



Robotics, Automation and Control

Robonaut 2: Logistics and Distribution

Highly dexterous humanoid robot designed to handle complex environments to accomplish tasks

Researchers at the NASA Johnson Space Center (JSC), in collaboration with General Motors and Oceaneering, have designed a state-of-the-art, highly dexterous, humanoid robot: Robonaut 2 (R2). R2's nearly 50 patented and patent-pending technologies have the potential to be game-changers in multiple industries including logistics and distribution. Even though R2 is currently designed with only a mobile upper body, R2's ability to accomplish complex and delicate operations provides a higher level of sophistication not currently seen in the existing robotics field for logistics and distribution. In terms of handling inventory, R2's dexterity would allow it to handle a multitude of items, including delicate ones. R2 can safely work in close proximity to humans, making the robot suitable to work in complex environments such as distribution centers. R2 has the ability to operate equipment and machines designed for humans, like hand-held power tools or inventory-scanning equipment. R2's design enables many useful applications in logistics and distribution.

National Aeronautics and
Space Administration



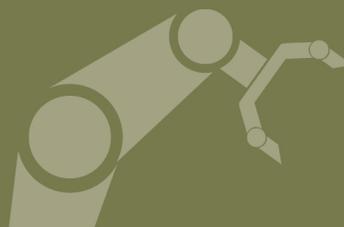
BENEFITS

- ➔ Upper Body: Designed to handle unexpected objects coming into its path
- ➔ Sensing: Uses its vision, force and tactile sensing to carry out tasks in real time
- ➔ Visual system: Multiple cameras provide stereo vision and depth perception
- ➔ Dexterous: Uses many of the same tools created for human use
- ➔ Safe Interactions: Capable of working side-by-side with people

APPLICATIONS

- ➔ Logistics
- ➔ Distribution Centers and Warehouses
- ➔ Freight Transportation
- ➔ Inventory Management

technology solution



THE TECHNOLOGY

R2 was designed to work side-by-side with people and to be sensitive to its surroundings. The robot's advanced vision systems and recognition processing can quickly recognize a person in its path and take the appropriate action. If the robot comes into contact with a person or piece of equipment, it gives. There is no need to design specialized equipment for R2 because the robot has the ability to operate equipment and machines designed for humans, like hand-held power tools. R2 has the capability to improve the speed and accuracy of operations while maintaining sensitivity to its surroundings, making the robot prime for the logistics and distribution environment.

R2 was designed to handle unexpected objects coming into its path since it has to function in space where not everything is locked down. The robot has the ability to move in unconventional ways as compared to existing robots. Robonaut 1, an earlier version of R2, was integrated with a two-wheeled Segway personal transporter, giving it a range of motion. R2 has the capability of being integrated onto a two-wheeled base or a more rugged four-wheel base. An adaptable interface would enable R2 to integrate with other surface mobility systems.

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VISION: Infrared cameras for depth perception and 4 visible light cameras to provide stereo vision as auxiliary cameras

NECK: 3 degrees of freedom

HANDS: 12 degrees of freedom
4 in the thumb and 3 each in the index and middle fingers

ARMS: 7 degrees of freedom and approximately 2'8" long

TORSO: R2's brain

FINGERS: 5 pounds grasping force/finger. A minimum of 20 lbs. across the hand.

R2 SYSTEM: 50 actuators, 350 sensors, and 42 independent degrees-of-freedom

Robonaut 2 is a humanoid robot with many capabilities that allow it to perform tasks normally not done by robots.



Robonaut 2 is capable of working safely side-by-side with astronauts on the International Space Station.

PUBLICATIONS

Patent No: 8176809; 8291788; 8,443,693; 8,443,694; 8442684; 8,919,842

Patent Pending

Included is a sample list of the R2 arm technology patents. For patent information on the complete R2 systems, please visit <http://go.nasa.gov/1xWCiU5>.

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Agency Licensing Concierge

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NP-2015-04-1491-HQ

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MSC-24569-1, MSC-24736-1, MSC-24736-2, MSC-24736-3, MSC-24742-1, MSC-24742-JP, MSC-25782-1
MSC-TOPS-46

