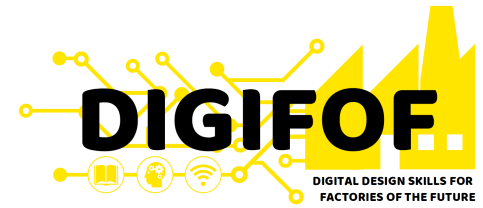


Collaborative robots in action

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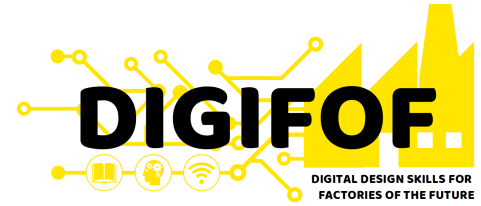


Welcome



Prof. Juha Röning
University of Oulu
Biomimetics and Intelligent
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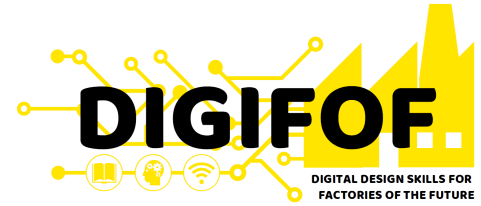
Agenda



- **Introduction**
- **Simple applications**
 - **Pick and place**
 - **Machine tending**
- **Complex applications**
- **Summary**
- **Questions and Answers**

Introduction

What are collaborative robots

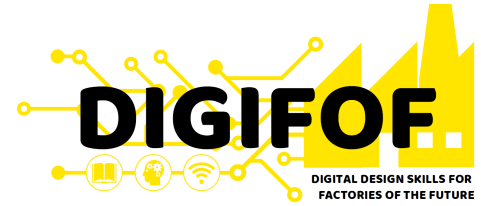


- ▶ Usually, robotic arms with 4-7 degrees of freedom
- ▶ Additional safety features that make them safer around humans
- ▶ “Teaching” mode
- ▶ Advantages
 - Easy to use and program
 - No need for security enclosing
 - Possibility of working alongside of humans
 - Can be build to be movable
- ▶ Disadvantages
 - Reduced speed and payload (FANUC CR-35IA high-load robot with payload 35kg)
 - Expensive
 - Not totally safe

Introduction

Applications

- Pick and place
- Machine tending
- Actuators for mobile robots
- More complex task



Application



- Pick and place
- Moving items to or from conveyor belt
- Packing and packaging
- Palletizing
- When combined with sensors can be used in quality control or sorting

Application

Machine tending



- Feeding materials to machine
- Removing processed parts from the machine
- Can operate some physical buttons

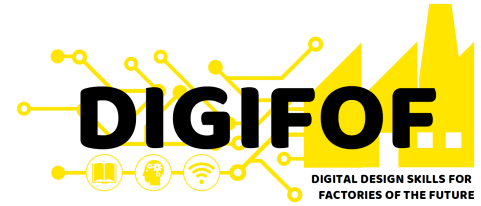
More complex tasks

Integrating with machine vision



More complex tasks

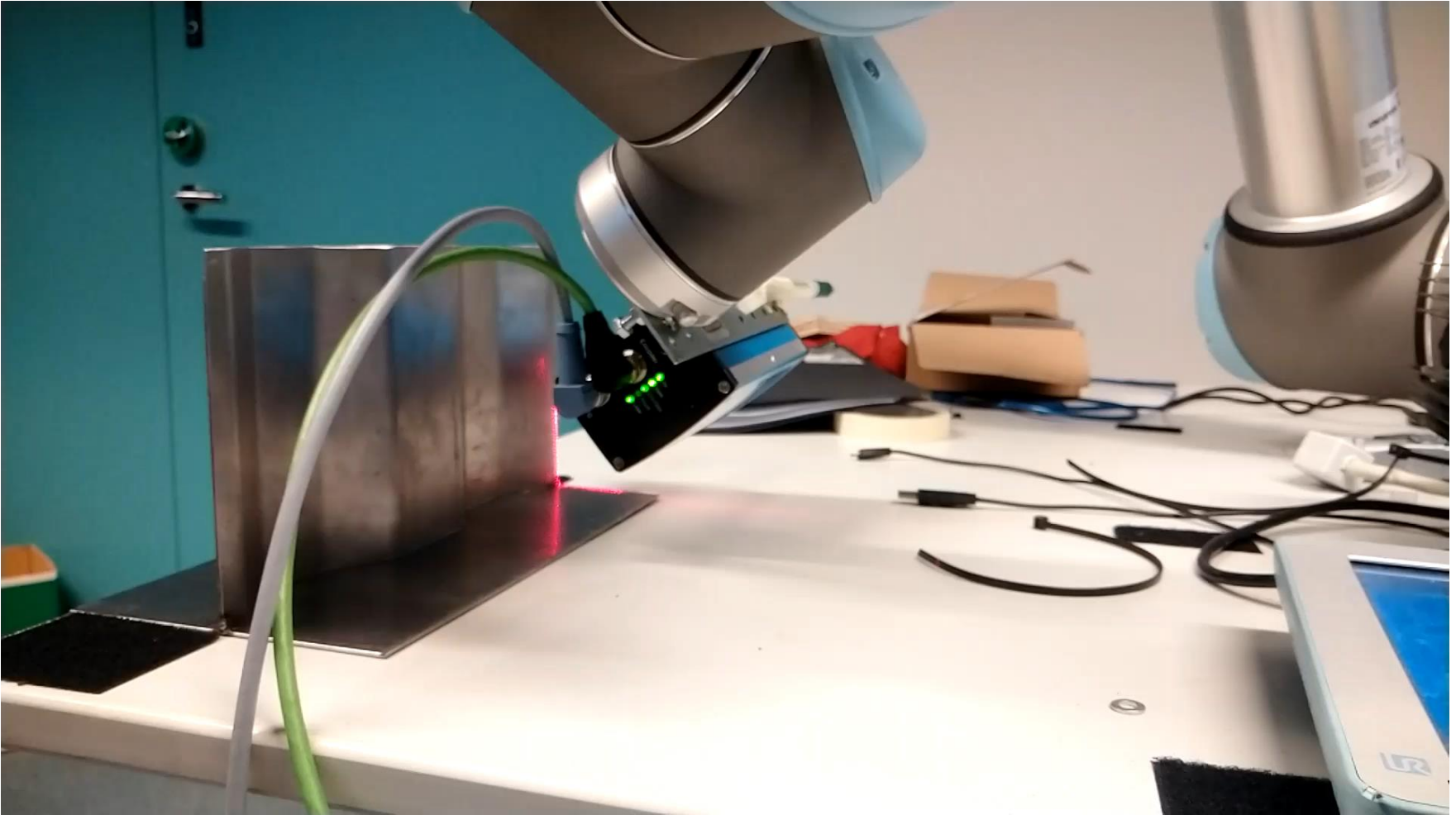
Integrating with machine vision



- Material identification demo for GarBot
- Software is given area where object is
- Object location and surface orientation is determined using Intel Realsense depth camera
- Probing spectrometer is moved to object surface and infrared spectrum is measured

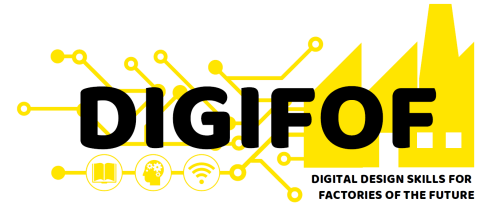
More complex tasks

Seam following



More complex tasks

Seam following

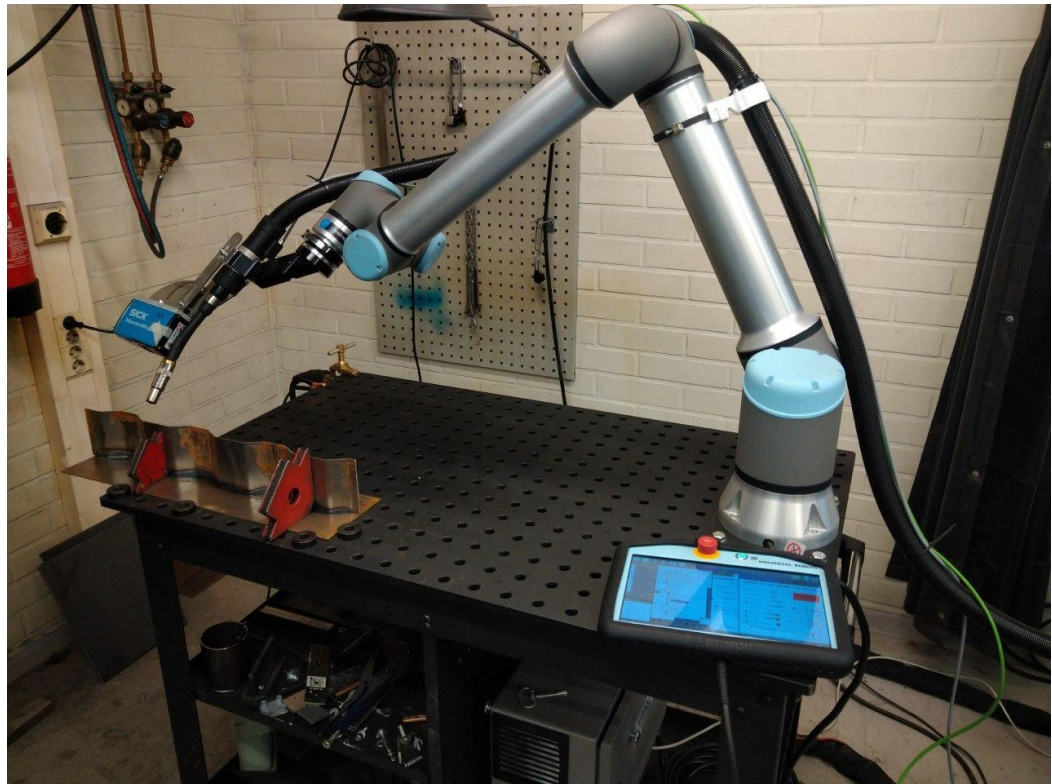


- Seam is scanned with 2D laser scanner
- Robot follows the seam with end effector
- Could be used for example for gluing, sealing or welding
- Safety issues from laser scanner and end effector

More complex task

Welding robot

- Oulu university of applied sciences
- UR10 arm and Kemppi A7 – automated welding system
- Safety issues:
 - Welding gun and wire
 - Welding torch
 - Sparks during welding
 - Safety scanner



More complex task

Mobile robots



- With cobot mobile robots can interact with environment
- Mobile robot needs to be aware of arm position or arm needs to be moved to safe orientation during driving

More complex task

Mobile robots

- Mörri platform with Kinova Jacob arm
- With cobot mobile robots can interact with environment
- Mobile robot needs to be aware of its arm position or the arm needs to be moved to safe orientation during driving



Summary



- Cobots can be useful for automating repetitive tasks
- Collaborative robots' safety features are designed only for the arm and not for the end effectors
- Safety for application will need to be reviewed for each case

Questions?