Collaborative Robot Applications Overview

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Company Structure
KUKA Systems

KUKA Roboter

- KUKA QUANTEC
- smartPAD
- KR C4
- WorkVisual

Automotive: 50%
General Industry: 50%

HEALTHCARE Segment

- Technology Platforms
- New Markets

KUKA Systems

Automotive: 90%
General Industry: 10%

Structure
Letting Industry Drive New Robotic Markets

Industry Requirements → New Technology (safe robotics) → New Markets (medical, service)
Spectrum of Collaboration
Forms of Human-Robot Collaboration

No fixed guard, virtual safety fence
→ contact not desired, unlikely (e.g. photo-electric barrier)

Fixed safety fence
→ contact not possible

Robot workspace

Operator workspace

Increase in Human-Robot Collaboration

Shared workspace,
but exclusive motion
→ contact possible, but only
with stationary robot
e.g. in the case of industrial robot as handling assistant

Shared workspace
→ contact desired, simultaneous motion (e.g. manual guidance)

Shared workspace
→ contact not desired, but possible
Focus Has Been on **Fully** Collaborative Applications

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Increase in Human-Robot Collaboration
Collaborative Robot Segmentation

Two main “collaborative” markets

- High level force control arms
- Lightweight construction
- Heavier payloads
- Industrial speeds when workspace is free
- Risk managed via force control and Advanced software features

Task complexity & payload control

- Low cost, smaller arms
- Lightweight construction
  Reduced risk of injury due to low payload and limited speeds
How to Find the Right **Collaborative** Robot

- Start with Payload, Speed & Reach (as always)
  - Do you require higher payloads?
  - Do you require higher speeds?
  - Do you require higher/variable arm stiffness?
  - Do you require force sensing along the arm? At the flange?
  - Do you require virtual walls?
  - Do you require advanced software programming?
  - Do you require user activation buttons on the robot/flange?
  - Do you require extra power & i/o at the robot flange?
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Collaborative Robot
KUKA iiwa Collaborative Robot
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KUKA iiwa Robot

- 7 Axis
- 7kg & 14kg Payload
- Senses Force on DRIVEN side of the motor
- Meets ISO 10218-1 & ISO 10218-2
- Redundant force & position sensors, software
- Independent Safety software layer
- Advanced software options
- JAVA API
Not Every Collaborative Application Needs a Specifically ‘Collaborative’ Robot!

- Many new robots developed specifically for full collaboration
- Market focus has limited thinking on many applications
- HUGE potential for ‘guardless’ applications
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Examples of Human Robot Collaboration
Medical Collaborative Application
Medical Collaborative Application
Example of Medical Human Robot Collaboration
Examples of Two Approaches to Machine Tending
Laser Scanner Alternative to Collaborative Robot For Machine Tending

**Advantages** -
- Higher Payload Capacities
- Faster Robot Motion, Results in Higher Machine Spindle Utilization
- Shorter Door Open/Close Time

**Disadvantages** -
- Large Scan Area Can Result in Robot Slowing Down Due to Scan Area Personnel Intrusion
Collaborative Robot Alternative For Machine Tending

Advantages -
• Can Be Flexible/Portable To Move From Machine To Machine
• Could Be A More Effective Way To Address Wide Part Variety

Disadvantages -
• Lower Machine Utilization
• Still Need To Address Controls Integration To Machine For End Of Cycle, Chuck Open/Close
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Collaborative Robot
Application Examples
Dishwasher Assembly Example
Facility Utilization – Human and Robot Share Space

Automotive Example
Application Should Drive Robot Selection
Good Applications For Collaborative Robots

• Application Requires Human Robot Collaboration (HRC)

• Applications Where Utilization Of Manual Assembly Fixtures Is Required

• Applications Where There Is A High Degree Of Product Variation/Sku’s
Good Applications For Standard Robots

- Applications Where Maximum Through-put Rate Is Required
  - Machine Tending
  - Injection Mold Machine Tending
- Applications Where The Application Itself Is Not Safe, And Will Require Guarding
- Payload And Speed Requirements Exceed Specifications Of Collaborative Robots
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