, these performances have been obtained while degrading the ease-of-use. This is not only due to the mechanical structure of the platform but also to the complex command laws.

2. OBJECTIVES

One of the main objectives of this internship is to increase the ease-of-use of the system and to make it as most intuitive as possible. For this purpose, a 3D representation of the manipulation area in a virtual reality environment to control the tweezers in 6D of freedom would be very useful. Possible applications are related, but are not limited, to biological experiments with cells or small organisms. For example, we would be interested to study the mechanical response of a paramecium with respect to different stimuli (in a mechanical or a chemical way). Optical tweezers may be a solution for precise drug delivery with the advantage of a contactless and non-destructive method. Moreover, a key point is to create a link between the 3D representation and the real world. Virtual reality appears as a very good candidate to reach this goal.

Several tools such as headsets, fish tanks or 3D glasses are available in the lab to interact between 3D scenes and the real world. The candidate is expected to contribute, with other members of the team, to the development of a new interface to introduce virtual reality in the current optical tweezer system.

Please feel free to contact us for technical details!