

# ROS2 Control HW Interfaces for Yaskawa Motoman HC20SDTP

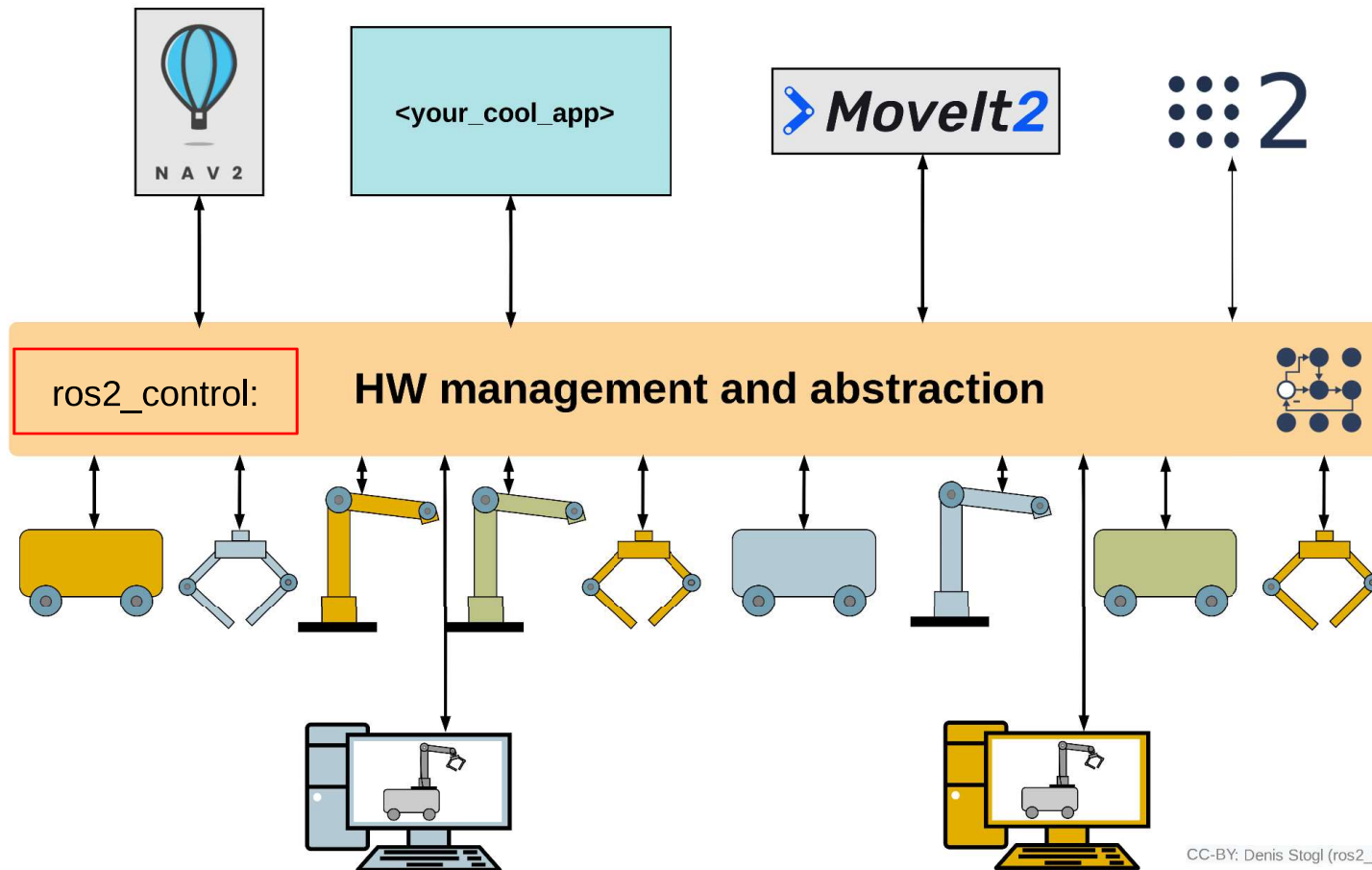
ROSCon DE 2024

---

Repo: [github.com/StoglRobotics/motoros2\\_hw\\_interfaces](https://github.com/StoglRobotics/motoros2_hw_interfaces)

Daniel Azanov M.Sc.  
Dr. Denis Štogl

# ros2\_control - kernel for ROS2



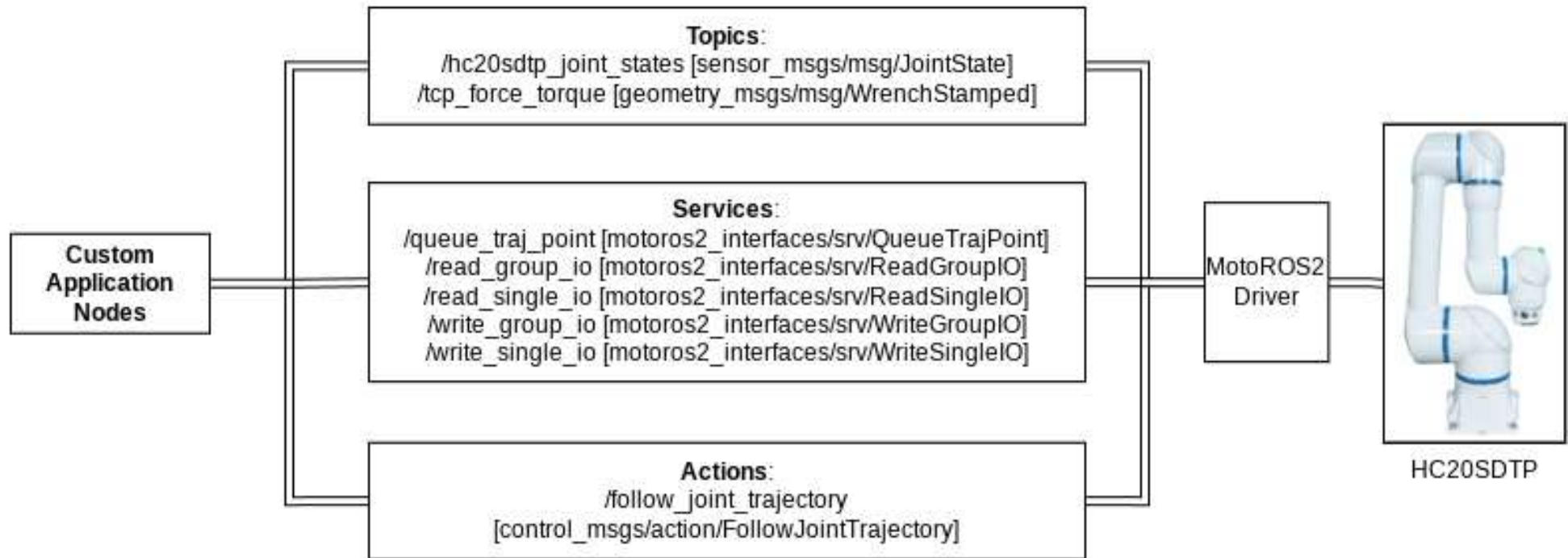
# ros2\_control @b-robotized.com



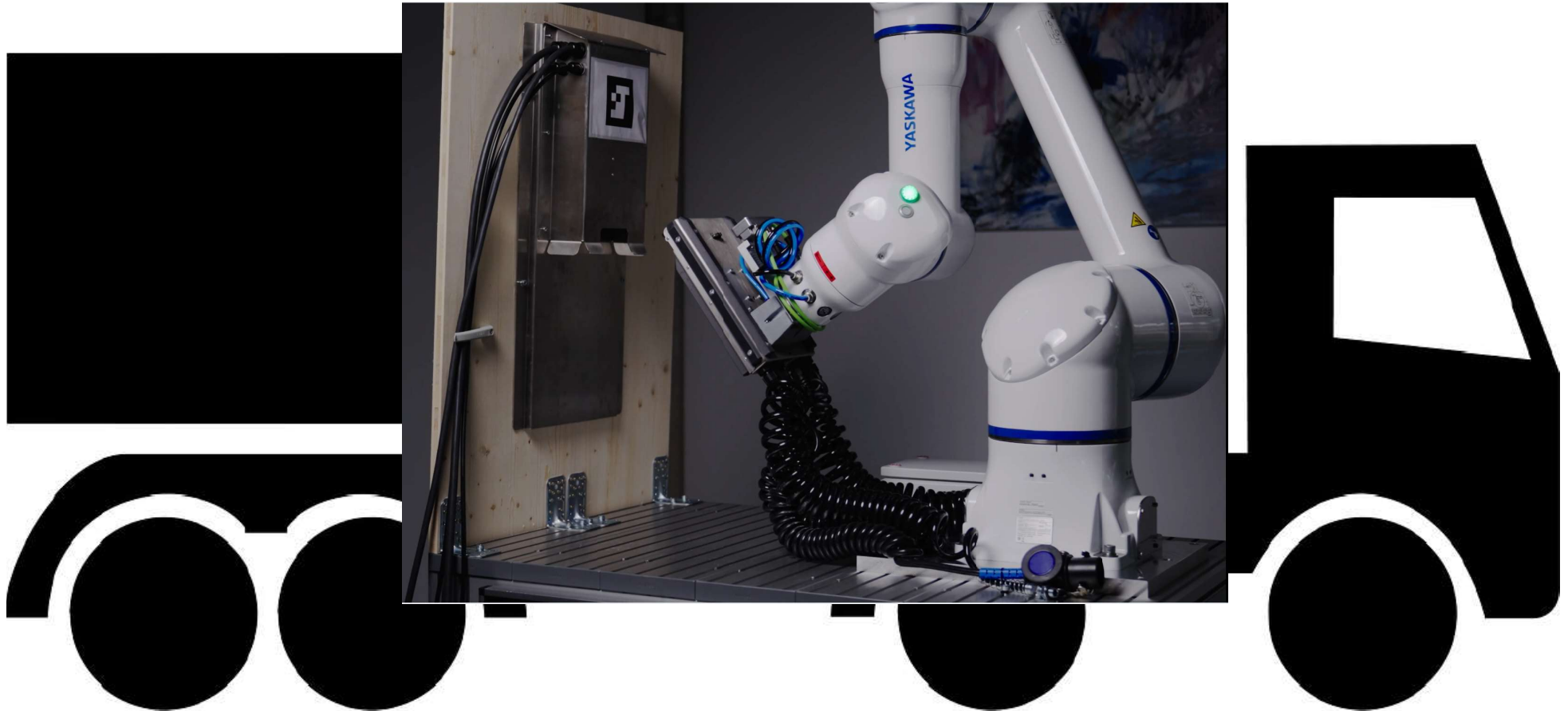
- Professional integration and development of ROS and ROS2 robotics applications
  - Real-time HW control & development
  - Prototypes and products for novel robotics products
  - Industrial automation with ROS2
  - Robotics Hardware
- Dr.-Ing. Denis Štogl
  - ros2\_control maintainer, robotics expert
- Daniel Azanov
  - robotics engineer
- 4 full-time engineers



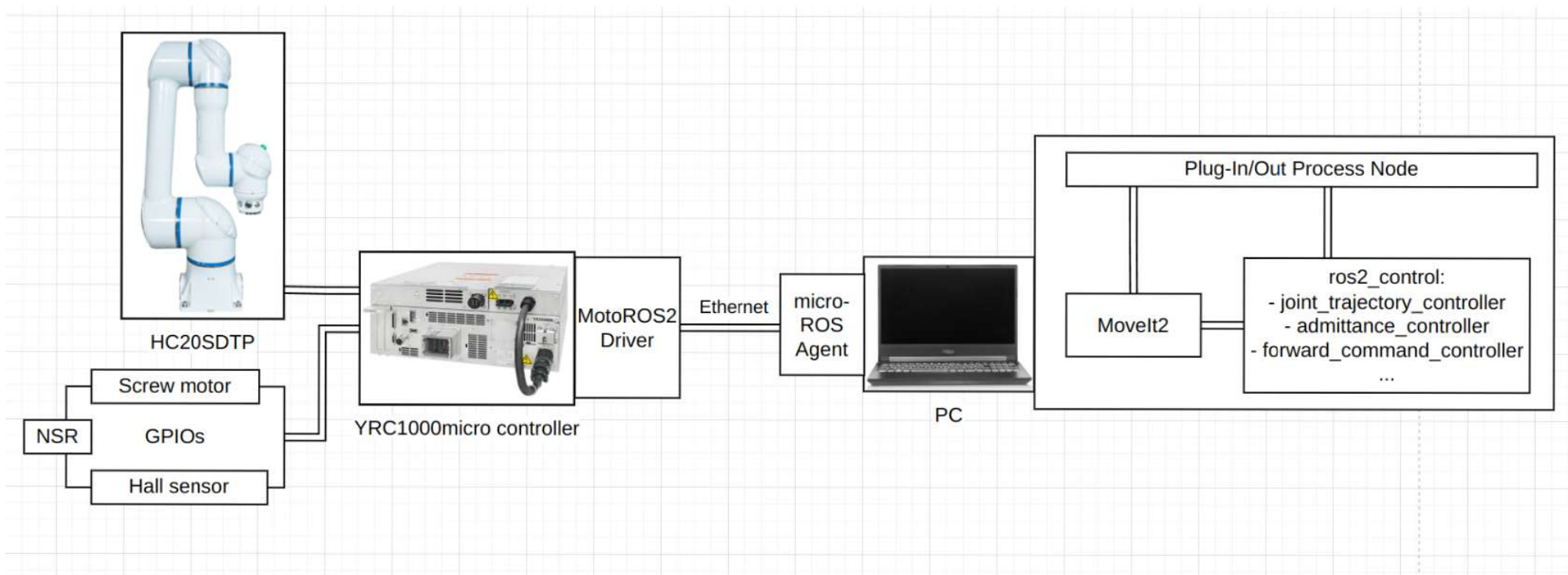
# MotoROS2 Driver Schnittstellen



# Overview of the Setup



# Overview of the Setup (2)



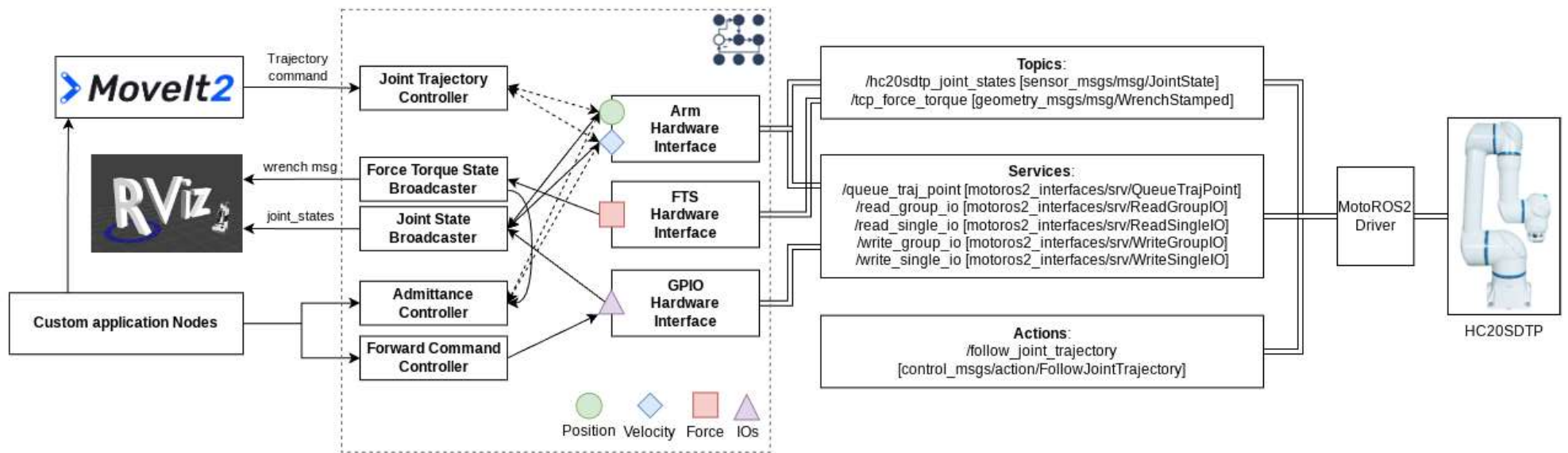
# Overview of the Setup (3)

## Tasks:

- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?



# MotoROS2 HW Interfaces





# Arm joints

## MotoROS2 Hardware Interface:

- Joint state & command interfaces
  - joint\_trajectory\_controller
  - admittance\_controller

## Tasks:

- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?



# Arm joints

## MotoROS2 Hardware Interface:

- Joint state & command interfaces
  - joint\_trajectory\_controller
  - admittance\_controller

## Tasks:

- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?

```
<ros2_control name="motoros2_hw" type="system" is_async="true" >
  <hardware>
    <plugin>motoros2_hw_interfaces/MotoROS2HardwareInterface</plugin>
    <param name="queue_traj_point_srv_name">/queue_traj_point</param>
    <param name="joint_states_topic_name">/hc20sdtp_joint_states</param>
  </hardware>

  <joint name="joint_1_s">
    <command_interface name="position"/>
    <state_interface name="position">
      <param name="initial_value">0</param>
    </state_interface>
    <command_interface name="velocity"/>
    <state_interface name="velocity"/>
  </joint>
  <joint name="joint_2_l">
    <command_interface name="position"/>
    <state_interface name="position">
      <param name="initial_value">0</param>
    </state_interface>
    <command_interface name="velocity"/>
    <state_interface name="velocity"/>
  </joint>
  <joint name="joint_3_u">
```

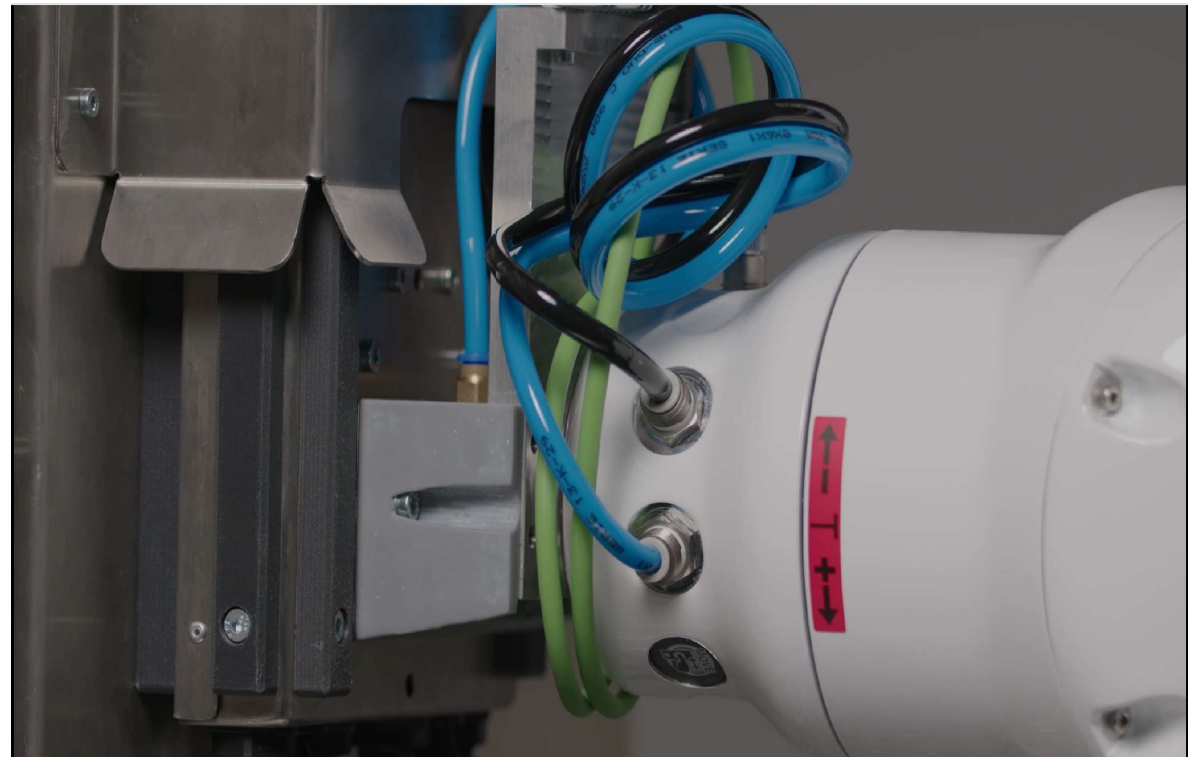
# Force-Torque Sensor

## FTS Hardware Interface:

- Sensor state interfaces
  - force\_torque\_sensor\_broadcaster
  - admittance\_controller

## Tasks:

- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?



# Force-Torque Sensor

## FTS Hardware Interface:

- Sensor state interfaces
  - force\_torque\_sensor\_broadcaster
    - admittance\_controller

## Tasks:

- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?

```
<ros2_control name="fts_hw" type="sensor" is_async="true" >
  <hardware>
    <plugin>motoros2_hw_interfaces/FTSHardwareInterface</plugin>
    <param name="fts_topic">/tcp_force_torque</param>
    <param name="force_x_name">force.x</param>
    <param name="force_y_name">force.y</param>
    <param name="force_z_name">force.z</param>
    <param name="torque_x_name">torque.x</param>
    <param name="torque_y_name">torque.y</param>
    <param name="torque_z_name">torque.z</param>
  </hardware>
  <sensor name="force_torque_sensor">
    <state_interface name="force.x"/>
    <state_interface name="force.y"/>
    <state_interface name="force.z"/>
    <state_interface name="torque.x"/>
    <state_interface name="torque.y"/>
    <state_interface name="torque.z"/>
  </sensor>
</ros2_control>
```

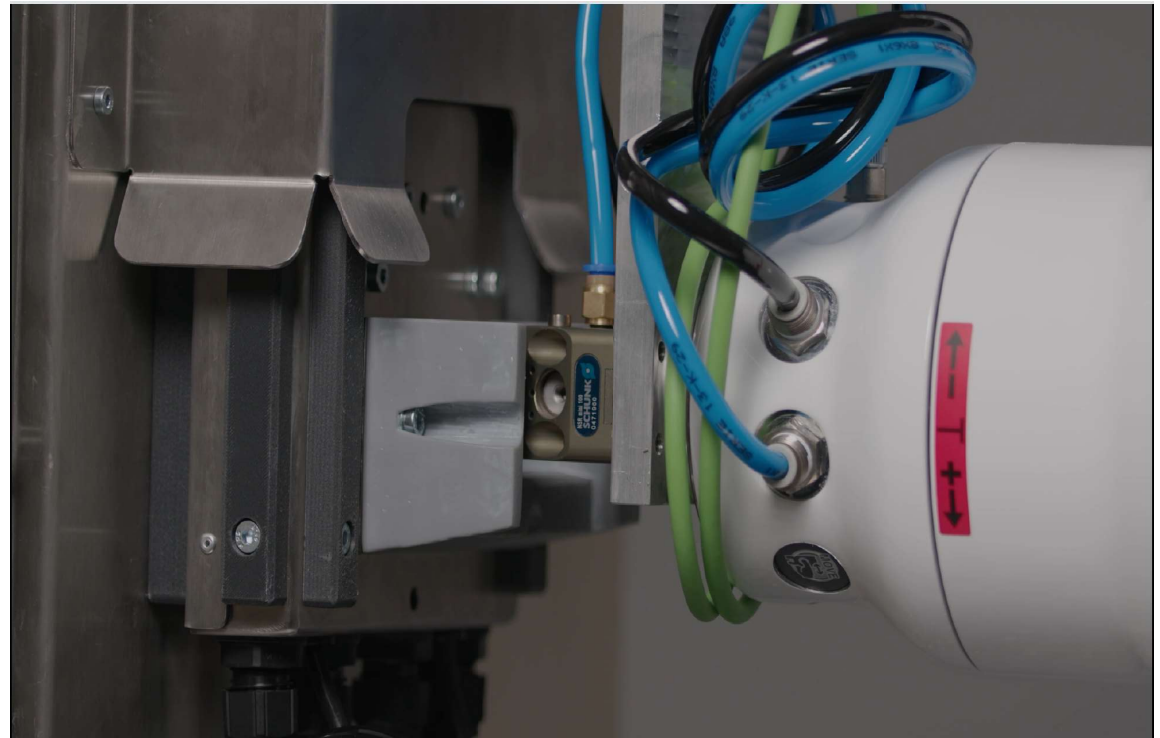
# GPIOs

## GPIO System:

- GPIO state & command interfaces
  - forward\_command\_controller

## Tasks:

- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?



# GPIOs

## GPIO System:

- GPIO state & command interfaces
  - forward\_command\_controller

## Tasks:

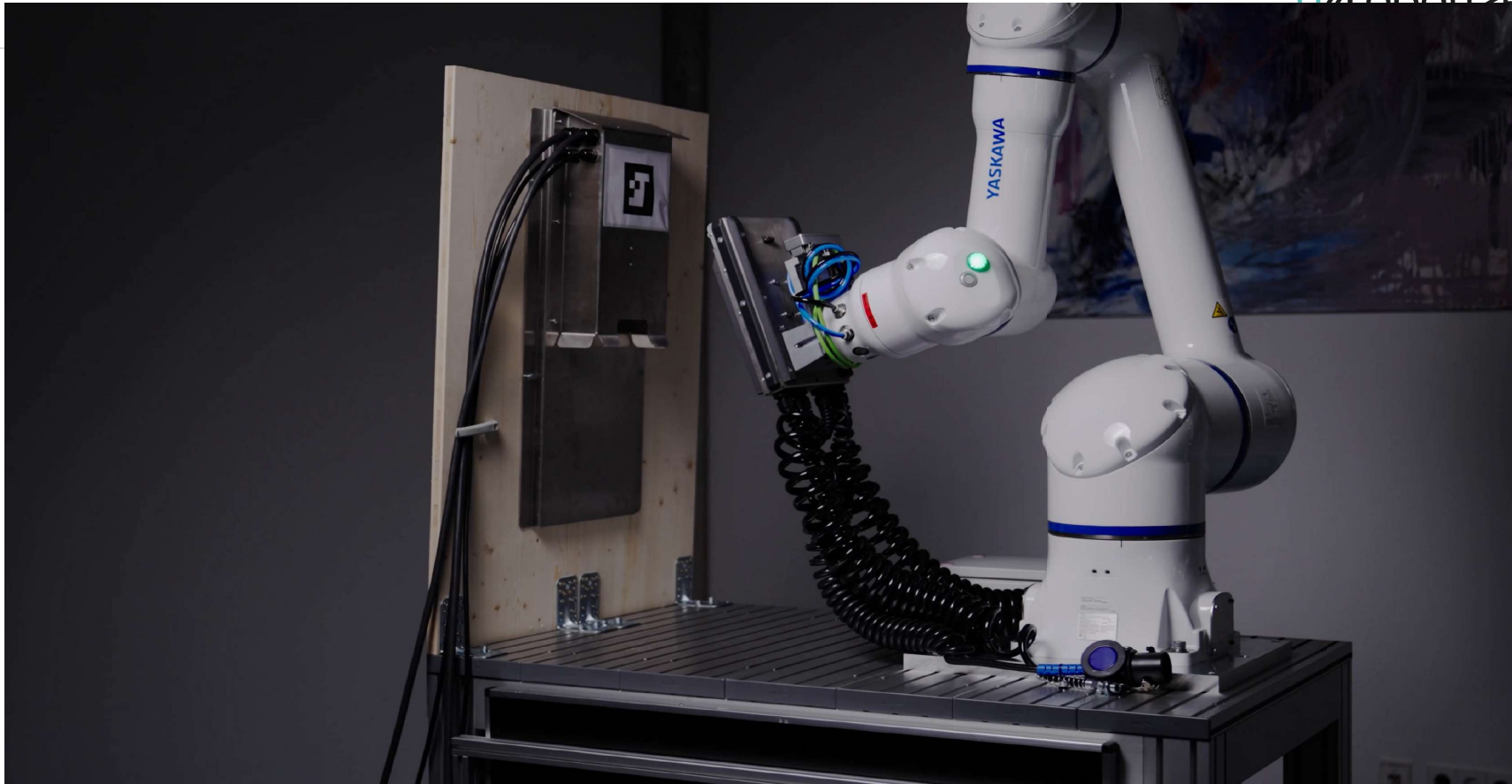
- Collision-free approach (MoveIt)
- Force control during contact
- Control external devices (GPIO):
  - NSR: attach/detach plug
  - Screw motor: hold/release plug
  - 2 Sensoren: plug inside / coupled?

```
<xacro:macro name="iaa_gpio_ros2_control_macro" params="name">

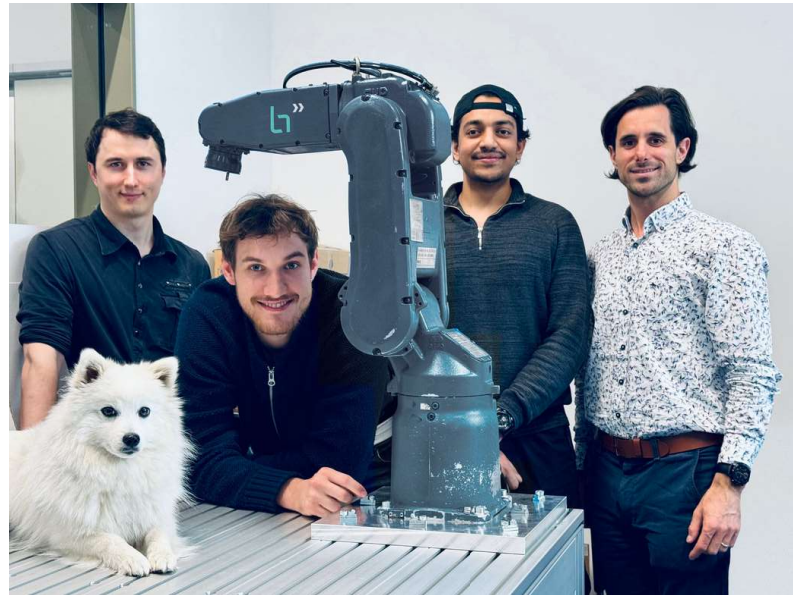
  <ros2_control name="${name}" type="system" is_async="true">
    <hardware>
      <plugin>iaa_hardware_interfaces/GPIOSystem</plugin>
      <param name="read_single_io_srv">/read_single_io</param>
      <param name="write_single_io_srv">/write_single_io</param>
      <param name="read_group_io_srv">/read_group_io</param>
      <param name="write_group_io_srv">/write_group_io</param>
    </hardware>

    <!-- Group IO Type version -->
    <gpio name="nsr">
      <param name="io_type">group</param>
      <param name="address">1001</param>
      <command_interface name="open">
        <param name="bit_index">2</param>
      </command_interface>
      <state_interface name="open">
        <param name="bit_index">2</param>
      </state_interface>
      <command_interface name="close">
        <param name="bit_index">1</param>
      </command_interface>
      <state_interface name="close">
        <param name="bit_index">1</param>
      </state_interface>
    </gpio>

    <gpio name="truck_motor">
      <param name="io_type">group</param>
      <param name="address">1001</param>
    </gpio>
  </ros2_control>
</xacro:macro>
```



Reach out to us! <https://www.b-robotized.com/>



Repo: [github.com/StoglRobotics/motoros2\\_hw\\_interfaces](https://github.com/StoglRobotics/motoros2_hw_interfaces)

Daniel Azanov M.Sc.

Dr. Denis Štogl