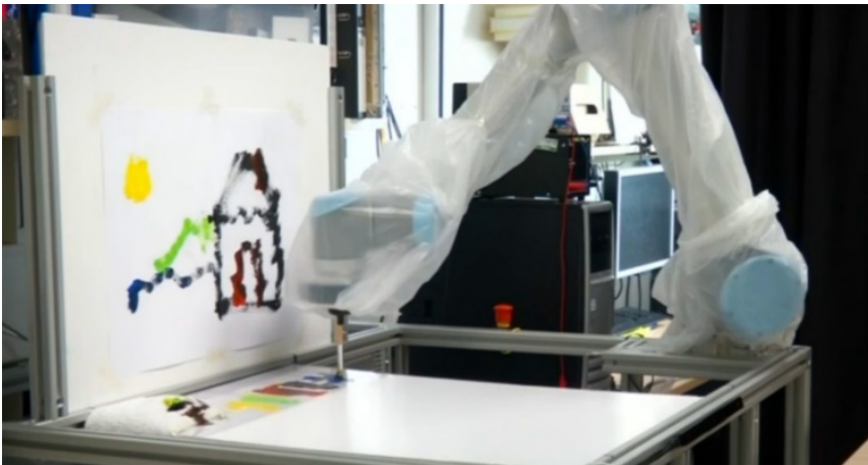# Task #1: Painting robot

"Using a haptic device, the operator will control a robot and attempt to paint on a canvas via a paintbrush / pen fitted with a strain gauge / sensor to measure the contact force of the robot on the canvas and use this metric as feedback for the operator'

Task #1: Painting robot

- Robot is controlled by an operator through the haptic device

- Simple force sensor integrated in brush/pen

- Force (and ripple) as haptic feedback

  - Warning vibration before breaking pressure

  - Possible "guidance system": Auto-Picasso

- Machine Vision registration of painting

- IMU sensors to control 1 or 2 of the robot's DoF.

- EMG monitoring while controlling robot?

  - Possible additional/alternative control input?

  - Force-EMG signal comparison

  - Pattern recognition

  - Analysis of EMG during fine and dexterous movement

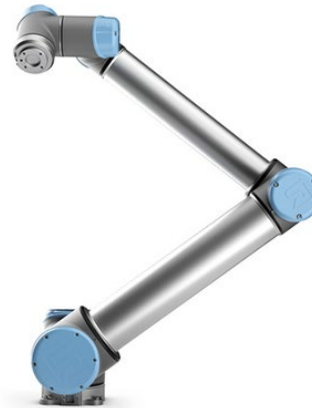 - Not much application for aiding in robot control.
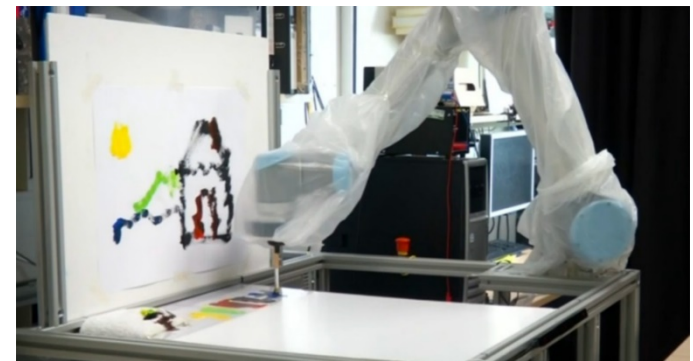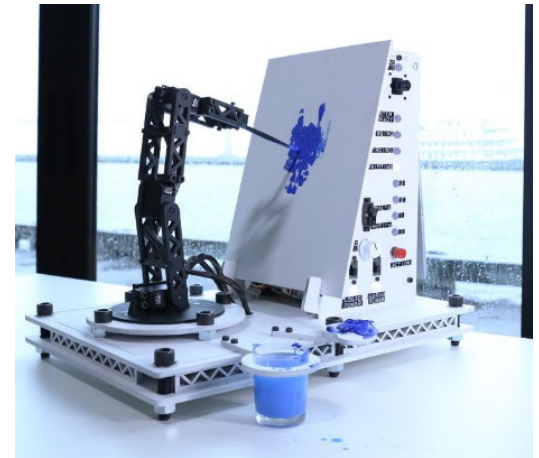
Task #1: Equipment

KUKA KR 16

- 6 axis serial robot
- RSI interface (real-time control through network)
  - waiting for funding

Universal UR5 / UR10

- 6 Degrees of Freedom
- 5 kg payload
- TCP/IP communication
- 18 kg weight

Haptic Device

- X, Y, Z forces
- Vibration/Rumble
- Simulation of material texture/"rippling"

# Task #2: Estimation of internal muscle parameters using biosensor signals

- Record EMG and movement data (using Vicon) of human movement.

- Use EMG to drive simulation model.

- Compare trajectories and use "machine learning" to learn muscle parameters.

- Hypothesis: if simulation model parameters match, movements are the same.
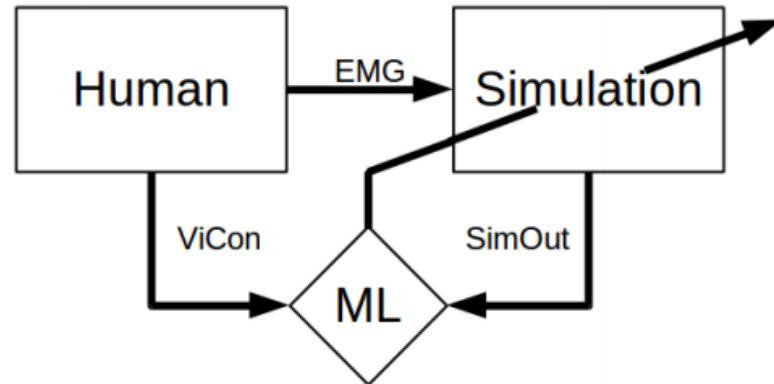
Task #2: Equipment

VICON Motion Capture

- Multi-camera setup
- Wide space motion tracking.
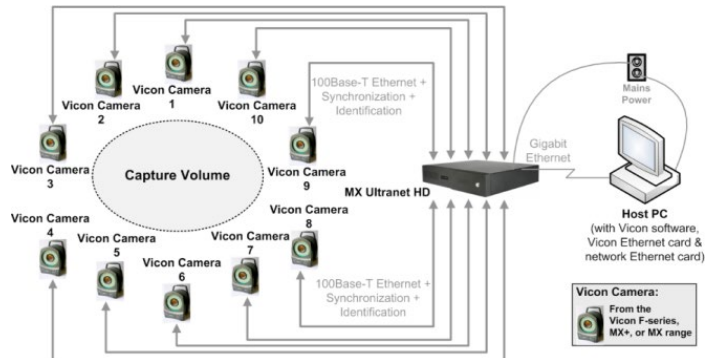
EMG

- Less than 10 channels required.
- Could use either BioSemi or Shimmer