VR and AR for prototyping and designing new Collaborative Environments for Industry 4.0

IMT Atlantique + elm.leblanc

NICOLAS BAUDIN
INTERNSHIPS IN FRANCE INITIATIVE

Name of the hosting institution in France	IMT Atlantique
Name of the host laboratory / research team	Lab-STICC équipe IHSEV
Address	Technopôle Brest-Iroise CS 83818 – 29238 Brest Cedex 3
Web site	https://www.labsticc.fr/en/index/
Name of the supervisor	Thierry Duval
Function	Full Professor of Computer Science – co leader of the IHSEV team of the lab-STICC Lab
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Internship offer

Topic of the internship (title)	VR and AR for prototyping and designing new Collaborative Environments for Industry 4.0			
Proposed dates of the internship	**Start:**	2019-12-02	**End**	2020-05-29

Scientific and academic objectives of the internship (detailed description of the internship content, work expected from the intern and expected outcomes):

The future of Industry is to use Augmented Reality (AR) and Virtuel Reality (VR) techniques to build a digital twin of modern factories. Thanks to a 3D modelling of the factory and to a 3D tracking of the operators, it becomes possible to project information on AR displays (see-through AR systems such as the Microsoft Hololens) to help the operators of the factory during their tasks, and it is also possible to enable a 3D monitoring of these operators' activity. To do this monitoring, it is necessary to add additional information in the global 3D model of the system to make it possible for a monitoring engineer to understand what the operators are doing, how they are feeling (what are their emotional and cognitive state), and what are their objectives (according to a task to achieve). Such a collaboration could also allow the monitoring engineer to give additional help to the AR operator of the factory. So, to be able to design such futuristic collaborative systems for industry 4.0, we must propose a Collaborative Virtual Environment model for collaboration including not only the main features of the system (physical devices of the system and logical tasks that must be achieved), but also the characteristics of the users, including their position and their emotional and cognitive state (we will also have to monitor them through recordings some of their status such as their heart rate, their pupil diameter, EEG, and so on...), in order to be able to represent them in the augmented views of the other users. This model could be inspired by some results of the FP7 "Beaming" project (see some work from Mel Slater and Anthony Steed about this project). With such a model, we could also add additional VR users, either for a global monitoring of the system, or to enable additional collaboration between VR users and AR users. These VR users potentially have access to a great variety and quantity of information, but these VR users lack the in-situ spatial awareness of the AR users. A first step toward this global system could be to focus on the model of the collaboration and of the collaborative users, and on the way to make users aware of what other users are doing, and what is their emotional and cognitive state. A first implementation was realized in another context (future command and control systems realized in AR and VR for a simple task in order to have a 3D monitoring of a user doing a simple but intensive task) by a trainee from the Nicholas Baudin 2018 round. The first part of this second Nicholas Baudin internship could consist in conducting some evaluation of the existing system, and then to make some modifications in order to adapt it to the context of industry 4.0, in order to make it possible for a VR monitoring engineer to give some help to an AR operator in the factory. The context would be the IRON-MEN project (project "Grand défi du numérique" funded by the french BPI) which is led by the elm.leblanc french company and in which IMT Atlantique participates for the 3D VR and AR aspects of the project.

Name of industrial partner	elm.leblanc
Role of the industrial partner in the internship project	elm.leblanc will give us a real industrial context with real use-cases that could be useful for the IRON-MEN project. The French part of the funding of the internship would also come from the IRON-MEN project.
Main contact at the French industrial partner	Emmanuel Bricard
Name of the Australian partner institution	University of South Australia
Name of lab/department/team involved in the collaboration at the Australian partner institution	Advanced Computing Research Centre - the Wearable Computer Lab
Main contact in the Australian partner institution	Bruce Thomas
Function of the main contact in the Australian partner institution	Full Professor - Head of the Wearable Computer Lab
Email address of the main contact in the Australian partner institution	bruce.thomas@unisa.edu.au
Outside of this ongoing collaboration, will applications coming from students of other eligible Australian universities be considered by the hosting institution in France?	Yes

Expected profile of applicant

Level of study	Master's student or Bachelor with Honours
Discipline	Computer Science
Required qualities, knowledge and skills	Knowledge in Computer Graphics, HCI, VR, AR, software development with Unity 3D (C#)