LEVER

Progressive Robotics

CHALLENGES

Progressive Robotics aimed to solve the critical problem of physical strain and safety risks faced by workers performing heavy-lifting tasks in industrial assembly and disassembly. In sectors like automotive recycling, workers must manually dismantle heavy components, such as electric vehicle batteries, leading to back pain and Musculoskeletal Disorders (MSDs).

Before the implementation of LEVER, existing solutions were insufficient:

- Collaborative robots (cobots) generally have low-to-medium payloads, making them unsuitable for heavy objects.
- Traditional industrial robots are powerful but require strict workspace separation from humans for safety and take too long to program for variable tasks.
- Smart lifting devices (hoists) offer limited flexibility, typically only facilitating vertical movements.
- High-payload robots often have high inertia, requiring significant human force (e.g., 100 N) for manual guidance, which makes collaboration exhausting and ineffective.

THE SOLUTION

The LEVER project developed a solution designed to transform standard high-payload industrial robots into truly collaborative tools. The solution consists of two primary technical components:

- **Adaptive Admittance Controller**: A hardware-agnostic, ROS 2-based software system that dynamically reshapes the robot's apparent inertia and damping. This allows the robot to respond predictably and compliantly to human touch, balancing stability with low human effort.
- **Sensorized Smart Handle**s: Ergonomic, low-cost handles equipped with built-in electronics to distinguish between voluntary and involuntary contact. These act as a smart enabling device, activating the collaborative mode only when a worker intentionally grips the handles.

The solution has been evaluated with a 300kg industrial robot allowing safer and more effective human-robot collaboration.

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RESULTS

The project successfully met or exceeded its technical and user-centric KPIs:

- **Inertia Reduction**: Achieved a 90% reduction in apparent inertia, allowing operators to manipulate heavy loads with minimal effort.
- **Technical Validation**: The system was successfully validated using a 300 kg payload KUKA robot, significantly exceeding the initial 100 kg target.
- **Smart Handle Performance**: The handles achieved a 0% false positive rate for voluntary contact detection and cost only ~€50 to manufacture (beating the €100 target).
- **User Acceptance**: In specialized surveys for evaluating assisting devices, the system achieved an 87.5% user acceptance rate.
- **User Experience**: 100% of survey participants found the system useful and felt comfortable during operation, while 87.5% found it easy to use and expressed interest in using it for future tasks.

IMPACT

Participating in the EARASHI project has provided Progressive Robotics with several concrete organizational benefits:

- **Technology Maturation**: The project successfully advanced the LEVER technology from TRL 5 to TRL 7, moving it from a lab environment to a system demonstrated in an operational environment.
- **Strategic Partnerships**: We established vital collaborations with IKERLAN, gaining access to their advanced facilities and integrating their Building Block 5 (Robot Intelligent Control) into our framework.
- **Industry Credibility**: We presented the solution in manufacturing companies, which expressed interest in validating our technology in machine tending operations that are currently done manually.
- **Business Growth**: The project helped us identify new business opportunities in collaborative hand-guidance solutions.

GET IN TOUCH WITH LEVER

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