Collaborative Robots and Industry 4.0

A Technology Leader
Mitsubishi – 144 Years of growing into a major brand covering over 40 companies

Each Mitsubishi company is separate entity and operates independently
MITSUBISHI ELECTRIC’s Factory Automation – Product portfolio

- Software
- MMI
- PLCs
- Inverter Drives
- Motion Controllers
- Servos
- Motor Starters
- Switchgear
- Robots
- CNC
- EDM
- Laser Processing
The Art of Manufacturing
Making sense of the world

Cloud of confusion?

Statistical degrees of freedom

Big data

Industrie 4.0

Cyber physical systems

Cyber security

Creative economy

Industrial Internet Consortium

IoT

Analytics

Small data

Smart Factory

Edge processing

But what does it actually all mean?

中国製造2025

Azure

Stuxnet
They are all related to the same thing...

A world where all parts are interlinked and coexist

...where efficiencies, cost reductions and productivity increases can be achieved through integrated automation and extracting hidden benefits from existing resources.
An ICT driven world enables this process to be faster and more efficient.
e-F@ctory uses FA technologies and IT technologies to reduce total cost of development, production, and maintenance and to support advanced manufacturing (Monozukuri).

- Collect production-site data in real time
- Seamlessly link data collected through FA with the IT system
- Feed back analysis results from the ICT system to production sites
FA Integration Solution

This solution improves
- Productivity
- Quality
- Environment
- Safety
- Security

through
- Visualization with analysis
- Improvements
- Increased availability at production sites

It assists companies to reduce TCO and to improve the company values.

Alliance Partners:
- Direct 279 companies
- Indirect 2800 companies

Installed systems:
- 130 factories,
- more than 5000

Visualization with analysis and improvements

since 2003
Experience

- Innovative, PC-less connection shop floor to MES connection
- The first Industrial 1GBPs network technology released
- Hit 2000 members
- Industrial Internet is coined
- Partner program expanded
- 2000
- First partners
- Foundation "open" technologies
- 2003
- "model" factory deployed at Mitsubishi Electric, Nagoya Japan
- 2005
- First mention of IoT as a concept
- 2007
- ARC white paper on e-F@ctory
- 2009
- "model" factory Fukuyama, Japan
- 2011
- Partner program expanded
- 2013
- "model" factory Gunma, Japan Changshu, China
- 2015
- "model" factory Kani, Japan
- First mention of Industrie 4.0
- Winner of Frost and Sullivan Best Practice Award
The effect

Improvement zone

How?
• through seamless integration, control and visualization of the production activity
• working in harmony with existing assets
• utilizing a "best in class" approach providing real time operations and data collection
• offering scalable implementation

Productivity + Quality + Safety + The manufacturing Environment

Reduced Total Cost of Ownership (TCO)

Creates New Value (time, quality, uniqueness, etc.)
Robotics in an Industry 4.0 context
Why robots are important for I 4.0 ?

• Statement from IFR : “By 2018 global sales of industrial robots will on average grow year on year by 15 percent”

• Flexible production is a main point of I4.0
  • Constant operation at high speed
  • Reduced operation costs
  • Reliable
  • robots are giving the flexibility
  • Down to single lot production
  • Simulation and automatic program creation
Robotics in manufacturing

New kind of applications and tasks can be handled by collaborative robots which have not been automated before.

**Traditional industrial robots (Cooperative)**
To improve the performance of the machine
Very fast and precise
Human can interact and co-operate with the robot with reduced speed/torque and limited position

**Collaborative robots**
Support the worker -> work like humans
Safety first
Slow and easy to use and easy to move
Human can work all the time close to the robot

Collaborative robots are more a complementary to industrial robots than a competitor of traditional industrial robots
Cooperating robots for I 4.0

Intelligent periphery
- Force sensor (control the force like human being)
- Camera (to see like human being)
- 3D vision for bin picking
- Safety (worker can interact with the robot without stopping the robot)
Collaborative Robots

What is next important?

• Detecting the collision before the worker touches the robot by wireless sensors
• Easy teaching by moving the arm manually to the position
• Interactive control of robot by touching the robot arm and give commands like start, program change

Start Program

Reset Program

Switch operation mode

Muting mode
Expanding beyond collaborative robots

Information within a single platform is available for all disciplines

Result:
- far lower integration cost
- Single interface to enterprise systems
Automated and manual processes coexist in manufacturing environment. Human for high intelligence flexibility. Automation supports the human by doing repetitive and low level intelligent tasks along the value chain.
iQ Platform Architecture

Corporate Enterprise

Interacts with Corporate Enterprise Systems

Integrates all automation relevant aspects

Enterprise

Only 2 layer Reducing TCO

Shop Floor

CNC
Discrete
Motion
Robotic

COPYRIGHT MITSUBISHI ELECTRIC
Cloud and Robotics

Mitsubishi Electric – Cloud Interface

Maintenance  Productivity  Running Cost
OEE  Behavior
Example:
Cloud and Robotics Architecture

Cloud (HANA SAP)

Services / HTML 5

iQ-R C-Controller

Maintenance
Productivity
Running Cost
OEE
Behavior
Thank you.
Danke.
Merci.
Grazie.
Gracias.
Teşekkürler.
شكراً
ありがとうございました。
謝謝。
спасибо