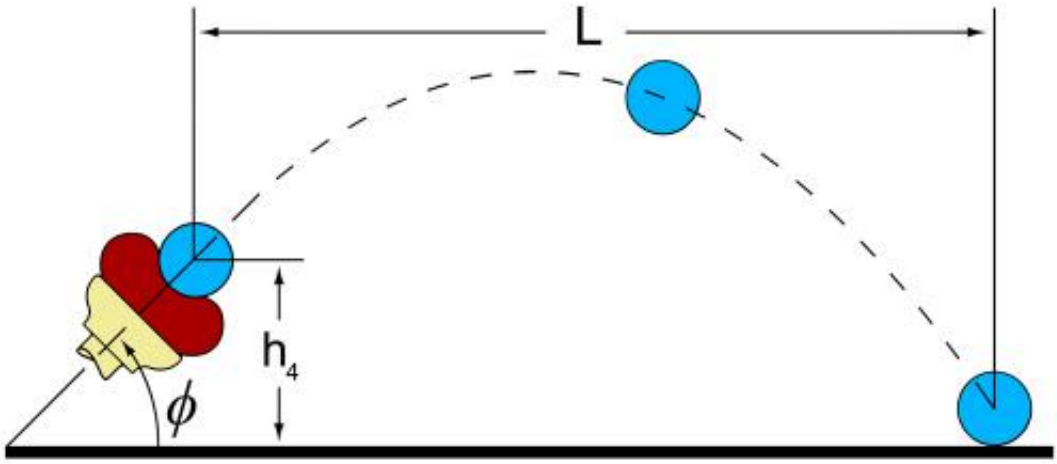
Research group extends capabilities of jamming universal gripper robot arm effector (w/ video)

February 15 2012, by Bob Yirka



Credit: John Amend, Cornell University

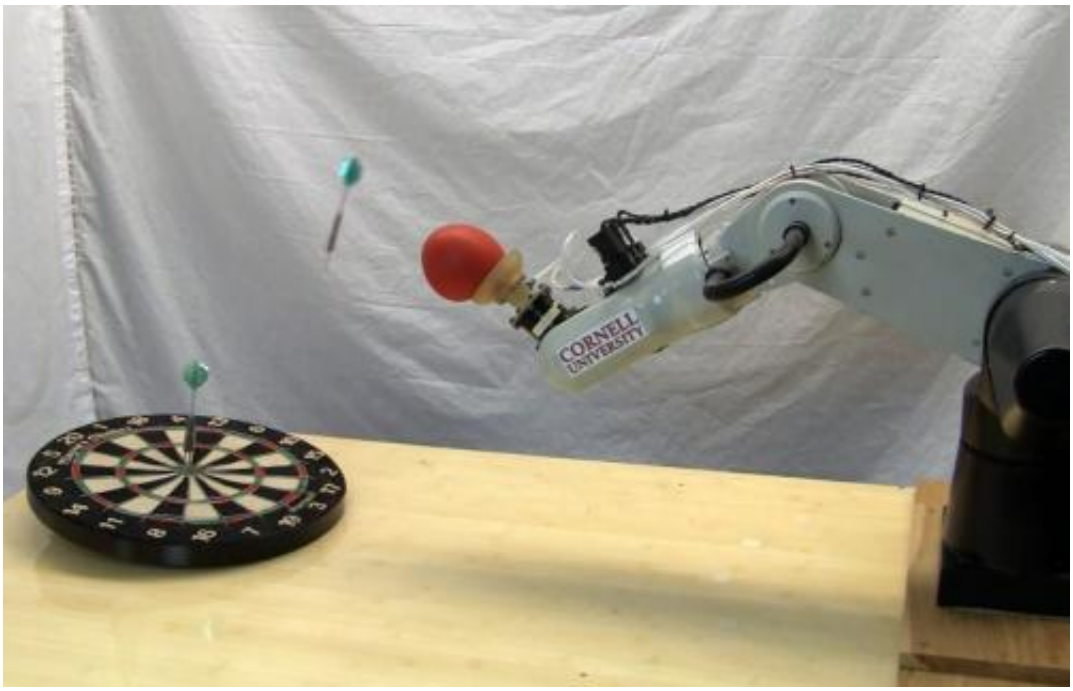
(PhysOrg.com) -- Last we heard, researchers from Cornell University, the University of Chicago and iRobot had together designed and built a robot “hand” or end effector that worked by taking advantage of the jamming that occurs when air is added to or removed from an enclosed container that holds a material that can be compressed. In this case, the team had filled an ordinary party balloon with dried coffee, which they then affixed to a vacuum pump. Adding air made the coffee pliant enough to allow the balloon to settle around an object. Quickly sucking out the air caused the coffee to compress (jam together) exerting

pressure on the object, allowing it to be held and moved around by the gripper which was attached to a programmable robot arm. Now, a subset of that team has added a new feature to their universal gripper, the ability to accurately toss the objects that it picks up. They describe their work in a paper soon to be published in *IEEE Transactions on Robotics*.

The team found that by very quickly pumping air back into the coffee filled balloon, they could cause the object being held by the gripper to be flung through the air with a reasonable degree of precision (±60 millimeters with 95% confidence in the direction perpendicular to flight.) In the demonstration video, the gripper is seen tossing small balls into a basket with accuracy that would be the envy of any basketball player. Next, it's seen sorting and tossing bolts and springs into two clearly labeled boxes, followed by a demonstration of its ability to roll objects across a table into other objects. And then, for its grand finale, the gripper plays a game of darts displaying more accuracy than most would ever see at the local pub.

Credit: John Amend, Cornell University

What is perhaps most interesting is the elegance displayed by the gripper. Rather than the clunky mix of artificial fingers seen on many robot arms, this gripper moves with the smooth grace of a ballet dancer. Comparing it to other robot hands is rather like taking note of the difference between the playing styles of tennis greats Rafael Nadal and Roger Federer. One takes the blunt force approach, the other glides smoothly across the court without breaking a sweat.



Credit: John Amend, Cornell University

Another clear advantage of such a gripper is that it's clearly less expensive to build than other devices that rely on mechanical finger manipulations; plus, it appears more nimble, as adept at picking up coke bottles or eggs as it is picking a dime up off the table.

It's not difficult to envision applications for this new kind of gripper, though if it's to be commercialized something much more durable than an ordinary balloon will need to be crafted. If robots are ever to become commonplace in the home, its likely technology like this will be leading the way.

More information: creativemachines.cornell.edu/p … ive_pressure_gripper