Use of Virtual Reality and AI for the Design of Workstations in a Circular Economy

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Context

The Circular Economy (CE) rethinks the traditional linear model ("extract, produce, consume, dispose") and replaces it with a sustainable system based on reduction, reuse, repair, remanufacturing, and recycling.

To address the industrial challenges of implementing CE, emerging technologies from Industry 4.0/5.0—such as simulation, virtual and augmented reality, collaborative robotics, and artificial intelligence (AI)—have proven to be powerful enablers. They make it possible to design and simulate circular processes (disassembly, re-engineering, remanufacturing), to virtually test different scenarios before real deployment, while also integrating aspects of operator safety and well-being.

Objectives

The project objectives may include:

- Programming and simulating collaborative scenarios between a human operator and a virtual cobot or avatar.
- Exploring two interaction modes: avatars controlled in real time by an operator, or trained via AI to reproduce collaborative behaviors.
- Developing an industrial demonstrator to illustrate the benefits of these technologies for the co-design and implementation of circular and sustainable workstations.

The objectives may be adapted depending on the student's interests and the findings from the initial state-of-the-art review. For example, the student may choose to explore ergonomic components

(both physical and cognitive) related to workstation use, such as postural analysis, cognitive load, stress, etc.

Methods

The student will work in collaboration with the COSYS team at G-SCOP and the Visionnair platform of S.MART (INP-Grenoble).

They will use immersive tools, including motion capture systems and VR headsets, and will program in C++ and/or Blueprints within the Unreal Engine environment.