DEVINE

Collaborative Robots for Flexible Manufacturing Systems

Pro²Future

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MOTIVATION & GOALS

Flexible manufacturing systems rely on humans for their flexibility and advanced cognitive abilities, allowing them to swiftly adapt to unforeseen situations. In the context of human-robot collaboration, a rigidly programmed robot can impede this flexibility. The objective of this project is to **repurpose human-robot collaboration** for flexible manufacturing systems. Rather than merely coexisting in a shared workspace, the aim is **to enable robots to dynamically respond to the worker, process, and environment changes**.

Project FactBox

Project Name DEVINE
Project ID StratP II 2.4
Duration 12 Months

Area 2
Cognitive Robotics and Shop Floors

Project Lead
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APPROACH

The approach integrates various **sensory inputs**, including cameras and wearable sensors, to endow the robot with **advanced perception capabilities**. This awareness enables the robot to track both the worker's actions and the progress of the manufacturing process. Utilizing the **detected progress** as cues, the manufacturing execution system then directs the robot to execute suitable **assistive tasks** autonomously. Consequently, there is no need for explicit commands from the human operator, reducing the likelihood of the robot undertaking incorrect tasks, even when the operator changes the order of operations.

CONTRIBUTION

Scientific contribution

- Seamless integration of different sensory input to enhance the cobot's perceptual skills.
- Integration of a heuristics approach within the manufacturing execution system to identify the ongoing assembly tasks.

Economic contribution

Our approach enhances production efficiency in semi-automated manufacturing systems. It also supports the flexibility of the overall system and Enables the utilization of cobot technology in flexible manufacturing scenarios where rigid processes are not feasible.

SYSTEM ARCHITECTURE

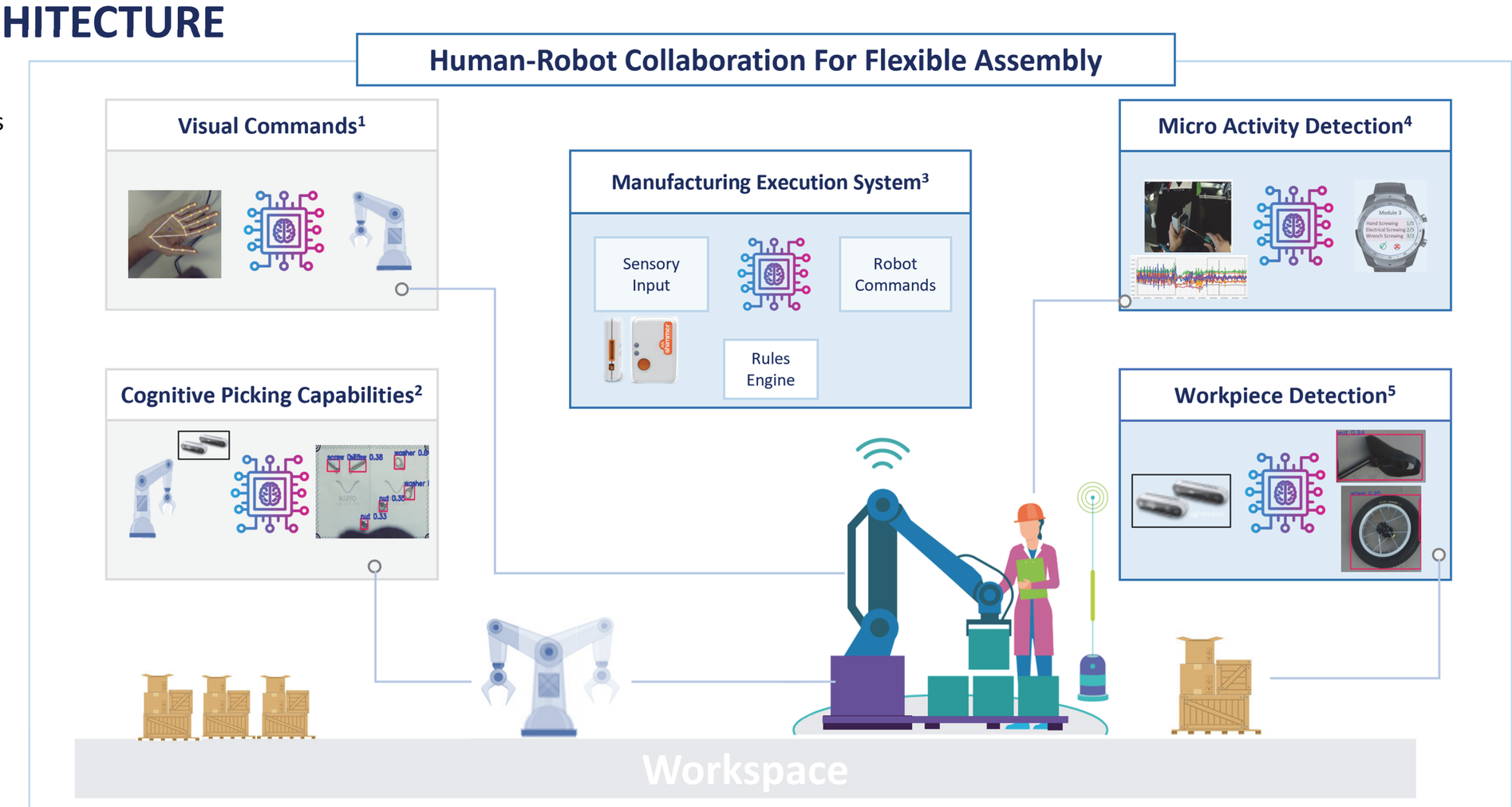
1: Computer vision technologies (MediaPipe) to detect visual commands and interface with the cobot.

2: Cobot with a camera for dynamic part recognition using deep learning models, without relying on preprogrammed locations.

3: MES combines the different sensory input, funnelling them into the rules engine for identifying the process progress and commanding the cobot.

4: Deep learning models to classify assembly activities from timeseries data.

5: Deep learning techniques on camera stream to identify the selected workpieces.



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