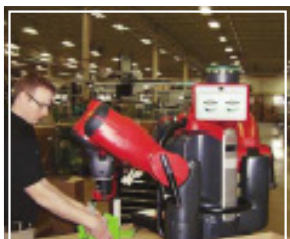# COLLABORATIVE ROBOTICS

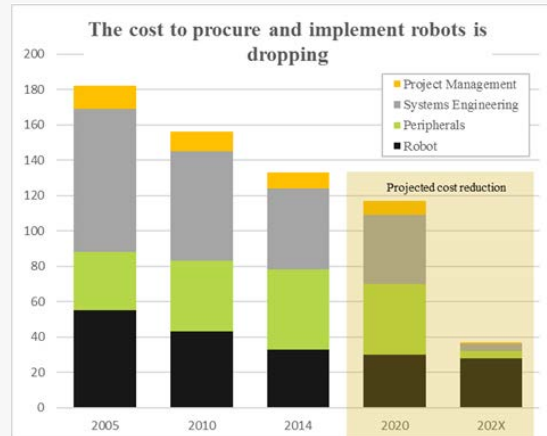## Bringing the proficiency, precision, and persistence of robots to our lives

COLLABORATIVE ROBOTICS increases the range of what humans can do by making the efficiency, precision, and tirelessness of robots accessible to task experts as well as programming experts. Co-robots are trained by humans - not programmed - to complete dull, dirty, dangerous jobs, leaving humans free to analyze, aim, attribute and achieve.

Robots manipulate heavy materials precisely without risk of contamination.

Collaborative robots aid a broad range of industry activities from product design to production (above) to job training (right).

The cost to procure and implement robots is dropping

- Project Management
- Systems Engineering
- Peripherals
- Robot

Projected cost reduction

The cost to purchase and implement robots has dropped. 21st century robotics accelerate this trend by empowering *workers* to program robots, dramatically reducing integration time. Today's research efforts will help robots understand humans, complete tasks as a human's co-worker, and be able to analyze more types of data.

INCREASING EFFICIENCY AND APPLICATIONS:

» We create gesture-based programming for robots to learn tasks and understand the intent of humans through gestures and natural interaction.

» We build physical and virtual robots, tailored to specific needs at home or at work, that develop trust between humans and machines either individually or in teams.

» We research intuitive autonomy, allowing robots to better understand their surroundings and humans nearby to promote safer, less obtrusive robots that respond and adapt to uncertainties in predictable ways.

PURDUE CONNECTS WITH INDUSTRY THROUGH:

» Purdue's *Robotics Accelerator* brings together 55 faculty across Purdue from the College of Science, College of Engineering, College of Agriculture, College of Health & Human Sciences, College of Liberal Arts, and the Polytechnic Institute to create a cohesive resource for industry. More information is available at: *http://robotics.purdue.edu*

» Purdue engages with industry through the national industry/university cooperative research center for *RObots and SEnsors for HUman well-Being* (ROSE-HUB). ROSE-HUB focuses on near-term research for enhancing robot collaboration with humans in areas including homeland security, emergency preparedness and response, and home healthcare.

Dr. Voyles leverages his 30 years of experience to apply Purdue's broad portfolio of robotics expertise to beneficially impact humans.
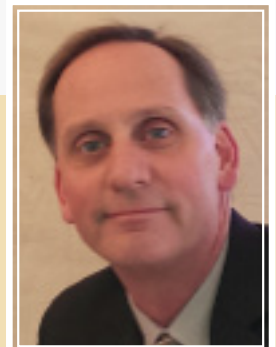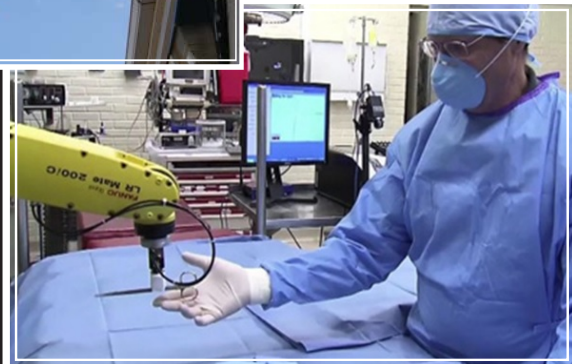
PURDUE
POLYTECHNIC

CREATING EFFICIENCIES IN EVERY SECTOR:

» *Precision Agriculture:* Purdue engages with animal and crop agriculture to develop the capability to sense the health of animals or crops as a whole, in part, or individually and deliver nutrients, antibiotics, and/or pesticides only when or where necessary.

» *Manufacturing:* Robots are becoming easier for small and large corporations to integrate into their business. Purdue experts can work with you to develop next-generation co-robots that will help you meet today's challenges of mass customization and shorter product lifecycles.

» *Healthcare:* Surgical robots have revolutionized the work of caregivers within the operating room (OR) and drastically reduced the recovery period outside the OR. Assistive robots will do the same for wellness caregivers in the home, extending the independence of the elderly and nurturing those with autism or depression so they can remain in their homes with dignity.

» *Emergency Response:* Purdue experts enhance the mobility and autonomy of robots in unknown and changing environments. Collaborative robots collect and provide situational information to humans to simplify decision-making while providing protection and resilience to dangers.

The information generated by collaborative robots integrates with other sources in systems like surveillance or healthcare to maximize capabilities.

SAMPLE PROJECTS COMPLETED AT PURDUE:

» *GestoNurse:* A robotic scrub nurse was developed in Purdue's Industrial Engineering department to provide precise and sterile selection of surgical tools for surgeons in the operating room.

» *Understanding subtleties and nuances in human movement:* Experts across Purdue's departments of Psychology, Linguistics, Engineering and Technology investigate how humans perceive human motions in order to build robots that better understand human motions and non-verbal communication.

» *Wireless control networks for heterogeneous teams:* Purdue's Engineering Technology and Electrical Engineering experts developed modular ground-based and aerial robots that can be rapidly assembled into teams to perform complex, distributed tasks.

Undergraduate and graduate students in collaborative robotics at Purdue complete hands-on projects and develop new methods to both interact with and program robots.

For more information, please contact:

Richard Voyles, Ph.D.
Professor and Director, Robotics Accelerator
Purdue University
156 Knoy Hall
West Lafayette, IN 47906
rvoyles@purdue.edu
(765) 494-3733

An equal access/equal opportunity university