Robot Grip Can Lift Eggs as Well as Steel Beams
A stress ball-like robotic hand has a delicate, yet very firm touch.
By Eric Bland | Mon Oct 25, 2010 12:10 PM ET

The sand-filled rubber stress ball sitting on your desk could be the key to a new generation of robotic grippers, according to a new study. The new gripper, which uses a rubber membrane filled with everyday materials, could help robots grasp objects as delicate as raw eggs or as heavy as steel girders.

"This smart material is one of the most innocent materials, a bunch of grains of sand, glass beads, or ground coffee beans," said Heinrich Jaeger, a scientist at the University of Chicago and a co-author, along with scientists from Cornell University and iRobot, of a new paper that appears today in Proceedings of the National Academies of Sciences.

The new gripper holds objects through a combination of suction, friction and geometric interlocking. Say a robot wants to grab an egg. The gripper ball will extend, touch and wrap around a small part of the egg. Once the air is sucked out of the rubber ball the coffee grounds, sand, glass beads, or other granular material lock into each other and solidify around the object.

At the same time a mild suction forms between the egg and the gripper. Finally, the friction of the rubber membrane against the egg's shell completes the grip. The arm rises, along with the unbroken egg.

The rubber ball does all of this automatically, in stark contrast to how most robot grippers function, said Jaeger. Most existing grippers require a good amount of programming that tells the robot where to pick up an object, how hard or how gently to hold it, etc. so they don't crush the egg or drop the egg.

Since the rubber membrane conforms to virtually any object's size and shape, it can pick up one object after another, even objects with wildly different shapes, like a jack or a spring, with no additional programming.

The new robotic gripper should find a wide range of uses sooner rather than later, said Mark Yim, a scientist at the University of Pennsylvania not involved in the new research.

"You don't need a special gripper for each object you want to pick up," said Yim. "Say you had a robot around the house that needed to pick up random objects. This gripper would be more useful than a two or three fingered gripper that could pick up a pencil but not a book."

Besides a delicate touch with everyday objects, the new gripper is also incredibly strong. Scaled up, Jaeger says that a gripper, three feet across, would be strong enough to lift steel beams.

Jaeger and his colleagues say that they don't have any immediate plans to develop a crane equipped with a giant rubber ball quite yet. Next they plan to eliminate the vacuum and switch the material with one that responds to electricity or a magnetic field.

"We have filed various patent applications," said Jaeger. "So we here at Chicago would love to see this picked up, pun intended, by someone."