Development of interactive microfabrication course through Mixed Reality (MR)

Master/Semester project

(Section: Microengineering – Electric Engineering)
(Section: Computer science(IC)–Human-computer-interaction)

One of the most promising advancements in students learning benefit is mixed reality (MR) technology[1,2]. MR has the potential to revolutionize education by offering new ways of teaching complex concepts and fostering deeper understanding with multimodal information while reducing the cognitive load.This is particularly relevant in technical fields like microfabrication, where traditional learning methods may not fully capture the intricacies of the subject matter, and the practical course requires hands-on experiment so that students could succeed in building complete fabrication processes. As MR technology continues to gain traction in educational settings, it is crucial to investigate its effectiveness and determine the optimal integration of MR with traditional learning approaches.

At the LMIS1, we are currently investigating new possibilities of providing an interactive MR learning material for the microfabrication process, cleanroom training, etc. By investing the difference of multimodal learning with mixed reality, we have combined different 3D model, figures, videos, anchors, texts, etc into the existing HoloLens 2 Mixed reality goggles.

This student project will contribute to enhance the interactables of the system, either by add interactive functions such as gamification or by hand interactions, The topic is highly multidisciplinary, involving aspects of human-computer interaction, understanding or interest of microengineering, and cleanroom microfabrication. **The focus can be adjusted depending on the student's preferential interests, best knowledge, previous experience and motivation.**

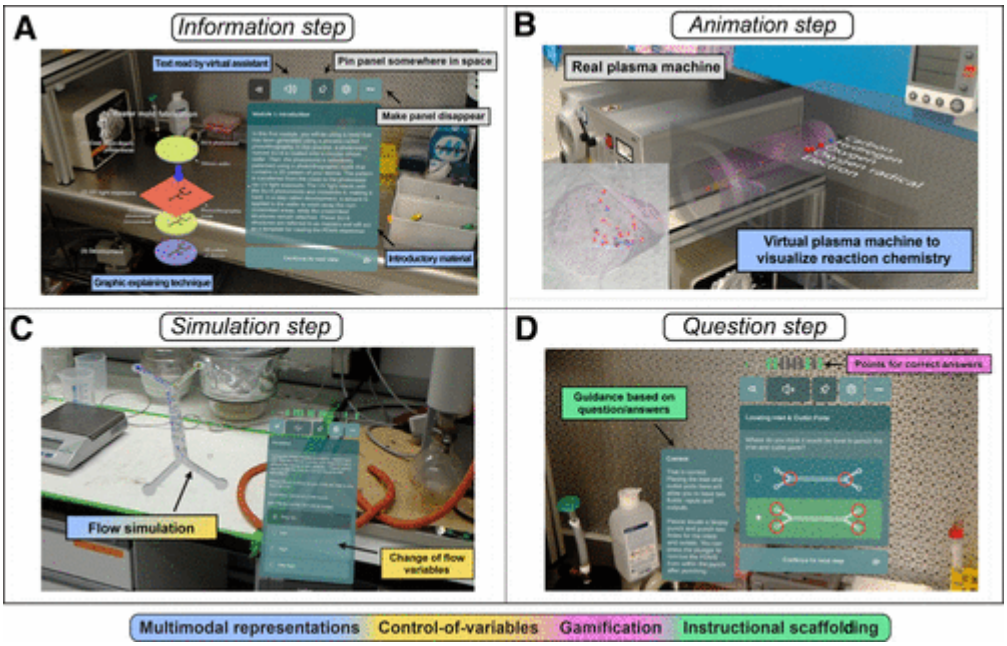

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Figure1: Combination of virtualism and reality in HoloLens for the microfluidics lab. De Micheli, A. J., Valentin, T., Grillo, F., Kapur, M., & Schuerle, S. (2022). Mixed Reality for an Enhanced Laboratory Course on Microfluidics. Journal of Chemical Education, 99(3), 1272-1279.
Figure2: HoloLens 2, https://learn.microsoft.com/en-us/hololens/hololens2-industrial-edition-faq

The main tasks in the project will be:

- Conduct research, design, programming phrases of product (adjustable);
- Interaction development based on brand new Microsoft Mixed Reality HoloLens 2
- Cooperate with the course designer to integrate the content and optimize it.

Desired Skills:

- The Hololens development is based on C# Programming in Unity 3D, it's better if you have experience on that, if not, we prefer you are fluent at java or C++ or Python, at least one programming language;
- Knowledge in TCP\IP communication, server maintenance is a plus
- Knowledge in cleanroom processes is a plus

What you will gain:

- Experience of conducting research, designing, engineering phrases of product;
- Collaboration, communication, and nice group friendship.

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[1] Fisch, S. M. (2017). Chapter 11 - Bridging Theory and Practice: Applying Cognitive and Educational Theory to the Design of Educational Media. In F. C. Blumberg & P. J. Brooks (Eds.), *Cognitive Development in Digital Contexts* (pp. 217–234). Academic Press.
[2] Gattullo, M., Laviola, E., Boccaccio, A., Evangelista, A., Fiorentino, M., Manghisi, V. M., & Uva, A. E. (2022). Design of a Mixed Reality Application for STEM Distance Education Laboratories. *Computers*, *11*(4), Article 4.

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