Digital Twin: Virtual and Augmented reality interfaces and human behavior analysis in modern manufacturing

Summary

Taltech Department of of Mechanical and Industrial Engineering, Smart Industry Research Group offers a 4-year PhD position in Digital Manufacturing

Research field:	Mechanical engineering
Supervisors:	Tauno Otto Dr. Vladimir Kuts
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between June 01, 2020 00:00 and July 03, 2020 23:59 (Europe/Zurich)

Description

The doctoral research project is using Digital Twins and VR/AR technologies as an interface to analyze and develop a human-robot collaboration system with the scope of teaming and safe teleoperation. There is a need to develop metrics for measurements and validate Human-Robot Interactions standards in Digital Twins of manufacturing systems as a proper and useful tool for this. The central hypothesis of the upcoming doctoral project is that the test method and metrics for human-robot teaming should be developed first in DT to increase the safety level of physical industrial robotic and overall manufacturing systems.

Based on developed test methods and metrics, Digital Twin synchronized with the real environment [1] will be used for finding novel adaptive control methods for multiple robots at the same time. The second project aim can be stated as – Digital Twins usage for training on various methods is a safe and effective approach for experiments on real machinery. Also, to provide research on what contributes to a truly immersive VR/AR training system, which provides an agent with higher-level involvement than customary training and thus being more efficient.

Future research will also address cybersecurity, connectivity methods (between physical and virtual worlds) optimization, and development of virtual distributed infrastructure with open access for experimental design environment with various machinery for system integrators and end-user as well researchers.

Responsibilities and tasks:

- Research on the defined topic
- Virtual environment development
- Robot programming methodology through VR/AR interfaces
- Representation of the Industrial VR/AR laboratory on events, conferences, demos [2]
- Teaching assistance in Digital Manufacturing, Production Digitalization courses (labs)

Qualifications / The applicants should fulfill the following requirements:

- Mandatory:
  - Programming languages: C#/C++, Python
  - Familiar with VR/AR domain
  - Unity3D / Unreal Engine software knowledge
  - MatLab
- Good to have:
  - Robot Operation System (ROS)
  - 3D Modelling (CAD/Blender/3DMax etc.)
  - Knowledge of manufacturing equipment domain
  - Machine vision experience
  - Human modeling experience

References:
[1] Kuts, V.; Otto, T.; Tähemaa, T.; Bondarenko, Y. (2019). Digital twin based synchronised control and simulation of the industrial robotic cell using virtual reality. JOURNAL OF MACHINE ENGINEERING, 19 (1), 128−145.2010.5604/01.3001.0013.0464.
[2] https://ivar.taltech.ee/ [Online]