

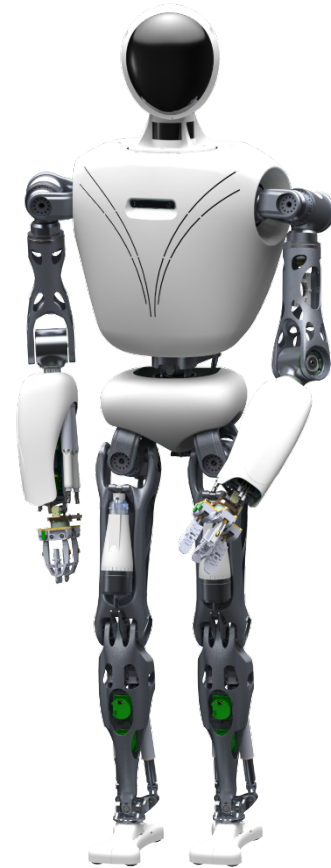
# RH5

## Humanoid robot as an assistance system in a human-optimized environment

### System Description

The humanoid robot RH5 was developed as an assistance robot and against the background of long-term autonomous missions in environments designed for humans, e.g. on a future moon station. A humanoid design of the robot is suitable for interaction with humans as well as for locomotion and manipulation in a real environment. In addition to autonomous and semi-autonomous use, the robot should also be able to be teleoperated by means of an exoskeleton, whereby the visual perception and acting forces and torques of the robot are made available to the controlling person by means of virtual reality methods.

In the mechanical development, a hybrid serial parallel design architecture was employed to achieve a lightweight design with high stiffness and good dynamic properties. In addition to rotatory drive units, linear drive units are also used to exploit non-linear transmission properties.



Rendering of the humanoid robot RH5

### Technical Details

- **Size:** 360 x 750 x 2000 mm
- **Weight:** 62 kg
- **Runtime:** ca. 30 minutes
- **Speed: max. 1 m/s**
- **70 degrees of freedom:** 2 x 7-DOF arms (Payload/Weight > 1), 4-DOF torso, 2-DOF head, 12-DOF mobile base, 2 x 18-DOF hands
- **34 degrees of freedom :** 2 x 7-DOF arms, 3-DOF torso, 3-DOF head, 2 x 6-DOF legs, 2 x 1-DOF gripper
- **Actuation:** 17x BLDC RoboDrive + HarmonicDrive, 10x RoboDrive + Ballscrew, 4x Maxon, 3x Dynamixel
- Optional integrateable serial elastic drive units for leg actuation
- 1 DOF passive adaptive grippers
- Occipital Structure Sensor ST01 near field object detection
- Xsens MTi-300 AHRS IMU
- Velodyne LiDAR VLP-16 Puck for mapping and self-localization
- ZED Stereo camera for mapping and object detection
- ATI 6-DOF force torque sensors (4 pc.) at wrist and ankle joint
- Two Core i7 CPUs in the head and torso of the robot
- Three GPU Nvidia Jetson TX1

**Application:** Production and Consumer, Space

**Projects:**

- **TransFIT**  
Flexible Interaction for infrastructures establishment by means of teleoperation and direct collaboration; transfer into industry 4.0  
(07/2017 - 06/2021)
- **VeryHuman**  
Learning and Verifying Complex Behaviors for Humanoid Robots  
(06/2020 – 05/2024)

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