JARVIS

EXTENDING HUMAN CAPABILITIES THROUGH HUMAN-CENTRIC HUMAN-ROBOT INTERACTION

Funded by the European Union

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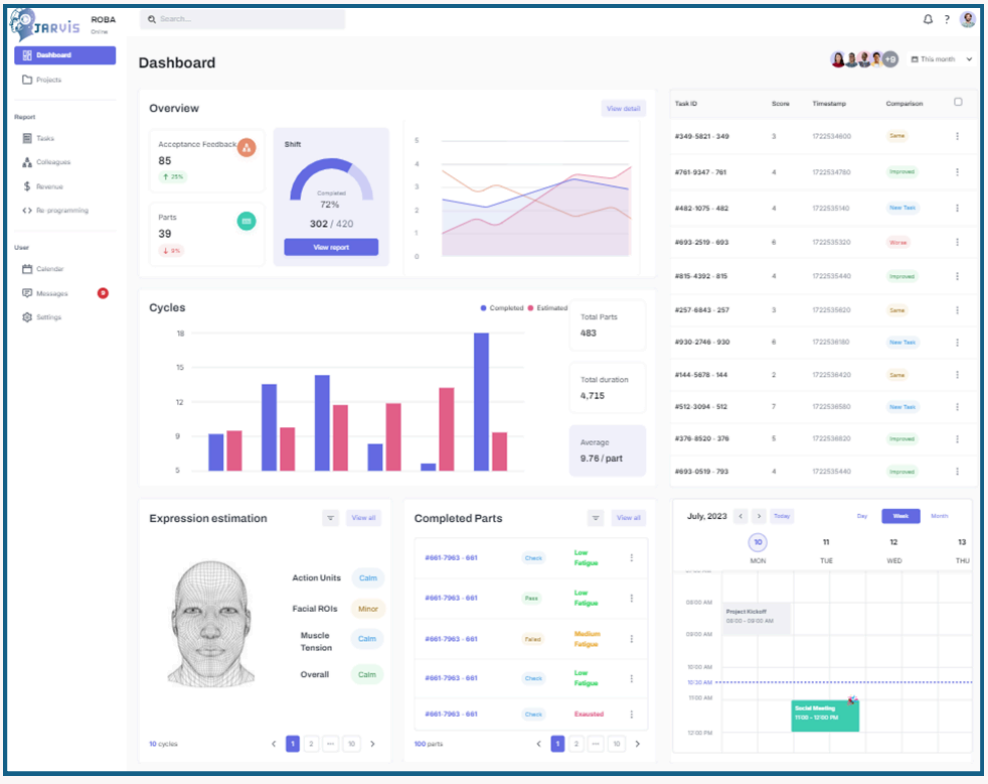
As robots become a vital part of today's industry, traditional robotic systems, while highly efficient in repetitive, low dexterity tasks, struggle with dynamic workspaces and safe and seamless collaboration with humans. Human Robot interaction (HRI) is crucial for many industrial sectors, where human agility and decision-making skills are needed. So, the challenge is to create robotic systems that extend human capabilities, keeping the operator safe and satisfying his/her needs.

JARVIS promises to advance HRI using AI-driver, and multimodal tools, to improve interaction with the machine more socially, keeping operator acceptance high and removing the boring, high-fatigue tasks from the operator's daily work-life. By fostering collaboration between humans and robots, JARVIS seeks to create a future where robots work as intuitive assistants, seamlessly adapting to human preferences, actions, and environments. Two definitive modules in this effort are **ROBA (Robot Behavior Adaptation)** and **Teaching by Demonstration (TDM)**, both aiming to build a more intuitive, user-friendly robotic collaboration for humans.



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ROBA: ROBOT BEHAVIOR ADAPTATION

The main drawback in today's collaborative systems is that all operators are treated as a whole, not taking into consideration the personality and preferences of each operator. During traditional human-human collaboration, healthy social communication is noticed to optimise the performance of the operator. Given enough time, operators learn how to work alongside their partners. This phenomenon inspired JARVIS for the **ROBA module**. In the modern workplace, robots are expected to perform complex tasks alongside humans, often needing to adjust their behavior to match the operator's actions, and intentions, and distinguish satisfaction or intention by monitoring the operator's expressions. This is the challenge addressed by the **ROBA (Robot Behavior Adaptation)** module within the JARVIS project. Developed by LMS with support from TAU, this module leverages cutting-edge AI algorithms to enable robots to continuously adapt and optimise their behavior based on the actions and reactions of human operators.

ROBA can assess the operator's actions, posture, and facial expressions, using advanced AI techniques such as **reinforcement learning**, and **evolutionary algorithms**. These state-of-the-art methods allow the robotic system to form an understanding of the operator's behavior. Online training also enables the system to adapt its actions during the task execution, without the need for reprogramming or manual intervention.

For instance, imagine an industrial robot working alongside a human operator on a production line. Through the ROBA system, the robot can adjust its movements in response to the operator's signals of fatigue or changes in item handling technique. For example, the robot may slow down or adjust its grasp to reduce human strain and increase the ergonomic score during a specific task.

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HUMAN-CENTRIC ROBOTICS: THE WAY TO SEAMLESS HRI

JARVIS technologies aim to have a grave impact on the social aspects of industrial workplaces while maximising production efficiency. This can be achieved by shifting the role of robots from “just” tools to capable collaborators, which serve as an always learning entity on the shop floor. By focusing on the Human Centric HRI, JARVIS is setting the basis for robots, not only to extend human abilities but to create a more natural and productive environment.

We believe that the adaption of such technologies in today’s industry will no longer make workers see the robots as 'cold' machines, but as the greatest tool they could be equipped with during their shift.

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