Internship on Human Robot Interaction evaluation in Virtual Reality.

Keywords: Human Machine Interaction, Human Robot Collaboration, Virtual Reality, Virtual Reality Training System (VRTS), Evaluation, Smart manufacturing.

Context:

In the context of Industry 4.0 and digital factory, digital twin and virtual reality represent technologies that can deal with several industrial issues like design, simulation and optimisation of industrial systems. They are helpful to perform operator's training of industrial situation and evaluate them (Fratczak, Goh, Kinnell, Soltoggio, & Justham, 2019) (Havard, Jeanne, Lacomblez, & Baudry, 2019) (Matsas & Vosniakos, 2017).

Moreover, humans and robots can fully collaborate without separation or safety barriers. With current advances in industrial environments, robots are steadily shifting into a more human populated environment, which leads to the need of evaluating these new interactions means. Indeed, cobotic arm can create stress for operators since human and robot share the same working space. Moreover, new interaction systems, such as gesture recognition, can lead to unexpected behaviour of the robot from a human perspective. That is why, in this internship we need to evaluate those new collaboration means thanks to the existing platform at LINEACT CESI Rouen.

LINEACT CESI has developed a flexible manufacturing system (FMS) involving several robots with different capabilities in a shop floor layout context. This use case is composed of an automatic production system and a set of manual workstations where the operator can be assisted by cobotic arms for assembly tasks. A digital twin associated to Human-machine interface (HMI) based on virtual or augmented reality is also present and allows to perform simulation in Virtual Reality Training Systems (VRTS). Particularly, Virtual Reality simulates a case study where an operator is working in collaboration with a robotic arm (UR10) to assemble a subassembly of a children's bike. This use case will be used during the internship in order to evaluate the Human Robot Collaboration.

This work will be conducted in collaboration with the Digital Automation Systems Design Laboratory within the Intelligent Automation Centre from Loughborough University.

Missions:
- A literature review about Human behaviour in the context of industrial Human Robot Interaction (HRI) and Virtual Reality Training System (VRTS) for HRI.
- A design of the experimentation for evaluating several human behaviours based on the robot ones. With the platform available at LINEACT CESI Rouen, the following data will be available: ECG, GSR, EEG, Head position, Gaze tracking, VR interactions and simulation,…
- Data analysis from the experimentation.
- Writing a paper about the results obtained.

Skills :
- A master level in computer sciences or industrial engineering,
- Skills in Human Robot Interaction,
- Knowledge in Unity - C# and Virtual Reality,
- Human skills
    - Good interpersonnal skills
    - Writing ability

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- David BAUDRY (dbaudry@cesi.fr), Head of Engineering and digital tools research team, LINEACT CESI Rouen.

How to apply :
Submit you application to Vincent Havard vhavard@cesi.fr.
Please, fill the email object as: *"[Internship] HRI evaluation in VR"*
The application must contain:
- **CV** ;
- **A cover letter** for the subject ;
- Results of the current master.
- Recommendation letters if available.

*Thank you to send **NOM prénom.zip**.*

Contract: internship of 5 to 6 months.

Location :
CESI Rouen
80 rue Edmund Halley
Rouen Madrillet Innovation
CS 10123
76808 Saint-Etienne-du-Rouvray.

Aknowledgment :
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References

Fratczak, P., Goh, Y. M., Kinnell, P., Soltoggio, A., & Justham, L. (2019). Understanding Human Behaviour in Industrial Human-Robot Interaction by Means of Virtual Reality. *Proceedings of the Halfway to the Future Symposium 2019.* New York, NY, USA: Association for Computing Machinery. doi:10.1145/3363384.3363403

Havard, V., Jeanne, B., Lacomblez, M., & Baudry, D. (2019). Digital twin and virtual reality: a co-simulation environment for design and assessment of industrial workstations. *Production & Manufacturing Research, 7*, 472-489. doi:10.1080/21693277.2019.1660283

Matsas, E., & Vosniakos, G.-C. (2017). Design of a virtual reality training system for human--robot collaboration in manufacturing tasks. *International Journal on Interactive Design and Manufacturing (IJIDeM), 11*, 139-153. doi:http://dx.doi.org/10.1007/s12008-015-0259-2