Internship position on
“Thermal sensations for a hand-held haptic interface”

Environment

The work will be carried out at **IRISA-INSA in Rennes** as part of the Rainbow team (https://team.inria.fr/rainbow/), which is internationally recognized for its scientific activity as well as for technology transfer experience in the field of shared control, multi-robots, haptics, sensor-based control, visual tracking, and visual servoing.

Founded in 1966, **INSA Rennes** is the largest engineering school in Brittany. INSA Rennes ranks among the top post-baccalaureate engineering schools in France. A member of the INSA Group, France's leading network of public engineering schools, INSA Rennes is recognized for its training and scientific research.

Rennes in a lively city in the north-west part of France, capital of the Britanny region. Located 90 minutes from Paris and less than one hour from the sea, **Rennes was named as the leading French city in Europe for “quality of life”** in 2020 and has the highest satisfaction rate among its inhabitants (source: European Commission).

Topic

In the ever-evolving landscape of virtual reality (VR), **the integration of sensory feedback has become a strong focus to enhance user immersion and interaction**. One important advancement is the incorporation of **thermal haptic feedback**. Unlike traditional haptic feedback that primarily relies on vibrations or (kinesthetic) force feedback, thermal haptic feedback introduces a new dimension by simulating temperature sensations within the virtual environment. This technology leverages thermal stimuli to mimic sensations such as warmth, coolness, or even subtle changes in temperature, providing users with a heightened sense of presence and realism. Imagine feeling the gentle warmth of sunlight on your skin as you step into a virtual tropical landscape or the cool breeze when standing atop a virtual mountain summit. These nuanced temperature cues not only amplify the overall sensory experience but also open avenues for developers to craft more immersive narratives and scenarios. As the technology continues to mature, thermal haptic feedback stands poised to redefine the way we perceive and engage with virtual environments.

The objective of this research work is to **design a thermal hand-held haptic interface** and **evaluate it in a Virtual Reality scenario.**

Figure. Diving into a world of sensations: Harnessing the power of thermal haptic feedback in VR, where every touch brings a spectrum of temperatures to life.

The work will address the following points, tuned according on the expertise and interests of the student:

- Design of the haptic interface: mechatronic development of a hand-held interface suitable for use in VR, integrating thermal cells such as Peltier elements.
- Haptic rendering: design a haptic rendering algorithm to provide suitable thermal sensations during VR interaction.
- Human-subjects evaluation: carry out a human subjects study to evaluate the effectiveness and viability of the proposed rendering interface and techniques in an immersive VR scenario.

Requirements

- B.Sc. degree in computer science or related fields;
- Experience in C/C++/C# , Unity3D, VR/AR tools, human-robot interaction;
- Excellent scientific curiosity, motivation, and ability to work independently.

References

- Peiris, Roshan Lalintha, et al. "Thermovr: Exploring integrated thermal haptic feedback with head mounted displays." Proc. 2017 CHI Conference on Human Factors in Computing Systems. 2017.
- Liu, Yuhu, et al. "ThermoCaress: A wearable haptic device with illusory moving thermal stimulation." Proc. 2021 CHI Conference on Human Factors in Computing Systems. 2021.

- Wolf, Dennis, et al. "Face/on: Multi-modal haptic feedback for head-mounted displays in virtual reality." IEEE Trans. visualization and computer graphics 25.11 (2019): 3169-3177.

Duration

5-6 months

Benefits and Salary

According to French laws (e.g., subsidized meals, partial reimbursement of public transport costs, flexible organization of working hours, insurance, gratification salary of about 650 EUR/month).

Advisors and contact

Marie Babel:
(marie.babel@irisa.fr, https://team.inria.fr/rainbow/fr/team/marie-babel)

Maud Marchal:
(maud.marchal@irisa.fr, https://team.inria.fr/rainbow/fr/team/maud-marchal)

Claudio Pacchierotti:
(claudio.pacchierotti@irisa.fr, https://team.inria.fr/rainbow/cpacchierotti)

Pierre-Antoine Cabaret
(pierre-antoine.cabaret@irisa.fr)

How to apply

Contact Pierre-Antoine Cabaret at pierre-antoine.cabaret@irisa.fr providing

- Complete Curriculum Vitae (CV)
- Transcript of record