

## Design and Evaluation of Augmented Interaction Techniques for Assembly Tasks

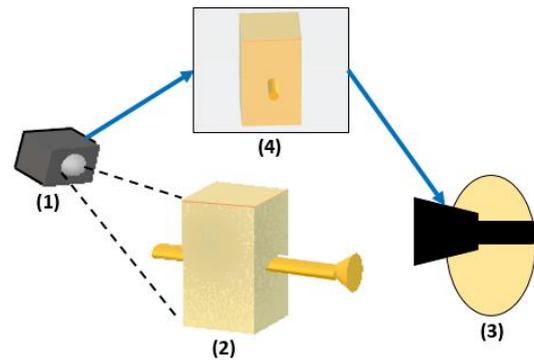
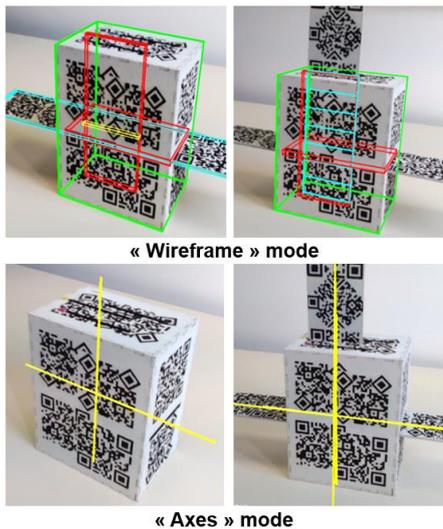


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Assembly tasks are one of the major issues of industrial manufacturing (e.g. automotive assembly lines). This internship investigates how Augmented or Mixed Reality (AMR) techniques can provide actual assistance to operators during real assembly [1]. In 2017, the host team carried out the evaluation of “X-ray” augmentation with a HoloLens, corresponding to situations where an object is hidden inside another (see left figure). Two modes were considered: “wireframe” and “axes”. Users reported very positive feedback in both situations compared to blind assembly [2].



Rear-view camera for AMR. (1) External camera; (2) Assembly task: a wand inserted into a box; (3) User with HMD; (4) The third-person view augmenting the real world perception.

Testbed for the evaluation of AMR during an assembly task.

The objective of the internship is to extend and generalize this study to the case where an object interposes between the operator and the assembly (see right figure), preventing a direct visualization of all system components. In this case, in addition to the augmentation modes already studied, it is possible to provide the user with an additional, external viewpoint similar to that provided by a rear mirror (except that the viewpoint remains attached to the user and not to the scene). To do this, a camera captures the assembly area from a third party vantage point, and the resulting video stream is presented in the user's field of view.

The internship will firstly consist of defining the experimental framework more precisely (definition of the task, manufacture of the objects to be assembled, definition of the protocol), before proceeding with the experiments and evaluating the results, both objectively (time of completion, error rate, quality of assembly) and subjectively (based on questionnaires). A full design cycle (design/implementation/evaluation/redesign) should thus be possible during the internship.

Possibility to apply for a PhD scholarship at the end of the internship.

REQUIRED SKILLS: Unity / C# / Visual Studio / FabLab

### REFERENCES:

- [1] A. Syberfeldt, O. Danielsson, M. Holm, L. Wang. "Visual Assembling Guidance Using Augmented Reality", 43rd Proceedings of the North American Manufacturing Research, Procedia Manufacturing Volume 1, 2015, Pages 98–109.
- [2] N. Khenak. "Mixed Reality and Tangible Interface for Assembly Tasks" Master Internship report 2017.