2018-00920 - Touching Objects in Virtual Reality Using Next-Generation Haptic Interfaces

General Information
- Theme/Domain: Interaction and visualization
- Town/city: Rennes
- Inria Center: ICSI Rennes - Bretagne Atlantique
- Starting date: 2018-10-01
- Duration of contract: 3 years
- Deadline to apply: 2018-09-30

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Conditions for application
Please submit online: your resume, cover letter and letters of recommendation eventually

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Assignment
In a Virtual Reality simulation, haptic devices are supposed to allow a more tangible and physical interaction with the virtual environment. To date, efficient haptic devices do exist and can be purchased along with industrial applications, but they suffer from several drawbacks. Particularly, they usually have to be permanently held by the user and do not allow for touching virtual object in a natural fashion. Yet, many applications require hand-free interaction. This is particularly the case with simulations that require tactile exploration of the physical properties of virtual objects, or simulations that require a high fidelity haptic feedback. Due to the lack of relevant solutions, it is still to date impossible to carry on such a natural haptic interaction in a virtual reality simulation.

Encountered-type haptic devices are an alternative category of haptic devices that may address that requirement. They rely on a mobile physical prop, usually actuated by a robot, that constantly follows the user hand, and encounter it only when needed, e.g. to simulate a contact between the user and the virtual environment. Just as the lobby-boy, in the Grand Budapest Hotel movie, is supposed to anticipate any customer wishes, our Lobby-Bot robot is supposed to anticipate any motion of the user in the simulation.

However, numerous limitations have to be overcome prior to a real industrial usage involving encountered-type haptic devices may be considered.

Main activities
In this PhD program, we aim at designing novel 3D interactive techniques specifically adapted to this unique kind of haptic interface in immersive Virtual Reality. The successful candidate will thus study, design, and then assess a set of several novel software-interaction techniques in order to compensate for intrinsic limitations of encountered-type haptic devices. Examples of such limitations are the potential delays between the encountered-type haptic devices and the user, the limited set of shapes and textures that can be simulated, or the problems related to surface follow-through.

The PhD results will be integrated into an operational prototype available in CLARTE facilities, and will be used to assess the benefits of encountered-type haptic devices when used in an industrial use-case that can not be simulated with current haptic technologies (provided by RENAULT company): the perceived quality in an automotive interior.

Skills
- Master of Science (or equivalent) in Computer Science (Computer Science, Visualization, Virtual Reality, Computer Graphics)
- Good programming skills: C/C++
- Motivation for Human Perception, or Cognitive Sciences.

Benefits package
- Subsidised catering service
- Partially-reimbursed public transport

Remuneration
Monthly gross salary amounting to 1982 euros for the first and second years and 2085 euros for the third year