



Robotics, Automation and Control

## Robo-Glove

**Wearable technology that reduces the force needed to operate tools for extended times and reduces strain when performing repetitive motion tasks**

Researchers at the NASA Johnson Space Center (JSC) in collaboration with General Motors (GM) have designed and developed Robo-Glove, a wearable human grasp assist device, to help reduce the grasping force needed by an individual to operate tools for an extended time or when performing tasks having repetitive motion. Robo-Glove has the potential to help workers, such as construction workers, hazardous material workers, or assembly line operators, whose job requires continuous grasping and ungrasping motion. The Robo-Glove also has potential applications in prosthetic devices, rehabilitation aids, and people with impaired or limited arm and hand muscle strength.

### BENEFITS

- Wearable assistive technology—a lightweight robotic glove that fits on your hand
- Small and compact—the existing prototype is small and compact, weighing two pounds, and future iterations should weigh less
- Human-safe robotics—the pressure sensors give the device a sense of touch (haptic feedback), making it safe for human interaction with the device
- Self-contained unit—all actuators, pressure sensors, and synthetic tendons are embedded into the glove.
- Ergonomic—the system helps reduce muscle strain from repetitive motion tasks

technology solution



# NASA Technology Transfer Program

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## THE TECHNOLOGY

Originally developed by NASA and GM, the Robo-Glove technology was a spinoff of the Robonaut 2 (R2), the first humanoid robot in space. This wearable device allows the user to tightly grip tools and other items for longer periods of time without experiencing muscle discomfort or strain. An astronaut working in a pressurized suit outside the space station or an assembly operator in a factory might need to use 15 to 20 pounds of force to hold a tool during an operation. Use of the Robo-Glove, however, would potentially reduce the applied force to only 5 to 10 pounds.

The Robo-Glove is a self-contained unit, essentially a robot on your hand, with actuators embedded into the glove that provide grasping support to human fingers. The pressure sensors, similar to the sensors that give R2 its sense of touch, are incorporated into the fingertips of the glove to detect when the user is grasping an object. When the user grasps the object, the synthetic tendons automatically retract, pulling the fingers into a gripping position and holding them there until the sensor is released by releasing the object.

The current Robo-Glove prototype weighs around two pounds, including control electronics, actuators and a small display for programming and diagnostics. A lithium-ion battery, such as one for power tools, is used to power the system and is worn separately on the belt. The next generation prototype will reduce the size and weight of the system. This technology is a contribution to the future prospect of robot-human teaming, where a machine's strength and a human's ability to see, feel, and think are combined to develop a more robust system than if each operates separately.



Robonaut and spacesuit-gloved hands are extended toward each other to demonstrate the collaboration between robots and humans in space.

## APPLICATIONS

The technology has several potential applications:

- Construction
- Hazardous material handling
- Oil and gas exploration
- Automotive
- Manufacturing
- Medical
- Repetitive motion work

## PUBLICATIONS

U.S. Patent 8,255,079

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